244 / 245 SCOPE READ & PLOT

SCOPE FORMAT READ: 244

INPUT: B1 is codeword address if B1 > 200. Otherwise B1 = 246 is codeword address of stored flexowriter hexads. Data on flexowriter tape should not be proceded by any spill character. It is necessary to return the carriage by hand after typing the control word to execute 244 and before typing any data. Lower case is assumed until upper case is encountered.

OUTPUT: Flexowriter hexads are stored in memory nine hexads per word with first word address in the codeword specified by B1. Blocks of data can be separated by stop codes. When a stop code is encountered, the last hexad of the last word stored contains the number of significant hexads in that word and the word has a tag 1 set. B1 is advanced by one and a new codeword is established for the next block of data which may be ended by a stop code or end of tape; i.e., codewords are generated sequentially by stop codes. When end of tape is encountered, the last hexad of the last word contains the number of significant hexads for that word and the word has a tag 2 set.

REGISTERS, LIGHTS USED: SAVE and UNSAVE are used to restore registers used.

LENGTH: 57 (octal)

RUNNING TIME: Limited by reader time.

NOTE: This program is designed to work in conjunction with Program 245, SCOPE FORMAT PLOT.

Forest Baskett
July 1963

SCOPE FORMAT PLOT: 245

INPUT: B1 is codeword address of a block of hexads set up by 244, SCOPE FORMAT READ. Only the first 27 characters of a line are displayed and only the first 18 lines of a block are displayed.

OUTPUT: Sense Light Options:
SL9: the display is reversed for poloroid display.
SL12: the film is advanced on entry.
SL13: the film is advanced on exit (the preferred method).
SL14: the display is repeated X times.
SL15: the display is repeated until sense light 15 is manually turned off.

REGISTERS, LIGHTS USED: T7 is used. All other registers are restored by SAVE and UNSAVE.

LENGTH: 336 (octal)

RUNNING TIME: 1/4 sec. per character.

Forest Baskett
July 1963

```
244                 ORG
                    REM             SCOPE FORMAT
                    REM             READ ROUTINE
                -Z  TRA             *136,U→R
                Z   BAU+2           ~~77775~~ X,B6+1
                    ~~STO~~         ~~B6,B6+1~~
                Z   BAU+2           ~~77771~~ IL,B6+1
                    ~~STO~~         ~~B6,B6+1~~
                B6  RPA             SVB6
                B1  IF(POS)SKP      a200
                    SB1             a246
                Z   BAU             100,U→B6
                    STO             B1
                77  ~~LDR+4~~ LT4   ~~SPILL~~CC-1
                CC  IF(NTG,MOV)TRA  CC,U→PF
HEXZER          Z   STX             a77771,U→B3
                Z   SB2             Z,U→T5
RDHEX           T4  RHX+41          T6
                    IF(MOV)TRA      TAG2
                T4  SYD             T6,R→Z
                    IF(NUL)TRA      TAG1
                T5  LUL             a6,R→Z
                    ORU             T6,B2+1
                    STO             T5,B3+X
                B2  IF(ZER)SKP      ad9
                    TRA             RDHEX
                    ~~LDR+60~~ LT6  TAGLST
                    TRA             STORE-1
LFTNRM              CLA             a1B3+d54],U→B3
                T5  LUL             B3,U→T5
                B2  ORU→            T5
                T6  RPL             STORE
STORE           T5  STO             B6,B6+1
                    TRA             PF
~~SPILL~~           ~~OCT~~         ~~77000000000000000~~
TAGLST              OCT             052000126000000000
                    OCT             052001126000000000
                    OCT             052002126000000000
TAG1                ~~LDR+60~~ LT6  TAGLST+1,B1+1
                    SPF             HEXZER-1,B6+1
                B6  STO             B1,B6-1
                    TRA             LFTNRM
TAG2                ~~LDR+60~~ LT6  TAGLST+2
                    TSR             LFTNRM
                B6  ~~STO~~ RPA     100
SVB6                SB6             (SVB6)
                    ~~42001~~ ILN   *B6-1,B6-1
                    ~~43005~~ STX   *B6-1,B6-1
                -Z  TRA             *137,U→R
                    TRA             PF
                    END
```

```
:220        SVB6      0    53    0    660000000000000    0
:221        SPILL     0    40    0    500000000000000    0
:222        HEXZER    0    15    0    240000000000000    0
:223        RDHEX     0    17    0    260000000000000    0
:224        TAG2      0    50    0    630000000000000    0
:225        TAG1      0    44    0    570000000000000    0
:226        TAGLST    0    41    0    520000000000000    0
:227        STORE     0    36    0    450000000000000    0
:230        LFTNRM    0    32    0    410000000000000    0
SCOPE FORMAT
READ ROUTINE
          10                1    1001000024400000136
          11                2     20100000000077775
          12                3    12000126410000000
          13                4     20100000000077771
          14                5    12000126410000000
          15                6    45216010000000100044          SVB6
          16                7    41021100040000200
          17               10     14000100400000246
          20               11     20100460000000100
          21               12    12000100400200000
          22               13    15044000000100024          SPILL
          23               14    40012044740010000
          24   HEXZER      15     43005434000777 71
          25               16     40002054000000000
          26   RDHEX       17     46014100400000006
          27               20    10120000400100027          TAG2
          30               21    45322010000000006
          31               22    10104000400100021          TAG1
          32               23    54502010400000006
          33               24    15001022000000006
          34               25    12000133400000005
          35               26    43020100040000011
          36               27    10100000400177766          RDHEX
          37               30    15046000000100010          TAGLST
          40               31    10100000400100003          STORE
          41   LFTNRM      32    12170043601000066
          42               33    54502005401000000
          43               34    42500110000000005
          44               35     62030100000177777         STORE
          45   STORE       36    52000126410000000
          46               37    10100000420000000
          50   SPILL       40   77000000000000000
          52   TAGLST      41    52000126000000000
          54               42    52001126000000000
          56               43    52002126000000000
          57   TAG1        44    15046021000177774          TAGLST
          60               45    14000726400177745          HEXZER
          61               46    46200016640020000
          62               47    10100000400177761          LFTNRM
          63   TAG2        50    15046000000177771          TAGLST
          64               51    14000000400177757          LFTNRM
          65               52    46200010040000100
          66   SVB6        53    14000600400000000
          67              ~~54~~   14200166010077776
          70              ~~55~~   14300566010077776
          71               56    10010000244000137
          72               57    10100000420000000
```

```
245                 ORG
                    REM              SCOPE FORMAT
                    REM              PLOT ROUTINE
            -Z      TRA              *136,U→R
            Z       BAU              77770  SL
                    STO              B6,B6+1
            Z       BAU              77775  X
                    STO              B6,B6+1
                    IF(SLN)SKP       a2
            Z       STO              77775  X
            B6      RPA              SVB6
            B1      RPA              SVB1
            -T4     IF(SLF)SKP       a00010
                    67700            aZ
            T4      IF(SLF)SKP       a00100
            -T4     CLA              CC-4,CC+1
            T4      CLA              CC-1
                    RPE              PLOT,CC+1
SVB1                SB1              (SVB1)
REPEAT      Z       SB2              aZ,U→B3
            Z       SB5              aZ,U→B6
                    IF(SLF)SKP       a10
                    67700            aZ
                    CLA              B1,U→B1
                    SLF              a60000
            CC      MLF              a4000,U→PF
                    LDR              HEXSAV
            B6      IF(NZE)TRA       NEXHEX
                    IF(SLF)SKP       a20000
                    TRA              EXIT
                    CLA,WTG          B1,U→R
                    IF(TG1)TRA       LASTWD,B1+1
                    IF(TG2)TRA       LASTWD
                    SB6              a11
NEXHEX      Z       LLS              a6,U→B4
            R       STO              HEXSAV
            B4      IF(NZE)SKP       a76,B6-1
            PF      SB5              aZ,U→CC
            B4      IF(NZE)SKP       a74
            PF      SB5              a100,U→CC
            B4      IF(NZE)SKP       a24
                    TRA              CARRET,B2+1
                    IF(SLF)SKP       a40000
                    TRA              PF
            B5      ADD              aB4,U→B4
                    LDR+8 LT6        DINCR
            B3      IF(ZER)TRA       CC+3,R→Z
                    MPY              XINCR
                    IF(NUL)TRA       CC+1
            R       STO              T4,CC+1
            R       ADD              -ONE,U→T4
            B2      IF(ZER)TRA       CC+3,R→Z
                    MPY              YINCR
                    IF(NUL)TRA       CC+1
            -R      STO              T5,CC+1
            -R      ADD              ONE,U→T5
            T4      LDR              TABLE+B4,U→T7
                    TRA              CC+1,B3+1
LOOP        -T6     ADD→             T5
            T7      SB4              a6,U→T4
            Z       LLS              a1
                    IF(NUL)TRA       CC+1
PLOT        T4      67000 PLT        T5
            T6      ADD→             T4,B4-1
            B4      IF(NZE)TRA       LOOP+2
```

```
                    TRA         LOOP                    104
          B3        IF(NEG)SKP  a32                     105
                    SLN         a40000                  106
                    TRA         PF                      107
CARRET    Z         SLF         a40000,U+B3             110
          B2        IF(PNZ)SKP  a21                     111
                    TRA         PF                      112
                    TRA         EXIT                    113
LASTWD              SLN         a20000                  114
                    LRS         a6                      115
          Z         LLS         a6,U+B6                 116
                    TRA         PF+1                    117
EXIT                IF(SLF)SKP  a4                      120
                    67700       aZ                      121
                    CLA         77775 X                 122
                    IF(ZER)TRA  OUT                     123
          -(Z)      ADD+        77775 X                 124
                    TRA         SVB1                    125
OUT                 IF(SLF)SKP  a1                      126
                    TRA         SVB1                    127
SVB6                SB6         (B6)                    130
                    42005 STX   *B6-1,B6-1              131
                    SLF         a77777                  132
                    42000 SLN   *B6-1,B6-1              133
          -Z        TRA         *137,U+R                134
                    TRA         PF                      135
SPILL               OCT         020000000000000000      136
DIINCR              OCT         000031221303746556      137
ONE                 OCT         003777777777777777      140
XIINCR              OCT         000227550227550227      141
YIINCR              OCT         000343434343434343      142
TABLE               OCT         344242424242340000      143
                    OCT         301010101010760000      144
                    OCT         344202344040760000      145
                    OCT         344202140242340000      146
                    OCT         444444447604040000      147
                    OCT         764040740242340000      150
                    OCT         344040744242340000      151
                    OCT         760410204040400000      152
                    OCT         344242344242340000      153
                    OCT         344242360202340000      154
                    OCT         000076242424240000      155
                    OCT         0                       156
                    OCT         0                       157
                    OCT         0                       160
                    OCT         0                       161
                    OCT         0                       162
                    OCT         001010761010000000      163
                    OCT         000000760000000000      164
                    OCT         103452101010100000      165
                    OCT         101010105234100000      166
                    OCT         0                       167
                    OCT         0                       170
                    OCT         0                       171
                    OCT         0                       172
                    OCT         0                       173
                    OCT         0                       174
                    OCT         0                       175
                    OCT         0                       176
                    OCT         0                       177
                    OCT         004224102442000000      200
                    OCT         000076007600000000      201
                    OCT         000000000030300000      202
                    OCT         000036424242360000      203
                    OCT         404074424242740000      204
```

```
OCT     [illegible]
OCT     020236424242360000      206
OCT     000034427640340000      207
OCT     142220207420200000      210
OCT     001422221402340000      211
OCT     404076424242420000      212
OCT     100030101010140000      213
OCT     100010101050200000      214
OCT     404050606050440000      215
OCT     201010101010140000      216
OCT     000024524242420000      217
OCT     000074424242420000      220
OCT     000034424242340000      221
OCT     000070447040400000      222
OCT     003044443020160000      223
OCT     000054624040400000      224
OCT     000034403402340000      225
OCT     101076101012040000      226
OCT     000042424242360000      227
OCT     000024242424100000      230
OCT     000042424252240000      231
OCT     000042241024420000      232
OCT     000042241020400000      233
OCT     000076041020760000      234
OCT     020410201004020000      235
OCT     0                       236
OCT     0                       237
OCT     0                       240
OCT     0                       241
OCT     0                       242
OCT     041020202010040000      243
OCT     201004040410200000      244
OCT     105234103452100000      245
OCT     002476247624000000      246
OCT     004020102442000000      247
OCT     000036444430000000      250
OCT     000032444432000000      251
OCT     003044704470400000      252
OCT     002410242410000000      253
OCT     001000240076000000      254
OCT     762424242424240000      255
OCT     0                       256
OCT     0                       257
OCT     0                       260
OCT     0                       261
OCT     0                       262
OCT     000204102040000000      263
OCT     001004760410000000      264
OCT     103452101010100000      265
OCT     101010105234100000      266
OCT     0                       267
OCT     0                       270
OCT     0                       271
OCT     0                       272
OCT     0                       273
OCT     0                       274
OCT     0                       275
OCT     0                       276
OCT     0                       277
OCT     762210041022760000      300
OCT     101010101010100000      301
OCT     000000303010200000      302
OCT     102442427642420000      303
OCT     704444744242740000      304
OCT     344240404042340000      305
OCT     704442424244700000      306
```

```
OCT   7640407040400000   310
OCT   3440405642423400000   311
OCT   4242427642424200000   312
OCT   7610101010107600000   313
OCT   3604040404443000000   314
OCT   4244506050444200000   315
OCT   4040404040407600000   316
OCT   4266524242424200000   317
OCT   4242625246424200000   320
OCT   3442424242423400000   321
OCT   7442427440404000000   322
OCT   3442424252463400000   323
OCT   7442427450444200000   324
OCT   3640403402027400000   325
OCT   7610101010101000000   326
OCT   4242424242423400000   327
OCT   4242424242241000000   330
OCT   4242424252664200000   331
OCT   4242241024424200000   332
OCT   4242241010101000000   333
OCT   7602041020407600000   334
OCT   0410201004007600000   335
OCT   0   336
OCT   0   337
OCT   0   340
OCT   0   341
END   342
      343
```

