



NATIONAL RADIO ASTRONOMY OBSERVATORY

ELECTRONICS DIVISION TECHNICAL NOTE NO. 109

TITLE: HP 9825 BLOCK DIAGRAM PROGRAM

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## HP 9825 BLOCK DIAGRAM PROGRAM

James R. Coe

### General

A program has been written to utilize the HP 9825 calculator and the 9862 HP plotter to help prepare block diagrams, flow charts and view graphs. This program plots the various symbols shown on the attached diagram. The symbol size and location are selected by the user. Titles and labels can be conveniently added and lines drawn to interconnect the symbols.

### Operation

The maximum plotting area is 10" x 15". Any suitable paper could be used. Using mylar material with 0.1" grid helps in constructing the diagram. Errors also can be readily corrected on this material.

Turn the HP 9825 calculator ON.

Insert the tape labeled "Block Diagram Program".

Press LOAD 1 and then EXECUTE.

After the tape has stopped driving press RUN.

The calculator displays "Set Up Plotter" and loads the special function keys from file 0. Put the paper on the plotter. Set the lower left and upper right limits on the plotter.

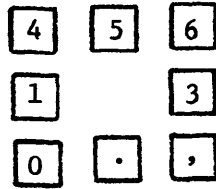
When the display shows "Horizontal Scale?", enter the horizontal length of the plot in units of 0.1 inch, i.e., 10 inches enter 100. Then enter the number of 0.1 inch units in the vertical height of the plot.

The calculator displays "Select Operation".

Using the special function keys, select the symbol type, label or line required. The program prompts, on the display, guide you through most of the operations.

When the calculator displays "Here?" to verify a location prior to plotting a symbol, you can push YES or 1 and CONTINUE. If the plotter is not at the right location, press CONTINUE.

When the operation "Draw" is selected, the keys (as shown below) move the plotter pen in the direction indicated by the key position.



Pressing key **2** causes the pen to go down. By releasing key **2** after one of the other keys is depressed allows you to draw a line. The pen does not stay down going to the left for some unknown reason. The horizontal and vertical locations are displayed with 0.01 inch resolution. Pressing key **9** returns to "Select Operation".

When the operation "Label" is selected, the display is CHARACTER SIZE? The number entered determines the height of the characters as a percentage of the total vertical height of the plot. Enter a number, generally in the 1 to 2 range. Then press CONTINUE.

Next it displays "Label? 15 Characters Max". Enter the desired label and press CONTINUE. The program then moves the pen to the last location used and offsets the pen to the left one-half the label length and down one-half the character height and displays "Here?". If you want the label started here, press YES or 1 and CONTINUE. If you want to move the label just press CONTINUE and the horizontal and vertical positions will be displayed and the numeric key pad allows you to move the pen. When you locate the pen at the point you want the label centered, press numeric key 8 . The pen will offset to the starting position for the label and the display will be "Here?". Proceed as outlined above. The label or character size need not be re-entered if no changes are required.

You can also use the "PTYP" mode of labeling with the plotter in the typewriter mode. The keys



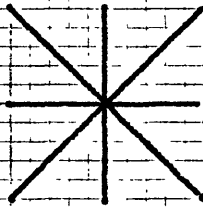
will move the pen with a resolution of one character space and will plot any character you type. Type slow or you will lose characters.

If you decide not to use a symbol after you have selected it, press STOP. Then select a new operation. If all else fails, press STOP and RUN. You then will have to re-enter the scale factors.

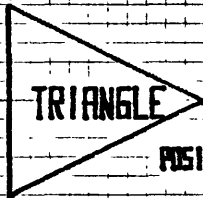
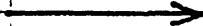
It takes two to three hours to make and label a detailed block diagram, but at least it is legible when you finish.

# BLOCK DIAGRAM PROGRAM

DRAW



LINE



POSITION #



1



2



3

RECTANGLE



VERTICAL

SCALE = 100

START



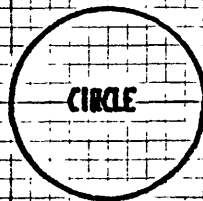
CHARACTER SIZE = 1.5

END



CHARACTER SIZE = 1.5

CIRCLE



DIAMETER = 10



HORIZONTAL SCALE = 70



## BLOCK DIAGRAM TAPE

TRK 0 FILE 1

```

0: "BLOCK DIAGRAM PROGRAM":
1: "INITIALIZE":
2: dim H[1],J[1],K[1],L[1],O[1],5]
3: dsp "Block Diagram Program"
wait 2000
4: dsp "Set Up Plotter";ldk a;
wait 1300

```

```

5: "SCALES":
6: ent "Horizontal Scale?";X;
"Vertical Scale?";Y;sc1 0;X;0;
Y

```

```

7: "SELECT":
8: dsp "Select Operation";stp;
jsw 0

```

```

9: "LOCATION":
10: ent "Horizontal Position?";
H; "Vertical Position?";V
11: plt H;V;1;
ent "Here?";1;
if OK;G;if
G#1;jsw -1
12: H-G;ret

