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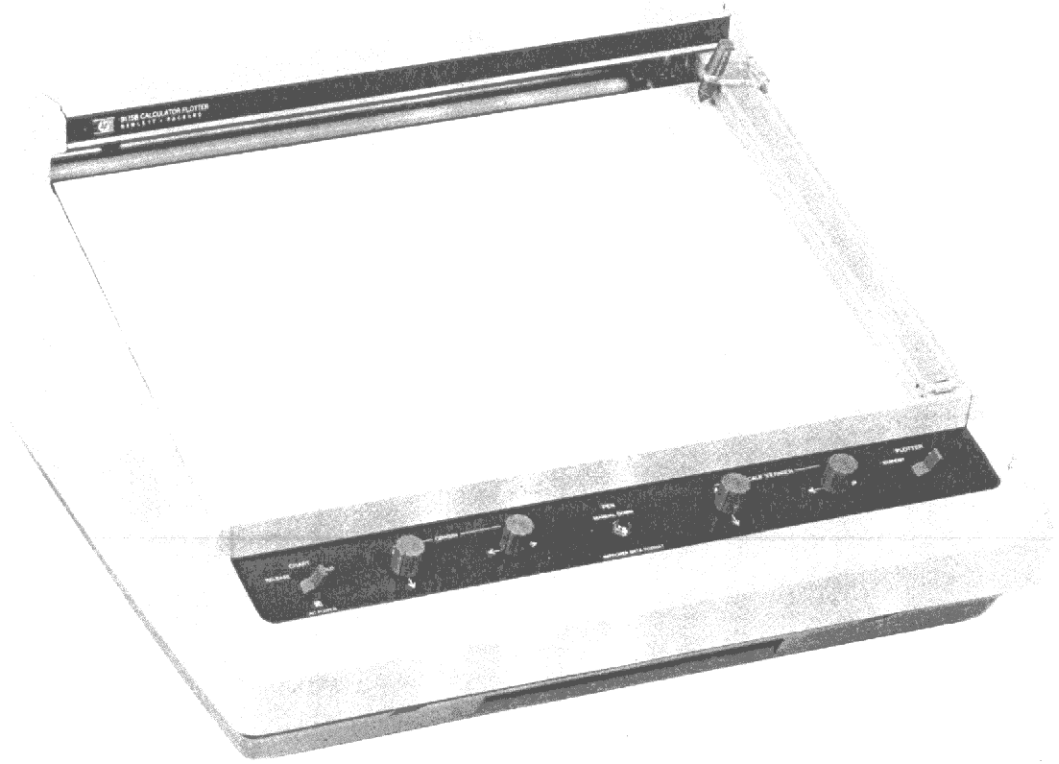
HEWLETT-PACKARD 9125B CALCULATOR PLOTTER



The 9125B Calculator Plotter presents graphic solutions to problems solved by the 9100 Calculator. The graphs show the relationship between two or more variables. This relationship is ordinarily programmed in the Calculator which then automatically drives the Plotter. As the Calculator solves the problem, the Plotter graphs the results.

The Calculator can also be used in the manual mode to transfer data coordinates directly to the Plotter.

SPECIFICATIONS

Plotting Area

10 inches on the Y-axis by 15 inches on the X-axis (25 cm by 38 cm on metric paper).

Origin

Origin can be set anywhere on the plotting surface, allowing four-quadrant plotting.

Scale Factor

500 counts per inch (200 counts per cm) adjustable by at least ±10 counts per inch (4 counts per cm) by front-panel SCALE VERNIER control.

Plotting Accuracy

±0.03 in. (0,8 mm).

Dynamic Accuracy

Deviation from a straight line between two data points is less than 0.04 in. (1,0 mm), for data points up to 5 in. (12,5 cm) apart.

Resettability

0.007 in. (0,18 mm).

Plotting Time

Minimum of 0.4 second from one plot point to the next. Total plotting time depends upon calculation time and the number of plot points per unit distance.

Temperature

Plotting Accuracy and Resettability specifications above are for any constant temperature from 5°C to 55°C. Origin stability is better than 0.002 in./°C, (0,05 mm/°C). Scale Factor temperature coefficient is less than 0.02%/°C.

To Dynamic Accuracy specification add ±0.2% of displacement for operation over the range of 15°C-35°C, or ±0.5% of displacement for operation at 5°C-15°C or 35°C-55°C.

Weight

Net, 36 lb (16,3 kg); shipping, 48 lb (21,8 kg).

Dimensions

20 in. x 19¾ in. x 8½ in. (500 x 484 x 213 mm).

SPECIFICATIONS
CONTINUED

Power

The Model 9125B requires either 115 or 230 volts ac ±10%, 48-66 Hz, and less than 100 watts of power.

CAUTION

DO NOT APPLY OPERATING POWER TO THE 9100 UNLESS THE 115/230 LINE VOLTAGE SWITCHES ON THE REAR PANELS OF THE 9100 AND THE 9125B ARE IN THE PROPER POSITION. DAMAGE TO THE POWER TRANSFORMERS MAY RESULT FROM IMPROPER SETTING.

GROUNDING REQUIREMENTS

To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the 9100 and 9125B panels and cabinets be grounded. The three-conductor power cables supplied with the 9100 and the 9125B ground the cabinets when plugged into the proper receptacle. The Model 9125B meets the International Electro-Technical Commission (IEC) specifications.