:220	SVB6	0	124	0	1330000000000000	0
:221	SVB1	0	20	0	270000000000000	0
:222	PLOT	0	74	0	1030000000000000	0
:223	REPEAT	0	21	0	300000000000000	0
:224	HEXSAV	0	336	0	5520000000000000	0
:225	NEXHEX	0	40	0	470000000000000	0
:226	EXIT	0	114	0	1230000000000000	0
:227	LASTWD	0	110	0	1170000000000000	0
:230	CARRET	0	104	0	1130000000000000	0
:231	DINCR	0	133	0	1440000000000000	0
:232	XINCR	0	135	0	1500000000000000	0
:233	ONE	0	134	0	1460000000000000	0
:234	YINCR	0	136	0	1520000000000000	0
:235	TABLE	0	137	0	1540000000000000	0
:236	LOOP	0	70	0	770000000000000	0
:237	OUT	0	122	0	1310000000000000	0
:240	SPILL	0	132	0	1420000000000000	0

SCOPE FORMAT
PLOT ROUTINE

10		1	1001000024400000136	
11		2	12010000000077770	
12		3	12000126410000000	
13		4	12010000000077775	
14		5	12000126410000000	
15		6	10203000400000002	
16		7	12000100400077775	
17		10	4621601000000100113	SVB6
20		11	4121601000000100006	SVB1
21		12	1402070004000000 10	
22		13	1677000040000000 0	
23		14	4020700040000010 0	
24		15	1217002000017777 3	
25		16	1217000000017777 4	
26		17	1207012000010005 4	PLOT
27	SVB1	20	1400010040000000 0	
30	REPEAT	21	4000243400000000 0	
31		22	4000546400000000 0	
32		23	1020700040000001 0	
33		24	1677000040000000 0	
34		25	1217004100020000 0	
35		26	1420040040006000 0	
36		27	4042006474000040 0	
37		30	1504000000010030 5	HEXSAV
40		31	4601050004001000 6	NEXHEX
41		32	1020700040002000 0	
42		33	1010000040010006 0	EXIT
43		34	1217400200020000 0	
44		35	1010012140010005 2	LASTWD
45		36	1010020040010005 1	LASTWD
46		37	1400060040000001 1	
47	NEXHEX	40	4506244400000006	
50		41	2200010040010027 4	HEXSAV
51		42	4402050664000007 6	
52		43	4740005404000000 0	
53		44	4402050004000007 4	
54		45	4740005404000001 0	
55		46	4402050004000002 4	
56		47	1010002240010003 4	CARRET
57		50	1020700040004000 0	
60		51	1010000042000000 0	
61		52	4510000444020000 0	
62		53	1504600000010005 7	DINCR
63		54	4301010104001000 3	
64		55	1102000000010005 7	XINCR

66		57	22000120400000004	
67		60	21000004100100053	ONE
70		61	42010100400100003	
71		62	11020000000100053	YINCR
72		63	10104000400100001	
73		64	12200012040000005	
74		65	12100000500100046	ONE
75		66	45040007002100050	TABLE
76		67	10100023400100001	
77	LOOP	70	16100010000000005	
100		71	74000404400000006	
101		72	4506200400000001	
102		73	10104000400100001	
103	PLOT	74	46700000000000005	
104		75	61000164000000004	
105		76	44010500400177772	LOOP
106		77	20104000400100001	
107		100	10100000400177766	LOOP
110		101	43025100040000032	
111		102	14200000400040000	
112		103	10100000420000000	
113	CARRET	104	4200443400040000	
114		105	42061500040000021	
115		106	10100000420000000	
116		107	10100000400100004	EXIT
117	LASTWD	110	14200000400020000	
120		111	14501500400000006	
121		112	4506246400000006	
122		113	10100000420000001	
123	EXIT	114	10207000400000004	
124		115	16770000400000000	
125		116	12170000000077775	
126		117	10101000400100002	OUT
127		120	30100010000077775	
130		121	10100000400177675	SVB1
131	OUT	122	10207000400000001	
132		123	10100000400177673	SVB1
133	SVB6	124	14000600400000000	
134		~~125~~	14300566010077776	45
135		~~126~~	14200400400077777	
136		~~127~~	14200066010077776	
137		130	10010000244000137	45
140		131	10100000420000000	
142	SPILL	132	20000000000000000	
144	DINCR	133	3122130374 6556	
146	ONE	134	3777777777777777	
150	XINCR	135	227550227550227	
152	YINCR	136	343434343434343	
154	TABLE	137	34424242424234000 0	
156		140	30101010101076000 0	
160		141	34420234404076000 0	
162		142	34420214024234000 0	
164		143	44444444760404000 0	
166		144	76404074024234000 0	
170		145	34404074424234000 0	
172		146	76041020404040000 0	
174		147	34424234424234000 0	
176		150	34424236020234000 0	
200		151	762424242400 00	
202		152	0	
204		153	0	
206		154	0	
210		155	0	
212		156	0	
214		157	1010761010000000	

220	161	1034521010100000
222	162	1010101052341000000
224	163	0
226	164	0
230	165	0
232	166	0
234	167	0
236	170	0
240	171	0
242	172	0
244	173	0
246	174	42241024420000000
250	175	760076000000000
252	176	303000000
254	177	364242423600000
256	200	4040744242427400000
260	201	34424040360000
262	202	302364242423600000
264	203	3442764034000000
266	204	1422202074202000000
270	205	142222140234000000
272	206	4040764242423000000
274	207	1000301010101400000
276	210	1000101010502000000
300	211	4040506060504400000
302	212	2010101010101400000
304	213	24524242420000
306	214	74424242420000
310	215	34424242340000
312	216	70447040400000
314	217	3044443020160000
316	220	54624040400000
320	221	34403402340000
322	222	1010761010120400000
324	223	42424242360000
326	224	24242424100000
330	225	42424252240000
332	226	42241024420000
334	227	42241020400000
336	230	76041020760000
340	231	204102010040200000
342	232	0
344	233	0
346	234	0
350	235	0
352	236	0
354	237	410202020100400000
356	240	201004040410200000
360	241	10523410345210000
362	242	24762476240000000
364	243	40201024420000000
366	244	364444300000000
370	245	324444320000000
372	246	304470447040000
374	247	2410242410000000
376	250	1000240076000000
400	251	7524242424242400000
402	252	0
404	253	0
406	254	0
410	255	0
412	256	0
414	257	204102040000000
416	260	100476041000000
420	261	1034521010100000

424	263	0
426	264	0
430	265	0
432	266	0
434	267	0
436	270	0
440	271	0
442	272	0
444	273	0
446	274	762210041022760000
450	275	101010101010100000
452	276	303010200000
454	277	102442427642420000
456	300	704444744242740000
460	301	344240404042340000
462	302	704442424244700000
464	303	764040744040760000
466	304	764040704040400000
470	305	344040564242340000
472	306	434242764242420000
474	307	761010101010760000
476	310	360404040444300000
500	311	434450605044420000
502	312	404040404040760000
504	313	436652424242420000
506	314	434262524642420000
510	315	344242424242340000
512	316	744242744040400000
514	317	344242425246340000
516	320	744242745044420000
520	321	364040340202740000
522	322	761010101010100000
524	323	434242424242340000
526	324	434242424224100000
530	325	434242425266420000
532	326	434224102442420000
534	327	434224101010100000
536	330	760204102040760000
540	331	410201004007600000
542	332	0
544	333	0
546	334	0
550	335	0
552	336	0

120 SCOPE FIGURE DISPLAY

January 29, 1963

FIGURATIVE DISPLAY

The purpose of program *120 is to facilitate display of numeric and alphabetic characters on the oscilloscope attached to the computer. The set of characters stored within *120 is that available on the printer, as listed in the Manual -- with the exception of the plotting symbols. Hexad 23 displays as a period (or decimal point); hexad 24 displays as π; and hexad 25 displays as a space. Spacing between characters on a line and between adjacent lines of the display is provided by *120.

The data to be displayed is stored on entry in T7. The display mode is given by (B1) as follows:

(B1)<0: display 5-character octal field, rightmost 5 triads of (T7) converted

=0: display 18-character octal field, all of (T7) converted

=1: display 9-character hexad field, all of (T7)

=2: advance movie film one frame

=3: display 18-character decimal field, all of (T7) converted, in form

±X.XXXXXXXXXXX±XX for floating point

or S...S±X...X for fixed point

spaces as necessary

=4: display 9-character decimal field, all of (T7) converted and truncated, in form

±X.XXX±XX for floating point

or S...S±X...X for fixed point

spaces as necessary

Other parameters of display are given by

(B2)=number of line on which display is to be placed, these being numbered from 1 through YLIM from top to bottom on the display.

(B3)=number of the position on the line at which the display field is to begin, numbered from 1 through XLIM from left to right on the display.

(B4) denotes size of display, YLIM lines by XLIM positions per line, as follows:

=0: YLIM = 6, XLIM = 9

=1: YLIM = 12, XLIM = 18

=2: YLIM = 18, XLIM = 27

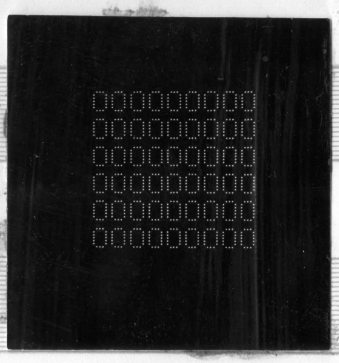
=3: YLIM = 24, XLIM = 36

=4: YLIM = 30, XLIM = 45

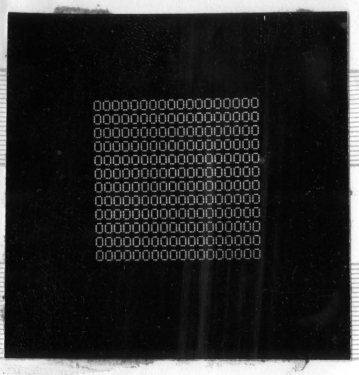
Any portion of a display field which would be off the display area is suppressed. A field which begins within the display area and would extend beyond the righthand boundary is truncated at that boundary.

Upon exit (B1), (B2), (B4) are unchanged, and (B3) is advanced over the field displayed. Fast registers not used as parameters are not distrubed by the routine.