```

```

13: "CIRCLE":
14: if not fls1;
ent "Diameter?";
R;
15: if fls1;dsp
"Diameter = ";
R;wait 1500;
ent "Change Diameter?";R;
16: esb "LOCATIO
N"
17: for B=0 to
360 by 3;plt
(R/2)cos(B)+H,
(R/2)sin(B)+V
18: next B;pen;
sfs 1;sto "SELE
CT"

```

```

19: if not fls3;
ent "Length?";
L; "Width?";W
20: if fls3;dsp
"Length=";L;
"Width=";W;wait
1500
21: if fls3;ent
"Change Length?";
L; "Change Width?";W
22: if fls3;ent
"Change Length?";
L; "Change Width?";W
23: esb "LOCATIO
N";sfs 3
24: plt -L/2,-
W/2;1;plt 0;W,
2;plt L;0;plt
0;-W;plt -L,
0;pen
25: sto "SELECT"

```

```

26: "TRIANGLE":
27: if not fls4;
ent "Length of side?";S
28: if not fls4;
ent "Orientation";T
29: if fls4;dsp
"Length of Side =";
S;wait 1500
30: if fls4;dsp
"Orientation=";
T;wait 1000
31: if fls4;ent
"Change Length?";
S; "Change Orientation?";T
32: sfs 4;esb
"LOCATION"
33: if T=0;plt
S/2;0;1;plt -
S;S/2;2;plt
-S;plt S;S/2;
pen
34: if T=1;plt
0;-S/2;1;plt -
S/2;S;2;plt S,
0;plt -S/2;-S;
pen
35: if T=2;plt
-S/2;0;1;plt
S;S/2;2;plt 0,
-S;plt -S;S/2;
pen
36: if T=3;plt
0;S/2;1;plt -
S/2;-S;2;plt
S;0;plt -S/2,
S;pen
37: sto "SELECT"

```

```

38: "RHOMBIC":
39: if not fls5;
ent "Length?";
C; "Width?";D
40: if fls5;dsp
"Rhombic Length =";
C; "Width=";
D;wait 1500
41: if fls5;ent
"Change Length?";
C; "Width?";D
42: esb "LOCATIO
N";sfs 5
43: plt 0;-D/2,
1;wait 200;plt
-C/2;D/2;2;
wait 200;plt
C/2;D/2;2;wait
200
44: plt C/2;-D/
2;wait 200;plt
-C/2;-D/2;pen

```

```

45: "RECTANGLE":
46: if not fls6;
ent "Length?";
E; "Width?";F
47: esb "LOCATIO
N"
48: if fls6;dsp
"Length=";E;
"Width=";F;wait 1500
49: if fls6;ent
"Change Length?";
E; "Change Width?";F
50: if fls6;ent
"Change Length?";
E; "Change Width?";F
51: for B=90 to
270 by 3;plt
-Fsin(B)/38.2;
Fcos(B)/38.2;
28.2;next B;
plt -E,0
52: esb "LOCATIO
N";sfs 6

```

```

53: "RECTANGLE":
54: esb "LOCATIO
N"
55: ent "Horizontal to right?";
G;if G;plt .5,
-.5;2;plt .5,
1;plt .5,-1;
56: if G;plt
.5;1;plt .5,-
1;plt .5,1;
plt .5,-1;plt
.5;.5;pen;jsw
4
57: if not G;
ent "Vertical Down?";
G;if not G;jsw 3
58: plt -1,-.5,-
.5;2;plt 1,-
.5;plt -1,-.5;
plt 1,-.5;plt
-1,-.5
59: plt 1,-.5;
plt -.5,-.5;
pen
60: G+G;sto "SEL
ECT"

```

```

61: "DRAW LINE":
ldk
62: plt H;V;1
63: rdi 4;A;rdi
4+K;if A=K;esb
"DRAW"
64: if A#K;0+Q;
1+U;jsw -1
65: fxd 1;dsp
"HorizPos";H;";
VertPos.";V;
0+P+0;jsw -2
66: "DRAW":if
K=79;-1+P
67: if K=81;.1+P
68: if K=83;.1+0
69: if K=85;-
.1+0
70: if K=78;-
.1+P;-1+0
71: if K=82;-
.1+P;.1+0
72: if K=84;.1+P
;.1+0
73: if K=89;.1+P
;-1+0
74: if K=80;2+U
75: if K=87;sto
"SELECT"
76: plt H;V;U
77: Q+.1+Q;if
Q>2;2+Q
78: H+Q+H;V+
Q;pen