ACCESSORIES

EQUIPMENT SUPPLIED

The accessories and equipment supplied with each Model 9125B are listed below:

PART NO.	QTY	DESCRIPTION
09125-90012	2	Operating manual
09125-90014	1	Magnetic card with diagnostic program
8120-1348	1	Power cord
8120-1370	1	Inter-instrument cord
4040-0477	1	Dust cover
09125-90011	1	Pull-out instruction card
5080-3605	1	Slidewire cleaner
5080-3635	1	Slidewire lubricant
5080-7979	1	Pkg. of 3 red pens
5080-7980	1	Pkg. of 3 blue pens
9270-1004	10	Graph paper (English)
9270-1024	10	Graph paper (metric)

PLOTTING PAPER AVAILABLE

To gain maximum benefit from your 9125B Calculator Plotter, you will want to use precision-ruled plotting paper. Hewlett-Packard Company offers a wide variety of papers, available through all field offices. These are 11 in. by 16.5 in. (28 cm by 42 cm) overall, and are packaged 100 sheets per box.

	PART NO.	PLOT AREA
LINEAR:	9270-1004	10 in. x 15 in.
	9270-1024	25 cm x 38 cm
SEMI-LOG:	9280 0159	10 in. x 2 cycle
	9280-0160	10 in. x 3 cycle
	9280-0169	2 cycle x 15 in.
	9280-0168	3 cycle x 15 in.
LOG-LOG:	9280-0167	2 cycle x 3 cycle
	9280-0165	3 cycle x 2 cycle
	9280-0171	3 cycle x 4 cycle

PENS AVAILABLE

PART NO.	DESCRIPTION
5080-7979	Package of 3 red pens
5080-7980	Package of 3 blue pens
5080-7981	Package of 3 green pens
5080-7994	Package of 3 black pens

SERVICE CONTRACTS

Service Contracts are recommended for your 9100 Calculator and 9125B Calculator Plotter to ensure maximum operating life. For further information contact your local Hewlett-Packard Sales and Service Office.

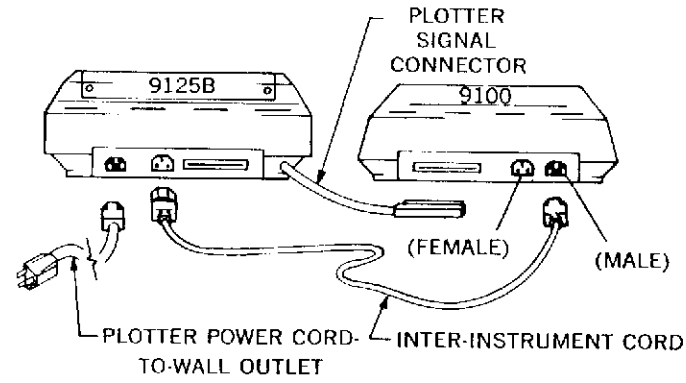
4 PLOTTER INSTALLATION

INITIAL INSPECTION

The Plotter was carefully inspected prior to shipment. It should be free of mars or scratches and in perfect operating condition when received. Inspect the Plotter for physical damage and inventory the supplied accessories listed on page 2. If the Plotter is damaged or if a performance deficiency is indicated, file a claim with the carrier or refer to the warranty on the inside front cover of this manual.

INSTALLATION

Turn the Calculator OFF. Place the Plotter on the right of the Calculator (see diagram) and insert the Plotter signal connector into the input connector at the rear of the Calculator. Connect the inter-instrument cord between the units. Connect the Plotter's power cord to an appropriate power receptacle.



NOTE

Early 9100A Calculators are not equipped to use the Inter-instrument cord. To use a 9125B with an early 9100A, connect their individual power cords to a wall outlet.

DIAGNOSTIC PROGRAM

The following procedure confirms the Plotter is operating properly when it is correctly installed:

1. Confirm the 9100 Calculator is operating by executing the calculator diagnostic routine (see your 9100 Operating Manual).
2. Place a sheet of the plotter paper supplied with the 9125B (10 in. x 15 in. grid) on the plotter platen firmly against the bottom paper guide and left edge paper stop. Set **CHART RELEASE-HOLD** switch to **HOLD**. Smooth paper to the platen.
3. Calibrate the Plotter using the following steps:

STEP 1 Set **PLOTTER** switch to **ON** and press the

the **STOP** key.

STEP 2 Use the **ORIGIN** controls to position the pen at the lower left corner of your chart. Use the **PEN MANUAL DOWN** pushbutton to verify the pen location.

STEP 3 Enter the value of Y_{plot} into the Y register which will place the pen at the upper left corner (5000 for 10 in. or 25 cm grid). Enter the value of X_{plot} into the X register which will place the pen at the upper right corner (7500 for 15 in. grid, 7600 for 38 cm grid).

STEP 4 Press 

Use the **SCALE VERNIER** controls to fix the exact position at the top right edge of the grid.

4. Insert the PLOTTER DIAGNOSTIC CARD into the Calculator's card reader.

> **NOTE**
> The same program is on both sides of the diagnostic card, therefore, either end of the card can be put into the card reader.

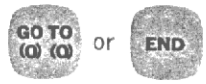
5. On the Calculator

SET **ON**

SET **DECIMAL WHEEL TO** 

SET **RUN**

SET **DEGREES**

PRESS 

PRESS 

PRESS 

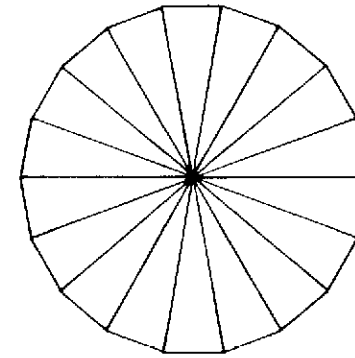
6. On the Plotter, set the pen in the exact center of the paper using the **ORIGIN** controls.