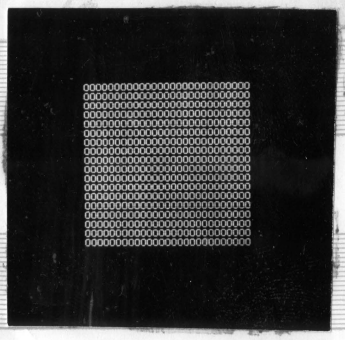
Note: The shutter on the 16mm movie camera is open except when the film is being advanced.



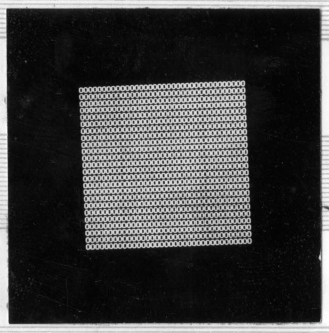
(B4)=0, 6×9



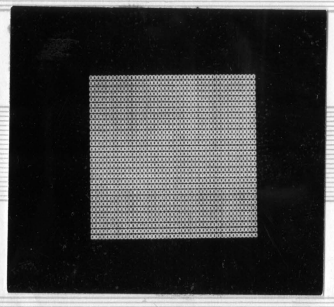
(B4)=1, 12×18



(B4)=2, 18×27



(B4)=3, 24×36



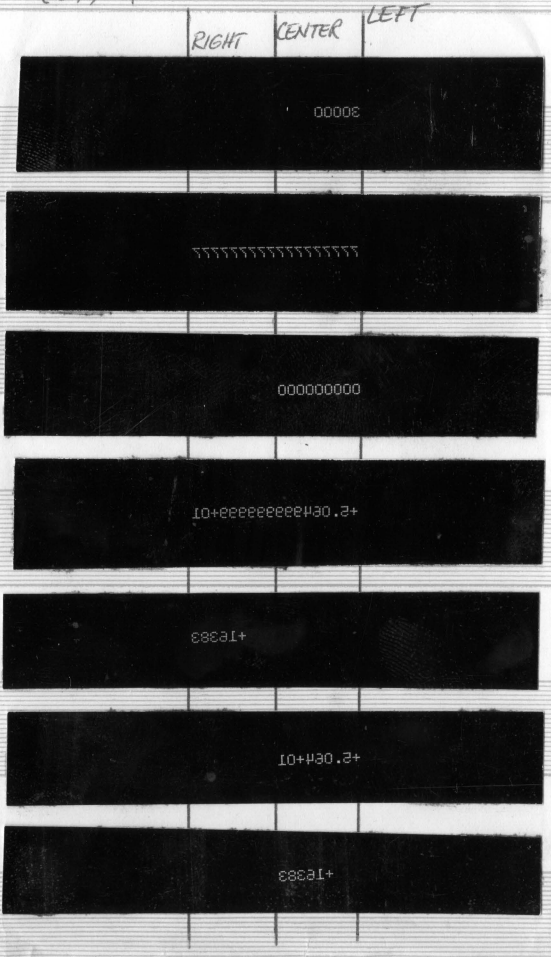
(B4)=4, 30×45

FULL CHARACTER SET, (B4)=1

INVERTED DISPLAYS OF SINGLE INPUT:

(B3)=1 SO THAT FIELD BEGINS AT LEFT DISPLAY BOUNDARY

(B4)=1



(B1)<0, SHORT OCTAL
5-CHARACTER FIELD

(B1)=0, LONG OCTAL
18-CHARACTER FIELD

(B1)=1, HEXAD
9-CHARACTER FIELD

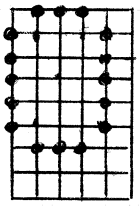
(B1)=3, LONG DECIMAL FLOATING POINT
18-CHARACTER FIELD

(B1)=3, LONG DECIMAL INTEGER
18-CHARACTER FIELD

(B1)=4, SHORT DECIMAL FLOATING POINT
9-CHARACTER FIELD

(B1)=4, SHORT DECIMAL INTEGER
9-CHARACTER FIELD

TABLE OF CHARACTERS IN *120, FIGURATIVE PLOT



CHARACTER 0, FIRST IN TABLE IS SHOWN

FIELD FOR ONE CHARACTER IS 6×9 DOTS, BUT CHARACTER ITSELF SPANS ONLY 5×7 GRID, LEAVING SPACE BETWEEN CHARACTERS VERTICALLY & HORIZONTALLY.

