Hewlett Packard 9815A Calculator
98130A Plotter Interface
Operating and Service

HEWLETT PACKARD

Warranty Statement

Hewlett-Packard products are warranted against defects in materials and workmanship. For Hewlett-Packard Desktop Computer Division products sold in the U.S.A. and Canada, this warranty applies for ninety (90) days from date of delivery.* Hewlett-Packard will, at its option, repair or replace equipment which proves to be defective during the warranty period. This warranty includes labor, parts, and surface travel costs, if any. Equipment returned to Hewlett-Packard for repair must be shipped freight prepaid. Repairs necessitated by misuse of the equipment, or by hardware, software, or interfacing not provided by Hewlett-Packard are not covered by this warranty.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES.

*For other countries, contact your local Sales and Service Office to determine warranty terms.

Operating and Service

HP 98130A Plotter Interface

Hewlett-Packard Desktop Computer Division
3404 East Harmony Road, Fort Collins, Colorado 80525
(For World-wide Sales and Service Offices see back of manual.)

TABLE OF CONTENTS

Section 1: Introduction

Section 2: Plotting

Section 3: Labeling

Section 4: Digitizing

Section 5: Advanced Plotting

Section 6: Service

Appendices

Figures

Chapter 1
Introduction

The HP 9872A Plotter interfaced with the HP 9815A Calculator produces a plotting system capable of providing hard-copy, multi-color, graphic solutions for problems processed by the calculator. The HP 9872A Plotter can be used to plot, label, and digitize.

The calculator controls the functions of the plotter through the HP 98130A Plotter Interface. The HP 98130A Interface is not designed to be compatible with the HP-IB Interface. This means that you do not have to set the select code switches on the plotter rear panel as stated in the plotter manual (HP P/N 09872-90000).

Option 002

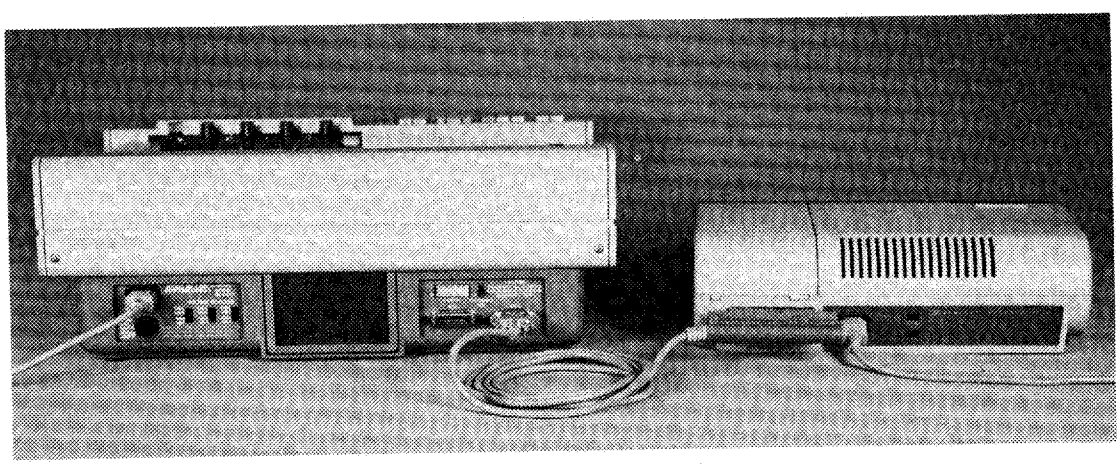
The calculator must be equipped with Option 002, two-channel I/O, before it is possible to connect the plotter interface. If you do not have Option 002, contact your nearest HP Sales and Service Office. The HP Sales and Service Offices are listed in Appendix E.

Connecting the System

NOTE

The calculator must be switched off before connecting the interface.

The calculator-plotter system will function properly only if it is connected with the calculator switched off. If you accidentally connect the interface with the calculator on, you must switch the calculator off and then on again.



With the calculator switched off, connect the interface to the calculator and plotter as shown above. The interface may be connected to either I/O channel on the calculator. The interface may be connected only to the smaller connector (labeled 9815A) on the plotter.

CAUTION

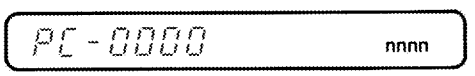
THE MOUNTING FASTENERS SHOULD BE TIGHTENED UNTIL THEY ARE FINGER-TIGHT. DO NOT OVER-TIGHTEN THE MOUNTING FASTENERS. THIS COULD RESULT IN BENDING OR WARPING THE FASTENER PLATE ON THE INTERFACE CABLE.

When the interface connections are complete, switch the calculator on. (Refer to the next section for plotter turn-on.)

The plotter interface requires the use of 48 calculator program steps, as can be seen by performing the following key sequence:

1. Switch to the run mode. 

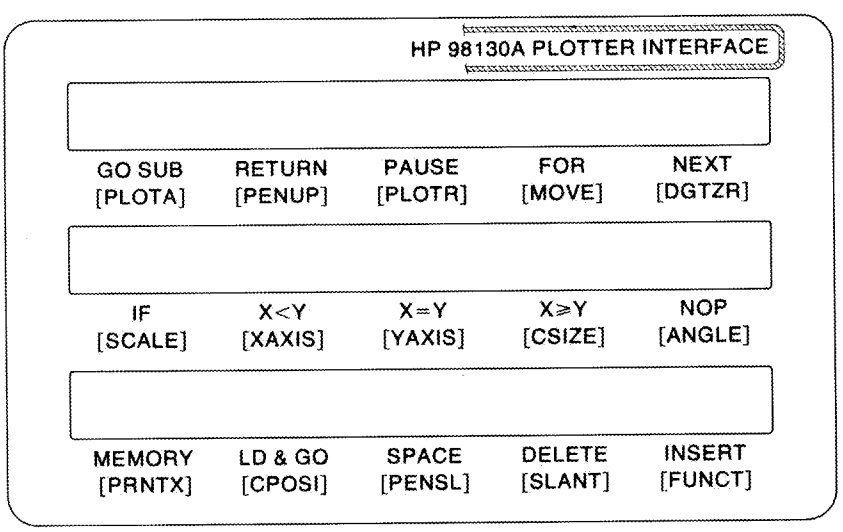
2. Press (END)
3. Switch to the program mode. 



The number on the right side of the display (nnnn) should be 48 steps less than the number of steps available without the interface connected. The exact number of steps available depends upon the memory option of your calculator and the connection of any other interfaces.

Key Overlay

The interface provides the calculator with a set of key-sequence instructions that are used to control various plotter operations. The instructions can be executed from either the keyboard or a program. A key overlay (HP P/N 7120-6347) showing the HP 98130A Interface instructions is provided with the interface. The overlay (shown below) should be placed over the keys A through 0. A copy of the secondary instruction set in an overlay format can be found in Appendix B.



The HP 9872A Plotter

Information concerning the plotter is contained in the HP 9872A Plotter Operation and Service Manual (P/N 09872-90000). Refer to that manual for complete information regarding plotter installation, initial turn-on procedure, plotter maintainence, etc. The following plotter "set up" information is included here for your convenience.

Before turning on the 9872A Plotter verify that:

1. Proper initial turn-on procedures have been performed according to the HP 9872A Plotter Operation and Service Manual (P/N 09872-90000).
2. The power cord is connected to the plotter, and is plugged into a suitable power outlet.

Power On

Switch the plotter on.

At turn-on of the power switch, the pen is raised and moved to the lower right of the platen. This is the **initialize** position. At this time, the following default conditions are established:

Default Values

CHART HOLD: On

LABEL: The shift and tab flags are cleared. The characters are taken from Character Set 0.

PEN UP: The pen is up.

DGTZR: The enter light is off.

P1 & P2: The points are set for 25cm x 38cm paper. (The points are subject to paper guide error.)

SCALE: The values are set from 0 to 100% of full platen area.

CSIZE: The labeling character size is set for .75% of $P_{2x} - P_{1x}$ distance as the character width. The character height is set for 1.5% of the $P_{2Y} - P_{1Y}$ distance.

ANGLE: The labeling direction is set at 0° from the horizontal axis (X-axis).

SLANT: The labeling character slant is set at 0° from the vertical axis (Y-axis).

LIMIT: The plotting window is set to the full platen area.

LINE: The line type and pattern length is set to a solid line.

CHAR: The labeling characters will be taken from character set 0 in both STD and ALT sets.

SPEED: All pen speeds are set at 36cm/sec.

SYMB: The ASCII symbol mode is turned off.

TICS: The axes tic length is fixed at .5% of $P_2 - P_1$ points for the respective axes.

AUTOL: The axes tic labeling is turned off.

LOG: Log plotting is turned off. Both axes are plotted linearly.

MODE: The labeling character size and angle are set to a percent of P1 and P2.

AVEL: Automatic pen tracking velocity is off. All pens will track at 36cm/sec.

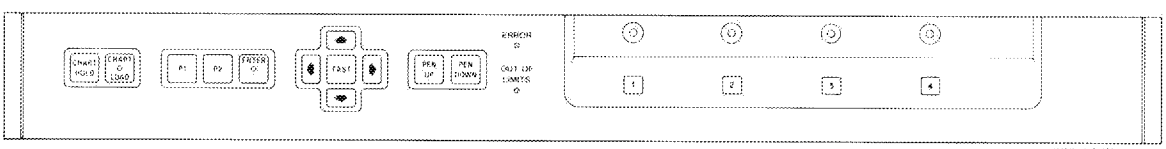
APEN: Automatic pen pick up after 65 seconds is on.

Stop Key Interaction

The (RUN STOP) key interacts with the plotter operations as follows:

1. During an XAXIS or YAXIS instruction, termination occurs upon completion of the axis line segment before the tic is to be drawn.
2. During a LABEL instruction, termination occurs upon completion of the next character in the alpha string.
3. During a DGTZR instruction, termination occurs before the plotter coordinates are entered into the stack. The [ENTER] light is turned off. The digitizer mode is terminated.

Front Panel Controls



The remainder of the controls are located on top of the plotter's front panel, as shown above.

WARNING

DO NOT TOUCH THE PLOTTER ARM OR THE PLATEN WHEN THE PLOTTER IS IN OPERATION. THE PLOTTER ARM MOVES WITH SUFFICIENT SPEED TO CAUSE INJURY.

CAUTION

THE PLATEN MUST BE CLEAR OF ALL OBJECTS BEFORE PERFORMING ANY PLOTTING OPERATIONS. STRIKING ANY OBJECTS WITH THE PLOTTER ARM COULD DAMAGE THE PLOTTER.

Chart Load

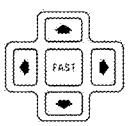
Paper must be loaded before performing any plotting operation. To load paper, press the [CHART LOAD] button. [CHART LOAD] lights and the plotting arm moves to the chart load position (upper right of platen).

After placing the paper on the platen, press the [CHART HOLD] button. The [CHART LOAD] light extinguishes and the electrostatic paper hold down is activated.

P1 and P2

P1 and P2 are selectable reference points. P1 and P2 correspond to the Xmin, Ymin and Xmax, Ymax coordinates, respectively. P1 and P2 form a rectangular plotting area for the SCALE instruction to process. To manually set P1 and P2, use the cursor controls to position the pen at a desired point and press [P1] or [P2] and [ENTER]. The pen coordinate is entered into its respective position.

Cursor Controls



The cursor controls are used to position the pen from the plotter front panel. The pen moves in the direction specified by the arrow on the control.

Indicator Lamps

Error Lamp: The error lamp will blink during an error. If the lamp is on for a prolonged period of time, you must turn off the plotter. The plotter should then be turned on and the program re-executed.

Out of Limit: The Out of Limit lamp lights whenever any one of the three possible Out of Limit conditions occur. The three possible conditions are:

1. Out of WINDOW Limit
2. Out of BOUNDARY Limit.
3. Lost.

Out of WINDOW Limit

This occurs when the pen intersects the plotting window (refer to LIMIT instruction, Section 2). The pen raises and does not plot until the program re-enters the plotting window boundaries.

Out of BOUNDARY Limit

This occurs when the pen is instructed to plot at a point which is outside the platen area, but within the over range limit. The platen area is defined as being 16,000 plotter units along the X axis and 11,400 plotter units along the Y axis. The over range limit is defined as being 32,767 plotter units along each axis. Therefore the over range limits are 2.05 times the X axis and 2.87 times the Y axis for full platen.

The plotter units relate to your program in the following manner:

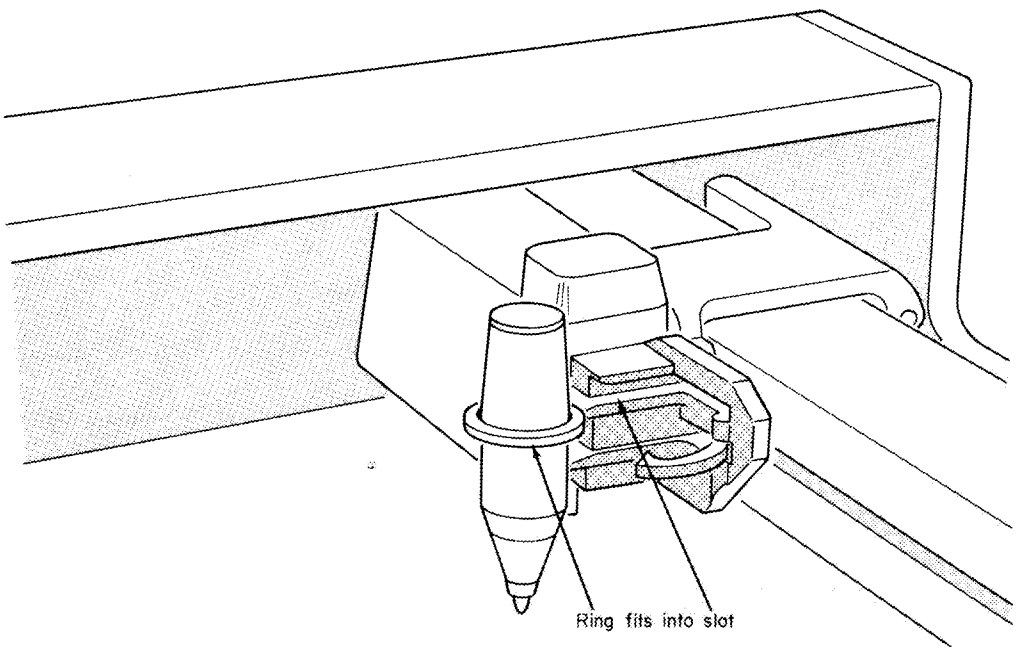
- If you are executing a program and the algorithms in your program generate an X value which is up to 2.05 times the full platen X axis value, the plotter will be able to use that new value for processing PLOTR instructions.
- If you were executing a program and the alogrithms in your program generate a Y value, which is up to 2.87 times the full platen Y axis value, the plotter will be able to use that new value for processing PLOTR instructions.

Lost

This occurs when the algorithms in your program generate a value which is greater than 2.05 times the full platen X axis value or greater than 2.84 times the full platen Y axis value. When this happens and you try to execute a PLOTR instruction, the plotter can not accept the data correctly and the resulting plots may not be accurate. If you execute a PLOTA instruction to a point within the plotting area, the plotter will regain its position and begin to process new data correctly.

Pens

The 9872A plotter's pens are housed in the pen stable. To load a pen, plotter power must be on and the plotter arm must have stopped.



Select the color of pen that you want in pen stable #1. Remove the pen cap and place the pen in the pen holder as shown in the picture above. Note that the thick ring around the middle of the pen fits into the slot in the pen holder. Now press [ENTER] and the pen stable button [1]. The plotter arm will put the pen in the first storage stable. Repeat this procedure with three more pens, substituting the appropriate pen stable button for each one.

NOTE

Save the pen caps in case you wish to remove a pen temporarily from the plotter.

To select a pen, press the pen select button you desire. The plotter will go through the following sequence: Move to the lower right hand corner of the plotter, replace original pen, select new pen, return to the last coordinate where it was prior to the select instruction.

To replace a pen without selecting another, press [ENTER] and the vacant pen stable button. This will load the pen into the stall. This procedure is recommended for any period of non-use to reduce the effect of the pen tip drying out. The stable will automatically cap the pens.

The [PEN UP] and [PEN DOWN] controls raise and lower the pen, respectively.

System Test

The following procedure will verify the operation of your plotter and plotter interface.

NOTE

This procedure requires that the calculator and plotter be properly connected. For installation instructions, refer to the beginning of this section.

---

1. Switch the calculator on.
2. Switch the plotter on.
3. On the plotter:
   a. Press the [CHART / LOAD] button.
   b. Load a sheet of 25 x 38 cm paper (HP P/N 9270-1024) on the platen. Align the paper against the guides located on the left and lower sides of the platen.
   c. Press the [CHART HOLD] button and smooth out the paper.
   d. Verify that all four pen stables have pens loaded.

Dynamic Performance Test

Insert the Utility and Test Cartridge (HP P/N 09815-10004*) into the tape drive and load file −27.

Press [CLEAR] [2] [7] [+/-] [LOAD]

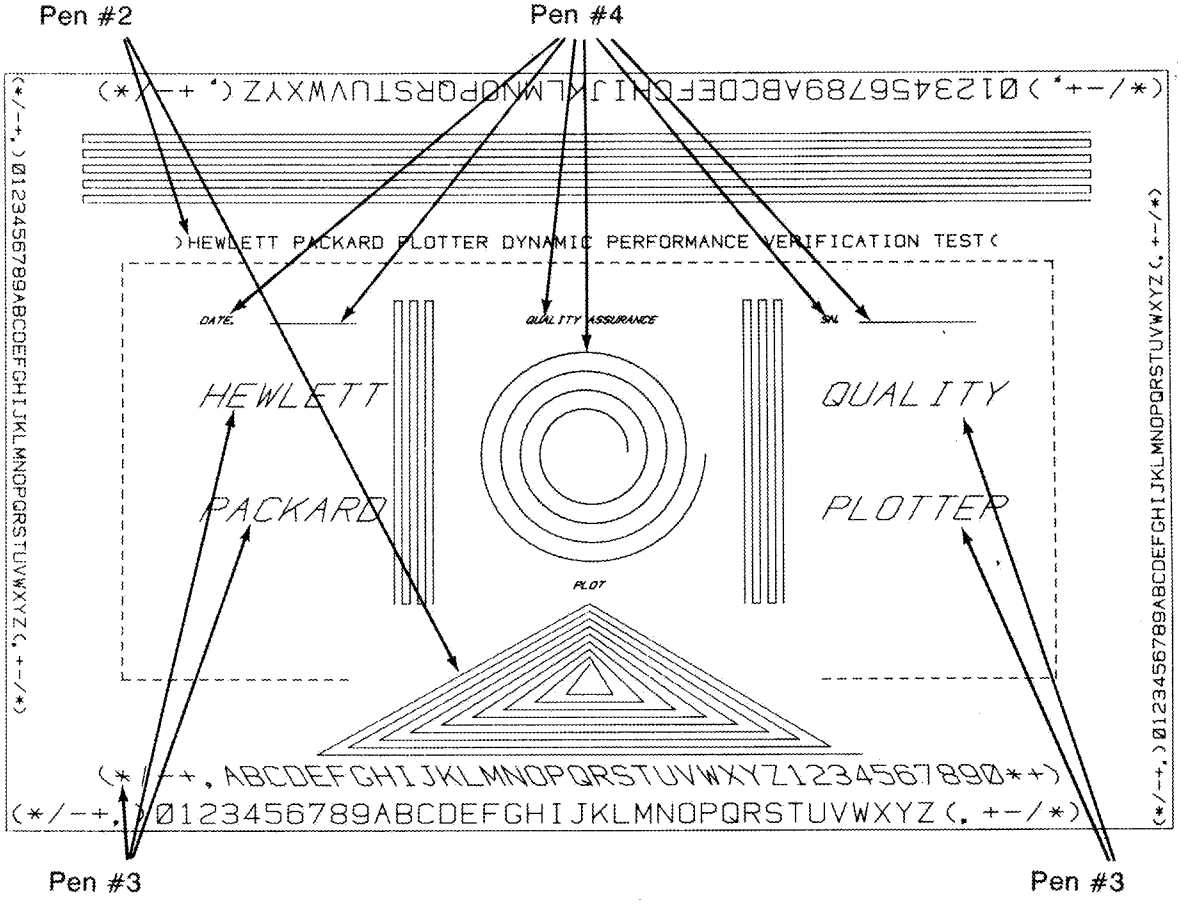
when the tape drive halts:

Press [END] [RUN STOP]

* The Dynamic Performance Test for the HP 9872A Plotter begins with Revision K tapes.

The resulting plot should duplicate the sample plot shown below. If some characters or lines are incorrectly drawn, the plotter pen may be skipping. This can be verified by installing a new pen in the appropriate stable and repeating the test procedure. Should the plot still differ from the sample plot below, disconnect the plotter and the interface. Then perform the calculator test shown in Appendix 2 of the 9815A Calculator Operating and Programming Manual (HP P/N 09815-90000) and the Plotter Confidence Test shown in Section 3 of the 9872A Graphics Plotter Manual (HP P/N 09872-90000).

If the calculator or plotter fail their tests, contact the nearest HP Sales and Service Office. If the calculator and plotter pass their tests, reconnect the system and rerun the Dynamic Performance Test. If the Dynamic Performance Test cannot be successfully completed, contact your nearest HP Sales and Service Office. A complete listing of the Sales and Service Offices can be found in Appendix E.



Notes

Chapter 2
Plotting

Plotting is a method of graphically displaying data. Stated simply, plotting is graphing. Plotting allows you to: draw graphs and charts; locate a point by means of coordinates; and locate a line by means of points. Plotting is not limited to the previous examples, however. This section explains the instructions used in the plotting operation.

The instructions for the HP 9872A Plotter, are divided into a primary instruction set and a secondary instruction set. The key sequence for the primary instruction set is [CALL ALPHA] (1) and the desired key [A] through [N]. The key sequence for the secondary instruction set is [CALL ALPHA] (1) [0] and the desired key (0) through (9) or (+) (−) (×) (·). Both instruction sets are used in plotting and labeling and digitizing.

The primary instruction set contains the commands which tend to be used and modified during a program. The secondary instruction set contains the commands which are normally specified at the beginning of a program. Since both instruction sets are used in plotting and labeling operations, they explained in a normal operating sequence for these operations. Individual examples are given for each instruction. Typical programs which utilize these instructions can be found at the end of this section.

The examples which are given for each instruction require that paper be loaded on the plotter. If you have not loaded the plotter with paper, do so at this time. This will prevent any pen marks on the platen. The platen can be cleaned with a damp cloth.

NOTE

This manual assumes that the reader is familiar with the operation of the calculator as described in the Operating and Programming Manual (HP P/N 09815-90000).

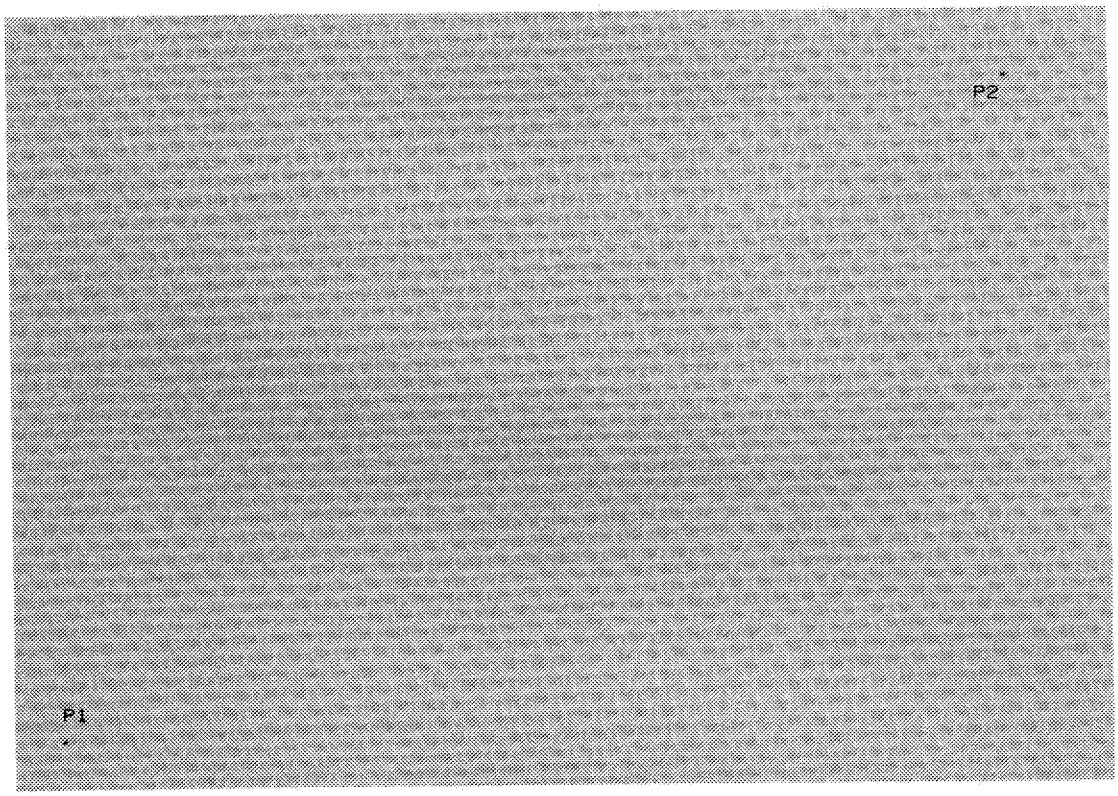
The calculator controls the plotter through various key sequences. The sequences and the instructions they represent are shown in Appendix A. The entire key sequence must be pressed each time an instruction is used.

Initialize Instruction (INIT)

[CALL ALPHA] 1 [0] [×]

```
FUNCT
*
```

The Initialize Instruction (INIT) sets the plotter to its turn on parameters. The turn on parameters are the same as the default parameters shown in Section 1, with one exception. P1 and P2 are not set by the default condition, while the INIT instruction causes the plotter to set P1 and P2 as shown below.



When executing the INIT instruction, the plotter performs the following sequence: the plotter arm moves to the right side of the platen; the pen moves to the lower right hand corner of the platen.

To execute the INIT instruction, press: [CALL ALPHA] 1 [0] [×]

The plotter initializes.

Because the plotter is programmable, the execution of an INIT instruction should occur at the beginning of each program. This allows you to reference all programming steps to the initialized conditions.

Set Positions Instruction (SETP)

CALL ALPHA 1 ▫ 0

FUNCT
0

Xmin → T
Xmax → Z
Ymin → Y
Ymax → X

The Set Positions Instruction allows you to position the reference points P1 and P2 from the calculator keyboard. This instruction is very useful when using smaller sized paper, perspective drawing and rubber plot drawings (see Advanced Plotting, Section 5).

The parameter value limits are:

$$0 \leq Xmin < Xmax \leq 100$$
$$0 \leq Ymin < Ymax \leq 100$$

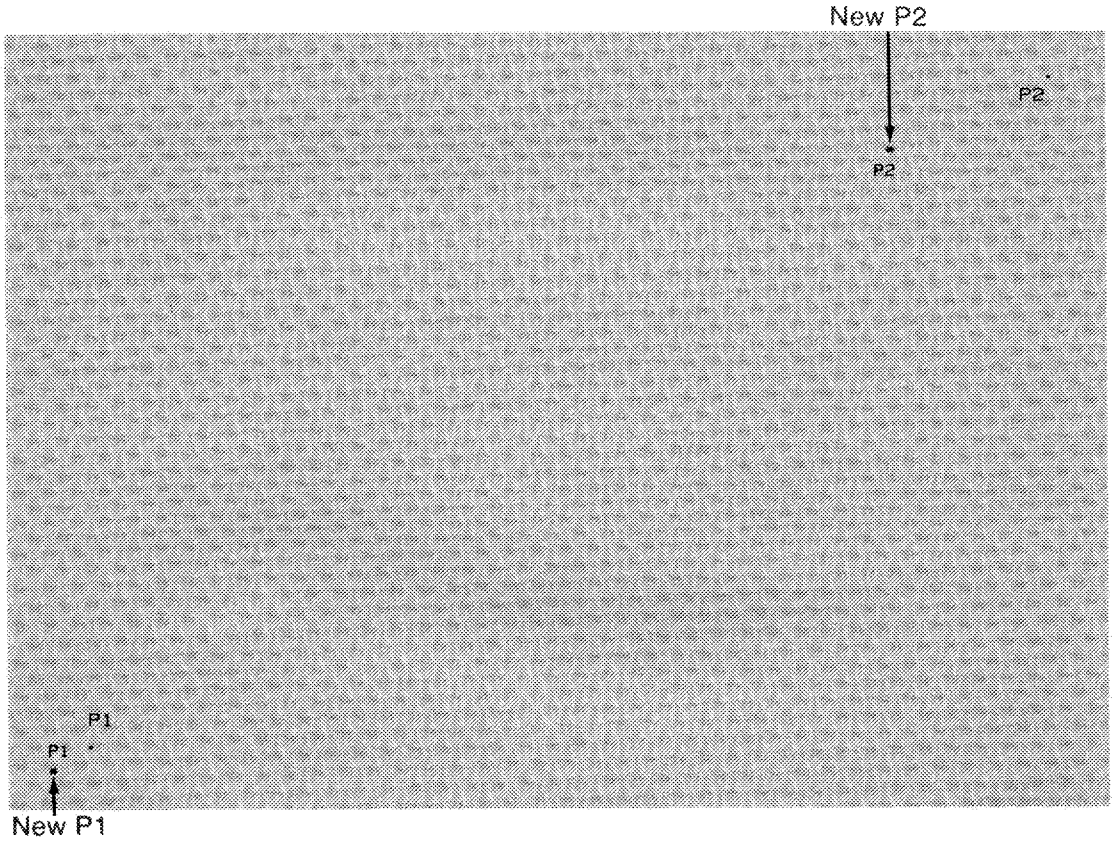
The parameter values are expressed as percentages of the full platen area. (Xmin, Ymin = 0; Xmax = 40cm; Ymax = 28.5 cm).

You have a choice of selecting either the default values or selecting your own P1 and P2 locations.

This example sets both P1 and P2 at 80% of the platen area.

SETP Example:

	Description
0 ENTER	Set Xmin at 0% of 40 cm. (0)
80 ENTER	Set Xmax at 80% of 40cm. (32cm)
0 ENTER	Set Ymin at 0% of 28.5cm (0).
80 CALL ALPHA 1 ▫ 0	Set Ymax at 80% of 28.5cm. (22.5cm)



Now Press [P1] and [P2]. The plotter pen will move to the new position respectively.

NOTE

Entering a 0 in all registers will set the initialized condition.

Scale Instruction (SCALE)

CALL ALPHA 1 F

SCALE

Xmin → T
Xmax → Z
Ymin → Y
Ymax → X

The Scale Instruction (SCALE) assigns user unit values to the rectangular area defined by P1 and P2. The initialized value divides the full platen rectangular area into 100 units by 100 units.

User units are arbitrary values which you establish. The SCALE instruction divides that reference area into evenly spaced increments dependent upon the P1 and P2 positions.

P1 and P2 must be set prior to the SCALE instruction, or the SCALE instruction applies to the initialized P1 and P2 positions.

NOTE

When performing logarithmic plotting, the LOG instruction must be executed prior to the SCALE instruction. (Refer to page 30.)