7. On the Calculator

PRESS 

DIAGNOSTIC PROGRAM
CONTINUED

DIAGNOSTIC PLOT



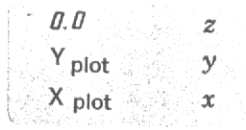
Proper execution of the program is indicated by a plot as indicated. The plot should be well formed, with the retraces having no more than 0.04 in. (1,0 mm) openings. The lines may exhibit some waviness or a slight oscillatory appearance, particularly at the ends. This waviness must not make the distance between outside edges of the line exceed one pen width plus 0.04 in. (1,0 mm). Should the plotter fail the diagnostic, check to see if the DEGREE/RADIAN switch is to set to DEGREES; clean the slidewires (see page 23) and try the diagnostic again. If the Plotter again fails to execute the program properly, contact your nearest Hewlett-Packard Sales and Service Office listed in the rear of this manual.

SHIPPING

Before returning the instrument for any reason, notify the local field sales office of the difficulty encountered, giving the model and serial number of the instrument. They will furnish shipping instructions. The following precautions should be taken when repackaging the recorder:

1. Remove the ink pen.
2. Secure the upper end of the carriage arm and pen carriage to the right side of the recorder with the bracket (5080-7834) supplied with the mainframe, to prevent movement while in transit.
3. If being returned for repair, do not send power cord, accesory kit, or other accessories.
4. Wrap the instrument in heavy paper or plastic and surround with three to four inches of shock-absorbing material to cushion and prevent movement inside the shipping container. The container should be sufficiently durable to prevent damage to the instrument during handling. If in doubt, request shipping carton (Part No. 09125-80210) from the nearest Hewlett-Packard Sales and Service Office listed in the rear of this manual.

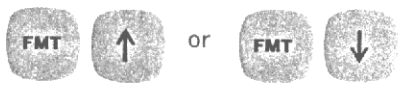
The 9125B Plotter plots straight line segments between data points. Curves on the finished plot are normally smooth if the interval between successive plot points is made small. The coordinates of each plotted point must first appear in the Calculator's X keyboard and Y accumulator registers; the coordinates are then transferred to the Plotter with a command for the pen to move to the point determined by these coordinate values. The value of these plot coordinates will be designated X_{plot} and Y_{plot}.



X_{plot} corresponds to a distance from the origin on the Plotter's horizontal axis and Y_{plot} corresponds to a distance from the origin on the plotter's vertical axis. Taken together, they correspond to a unique point on the Plotter's writing surface. The contents of the Z temporary register are not transferred to the Plotter and in no way affect the position of the plotted point.

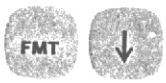
CALCULATOR PLOTTER COMMANDS

Two sets of Calculator commands are used for transferring the plotting coordinates from the Calculator to the Plotter:



These commands can be executed as either programmed instructions or as manual key strokes.

Raises the pen and then moves it to the coordinates X_{plot} (in the X register) and Y_{plot} (in the Y register). The pen remains in the up position after reaching the specified point.



Moves the pen to the coordinates X_{plot} and Y_{plot}. If the pen is down before the command, the pen traces a straight line to the next coordinate; if not, the pen is moved while in the raised position and then lowered to the paper.

When manually pressed, raises and positions the pen at the origin ($X_{plot} = 0$, $Y_{plot} = 0$) regardless of the contents of the X and Y registers. When executed as a programmed instruction, the STOP command has no special effect on the Plotter.

8 PLOTTER OPERATION

PLOTTER CONTROL PANEL

AC POWER

Lights to indicate when ac power is applied to the 9125B; ac power is controlled by the power switch on the 9100.

CHART
RELEASE HOLD

Controls electric paper hold down, the "Autogrip." In the **RELEASE** position, Autogrip is de-energized, allowing recording paper to be positioned or changed. In the **HOLD** position, Autogrip is energized, holding the paper firmly for plotting.

PLOTTER
STANDBY ON

When in **STANDBY** position, the motors controlling the pen movement are disabled. The plotter should be placed in **STANDBY** when not in use.

PEN
MANUAL DOWN

Drops the pen when pressed and lifts it when released. This switch is normally used for marking the pen location for exact pen positioning.

ORIGIN

Controls the origin of the plot on the recording paper. Arrows indicate the axis controlled by each knob. The plot origin can be set anywhere on the plotting surface.

SCALE VERNIER

Allows small adjustments of the Plotter sensitivity. Nominal senstivity is 500 counts per inch. This sensitivity may be changed by front panel controls to adjust for tolerances among standard graph papers and for using metric graph papers (200 counts/cm). Arrows indicate axis being adjusted.

IMPROPER DATA FORMAT

Lights to indicate the Decimal Digits Wheel is improperly set or the coordinates are outside the range which can be accepted by the Plotter. When executing a program the calculation continues but the pen lifts until data of the proper format is encountered.

NOTE
Decimal digits wheel must be set to 6 or less.

Drawing the letter "T" is a simple way to become familiar with plotter commands. Try drawing on different parts of the paper and drawing different sized letters.

To draw the letter "T," follow these steps:

STEP 1 Set the Decimal Wheel at 6 or less.

STEP 2 Depress the STOP key and using the **ORIGIN** control, place the pen at the lower left corner of your paper.