151	3442424242423400000	0	0
152	3010101010107600000	1	01
153	3442023440407600000	2	02
154	3442021402423400000	3	03
155	4444444476040400000	4	04
156	7640407402423400000	5	05
157	3440407442423400000	6	06
160	7604102040404000000	7	07
161	3442423442423400000	8	10
162	3442423602023400000	9	11
163	364242423600000	a	12
164	4040744242427400000	b	13
165	344240403600000	c	14
166	2023642423423600000	d	15
167	34427640340000	e	16
170	1422202074202000000	f	17
171	10107610100000000	+	20
172	760000000000	−	21
173	2041020400000000	/	22
174	30300000	.	23
175	76242424240000	π	24
176		space	25
177	1052343452100000000	*	26
200	247624762400000000	#	27
201	1052341034521000000	*	30
202	52347634520000000	*	31
203	1010101010101000000	!	32
204	4102020201004000000	(	33
205	2010040404102000000	)	34
206	42241024420000000	x	35
207	76007600000000	=	36
210	0000030301020000000	,	37
211	1024424276424200000	A	40
212	7044447442427400000	B	41
213	3442404042342000000	C	42
214	7044424242447000000	D	43
215	7640407440407600000	E	44
216	7640407040404000000	F	45
217	3440405642423400000	G	46
220	4242427642424200000	H	47
221	7610101010107600000	I	50
222	3604040404443000000	J	51
223	4244506050444200000	K	52
224	4040404040407600000	L	53
225	4266524242424200000	M	54
226	4242625246424200000	N	55
227	3442424242423400000	O	56
230	7442427440404000000	P	57
231	3442424252463400000	Q	60
232	7442427450444200000	R	61
233	3640403402027400000	S	62
234	7610101010101000000	T	63
235	4242424242423400000	U	64
236	4242424242241000000	V	65
237	4242424253266420000	W	66
240	4242241024424200000	X	67
241	4242241010101000000	Y	70
242	7602041020407600000	Z	71
243	2041020100402000000	<	72
244	4102010040076000000	≤	73
245	1034521010101000000	↑	74
246	102076201000000	←	75
247	100476041000000	→	76

```
120                     ORG

                        REM            FIGURATIVE DISPLAY / JANE
                        REM            (B1)=MODE, (B2)=LINE,
                        REM            (B3)=POSITION, (B4)=SIZE

                        LDR            a747
                        TRA            *SAVE

                        REM            CONVERT INPUT DATA
                        REM            TO HEXAD FORM

              B1        IF(NMZ)TRA     SOCT
                        TRA            CC+B1
                        TRA            LOCT
              T7        TRA            HEX
                        TRA            FILM
              T7        TRA            LDEC,U+T4
              T7        TRA            SDEC,U+T4

                        REM            SHORT DECIMAL INPUT

SDEC          B2        RPA            CC+1
              B3        TSR            *BINDEC,U+B5
              B5        SB2            Z,J+B3
              Z         BEU            T7
                        IF(NUL)TRA     SINTG
SFLPT                   LDR            T4
              7         LLS            d12
                        LUL            6
                        ORU            a23
                        LLS            d13
                        LDR            T5
                        LRL            d30,CC+1
SINTG         T4        LDR            T5,CC+1
                        LLS            d13,CC+1
                        LRS            6,R+U
                        TRA            HEX

                        REM            LONG DECIMAL INPUT

LDEC          B2        RPA            CC+1
              B3        TSR            *BINDEC,U+B5
              B5        SB2            Z,J+B3
              Z         BEU            T7
                        IF(NUL)TRA     LINTG
                        LDR            T4
              7         LLS            d12
                        LUL            6
                        ORU            a23
                        LLS            d36
                        STO            INPUT1
              T5        LUR            6
                        ORU            R
                        TRA            CC+4
LINTG                   LDR            a77
              T5        XTR            a25,U+R
              T4        CRR            6
                        STO            INPUT1,R+U
                        STO            INPUT2
                        SB5            d18
                        TRA            POSITN

                        REM            FILM ADVANCE
```

```
                        07700         a-EXIT?I-CC

                        REM           HEXAD INPUT

HEX                     STO           INPUT1
                        SB5           d9
                        TRA           POSITN

                        REM           LONG OCTAL INPUT

LOCT                    SB5           d13,I-B1
            T7          LRS           3,U-T7
                        LDR           3,B1-1
            B1          IF(ZER)TRA    CC+3
            B1          IF(NZE)SKP    a49
            R           STO           INPUT2
                        TRA           CC-6
            R           STO           INPUT1
                        TRA           POSITN

                        REM           SHORT OCTAL INPUT

SOCT                    SB5           5,I-B1
                        TRA           LOCT+1

                        REM           STORE PARAMETERS
                        REM           DEPENDING ON SIZE AND
                        REM           CALCULATE INITIAL POSITION

POSITN                  CLA           XLIM+B4
                        RPA,WTG       TXLIM
                        CLA           YLIM+B4
                        RPA,WTG       TYLIM,B3-1
                        LDR+60 LT6    DINCR+B4,B2-1
            B3          IF(POS)TRA    XCALC
                        LDR           INPUT2
                        CLA           INPUT1
                        SB5,EB4       B5+B3
                        LLS           6,B3+1
                        STO           INPUT1
            R           STO           INPUT2
XCALC       B3          IF(ZER)TRA    CC+3,R-Z
                        MPY           XINCR+B4
                        IF(NUL)TRA    CC+1
            R           STO           T4,CC+1
            R           ADD           -ONE,U-T4
YCALC       B2          IF(ZER)TRA    CC+3,R-Z
                        MPY           YINCR+B4
                        IF(NUL)TRA    CC+1
            -R          STO           T5,CC+1
            -R          ADD           ONE,U-T5
                        STO           YSTO,R-Z

                        REM           SCAN HEXADS

            B2          IF(NNZ)TRA    EXIT,B2+1
            B3          IF(NNZ)TRA    EXIT,B3+1
TYLIM       B2          IF(PNZ)SKP    a7,R-B4
TXLIM       B3          IF(NEG)SKP    a7,B4+1
                        TRA           EXIT
            B4          IF(NEG)SKP    a35
                        TRA           EXIT
            B4          IF(ZER)SKP    a410
                        LDR           INPUT1,CC+1
                        LDR           INPUT2
            Z           LLS           6,U-B1
```

```
                P       STO     INPUT1,B3+1                                 205
                                                                            206
                        REM     PLOT CHARACTER B1                           207
                                                                            210
                T4      LDR     TABLE+B1,U+T7                               211
                        TRA     CC+1                                        212
LOOP            -T6     ADD+    T5                                          213
                T7      SB1     6,U+T4                                      214
                Z       LLS     1                                           215
                        IF(NUL)TRA CC+1                                     216
                T4      6700?   T5                                          217
                T6      ADD+    T4,B1-1                                     220
                B1      IF(NZE)TRA LOOP+2                                   221
                P       IF(NUL)TRA CC+1                                     222
                        TRA     LOOP                                        223
                        LDR+50 LTS YSTO                                     224
                        TRA     TXLIM                                       225
                                                                            226
EXIT                    TRA     *UNSAVE                                     227
                        TRA     PF                                          230
                                                                            231
                        REM     TABLE OF CHARACTERS                         232
                                                                            233
TABLE                   BSS     100                                         234
                                                                            235
                        REM     EQUIVALENTS                                 236
                                                                            237
SAVE                    EQU     136                                         240
UNSAVE                  EQU     137                                         241
BINDEC                  EQU     155                                         242
                                                                            243
                        REM     CONSTANTS                                   244
                                                                            245
ONE                     OCT     0037777777777777777                         246
XLIM                    DEC     9                                           247
                        DEC     18                                          250
                        DEC     27                                          251
                        DEC     36                                          252
                        DEC     45                                          253
YLIM                    DEC     6                                           254
                        DEC     12                                          255
                        DEC     18                                          256
                        DEC     24                                          257
                        DEC     30                                          260
XINCR                   OCT     0007070707070707070   1/9                   261
                        OCT     0003434343434343433   1/18                  262
                        OCT     0002275502275502277   1/27                  263
                        OCT     0001616161616161616   1/36                  264
                        OCT     0001330133013301331   1/45                  265
YINCR                   OCT     0012525252525252525   1/6                   266
                        OCT     0005252525252525252   1/12                  267
                        OCT     0003434343434343433   1/18                  270
                        OCT     0002525252525252525   1/24                  271
                        OCT     0002104210421042104   1/30                  272
DINCR                   OCT     0001136641136641136   1/54                  273
                        OCT     0000457320457320457   1/100                 274
                        OCT     0000312213037466556   1/142                 275
                        OCT     0000227550227550227   1/216                 276
                        OCT     0000161616161616161   1/270                 277
                                                                            300
                        END                                                 301
                                                                            302
```

```
  220        SAVE        0   126     0          3570000000000000     2
  221        SOCT        0    74     0          1420000000000000     0
  222        LOCT        0    63     0          1260000000000000     0
  223        HEX         0    60     0          1200000000000000     0
  224        FILM        0    57     0          1140000000000000     0
  225        LDEC        0    32     0           640000000000000     0
  226        SDEC        0    12     0           410000000000000     0
  227        BINDEC      0   155     0          3610000000000000     2
  230        SINTG       0    26     0           550000000000000     0
  231        SFLPT       0    17     0           460000000000000     0
  232        LINTG       0    50     0          1020000000000000     0
  233        INPUT1      0   312     0          4510000000000000     0
  234        INPUT2      0   313     0          4520000000000000     0
  235        POSITN      0    76     0          1570000000000000     0
  236        EXIT        0   156     0          2450000000000000     0
  237        XLIM        0   261     0          3670000000000000     0
  240        TXLIM       0   130     0          2140000000000000     0
  241        YLIM        0   266     0          4010000000000000     0
  242        TYLIM       0   127     0          2130000000000000     0
  243        DINCR       0   305     0          4370000000000000     0
  244        XCALC       0   112     0          1730000000000000     0
  245        XINCR       0   273     0          4130000000000000     0
  246        ONE         0   260     0          3650000000000000     0
  247        YINCR       0   300     0          4250000000000000     0
  250        YSTO        0   314     0          4530000000000000     0
  251        TABLE       0   160     0          2540000000000000     0
  252        LOOP        0   143     0          2320000000000000     0
  253        UNSAVE      0   137     0          3600000000000000     2
FIGURATIVE DISPLAY / JANE
(B1)=MODE, (B2)=LINE,
(B3)=POSITION, (B4)=SIZE
            16                1      1504000040000747     0
            17                2      1010000440000136     2     SAVE
CONVERT INPUT DATA
TO HEXAD FORM

            26                3      4105550004001000 70     2     SOCT
            27                4      1010000040030000     0
            30                5      1010000040010005 5     2     LOCT
            31                6      7010000040010005 1     2     HEX
            32                7      1010000040010004 7     2     FILM
            33               10      7010000440010002 1     2     LDEC
            34               11      7010000440017777 7     2     SDEC
SHORT DECIMAL INPUT
            41    SDEC       12      4221601000001000 01    1
            42               13      4340000454400001 55    2     BINDEC
            43               14      4540002434000000 00    0
            44               15        2100000000000007     0
            45               16      1010400040010000 7     2     SINTG
            46    SFLPT      17      1504000000000000 4     1
            47               20       4506200400000014     0
            50               21      1450300040000000 6     0
            51               22      1500100040000002 3     0
            52               23      1450620040000002 2     0
            53               24      1504000000000000 5     0
            54               25      1450022040000003 6     0
            55    SINTG      26      4504002000000000 5     1
            56               27      1450622040000002 2     0
            57               30      1450161140000000 6     0
            60               31      1010000040010002 6     2     HEX
LONG DECIMAL INPUT
            64    LDEC       32      4221601000001000 01    1
            65               33      4340000454400001 55    2     BINDEC
            66               34      4540002434000000 00    0
```

```
      67           35    21000000000000007    0
      70           36    10104000400100011    2    LINTG
      71           37    15040000000000004    0
      72           40     4506200400000014    0
      73           41    14502000400000006    0
      74           42    15001000400000023    0
      75           43    14506200400000044    0
      76           44    12000100400100245    2    INPUT1
      77           45    54501000400000006    0
     100           46    15001000000000002    0
     101           47    10100000400100004    0
     102   LINTG   50    15040000400000077    1
     103           51    55002002400000025    0
     104           52    44505500400000006    0
     105           53    12000111400100236    2    INPUT1
     106           54    12000100400100236    2    INPUT2
     107           55    14000500400000022    0
     110           56    10100000400100017    2    POSITN
FILM ADVANCE
     114   FILM    57    16770070400100076    3    EXIT
HEXAD INPUT
     120   HEX     60    12000100400100231    3    INPUT1
     121           61    14000500400000011    0
     122           62    10100000400100013    2    POSITN
LONG OCTAL INPUT
     126   LOCT    63    14000571400000022    1
     127           64    74501507400000003    0
     130           65    14500161400000003    0
     131           66   410101000400100003    0
     132           67   410205000400000011    0
     133           70    22000100400100222    2    INPUT2
     134           71    10100000400177771    0
     135           72    22000100400100217    2    INPUT1
     136           73    10100000400100002    2    POSITN
SHORT OCTAL INPUT
     142   SOCT    74    14000571400000005    1
     143           75    10100000400177765    2    LOCT
STORE PARAMETERS
DEPENDING ON SIZE AND
CALCULATE INITIAL POSITION
     157   POSITN  76    12170000002100162    3    XLIM
     160           77    12164100000100030    2    TXLIM
     161          100    12170000002100165    2    YLIM
     162          101    12164163000100025    2    TYLIM
     163          102    15046062002100202    2    DINCR
     164          103   430111000400100006    2    XCALC
     165          104    15040000000100206    2    INPUT2
     166          105    12170000000100204    2    INPUT1
     167          106    14003500405000000    0
     170          107    14506223400000006    0
     171          110    12000100400100201    2    INPUT1
     172          111    22000100400100201    2    INPUT2
     173   XCALC  112   430101010400100003    1
     174          113    11020000002100157    2    XINCR
     175          114    10104000400100001    0
     176          115    22000120400000004    0
     177          116    21000004100100141    2    ONE
     200          117   420101010400100003    0
     201          120    11020000002100157    2    YINCR
     202          121    10104000400100001    0
     203          122   122000120400000005    0
     204          123   121000005000100134    2    ONE
     205          124    12000110400100167    2    YSTO
SCAN HEXADS
     211          125   420555022400100030    2    EXIT
     212          126   420555023400100027    2    EXIT
```

```
213     TYLIM    127     4208[illegible]          1
214     TXLIM    130     42025102440000000        1
215              131      1010000400100024        2     EXIT
216              132     44025100040400000        0
217              133      1010000400100022        2     EXIT
220              134     44020100040000012        0
221              135      1504002000100154        2     INPUT1
222              136      1504000000100154        2     INPUT2
223              137       4506241400000006       0
224              140     22000123400100151        2     INPUT1
PLOT CHARACTER B1
230              141     45040007000300016        2     TAPLE
231              142      1010000400100001        0
232     LOOP     143     16100010000000005        1
233              144     74000104400000006        0
234              145      4506200400000001        0
235              146      1010400400100001        0
236              147     46700000000000005        0
237              150     61000161000000004        0
240              151     41010500400177772        2     LOOP
241              152     20104000400100001        0
242              153      1010000400177766        2     LOOP
243              154      1504500000100137        2     YSTO
244              155      1010000400177751        2     TXLIM
245     EXIT     156      1010000440000137        3     UNSAVE
246              157      1010000420000000        0
TABLE OF CHARACTERS
254     TABLE    160                     0        1
255              161                     0        0
256              162                     0        0
257              163                     0        0
260              164                     0        0
261              165                     0        0
262              166                     0        0
263              167                     0        0
264              170                     0        0
265              171                     0        0
266              172                     0        0
267              173                     0        0
270              174                     0        0
271              175                     0        0
272              176                     0        0
273              177                     0        0
274              200                     0        0
275              201                     0        0
276              202                     0        0
277              203                     0        0
300              204                     0        0
301              205                     0        0
302              206                     0        0
303              207                     0        0
304              210                     0        0
305              211                     0        0
306              212                     0        0
307              213                     0        0
310              214                     0        0
311              215                     0        0
312              216                     0        0
313              217                     0        0
314              220                     0        0
315              221                     0        0
316              222                     0        0
317              223                     0        0
320              224                     0        0
321              225                     0        0
322              226                     0        0
```

```
                324                 230                                 0       0
                325                 231                                 0       0
                326                 232                                 0       0
                327                 233                                 0       0
                330                 234                                 0       0
                331                 235                                 0       0
                332                 236                                 0       0
                333                 237                                 0       0
                334                 240                                 0       0
                335                 241                                 0       0
                336                 242                                 0       0
                337                 243                                 0       0
                340                 244                                 0       0
                341                 245                                 0       0
                342                 246                                 0       0
                343                 247                                 0       0
                344                 250                                 0       0
                345                 251                                 0       0
                346                 252                                 0       0
                347                 253                                 0       0
                350                 254                                 0       0
                351                 255                                 0       0
                352                 256                                 0       0
                353                 257                                 0       0
EQUIVALENTS
CONSTANTS
                365     ONE         260     3777777777777777            1
                367     XLIM        261                  11             1
                371                 262                  22             0
                373                 263                  33             0
                375                 264                  44             0
                377                 265                  55             0
                401     YLIM        266                   6             1
                403                 267                  14             0
                405                 270                  22             0
                407                 271                  30             0
                411                 272                  36             0
                413     XINCR       273     7070707070707070            1
                415                 274     3434343434343434            0
                417                 275     2276502275502276            0
                421                 276     1616161616161616            0
                423                 277     1330133013301330            0
                425     YINCR       300     1252525252525252            1
                427                 301     5252525252525252            0
                431                 302     3434343434343434            0
                433                 303     2525252525252525            0
                435                 304     2104210421042104            0
                437     DINCR       305     1136641136641136            1
                441                 306      457320457320457             0
                443                 307      312213037465560             0
                445                 310      227550227550227             0
                447                 311      161616161616161             0
                451                 312                   0             0
                452                 313                   0             0
                453                 314                   0             0
```

```
133             ORG
                REM             CHECK NEG POSITION IN 120

        FF      RPA             EXIT
                CLA             DATA,U→T6
                SB1             1,I→B4
LOOP            SB3             1,I→B2
        T6      TSR             *120,U→T7
                SB3             77767,B2+1
        T6      TSR             *120,U→T7
                SB3             77775,B2+1
        T6      TSR             *120,U→T7
                HTR             LOOP
EXIT            TRA             Z

DATA            BCD             ABCDEFGHI

                END
```

220	EXIT	0	13	0	200000000000000	0	
221	DATA	0	14	0	220000000000000	0	
222	LOOP	0	4	0	110000000000000	0	

CHECK NEG POSITION IN 120

6		1	472160100000100011	2	EXIT
7		2	121700060000100011	2	DATA
10		3	140001744000000001	0	
11	LOOP	4	140003724000000001	1	
12		5	640000074400000120	0	
13		6	140003224000077767	0	
14		7	640000074400000120	0	
15		10	140003224000077775	0	
16		11	640000074400000120	0	
17		12	100000004000177770	2	LOOP
20	EXIT	13	101000004000000000	1	
22	DATA	14	404142434445464750	1	

123 SCOPE GRAPH DISPLAY

*123, GRAPH

This program plots two floating point vectors against each other, or one floating point vector against its fixed point integer index, according to various options specified by a control word in T7 as follows:

T7:

1 — 15	16 — 18	19 — 21	22 — 24	25 — 27
X vector codeword address	Rx	Ry	P	D

28 — 30	31 — 33	34 — 36	37 — 39	40 — 54
A	G	Lx	Ly	Y vector codeword address

Rx, Ry: Ranges of X and Y:

0: positive values, zero to max X or max Y
1: -max|X| to +max|X|, or -max|Y| to +max|Y|
2: min X to max X, or min Y to max Y
3: min X and max X, or min Y and max Y, on B6 list

4-7: As above, with total range increased to 1, 2, or 5 times a power of 10, just greater than or equal to given range

Note: If codeword address of X vector is zero, then Y index is used in place of X data. If Rx = 3 or 7, fixed point integer values must be placed on the B6 list.