The parameters of the SCALE instruction are:

$$Xmin < Xmax$$
$$Ymin < Ymax$$

To execute the SCALE instruction, enter the parameters and press:

SCALE Example:

	Description
0 ENTER	
100 ENTER	Sets the area from Xmin to Xmax into 100 equal units.
0 ENTER	
1000 CALL ALPHA 1 F	Sets the area from Ymin to Ymax into 1000 equal units.

Pen Select Instruction (PENSL)

CALL ALPHA 1 M

PENSL

Pen # → X

The Pen Select Instruction (PENSL) allows you to select any of the four pens for the plotter to use.

During this operation, the plotter replaces any pen which is currently loaded in the arm, selects the new pen, and returns to the last pen position prior to the PENSL instruction. The program will continue to be executed.

The first digit in the X register will determine which pen is to be selected. The digit must be an integer between 0 and 4.

Entering a value of 0 into the X register followed by the PENSL instruction loads the pen currently in use into the pen stable.

If a PENSL instruction results in calling for a pen already in use, the PENSL instruction will be ignored. The program continues to be executed.

PENSL Example:

	Description
1 CALL ALPHA 1 M	Select Pen #1.
2 CALL ALPHA 1 M	Select Pen #2.
3 CALL ALPHA 1 M	Select Pen #3.
4 CALL ALPHA 1 M	Select Pen #4.

Pen Speed Instruction (SPEED)

[CALL ALPHA] (1) [ ] (4)

FUNCT
4

Pen# → Y
Speed → X

The Pen Speed Instruction (SPEED) specifies a maximum velocity (cm/sec) for each pen.

The pen number selects which pen runs at a given speed. Entering a 0 as the pen number sets all pens to the given speed.

The speed is determined by the rounded integer in the X register.

The parameter for the speed instruction is:

$$1 \leq \text{speed} \leq 36$$

A value of 0 as the pen speed sets the speed to maximum. (36cm/sec)

SPEED Example:

	Description
1 [ENTER]	Pen #1
15 [CALL ALPHA] (1) [ ] (4)	Chart at 15cm/sec
2 [ENTER]	Pen #2
8 [CALL ALPHA] (1) [ ] (4)	Chart at 8cm/sec
0 [ENTER]	All pens
[CALL ALPHA] (1) [ ] (4)	Chart at 36cm/sec

Plot Absolute Instruction (PLOTA)

CALL ALPHA 1 A

PLOTA

Y coordinate → Y
X coordinate → X

The Plot Absolute Instruction (PLOTA) moves the pen to the specified X,Y coordinate. The X,Y coordinates are in user units as specified by the SCALE instruction.

When the PLOTA instruction is executed, the pen is moved to the specified X,Y coordinate. If the pen was up (raised) prior to the PLOTA instruction, it will be lowered at the specified coordinate. If the pen was down prior to the PLOTA instruction, the pen will be moved with the pen tip on the chart.

The parameters for the PLOTA instruction are the X,Y coordinate values specified in user units.

To execute the PLOTA instruction, enter the parameters and press: CALL ALPHA 1 A

Press PEN UP before executing this example.

PLOTA Example:

	Description
5 ENTER CALL ALPHA 1 A	Plot absolute at X = 5,Y = 5
15 ENTER	
20 CALL ALPHA 1 A	Plot absolute at X = 20, Y = 15

The pen was up during the first PLOTA instruction. The second PLOTA instruction drew a line from X = 5,Y = 5 to X = 20,Y = 15.

Plot Relative Instruction (PLOTR)

CALL ALPHA 1 C

PLOTR

ΔY coordinate → Y
ΔX coordinate → X

The Plot Relative Instruction (PLOTR) moves the pen. The movement is an incremental move relative to the previous position of the pen. This movement can be in either a positive or negative direction.

When the PLOTR instruction is executed, the pen is moved the incremental X,Y values. If the pen was up (raised) prior to the PLOTR instruction, it will be lowered at the new coordinate. If the pen was down prior to the PLOTR instruction, the pen will be moved with the pen tip on the chart.

The PLOTR instruction can only be executed on a linear plot. If you are plotting logarithmically the PLOTR instruction is not processed and the error message NO PLOTR IN LOG is printed. (See Appendix F.) If you are plotting on an axis and the other axis has been specified as a log axis, the same NO PLOTR IN LOG error will be generated. Refer to the LOG instruction, page 30 for more information.

The parameters for the PLOTR instruction are the incremental values of X and Y, specified in user units.

To execute the PLOTR instruction, enter the parameters and press: CALL ALPHA 1 C

Press PI before trying this example.

PLOTR Example:

	Description
50 ENTER	Plot relative X = +50,Y = +50
CALL ALPHA 1 C	

A PLOTR can be done in a negative direction along either axis.

30 +/- ENTER	
25 CALL ALPHA 1 C	Plot Relative X = +25,Y = −30

A PLOTR can be done in a negative direction along both axes.

15 [+/-] [ENTER↑] Plot Relative X = −15,Y = −15

[CALL ALPHA] [1] [C]

The first PLOTR moved from P1 to a position 50 units up (Y) and 50 units to the right (X). The pen was up during this instruction. With P1 being (0,0), the resulting new position was (50,50).

The second PLOTR moved the pen down 30 units (Y) and to the right 25 units (X) of the previous position. The pen was down, thus drawing a line segment to the resulting new coordinate (75,20).

The third PLOTR moved the pen down 15 units (Y) and 15 units to the left (X) of the previous position. The pen was down drawing a line segment to the resulting new coordinate (60,5).

Move Instruction (MOVE)

[CALL ALPHA] [1] [D]

MOVE

Y coordinate → Y
X coordinate → X

The Move Instruction (MOVE) raises the pen and moves it to the X,Y coordinate given. The X,Y coordinate is in user units as specified by the SCALE instruction.

The pen remains up after a MOVE instruction. Therefore, if you wish to plot a line segment after a MOVE instruction you must execute a PLOTA instruction to lower the pen. The MOVE instruction allows the X,Y values to be retained in their respective registers, so following a MOVE with a PLOTA lowers the pen at that same point.

The parameters of the move instruction are the desired X,Y coordinate values specified in user units.

To execute the MOVE instruction, enter the parameters and press: CALL ALPHA 1 D

MOVE Example:

	Description
35 ENTER CALL ALPHA 1 D	Raise pen and move to X = 35,Y = 35
20 ENTER CALL ALPHA 1 D	Raise pen and move to X = 20,Y = 20
75 CALL ALPHA 1 A	Move and lower pen at X = 75,Y = 20

Pen Up Instruction (PENUP)

CALL ALPHA 1 B

PENUP

The Pen Up Instruction (PENUP) unconditionally raises the pen. This instruction is useful when plotting coordinates which should not be connected by a line segment. The PENUP raises the pen and allows either a PLOTA or PLOTR instruction to be executed without making any connecting marks on the chart.

To execute the PENUP instruction, press: CALL ALPHA 1 B

PENUP Example:

	Description
50 ENTER	
CALL ALPHA 1 A	PLOTA at X = 50,Y = 50
CALL ALPHA 1 B	Raise Pen
75 ENTER	
80 CALL ALPHA 1 A	PLOTA at X = 80,Y = 75

The pen is placed down at (50,50). Then the pen is raised before the next PLOTA instruction. The subsequent PLOTA instruction will be executed with the pen up. The pen is lowered at (80,75). Because the PENUP instruction raised the pen, no line segment was drawn between (50,50) and (80,75).

Automatic Pen Raise Instruction (APEN)

[CALL ALPHA] (1) [0] (−)

On/Off → X
(0/1)

FUNCT

The Automatic Pen Raise Instruction (APEN) raises the pen from the platen if the pen has not moved during the last 65 seconds. The APEN instruction reduces the possibility that prolonged pen contact with the paper will leave an ink blot. The APEN instruction is set "on" as a default condition.

The values for the APEN instruction are:

0	Allows the pen to raise automatically
1	Disables the automatic pen raise

To execute the APEN instruction, enter the desired value (0 or 1) and press: [CALL ALPHA] (1) [0] (−)

APEN Example:

	Description
0 [CALL ALPHA] (1) [0] (−)	Set APEN on.
1 [CALL ALPHA] (1) [0] (−)	Set APEN off.

Draw X-Axis Instruction (XAXIS)

[CALL ALPHA] (1) [G]

Start point → T
End point → Z
Tic Interval → Y
Y Intercept → X

XAXIS

The Draw X-Axis Instruction (X-AXIS) draws a solid line along the X (horizontal) axis.

The start point specifies the point at which the plotter begins drawing the X-Axis.

The end point specifies the point at which the plotter stops drawing the X-Axis.

The Tic Interval is the unit of distance between the axis dividing marks.

The Y intercept is the coordinate where the X-Axis intercepts the Y-Axis.

All of the above parameters are in user units as specified by SCALE instruction.

To execute the XAXIS instruction, enter the parameters and press: [CALL ALPHA] (1) [G]

XAXIS Example:

	Description
0 [ENTER]	Start drawing the X-Axis at X = 0
100 [ENTER]	Stop drawing the X-Axis at X = 100
1 [ENTER]	Place Tics at one-unit intervals
50 [CALL ALPHA] (1) [G]	Intercept the Y-Axis at Y = 50

NOTES

1. If a tic size other than the default value (0.5% of the distance Xmax-Xmin, 0.5% of the distance Ymax-Ymin) is desired, the TICS instruction must be executed before the XAXIS instruction. The TICS instruction can be found on page 27.

2. Automatic labeling of the X-Axis tic marks is explained under the AUTOL instruction, page 29.

3. When you press the [RUN STOP] key during the XAXIS instruction, termination will take place at the end of the current axis line segment prior to the drawing of the next tic mark.

Draw Y-Axis Instruction (YAXIS)

[CALL ALPHA] (1) [H]

YAXIS

Start point → T
End point → Z
Tic Interval → Y
X Intercept → X

The Draw Y-Axis Instruction (YAXIS) will draw a solid line along the Y (vertical) axis.

The start point specifies the point at which the plotter begins drawing the Y-Axis.

The end point specifies the point at which the plotter stops drawing the Y-Axis.

The Tic interval is the unit of distance between the axis dividing marks.

The X intercept is the coordinate where the Y-Axis intercepts the X-Axis.

All of the above parameters are in user units as specified by the SCALE instruction.

To execute the Y-Axis instruction, enter the parameters and press: [CALL ALPHA] (1) [H]

YAXIS Example:

	Description
0[ENTER]	Start drawing the Y-Axis at Y = 0.
100[ENTER]	Stop drawing the Y-Axis at Y = 100.
5[ENTER]	Place Tics at 5 unit intervals.
25[CALL ALPHA] (1) [H]	Intercept the X-Axis at X = 25.

NOTES

1. If a tic size other than the default value (0.5% of the distance of Xmax-Xmin, 0.5% of the distance Ymax-Ymin) is desired, the TICS instruction must be executed before the YAXIS instruction. The TICS instruction can be found following this instruction.

2. Automatic labeling of the Y-Axis is covered under the AUTOL instruction page 29.

3. When you press (RUN STOP) during the YAXIS instruction, termination will take place at the end of the current axis line segment prior to the drawing of the next tic mark.

Tic Length Instruction (TICS)

(CALL ALPHA) (1) (0) (7)

FUNCT
7

down & left → Y
up & right → X

The Tic Length Instruction (TICS) sets the tic length as a % of distance between max and min for a given axis.

The initialized value for tics on the X-Axis is 0.5% of Ymax-Ymin. The default value for tics on the Y-Axis is 0.5% of Xmax − Xmin.

When the TICS instruction is used, it must be executed prior to the axis instructions (XAXIS and YAXIS). Tics which extend beyond the plotting area (set by P1 and P2) are not drawn beyond the plotting area.

The parameters for the TICS instruction are:

$$0 \leq \text{value} < 128$$

The value is treated as a percentage. (5 = 5%; 1.6 = 1.6%)

To execute the TICS instruction, enter the parameters and press: (CALL ALPHA) (1) (0) (7)

TICS Example:

	Description
2 ENTER	X-Axis tics down; Y-Axis tics left set at 2%.
5 CALL ALPHA 1 . 7	X-Axis tics up; Y-Axis tics right set at 5%.

Tic length may be set to the same values in all directions depending upon the X and Y axis intercept points. If you are drawing tics which are 50% of the max – min distance and they are not drawn from the center of the chart, they will not be completely drawn.

Drawing Tics which are 100% of the max – min distance can be very useful in laying out lined charts or tables.

TICS Example:

	Description
100 CALL ALPHA 1 . 7	Draw tics up from X-Axis; right of Y-Axis at 100% of max – min distance.

Followed by XAXIS and YAXIS instruction which have the X and Y intercept at X = 0, Y = 0 will chart a grid. The number of tics is determined by the tics value specified in the XAXIS and YAXIS instruction.

NOTE

A tic will always be placed at the beginning of the axis. A tic will occur at the end of an axis only if the tic interval equals the end of the axis range.

Automatic Labeling Instruction (AUTOL)

CALL ALPHA 1 0 8

FUNCT
8

Y-Axis Frequency → Y
X-Axis Frequency → X

The Automatic Labeling Instruction (AUTOL) sets the tic labeling frequency and the tic labeling direction on each axis. This can be accomplished with the axes drawn in either the linear or logarithmic mode. The AUTOL instruction must be executed prior to the XAXIS and YAXIS instructions to label the axes automatically.

The AUTOL instruction is turned off as an initialized condition.

Since the AUTOL instruction is a labeling instruction, it can be modified by the appropriate LABEL mode instructions, as all lettering and labeling operations are. To explain the AUTOL instruction the initialized values are used. Refer to Section 3 for further labeling information.

Slant: 0 degrees. (Characters will be vertically printed.)

Mode: Characters remain relative (% of max – min) to total plotting area.

Machine Format: Numbers are labeled with 2 decimal places.

Angle: The AUTOL instruction sets the labeled tic marks at right angles to their respective axes.

NOTES

1. If the initialized values are not satisfactory, refer to LABELING (Section 3) of this manual.

2. Any changes must be executed prior to executing the XAXIS and YAXIS instructions.

The value which is entered into the appropriate register determines the frequency of labeling the tic marks. (1 labels every tic; 2 labels every other tic, etc.) $0 \leq$ Labeling Frequency ≤ 99

The sign of the value (+ or −) determines the side of the axis that the label will appear on.

+ =	Below the X-Axis	Left of the Y-Axis
− =	Above the X-Axis	Right of the Y-Axis

If you attempt to enter a labeling frequency which is greater than −1 and less than +1, the value is treated as 0. Any input of 0 as a value (including values treated as 0) will turn off the AUTOL instruction for that specified axis.

To execute the AUTOL instruction, enter the parameters and press: [CALL ALPHA] [1] [.] [8]

AUTOL Example:

	Description
3 [+/−] [ENTER]	Label every third Y-Axis tic to the right of the Y-Axis.
6 [CALL ALPHA] [1] [.] [8]	Label every sixth X-Axis tic below the X-Axis.

Then execute an XAXIS and YAXIS instruction. Both axes will be labeled automatically.

Logarithmic Plotting Instruction (LOG)

[CALL ALPHA] [1] [.] [9]

FUNCT
9

LOG Y-Axis → Y
LOG X-Axis → X

The Logarithmic Plotting Instruction (LOG) allows logarithmic plotting on either one or both axes in LOG base 10. The LOG instruction is off as an initialized condition.

The LOG instruction must be executed prior to the SCALE instruction to achieve LOG plotting. When using the LOG instruction, the SCALE instruction should be set to the minimum LOG limit to plot properly. (If you wanted to plot an axis in LOG from 1 to at least 1e6, the SCALE instruction for that axis should be from 1 to 1e6 also.)

You can label an axis plotted in LOG with the AUTOL instruction.

The values for the LOG instruction are:

0 allows linear axis plotting
1 allows logarithmic axis plotting

The LOG instruction will interact with the tic interval for axis drawing. The new parameters for the tic interval are:

1. If the tic interval is <1, the tic interval is specified as the fractional portion of the decade. (A decade from 1 to 10 with a tic interval of .2 has tic marks at 1, 2, 4, 6, 8, 10.)
2. If the tic interval is ≥1, only the integer value is used. The tic marks are placed at the beginning of each decade as specified. (A LOG plot from 1 to 1K with a tic interval of 1 has tic marks at 1, 10, 100, 1K.)

A tic mark is always placed at the beginning of the decade. This occurs without respect to Xmin and Ymin as specified in the SCALE instruction. A tic mark is placed at the end of the axis if the last tic interval equals the end of the range.

To execute the LOG instruction, enter the values and press: CALL ALPHA (1) (.) (9)

LOG Example:

	Description
0 ENTER	Plot Y-Axis in linear
1 CALL ALPHA (1) (.) (9)	Plot X-Axis in logarithmic.

To plot both axes in LOG:

1 ENTER CALL ALPHA (1) (.) (9)	Plot X and Y axes in logarithmic.

NOTES

1. The limits of the LOG instruction must be set by the SCALE instruction for proper plotting.
2. A LOG axis must begin with a non-zero positive number or a `LOG OF # <=0` error will be generated.
3. Attempting to execute a PLOTA with any negative or zero value along a logarithmic axis results in a `LOG OF # <=0` error.
4. Attempting to execute a PLOTR if either axis is logarithmic results in a `NO PLOTR IN LOG` error.

Plotting Window Limit Instruction (LIMIT)

CALL ALPHA 1 0 1

FUNCT
1

Xmin → T
Xmax → Z
Ymin → Y
Ymax → X

The Plotting Window Limit Instruction (LIMIT) sets a defined area for plotting. This area can be varied from a small percentage of the platen to the full platen area. The full platen area is the initialized condition.

The parameters for the LIMIT instruction are in user units. Xmin must be less than Xmax and Ymin must be less the Ymax.

One of the two coordinate points must be within the platen area. It is not required that the point be within the area defined by P1 and P2.

A parameter which is ≤ 0 will not be accepted if the axis is to be plotted in LOG.

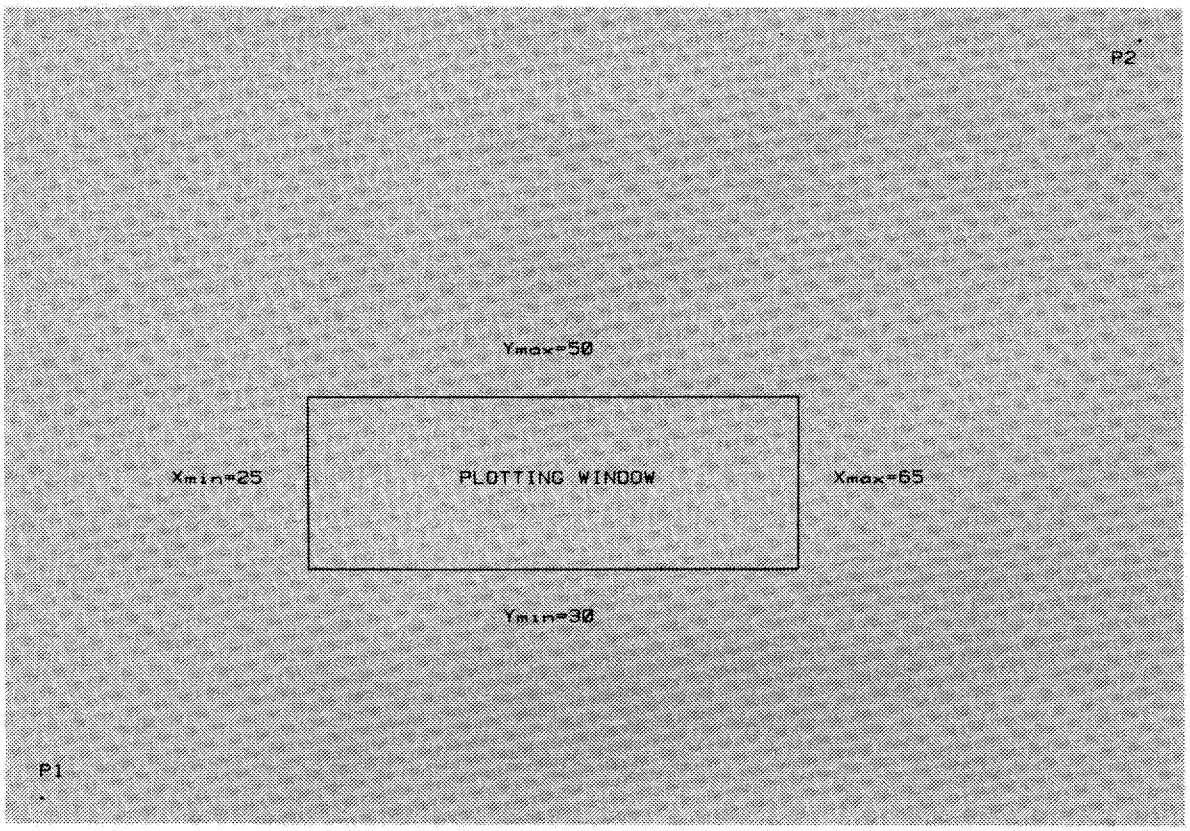
If all parameters are 0, the window is set to the initialized area (full platen).

To execute the LIMIT instruction, enter the parameters and press: CALL ALPHA 1 0 1

LIMIT Example:

	Description
25 ENTER	Window Limit Xmin = 25
65 ENTER	Window Limit Xmax = 65
30 ENTER	Window Limit Ymin = 30
50 CALL ALPHA 1 0 1	Window Limit Ymax = 50

If the initialized conditions for P1 and P2 and the SCALE are used, the resulting plotting area looks like this:



All coordinates that are within the window limits are plotted. Any coordinates which are outside the window limits are not plotted. They would be processed in the program if they did not exceed 32,767 plotter units.

NOTE

The LIMIT instruction should be executed after the XAXIS and YAXIS instructions. This allows the AUTOL instruction to label the axes without being clipped on any labels which intersect the window boundaries.

Line Type Instruction (LINE)

CALL ALPHA 1 0 2

```
FUNCT
2
```

Pattern Length → Y
Line Type → X

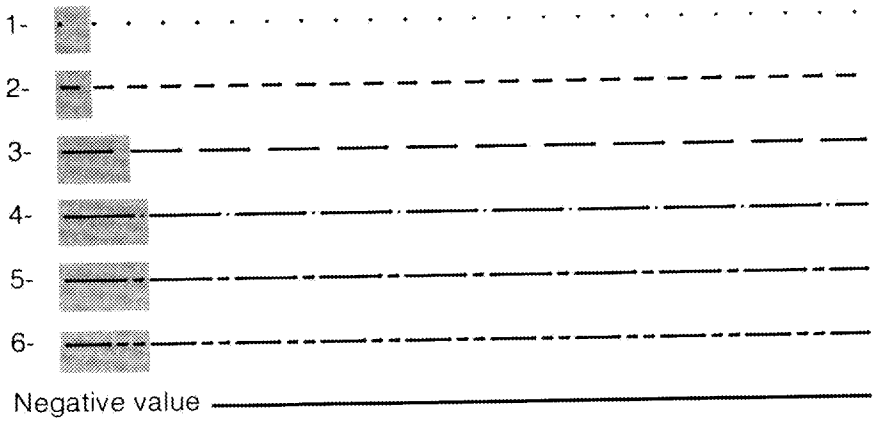
The Line Type Instruction (LINE) allows you to select the line pattern and repetition frequency of the line pattern.

The parameters of the line instruction are as follows:

$$0 \leq \text{line type} \leq 6$$

The line type value is an integer between 0 and 6. This value should be positive. A negative value sets the initialized line type (solid line). The eight combinations of line type which can be selected are shown below.

0-specifies dots only at the points that are plotted.



The pattern length specifies the repetitive pattern length as a percent of the DIAGONAL distance between P1 and P2.

Entering a 0 for length results in a `BAD PARAMETER` error.

To execute the LINE instruction, enter the parameters and press: CALL ALPHA 1 0 2

Line Example:

	Description
5 ENTER	
3 CALL ALPHA 1 0 2	Plot with line type 3 with a pattern repetition of 5% of the diagonal distance of P2−P1.

Automatic Tracking Velocity Instruction (AVEL)

CALL ALPHA 1 0 +

FUNCT
+

On/Off → X
(1/0)

The Automatic Tracking Velocity (AVEL) allows the plotter to plot data at the incoming data rate. This results in a smoother plot when the data rate changes very slowly.

The values for the AVEL instruction are:

0 disables AVEL (initialized condition)
1 enables AVEL

To execute the AVEL instruction, enter the value and press: CALL ALPHA 1 0 +

AVEL Example:

	Description
1 CALL ALPHA 1 0 +	Set pen to plot at incoming data rate.

Example Programs

These example programs demonstrate the basic plotting capabilities of the HP 9815A/9872A plotting system.

Verify that the plotter is set up according to the HP 9872A Plotter Manual (HP P/N 09872-90000).

The example programs are designed to fit on chart paper which is 11" x 17" (27.94cm x 43.18cm). Verify that the paper you are going to use is this size. If your paper is not this size, then you may find it necessary to change the SCALE and SETP instructions to avoid marking on the platen.

Example Program #1

This program demonstrates the following instructions:

INIT
SETP
SCALE
PENSL
XAXIS
YAXIS

Program #1 synopsis:

1. Draw X-axis from Xmin = 0 Xmax = 100
2. Draw Y-axis from Ymin = 0 Ymax = 20
3. X intercept is 50, Y intercept is 10
4. X tic marks every 1 unit-intervals.
5. Y tic marks every 5 unit-intervals.
6. Change pens during execution.

Enter and execute the following program:

```
0000 FUNCT
0002 *
0003 1
0004 PENSL
0006 0
0007 ENTER↑
0008 9
0009 0
0010 ENTER↑
0011 0
0012 ENTER↑
0013 9
0014 0
0015 FUNCT
0017 0
0018 0
0019 ENTER↑
0020 1
0021 0
0022 0
0023 ENTER↑
0024 0
0025 ENTER↑
0026 2
0027 0
0028 SCALE
0030 0
0031 ENTER↑
0032 1
0033 0
0034 0
0035 ENTER↑
0036 1
0037 ENTER↑
0038 1
0039 0
0040 XAXIS
```

Initializes Plotter

Select Pen #1

Set P1 (X) to 0% of full platen.

Set P1 (Y) to 0% of full platen.

Set P2 (X) to 90% of full platen. (36cm)

Set P2 (Y) to 90% of full platen. (26.65cm)

Sets rectangular area defined by P1 and P2 to 100 equal units on the X-Axis and 20 equal units on the Y-Axis

Draws X-Axis from X = 0 to X = 100

Tics every 1 user unit

Y-Axis intercept at Y = 10

```
0042 4
0043 PENSL
0045 0
0046 ENTER↑
0047 2
0048 0
0049 ENTER↑
0050 5
0051 ENTER↑
0052 5
0053 0
0054 YAXIS
0056 0
0057 PENSL
0059 END
```

Select pen #4

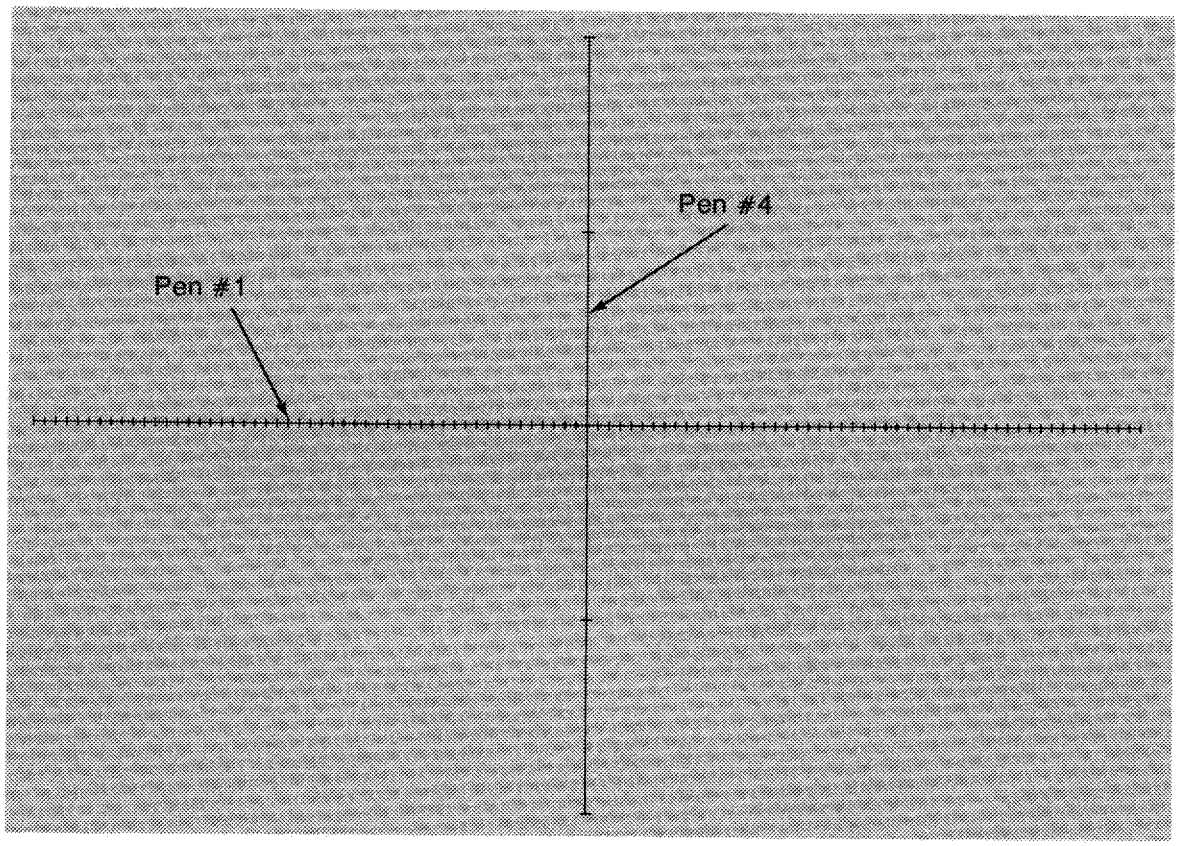
Draws Y-Axis from Y = 0 to Y = 20

Tics every 5 user units

X-Axis intercept at X = 50

Replaces pen

Ends Program



Since the APEN instruction is set as an initialized condition, the pen raises approximately 65 seconds after the program is completed. If you wish to test the APEN instruction insert the following steps after YAXIS:

```
0056 1
0057 FUNCT    Turn APEN off
0059 +
```

When the program is re-executed, the pen remains down after the 65 second time period has expired.