```

VARIABLES

Line No.'s

```

41: ent Line
From Horizontal
Position?";
H[11]: "Vertical
Position?"; J[11]
62: plt H[11];
J[11]; if G#1:
Here?"; G#1:
JMP -2
83: 0+G; ent "Lin
e To Horizontal
Position?";
K[11]; if f1=13;
H[11]; K[11]
84: cfa 13; ent
"Line To Vertic
al Pos?"; L[11];
if f1=13; J[11]-L
[11]
85: plt K[11];
L[11]; if ent "To
Here?"; G#1:
G#1; jmp -2
86: plt H[11];
J[11]; if ent K[11]
; L[11]; 2; pen;
0+G; K[11]+H; L[11]
+V
87: ent "Arrow
Here?"; G#1:
to "SELECT
"
88: 0+G
89: if J[11]=L[11]
; if K[11]>H[11];
iplt -1.5;.5;.1;
wait 500
90: if J[11]=L[11]
; if K[11]>H[11];
plt K[11]; L[11];
2; wait 100; iplt
-1.5;-.5
91: if J[11]=L[11]
; if H[11]>K[11];
iplt 1.5;.5;.1;
wait 500
92: if J[11]=L[11]
; if H[11]>K[11];
plt K[11]; L[11];
2; wait 50; iplt
1.5;-.5
93: if H[11]=K[11]
; if L[11]>J[11];
iplt -.5;-1.5;.1;
wait 500
94: if H[11]=K[11]
; if L[11]>J[11];
plt K[11]; L[11];
2; wait 50; iplt
.5;-1.5
95: if H[11]=K[11]
; if J[11]>L[11];
iplt -.5;1.5;.1;
wait 500
96: if H[11]=K[11]
; if J[11]>L[11];
plt K[11]; L[11];
2; wait 50; iplt
.5;1.5
97: pen; to "SEL
ECT"

```

```

ent Size"; Z:
csiz Z
100: ent "Label"
15 Characters
wa. "0#;0+G;
1+U; ikd
101: plt H; V; 1;
cplt -; ent D#; /
2; -; 3; ent "Here
?"; G#1: if G=1;
JMP 6
102: rdi 4+A;
rdi 4+K; if A=K;
asb "DRAW"
103: if A#K; 0+G;
1+U; jmp -1
104: fxd 1; dsp
"HorizPos"; H; /;
VertPos"; V; 0+P;
0
105: if K=86;
jmp -4
106: jmp -4
107: if 0#; 0+G;
"Character Size?"; Z:
csiz Z
110: dsp "Plotte
r Type Mode";
plt H; V; 1; type
111: to "SELECT
"
*26626
SPECIAL FUNCTION KEYS
FILE 0
f0: *1+G
f1: +cont "CIRCLE
"
f2: *cont "RECTAN
GLE"
f3: *cont "TRIANG
LE"
f4: *cont "RHOMB
IC"
f5: *cont "START"
f7: *cont "LINE"
f8: *cont "RESIST
OR"
f9: *cont "DRAW L
INE"
f10: *cont "LABEL
"
f11: *cont "PTYP
"

```

Key Identifier

63	63	64
102	102	103
"CIRCLE" Angle		
17	17	17
18	49	50
50	51	51
"RHOMBIC" Length		
39	40	41
43	43	44
"RHOMBIC" Width		
39	40	41
43	43	44
"START" Length		
47	49	49
"START" Width		
47	49	50
50	51	51
G = 1 YES; G = 0 NO		
11	11	12
55	55	56
57	57	60
82	83	85
86	87	87
100	101	101
Horizontal Position		
10	11	17
65	76	78
86	101	104
Array Index		
80	81	91
82	82	83
83	84	84
85	85	86
86	86	86
89	89	89
90	90	90
90	90	91
91	91	92
92	92	92
93	93	93
94	94	94
94	94	95
95	95	96
96	96	96
Key Verifier		
63	63	64
66	67	69
70	71	73
74	75	102
103	105	
"RECTANGLE" Length		
20	21	22
24	24	24
Vertical Increment		
65	68	69
70	71	73
78	104	
Horizontal Increment		
65	66	67
70	71	73
78	104	
Increment Multiplier		
64	77	77
77	77	78
102		

"CIRCLE" Diameter

17	17		
"TRIANGLE" Side Length			
27	27	31	
33	33	33	33
33	33	34	34
34	34	34	34
35	35	35	35
35	35	36	36
36	36	36	36
"TRIANGLE" Orientation			
28	30	31	
33	34	35	36
Pen Control 1 UP; 2 DOWN			
64	74	76	
VERTICAL POSITION			
10	11	17	
62	65	76	78
86	101	104	
"RECTANGLE" Width			
20	21	22	
24	24	24	
HORIZONTAL SCALE			
6	6		
VERTICAL SCALE			

CHARACTER SIZE

99	99	109	109
----	----	-----	-----

LINE START HORIZONTAL			
81	82		
83	86	89	90
91	92	93	94
95	96		
LINE START VERTICAL			
J[*]2	81	82	
84	86	89	90
91	92	93	94
95	96		
LINE END HORIZONTAL			
K[*]2	83	83	
85	86	86	89
90	90	91	92
92	93	94	94
95	96	96	
LINE END VERTICAL			
L[*]2	84	84	
85	86	86	89
90	90	91	92
92	93	94	94
95	96	96	
LABEL			
D# 2	100	101	
107			

BLOCK DIAGRAM