P: Plotting of projections of data along X and/or Y axes:

0: plot no projections
1: plot projection of data along X axis
2: plot projection of data along Y axis
3: plot projection of data along both axes

D: Plotting of data:

0: do not plot data points
1: do plot data points

A: Plotting of axes:

0: plot neither axis
1: plot X axis only
2: plot Y axis only
3: plot both X and Y axes

Note: If either axis is off the screen, then the program ignores requests for plotting that axis, or for plotting projections of data along that axis.

G: Plotting of grid:

0: do not plot grid
1: do plot grid

Note: Ten or eleven grid points are plotted vertically and horizontally. If either axis is located on the screen (whether or not it is plotted), then the usual maximum number of grid rows parallel to that axis is ten, with one row lying along the axis. If either axis is off the screen, then eleven rows of grid points are plotted parallel to that axis from one edge of the screen to the other.

Lx, Ly: Labels of X and Y ranges:

0: plot no X or Y labels
1: plot min X or min Y label
2: plot max X or max Y label
3: plot both X or both Y labels

Note: Labels are centered at edges of screen and are short decimal (see program *120), unless Y index is used in place of X data; then X labels are short octal. Also, for plots of positive values (Rx or Ry 0 or 4), min X or min Y label is a short octal zero.

If any data points lie outside the range specified, they (and their projections) are omitted. Thus any portion of a graph may be "blown up" by setting Rx and Ry to 3 or 7 and storing appropriate values on the B6 list. If two values are specified, they are stored as follows:

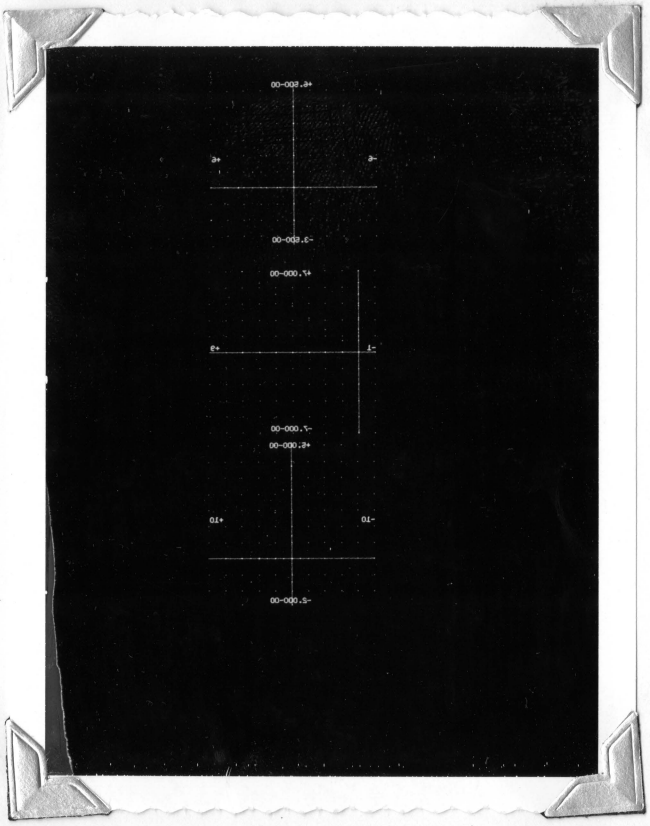
```
(min X,Y)      STO     aB6, B6+1
(max X,Y)      STO     aB6, B6+1
```

If four values are specified, they are stored as follows:

```
(min X)        STO     aB6, B6+1
(max X)        STO     aB6, B6+1
(min Y)        STO     aB6, B6+1
(max Y)        STO     aB6, B6+1
```

Storing of these values should take place immediately before transfer to *123 so that the B6 list will not be altered inadvertently. Program *123 picks up the stored values as specified by Rx and Ry without altering B6.

Jo Kathryn Mann
April 2, 1963



T7: 00000 16313133 00233

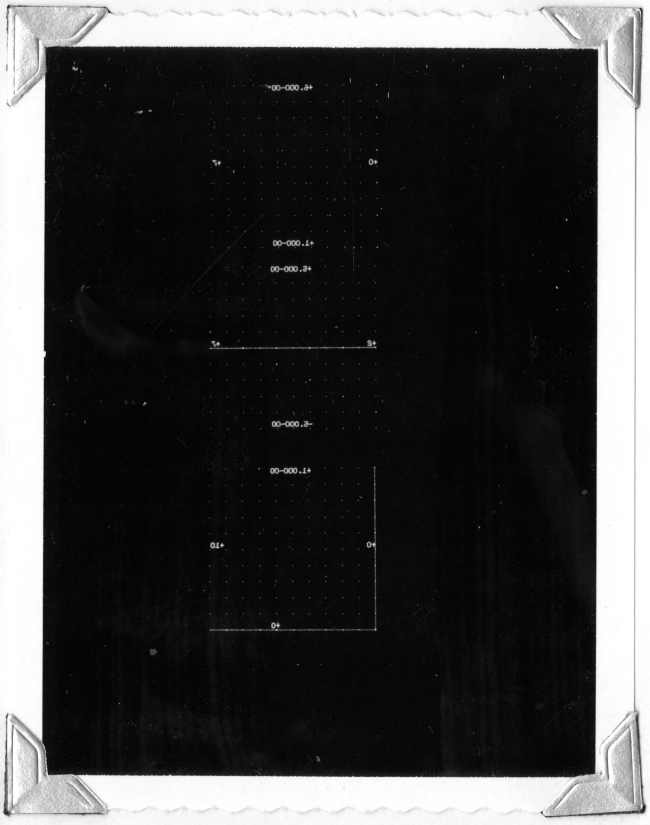
X	-1	0	+1	+2	+3	+4	+5	+6
Y	5.0	4.0	3.0	2.0	1.0	0	-1.0	-2.0

T7: 00000 61313133 00230

X	1	2	3	4	5	6	7
Y	1.0	2.0	3.0	4.0	5.0	6.0	7.0

T7: 00000 52313133 00233

X	-1	0	1	2	3	4	5	6
Y	5.0	4.0	3.0	2.0	1.0	0	-1.0	-2.0



B6 list: +2.0, +5.0

T7: 00000 07 3101 33 00230

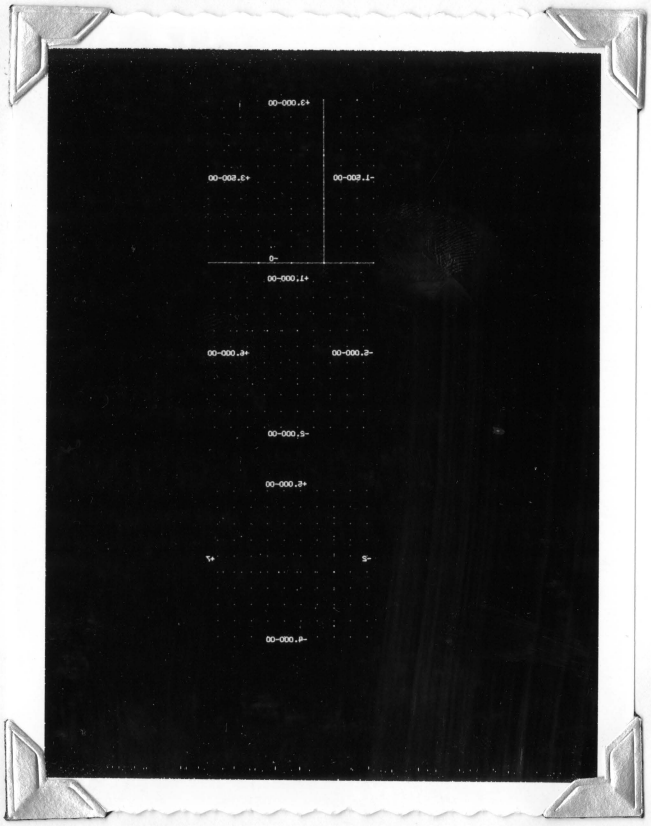
X	1	2	3	4	5	6	7
Y	1.0	2.0	3.0	4.0	5.0	6.0	7.0

T7: 0000 25 3131 33 00231

X	2	3	4	5	6	7
Y	-4.0	-3.0	-2.0	-1.0	0	1.0

T7: 00000 44313133 00231

X	2	3	4	5	6	7
Y	-4.0	-3.0	-2.0	-1.0	0	1.0



B6 list: -1.0, +3.0

T7: 00233 70313133 00232

X	5.0	4.0	3.0	2.0	1.0	0	-1.0	-2.0
Y	-3.0	-2.0	-1.0	0	+1.0	+2.0	+3.0	—

T7: 00233 33 3101 33 00232

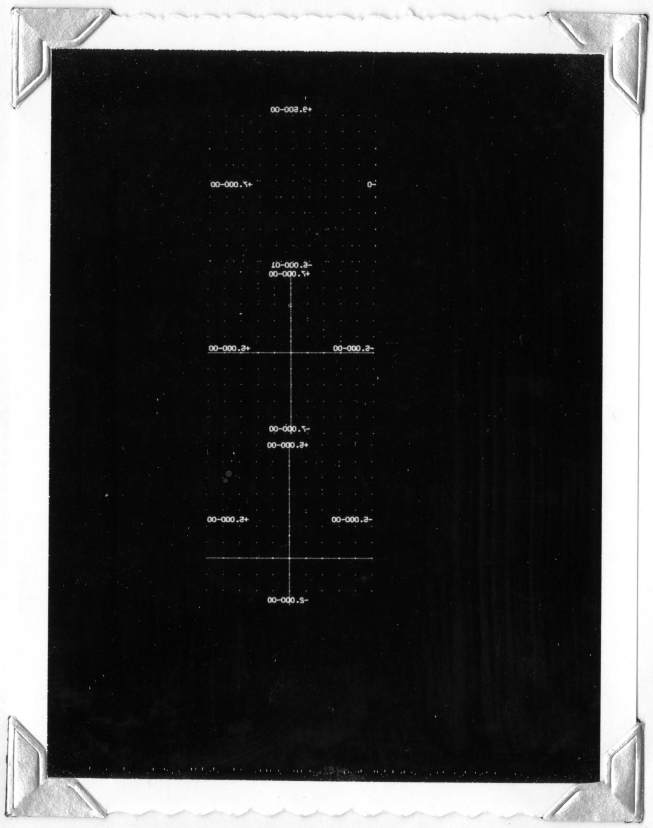
X	5.0	4.0	3.0	2.0	1.0	0	-1.0	-2.0
Y	-3.0	-2.0	-1.0	0	+1.0	+2.0	+3.0	—