Example Program #2

This program demonstrates the following new instructions:

SPEED
PLOTA
PLOTR
MOVE
PENUP

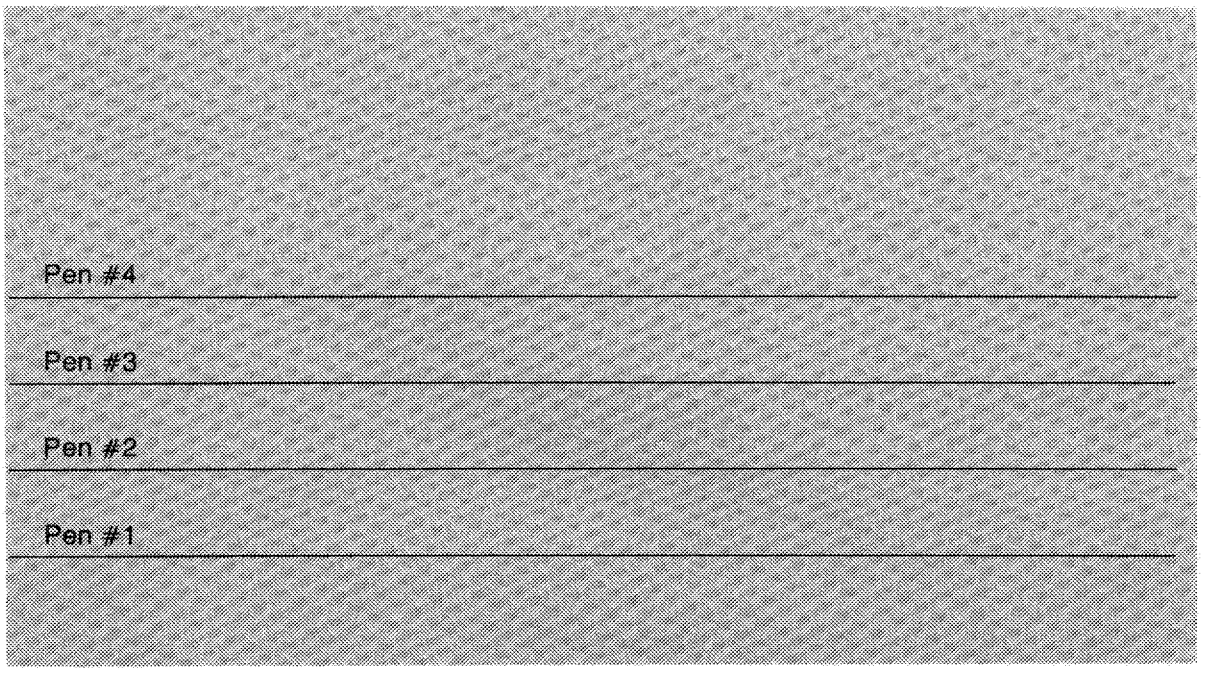
Program #2 synopsis:

1. Change pens during execution.
2. Change speeds during execution.
3. Move to a specified point.
4. PLOTA at a specified point.
5. PLOTR to a specified point.

Enter and execute the following program:

```
0000 FUNCT        } Initializes Plotter
0002 *
0003 6
0004 STO    B
0005 1
0006 STO    A     } A & F set up the test loop
0007 4
0008 STO    F
0009 FOR    A*F   Begin test
0010 RCL    A     } Select pen # depending upon the value A
0011 PENSL
0013 RCL    B     } Select pen speed depending upon the value B
0014 FUNCT
0016 4
0017 RCL    B     } PLOTA at X = 0, Y = B
0018 ENTER↑
0019 0
0020 PLOTA

0022 0            } PLOTR to X = 100, Y = B at speed set in steps 13 through 16
0023 ENTER↑
0024 1
0025 0
0026 0
0027 PLOTR
0029 PENUP        Raises the pen
0031 1            } Increments B
0032 0
0033 STO+   B
0034 NEXT   A     Repeats Loop
0035 0            } Replaces pen
0036 PENSL
0038 END          Ends Program
```



Example Program #3

This program demonstrates the following new instructions:

TICS
AUTOL
LOG
AVEL

Program #3 synopsis:

1. Draw a logarithmic X-axis from 1 to 10000.
2. Draw linear Y-axis from 0 to 100.
3. Label both axes at the specified tic interval.
4. Use the tic instruction to extend tic length across the chart.
5. Plot X = Y, with X,Y as coordinate values.
6. Plot X^2 = Y, with X,Y as coordinate values.

Enter and execute the following program:

```
0000 FUNCT      } Initializes Plotter
0002 *
0003 1          } Set AVEL on
0004 FUNCT
0006 +
0007 1          } Select Pen #1
0008 PENSL
0010 1
0011 0
0012 ENTER↑
0013 9
0014 9          Set P1(X) at 4cm
0015 ENTER↑     Set P2(X) at 39.8cm
0016 1
0017 0          Set P1(Y) at 2.5cm
0018 ENTER↑     Set P2(Y) at 25.65cm
0019 9
0020 0
0021 FUNCT
0023 0
0024 FIX    0   Set machine format at FIX 0
0026 0
0027 ENTER↑     Plot Y-Axis in LIN
0028 1
0029 FUNCT      Plot X-Axis in LOG
0031 9
0032 1
0033 ENTER↑
0034 EEX
0035 4
0036 ENTER↑     Set area from P1(X) to P2(X)
0037 1          into 1ee4 equal user units
0038 ENTER↑
0039 1          Set area from P1(Y) to P2(Y)
0040 0          into 100 equal user units
0041 0
0042 SCALE
0044 1
0045 ENTER↑     Auto-label on both axes
0046 FUNCT
0048 8
0049 0
0050 ENTER↑
0051 1          Set tics down and left to 0%.
0052 0
0053 1          Set tics up and right to 101%
0054 FUNCT
0056 7
0057 1
0058 ENTER↑
0059 EEX
0060 4          Plot X-Axis from X = 0 to
0061 ENTER↑     X = 1e4
0062 1          Tics every decade
0063 ENTER↑
0064 0          Y-Axis intercept at Y = 0
0065 XAXIS
0067 0
0068 ENTER↑
0069 1          Set tics Down and Left to 0%
0070 0
0071 0          Set tics Up and Right to
0072 FUNCT      100%
0074 7
0075 0
0076 ENTER↑
0077 1
0078 0          Plot Y-Axis from Y = 0 to
0079 0          Y = 100
0080 ENTER↑
0081 5          Tics every 5 user units
0082 ENTER↑
0083 1          X-Axis intercept at X = 1
0084 YAXIS
0086 2          } Select pen #2
0087 PENSL
0089 1
0090 STO    A
0091 1
0092 0          Sets values for Test exam-
0093 0          ples
0094 STO    F   Test 1 A & F
0095 1
0096 STO    B   Test 2 B & G
0097 1
0098 0
0099 0
0100 STO    G
0101 FOR    A→F Starts test #1
```

```
0102 RCL     A
0103 ENTER↑
0104 PLOTA
0106 NEXT    A
0107 PENUP
0109 3
0110 PENSL
0112 FOR     B÷C
0113 RCL     B
0114 ENTER↑
0115 ENTER↑
0116 *
0117 PLOTA
0119 NEXT    B
0120 0
0121 PENSL
0123 END
```

Plot X = Y

Repeat test #1

Raises the pen

Select pen #3

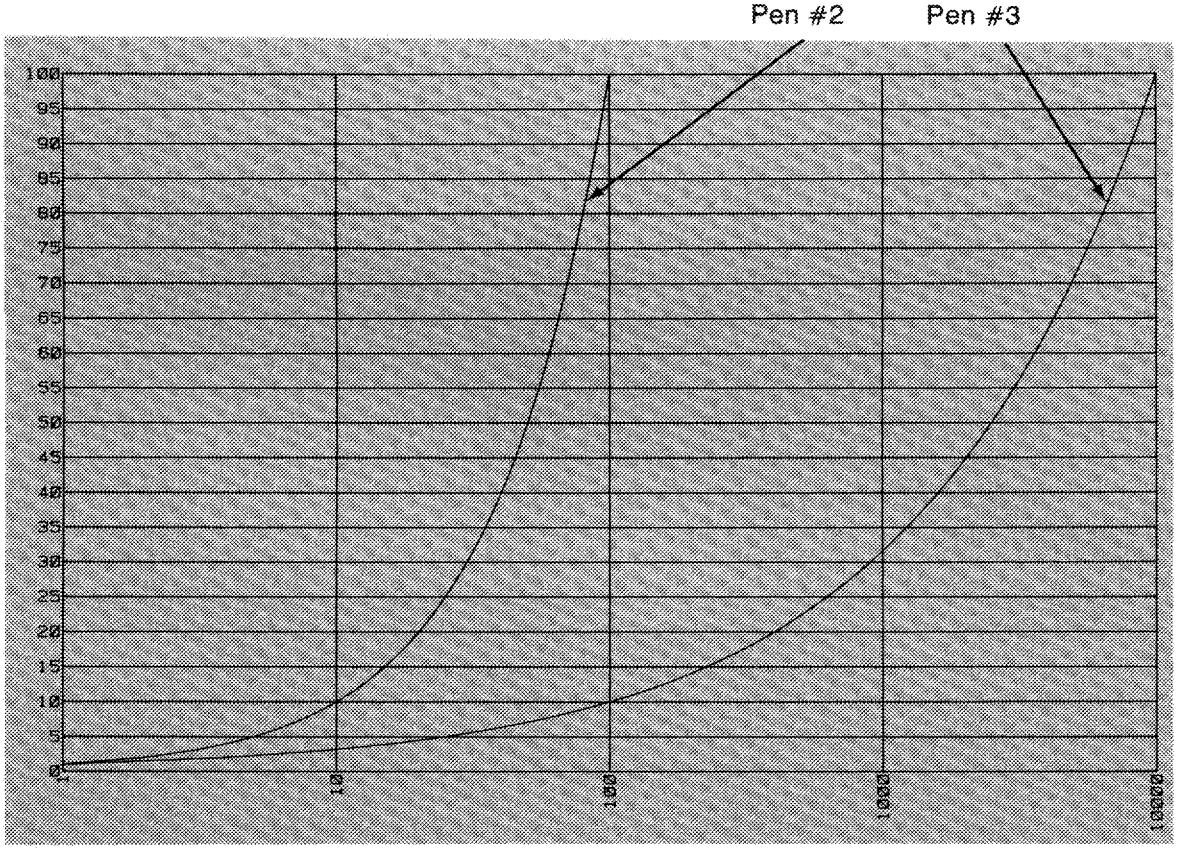
Starts test 2

Plot $X^2 = Y$

Repeat test 2

Replaces pen

Ends Program



Example Program #4

This program demonstrates the following new instructions:

LIMIT
LINE

Program #4 synopsis:

1. Draw X axis from Xmin = 0 to Xmax = 100 with tics at 5 unit intervals.
2. Draw Y axis from Ymin = 0 to Ymax = 100 with tics at 10 unit intervals.
3. Plot all the line types.
4. Establish a plotting window with Ymin = 25 and Ymax = 60.
5. Plot all the line types through the window.

Enter and execute the following program:

```
0000 FUNCT      } Initializes Plotter
0002 *
0003 1          } Select Pen #1
0004 PENSL
0006 5
0007 ENTER↑
0008 9
0009 0          Set P1(X) at 2cm
0010 ENTER↑     Set P2(X) at 36cm
0011 5          Set P1(Y) at 1.45cm
0012 ENTER↑     Set P2(Y) at 25.65cm
0013 9
0014 0
0015 FUNCT
0017 0
0018 0
0019 ENTER↑
0020 1
0021 0
0022 0
0023 ENTER↑     Set area defined by P1 and
0024 0          P2 into
0025 ENTER↑     100 equal units on both axes
0026 1
0027 0
0028 0
0029 SCALE
0031 0
```

```
0032 ENTER↑     }
0033 1          }
0034 0          }
0035 0          } Plot X-Axis from X = 0 to
0036 ENTER↑     } X = 100
0037 5          } Tics at every 5 user units
0038 ENTER↑     } Y-Axis intercept at Y = 50.
0039 5          }
0040 0          }
0041 XAXIS      }
0043 0          }
0044 ENTER↑     }
0045 1          }
0046 0          }
0047 0          } Plot Y-Axis from Y = 0 to
0048 ENTER↑     } Y = 100
0049 1          } Tics every 10 user units.
0050 0          } X-Axis intercept at X = 50
0051 ENTER↑     }
0052 5          }
0053 0          }
0054 YAXIS      }
0056 2          } Select pen #2
0057 PENSL      }
```

```
0059  3
0060  STO     B
0061  GOSUB   D
0063  0
0064  ENTER↑
0065  1
0066  0
0067  0
0068  ENTER↑
0069  2
0070  5
0071  ENTER↑
0072  6
0073  0
0074  FUNCT
0076  1
0077  3
0078  PENSL
0080  5
0081  8
0082  STO     B
0083  GOSUB   D
0085  0
0086  PENSL
0088  STOP
```

Start pattern on left side of axis

Gosub "Draw"

Set plotting window at Ymin = 25 Ymax = 60 (full X range allowed)

Select pen #3

Start pattern on right side of axis

Gosub "Draw"

Replace pen and stop

```
0089  LBL
----  D
0091  1
0092  +/-
0093  STO     A
0094  6
0095  STO     F
0096  FOR     A+F
0097  4
0098  RCL     A
0099  FUNCT
0101  2
0102  0
0103  RCL     B
0104  PLOTR
0106  1
0107  0
0108  0
0109  ENTER↑
0110  0
0111  PLOTR
0113  PENUP
0115  5
0116  STO+    B
0117  NEXT    A
0118  RETURN
0119  END
```

"Draw" subroutine

Setup FOR-NEXT loop = 1 to 6

Select line type = A

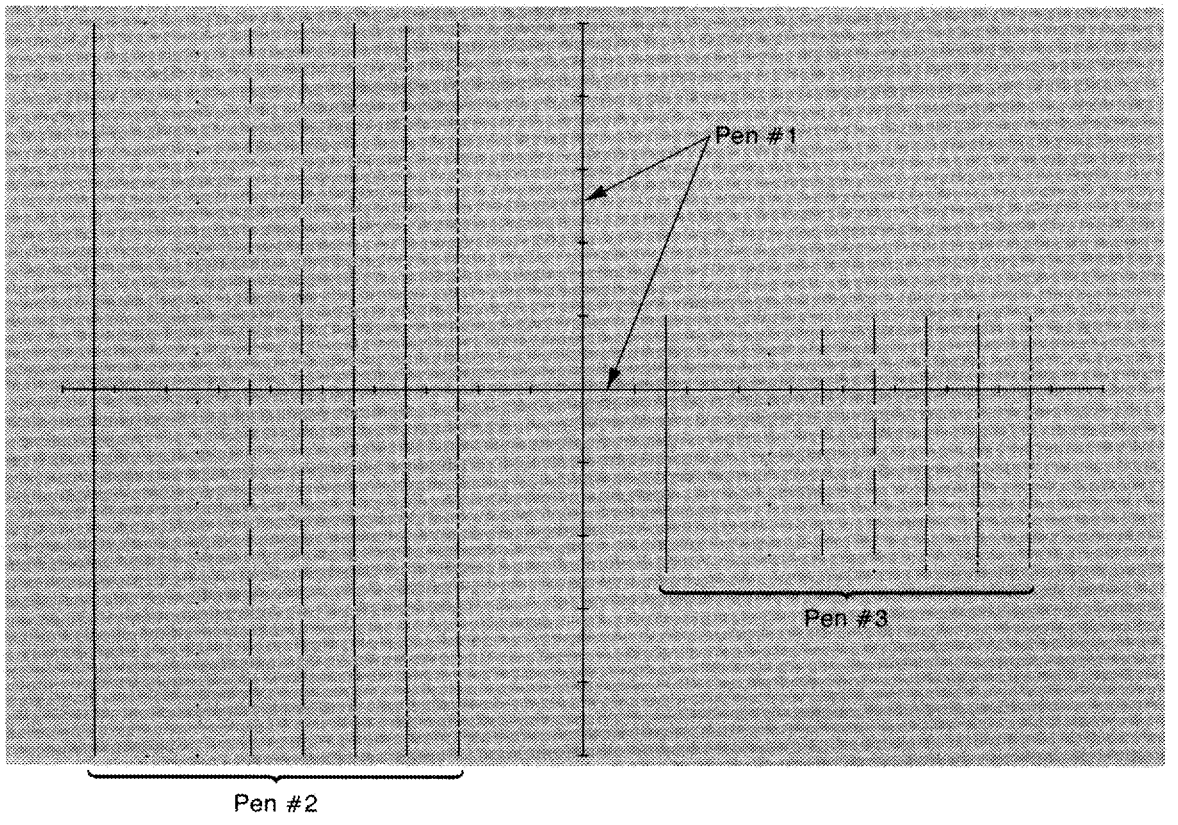
Position pen at Y = 0, X = B

Plot relative from Y = 0 to Y = 100

Raise pen

Increment B

Loop until all 8 line types are drawn


Pen #1
Pen #3
Pen #2

Notes

Chapter 3
Labeling

This section explains the instructions associated with labeling. Labeling is used to print characters on the chart.

The instructions use the same general format as the plotting instructions; enter the appropriate parameters in the stack and press the appropriate instruction key sequence.

The instructions are explained in a normal usage sequence. Example programs utilizing the instructions will be found at the end of this section.

Character Set Instruction (CHAR)

CALL ALPHA 1 0 3

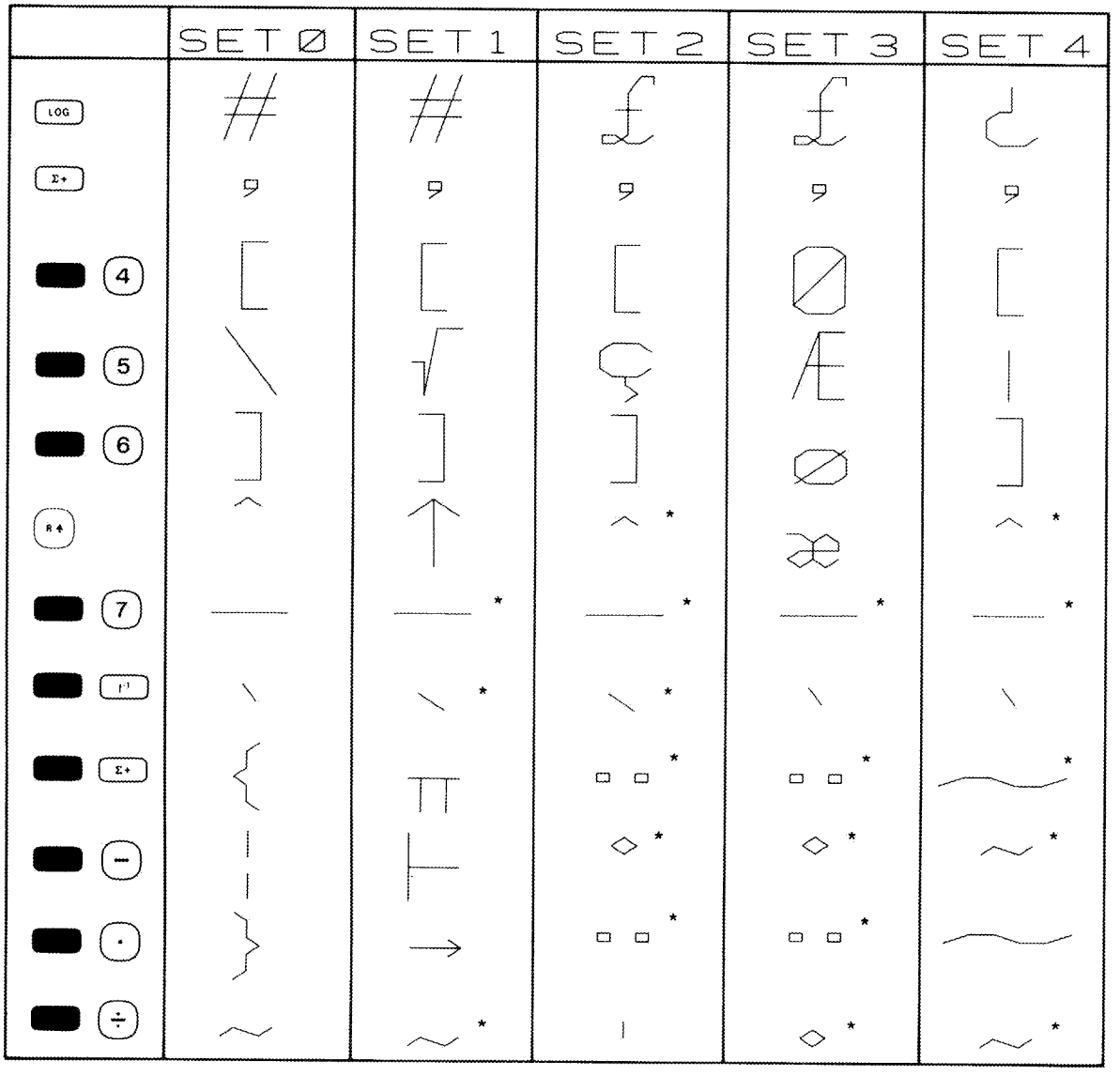
```
FUNCT
3
```

Alternate Set # ⟶ Y
Standard Set # ⟶ X

The Character Set Instruction (CHAR) allows you to select character types from 5 character sets (0 through 4). Two character sets can be retained in the plotter and selected as the standard set or the alternate set.

Each character set consists of 95 characters. 56 characters are directly accessed by pressing the desired keys when you have the plotter in the Label (Alpha) mode. The other 39 characters are accessed by pressing the shift key, followed by the desired keys when the plotter is in the Label mode.

The major differences between the various character sets can be found on the table on the next page. A complete list of all character sets can be found in Appendix C. Appendix C shows the characters contained in each set and the difference between Set 0 and the respective set.



* Automatic backspace

Character set 0 is both the standard and the alternate character set for the initialized conditions.

The character sets are selected by choosing the appropriate integer between 0 and 4, and entering it into the appropriate register.

To execute the CHAR instruction, enter the desired values and press: CALL ALPHA 1 0 3

CHAR Example:

	Description
2 [ENTER]	Character set 2 is alternate.
0 [CALL ALPHA] 1 0 3	Character set 0 is standard.

The CHAR instruction is indirectly modified by the following Label mode instructions: MODE; CSIZE; ANGLE.

Relative/Absolute Mode Instruction (MODE)

[CALL ALPHA] 1 0 .

FUNCT
.

0/1 → X
(relative/absolute)

The Relative/Absolute Mode Instruction (MODE) allows you to specify the character size and angular units as values relative to the P2-P1 distance (%) or as an absolute unit (cm or degrees, radians or grads depending upon the calculator's machine format). The values for the MODE instruction are:

0 sets the mode as a percentage of P2-P1.
1 sets the mode as an absolute value.

To execute the MODE instruction, enter the value and press: [CALL ALPHA] 1 0 .

MODE Example:

	Description
0 [CALL ALPHA] 1 0 .	Sets the ANGLE and CSIZE instructions as a % of P2-P1.
1 [CALL ALPHA] 1 0 .	Sets the ANGLE and CSIZE instructions to their absolute values. (degrees or cm)

The initialized value of the plotter is MODE 0. This allows any plots done with a smaller SETP instruction to have the LABELING automatically reduced in size.

Further explanation of how the MODE instruction interacts with the CSIZE and ANGLE instructions is covered by the respective instructions.

Character Size Instruction (CSIZE)

CALL ALPHA (1) [,]

CSIZE

Character Height → Y
Character Width → X

The Character Size Instruction (CSIZE) sets the size (height and width) of the Labeling character. This instruction is modified by the MODE instruction to be either a percentage of P2-P1 (mode 0) or an absolute value in cm. (mode 1).

The parameters for the CSIZE instruction are:

MODE = 0 Height = % of Ymax − Ymin
Width = %of Xmax − Xmin
MODE = 1 Height = absolute value in cm.
Width = absolute value in cm.

To execute the CSIZE instruction, enter the parameters and press: CALL ALPHA (1) [,]

CSIZE Example:

	Description
8 ENTER	If MODE = 0: Character height = 8% of Ymax − Ymin Character width = 4% of Xmax − Xmin
4 CALL ALPHA (1) [,]	If MODE = 1: Character height = 8cm Character width = 4cm

NOTE

The initialized values are: height = 1.5% of Ymax − Ymin; width = .75% of Xmax − Xmin.

Character Slant Instruction (SLANT)

CALL ALPHA 1 N

SLANT

Angle → X

The Character Slant Instruction (SLANT) allows you to print characters which are slanted from the vertical (0 degrees). The initialized value is set to 0 degrees. This causes the characters to be printed without any slant, just like the characters in this line of text.

Since the value of the SLANT instruction is an angular unit, the machine format (degrees, radians, and grads) will affect the angular units used in the SLANT instruction.

The parameters for the SLANT instruction are:

$$-89 \leq \text{Angle} \leq 89$$

A negative value slants the character to the left.

A positive value slants the character to the right.

To execute the SLANT instruction, enter the parameters and press: CALL ALPHA 1 N

SLANT Example:

	Description
25 CALL ALPHA 1 N	Slant the characters to the right 25°
55 +/- CALL ALPHA 1 N	Slant the characters to the left 55°

Character Labeling Angle Instruction (ANGLE)

CALL ALPHA 1 ↵

ANGLE

Angle → X

The Character Labeling Angle Instruction (ANGLE) allows you to label a line of characters at a specified angle. This is different from the preceding SLANT instruction. The SLANT instruction applies to the characters themselves, while the ANGLE instruction applies to the line of characters.

The initialized value of this instruction is 0 degrees. This means that the lines of characters go straight across your paper. Since the ANGLE instruction is in angular units, the machine format (degrees, radians, and grads) will affect the angular unit.

The parameter of the ANGLE instruction is the desired angle. The angular unit is converted to its primary value (an angle between 0 and 360 degrees). This results in two ways to achieve the same angle, as shown in the following paragraphs.

If you enter an angle of +10 degrees, the line of characters will be labeled away from the front panel controls at a 10 degree angle. If you enter an angle of +370 degrees, the line of characters will be labeled away from the front panel controls at a 10 degree angle.

If you enter an angle of −15 degrees, the line of characters will be labeled towards the front panel controls at a 15 degree angle. If you enter an angle of +345 degrees, the line of characters will be labeled towards the front panel controls at a 15 degree angle.

To execute the ANGLE instruction, enter the parameter and press: CALL ALPHA 1 ↵

ANGLE Example:

	Description
30 CALL ALPHA 1 ↵	Label the character string at +30°
15 +/− CALL ALPHA 1 ↵	Label the character string at −15°

The labeling angle for the previous examples will change if you are in the relative (percent) mode and you change the position of P1 and P2. Refer to Rubber Plotting, Section 5 for further information.

Label Instruction (LABEL)

CALL ALPHA 1 CALL ALPHA

LABEL

Field Width → Y
Data → X

The Label Instruction (LABEL) allows the plotter to label (print) characters on the plotting chart. The LABEL instruction is modified by the five previously explained instructions: CHAR, MODE, CSIZE, SLANT, and ANGLE.

The initialized values for these five modifying instructions are used in explaining this LABEL instruction. If the initialized values are not satisfactory for your particular needs, refer to the appropriate instruction so you may change the values.

The initialized values for the five instructions are as follows:

CHAR: The standard and alternate character sets are taken from Character Set 0.

MODE: Relative Mode is set. The CSIZE is fixed as a percent of P2−P1.

CSIZE: Character height is 1.5% of Ymax − Ymin distance. Character width is .75% of Xmax − Xmin distance.

SLANT: The characters are printed at 0 degrees from the vertical.

ANGLE: The character string is printed at 0 degrees from the horizontal.

The parameters for the LABEL instruction are:

Field width: This parameter is part of the LABEL instruction, but it is used with the [PRINT] key. It is used for aligning the printed X register contents. The characters can be aligned with the left side digit (left justified) or aligned with the right side digit (right justified). The field width value is an integer ≤ 255. If the number of characters in the X register is $\geq$ the field width value, the printed characters will be left justified. If the number of characters in the X register is $<$ the field width value the characters will be right justified.

Data: The data is the data which is in the X register and is being printed. The justification (left or right) is determined by the field width which was previously mentioned. The data can be printed in any machine format (Fixed, SCI, SCI 3).

To execute the LABEL instruction, press: [CALL ALPHA] [1] [CALL ALPHA]

This enables the LABEL (or alpha) mode. When you press a key which corresponds to a character, the specified character will be printed on the chart. Pressing [CALL ALPHA] while in the LABEL mode terminates the LABEL instruction.

The LABEL mode adds 12 new functions to the keyboard. The new functions are as follows:

[STEP] Advances pen 1 space[1], while the keyboard is being used to LABEL.*

[RESET BKSTEP] Backspaces pen 1 space, while the keyboard is being used to LABEL.*

[RUN STOP] Advances pen 1 space while in the Program mode.

[X≷Y] [LIST] (S) Selects the Character set which you have designated as Standard. (Tab S)

[X≷Y] [A] Selects the Character set which you have designated as Alternate. (Tab A)

* When you are in the PROGRAM mode, the [STEP] and [RESET BKSTEP] keys retain their normal editing functions.

NOTE

Once a Tab S or a Tab A is executed, the character set will remain in use unless changed or an INIT instruction is executed.

TAB 0 (x,y) (0)	Backspaces the pen 1 space. [1]
TAB 1 (x,y) (1)	Executes a carriage return (CR)[2] to the beginning of the line[3].
TAB 2 (x,y) (2)	Executes a linefeed (LF)[4]. The pen moves 1 line closer to the front panel controls on the plotter.
TAB 3 (x,y) (3)	Executes an inverse linefeed (LF^{-1}). The pen moves 1 line away from the front panel controls on the plotter.
CR-LF (ENTER)	The pen executes a combination carriage return/linefeed.
■ Followed by characters	Selects the additional 39 characters from the character set in use.

NOTE

Once the shift key is set, the shifted characters continue to be used until the shifted set is changed or the LABEL mode is ended.

The LABEL mode is operated so that all illegal keyboard entries are ignored. No error will be generated. However, if you choose an undesired key which is legal, the undesired character will be printed on the chart.

When you press the (RUN STOP) key while executing a programmed LABEL instruction, termination occurs upon completion of the next character in the alpha string.

1 SPACE: A space is equal to 3/2 character widths, as set by CSIZE.

2 CR: The CR position depends upon the origination point of the LABEL mode. Refer to the description of POSITION on the next page.

3 LINE: A line is equal to twice the character height, as set by CSIZE.

4 LF: The LF is referenced to the position of the pen at the time of execution of the LF command.

POSITION

The LABEL instruction requires a reference position for CR and LF. There are several methods which you can use to establish and update this reference position (origination point). The following four instructions will update the CR position.

1. PLOTA — If you execute a PLOTA instruction and then enter the LABEL mode, the PLOTA point will become the origination point. The disadvantages of using the PLOTA instruction are that if you do not execute a PENUP before the PLOTA and the pen is down, you draw a line segment across the chart; if the pen is up, it will be put down when the origination point is reached. This will place a mark on the chart.

2. PLOTR — If you execute a PLOTR instruction and then enter the LABEL mode, the PLOTR point will become the origination point. the disadvantages of using the PLOTR instruction are that if you do not execute a PENUP before the PLOTR and the pen is down, you draw a line segment across the chart; if the pen is up, it will be put down when the origination point is reached. This will place a mark on the chart.

3. MOVE — If you execute a MOVE instruction and then enter the LABEL mode, the MOVE point will become the origination point.

4. CURSOR CONTROL — If you use the cursor controls to move the pen and then enter the LABEL mode, the point that you moved the pen to becomes the origination point.

5. CPOSI — The CPOSI instruction is normally used to update the LF command. You can adapt this instruction to update the CR position by executing a CPOSI followed by an INPUT (Section 4) and then execute a MOVE instruction. The INPUT enters the X,Y coordinate position, which the CPOSI moved to, into the stack. The MOVE instruction uses these stack values to update the CR position.

The LF position is referenced to the position of the pen at the time of execution of a LF or LF^{-1}. It does not require an update.

LABEL Example:

	Description
[CALL ALPHA] [1] [CALL ALPHA]	LABEL from the Standard Character Set
[GO TO] [E] [LIST] [GO TO] (T S T)	LABEL "TEST"
[END]	End LABEL mode

Print X Register Instruction (PRNTX)

[CALL ALPHA] [1] [X]

PRNTX

Field Width → Y
Data → X

The Print X Register Instruction (PRNTX) allows you to print the X register contents without entering the LABEL mode. This PRNTX instruction is the equivalent of being in the LABEL mode and pressing the [PRINT] key.