STEP 3 Enter 2000 into both the X and Y registers

PRESS: FMT ↓

STEP 4 Enter 4000 into the Y register leaving 2000 in the X register

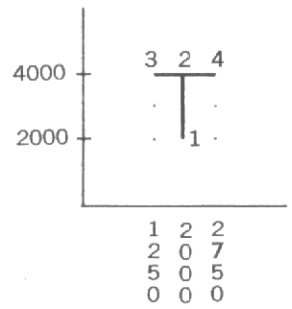
PRESS: FMT ↓

STEP 5 Enter 1250 into the X register leaving 4000 in the Y register

PRESS: FMT ↑ then FMT ↓

STEP 6 Enter 2750 into the X register leaving 4000 in the Y register

PRESS: FMT ↓ then STOP



PAPER POSITIONING

Hewlett-Packard supplies graph paper especially manufactured for use with the 9125B Plotter. This paper is manufactured with rigid control over margin tolerances and alignment. This insures that vertical and horizontal lines drawn by the Plotter will always be parallel or perpendicular to the lines on the graph paper.

To position the paper, place the **CHART** switch to **RELEASE.** Place the paper against the bottom guide and the left edge paper stop. Move the **CHART** switch to **HOLD** and smooth the paper to the platen.

PAPER POSITIONING
CONTINUED

The following steps may be necessary to obtain precise alignment or when using other than Hewlett-Packard chart paper.

STEP 1 Turn **PLOTTER** switch to **ON** and press the **STOP** key.

STEP 2 Use the **ORIGIN** controls to position the pen at the lower left grid corner of your chart. Use the **PEN MANUAL DOWN** pushbutton to verify the pen location.

STEP 3 Now, enter the value of X_{plot} into the X register which will place the pen at the lower right corner (7500 for 15 in. grid, 7600 for 38 cm grid. Press

FMT ↑ Use the **SCALE VERNIER** controls and the **PEN MANUAL DOWN** pushbutton to fix the exact horizontal position at the right edge of the grid. Move the **CHART** switch to **RELEASE**. Wait a few seconds, then rotate the paper about the lower left corner to fix the vertical position. Move the **CHART** switch to **HOLD** and smooth the paper to the Plotter platen. Your graph paper is now precisely positioned for plotting.

DATA FORMAT

Plot coordinates are interpreted by the Plotter as FIXED POINT numbers. The digits to the right of the decimal are not recognized. Only the integer value of the number is used for the value of the plot coordinates. If the number cannot be displayed in fixed point (because of the position of the 9100 decimal digits wheel or the magnitude of the number) then only the digits to the left of the decimal point are transferred to the Plotter.

3	0. 1534.739 6983.046	$Y_{plot} = 1534$ $X_{plot} = 6983$

FIXED POINT

2	0. 1.534739 6.983046	00 03 03	$Y_{plot} = 1534$ $X_{plot} = 6983$

FLOATING POINT

6	0. 5.678 1.234	00 02 04	$Y_{plot} = 567$ I.F. Lamp ON

FLOATING POINT

Plot coordinates can be entered and displayed in the X and Y registers in either FIXED POINT or FLOATING POINT notation. When the Plotter takes the coordinates from the Calculator, it briefly over-rides the "FIXED-POINT-FLOATING POINT" switch displaying the coordinates in FIXED POINT notation provided they are not too large for the decimal wheel setting. The number of digits that can be displayed in FIXED POINT notation is limited by the following relationship:

NOTE

Number of digits to the left of the decimal point plus the decimal wheel setting must be less than or equal to ten.

If the number is too large to be displayed in FIXED POINT notation, the Calculator displays it as a floating point number.

IMPROPER DATA FORMAT

A FMT ↑ or FMT ↓ command to plot with improper data in the X or Y registers causes the pen to lift and the **IMPROPER DATA FORMAT** indicator light to come on. Plot coordinates are interpreted as improper if:

1. A plot coordinate in either the X or Y register is too large for the decimal wheel setting and is forced to remain as a floating point number. Only the most significant digit of this number is transferred to the Plotter since this is the only digit to the left of the decimal point.
2. The absolute value of either plot coordinate equals or exceeds 100,000.
3. The Decimal Wheel is set to a number greater than six.

EXAMPLES:

NO.	FLT-PT FIXED SWITCH	DECIMAL WHEEL SETTING	DISPLAY BEFORE PLOTTING	DISPLAY WHILE PLOTTING	PLOT. COOR.	IMPROPER DATA LIGHT ON?	REASON
1275	FLT-PT	≤ 6	1.275..03	1275	1275	NO	
1275	FLT-PT	> 6	1.275..03	1.275..03	1	YES	(1)&(3)
12750	FIXED	$= 6$	1.275..04	1.275..04	1	YES	(1)
12750	FIXED	< 6	12750	12750	12750	NO	
375	FIXED	$= 7$	375	375	375	YES	(3)
375	FIXED	≤ 6	375	375	375	NO	
535.5	FLT-PT	≤ 6	5.355..02	535.5	535	NO	
535.5	FLT-PT	> 6	5.355..02	5.355..02	535	YES	(1)&(3)
535.5	FIXED	$= 0$	536	536	536	NO	
112000	FIXED	< 5	112000	112000	112000	YES	(2)

PLOT COORDINATE NUMBER RANGE

The Plotter sensitivity is 500 counts per in. or 200 counts per cm. For every change of 500 in the value of X_{plot} or Y_{plot}, the Plotter pen moves one inch. The plotting surface of the 9125B is 15 x 10 in. (38 x 25 cm). Therefore, with the origin placed in the extreme lower left corner of the platen, the full scale coordinates are:

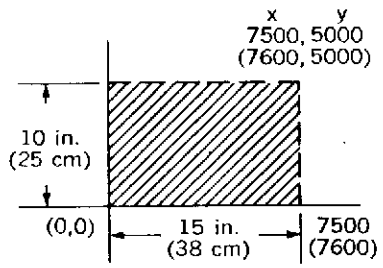
X_{plot} = 500 counts/inch x 15 inch = 7500 counts

Y_{plot} = 500 counts/inch x 10 inch = 5000 counts

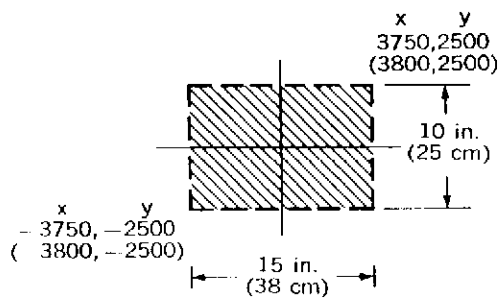
In centimeters, the full-scale coordinates are:

X_{plot} = 200 counts/cm x 38 cm = 7600 counts

Y_{plot} = 200 counts/cm x 25 cm = 5000 counts



These are the largest values the coordinates may have with the origin located in the extreme lower left corner, without the pen hitting the stops on the right or the top edge of the Plotter. If the origin is set anywhere else using the **ORIGIN** controls, coordinate values below these limits will cause the pen to hit the stops. For instance, if the **ORIGIN** controls are used to set the origin at the exact center of a 15 in. x 10 in. grid, the maximum on scale values for X_{plot} will be ±3750 and for Y_{plot} ±2500.



PROBLEM VARIABLE TRANSFORMATION

To obtain a satisfactory plot, the problem variables must be changed to the required plotter coordinate variables, X_{plot} and Y_{plot}. This transformation is explained in the following steps:

STEP 1. DETERMINE PROBLEM VARIABLE RANGE.

$$x \text{ Var Range} = x_{max} - x_{min}$$

$$y \text{ Var Range} = y_{max} - y_{min}$$

x_{max} and x_{min} are generally specified, y_{max} and y_{min} are determined by techniques such as substituting successive values of x into the equation to be plotted and solving for y. A Plotter program [09100-70026, Maximum and minimum of y = f(x)] is available to solve for y_{max} and y_{min} given the function f(x) and the range of x.

STEP 2. DETERMINE GRAPH CALIBRATION.

x_{scale} = Problem units per inch (or per cm)

y_{scale} = Problem units per inch (or per cm)

Considering the variable range and the desired size of the finished plot, select a graph calibration in problem units/inch (or problem units/cm). Generally, the selected graph calibration should yield the largest possible plot while providing easily-interpolated values between major grid divisions.

STEP 3. CONVERT PROBLEM VARIABLES to X_{plot} AND Y_{plot}.

Let x_i and y_i represent the calculated values to be plotted.

$$X_{plot} = \frac{500\,(x_i)}{x_{scale}} \quad ; \quad Y_{plot} = \frac{500\,(y_i)}{y_{scale}}$$

These relationships assume the pen is positioned, using the front panel **ORIGIN** controls, to the problem's origin location on the graph paper. If the origin is located off the paper, or if additional convenience is to be obtained, the pen may be positioned at the lower left corner of the plot area and the following relationships used:

$$X_{plot} = \frac{500\,(x_i - x_{shift})}{x_{scale}} \quad ;$$

$$Y_{plot} = \frac{Y_{plot} = 500\,(y_i - y_{shift})}{y_{scale}}$$

PROBLEM VARIABLE TRANSFORMATION

CONTINUED

x_{shift} and y_{shift} represent the coordinate values of the lower left corner of the plot area. In many applications x_{shift} and y_{shift} will equal x_{min} and y_{min}.

INCREMENTING INDEPENDENT VARIABLE

In order to plot y f(x) automatically, an increment for x, Δx, must be included in the program. Δx may be chosen indiscriminately as long as the value results in at least one point every five inches (to maintain linearity). However, if Δx is merely picked, there is a possibility that the point representing x_{max} will never be plotted. For instance, if $x_{max} = 1300$, $x_{min} = 50$ and Δx is chosen to be 200, then the plotter will plot the points 50, 250, 550 . . . 1250 and will stop at $x_i = 1250$ if the plotter is programmed to reset at $x_i \geq x_{max}$.

Δx may be calculated using the formula below:

$$\Delta x = \frac{x_{scale}}{N}$$

where N (chosen by the operator) is the number of points the plotter will plot in a space of one inch (plot point density). A value of 3 for N gives sufficient accuracy for most applications.