B6 list: -5.0, +6.0; -2.0, +1.0

T7: 00000 33 3101 33 00232

X	0	1	2	3	4	5	6
Y	-3.0	-2.0	-1.0	0	+1.0	+2.0	+3.0

B6 list: -2, +7; -4.0, +5.0



T7: 00230 07 3101 33 00230

X	1.0	2.0	3.0	4.0	5.0	6.0	7.0
Y	1.0	2.0	3.0	4.0	5.0	6.0	7.0

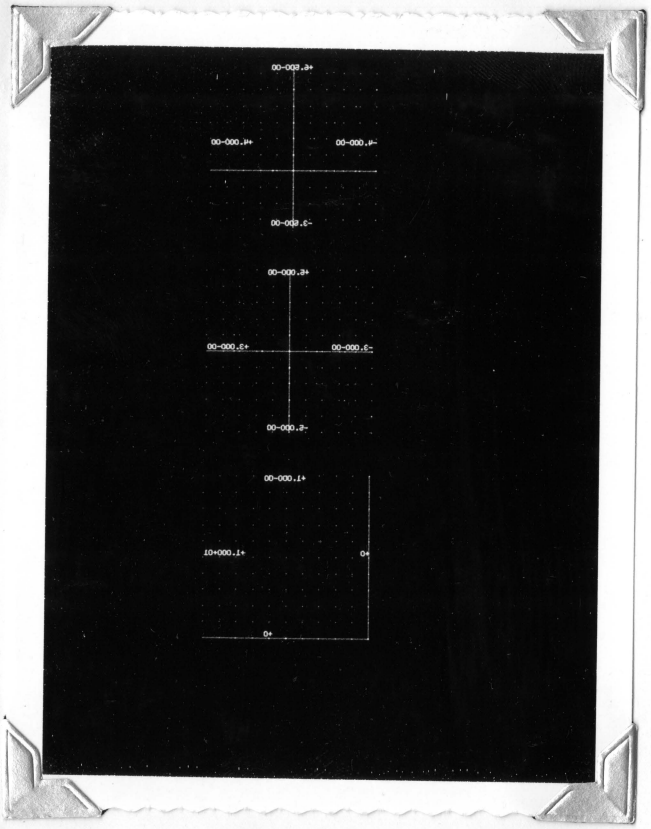
B6 list: +1.0, +8.0

T7: 00232 61 3131 33 00230

X	-3.0	-2.0	-1.0	0	+1.0	+2.0	+3.0
Y	1.0	2.0	3.0	4.0	5.0	6.0	7.0

T7: 00231 52 3131 33 00233

X	-4.0	-3.0	-2.0	-1.0	0	+1.0	—	—
Y	5.0	4.0	3.0	2.0	1.0	0.	-1.0	-2.0



T7: 00231 16 3131 33 00233

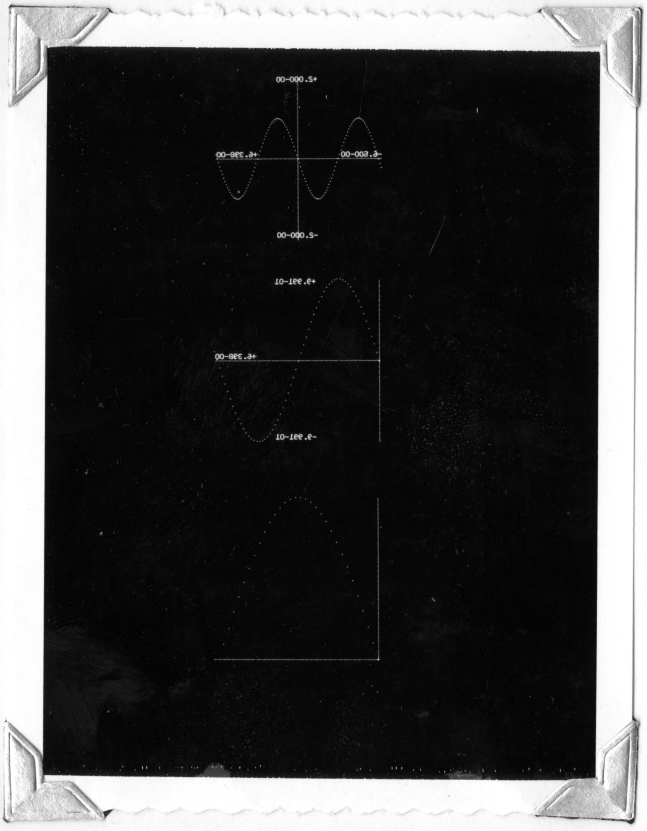
X	-4.0	-3.0	-2.0	-1.0	0	+1.0	—	—
Y	5.0	4.0	3.0	2.0	1.0	0	-1.0	-2.0