The PRNTX instruction prints the XR contents based upon the machine format (FIX, SCI, SCI3). The XR contents can be printed in either left or right justified form.

The parameters for the PRNTX instruction are:

Field Width: If used for aligning the printed X register contents. The characters can be aligned with the left side digit (left justified) or aligned with the right side digit (right justified). The Field Width value is an integer ≤ 225. If the number of characters in the X register is $\geq$ the Field Width value, the printed characters will be left justified. If the number of characters in the X register is $<$ the Field Width value the characters will be right justified.

Data: The Data parameter is the data which is in the X register and is being printed. The justification (left or right) is determined by the field width which was previously mentioned. The data can be printed in any machine format (Fix, SCI, SCI 3).

To execute the PRNTX instruction, enter the parameters and press: [CALL ALPHA] [1] [x]

PRNTX Example:

	Description
15 [ENTER↑]	Field Width is set at 15 Characters
376 [CALL ALPHA] [1] [x]	Print X register contents (XR = 376)

There are 3 characters in the XR (376). The field width is set for 15 characters. Since the field width is > the data, the X register contents will be printed in right justified form.

If the machine is set for FIX 0, the value is printed as

* 376 with 12 spaces from the left hand margin (*)

If the machine is set for Fix 2, the value is printed as

* 376.00 with 9 spaces from *

If the machine is set for SCI, the value is printed as

* 3.760E+02 with 6 spaces from *

If the machine is set for SCI 3, the value is printed as

* 376.000E+00 with 4 spaces from *

As you can see, the E in SCI and SCI 3 formats, the decimal point (.) , and + and − signs all use 1 space.

Character Position Instruction (CPOSI)

CALL ALPHA 1 L

CPOSI

ΔLine → Y
ΔSpace → X

The Character Position Instruction (CPOSI) allows you to move the pen an incremental number of lines and character spaces. The pen is raised while performing the CPOSI instruction.

The parameters for the CPOSI instruction are as follows:

Line = The number of lines desired.
+ value moves the pen away from the front panel controls.
– value moves the pen towards the front panel controls.

Space = The number of spaces desired.
+ value spaces the pen (moves to the right side).
– value backspaces the pen (moves to the left side).

To execute the CPOSI instruction, enter the parameters and press: CALL ALPHA 1 L

CPOSI Example:

	Description
5 ENTER	Move incrementally 5 lines away from the front panel controls.
4 +/- CALL ALPHA 1 L	Backspace the pen 4 spaces (to the left hand side).

ASCII Symbol Labeling Instruction (SYMB)

[CALL ALPHA] [1] [0] [6]

```
FUNCT
6
```

ASCII → X
Symbol

The ASCII Symbol Labeling Instruction (SYMB) allows you to mark a specified point with an ASCII character. The character is selected from the specified character set (refer to CHAR). The character can be plotted with or without an accompanying line segment.

The parameters for the SYMB instruction are:

> The symbol is chosen by specifying the decimal equivalent value for the desired ASCII symbol. A complete listing of the available ASCII characters and their decimal values is shown on the next page.

A + value will cause the symbol to be printed without a line segment.

A – value will allow the symbol to be printed with a line segment. The line type that is used can be specified by the LINE instruction.

A decimal input between 0 and 10 will turn off the symbol mode. The symbol mode is turned off as a initialized condition.

To execute the SYMB instruction, enter the desired character's decimal value and press:

[CALL ALPHA] [1] [0] [6]

SYMB Example:

	Description
36 [CALL ALPHA] [1] [0] [6]	Print ASCII symbol "$"

Then press the desired plotting location

25 [ENTER ↑] [CALL ALPHA] [1] [A]	AT X = 25, Y = 25

The symbol $ is printed at the specified location.

ASCII Character Codes

ASCII Character	Octal Code	Decimal Code
SP	40	32
#	43	35
$	44	36
*	52	42
+	53	43
,	54	44
—	55	45
.	56	46
0	60	48
1	61	49
2	62	50
3	63	51
4	64	52
5	65	53
6	66	54
7	67	55
8	70	56
9	71	57
A	101	65
B	102	66
C	103	67
D	104	68
E	105	69
F	106	70
G	107	71
H	110	72
I	111	73
J	112	74
K	113	75
L	114	76
M	115	77
N	116	78
O	117	79
P	120	80
Q	121	81
R	122	82
S	123	83
T	124	84
U	125	85
V	126	86
W	127	87
X	130	88
Y	131	89
Z	132	90
a	141	97
b	142	98
c	143	99
d	144	100
e	145	101
f	146	102
g	147	103
h	150	104
i	151	105
j	152	106
k	153	107
l	154	108
m	155	109
n	156	110
o	157	111
p	160	112
q	161	113
r	162	114
s	163	115
t	164	116
u	165	117
v	166	118
w	167	119
x	170	120
y	171	121
z	172	122
◇	176	126

Example Program #5

Program #5 synopsis:

This example demonstrates the LABEL instruction and the 12 associated LABEL functions.

New Instructions:	New Functions:
CHAR	SPACE
LABEL	BACKSPACE
CPOSI	SHIFT
	TAB 0
	TAB 1
	TAB 2
	TAB 3
	TAB S
	TAB A
	CR-LF
	PRINT

Execute the following keystroke sequences:

CALL ALPHA 1 0 ×	Initialize plotter
1 CALL ALPHA 1 M	Select pen #1
3 ENTER↑	Character set 3 alternate
1 CALL ALPHA 1 0 3	Character set 1 standard
90 ENTER↑	
	MOVE to Y = 90, X = 0
0 CALL ALPHA 1 D	
CALL ALPHA 1 CALL ALPHA	Set LABEL MODE

You are now in the LABEL mode. The standard character set is automatically selected.

Press the following keys:

EXAMPLE KEYSTROKE SEQUENCE

A B E G H K M REWIND (Q) LIST (S) CLEAR (W) END (Z)

4 5 6 7 · ÷ − R↓ (!) (@) Σ+ (') LOG (#)

The characters which were printed are from set 1.

Now press: [STEP] The pen advances 1 space for each time the key is pressed.

[RUN STOP] Advances the pen the same as the [STEP] key.

[RESET BKSTEP] The pen back spaces for each time the key is pressed.

[ENTER] The pen executes a CR-LF for each time the key is pressed.

Now that the pen is positioned under the previously printed line, press [■] and repeat the example keystroke sequence again. The print shows the shifted characters for each key. Four of the keys ([7] [÷] [R↓] [√]) will auto-backspace to print. One key ([LOG]) will not print any shifted characters.

Press [x⇄y] [A] This selects the alternate character set.

Press [x⇄y] [0] Tab 0 The pen backspaces.

[x⇄y] [1] Tab 1 The pen executes a CR.

[x⇄y] [2] Tab 2 The pen executes a LF.

[x⇄y] [3] Tab 3 The pen executes a LF^{-1}.

Press [ENTER] This positions the pen at the start of the next line.

Press [■] This removes the shifted mode.

Now repeat the example keystroke sequence. The characters will be printed from set 3.

Press [ENTER] This positions the pen at the start of the next line.

Press [■]

Now repeat the example keystroke sequence. The shifted characters will be printed from set 3. Six keys ([7] [·] [÷] [R↓] [−] [Σ+]) will print with auto-backspace. One key ([LOG])will not print a shifted character. Press [CALL ALPHA] . This ends the label sequence.

Press 5 [ENTER] The CPOSI instruction will cause the pen to move incrementally 5 lines on the Y axis and 3 spaces on the X axis.

3 [CALL ALPHA] [1] [L]

Example Program #6

This program demonstrates the following instructions:

MODE
CSIZE

Program #6 Synopsis:

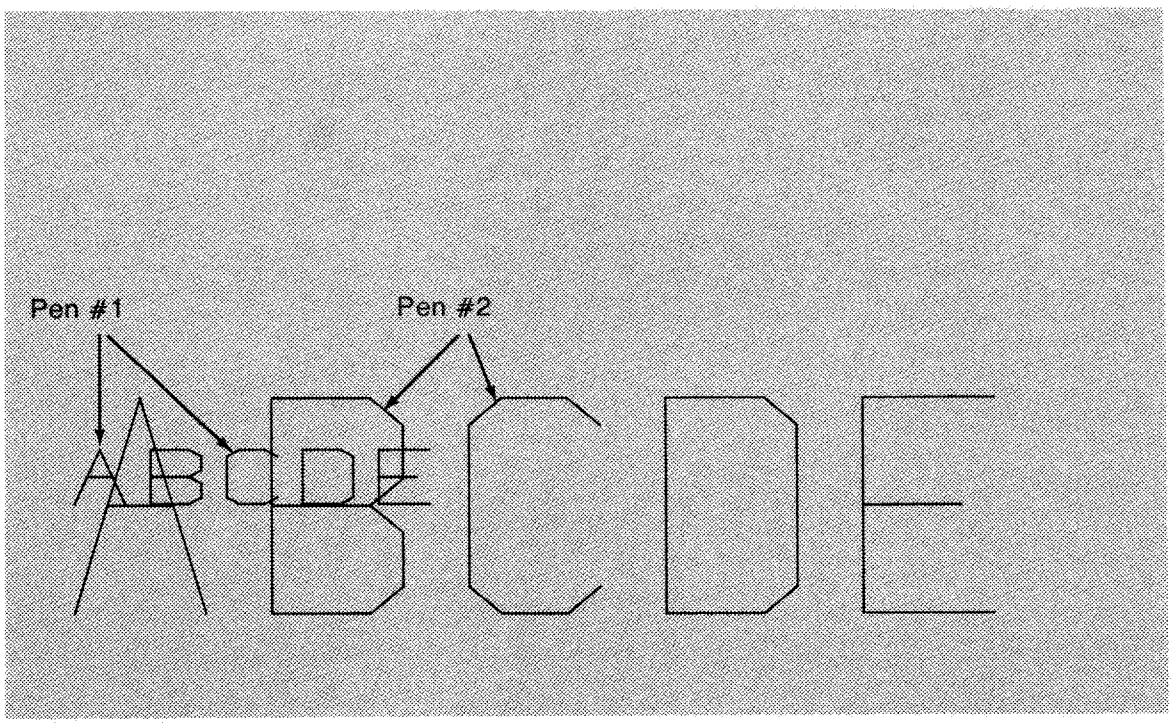
The example program:

1. Labels a character set with relative mode value CSIZE instructions.
2. Changes pens.
3. Labels a character set with absolute mode value CSIZE instructions.

Enter and execute the following program:

```
0000 FUNCT      } Initializes Plotter
0002 *          } (Default values set MODE to
                  relative)
0003 1          } Select Pen #1
0004 PENSL      }
0006 5          }
0007 0          }
0008 ENTER↑     } MOVE to X = 0, Y = 50
0009 0          }
0010 MOVE       }
0012 5          }
0013 ENTER↑     } Set CSIZE to 5% of Ymax-
0014 3          }   Ymin for height
0015 CSIZE      } 3% of Xmax - Xmin for width
0017 LABEL      }
0019 A          }
0020 B          } Enter LABEL mode
0021 C          }
0022 D          } Print Alpha Characters
0023 E          }
0024 LINE       } Execute CR-LF
0025 END∝       } End LABEL mode
0026 2          } Select pen #2
0027 PENSL      }
0029 1          }
0030 FUNCT      } Set MODE to absolute
0032 .          }
```

```
0033 5          }
0034 ENTER↑     } Set CSIZE at 5cm = height
0035 3          } 3cm = width
0036 CSIZE      }
0038 LABEL      }
0040 A          }
0041 B          } Enter LABEL mode
0042 C          }
0043 D          } Print Alpha Characters
0044 E          }
0045 END∝       } End LABEL mode
0046 0          } Replaces pen
0047 PENSL      }
0049 END        } Ends Program
```



Example Program #7

This program demonstrates the following instructions:

SLANT
ANGLE

Program #7 Synopsis

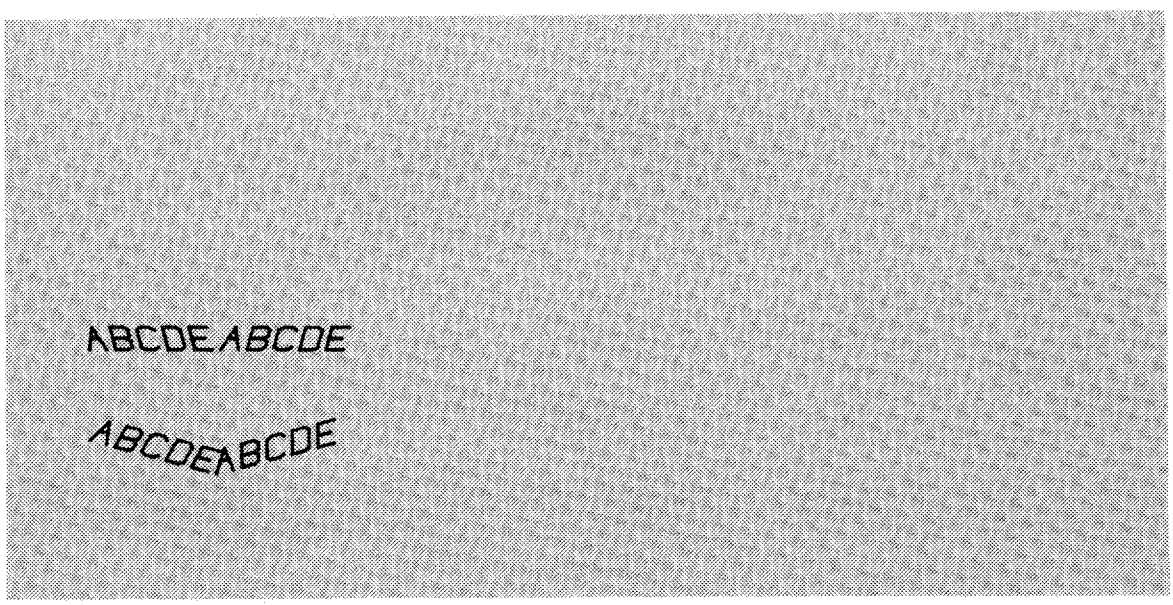
This program:

1. Labels a character string with −15° SLANT.
2. Labels a character string with +15° SLANT.
3. Labels a character string with −15° ANGLE.
4. Labels a character string with +15° ANGLE.

Enter and execute the following program:

```
0000 FUNCT   } Initializes Plotter
0002 +
0003 1       } Select Pen #1
0004 PENSL
0006 3
0007 0
0008 ENTER↑  } MOVE to X = 0, Y = 30
0009 0
0010 MOVE
0012 1
0013 5       } LABEL characters at -15° SLANT (to left)
0014 +÷-
0015 SLANT
0017 LABEL
0019 A
0020 B       } Enter LABEL mode
0021 C       } Print Alpha Characters
0022 D
0023 E
0024 END∝    } End LABEL mode
0025 1
0026 5       } Label characters at 15° SLANT (to right)
0027 SLANT
0029 LABEL
0031 A
0032 B       } Enter LABEL mode
0033 C       } Print Alpha Characters
0034 D
0035 E
0036 LINE    } Execute 2 CR-LF
0037 LINE
0038 END∝    } End LABEL mode
```

```
0039 1
0040 5       } Print Character string at -15° ANGLE (down)
0041 +÷-
0042 ANGLE
0044 LABEL
0046 A
0047 B       } Enter LABEL mode
0048 C       } Print Alpha Characters
0049 D
0050 E
0051 END∝    } End LABEL mode
0052 1
0053 5       } Print character string at 15° ANGLE (up)
0054 ANGLE
0056 LABEL
0058 A
0059 B       } Enter LABEL mode
0060 C       } Print Alpha Characters
0061 D
0062 E
0063 END∝    } End LABEL mode
0064 0       } Replaces pen
0065 PENSL
0067 END     } Ends Program
```



Example Program #8

This program demonstrates the PRNTX instruction.

Program #8 Synopsis

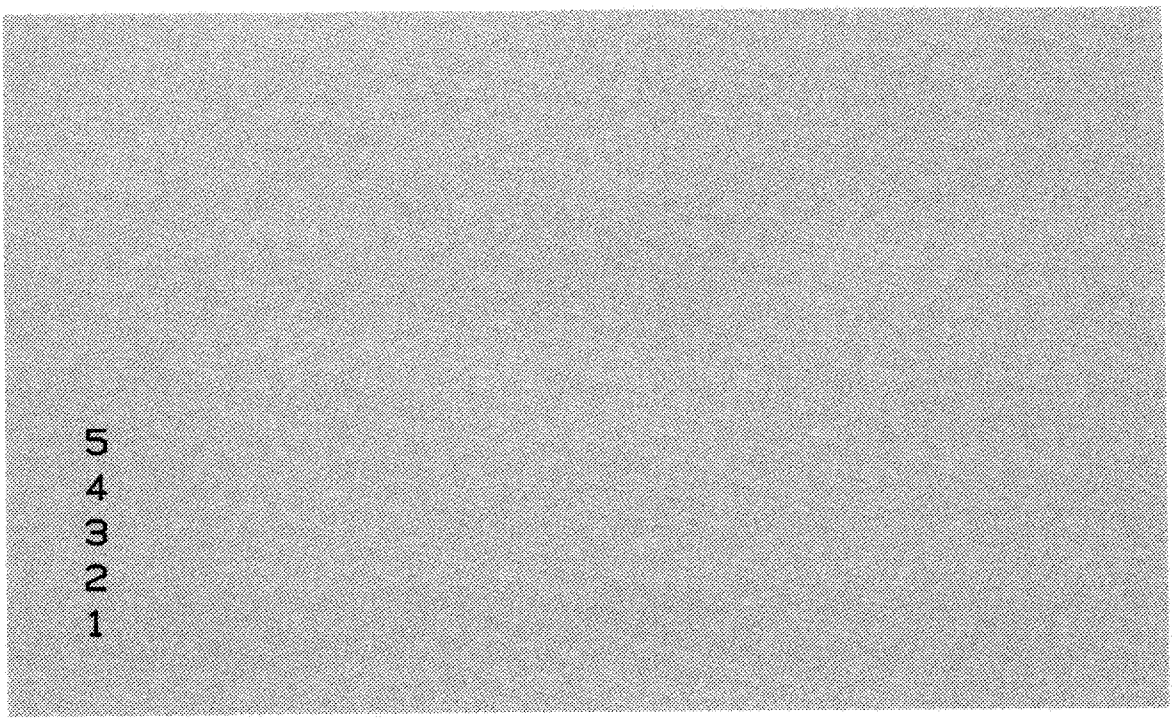
This program:

1. Prints the XR contents.
2. Executes a CR-LF^{-1}.

Press [■] [FIX] [+/-] [0] to set the printing format.

Enter and execute the following program:

```
0000 FUNCT          } Initializes Plotter
0002 *
0003 1              } Select Pen #1
0004 PENSL
0006 1
0007 STO    A       }
0008 5              } Set up test loop
0009 STO    F       }
0010 1              }
0011 0              } Move to X = 10, Y = 10
0012 ENTER↑         }
0013 MOVE           }
0015 FOR    A→F
0016 CLEAR          }
0017 RCL    A       } Print X register contents (A)
0018 LABEL          }
0020 PRINT          }
0021 TAB            }
0022 1              } Execute CR
0023 TAB            } Execute LF - 1
0024 3              }
0025 END α          End LABEL mode
0026 NEXT   A       Repeat test
0027 0              }
0028 PENSL          } Replaces pen
0030 END            Ends Program
```



Example Program #9

This program demonstrates the SYMB instruction.

Program #9 Synopsis

This program:

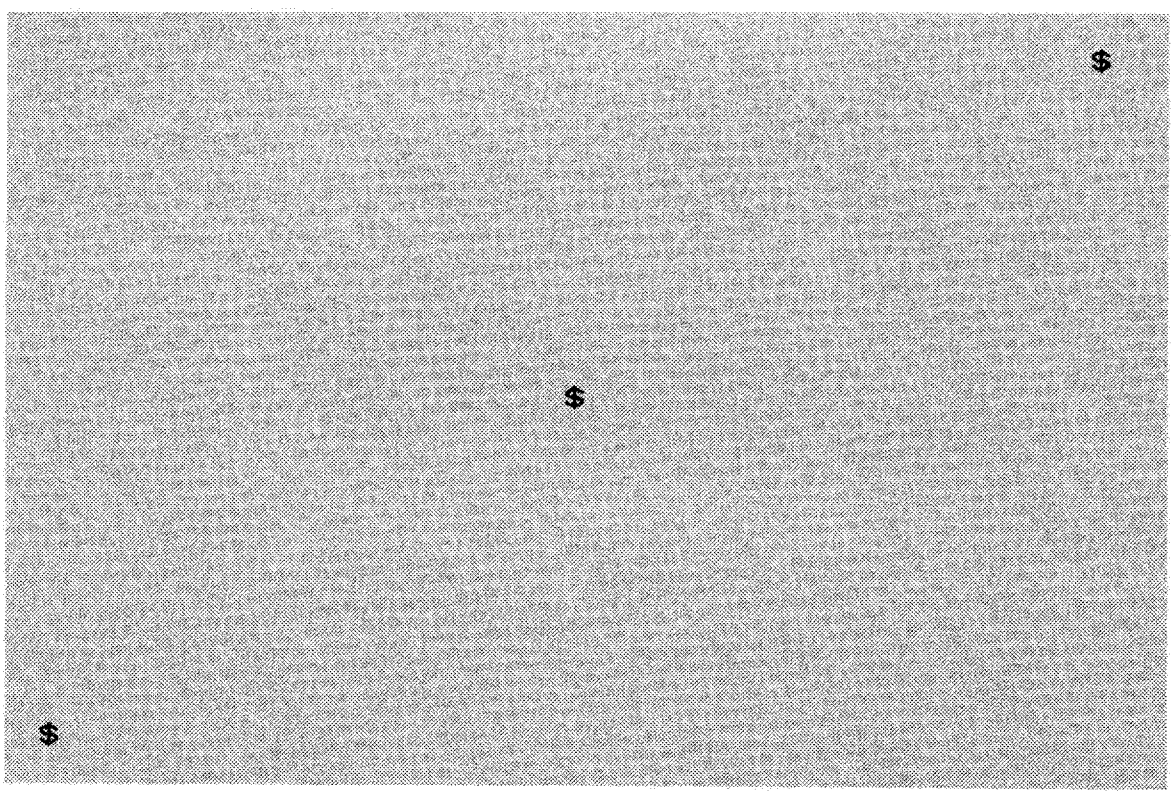
Plots an ASCII symbol ($) at the PLOTA points (25,25), (50,50) (75,75)

Enter and execute the following program:

If you insert the (+/-) key before P.C.0008, and re-execute the program, the coordinates will be connected with a line segment.

```
0000 FUNCT   } Initializes Plotter
0002 *
0003 1       } Select Pen #1
0004 PENSL
0006 3
0007 6
0008 FUNCT   } Plot with ASCII symbol $
0010 6
0011 0
0012 ENTER↑
0013 1
0014 0
0015 0
0016 ENTER↑  } Set scale for P1 and P2
0017 0         both axes are divided into
0018 ENTER↑    100 equal parts
0019 1
0020 0
0021 0
0022 SCALE
0024 2
0025 5
0026 ENTER↑  } PLOTA at X = 25, Y = 25
0027 PLOTA
```

```
0029 5
0030 0       } PLOTA at X = 50, Y = 50
0031 ENTER↑
0032 PLOTA
0034 7
0035 5       } PLOTA at X = 75, Y = 75
0036 ENTER↑
0037 PLOTA
0039 PENUP   Raises the pen
0041 0       } Replaces pen
0042 PENSL
0044 END     Ends Program
```



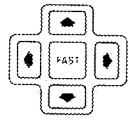
Notes

Chapter 4
Digitizing

Digitizing is the process of converting information into a numerical equivalency. The digitizing instructions for the HP 98130A Plotter Interface allow you to convert a specified point on the plotting surface into X,Y coordinates.

The digitizing process may require the use of the cursor controls and the digitizing sight.

Cursor Controls



The five Cursor Controls are used to position the pen. The pen responds vectorially to the signal from the controls.

Digitizing Sight

The digitizing sight may be used in obtaining X,Y coordinate information. The sight has a centering dot for accurate positioning.

To use the digitizing sight, load the sight into the plotter in the same manner as a pen. When you view down through the sight, the centering dot corresponds to the X,Y coordinate which will be entered into the calculator.

When you are positioning the sight with either the cursor controls or a pen movement instruction, keep the digitizing sight UP. This can be done with the PEN UP button on the plotter's front panel controls or with a PENUP instruction.

Keeping the sight up reduces the abrasive effect of the paper on the sight. When you have the sight in the approximate location where you wish to enter the coordinate values, lower the pen. This allows you to position the pen with maximum accuracy. The pen can be lowered by pressing the PEN DOWN button on the plotter's front panel controls or by executing an INPUT instruction followed by a PLOTA instruction.

Digitizing Instructions

The digitizing mode has two similar instructions:

1. Digitizer (DGTZR)
2. Input Coordinate (INPUT)

Both instructions enter the pen coordinates into the stack in user units. Both instructions move the contents of the stack up twice as shown below.

Register contents before DGTZR or INPUT instruction.		Register contents after DGTZR or INPUT instruction
4 → T	Pen Coordinates	2 → T
3 → Z	Y = 50	1 → Z
2 → Y		50 → Y
1 → X	X = 25	25 → X

Both the DGTZR and the INPUT instructions are programmable. The difference between the two instructions is that the DGTZR instruction enters the coordinate information when you press the [ENTER] button on the plotter's front panel controls. The INPUT instruction enters the coordinate information when you execute the INPUT key sequence.

Digitizer Instruction (DGTZR)

[CALL ALPHA] [1] [E]

DGTZR

Y value → Y
X value → X

The Digitizer Instruction (DGTZR) enters the X,Y coordinate of the pen into the registers when you press the [ENTER] button on the plotter's front panel controls.

The X,Y values are in user units as specified by the SCALE instruction.

To execute the DGTZR instruction, press: [CALL ALPHA] (1) [E]

Then position the pen with the cursor controls. When the pen is at the desired X,Y coordinate, press the [ENTER] button on the plotter. The X,Y coordinate values are now entered into the registers. The [ENTER] light goes out when this occurs.

The action of pressing the [ENTER] button to enter the X,Y values terminates the DGTZR instruction. If you wish to obtain more coordinate information, you must re-execute the DGTZR instruction.

When you press the [RUN STOP] key when performing a DGTZR instruction, termination occurs before the plotter coordinates are entered into the registers. The [ENTER] light is turned off and the digitizer mode is terminated.

Input Coordinate Instruction (INPUT)

[CALL ALPHA] (1) [0] (5)

```
FUNCT
5
```

Y value → Y
X value → X

The Input Coordinate Instruction (INPUT) enters the X,Y coordinate of the pen into the registers when you press the INPUT instruction key sequence.

The X,Y values are in user units as specified by the SCALE instruction.

To execute the INPUT instruction position the pen with the cursor controls to the desired location. Then press: [CALL ALPHA] (1) [0] (5)

The X,Y coordinate values are now entered into the stack.

Example Program #10

Program #10 Synopsis

This program demonstrates the digitizing mode and the DGTZR instruction.

The first program draws a reference figure.

Enter and execute the following program:

```
0000 FUNCT      } Initializes Plotter
0002 *
0003 1          } Select Pen #1
0004 PENSL
0006 2          }
0007 5          }
0008 ENTER↑     } PLOTA at X = 25, Y = 25
0009 PLOTA      }
0011 5          }
0012 0          }
0013 ENTER↑     } PLOTR to X = 25, Y = 75
0014 0          }
0015 PLOTR      }
0017 X⇌Y        }
0018 PLOTR      } PLOTR to X = 75, Y = 75
0020 5          }
0021 0          }
0022 +⇌-        }
0023 ENTER↑     } PLOTR to X = 75, Y = 25
0024 0          }
0025 PLOTR      }
0027 X⇌Y        }
0028 PLOTR      } PLOTR to X = 25, Y = 25
0030 0          }
0031 PENSL      } Replaces pen
0033 END          Ends Program
```

NOTE

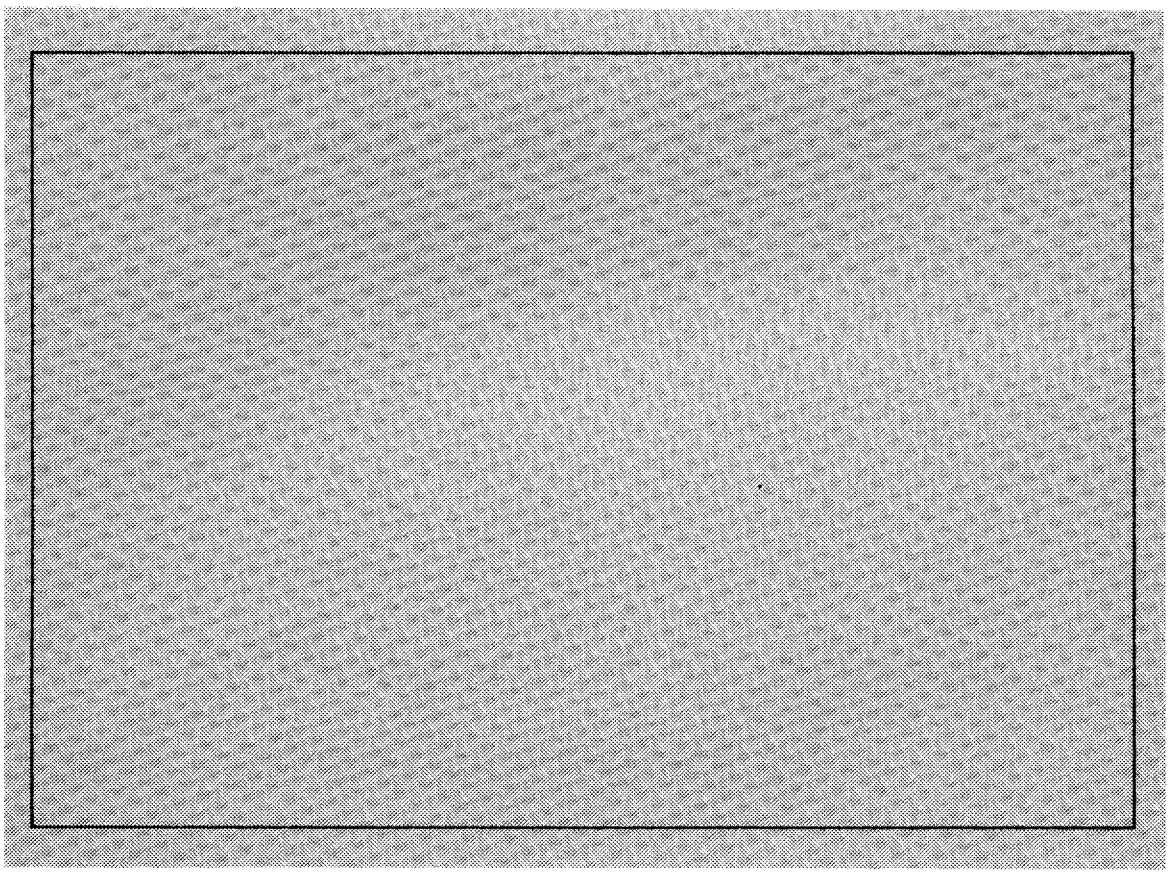
The next program requires that the digitizing sight be loaded in pen stall #1.