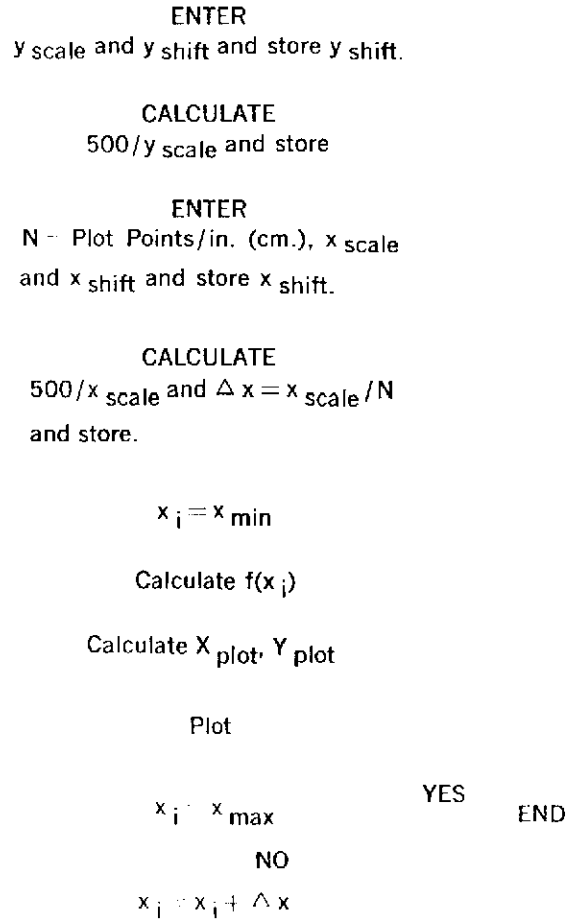
PROPER ORIGIN LOCATION

The plotter origin location is set (when X_{plot} and Y_{plot} equal zero) using the front panel **ORIGIN** controls. The origin location used is dependent on the conversion relationship used in Step 3 of Problem Variable Transformation (page 13). Generally, the Plotter origin location will be the lower left grid corner.

ITERATIVE PROGRAM

A function is plotted by executing a program in the Calculator which will repeatedly calculate the function and increment the independent variable. In this program, successive coordinates are calculated, transformed to plotting coordinates, placed in the Calculator's X and Y registers and then transferred to the Plotter using **FMT** commands. After the coordinates are transferred the Calculator goes on to compute the next pair of coordinates.

A simple scheme is: starting at $x_i = x_{min}$, calculate y_i, transform to (X_{plot}, Y_{plot}) and plot this coordinate. Then increase x_i by Δx giving x_1; calculate y_1, and again transform to (X_{plot}, Y_{plot}) and plot this coordinate. Continue in this way until $x_i = x_{max}$. The following flow-chart is a general one for plotting a function of the form $y = f(x)$. The flow chart uses the scheme described above.



EXAMPLE
$y = x^2$

The following examples illustrate the procedure for plotting a typical analytical function, $y = x^2$. The examples are identical except that in Example 1, $0 \leq x \leq 15$ and in Example 2, $-15 \leq x \leq 15$. The plot is on a 10-inch x 15-inch grid and the plotter's origin is adjusted, using the **ORIGIN** controls, to the lower left grid corner.

EXAMPLE 1: $y = x^2$ for $0 \leq x \leq 15$

STEP 1 DETERMINE PROBLEM VARIABLE RANGE.

$$x \text{ Var Range} = x_{max} - x_{min}$$
$$= 15 - 0 = 15 \text{ (given)}$$

$$y \text{ Var Range} = y_{max} - y_{min}$$
$$= 225 - 0 = 225 \text{ (by substitution)}$$

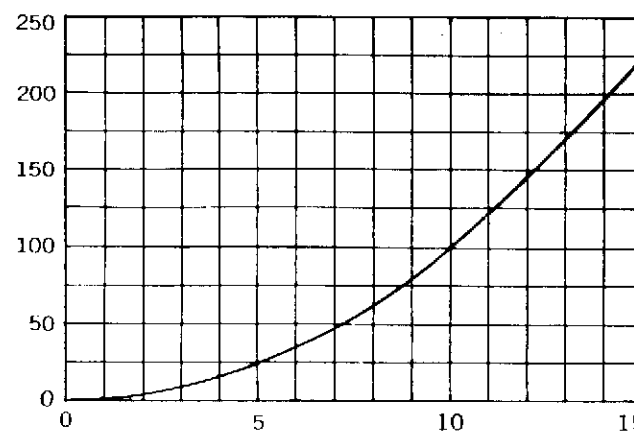
STEP 2 DETERMINE GRAPH CALIBRATION.

Any grid calibration may be used that will allow the entire final plot to be contained in the grid area. However, the largest plot with easily interpolated values will be produced when the graph calibration is: $x_{scale} = 1$ per inch; $y_{scale} = 25$ per inch.

STEP 3 CONVERT PROBLEM VARIABLE TO X_{plot} AND Y_{plot}. The following conversions must be included in the calculator's programs:

$$X_{plot} = \frac{500\,(x_i - x_{shift})}{x_{scale}} = \frac{500\,(x_i - 0)}{1}$$
$$= 500\,x_i$$

$$Y_{plot} = \frac{500\,(y_i - y_{shift})}{y_{scale}} = \frac{500\,(y_i - 0)}{25}$$
$$= 20\,y_i$$



EXAMPLE 2: $y = x^2$ for $-15 \leq x \leq 15$

STEP 1 DETERMINE VARIABLE RANGE.

x Var Range $= x_{max} - x_{min}$
$= 15 - (-15) = 30$ (given)

y Var Range $= y_{max} - y_{min}$
$= 225 - 0 = 225$ (by substitution)

STEP 2 DETERMINE GRAPH CALIBRATION
As in Example 1, many grid calibrations may be used, but the largest plot with easily-interpolated values will result from:

$x_{scale} = 2$ per inch

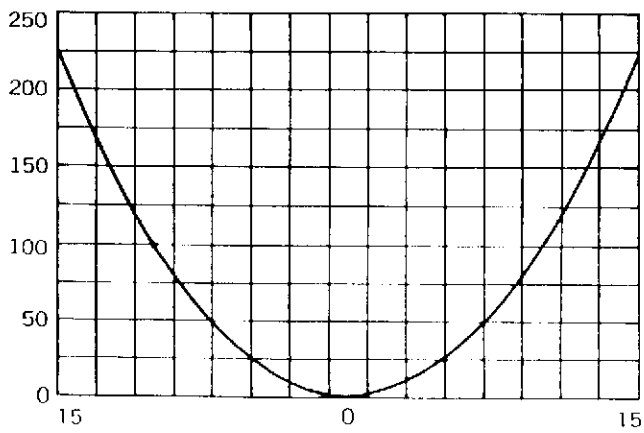
$y_{scale} = 25$ per inch

STEP 3 CONVERT THE PROBLEM VARIABLES TO X_{plot} AND Y_{plot}.
The following conversion must be included in the Calculator's programs:

$$X_{plot} = \frac{500\,(x_i - x_{shift})}{x_{scale}} = \frac{500\,(x_i - (-15))}{2}$$
$$= 250\,(x_i + 15)$$

$$Y_{plot} = \frac{500\,(y_i - y_{shift})}{y_{scale}} = \frac{500\,(y_i - 0)}{25}$$
$$= 20\,y_i$$

Note that x shift is -15 because plotter's origin is set to lower left grid corner.



PROGRAMMING TECHNIQUES

The *e* and *f* accumulator registers are convenient for storing and incrementing the independent variable. Placing $\triangle x$ in the register and x_i in the *f* register, x_i is easily incremented and re-stored using either of these sets of instructions:

RCL + y→( ) *e* or RCL ACC − + ACC +

SCALING CONSTANT STORAGE

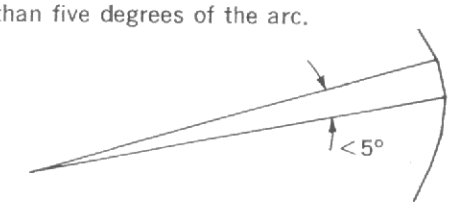
Scaling constants are usually stored in one of the alpha registers. But, if the full ten significant digits are not required, they can be stored as program instructions saving memory space. For example, this routine computes $X_{plot} = (125/6)(x_i - 180)$ storing the constants as program steps.

NOTE: x_i is in the *e* register

Step	Key	Code	Display x	Display y	Display z	Step	Key	Code	Display x	Display y	Display z
30	·					40	÷	35		125/6	
1	·					1	↓	25	125/6	X-180	
2	·					2	×	36		x_{plot}	
3	*e*	12	x			3	·				
4	↑	27		x		4	·				
5	1	01	1			5	·				
6	8	10	18			6					
7	0	00	180			7					
8	−	34		X-180		8					
9	1	01	1			9					
a	2	02	12			*a*					
b	5	05	125			*b*					
c	↑	27		125	X-180	*c*					
d	6	06	6			*d*					

ARCS

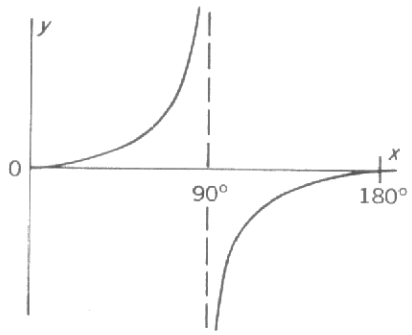
A rough rule for obtaining good resolution on arcs is to space the coordinates close enough that the line between them subtends less than five degrees of the arc.



DISCONTINUITIES

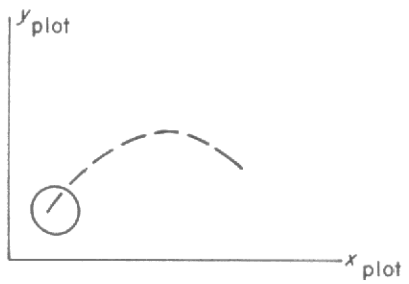
When a function contains a discontinuity, the function may be more accurately described by increasing the plot density on either side of the discontinuity.

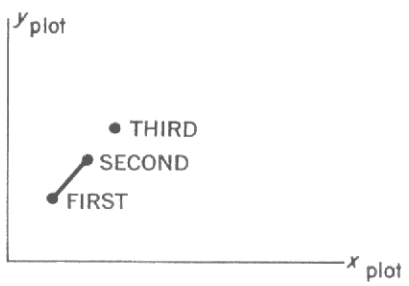
An example of this type of function is $y = \tan x$. The value of y goes to infinity for $x = 90°$ and the function is discontinuous at that point.



DASHED LINES

Plotting dashed lines and many other line formats such as - - or —— – —— – —— is possible by carefully programming the Calculator. As an example, here is a series of program steps designed to plot dashed lines. These steps would replace the normal FMT ↓ steps used to produce a continuous line.





ENLARGEMENT OF CIRCLED AREA

The first time through the series of program steps, the pen is at the origin and the FLAG is NOT SET. The flag is set and the FMT ↑ and FMT ↓ instructions are read. The pen will move to the first point and then lower. The second time through the series, the FLAG is SET. The flag is cleared and only the FMT ↓ instruction is read.

PROGRAMMING TECHNIQUES

CONTINUED

The pen traces a straight line to the next point. The third time through the FLAG is again NOT SET. The flag is set and the FMT ↑ and FMT ↓ instructions are read. The pen is raised and moved to the next point, then lowered. The process then repeats.

NOTE

STEP PRGM

9100A PROGRAM STEPPING

When single stepping a program using a 9100A in the RUN mode, execution of a FMT ↑ or FMT ↓ command will begin automatic execution of the program. To avoid this, replace each set of FMT ↓ or FMT ↑ instructions with either PAUSE or STOP instructions; or branch around the FMT commands using the GO TO key. Manually pressing FMT ↓ or FMT ↑ does not cause the program to automatically execute. These restrictions do not apply to the 9100B.