T7: 00232 25 3131 33 00231

X	-3.0	-2.0	-1.0	0	+1.0	+2.0	+3.0
Y	-4.0	-3.0	-2.0	-1.0	0	+1.0	—

T7: 00230 44 3131 33 00231

X	1.0	2.0	3.0	4.0	5.0	6.0	7.0
Y	-4.0	-3.0	-2.0	-1.0	0	+1.0	—



T7: 00230 23 0130 33 00231

B6 list: -2.0, +2.0

T7: 00230 02 0130 23 00231

B6 list: empty

T7: 00230 30 0130 00 00231

B6 list: +0, +3.25

Note: $|Y| < 1$ because X is never exactly equal to $\pi/2$.

```
123 GRAPH                     ORG
GRAPH         -Z              TRA             *+36, U→R  SAVE REM
                              CLA          IL 7777+, R→Z
                              RPA,WTG         EXIT+1, R→PF
              T7              STO             R, U→B2
              Z               LLS             a15, U→B1
              Z               LLS             a3, U→B3
              Z               LLS             a3, U→B4
                              LDR             Z+B2, R→B2
              B2              RPA,WTG         BTEST+2
              Z               LLS             a15, U→T4
              Z               LLS             a15, U→B5
              B5              LUR             a3, U→B5
              B5              RPA,WTG         BASE
              T4              AB2             aB5, U→B5
              B4              IF(EVN)TRA      MAXY
              B4              LUR             a1, R→Z
                              IF(EVN)TRA      ABSY, R→T5
                              LDR+5a LT5      Z+B6-13, PF-1
                              LDR+6a LT6      Z+B6-14, PF-1
                              TRA             YSET
ABSY          T5              IF(POS)SKP      |Z+B2+B5-1|, B5-1
                              CLA             |Z+B2+B5|, U→T5
              B5              IF(NZE)TRA      CC-3 ABSY
              -T5             TRA             YSET, U→T6
MAXY                          LDR+5a LT5      Z+B2+B5-1, B5-1
              T5              IF(POS)SKP      Z+B2+B5-1, B5-1
                              CLA             Z+B2+B5, U→T5
              B5              IF(NZE)TRA      CC-3 MAXY+1
              B4              LUR             a1, R→Z
                              IF(EVN)TRA      YSET, R→T6
              T5              SB5             a*T4, U→T6
MAXX          T6              IF(NEG)SKP      Z+B2+B5-1, B5-1
                              CLA             Z+B2+B5, U→T6
              B5              IF(NZE)TRA      CC-3 MAXX
YSET          T5              STO             MY
              T6              STO             NY
              T5              FSB→            T6, R→Z
              B4              IF(NNZ)SKP      a4, R→T5
              PF              TSR             ROUND+1, U→B5
              T5              FAD→            MY
              B4              IF(ZER)SKP      a4
              -T5             FAD→            NY, CC+1
              T5              FAD→            MY
              T6              VDF             DTWO, U→T6
                              STO             YFAC
                              CLA             MY
                              FAD             NY
                              FDV             ROUND
                              STO             YPLUS
              -U              FMP             YFAC
                              STO             YSUM, U→R
              R               FAD+40          SHIFT, U→R
              R               STO             YNOR
XVEC          B1              IF(ZER)TRA      BASE
                              LDR             Z+B1, R→B1
              Z               LLS             a15, U→B4
                              IF(POS)SKP      a*T4
              B4              NOP             Z, U→T4
              Z               LLS             a15, U→B5
              B5              LUR             a3, U→B5
              B4              AB1             aB5, U→B5
              B3              IF(EVN)TRA      XMAX
              B3              LUR             a1, R→Z
                              IF(EVN)TRA      ABSX, R→T5
```

```
                ~~LDR+60~~ LT6      Z+B6+PF-14              104
                TRA                 XSET                    105
ABSX     T5     IF(POS)SKP          |Z+B1+B4=1|, B4-1       106
                CLA                 |Z+B1+B4|, U+T5         107
         B4     IF(NZE)TRA          ~~CC-3~~ ABSX           110
         -T5    TRA                 XSET, U+T6              111
XMAX            ~~LDR+5~~ LT5       Z+B1+B4-1, B4-1         112
         T5     IF(POS)SKP          Z+B1+B4-1, B4-1         113
                CLA                 Z+B1+B4, U+T5           114
         B4     IF(NZE)TRA          ~~CC-3~~ XMAX+1         115
         B3     LUR                 a1, R+Z                 116
                IF(EVN)TRA          XSET, R+T6              117
         T5     SB4                 a35, U+T6               120
         T6     IF(NEG)SKP          Z+B1+B4-1, B4-1         121
                CLA                 Z+B1+B4, U+T6           122
         B4     IF(NZE)TRA          CC-3                    123
XSET     T5     STO                 MX                      124
         T6     STO                 NX                      125
         T5     FSB+                T6, R+Z                 126
         B3     IF(NNZ)SKP          a4, R+T5                127
         PF     TSR                 ROUND+1, U+B5           130
         T5     FAD+                MX                      131
         B3     IF(ZER)SKP          a4                      132
         -T5    FAD+                NX, CC+1                133
         T5     FAD+                MX                      134
         T6     VDF                 DTWO, U+T6              135
                STO                 XFAC                    136
                CLA                 MX                      137
                FAD                 NX                      140
                FDV                 ROUND, U+T6             141
         -U     FMP                 XFAC                    142
                STO                 XSUM, U+R               143
         R      FAD+40              SHIFT, U+R              144
         R      STO                 XNOR                    145
DPONE    T7     LUL                 a21, U+R                146
         Z      LLS                 a6                      147
                IF(NUL)TRA          AXIS, U+B3              150
         T4     ~~LDR+5~~ LT5       YPLUS, U+B5             151
                CLA                 DONE, U+T4              152
         T4     IF(POS)SKP          |YSUM|                  153
         B3     AND                 a67, U+B3               154
         T4     IF(POS)SKP          |XSUM|                  155
         B3     AND                 a57, U+B3               156
         B3     IF(NUL)TRA          AXIS                    157
         B5     TRA                 TEST, U+B4              160
LOOP     -T5    FAD                 Z+B2, B2+1              161
                FMP                 YFAC, U+T4              162
         -T6    FAD                 Z+B1, B1+1              163
                FMP                 XFAC, U+R               164
         R      STO                 RSTO, B5=1              165
         |R|    IF(NEG)SKP          DONE                    166
                TRA                 TEST                    167
         |T4|   IF(NEG)SKP          DONE                    170
                TRA                 TEST                    171
         T4     FAD+40              SHIFT, U+T4             172
                CLA                 RSTO, U+R               173
         R      FAD+40              SHIFT, U+R              174
         B3     IF(EVN)TRA          CC+1                    175
         R      ~~67000~~ ADV       T4        PLT S         176
PROJ     B3     LUR                 a3                      177
                IF(ZER)TRA          TEST                    200
                IF(EVN)TRA          VERT                    201
         R      ~~67000~~ ADV       YNOR      PLT S         202
         B3     LUR                 a4                      203
                IF(NUL)TRA          TEST                    204
```

```
VERT                    CLA         XNOR                    205
                        67000 ADV   T4          PLT S       206
TEST        B5          IF(NZE)TRA  LOOP                    207
                        TRA         AXIS                    210
BASE        T4          SB1         aZ, U→B5                211
            1B11        SB4         aB1+B5-1, U→R           212
            1B11        IF(POS)SKP  a1B41                   213
            1B41        NOP         Z, U→R                  214
            B3          AND         a3, U→B2                215
                        TRA         CC+B2                   216
            Z           TRA         FOUR, U→B1              217
            -R          SB4         a*R, U→B1               220
                        TRA         FOUR                    221
                        CLA         B6+PF-13, U→B4          222
                        CLA         B6+PF-14, U→B1          223
FOUR        B4          STO         MX                      224
            B1          STO         NX                      225
            B4          SUB         aB1, U→T6               226
            B3          IF(NNZ)SKP  a4                      227
                        TSR         FIXRD, U→B4             230
            T6          BEJ         TENTH, U→T4             231
                        FMP         SIX, U→T6               232
            T6          VDF         DTWO, U→T6              233
                        STO         XFAC                    234
            T4          BMJ         aB1+B4                  235
                        FMP         SIX                     236
                        FDV         ROUND                   237
            -U          FMP         XFAC                    240
                        STO         XSUM                    241
                        FAD+40      SHIFT                   242
                        STO         XNOR                    243
OPTWO       T7          LUL         ad21, U→R               244
            Z           LLS         ad6, U→R                245
                        IF(NUL)TRA  AXIS                    246
                        CLA         DONE, U→T4              247
            -U          STO         XPLOT, R→B3             250
            B3          SB3         a*BASE, U→R             251
            B4          IF(NEG)SKP  aB3+B5-1                252
                        SB4         aB3+B5-1                253
            R           LDR+50 LT5  YPLUS, U→B3             254
            T4          IF(POS)SKP  |YSUM|                  255
            B3          AND         a67, U→B3               256
            T4          IF(POS)SKP  |XSUM|                  257
            B3          AND         a67, U→B3               260
            B3          IF(NUL)TRA  AXIS                    261
BTEST       B1          IF(POS)SKP  a*BASE                  262
                        TRA         LTEST, B1+1             263
            -T5         FAD         Z+B1, B1+1              264
                        FMP         YFAC, U→T4              265
            1T41        IF(NEG)SKP  DONE                    266
                        TRA         LTEST                   267
            T4          FAD+40      SHIFT, U→T4             270
                        CLA         XPLOT, U→R              271
            B3          IF(EVN)TRA  PRON                    272
            R           67000 ADV   T4          PLT S       273
PRON        B3          LUR         a3                      274
                        IF(ZER)TRA  LTEST                   275
                        IF(EVN)TRA  YLINE                   276
            R           67000 ADV   YNOR        PLT S       277
            B3          LUR         a4                      300
                        IF(NUL)TRA  LTEST                   301
YLINE                   CLA         XNOR                    302
                        67000 ADV   T4          PLT S       303
LTEST       B1          IF(NEG)SKP  aB4                     304
                        TRA         AXIS                    305
            T6          FAD+40→     XPLOT                   306
```

```
AXIS      T7      LUL     ad27, U→R                          310
          Z       LLS     ad3, U→B3                          311
                  IF(NUL)TRA GRID, R→T5                      312
                  CLA     -DONE, U→T4                        313
                  CLA     XNOR, U→T6                         314
          IT41    IF(POS)SKP IYSUMI                          315
          B3      AND     a6, U→B3                           316
          IT41    IF(POS)SKP IXSUMI                          317
          B3      AND     a5, U→B3                           320
          T5      IF(NMO)TRA CC, U→R                         321
          B3      IF(NUL)TRA GRID-1, CC+1                    322
DELTA             OCT     000040000000000000                 323
XAXIS     B3      IF(EVN)TRA YAXIS                           324
          T4      67000 ADV  YNOR          PLT S             325
YAXIS     B3      IF(NNZ)SKP a2                              326
          T6      67000 ADV  T4            PLT S             327
          T4      ADD     DELTA, U→T4                        330
          T5      IF(NMO)TRA XAXIS, U→R                      331
GRID      7       LLS     ad3, R→T6                          332
                  IF(NUL)TRA LABEL, R→Z                      333
                  CLA     DONE, U→T5                         334
                  FDV     DFIV, U→T4                         335
          T5      IF(PNZ)SKP IXSUMI                          336
                  TRA     XSTO                               337
TOZ       -T4     FAD     XSUM                               340
          IUI     IF(NEG)SKP T5                              341
                  TRA     SAME                               342
          -T4     FAD→    XSUM                               343
                  TRA     CC-5 TOZ                           344
XSTO      T5      STO     XSUM                               345
SAME      T5      IF(PNZ)SKP IYSUMI                          346
                  TRA     YSTO                               347
ZUB       -T4     FAD     YSUM                               350
          IUI     IF(NEG)SKP T5                              351
                  TRA     MABSV                              352
          -T4     FAD→    YSUM                               353
                  TRA     CC-5 ZUB                           354
YSTO      T5      STO     YSUM                               355
MABSV             CLA→    -IYSUMI                            356
                  IF(NMO)TRA CC-5, I→CC BUZ                  357
                  CLA     -IXSUMI, U→T5                      360
          T5      67000 ADV  YSUM          PLT S             361
          T5      ADD     T4, U→T5                           362
                  IF(NMO)TRA MABSV+3                         363
          T4      ADD→    YSUM, CC+1                         364
BUZ       Z       RPR     T4                                 365
                  IF(NMO)TRA MABSV+2, R→Z                    366
LABEL             SB4     a3, I→B1                           367
          T6      LUL     ad3, R1+1                          370
                  CRL     ad3, R→B5                          371
          B5      IF(ZER)TRA LSUBX                           372
                  IF(EVN)TRA HIY                             373
                  SB2     ad24                               374
                  SB3     ad15                               375
                  CLA     NY, U→T7                           376
                  TSR     *120, B5=1 FIGDIS                  377
          B5      IF(ZER)TRA LSUBX                           400
HIY       Z       SB3     ad15, U→B2                         401
                  CLA     MY, U→T7                           402
                  TSR     *120, B2+1 FIGDIS                  403
LSUBX     T6      SB2     ad12, U→R                          404
          Z       LLS     ad3, I→B3                          405
                  IF(ZER)TRA EXIT, B3=1                      406
                  IF(EVN)TRA HIX, U→B5                       407
                  CLA     NX, U→T7                           410
```

```
                    IF(NZE)TRA      ~~CC+5~~ ZOT                    412
            IT7I    IF(PNZ)SKP      ad99                            413
            IT7I    IF(PNZ)SKP      ad9, CC+1                       414
                    TRA             CC+2                            415
                    SB3             a77771, CC+1                    416
                    SB3             a77772                          417
ZOT                 TSR             *~~120~~, 85=1 FIGDIS           420
            P5      IF(ZER)TRA      EXIT                            421
HIX                 SB3             ad28                            422
                    CLA             MX, U→T7                        423
                    TSR             *~~120~~ F16DIS                 424
EXIT                ILF             a77777                          425
                    ILN             a2                              426
                    TRA             *~~137~~ UNSAVE                 427
                    TRA             PF                              430
DONE                OCT             7737777777777777                431
DTWO                OCT             0100177777777777                432
DFIV                DEC             5.0                             433
TENTH               OCT             7703146314631463 14             434
SHIFT               OCT             7700000000000000                435
SIX                 OCT             0620000000000000                436
FIXRD               CLA             ad10, U→T5                      437
            T6      IF(NZE)SKP      T5                              440
                    TRA             FIXLM                           441
                    IF(NNZ)TRA      TWFV                            442
            T5      MPY             ad10, R→T5                      443
                    TRA             ~~CC=5~~ FIXRD+1                444
TWFV        T5      LUR             a1, U→R                         445
                    IF(NZE)SKP      T5                              446
                    TRA             FIXLM, R→T5                     447
                    IF(NNZ)TRA      FIXLM                           450
            T5      IDV             a5, U→R                         451
                    IF(NNZ)SKP      T5                              452
                    TRA             FIXLM, R→T5                     453
            T5      LUR             a1, U→T5                        454
FIXLM       T5      SUB             T5, U→T6                        455
            P4      IF(NZE)TRA      CC+2                            456
            IT6I    ADD→            MX, U→B4                        457
                    TRA             OKAY                            460
            IT6I    LUR             a1, U→R                         461
            P       ADD→            MX, U→B4                        462
            -R      ADD→            MX, U→B1                        463
            IT6I    IF(EVN)TRA      OKAY                            464
                    CLA             a1                              465
                    ADD→            MX, U→B4                        466
OKAY        T5      TRA             PF, U→T6                        467
ROUND               OCT             0100200000000000                470
            T6      STO             OLDR                            471
            T6      IF(NZE)SKP      CC+2, CC+1                      472
                    OCT             0100100000000000                473
                    TRA             FIXR                            474
                    IF(PNZ)TRA      TEN                             475
                    CLA             TENTH, U→T5                     476
                    STO             TEMP, CC+1                      477
ICI         T5      FMP→            TEMP                            500
            T6      IF(PNZ)SKP      TEMP                            501
                    TRA             ~~CC=3~~ ICI                    502
            U       IF(NEG)SKP      TEMP                            503
                    TRA             FIVE                            504
            -U      FAD→            T6                              505
                    TRA             FIXR                            506
FIVE                CLA             TEMP                            507
                    FMP             DFIV, U→T5                      510
            T5      IF(POS)SKP      T6                              511
            T5      FAD→            T5                              512
```

```
TEN             CLA     DTEN, U→T5                      514
                STO     TEMP, CC+1                      515
LA      T5      FMP→    TEMP                            516
        T6      IF(NEG)SKP TEMP                         517
                TRA     CC-3 LA                         520
                CLA     TEMP                            521
                FDV     DFIV, U→T5                      522
        T5      IF(NNZ)SKP T6                           523
        T5      TRA     FIXR, U→T6                      524
                CLA     TEMP                            525
                FDV     ROUND, U→T5                     526
                IF(POS)SKP T6                           527
                CLA     TEMP, U→T5                      530
        T5      TRA     FIXR, U→T6                      531
DTEN            DEC     10.0                            532
FIXR    T6      FSB     ONE                             533
                FDV     ROUND, U→T5                     534
        P5      TRA     PF, U→PF                        535
                END                                     536
                                                        537
                                                        540
```