Example Program #11

Program #11 Synopsis

When digitizing a simple figure, such as this example, only the corner coordinates need be entered. This is because the corners correspond to the points where the direction changes.

Digitizing more complex figures requires increased sample frequency to increase the accuracy of the data. This would require using more registers for storage. Refer to the HP 9815A Calculator Operating and Programming Manual (HP P/N 09815-90000), Section 2 for further information about register storage.



The first half of the program requires you to position the sight and press the [ENTER] button whenever the [ENTER] is lit.

After entering the 4 coordinate values, press [RUN/STOP]. The remainder of the program will redraw the figure based upon the coordinate values which were entered.

Enter and execute the following program:

```
0000 FUNCT      } Initializes Plotter
0002 *
0003 1          } Select Pen #1
0004 PENSL
0006 0          }
0007 ENTER↑     }
0008 1          }
0009 0          }
0010 0          } Set X-Axis into
0011 ENTER↑     } 100 equal units
0012 0          }
0013 ENTER↑     } Set Y-Axis into
0014 1          } 100 equal units
0015 0          }
0016 0          }
0017 SCALE      }
0019 DGTZR      Enter corner coordinates
0021 STO    A   }
0022 X≷Y        } Store in A,B
0023 STO    B   }
0024 DGTZR      Enter corner coordinates
0026 STO    C   }
0027 X≷Y        } Store in C,D
0028 STO    D   }
0029 DGTZR      Enter corner coordinates
0031 STO    E   }
0032 X≷Y        } Store in E,F
0033 STO    F   }
0034 DGTZR      Enter corner coordinates
0036 STO    G   }
0037 X≷Y        } Store in G,H
0038 STO    H   }
0039 STOP       Stop program. Press RUN to
                start.

0040 2          } Select pen #2
0041 PENSL      }
0043 RCL    B   }
0044 RCL    A   } PLOTA to A,B values
0045 PLOTA      }
0047 RCL    D   }
0048 RCL    C   } PLOTA to C,D values
0049 PLOTA      }
0051 RCL    F   }
0052 RCL    E   } PLOTA to E,F values
0053 PLOTA      }
0055 RCL    H   }
0056 RCL    G   } PLOTA to G,H values
0057 PLOTA      }
0059 RCL    B   }
0060 RCL    A   } PLOTA to A,B values
0061 PLOTA      }
0063 0          }
0064 PENSL      } Replaces pen
0066 END        Ends Program
```

Example Program #12

This program demonstrates the use of the INPUT instruction.

Enter and execute the following program:

```
0000 FUNCT   } Initializes Plotter
0002 *
0003 1       } Select Pen #1
0004 PENSL
0006 2       }
0007 5       }
0008 ENTER↑  } PLOTA at X = 25, Y = 25
0009 PLOTA   }
0011 5       }
0012 0       }
0013 ENTER↑  } PLOTR to X = 25, Y = 75
0014 0       }
0015 PLOTR   }
0017 X≷Y     } PLOTR to X = 75, Y = 75
0018 PLOTR   }
0020 5       }
0021 0       }
0022 +≷-     }
0023 ENTER↑  } PLOTR to X = 75, Y = 25
0024 0       }
0025 PLOTR   }
0027 X≷Y     } PLOTR to X = 25, Y = 25
0028 PLOTR   }
0030 0       } Replaces pen
0031 PENSL   }
0033 END     Ends Program
```

This will draw a reference figure on the chart.

Use the cursor controls to position the digitizer sight over any portion of the rectangular line.

Press: [CALL ALPHA] [1] [0] [5] [■] [PRINT]

The X,Y coordinates will appear as follows:

Y coordinate ⟶ Y
X coordinate ⟶ X

Leave the pen at its present location. Execute this SCALE instruction:

0 [ENTER ↑]
1000 [ENTER ↑]
0 [ENTER ↑]
50 [CALL ALPHA] [1] [F]

Now press: [CALL ALPHA] [1] [0] [5] [■] [PRINT]

The X,Y coordinates are now printed, converted to the new SCALE parameters.

Notes

Chapter 5
Advanced Plotting

This section is provided to assist you in maximizing the performance of your plotter. While all of you may not require the programs which are contained in this section, it is hoped that this section provides you with new insights and applications for your plotter, as well as offering some solutions to any new problem areas.

Compacting The Program

It is possible to save some program steps by utilizing the design parameters of the plotter. The initialized conditions should be adequate for most plotting applications, but if you need to use other values the following information may save some space in your programs.

It has been previously mentioned that the LOG, AVEL, APEN, and MODE instructions required a value of a "1" to be entered when selecting that particular instruction. All the interface requires is that the value be a non-zero number. Therefore, a program which looks like this:

```
0000 1
0001 FUNCT
0002 9
0004 1
0005 FUNCT
0007 +
0008 1
0009 FUNCT
0011 -
0012 1
0013 FUNCT
0015 .
```

could be rewritten like this:

```
0000 2
0001 FUNCT
0003 9
0004 FUNCT
0006 +
0007 FUNCT
0009 -
0010 FUNCT
0012 .
```

and still be executed correctly.

Another method of compacting your program concerns using repeated values. It was mentioned earlier in the manual that the stack registers retain their contents. This allows programs to be written which use the same stack contents for more than one instruction. A program like this:

```
0000 0
0001 ENTER↑
0002 1
0003 0
0004 0
0005 ENTER↑
0006 0
0007 ENTER↑
0008 1
0009 0
0010 0
0011 SCALE
```

```
0013 0
0014 ENTER↑
0015 1
0016 0
0017 0
0018 ENTER↑
0019 5
0020 ENTER↑
0021 5
0022 0
0023 XAXIS
0025 0
0026 ENTER↑
0027 1
0028 0
0029 0
0030 ENTER↑
0031 5
0032 ENTER↑
0033 5
0034 0
0035 YAXIS
```

can be rewritten like this:

```
0000 0
0001 ENTER↑
0002 1
0003 0
0004 0
0005 ENTER↑
0006 0
0007 ENTER↑
0008 1
0009 0
0010 0
0011 SCALE
0013 ENTER↑
0014 5
0015 ENTER↑
0016 5
0017 0
0018 XAXIS
0020 YAXIS
```

and still be executed correctly.

Perspective Plotting

Plotting in a perspective plane can be accomplished by moving and setting P1 and P2 while keeping the same scale values.

The example program shown below demonstrates plotting a function $Y = \sin^2 X$ (when sinX is positive) and Y = 0 (when the sinX is negative) with single point perspective. In single point perspective, the plot focuses upon a single convergent point.

This is accomplished by moving P1 and P2 a fixed distance each time. P1 is comprised of the variables G and I. G provides the Xmin value and I provides the Ymin value. P2 is comprised of the variable J and the fixed value 95. J is the Xmax value and Ymax is kept at 95.

The variables B and E are used to update G, J, and I. B and E are updated as well. This allows you to keep everything expressed as a percentage of the previously set P1 and P2 positions.

```
0000 FUNCT      } Initializes Plotter
0002 *          }
0003 0          }
0004 ENTER↑     }
0005 1          } Set pen speed to 10cm
0006 0          }
0007 FUNCT      }
0009 4          }
0010 1          } Select Pen #1
0011 PENSL      }
0013 0          }
0014 STO    C   }
0015 1          }
0016 1          }
0017 0          } Set test loop to
0018 STO    H   } start plotting
0019 2          } positions.
0020 0          }
0021 STO    D   }
0022 FOR    C↑HD}
0023 0          }
0024 RCL    C   } PLOTA at (0,0) (20,0)
0025 PLOTA      } (40,0)(60,0) (80,0) (100,0)
0027 9          }
0028 5          }
0029 ENTER↑     }
0030 7          } PLOTA to (75,95)
0031 5          }
0032 PLOTA      }
0034 PENUP      } Raises the pen
0036 NEXT   C   } Repeat test loop.
0037 DEGS       } Set machine to degrees
0038 2          } Select pen #2
0039 PENSL      }

0041 0          }
0042 STO    A   }
0043 STO    G   }
0044 STO    I   }
0045 2          }
0046 9          }
0047 STO    F   }
0048 1          }
0049 0          }
0050 0          }
0051 STO    J   }
0052 9          } Input values
0053 0          }
0054 5          }
0055 STO    H   }
0056 1          }
0057 0          }
0058 STO    D   }
0059 .          }
0060 1          }
0061 STO    E   }
0062 STO    B   }
0063 FOR    A↑F }
0064 RCL    G   }
0065 RCL    J   }
0066 RCL    I   }
0067 9          } Set P1 and P2. (Xmin = G,
0068 5          } Xmax = J,      Ymin = I,
0069 FUNCT      } Ymax = 95)
0071 0          }
0072 0          }
0073 ENTER↑     }
```

```
0074  9
0075  0
0076  0
0077  ENTER↑
0078  0
0079  ENTER↑
0080  1
0081  0
0082  SCALE
0084  0
0085  STO     C
0086  FOR     C→HD
0087  RCL     C
0088  ENTER↑
0089  SIN
0090  IF  -
0091  GOTO    0096
0093  X≠Y
0094  PLOTA
0096  NEXT    C
0097  PENUP
0099  9
0100  5
0101  RCL     E
0102  *
0103  STO     I
```

Scale X from 0 to 900, Y from 0 to 10

Generate number from 0 to 905, by units of 5.

PLOTA at C x sinC

Repeat this loop 40 times

Raises the pen

Update I (Ymin)

```
0104  7
0105  5
0106  RCL     E
0107  *
0108  STO     G
0109  1
0110  0
0111  0
0112  ENTER↑
0113  2
0114  5
0115  RCL     E
0116  *
0117  -
0118  STO     J
0119  RCL     B
0120  .
0121  9
0122  *
0123  STO     B
0124  STO+    E
0125  NEXT    A
0126  PENUP
0128  0
0129  PENSL
0131  END
```

Update G (Xmin)

Update J (Xmax)

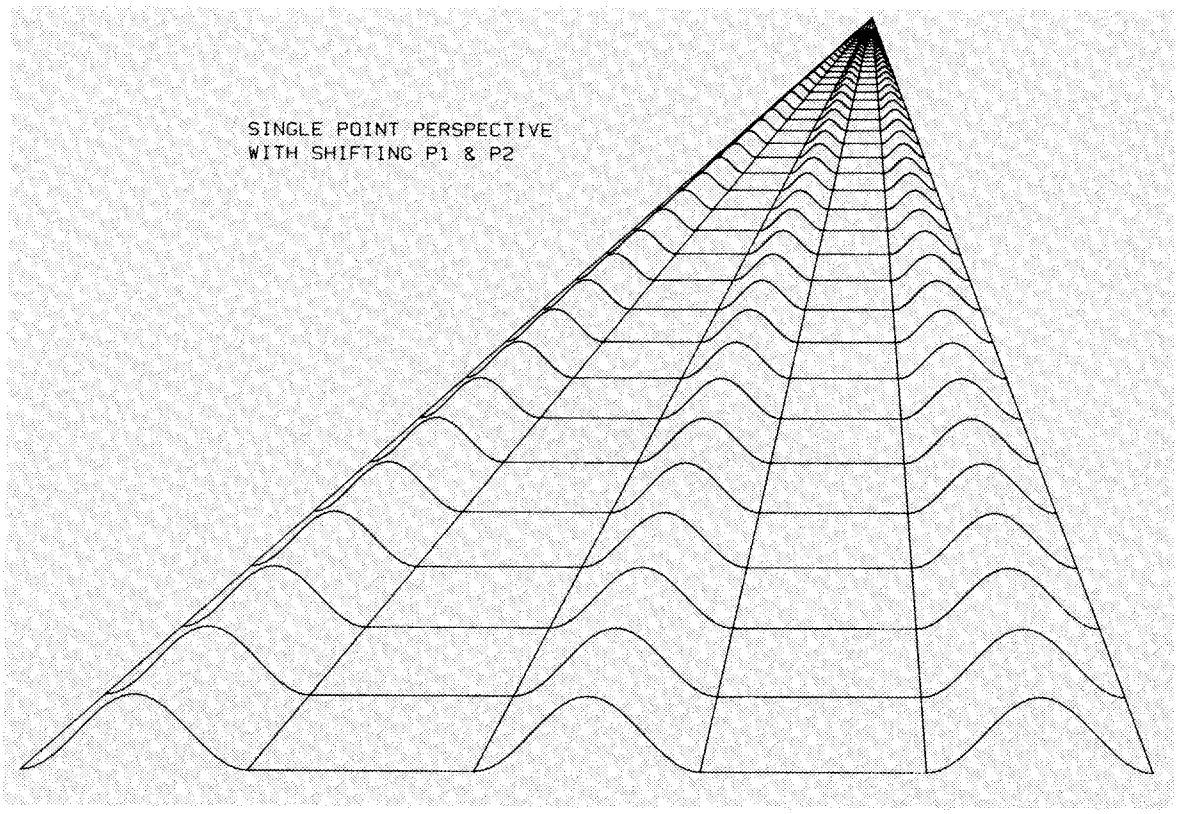
Update B,E

Set loop to run 40 times

Raises the pen

Replaces pen

Ends Program



Rubber Plotting

The last of our advanced plotting concepts is rubber plotting. This is a graphic representation of rubber sheet geometry.

Rubber sheet geometry can best be described by imagining a plot or a chart which is drawn on a piece of rubber. Whenever you pull or stretch the sheet, the plot changes and stretches proportionately. The repositioning of P1 and P2 before re-executing a program results in a rubber plot.

The examples for the rubber plots use the Dynamic Performance Test. This test can be found on the Utility and Test Cartridge (HP P/N 09815-10004, revision K, or subsequent revisions).

CAUTION

VERIFY THAT YOUR UTILITY AND TEST CARTRIDGE IS RECORD PROTECTED BEFORE RUNNING THESE EXAMPLE PROGRAMS. THIS WILL PREVENT THE RECORDING OF UNDESIRED DATA OVER YOUR UTILITY AND TEST PROGRAMS.

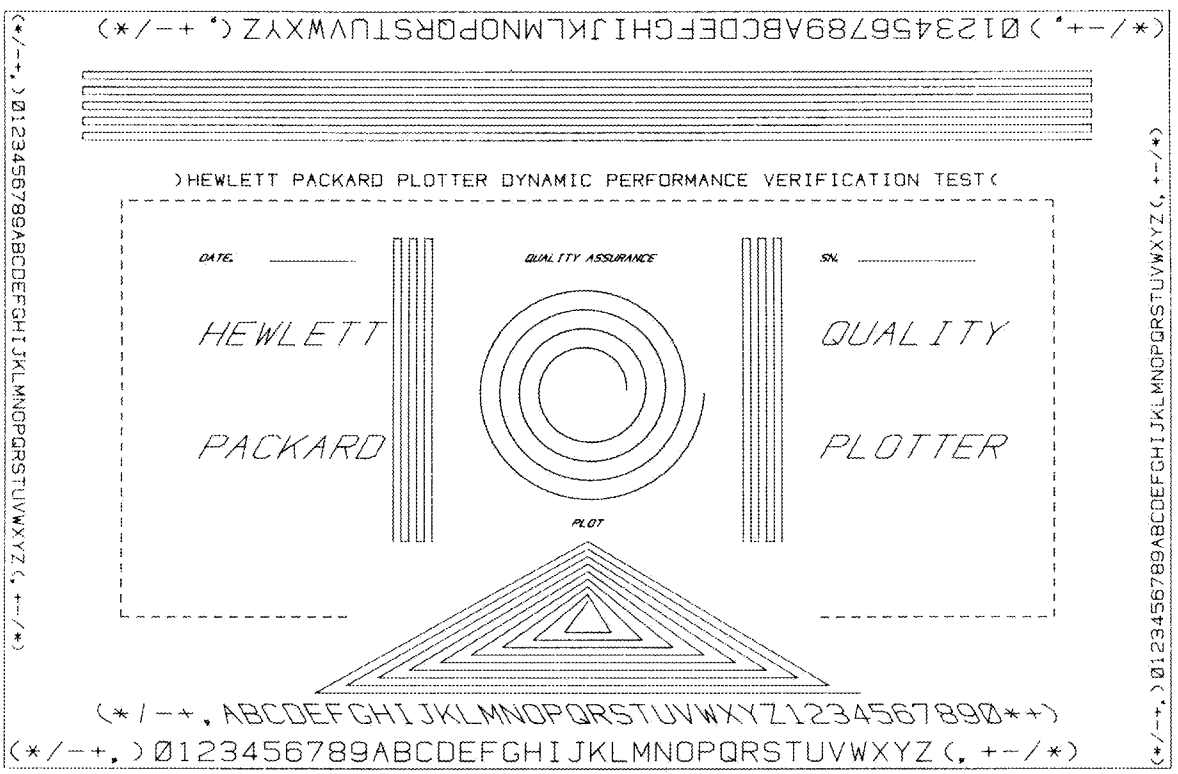
Load File −27 into the calculator. Before running the program, insert the following steps into the program.

```
0003 2
0004 5
0005 ENTER↑
0006 7
0007 5
0008 ENTER↑
0009 2
0010 5
0011 ENTER↑
0012 7
0013 5
0014 FUNCT
0016 0
```

This sets P1 and P2 to an area which is approximately half of the full platen plotting area. P1 = (25,25) P2 = (75,75)

Press (END) (RUN STOP). The Dynamic Performance Test is plotted below . This effectively reduces the physical size of your plot without changing the SCALE instruction.

Naturally, if you start with a small plot and move P1 and P2 so a larger plotting rectangle is obtained, the resulting plot is blown-up in size. You should notice that the SCALE instruction concerns the relationship of points in the plot to each other, rather than determining the absolute size of the plot.

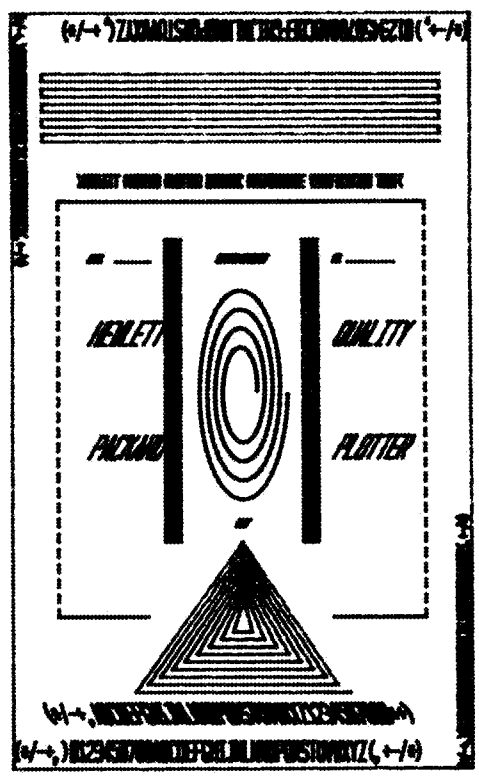


When this plot is finished, reload file –27 and insert the following steps.

```
0003 2
0004 5
0005 ENTER↑
0006 4
0007 0
0008 ENTER↑
0009 2
0010 5
0011 ENTER↑
0012 6
0013 0
0014 FUNCT
0016 0
```

Press (END) (RUN STOP)

In this example the P1 and P2 positions are placed so that they no longer form the original rectangular plotting area. This will result in the following plot.



As you can see, the labeling is at a point where some of the characters are illegible. The LABEL instruction references its characters to P1 and P2 in the relative MODE. Any change in P1 and P2 changes the character size unless the machine is set for the absolute MODE. In the absolute MODE, the characters would be plotted at their specified size. The relative MODE does allow the plot to be done with the characters automatically compensated for any change in P1 and P2. You particular requirement may necessitate a rubber plot for the data with any labeling done in the absolute MODE. This means that you may have to compute the new size of your characters.

The last rubber plot example also demontrates the possible interference between a rubber plot and the LABEL characters.

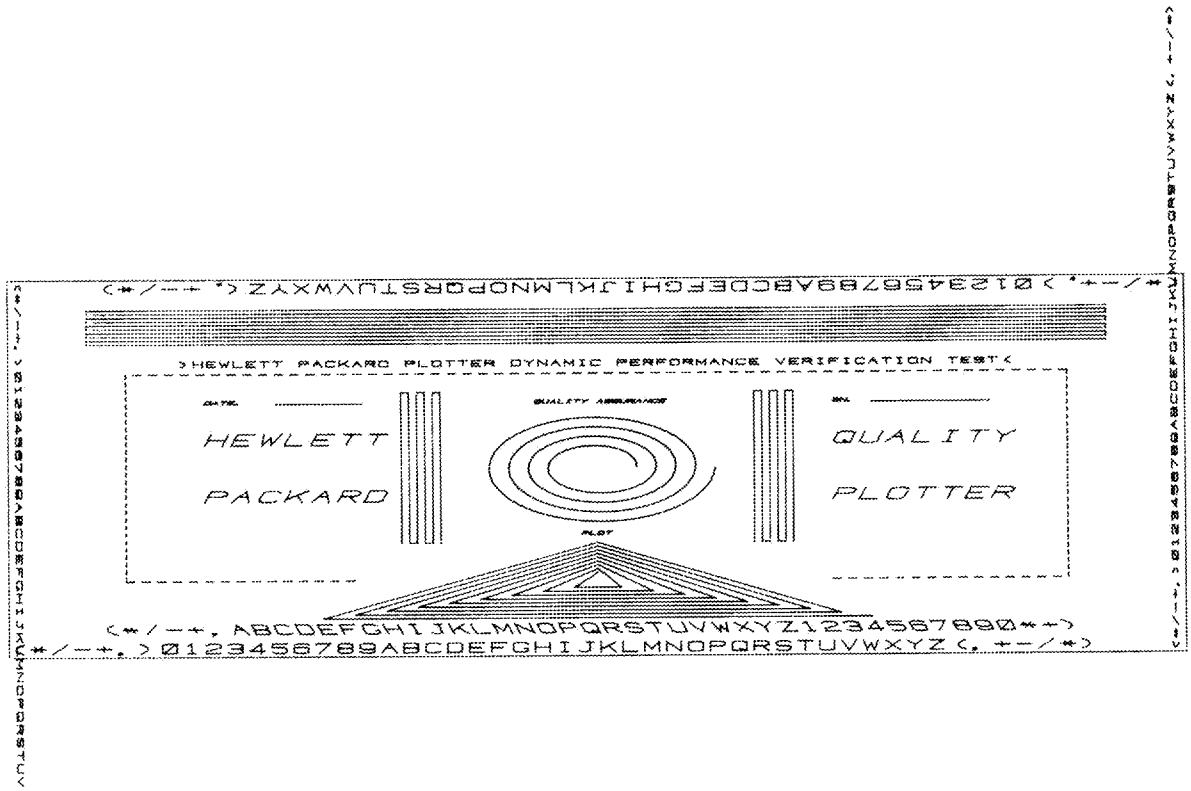
Reload file −27 into the calculator. Insert the following steps into the program.

```
0003 0
0004 ENTER↑
0005 8
0006 0
0007 ENTER↑
0008 1
0009 2
0010 .
0011 5
0012 ENTER↑
0013 4
0014 9
0015 FUNCT
0017 0
```

This example moves P1 and P2 into a rectangle which is very long on the X-axis and fairly short on the Y-axis.

Press (END) (RUN STOP)

The resulting plot looks like this:



Here you can see how the character width is determined from the Xmax to Xmin distance. The characters must occupy their specified width even if this results in their exceeding the P1 and P2 boundaries. If you had used a LIMIT instruction to set up a plotting window, the characters would not be printed when they exceed the window boundary.

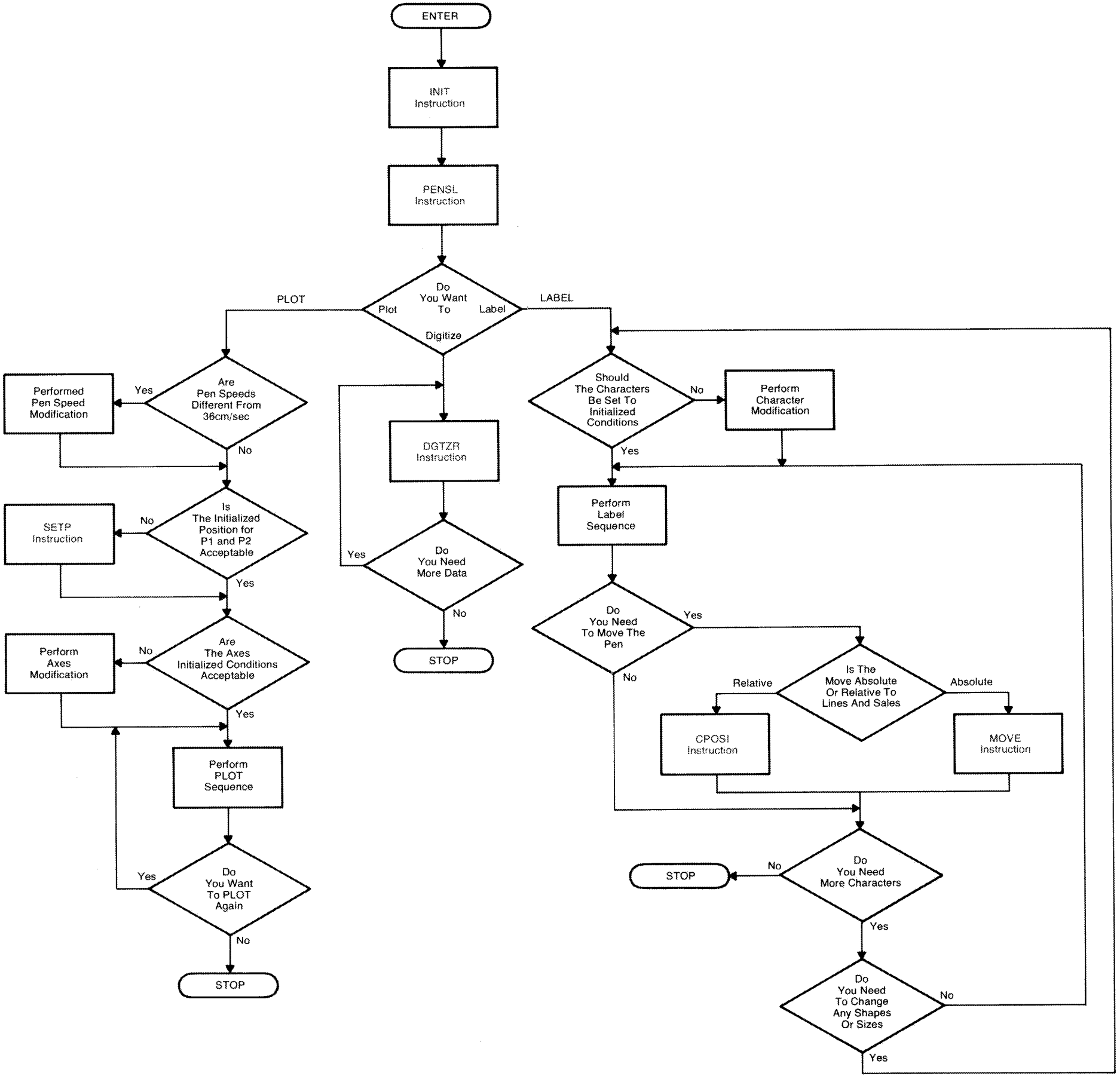
The shape of items which are plotted change with P1 and P2. In both of the last two examples the circular spiral has been changed to an elipse because P1 and P2 were moved.

Instruction Set Flowchart

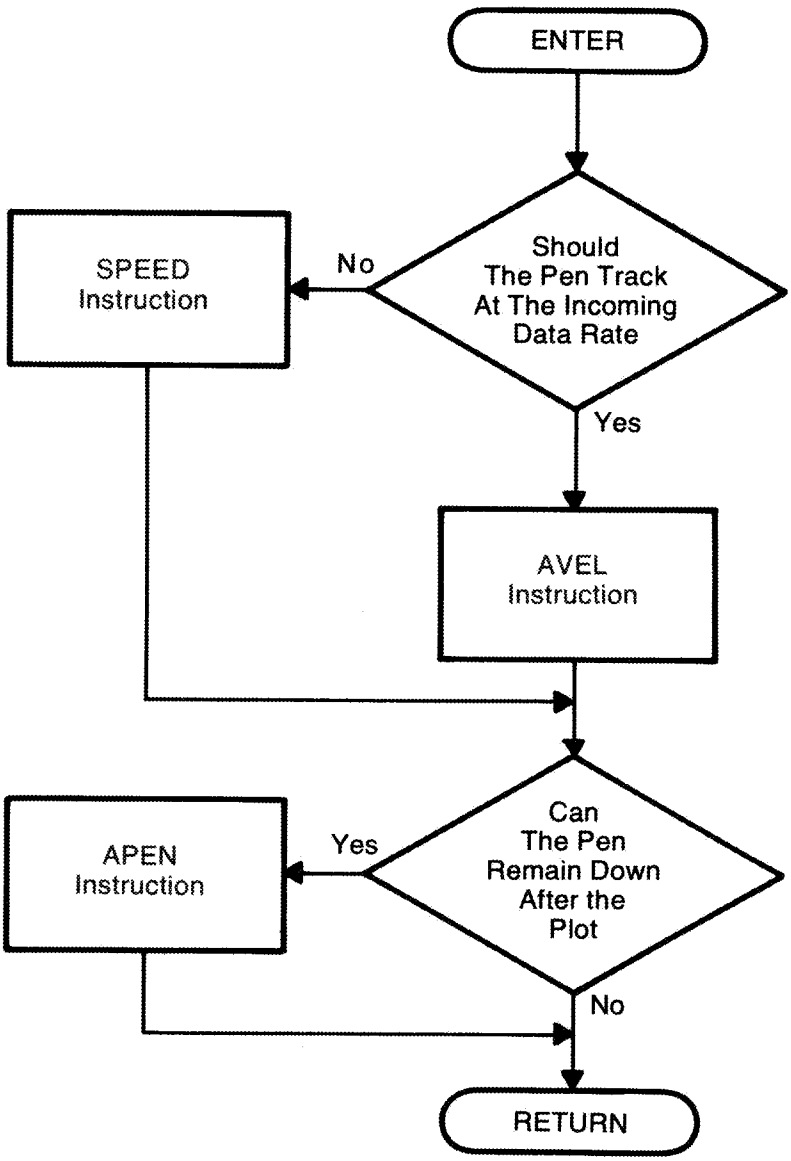
The following flowchart is provided to assist you in using your plotter.