The Model 9125B must be properly maintained to obtain accurate, trouble-free operation. Proper maintenance includes periodic lubrication, performance checks, and visual and electrical checks. In accordance with good maintenance procedures for all precision instruments, your Plotter should be protected from dust by covering when not in use.

CLEANING

The Plotter should be cleaned at regular intervals determined by type of operation, local air contamination and climatic conditions.

The Autogrip platen should be cleaned as follows:

1. Carefully select a soap for cleaning. A mild liquid soap is preferable. Do not use any product with abrasives or corrosive chemicals.

2. Also be careful in selecting a cleaning cloth. Use a soft cloth that will not scratch the surface but will readily absorb water.

3. Saturate the cloth in warm, soapy water. Wring the cloth until the majority of the water has been removed.

4. Wipe the table surface with this damp cloth until the Autogrip table is clean.

CAUTION
NEVER LET WATER STAND ON AUTOGRIP SURFACE. IT MAY PERMANENTLY DAMAGE THE TABLE. DO NOT USE SOLVENTS OR SILICONE-BASED CLEANERS OF ANY TYPE.

5. Wipe any moisture from surface.

6. Allow a few minutes to dry before recording.

BALANCE SLIDEWIRE MAINTENANCE

Irregular or "jumpy" plots on a properly adjusted recorder may indicate worn or dirty balance slidewire or wipers. Slidewires should be cleaned at least every six months.

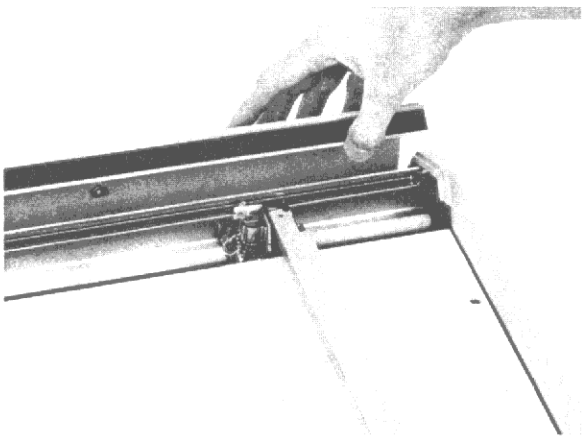
BALANCE SLIDEWIRE MAINTENANCE

CONTINUED

X-AXIS SLIDEWIRE ACCESS

To gain access to the X-axis slidewire, the rear hood of the 9125B must be removed.

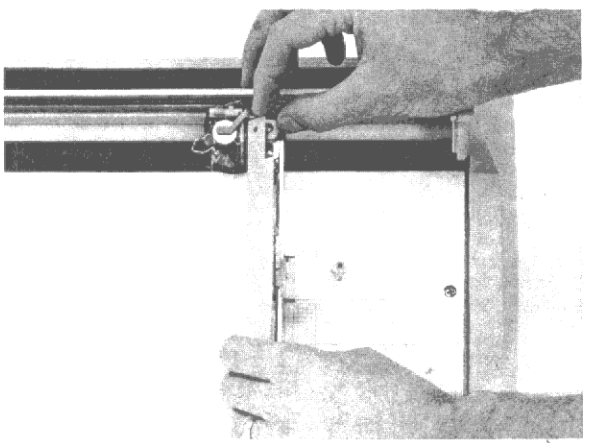
1. Turn the two screws securing the hood to the 9125B one full turn counterclockwise.
2. Remove the hood.



Y-AXIS SLIDEWIRE ACCESS

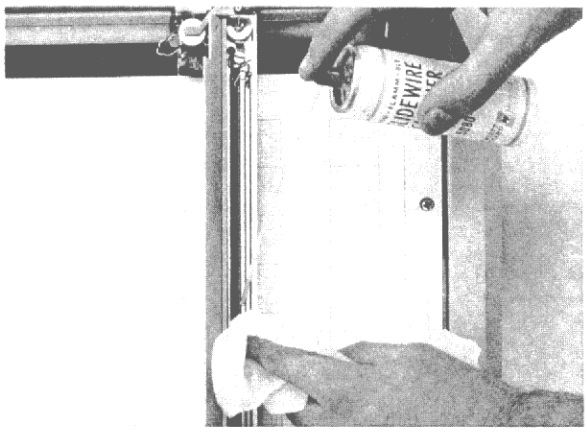
To gain access to the Y-axis slidewire, the rear hood must also be removed.

1. Remove the rear hood as described above.
2. Lift the pen holder up out of the way of the slidewire cover.
3. Turn the black nylon tab on the pen lift assembly one-quarter turn counterclockwise. This will free the slidewire cover.
4. Tilt the slidewire cover up, exposing the Y-axis slidewire.



SLIDEWIRE CLEANING

Clean the slidewire with the Plotter in the **STANDBY** mode. To clean the slidewire, spray the entire slidewire with Slidewire Cleaner (Part No. 5080-3605). Move the carriage arm or pen carriage rapidly through several full-scale excursions. Again spray the wiper with Slidewire Cleaner. Saturate a Kimwipe or cotton swab with Slidewire Cleaner. Rub the slidewire (mandrel and return strip) with the moistened tissue or swab. Repeat the cleaning procedure until there is no stain on the tissue, then clean once more to ensure that all contaminants have been removed.



SLIDEWIRE LUBRICATION

After cleaning, the slidewire (mandrel and return strip) must be lubricated sparingly with Slidewire Lubricant (Part No. 5080-3635). This lubrication will reduce wear and chemical contamination of the balance slidewire assembly. After completion of cleaning and lubrication, re-install the Y slidewire cover and rear hood.