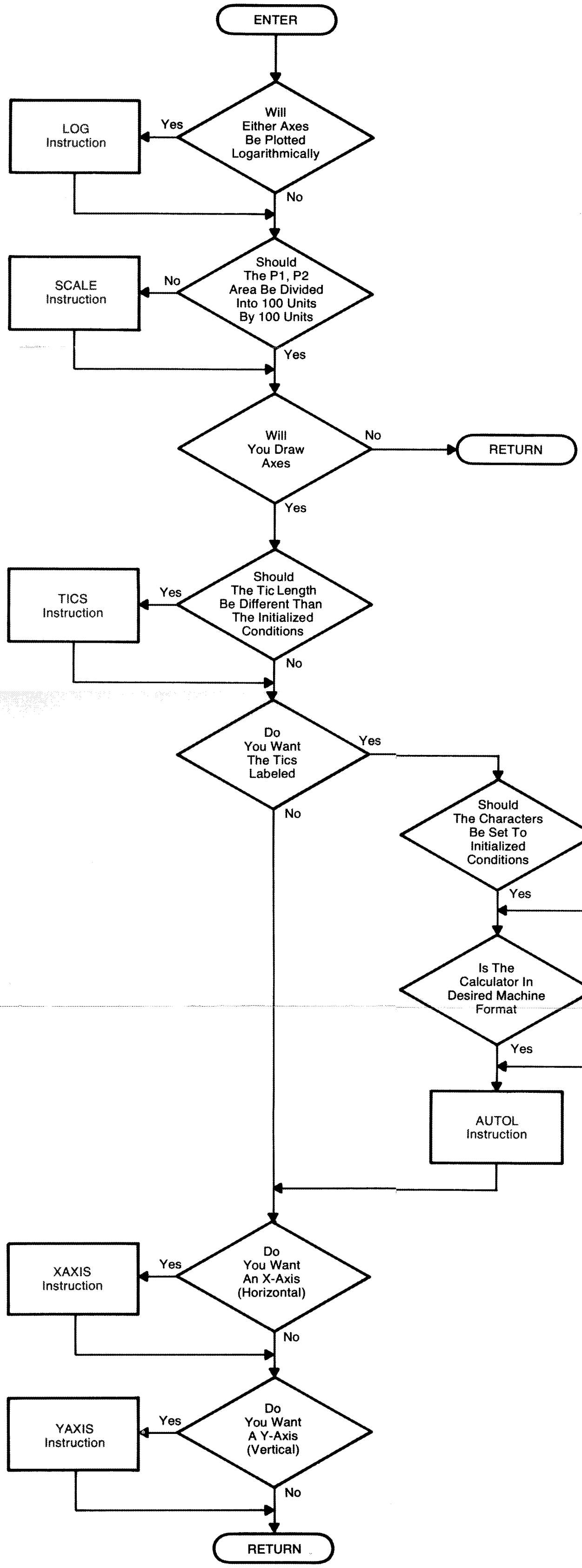
Instructions which must precede other instructions (i.e. LOG before SCALE) are listed in correct sequence to reduce errors.

This flowchart should provide you with a workable format that allows you to write working programs in a minimal amount of time.

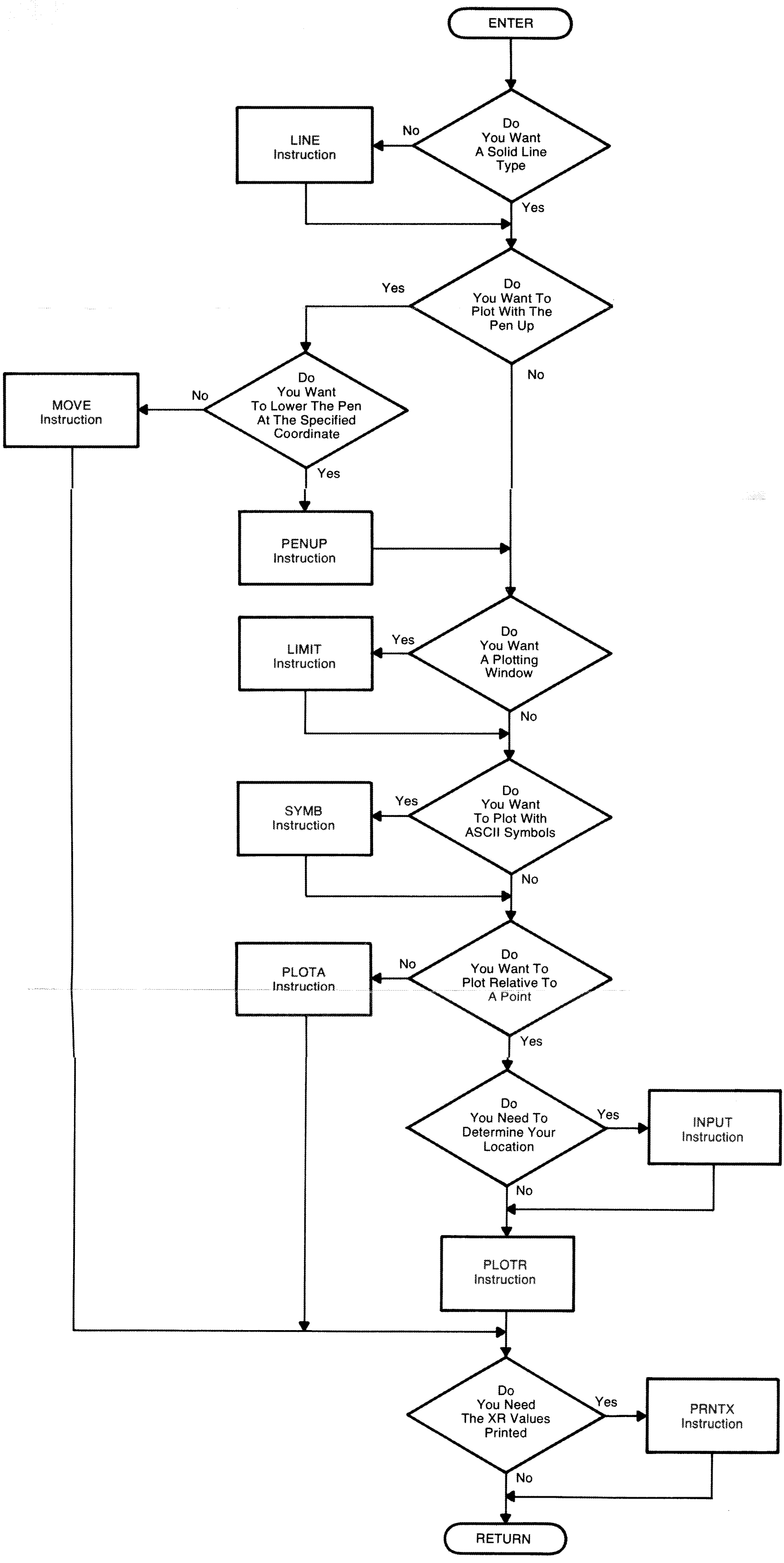

ENTER
INIT Instruction
PENSL Instruction
Do You Want To Plot Label Digitize
PLOT
LABEL
Are Pen Speeds Different From 36cm/sec
Yes
Performed Pen Speed Modification
No
Is The Initialized Position for P1 and P2 Acceptable
No
SETP Instruction
Yes
Are The Axes Initialized Conditions Acceptable
No
Perform Axes Modification
Yes
Perform PLOT Sequence
Do You Want To PLOT Again
Yes
No
STOP
DGTZR Instruction
Do You Need More Data
Yes
No
STOP
Should The Characters Be Set To Initialized Conditions
No
Perform Character Modification
Yes
Perform Label Sequence
Do You Need To Move The Pen
Yes
No
Is The Move Absolute Or Relative To Lines And Sales
Relative
Absolute
CPOSI Instruction
MOVE Instruction
Do You Need More Characters
No
STOP
Yes
Do You Need To Change Any Shapes Or Sizes
No
Yes

Pen Speed Modification

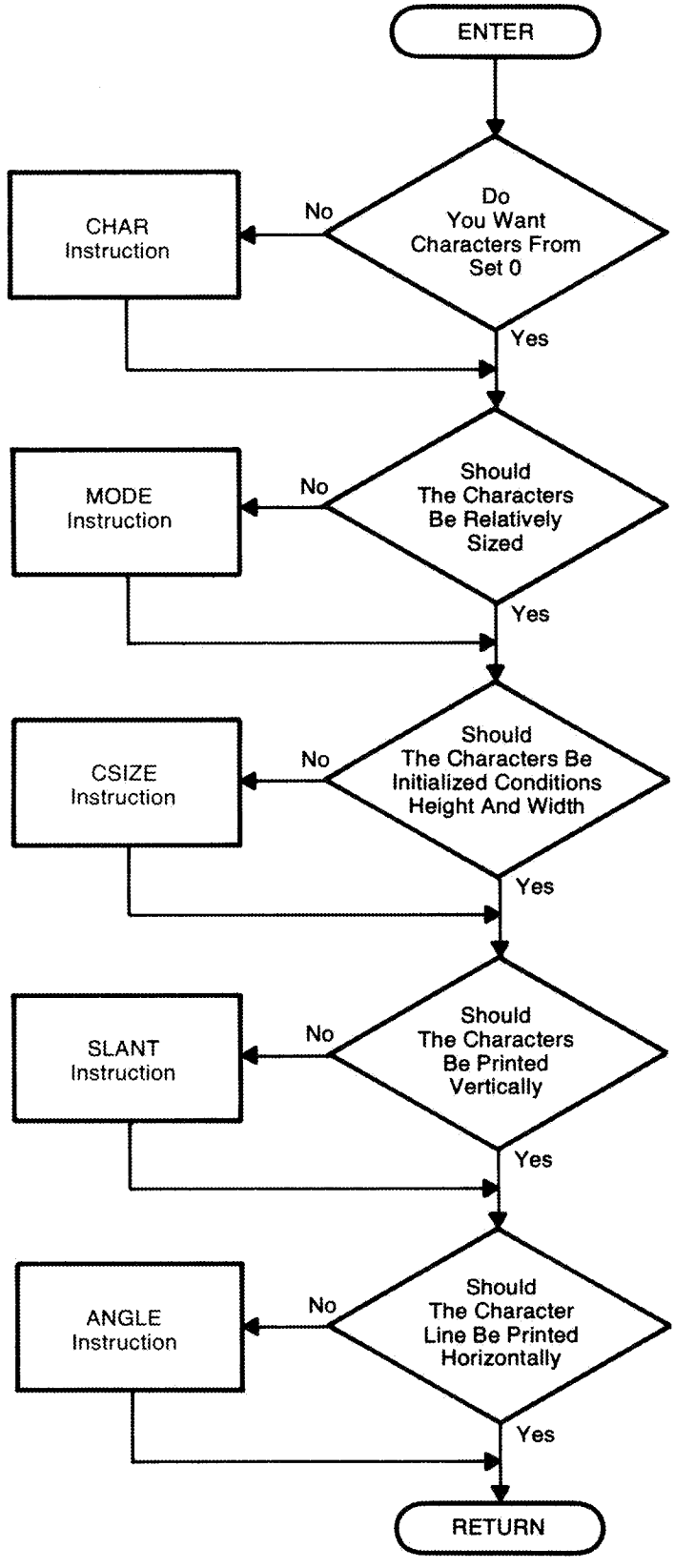


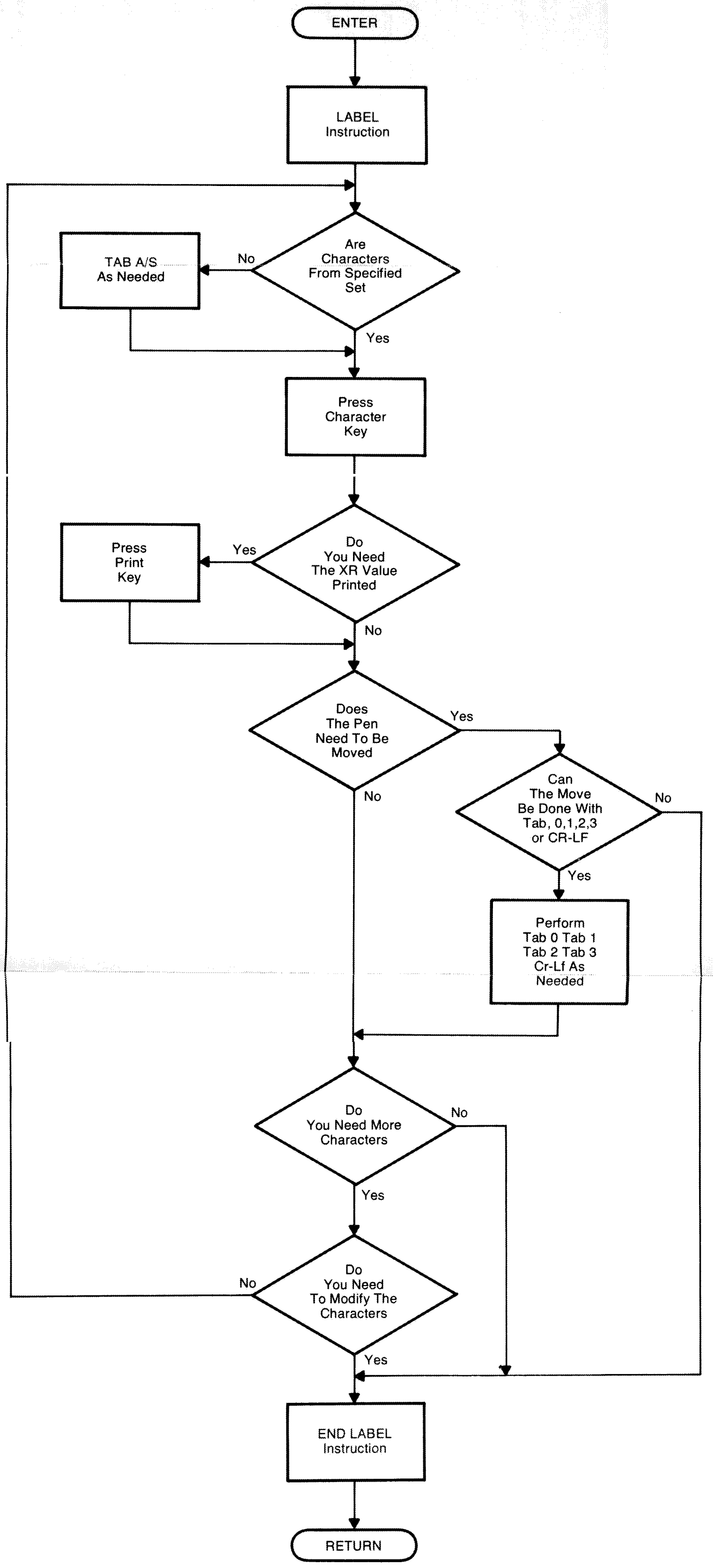

ENTER
Will Either Axes Be Plotted Logarithmically
Yes
LOG Instruction
No
Should The P1, P2 Area Be Divided Into 100 Units By 100 Units
No
SCALE Instruction
Yes
Will You Draw Axes
No
RETURN
Yes
Should The Tic Length Be Different Than The Initialized Conditions
Yes
TICS Instruction
No
Do You Want The Tics Labeled
Yes
No
Should The Characters Be Set To Initialized Conditions
No
Perform Character Modification
Yes
Is The Calculator In Desired Machine Format
No
Set Machine Format FIX, SCI SCI 3
Yes
AUTOL Instruction
Do You Want An X-Axis (Horizontal)
Yes
XAXIS Instruction
No
Do You Want A Y-Axis (Vertical)
Yes
YAXIS Instruction
No
RETURN

Plot Sequence



Character Modification




ENTER
LABEL Instruction
Are Characters From Specified Set
No
TAB A/S As Needed
Yes
Press Character Key
Do You Need The XR Value Printed
Yes
Press Print Key
No
Does The Pen Need To Be Moved
Yes
No
Can The Move Be Done With Tab, 0,1,2,3 or CR-LF
No
Yes
Perform Tab 0 Tab 1 Tab 2 Tab 3 Cr-Lf As Needed
Do You Need More Characters
No
Yes
Do You Need To Modify The Characters
No
Yes
END LABEL Instruction
RETURN

Chapter 6
Service

This section contains a brief description of the interface operation, complete circuit diagrams and a list of replaceable parts.

If you have difficulty repairing the interface or if you would rather have HP repair the interface, contact the nearest HP Sales and Service Office. The office locations are listed in Appendix E.

Theory of Operation

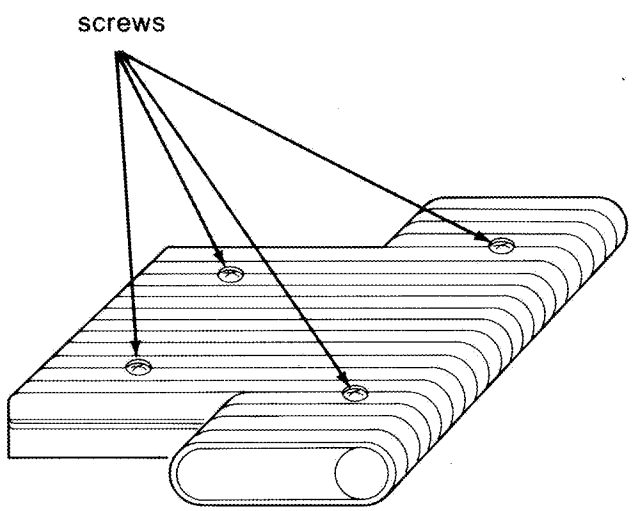
The interface consists of a printed circuit assembly (P/N 98130-66503). A block diagram of the interface components follows. Refer to the block diagram or schematic when reading the theory of operation.

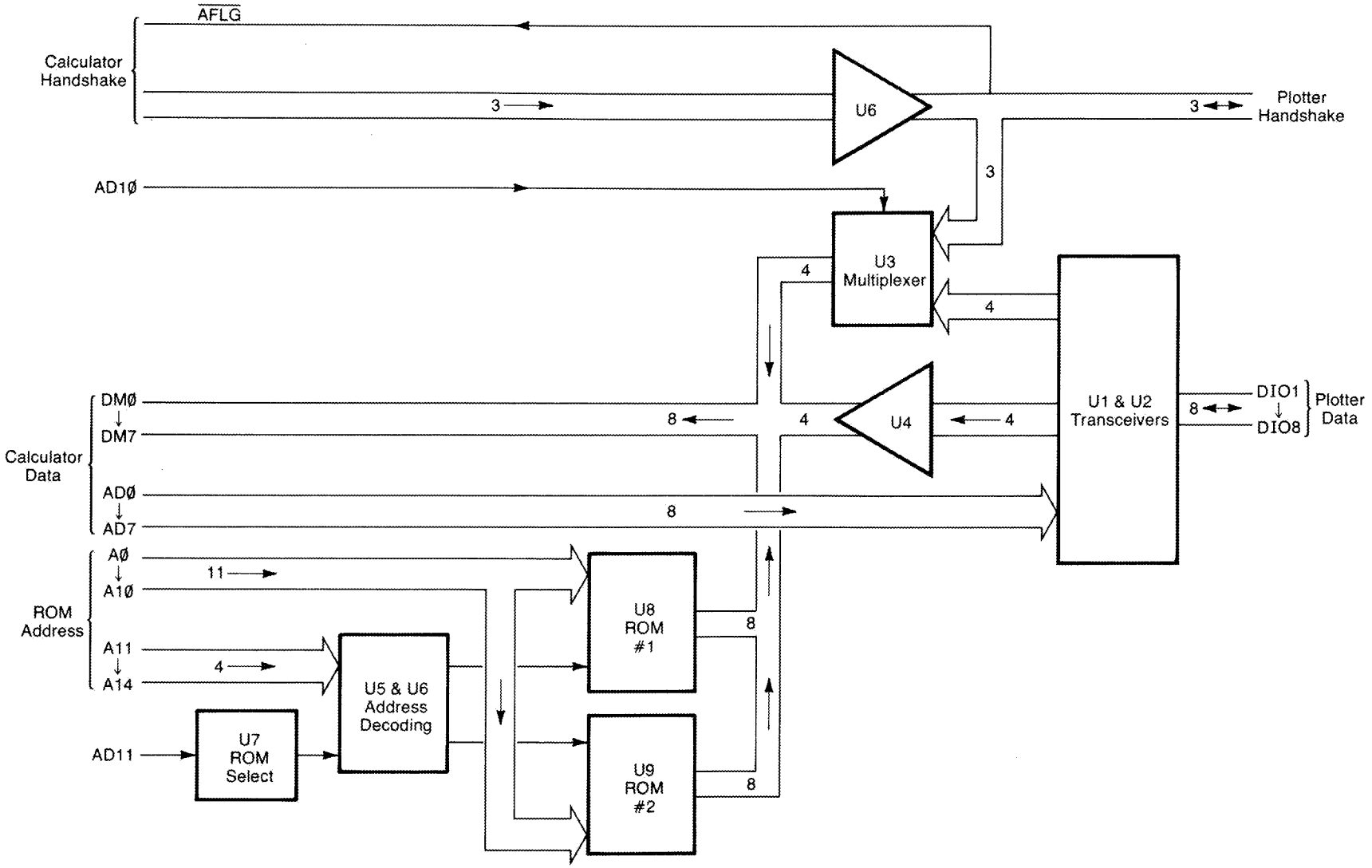
Logic Levels	The interface uses negative-true logic.
Transceivers	U1 and U2 comprise the interface transceivers. Data is transmitted from the plotter to the calculator on 8 data lines DI01-DI08. Data is transmitted from the calculator to the plotter along 8 data lines DM0-DM7.
Handshake Logic	U6 helps to buffer the handshake between the plotter and the calculator. The plotter's handshake lines are DAV, NRFD, and NDAC.
Multiplexer	U3 is the input multiplexer. The multiplexer sends the data to and from the calculator and plotter.
Drivers	U4 is the driver. The driver sends data to and from the calculator and plotter.
Address Decoding	U5 provides the address decoding to select either ROM #1 or ROM #2. Both ROMs can not be ON concurrently.

ROM Select	U7 selects ROM #1 or ROM #2. The state of U7 is determined due to the particular code that is being executed by ROM #1. ROM #2 is accessed as part of an instruction by ROM #1. In normal operation, ROM #2 is not accessed by the calculator.
ROMs	U8 and U9 are 16K ROMs that provide the instructions for the plotter.
ROM Power	U8 is powered by Q2 and the associated circuitry. U9 is powered by Q3 and its associated circuitry. Both ROMs draw a minimal amount of current when they are not being addressed while the interface is in use. When a ROM is addressed, it enables its associated power supply.
Interface Power	The power for the interface is supplied by the calculator.

Disassembly Procedure

1. Switch the calculator off and disconnect the interface cable.
2. Remove the four screws from the interface case and separate the case .

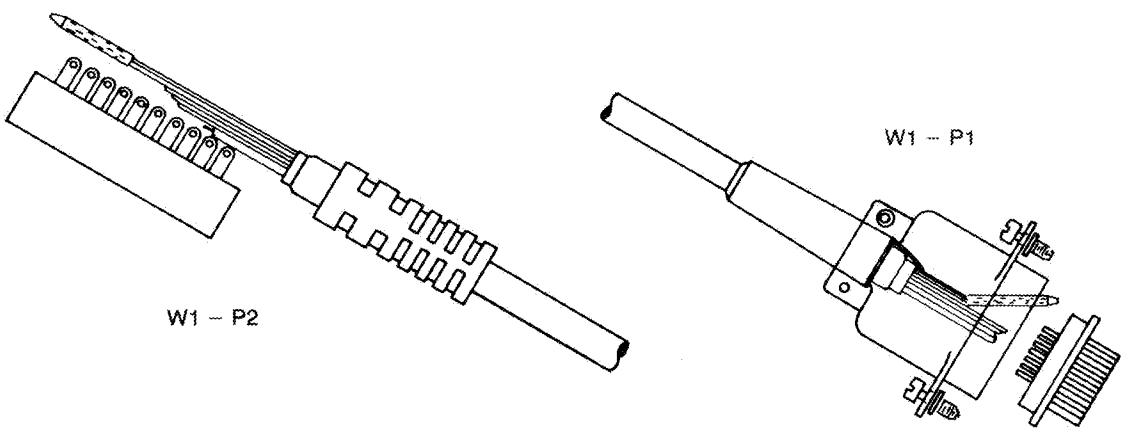




98130A Plotter Interface Block Diagram

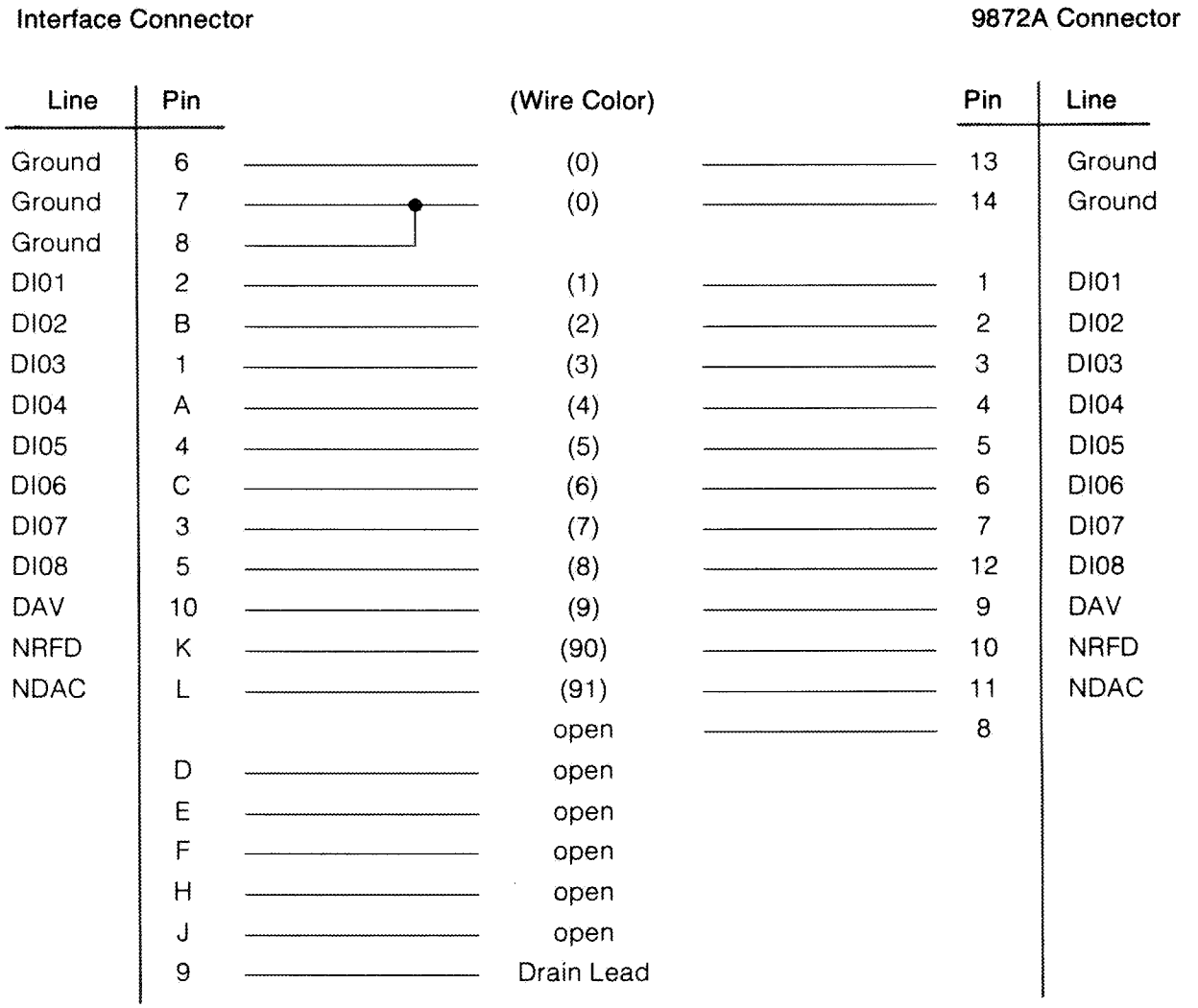
98130A Interface Replaceable Parts List

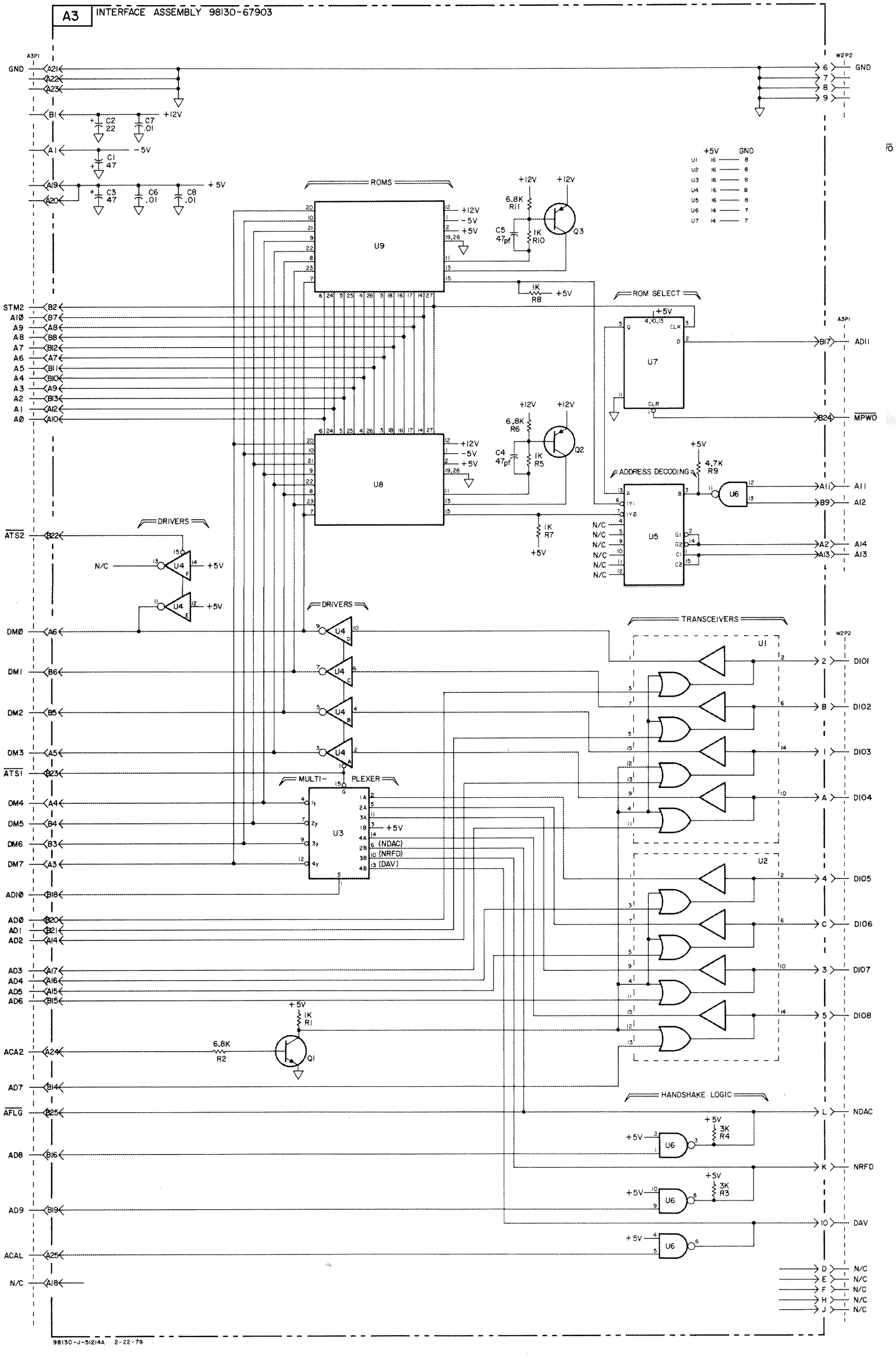
REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
A3	**98130-66503**		1	**PC Assembly**		
C1	0180-1704		2	C-F 47UF, 6V		
C2	0180-0228		1	C-F 22UF, 15V		
C3	0180-1074			C-F 47UF, 6V		
C4, C5	0160-4387		2	C-F 47pF, 200V		
C6 thru C8	0160-3847		3	C-F .01UF, 25V		
Q1	1854-0071		1	Transistor: NPN		
Q2, Q3	1853-0419		2	Transistor: PNP		
R1	0683-1025		5	R-F 1K, 5%		
R2	0683-6825		3	R-F 6.8K, 5%		
R3, R4	0683-3025		2	R-F 3K, 5%		
R5	0683-1025			R-F 1K, 5%		
R6	0683-6825			R-F 6,8K, 5%		
R7, R8	0683-1025			R-F 1K, 5%		
R9	0683-4725		1	R-F 4.7K, 5%		
R10	0683-1025			R-F 1K, 5%		
R11	0683-6825			R-F 6.8K, 5%		
U1, U2	1820-1869		2	IC: MC3446P		
U3	1820-1439		1	IC: 74LS258		
U4	1820-1492		1	IC: 74LS368N		
U5	1820-1245		1	IC: 74LS155		
U6	1820-1198		1	IC: 74LS03N		
U7	1820-1112		1	IC: 74LS74N		
U8	1818-2670		1	IC: 16K ROM		
U9	1818-2671		1	IC: 16K ROM		
W1	**98130-67903**		1	**Interface Assembly**		
W1-P1	1251-4821		1	Connector, 14 pin micro-ribbon		
W1-P2	1251-2262		1	Connector, PC Board		
	7120-6347		1	Key Overlay		
	98130-90000		1	Manual, Operating and Service		
	98130-90010		1	Operating Guide		



Interface Connectors

Interface Cable Wiring Diagram




A3 INTERFACE ASSEMBLY 98130-67903
A3P1
W2P2
GND
+12V
-5V
+5V
C1 47
C2 22
C3 47
C6 .01
C7 .01
C8 .01
ROMS
U9
U8
6,8K R11
6,8K R6
C5 47pf
C4 47pf
1K R10
1K R5
Q3
Q2
1K R8
1K R7
ROM SELECT
U7
4,10,13
CLR
MPWO
ADDRESS DECODING
4,7K R9
U6
U5
N/C
DRIVERS
U4
ATS2
DM0
DM1
DM2
DM3
ATS1
DM4
DM5
DM6
DM7
MULTI- PLEXER
U3
(NDAC)
(NRFD)
(DAV)
AD10
AD0
AD1
AD2
AD3
AD4
AD5
AD6
ACA2
AD7
AFLG
AD8
AD9
ACAL
N/C
1K R1
6.8K R2
Q1
TRANSCEIVERS
U1
U2
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
DIO8
HANDSHAKE LOGIC
3K R4
3K R3
NDAC
NRFD
DAV
98130-J-51214A 2-22-79

Appendix A

KEY	INSTR	XR	YR	ZR	TR	DESCRIPTION
∝	LABEL	DATA	FIELD WIDTH			PRINT THE CHARACTER STRING IN THE ALPHA MODE. MODIFICATIONS AND SPECIAL FUNCTIONS INCLUDED.
A	PLOTA	X VALUE	Y VALUE			MOVE THE PEN TO THE COORDINATES GIVEN. IF PEN PROGRAMMED UP, EXECUTE 'PEN DOWN' IF REQUIRED.
B	PENUP					UNCONDITIONALLY RAISE THE PEN.
C	PLOTR	IX VALUE	IY VALUE			MOVE THE PEN THE INCREMENTAL VALUES GIVEN. THE PEN FUNCTION IS THE SAME AS IN 'PLOTA'.
D	MOVE	X VALUE	Y VALUE			RAISE THE PEN, AND MOVE TO THE COORDINATES GIVEN. NO PEN FUNCTION EXECUTED AFTER MOVE.
E	DGTZR	X VALUE	Y VALUE			INPUT THE 'ENTERED' COORDINATES IN USER UNITS. CONTENTS OF THE STACK MOVED UP TWICE.
F	SCALE	Y MAX	Y MIN	X MAX	X MIN	ASSIGN USER UNIT VALUES TO THE AREA DEFINED BY (P1 AND P2) OR LOWER LEFT AND UPPER RIGHT.
G	XAXIS	Y VALUE	TIC INTER	X MAX	X MIN	DRAW SOLID LINE X-AXIS. OUTPUT CHARACTERISTICS SUBJECT TO SOME PREVIOUS INPUT INSTRUCTIONS.
H	YAXIS	X VALUE	TIC INTER	Y MAX	Y MIN	DRAW SOLID LINE Y-AXIS. SAME CONDITIONS APPLY AS IN 'XAXIS'.
I	CSIZE	WIDTH	HIGH			SET CHARACTER HEIGHT AND WIDTH. LINE=2*HEIGHT SPACE=(3/2)*WIDTH PARAMETERS DEPEND ON 'MODE'.
J	ANGLE	ANGLE				SETS LETTERING DIRECTION. INPUT VALUES FROM NORMAL COORDINATE SYSTEM AND DEPENDS ON 'MODE'.
K	PRNTX	DATA	FIELD WIDTH			PRINTS THE VALUE IN THE X REGISTER PER THE MACHINE FORMAT AND THE FIELD WIDTH PARAMETER.
L	CPOSI	SPACE	LINE			MOVE THE PEN POSITION THE INDICATED CHARACTER LINES AND SPACES, WITH THE PEN RAISED.
M	PENSL	PEN #				SELECT THE INDICATED PEN. A ZERO PEN NUMBER WILL RETURN THE PEN TO AN EMPTY STALL.
N	SLANT	ANGLE				SET CHARACTER SLANT ANGLE. INPUT ANGLE SPECIFIES SLANT FROM VERTICAL (+=RIGHT, -=LEFT)
O	FUNCT					THIS INSTRUCTION IS FOLLOWED BY AN ADDITIONAL KEY ENTRY TO PRODUCE THE SECONDARY SET.

9815-9872 INSTRUCTION SET

PRIMARY SET: CALL 1 KEY

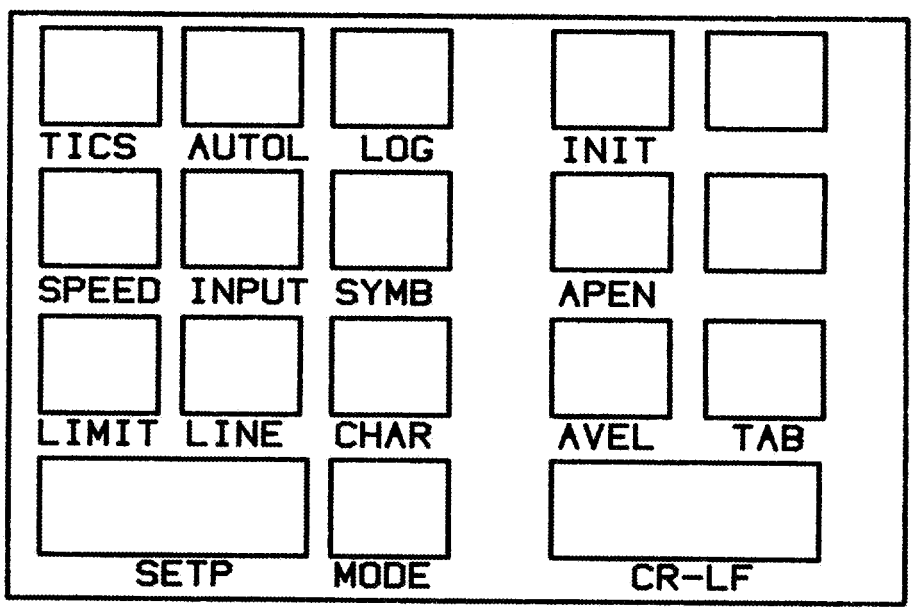
SECONDARY SET: CALL 1 0 KEY

KEY	FUNCT	XR	YR	ZR	TR	DESCRIPTION
Ø	SETP	Y MAX	Y MIN	X MAX	X MIN	SET (P1 AND P2) LOWER LEFT AND UPPER RIGHT. INPUT VALUES ARE PERCENT OF FULL PLATEN AREA.
1	LIMIT	Y MAX	Y MIN	X MAX	X MIN	SETS WINDOW PLOTTING LIMITS. PLOTTING OCCURS WITHIN WINDOW. INPUT IS IN USER UNITS.
2	LINE	TYPE	LONG			SET THE LINE TYPE AND PATTERN LENGTH. NEGATIVE TYPE VALUE SETS SOLID LINE.
3	CHAR	STD SET #	ALT SET #			SELECT TWO OF THE AVAILABLE CHARACTER SETS, DESIGNATED AS STANDARD AND ALTERNATE.
4	SPEED	SPEED	PEN #			LIMIT THE MAXIMUM SPEED IN CM/SEC TO THE SELECTED PEN. EACH PEN MAY BE DIFFERENT.
5	INPUT	X VALUE	Y VALUE			INPUT THE CURRENT COORDINATES OF THE PEN IN USER UNITS. STACK CONTENTS ARE MOVED UP TWICE.
6	SYMB	ASCII SYMB				DECIMAL EQUIVALENT OF ASCII CHAR FOR SYMBOL MODE PLOTTING. (-=WITH LINE, +=WITHOUT, Ø=OFF)
7	TICS	UP AND RIGHT	DOWN AND LEFT			SETS VALUES FOR AXES TIC LENGTH AS A PERCENT OF P1 AND P2 ONLY.
8	AUTOL	X AXIS FREQ	Y AXIS FREQ			SET THE TIC LABELING FREQUENCY AND DIRECTION ON EACH AXIS. (-=UP OR RIGHT, +=DOWN OR LEFT)
9	LOG	LOGX	LOGY			INDICATE ONE OR BOTH AXES TO BE IN LOG BASE 1Ø. (1=LOG, Ø=STANDARD)
.	MODE	FLAG VALUE				SET LABELING CHARACTER SIZE AND ANGLE TO BE CM OR PERCENT OF P1 AND P2. (Ø=PERCENT, 1=ABSOLUTE)
+	AVEL	FLAG VALUE				SET PEN SPEED TO AUTOMATICALLY TRACK THE INPUT DATA RATE. (Ø=NORMAL, 1=AUTOMATIC).
—	APEN	FLAG VALUE				IF NO PEN MOVEMENT OCCURS WITHIN APPROX 65 SEC, THE PEN WILL BE RAISED. (Ø=ON, 1=OFF)
*	INIT					REINITIALIZE THE SYSTEM TO ITS POWER-ON STATE.

Appendix B

Secondary Instruction Set

Keyboard Overlay



Appendix C

Character Set 0

ASCII

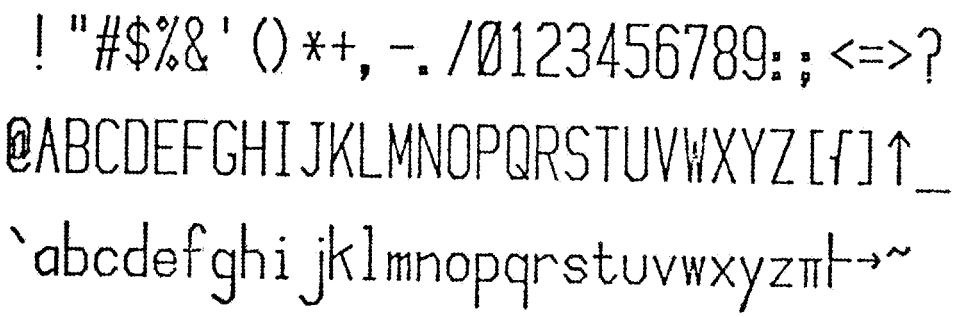
ASCII Characters from decimal 33 to decimal 126 (octal 41 to octal 176) give the following characters:

```
! "#$%&' ()*+,-./Ø123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
```

Character Set 1

9825A ASCII

ASCII Characters from decimal 33 to decimal 126 (octal 41 to 176) give the following characters:



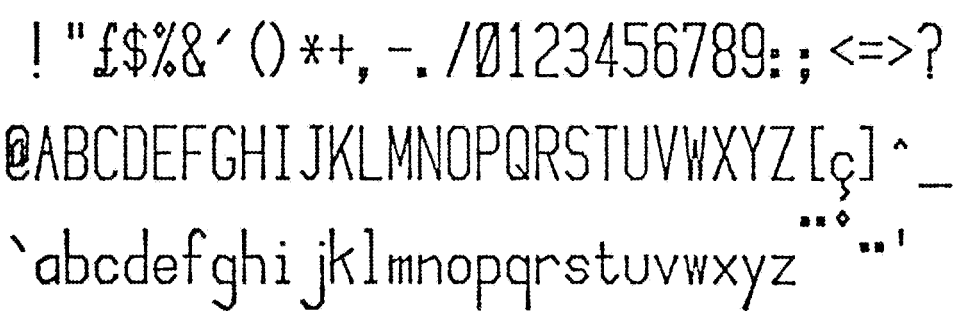
Characters which are changed from Set 0 are:

Set0	octal #	Set1	Auto-backspace
'	47	'	
\	134	\	
^	136	↑	
_	137	_	yes
`	140	`	yes
{	173	π	
|	174	⊢	
}	175	→	
~	176	~	yes

Character Set 2

French and German ASCII

ASCII Characters from decimal 33 to decimal 126 (octal 41 to octal 176) give the following characters:



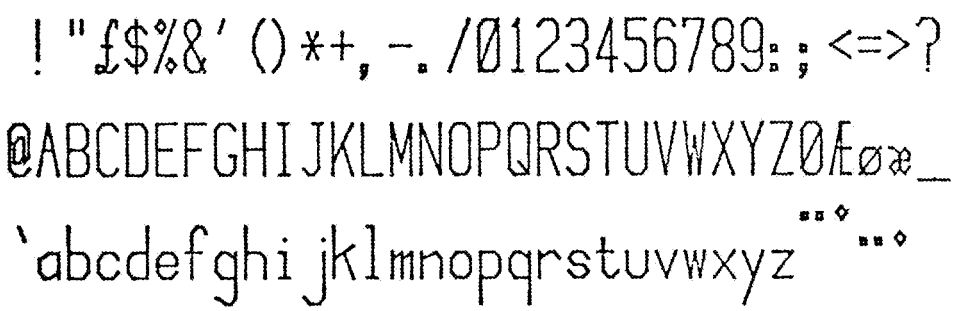
Characters which are changed from Set 0 are:

Set0	octal #	Set2	Auto-backspace
#	43	£	
'	47	´	yes
\	134	ç	
^	136	^	yes
_	137	_	yes
`	140	`	yes
{	173	¨	yes
¦	174	°	yes
}	175	¨	yes
~	176	'	

Character Set 3

Scandanavian ASCII

ASCII Characters from decimal 33 to decimal 126 (octal 41 to octal 126) give the following characters:



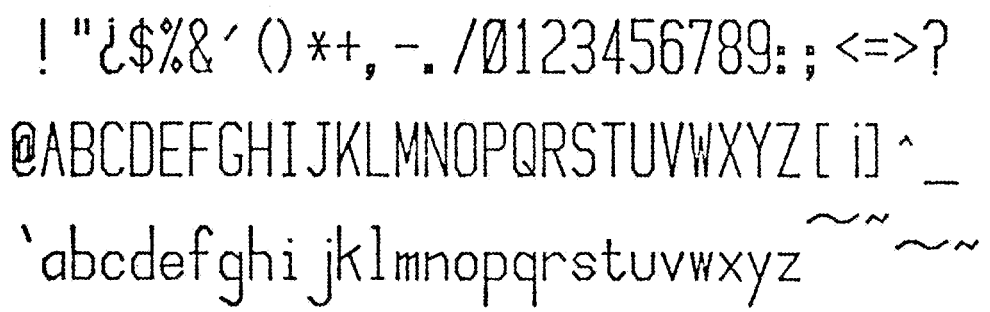
Characters which are changed from Set 0 are:

Set0	octal	#	Set3	Auto-backspace
#	43		£	
[	133		Ø	
\	134		Æ	
]	135		ø	
^	136		æ	
_	137		_	yes
{	173		¨	yes
¦	174		`	yes
}	175		¨	yes
~	176		`	yes

Character Set 4

Spanish ASCII

ASCII Characters from decimal 33 to decimal 126 (octal 33 to octal 126) give the following characters:



Characters which are changed from Set 0 are:

Set0	octal #	Set4	Auto-backspace
#	43	¿	
'	47	´	yes
\	134	i	
^	136	^	yes
_	137	_	yes
{	173	~	yes
¦	174	~	yes
}	175	~	yes
~	176	~	yes

Appendix D

Subject Index

a

c

d

f

i

l

m

o

p

r

s

t

x

y

HEWLETT hp PACKARD

SALES & SERVICE OFFICES

AFRICA, ASIA, AUSTRALIA

ANGOLA
Telectra
Empresa Técnica de Equipamentos Eléctricos, S.A.R.L.
R. Barbosa Rodrigues, 42-1°DT.°
Caixa Postal, 6487
Luanda
Tel: 35515/6
Cable: TELECTRA Luanda

AUSTRALIA
Hewlett-Packard Australia Pty. Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
P.O. Box 36
Doncaster East, Victoria 3109
Tel: 896351
Telex: 31-024
Cable: HEWPARD Melbourne

Hewlett-Packard Australia Pty. Ltd.
31 Bridge Street
Pymble
New South Wales, 2073
Tel: 4496566
Telex: 21561
Cable: HEWPARD Sydney

Hewlett-Packard Australia Pty. Ltd
153 Greenhill Road
Parkside, S.A., 5063
Tel: 2725911
Telex: 82536
Cable: HEWPARD Adelaide

Hewlett-Packard Australia Pty.Ltd.
141 Stirling Highway
Nedlands, W.A. 6009
Tel: 3865455
Telex: 93859
Cable: HEWPARD Perth

Hewlett-Packard Australia Pty. Ltd.
121 Wollongong Street
Fyshwick, A.C.T. 2609
Tel: 804244
Telex: 62650
Cable: HEWPARD Canberra

Hewlett Packard Australia Pty. Ltd.
5th Floor
Teachers Union Building
495-499 Boundary Street
Spring Hill, Queensland 4000
Tel: 2291544
Cable: HEWPARD Brisbane

BANGLADESH
The General Electric Co. of Bangladesh Ltd.
Magnet House 72
Dilkusha Commercial Area
Motijheil, Dacca 2
Tel: 252415, 252419
Telex: 734
Cable: GECDAC Dacca

ETHIOPIA
Abdella Abdulmalik
P.O. Box 2535
Addis Ababa
Tel: 11 93 40

GUAM
Medical Only
Guam Medical Supply, Inc.
Suite C, Airport Plaza
P.O. Box 8947
Tamuning 96911
Tel: 646-4513
Cable: EARMED Guam

HONG KONG
Schmidt & Co. (Hong Kong) Ltd.
Wing On Centre, 28th Floor
Connaught Road, C.
Hong Kong
Tel: 5-455644
Telex: 74766 SCHMC HX

INDIA
Blue Star Ltd.
Kasturi Buildings
Jamshedji Tata Rd
Bombay 400 020
Tel: 29 50 21
Telex: 011-2156
Cable: BLUEFROST

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
Tel: 45 78 87
Telex: 011-4093
Cable: FROSTBLUE

Blue Star Ltd.
Band Box House
Prabhadevi
Bombay 400 025
Tel: 45 73 01
Telex: 011-3751
Cable: BLUESTAR

Blue Star Ltd.
Bhavdeep
Stadium Road
Ahmedabad 380 014
Tel: 42880
Telex: 234
Cable: BLUEFROST

Blue Star Ltd.
7 Hare Street
P.O. Box 506
Calcutta 700 001
Tel: 23-0131
Telex: 021-7655
Cable: BLUESTAR

Blue Star Ltd.
Bhandari House
7th & 8th Floor
91 Nehru Place
New Delhi 110 024
Tel: 634770 & 635166
Telex: 031-2453
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House
11/11A Magarath Road
Bangalore 560 025
Tel: 55668
Telex: 043-430
Cable: BLUESTAR

Blue Star Ltd.
Meeakshi Mandiram
xxx/1678 Mahatma Gandhi Rd.
Cochin 682 016
Tel: 32069,32161,32282
Telex: 0885-514
Cable: BLUESTAR

Blue Star Ltd.
1-1-117/1
Sarojini Devi Road
Secunderabad 500 003
Tel: 70126, 70127
Telex: 015-459
Cable: BLUEFROST

Blue Star Ltd.
2/34 Kodambakkam High Road
Madras 600 034
Tel: 82056
Telex: 041-379
Cable: BLUESTAR

INDONESIA
BERCA Indonesia P.T.
P.O. Box 496/Jkt.
Jln.Abdul Muis 62
Jakarta
Tel: 349255, 349886
Telex: 46748 BERSIL IA
Cable: BERSAL

BERCA Indonesia P.T.
P.O. Box 174/Sby.
23 Jln. Jimerto
Surabaya
Tel. 42027
Cable: BErcacon

ISRAEL
Electronics Engineering Div. of Motorola Israel Ltd.
16, Kremenetski Street
P.O.Box 25016
Tel-Aviv
Tel: 38973
Telex: 33569, 34164
Cable: BASTEL Tel-Aviv

JAPAN
Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg., 4th Floor
4-20, Nishinakajima 5-chome
Yodogawa-ku, Osaka-shi
Osaka,532
Tel: 06-304-6021
Telex: 523-3624

Yokogawa-Hewlett-Packard Ltd.
29-21, Takaido-Higashi 3-chome
Suginami-ku, **Tokyo** 168
Tel: 03-331-6111
Telex: 232-2024 YHP-Tokyo
Cable: YHPMARKET TOK 23 724

Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
24 Kami Sasajima-cho
Nakamura-ku, **Nagoya**, 450
Tel. 052 571-5171

Yokogawa-Hewlett-Packard Ltd.
Tanigawa Building
2-24-1 Tsuruya-cho
Kanagawa-ku
Yokohama, 221
Tel: 045-312-1252
Telex: 382-3204 YHP YOK

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Building
105, 1-chome, San-no-maru
Mito, Ibaragi 310
Tel: 0292-25-7470

Yokogawa-Hewlett-Packard Ltd.
Inoue Building
1348-3, Asahi-cho, 1-chome
Atsugi, Kanagawa 243
Tel: 0462-24-0452

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi
Hachijuni Building
4th Floor
3-4, Tsukuba
Kumagaya, Saitama 360
Tel: 0485-24-6563

KENYA
Advanced Communications Ltd.
P.O. Box 30070
Nairobi
Tel: 331955
Telex: 22639

Medical Only
International Aeradio (E.A.) Ltd.
P.O. Box 19012
Nairobi Airport
Nairobi
Tel: 336055/56
Telex: 22201/22301
Cable: INTAERIO Nairobi

Medical Only
International Aeradio (E.A.) Ltd.
P.O. Box 95221
Mombasa

KOREA
Samsung Electronics Co., Ltd.
15th Floor, Daeyongak Bldg.,
25-5, 1-KA
Choong Moo-Ro, Chung-Ku,
Seoul
Tel: (23) 6811, 778-3401/2/3/4
Telex: 22575

MALAYSIA
Hewlett-Packard Sales SDN BHD
Suite 2.21/2.22
Bangunan Angkasa Raya
Jalan Ampang
Kuala Lumpar
Tel: 23320/27491

Protel Engineering
P.O. Box 1917
Lot 259, Satok Road
Kuching, **Serawak**
Tel: 53544
Cable: PROTELENG

MOZAMBIQUE
A.N. Goncalves, Ltd.
162, 1° Apt. 14 Av. D. Luis
Caixa Postal 107
Maputo
Tel: 27091, 27114
Telex: 6-203 NEGON Mo
Cable: NEGON

NEW GUINEA
Hewlett-Packard Australia Pty Ltd.
Development Bank Building
Ground Floor
Ward Strip
Port Moresby, Paupua
Tel: 258933

NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
4-12 Cruickshank Street
Kilbirnie, Wellington 3
P.O. Box 9443
Courtney Place
Wellington
Tel: 877-199
Cable: HEWPACK Wellington

Hewlett-Packard (N.Z.) Ltd.
Pakuranga Professional Centre
267 Pakuranga Highway
Box 51092
Pakuranga
Tel: 569-651
Cable: HEWPACK Auckland

Analytical/Medical Only
Medical Supplies N.Z. Ltd.
Scientific Division
79 Carlton Gore Road, Newmarket
P.O. Box 1234
Auckland
Tel. 75-289
Cable: DENTAL Auckland

Analytical/Medical Only
Medical Supplies N.Z. Ltd.
Norrie and Parumoana Streets
Porirua
Tel: 75-098
Telex: 3858

Analytical/Medical Only
Medical Supplies N.Z. Ltd.
P.O. Box 309
239 Stanmore Road
Christchurch
Tel: 892-019
Cable: DENTAL Christchurch

Analytical/Medical Only
Medical Supplies N.Z. Ltd.
303 Great King Street
P.O. Box 233
Dunedin
Tel: 88-817
Cable: DENTAL Dunedin

NIGERIA
The Electronics Instrumentations Ltd
N58/770 Oyo Road
Oluseun House
P.M.B. 5402
Ibadan
Tel: 461577
Telex: 31231 TEIL NG
Cable: THETIEL Ibadan

The Electronics Instrumentations Ltd.
144 Agege Motor Road, Mushin
P.O. Box 6645
Lagos
Cable: THETEIL Lagos

PAKISTAN
Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
Karachi-3
Tel: 511027, 512927
Telex: 2894
Cable: COOPERATOR Karachi

Mushko & Company, Ltd.
38B, Satellite Town
Rawalpindi
Tel: 41924
Cable: FEMUS Rawalpindi

PHILIPPINES
The Online Advanced Systems Corporation
Rico House
Amorsolo cor. Herrera Str.
Legaspi Village, Makati
P.O. Box 1510
Metro **Manila**
Tel: 85-35-81, 85-34-91,85-32-21
Telex: 3274 ONLINE

RHODESIA
Field Technical Sales
45 Kelvin Road North
P.O. Box 3458
Salisbury
Tel: 705231 (5 lines)
Telex: RH 4122

SINGAPORE
Hewlett-Packard Singapore (Pte.) Ltd.
1150 Depot Road
Alexandra P.O. Box 58
Singapore 4
Tel: 270-2355
Telex: HPSG RS 21486
Cable: HEWPACK, Singapore

SOUTH AFRICA
Hewlett-Packard South Africa (Pty.) Ltd.
Private Bag Wendywood,
Sandton, Transvaal, 2144
Hewlett-Packard Centre
Daphne Street, Wendywood.
Sandton, 2144
Tel: 802-1040,6
Telex: 8-4782
Cable: HEWPACK Johannesburg

Hewlett-Packard South Africa (Pty.), Ltd.
P.O. Box 120
Howard Place, Cape Province, 7450
Pine Park Centre, Forest Drive,
Pinelands, Cape Province, 7405
Tel: 53-7955 thu 9
Telex. 57-0006

SRI LANKA
Metropolitan Agencies Ltd.
209/9 Union Place
Colombo 2
Tel: 35947
Telex: 1377METROLTD CE
Cable: METROLTD

SUDAN
Radison Trade
P.O. Box 921
Khartoum
Tel: 44048
Telex. 375

TAIWAN
Hewlett-Packard Far East Ltd.
Taiwan Branch
39 Chung Hsiao West Road
Section 1, 7th Floor
Taipei
Tel. 3819160-9,3141010
Cable: HEWPACK TAIPEI

Hewlett-Packard Far East Ltd
Taiwan Branch
68-2, Chung Cheng 3rd. Road
Kaohsiung
tel: (07) 242318-Kaohsiung

Analytical Only
San Kwang Instruments Co., Ltd.
20 Yung Sui Road
Taipei
Tel. 3615446-9 (4 lines)
Telex: 22894 SANKWANG
Cable: SANKWANG Taipei

TANZANIA
Medical Only
International Aeradio (E.A.), Ltd.
P.O. Box 861
Dar es Salaam
Tel: 21251 Ext. 265
Telex: 41030

THAILAND
UNIMESA Co. Ltd
Elcom Research Building
2538 Sukumvit Ave.
Bangchak,Bangkok
Tel: 3932367, 3930338
Cable: UNIMESA Bangkok

UGANDA
Medical Only
International Aeradio (E.A.), Ltd.
P.O. Box 2577
Kampala
Tel: 54388
Cable: INTAERIO Kampala

ZAMBIA
R.J. Tilbury (Zambia) Ltd.
P.O. Box 2792
Lusaka
Tel: 73793
Cable: ARJAYTEE, Lusaka

OTHER AREAS NOT LISTED, CONTACT:
Hewlett-Packard Intercontinental
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 856-1501
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd.
11620A - 168th Street
Edmonton T5M 3T9
Tel: (403) 452-3670
TWX: 610-831-2431

Hewlett-Packard (Canada) Ltd.
210,7220 Fisher St. S.E.
Calgary T2H 2H8
Tel: (403) 253-2713
Twx: 610-821-6141

BRITISH COLUMBIA
Hewlett-Packard (Canada) Ltd.
10691 Shellbridge Way
Richmond V6X 2W7
Tel: (604) 270-2277
TWX: 610-925-5059

MANITOBA
Hewlett-Packard (Canada) Ltd.
380-550 Century St.
Winnipeg R3H 0Y1
Tel: (204) 786-6701
TWX: 610-671-3531

NOVA SCOTIA
Hewlett-Packard (Canada) Ltd.
800 Windmill Road
Dartmouth B3B 1L1
Tel: (902) 469-7820
TWX: 610-271-4482

ONTARIO
Hewlett-Packard (Canada) Ltd.
1020 Morrison Dr.
Ottawa K2H 8K7
Tel: (613) 820-6483
TWX: 610-563-1636

Hewlett-Packard (Canada) Ltd
6877 Goreway Drive
Mississauga L4V 1M8
Tel. (416) 678-9430
TWX: 610-492-4246

Hewlett-Packard (Canada) Ltd.
552 Newbold Street
London N6E 2S5
Tel: (519) 686-9181

QUEBEC
Hewlett-Packard (Canada) Ltd.
275 Hymus Blvd.
Pointe Claire H9R 1G7
Tel: (514) 697-4232
TWX: 610-422-3022
TLX: 05-821-521 HPCL

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett-Packard (Canada) Ltd. in Mississauga.

CENTRAL AND SOUTH AMERICA

ARGENTINA
Hewlett-Packard Argentina S.A.
Av. Leandro N. Alem 822 - 12°
1001 **Buenos Aires**
Tel: 31-6063,4,5,6
Telex: 122443 AR CIGY
Cable: HEWPACKARG

Biotron S.A.C.I.y M.
Bolivar 177
1066 **Buenos Aires**
Tel: 30-4846, 34-9356, 34-0460, 33-2863
Telex. 011-7595
Cable: Biotron Baries

BOLIVIA
Casa Kavlin S.A.
Calle Potosi' 1130
P.O. Box 500
La Paz
Tel: 41530,53221
Telex: CWC BX 5298,ITT 3560082
Cable: KAVLIN

BRAZIL
Hewlett-Packard do Brasil I.e.C. Ltda.
Alameda Rio Negro, 750
Alphaville
06400 **Barueri** SP
Tel: 429-3222
Cable: HEWPACK Sao Paulo

Hewlett-Packard do Brasil I.e.C. Ltda.
Rua Padre Chagas, 32
90000-**Pôrto Alegre**-RS
Tel: (0512) 22-2998, 22-5621
Cable: HEWPACK Porto Alegre

Hewlett-Packard do Brasil I.e.C. Ltda.
Av. Epitacio Pessoa, 4664
Lagoa
20000-**Rio de Janeiro**-RJ
Tel:
Telex: 021-21905 HPBR-BR
Cable: HEWPACK Rio de Janeiro

CHILE
Jorge Calcagni y Cia. Ltda
Vicuna Mackenna 3, Ofic. 1204
Casilla 16475
Correo 9, **Santiago**
Tel. 34152
Telex: JCALCAGNI

COLOMBIA
Instrumentación
Henrik A. Langebaek & Kier S.A.
Carrera 7 No. 48-75
Apartado Aéreo 6287
Bogotá, D.E.
Tel: 269-8877
Telex: 44400
Cable: AARIS Bogotá

Instrumentacion
H.A. Langebaek & Kier S.A.
Carrera 53 No. 49-A-31
Apartado 54098
Medellin
Tel: 304475

COSTA RICA
Científica Costarricense S.A.
Avenida 2, Calle 5
San Pedro de Montes de Oca
Apartado 10159
San Jose
Tel: 24-38-20, 24-08-19
Telex: 2367 GALGUR CR
Cable: GALGUR

ECUADOR
Computadoras y Equipos Electrónicos del Ecuador
P.O. Box 6423 CCI
Eloy Alfaro No. 1824,3°Piso
Quito
Tel: 453 482
Telex: 2548 CYEDE ED
Cable: CYEDE-Quito

Medical Only
Hospitalar S.A.
Casilla 3590
Robles 625
Quito
Tel: 545-250
Cable: HOSPITALAR-Quito

EL SALVADOR
IPESA
Bulevar de los Heroes 11-48
San Salvador
Tel: 252787

GUATEMALA
IPESA
Avenida Reforma 3-48, Zona 9
Guatemala City
Tel: 316627,314786,66471-5,ext.9
Telex. 4192 Teletro Gu

MEXICO
Hewlett-Packard Mexicana, S.A. de C.V.
Av. Periférico Sur No. 6501
Tepepan, Xochimilco
Mexico 23, D.F.
Tel: 905-676-4600
Telex: 017-74-507

Hewlett-Packard Mexicana, S.A. de C.V.
Ave. Constitución No. 2184
Monterrey, N.L.
Tel: 48-71-32, 48-71-84
Telex: 038-410

NICARAGUA
Roberto Terán G.
Apartado Postal 689
Edificio Terán
Managua
Tel: 25114, 23412,23454,22400
Cable: ROTERAN Managua

PANAMA
Electrónico Balboa, S.A.
Aparatado 4929
Panama 5
Calle Samuel Lewis
Edificio "Alfa", No.2
Cuidad de Panama
Tel: 64-2700
Telex: 3483103 Curundu, Canal Zone
Cable: ELECTRON Panama

PERU
Compañía Electro Médica S.A.
Los Flamencos 145
San Isidro Casilla 1030
Lima 1
Tel: 41-4325
Telex: Pub. Booth 25424 SISIDRO
Cable: ELMED Lima

SURINAME
Surtel Radio Holland N.V.
Grote Hofstr. 3-5
P.O. Box 155
Paramaribo
Tel: 72118, 77880
Cable: Surtel

TRINIDAD & TOBAGO
CARTEL
Caribbean Telecoms Ltd.
P.O. Box 732
69 Frederick Street
Port-of-Spain
Tel. 62-53068

URUGUAY
Pablo Ferrando S.A.C.e.I.
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel: 40-3102
Telex: 702 Public Booth Para Pablo Ferrando
Cable: RADIUM Montevideo

VENEZUELA
Hewlett-Packard de Venezuela C.A.
P.O. Box 50933
Caracas 105
Los Ruices Norte
3a Transversal
Edificio Segre
Caracas 107
Tel: 239-4133 (20 lines)
Telex: 25146 HEWPACK
Cable: HEWPACK Caracas

FOR AREAS NOT LISTED, CONTACT:
Hewlett-Packard Inter-Americas
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 856-1501
TWX: 910-373-1260
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

EUROPE, NORTH AFRICA AND MIDDLE EAST

AUSTRIA
Hewlett-Packard Ges.m.b H.
Handelskai 52
P.O. Box 7
A-1205 **Vienna**
Tel: 351621-27
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

BAHRAIN
Medical Only
Wael Pharmacy
P.O. Box 648
Bahrain
Tel: 54886, 56123
Telex: 8550 WAEL GJ
Cable: WAELPHARM

Analytical Only
Al Hamidiya Trading
and Contracting
P.O. Box 20074
Manama
Tel: 259978, 259958
Telex: 8895 KALDIA GJ

BELGIUM
Hewlett-Packard Benelux
S.A./N.V.
Avenue du Col-Vert, 1,
(Groenkraaglaan)
B-1170 **Brussels**
Tel: (02) 660 50 50
Cable: PALOBEN Brussels
Telex: 23-494 paloben bru

CYPRUS
Kypronics
19 Gregorios Xenopoulos Street
P.O. Box 1152
Nicosia
Tel: 45628/29
Cable: Kypronics Pandehis
Telex: 3018

CZECHOSLOVAKIA
Vyzkumna a Provozni Zakladna
Vyzkumnych Ustavu v Bechovicich
CSSR-25097 **Bechovice u Prahy**
Tel: 89 93 41
Telex: 12133

Institute of Medical Bionics
Vyskumny Ustav Lekarskej Bioniky
Jedlova 6
CS-88346
Bratislava-Kramare
Tel: 4251
Telex: 93229

DDR
Entwicklungslabor der TU Dresden
Forschungsinstitut Meinsberg
DDR-7305
Waldheim/Meinsberg
Tel: 37 667
Telex: 518741

Export Contact AG Zuerich
Guenther Forgber
Schlegelstrasse 15
1040 **Berlin**
Tel: 42-74-12
Telex: 111889

DENMARK
Hewlett-Packard A/S
Datavej 52
DK-3460 **Birkerod**
Tel. (02) 81 66 40
Cable: HEWPACK AS
Telex: 37409 hpas dk

Hewlett-Packard A/S
Navervej 1
DK-8600 **Silkeborg**
Tel: (06) 82 71 66
Telex: 37409 hpas dk
Cable: HEWPACK AS

EGYPT
I.E.A
International Engineering Associates
24 Hussein Hegazi Street
Kasr-el-Aini
Cairo
Tel: 23 829
Telex: 93830
Cable: INTENGASSO

SAMITRO
Sami Amin Trading Office
18 Abdel Aziz Gawish
Abdine-Cairo
Tel: 24932
Cable: SAMITRO CAIRO

FINLAND
Hewlett-Packard OY
Nahkahousunti 5
P.O. Box 6
SF-00211 **Helsinki** 21
Tel: (90) 6923031

FRANCE
Hewlett-Packard France
Avenue des Tropiques
Les Ulis
Boite Postale No. 6
91401 **Orsay**-Cedex
Tel: (1) 907 78 25
TWX: 600948F

Hewlett-Packard France
Chemin des Mouilles
B.P. 162
69130 **Ecully**
Tel: (78) 33 81 25.
TWX: 310617F

Hewlett-Packard France
Péricentre de la Cépière
31081 **Toulouse-Le Mirail**
Tel:(61) 40 11 12
TWX: 510957F

Hewlett-Packard France
Le Ligoures
Bureau de vente de Marseilles
Place Roudé de Villeneuve
13100 **Aix-en-Provence**
Tel: (42) 59 41 02

Hewlett-Packard France
2, Allee de la Bourgnette
35100 **Rennes**
Tel: (99) 51 42 44
TWX: 740912F

Hewlett-Packard France
18, rue du Canal de la Marne
67300 **Schiltigheim**
Tel: (88) 83 08 10
TWX: 890141F

Hewlett-Packard France
Immeuble péricentre
Rue van Gogh
59650 **Villeneuve** D Ascq
Tel: (20) 91 41 25
TWX: 160124F

Hewlett-Packard France
Bureau de Vente
Centre d' affaires Paris-Nord
Bâtiment Ampère
Rue de la Commune de Paris
B.P. 300
93153 **Le Blanc Mesnil Cédex**
Tel: (01) 931 88 50

Hewlett-Packard France
Av. du Pdt. Kennedy
33700 **Merignac**
Tel: (56) 97 22 69

Hewlett-Packard France
"France-Evry" immeuble Lorraine
Boilevard de France
91035 **Evry-Cedex**
Tel: 077 96 60

Hewlett-Packard France
60, Rue de Metz
57130 **Jouy aux Arches**
Tel: (87) 69 45 32

GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 **Frankfurt** 56
Tel: (0611) 50-04-1
Cable: HEWPACKSA Frankfurt
Telex: 04 13249 hpftm d

Hewlett-Packard GmbH
Technisches Büro Böblingen
Herrenberger Strasse 110
D-7030 **Böblingen**, Württemberg
Tel: (0703) 667-1
Cable: HEWPACK Böblingen
Telex: 07265739 bbn

Hewlett-Packard GmbH
Technisches Büro Düsseldorf
Emanuel-Leutze-Str. 1 (Seestern)
D-4000 **Düsseldorf**
Tel. (0211) 59711
Telex: 085/86 533 hpdd d

Hewlett-Packard GmbH
Technisches Büro Hamburg
Wendenstrasse 23
D-2000 **Hamburg** 1
Tel: (040) 24 13 93

Cable: HEWPACKSA Hamburg
Telex: 21 63 032 hphh d

Hewlett-Packard GmbH
Technisches Büro Hannover
Am Grossmarkt 6
D-3000 **Hannover 91**
Tel: (0511) 46 60 01
Telex: 092 3259

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyerstrasse 90
D-8500**Nürnberg**
Tel: (0911) 56 30 83
Telex: 0623 860

Hewlett-Packard GmbH
Technisches Büro München
Eschenstrasse 5
D-8021 **Taufkirchen**
Tel: (089) 6117-1

Hewlett-Packard GmbH
Technisches Büro Berlin
Kaithstrasse 2-4
D-1000 **Berlin** 30
Tel: (030) 24 90 86
Telex 018 3405 hpbln d

GREECE
Kostas Karayannis
8 Omirou Street
Athens 133
Tel: 32 30 303/32/37 731

Analytical Only
INTECO
G. Papathanassiou & Co.
17 Marni Street
Athens 103
Tel: 5522 915/5221 989
Telex: 21 5329 INTE GR
Cable: INTEKNIKA

Medical Only
Technomed Hellas Ltd.
52 Skoufa Street
Athens 135
Tel: 3628 972

HUNGARY
MTA
Müszerügy és Méréstechnikai
Szolgalata
Hewlett-Packard Service
Lenin Krt. 67, P.O.Box 241
1391Budapest VI
Tel: 42 03 38
Telex: 22 51 14

ICELAND
Medical Only
Elding Trading Company Inc.
Hafnarnvoli - Tryggvagotu
P.O.Box 895
IS-**Reykjavik**
Tel: 1 58 20/1 63 03
Cable: ELDING Reykjavik

IRAN
Hewlett-Packard Iran Ltd.
No. 13, Fourteenth St.
Mir Emad Avenue
P.O. Box 41/2419
Tehran
Tel: 851082-5
Telex: 213405 hewp ir

IRELAND
Hewlett-Packard Ltd.
King Street Lane
Winnersh, Wokingham
Berks, RG11 5AR
GB-England
Tel: (0734) 78 47 74
Telex: 847178
Cable: Hewpie London

Hewlett-Packard Ltd.
2C Avonbeg Industrial Estate
Long Mile Road
Dublin 12, Eire
Tel: (01) 514322
Telex: 30439

Medical Only
Cardiac Services (Ireland) Ltd.
Kilmore Road
Artane
Dublin 5, Eire
Tel: (01) 315820

Medical Only
Cardiac Services Co.
95A Finaghy Rd. South
Belfast BT10 0BY
GB-Northern Ireland

ITALY
Hewlett-Packard Italiana S.p.A.
Via G.Di Vittorio , 9
20063 Cernusco
Sul Naviglio (MI)
Tel: (2) 903691
Telex: 311046 HEWPACKIT

Hewlett-Packard Italiana S.p.A.
Via Turazza , 14
35100 **Padova**
Tel: (49) 664888
Telex: 41612 HEWPACKI

Hewlett-Packard Italiana S.p.A.
Via G. Armellini 10
1-00143 **Roma**
Tel: (06) 54 69 61
Telex: 61514
Cable: HEWPACKIT Roma

Hewlett-Packard Italiana S.p.A.
Corso Giovanni Lanza 94
I-10133 **Torino**
Tel:(011) 682245/659308

Medical/Calculators Only
Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43 G/C
I-95126 **Catania**
Tel:(095) 37 05 04

Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco A.
Capodimonte, 62A
I-80131 **Napoli**
Tel: (081) 7913544

Hewlett-Packard Italiana S.p.A.
Via E. Masi, 9/8
I-40137 **Bologna**
Tel: (051) 307887/300040

JORDAN
Mousher Cousins Co.
P.O. Box 1387
Amman
Tel: 24907/39907
Telex: SABCO JO 1456
Cable: MOUASHERCO

KUWAIT
Al-Khaldiya Trading &
Contracting
P.O. Box 830-Safat
Kuwait
Tel:42 4910/41 1726

LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue du Col-Vert, 1
(Groenkraaglaan)
B-1170 **Brussels**
Tel. (02) 672 22 40
Cable: PALOBEN Brussels
Telex: 23 494

MOROCCO
Dolbeau
81 rue Karatchi
Casablanca
Tel: 3041 82
Telex: 23051/22822
Cable: MATERIO

Gerep
3, rue d'Agadir
Casablanca
Tel: 272093/5
Telex: 23739
Cable: GEREP-CASA

Cogedir
31 rue Omar Slaoui
Casablanca
Tel: 27 65 40
Telex: 21737/23003
Cable: COGEDIR

NETHERLANDS
Hewlett-Packard Benelux N.V.
Van Heuven Goedhartlaan 121
P.O. Box 667
NL-**Amstelveen** 1134
Tel: (020) 47 20 21

NORWAY
Hewlett-Packard Norge A/S
Osterdalen 18
P.O. Box 34
1345 **Osterass**
Tel: (02) 1711 80
Telex: 16621 hpnas n

Hewlett-Packard Norge A/S
Nygaardsgaten 114
5000 **Bergen**

POLAND
Biuro Informacji Technicznej
Hewlett-Packard
Ul Stawki 2, 6P
00-950 **Warszawa**
Tel: 33.25,88,39 67.43
Telex: 81 24 53 hepa pl

UNIPAN
Biuro Obsługi Technicznej
01-447 Warszawa
ul **Newelska** 6
Poland

Zaklady Naprawcze Sprzetu
Medycznego
Plac Komuny Paryskiej 6
90-007 **Łódź**
Tel: 334-41, 337-83
Telex: 886981

PORTUGAL
Telectra-Empresa Técnica de
Equipamentos Eléctricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-**Lisbon** 1
Tel: (19) 68 60 72
Cable: TELECTRA Lisbon
Telex: 12598

Medical only
Mundinter
Intercambio Mundial de Comércio
S.a.r.l.
P.O. Box 2761
Avenida Antonio Augusto
de Aguiar 138
P - **Lisbon**
Tel: (19) 53 21 31/7
Telex: 16691 munter p
Cable: INTERCAMBIO Lisbon

QATAR
Nasser Trading & Contracting
P.O. Box 1563
Doha
Tel: 22170
Telex: 4439 NASSER
Cable: NASSER

RUMANIA
Hewlett-Packard Reprezentanta
Bd.n. Balcescu 16
Bucuresti
Tel: 15 80 23/13 88 85
Telex: 10440

I.I.R.U.C.
Intreprinderea Pentru
Intretinerea
Si Repararea Utilajelor de Calcul
8-dul Prof. Dimitrie Pompei 6
Bucuresti-Sectorul 2
Tel: 88-20-70, 88-24-40, 88-67-95
Telex: 118

SAUDI ARABIA
Modern Electronic
Establishment (Head Office)
P.O. Box 1228, Baghdadiah Street
Jeddah
Tel: 27 798
Telex: 40035
Cable: ELECTA JEDDAH

Modern Electronic
Establishment (Branch)
P.O. Box 2728
Riyadh
Tel: 62596,66232
Cable: RAOUFCO

Modern Electronic
Establishment (Branch)
P.O. Box 193
Al-Khobar
Tel: 44678-44813

SPAIN
Hewlett-Packard Española, S.A.
Calle Jerez 3
E-**Madrid** 16
Tel: (1) 458 26 00 (10 lines)
Telex: 23515 hpe

Hewlett-Packard Espadñola S.A.
Colonia Mirasierra
Edificio Juban
% Costa Brava, 13
Madrid 34

Hewlett-Packard Española, S.A.
Milanesado 21-23
E-**Barcelona** 17
Tel: (3) 203 6200 (5 lines)

Hewlett-Packard Española, S.A.
Av Ramón y Cajal, 1
Edificio Sevilla, planta 9°
-**Seville** 5
Tel: 64 44 54/58

Hewlett-Packard Española S.A.
Edificio Albia II 7° B
E-**Bilbao** 1
Tel: 23 83 06/23 82 06

Hewlett-Packard Española S.A.
C/Ramon Gordillo 1
(Entlo.)
E-**Valencia**-10
Tel: 96-361.13.54/361.13.58

SWEDEN
Hewlett-Packard Sverige AB
Enighetsvägen 3, Fack
S-161 **Bromma** 20
Tel: (08) 730 05 50
Telex: 10721
Cable: MEASUREMENTS
Stockholm

Hewlett-Packard Sverige AB
Frötallsgatan 30
S-421 32 **Västra Frölunda**
Tel: (031) 49 09 50
Telex: 10721 via Bromma office

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 307
CH-8952 **Schlieren-Zurich**
Tel: (01) 7305240
Telex: 53933 hpag ch
Cable: HPAG CH

Hewlett-Packard (Schweiz) AG
Château Bloc 19
CH-1219 **Le Lignon-Geneva**
Tel: (022) 96 03 22
Telex: 27333 hpag ch
Cable: HEWPACKAG Geneva

SYRIA
General Electronic Inc.
Nuri Basha-Annaf Ebn Kays Street
P.O. Box 5781
Damascus
Tel: 33 24 87
Telex: 11215 ITIKAL
Cable: ELECTROBOR DAMASCUS

Medical/Personal Calculator only
Sawah & Co.
Place Azmé
B.P. 2308
Damascus
Tel: 16 367-19 697-14 268

Suleiman Hilal El Mlawi
P.O. Box 2528
Mamoun Bitar Street, 56-58
DamascusTel: 11 46 63

TUNISIA
Tunisie Electronique
31 Avenue de la Liberte
Tunis
Tel: 280 144

Corema
1 ter. Av. de Carthage
Tunis
Tel: 253 821
Telex. 12319 CABAM TN

TURKEY
TEKNIM Company Ltd.
Riza Sah Pehlevi
Caddesi No. 7
Kavaklidere, **Ankara**
Tel: 275800
Telex: 42155

Teknim Com., Ltd.
Barbaros Bulvari 55/12
Besikyas, **Istanbul**
Tel: 613 546
Telex: 23540

Medical only
E.M.A.
Muhendislik Kolektif Sirketi
Mediha Eldem Sokak 41/6
Yüksel Caddesi
Ankara
Tel: 17 56 22
Cable: EMATRADE/Ankara

Analytical only
Yilmaz Özyurek
Milli Mudafaa Cad 16/6
Kizilay

Ankara
Tel: 25 03 09 - 17 80 26
Telex: 42576 OZEK TR
Cable: OZYUREK ANKARA

UNITED ARAB EMIRATES
Emitac Ltd. (Head Office)
P.O. Box 1641
Sharjah
Tel: 354121/3
Telex. 8136

Emitac Ltd (Branch Office)
P.O. Box 2711
Abu Dhabi
Tel: 331370/1

UNITED KINGDOM
Hewlett-Packard Ltd.
King Street Lane
Winnersh, Wokingham
Berks. RG11 5AR
Tel. (0734) 784774
Telex 847178-9

Hewlett-Packard Ltd.
Trafalgar House
Navigation Road
Altrincham
Cheshire WA14 1NU
Tel. (061) 928 6422
Telex: 668068

Hewlett-Packard Ltd.
Lygon Court
Hereward Rise
Dudley Road
Halesowen,
West Midlands B62 8SD
Tel: (021) 550 9911
Telex: 339105

Hewlett-Packard Ltd.
Wedge House
799, London Road
Thornton Heath
Surrey CR4 6XL
Tel: (01) 6840103
Telex: 946825

Hewlett-Packard Ltd
10, Wesley St.
Castleford
Yorks WF10 1AE
Tel: (0977) 550016
Telex: 557355

Hewlett-Packard Ltd
1, Wallace Way
Hitchin
Hertfordshire, SG4 0SE
Tel: (0462) 31111
Telex: 82.59.81

USSR
Hewlett-Packard
Representative Office USSR
Pokrovsky Boulevard 4/17-kw 12
Moscow 101000
Tel: 294.20.24
Telex: 7825 hewpak su

YUGOSLAVIA
Iskra-Standard/Hewlett-Packard
Miklosiceva 38/VII
61000 **Ljubljana**
Tel: 31 58 79/32 16 74

SOCIALIST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett-Packard Ges m.b.H
Handelskai 52
P.O. Box 7
A-1205 **Vienna**, Austria
Tel: (0222) 35 16 21 to 27

MEDITERRANEAN AND MIDDLE EAST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett-Packard S.A.
Mediterranean and Middle
East Operations
35, Kolokotroni Street
Platia Kefallariou
GR-Kifissia-**Athens**, Greece
Tel: 8080337/259/429

FOR OTHER AREAS NOT LISTED CONTACT
Hewlett-Packard S.A
7, rue du Bois-du-Lan
P.O. Box
CH-1217 Meyrin 2 - **Geneva**
Switzerland
Tel: (022) 82 70 00

UNITED STATES

ALABAMA
P.O. Box 4207
8290 Whitesburg Dr.
Huntsville 35802
Tel: (205) 881-4591

8933 E. Roebuck Blvd.
Birmingham 35206
Tel: (205) 836-2203/2

ARIZONA
2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 244-1361

2424 East Aragon Rd.
Tucson 85706
Tel: (602) 889-4661

***ARKANSAS**
Medical Service Only
P.O. Box 5646
Brady Station
Little Rock 72215
Tel: (501) 376-1844

CALIFORNIA
1579 W. Shaw Ave.
Fresno 93771
Tel: (209) 224-0582

1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2671

5400 West Rosecrans Blvd.
P.O. Box 92105
World Way Postal Center
Los Angeles 90009
Tel: (213) 776-7500
TWX: 910-325-6608

***Los Angeles**
Tel: (213) 776-7500

3003 Scott Boulevard
Santa Clara 95050
Tel. (408) 988-7000
***Ridgecrest**
Tel: (714) 446-6165

646 W. North Market Blvd
Sacramento 95834
Tel: (916) 929-7222

9606 Aero Drive
P.O. Box 23333
San Diego 92123
Tel: (714) 279-3200

***Tarzana**
Tel: (213) 705-3344

COLORADO
5600 DTC Parkway
Englewood 80110
Tel: (303) 771-3455

CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel: (203) 389-6551
TWX: 710-465-2029

FLORIDA
P.O. Box 24210
2727 N.W. 62nd Street
Ft. Lauderdale 33309
Tel: (305) 973-2600

4428 Emerson Street
Unit 103
Jacksonville 32207
Tel: (904) 725-6333

P.O. Box 13910
6177 Lake Ellenor Dr.
Orlando 32809
Tel: (305) 859-2900

P.O. Box 12826
Suite 5, Bldg. 1
Office Park North
Pensacola 32575
Tel: (904) 476-8422

GEORGIA
P.O. Box 105005
450 Interstate North Parkway
Atlanta 30348
Tel: (404) 955-1500
Medical Service Only
***Augusta** 30903
Tel: (404) 736-0592

P.O. Box 2103
1172 N. Davis Drive
Warner Robins 31098
Tel: (912) 922-0449

HAWAII
2875 So. King Street
Honolulu 96826
Tel: (808) 955-4455

ILLINOIS
5201 Tollview Dr.
Rolling Meadows 60008
Tel: (312) 255-9800
TWX: 910-687-2260

INDIANA
7301 North Shadeland Ave.
Indianapolis46250
Tel: (317) 842-1000
TWX: 810-260-1797

IOWA
2415 Heinz Road
Iowa City 52240
Tel: (319) 338-9486

KENTUCKY
Medical Only
3901 Atkinson Dr.
Suite 407 Atkinson Square
Louisville 40218
Tel: (502) 456-1573

LOUISIANA
P.O. Box 1449
3229-39 Williams Boulevard
Kenner 70063
Tel: (504) 443-6201

MARYLAND
7121 Standard Drive
Parkway Industrial Center
Hanover 21076
Tel: (301) 796-7700
TWX: 710-862-1943

2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS
32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN
23855 Research Drive
Farmington Hills 48024
Tel: (313) 476-6400

724 West Centre Ave.
Kalamazoo 49002
Tel. (606) 323-8362

MINNESOTA
2400 N. Prior Ave.
St. Paul 55113
Tel: (612) 636-0700

MISSISSIPPI
322 N. Mart Plaza
Jackson 39206
Tel: (601) 982-9363

MISSOURI
11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

1024 Executive Parkway
St. Louis 63141
Tel: (314) 878-0200

NEBRASKA
Medical Only
7101 Mercy Road
Suite 101
Omaha 68106
Tel: (402) 392-0948

NEVADA
***Las Vegas**
Tel: (702) 736-6610

NEW JERSEY
W. 120 Century Rd.
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

Crystal Brook Professional
Building, Route 35
Eatontown 07724
Tel:(201) 542-1384

NEW MEXICO
P.O. Box 11634
Station E
11300 Lomas Blvd., N.E.
Albuquerque 87123
Tel: (505) 292-1330
TWX: 910-989-1185

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 526-2484
TWX: 910-9983-0550

NEW YORK
6 Automation Lane
Computer Park
Albany 12205
Tel: (518) 458-1550
TWX: 710-444-4961

650 Perinton Hill Office Park
Fairport 14450
Tel: (716) 223-9950
TWX: 510-253-0092

No. 1 Pennsylvania Plaza
55th floor
34th street & 8th Avenue
New York 10001
Tel: (212) 971-0800

5858 East Molloy Road
Syracuse 13211
Tel: (315) 455-2488

1 Crossways Park West
Woodbury 11797
Tel: (516) 921-0300

NORTH CAROLINA
5605 Roanne Way
Greensboro 27405
Tel: (919) 852-1800

OHIO
Medical/Computer Only
Bldg. 300
1313 E. Kemper Rd.
Cincinnati 45246
Tel: (513) 671-7400

16500 Sprague Road
Cleveland 44130
Tel: (216) 243-7300
TWX: 810-423-9430

330 Progress Rd.
Dayton 45449
Tel: (513) 859-8202

1041 Kingsmill Parkway
Columbus 43229
Tel: (614) 436-1041

OKLAHOMA
P.O. Box 32008
6301 N. Meridian Avenue
Oklahoma City 73112
Tel: (405) 721-0200

9920 E. 42nd Street
Suite 121
Tulsa 74145

OREGON
17890 SW Lower Boones
Ferry road
Tualatin 97062
Tel: (503) 620-3350

PENNSYLVANIA
111 Zeta Drive
Pittsburgh 15238
Tel: (412) 782-0400

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel: (215) 265-7000
TWX: 510-660-2670

PUERTO RICO
Hewlett-Packard Inter-Americas
Puerto Rico Branch Office
Calle 272,
Edif. 203 Urg. Country Club
Carolina 00924
Tel: (809) 762-7255
Telex: 345 0514

SOUTH CAROLINA
P.O. Box 6442
6941-0 N. Trenholm Road
Columbia 29260
Tel: (803) 782-6493

TENNESSEE
8914 Kingston Pike
Knoxville 37922
Tel: (615) 523-0522

3027 Vanguard Dr.
Director's Plaza
Memphis 38131
Tel: (901) 346-8370

***Nashville**
Medical Service only
Tel: (615) 244-5448

TEXAS
4171 North Mesa
Suite C110
El Paso 79902
Tel: (915) 533-3555

P.O. Box 1270
201 E. Arapaho Rd.
Richardson 75080
Tel: (214) 231-6101

P.O. Box 42816
10535 Harwin Dr.,
Houston 77036
Tel: (713) 776-6400

***Lubbock**
Medical Service only
Tel: (806) 799-4472

205 Billy Mitchell Road
San Antonio 78226
Tel: (512) 434-8241

UTAH
2160 South 3270 West Street
Salt Lake City 84119
Tel: (801) 972-4711

VIRGINIA
P.O. Box 12778
Norfolk 23502
Tel: (804) 460-2671

P.O. Box 9669
2914 Hungary Springs Road
Richmond 23228
Tel: (804) 285-3431

WASHINGTON
Bellefield Office Pk.
1203-114th Ave. S.E.
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2446

P.O. Box 4010
Spokane 99202
Tel: (509) 535-0864

***WEST VIRGINIA**
Medical/Analytical Only
Charleston
Tel: (304) 345-1640

WISCONSIN
9004 West Lincoln Ave.
West Allis 53227
Tel: (414) 541-0550

FOR U.S. AREAS NOT LISTED:
Contact the regional office
nearest you: Atlanta, Georgia...
North Hollywood, California...
Rockville, Maryland...
Rolling Meadows,
Illinois. Their complete
addresses are listed above.

***Service Only**

Appendix F

Error Messages

*OVERFLOW	Number or result exceeds calculating range.
*SQRT OF NEG #	
*DIVISION BY ZERO	
*NO I/O DEVICE	Peripheral device or interface not connected.
ILLEGAL ADDRESS	Improper step address or storage register specified.
ILLEGAL ARGUMENT	Improper value for operation (e.g., improper scale or axis parameters).
MEMORY OVERFLOW	Program instruction, storage register assignment, or program loaded from tape exceeds available memory.
GOSUB OVERFLOW	More than seven subroutines (including special functions) nested at a time.
KEY NOT DEFINED	Special function just called is not defined.
IMPROPER SYNTAX	Incorrect use of FIX, SCI, SCI 3, →ALPHA, CALL, ALPHA←, SFG, CFG, D (FOR), E (NEXT) or F (IF)
*CHECKSUM ERROR	Program or data loaded into calculator not identical to that in file; this usually indicates a dirty tape head or a worn tape.
*VERIFY FAILED	Program or data in file not identical to that in calculator.
WRONG FILE TYPE	Attempting to load an empty, extra, or binary file; recording on an extra file.
END OF TAPE	End of tape reached during MARK operation. Also indicates a broken or defective tape; if the tape does not appear to be broken, (advance it using the drive wheel), replace the cartridge, press REWIND, and continue.
PROTECTED TAPE	The cartridge RECORD slide is positioned to prevent MARK and RECORD operations.

*These messages are suppressable; see "Flags" in Section 3 of the calculator operating manual.

SECURED MEMORY	Attempting to list, edit, or record a secured program.
MISSING FOR STMT	
LABLE NOT FOUND	
FILE NOT FOUND	
CARTRIDGE OUT	
MISSING GOSUB	
PLOTTER INACTIVE	Plotter is not connected to interface or the plotter is in a power-off state.
BAD PARAMETER	Input values exceed the parameter limits.
ILLEGAL CHAR	Character specified is not contained in the character set.
UNKNOWN CHAR SET	Character set specified as standard or alternate is not currently resident in the plotter.
NO PLOTR IN LOG	A PLOTR instruction was attempted while one or both axes were in LOG.
LOG OF # <=0	1. The calculator has attempted to find the LOG of a number which is ≤0.* 2. The plotter has received a LOG mode instruction while one of the parameters is set to 0. This occurs with the following instructions: PLOTA, MOVE, SCALE, XAXIS, YAXIS, LIMIT.

HP 98130A Plotter Interface

HEWLETT hp PACKARD

PART NO. 98130-90000
MICROFICHE NO. 98130-99000

PRINTED IN U.S.A.
February 2, 1979