FIGDIS EQU 120
SAVE " 136
UNSAVE " 137

220	GRAPH	0	1	0	20000000000000	0
221	EXIT	0	423	0	42500000000000	0
222	BTEST	0	260	0	26100000000000	0
223	BASE	0	207	0	21000000000000	0
224	MAXY	0	31	0	32000000000000	0
225	ABSY	0	25	0	26000000000000	0
226	YSET	0	43	0	44000000000000	0
227	MY	0	534	0	55000000000000	0
230	NY	0	535	0	55100000000000	0
231	ROUND	0	466	0	47700000000000	0
232	DTWO	0	430	0	43400000000000	0
233	YFAC	0	536	0	55200000000000	0
234	YPLUS	0	537	0	55300000000000	0
235	YSUM	0	540	0	55400000000000	0
236	SHIFT	0	433	0	44200000000000	0
237	YNOR	0	541	0	55500000000000	0
240	XVEC	0	66	0	67000000000000	0
241	XMAX	0	110	0	111000000000000	0
242	ABSX	0	104	0	105000000000000	0
243	XSET	0	122	0	123000000000000	0
244	MX	0	542	0	55600000000000	0
245	NX	0	543	0	55700000000000	0
246	XFAC	0	544	0	56000000000000	0
247	XSUM	0	545	0	56100000000000	0
250	XNOR	0	546	0	56200000000000	0
251	DPONE	0	144	0	14500000000000	0
252	AXIS	0	306	0	30700000000000	0
253	DONE	0	427	0	43200000000000	0
254	TEST	0	205	0	20600000000000	0
255	LOOP	0	157	0	16000000000000	0
256	RSTO	0	547	0	56300000000000	0
257	PROJ	0	175	0	17600000000000	0
260	VERT	0	203	0	20400000000000	0
261	FOUR	0	222	0	22300000000000	0
262	FIXRD	0	435	0	44500000000000	0
263	TENTH	0	432	0	44000000000000	0
264	SIX	0	434	0	44400000000000	0
265	DPTWO	0	242	0	24300000000000	0
266	XPLOT	0	550	0	56400000000000	0
267	LTEST	0	302	0	30300000000000	0
270	PRON	0	272	0	27300000000000	0
271	YLINE	0	300	0	30100000000000	0
272	GRID	0	330	0	33200000000000	0
273	DELTA	0	321	0	32300000000000	0
274	XAXIS	0	322	0	32400000000000	0
275	YAXIS	0	324	0	32600000000000	0
276	LABEL	0	365	0	36700000000000	0
277	DFIV	0	431	0	43600000000000	0
300	XSTO	0	343	0	34500000000000	0
301	SAME	0	344	0	34600000000000	0
302	YSTO	0	353	0	35500000000000	0
303	MABSV	0	354	0	35600000000000	0
304	LSUBX	0	402	0	40400000000000	0
305	HIY	0	377	0	40100000000000	0
306	HIX	0	420	0	42200000000000	0
307	FIXLM	0	453	0	46300000000000	0
310	TWFV	0	443	0	45300000000000	0
311	OKAY	0	465	0	47500000000000	0
312	OLDR	0	551	0	56500000000000	0
313	FIXR	0	531	0	54400000000000	0
314	TEN	0	512	0	52400000000000	0
315	TEMP	0	552	0	56600000000000	0
316	FIVE	0	505	0	51700000000000	0
317	DTEN	0	530	0	54300000000000	0

```
GRAPH   1    10010000244000136   1
        2    12170010000077771   0
        3    12164157000100420   2   EXIT
        4    72000142400000002   0
        5     4506241400000017   0
        6     4506243400000003   0
        7     4506244400000003   0
       10    15040052000400000   0
       11    42216410000100250   2   BTEST
       12     4506204400000017   0
       13     4506245400000017   0
       14    45450104540000003   0
       15    45216410000100171   2   BASE
       16     4410024540400000   0
       17    44010200040010001 1 2   MAXY
       20    44450101040000001   0
       21     1010201540010003   2   ABSY
       22     1504506701007764   0
       23     1504606701007763   0
       24     1010000040010016   2   YSET
ABSY   25     5021106520447776   1
       26     1217000520440000   0
       27    45010500040017774   0
       30    15010000640010012   2   YSET
MAXY   31     1504506500447776   1
       32     5021106500447776   0
       33     1217000500440000   0
       34    45010500040017774   0
       35    44450101040000001   0
       36     1010201640010004   2   YSET
       37     5400060644000004   0
       40     6025106500447776   0
       41     1217000600440000   0
       42    45010500040017774   0
YSET   43     5200010040010047 0  3   MY
       44     6200010040010047 0  2   NY
       45     5105011000000006   0
       46    44065501540000004   0
       47    47400004540010041 7  2   ROUND
       50     5104010000010046 3  2   MY
       51    44020100040000000 4  0
       52    15104012000010046 2  2   NY
       53     5104010000010046 0  2   MY
       54     6167000600010035 3  2   DTWO
       55     1200010040010046 0  2   YFAC
       56     1217000000010045 5  2   MY
       57     1104000000010045 5  2   NY
       60     1107000000010040 5  2   ROUND
       61     1200010040010045 5  2   YPLUS
       62     1110600000010045 3  2   YFAC
       63     1200010240010045 4  2   YSUM
       64     2104600200010034 6  2   SHIFT
       65     2200010040010045 3  2   YNOR
XVEC   66    41010100040010012 0  3   BASE
       67     1504005100020000 0  0
       70     4506244400000017   0
       71     1021100044000000 4  0
       72    44200400400000000 0  0
       73     4506245400000017   0
       74    45450104540000003   0
       75    44410014540400000 0  0
       76    43010200040010001 1  2   XMAX
       77    43450101040000000 1  0
      100     1010201540010000 3  2   ABSX
      101     1504500003007776 4  0
      102     1504600003007776 3  0
```

```
105   ABSX    104   5021106420277776   1
106           105   1217000520200000   0
107           106   4401050004001777 4   0
110           107   1501000064001000 12   2   XSET
111   XMAX    110   1504506400277776   1
112           111   5021106400277776   0
113           112   1217000500200000   0
114           113   4401050004001777 4   0
115           114   4345010104000000 1   0
116           115   1010201640010000 4   2   XSET
117           116   5400040640400000   0
120           117   6025106400277776   0
121           120   1217000600200000   0
122           121   4401050004001777 4   0
123   XSET    122   5200010040010041 7   3   MX
124           123   6200010040010041 7   2   NX
125           124   5105011000000000 6   0
126           125   4306550154000000 4   0
127           126   4740000454001003 40   2   ROUND
130           127   5104010000010041 2   2   MX
131           130   4302010004000000 4   0
132           131   1510401200001004 11   2   NX
133           132   5104010000010040 7   2   MX
134           133   6167000600010027 4   2   DTWO
135           134   1200010040010040 7   2   XFAC
136           135   1217000000010040 4   2   MX
137           136   1104000000010040 4   2   NX
140           137   1107000600010032 6   2   ROUND
141           140   1110600000001004 03   2   XFAC
142           141   1200010240010040 3   2   XSUM
143           142   2104600200010027 0   2   SHIFT
144           143   2200010040010040 2   2   XNOR
145   DPONE   144   7450200240000002 5   1
146           145   4506200400000006   0
147           146   1010404340010013 7   2   AXIS
150           147   4504504500010036 7   2   YPLUS
151           150   1217000400010025 6   2   DONE
152           151   4021100020010036 6   2   YSUM
153           152   4350314434000006 7   0
154           153   4021100020010037 1   2   XSUM
155           154   4350314434000005 7   0
156           155   4301040004001001 30   2   AXIS
157           156   4501000444001000 26   2   TEST
160   LOOP    157   1510400220004000 00   1
161           160   1106000400010035 5   2   YFAC
162           161   1610400210002000 0   0
163           162   1106000200010036 1   2   XFAC
164           163   2200016540010036 3   2   RSTO
165           164   2202510000001002 42   2   DONE
166           165   1010000040010001 7   2   TEST
167           166   2402510000001002 40   2   DONE
170           167   1010000040010001 5   2   TEST
171           170   4104600400010024 2   2   SHIFT
172           171   1217000200010035 5   2   RSTO
173           172   2104600200010024 0   2   SHIFT
174           173   4301020004001000 01   0
175           174   2670000000000000 4   0
176   PROJ    175   4345010004000000 03   1
177           176   1010100040010000 6   2   TEST
200           177   1010200040010000 3   2   VERT
201           200   2670000000010034 0   2   YNOR
202           201   4345010004000000 4   0
203           202   1010400040010000 2   2   TEST
204   VERT    203   1217000000010034 2   3   XNOR
205           204   1670000000000000 4   0
```

```
207          206   10100000400100077     2   AXIS
210   BASE   207   44000145400000000     1
211          210   61400040240427777 6   0
212          211   61021100060200000 0   0
213          212   64200400200000000 0   0
214          213   43503144240000000 3   0
215          214   10100000400500000     0
216          215   10004140010000 4      2   FOUR
217          216   12400044144000000 2   0
220          217   10100000400100002     2   FOUR
221          220   12170044030077764     0
222          221   12170041030077763     0
223   FOUR   222   44200010040010031 7    3   MX
224          223   41200010040010031 7    2   NX
225          224   44101000640020000     0
226          225   43065500040000000 4   0
227          226   14000044400100206     2   FIXRD
230          227   62100004000100202     2   TENTH
231          230   11060006000100203     2   SIX
232          231   61670006000100176     2   DTWO
233          232   12000100400100311     2   XFAC
234          233   42070000402200000     0
235          234   11060000000100177     2   SIX
236          235   11070000000100230     2   ROUND
237          236   11106000000010030 5   2   XFAC
240          237   12000100400100305     2   XSUM
241          240   11046000000100172     2   SHIFT
242          241   12000100400100304     2   XNOR
243   DPTWO  242   74502002400000025     1
244          243   45062024000000006     0
245          244   10104000400100041     2   AXIS
246          245   12170004000100161     2   DONE
247          246   11200015340010030 1   2   XPLOT
250          247   43400030244017773 6   2   BASE
251          250   44025100040507777 6   0
252          251   14000400405077776     0
253          252   25045043000100264     2   YPLUS
254          253   40211000200100264     2   YSUM
255          254   43503144340000006 7   0
256          255   40211000200100267     2   XSUM
257          256   43503144340000005 7   0
260          257   43010400040010002 6   2   AXIS
261   BTEST  260   41021100044017772 5   3   BASE
262          261   10100021400100020     2   LTEST
263          262   15104002100020000 0   0
264          263   11060040001002522     2   YFAC
265          264   24025100000010014 2   2   DONE
266          265   10100000400100014     2   LTEST
267          266   41046004000100144     2   SHIFT
270          267   12170002000100260     2   XPLOT
271          270   43010200040010000 1   2   PRON
272          271   26700000000000004     0
273   PRON   272   43450100040000000 3   1
274          273   10101000400100006     2   LTEST
275          274   10102000400100003     2   YLINE
276          275   26700000000100243     2   YNOR
277          276   43450100040000000 4   0
300          277   10104000400100002     2   LTEST
301   YLINE  300   12170000000100245     3   XNOR
302          301   16700000000000004     0
303   LTEST  302   41025100040200000 0   1
304          303   10100000400100002     2   AXIS
305          304   61046100000100243     2   XPLOT
306          305   10100000400177751     2   BTEST
307   AXIS   306   74502002400000033     1
```

```
        310   10104015400100017    2   GRID
        311   12170004100100115    2   DONE
        312   12170006000100233    2   XNOR
        313   240211000200100224   2   YSUM
        314   43503144340000006    0
        315   240211000200100227   2   XSUM
        316   43503144340000005    0
        317   50160002400100000    0
        320   430104020400100006   2   GRID
DELTA   321   40000000000000       1
XAXIS   322   430103000400100001   3   YAXIS
        323   46700000000100215    2   YNOR
YAXIS   324   430655000400000002   1
        325   66700000000000004    0
        326   41000004000177771    2   DELTA
        327   50160002400177771    2   XAXIS
GRID    330   4506216400000003     1
        331   10104010400100033    2   LABEL
        332   12170005000100074    2   DONE
        333   11070004000100075    2   DFIV
        334   50615000200100210    2   XSUM
        335   10100000400100005    2   XSTO
        336   141040000000100206   2   XSUM
        337   210251000000000005   0
        340   10100000400100003    2   SAME
        341   141040100000100203   2   XSUM
        342   10100000400177772    0
XSTO    343   52000100400100201    3   XSUM
SAME    344   50615000200100173    3   YSUM
        345   10100000400100005    2   YSTO
        346   141040000000100171   2   YSUM
        347   210251000000000005   0
        350   10100000400100003    2   MABSV
        351   141040100000100166   2   YSUM
        352   10100000400177772    0
YSTO    353   52000100400100164    3   YSUM
MABSV   354   12170100300100163    3   YSUM
        355   10160070400100005    0
        356   12170005300100166    2   XSUM
        357   56700000000100160    2   YSUM
        360   51000005000000004    0
        361   10160000400177774    2   MABSV
        362   41000120000100155    2   YSUM
        363   2140100000000004     0
        364   10160010400177770    2   MABSV
LABEL   365   14000471400000003    1
        366   64503021400000003    0
        367   14506655400000003    0
        370   45010100400100011    2   LSUBX
        371   10102000400100005    2   HIY
        372   14000200400000030    0
        373   14000300400000017    0
        374   12170007000100140    2   NY
        375   14000065440000120    0
        376   45010100400100003    2   LSUBX
HIY     377   4000342400000017     1
        400   12170007000100133    2   MY
        401   14000022440000120    0
LSUBX   402   64000202400000014    1
        403   4506273400000003     0
        404   10101063400100016    2   EXIT
        405   10102045400100012    2   HIX
        406   12170007000100134    2   NX
        407   274501563400000007   0
        410   10105000400100005    0
```

```
413            411   27061500040000143   0
414            412   27061502040000011   0
415            413    1010000400100002   0
416            414    1400032040007771   0
417            415    1400030040007772   0
420            416    1400006544000120   0
421            417   45010100040010000   2   EXIT
422   HIX      420    1400030040000034   1
423            421    1217000700100120   2   MX
424            422    1400000044000120   0
425   EXIT     423    1420050040077777   1
426            424    1420010040000000   0
427            425    1010000044000137   0
430            426    1010000042000000   0
432   DONE     427   77377777777777777   1
434   DTWO     430    1001777777777777   1
436   DFIV     431    1005000000000000   1
440   TENTH    432   77031463146314631   1
442   SHIFT    433   77000000000000000   1
444   SIX      434    6200000000000000   1
445   FIXRD    435    1217000540000012   1
446            436    6020500000000005   0
447            437    1010000400100013   2   FIXLM
450            440    1055500040010002   2   TWFV
451            441    5102001540000012   0
452            442    1010000400177772   0
453   TWFV     443    5450100240000001   1
454            444    1020500000000006   0
455            445    1010001540010005   2   FIXLM
456            446    1055500040010004   2   FIXLM
457            447    5133000240000005   0
460            450    1065500000000006   0
461            451    1010001540010001   2   FIXLM
462            452    5450100540000001   0
463   FIXLM    453    5101000600000006   1
464            454   44010500040010002   0
465            455   26100014400010064   2   MX
466            456    1010000040010006   2   OKAY
467            457   26450100240000001   0
470            460    2100014400010061   2   MX
471            461   12100014100010061   2   NX
472            462   26010200040010002   2   OKAY
473            463    1217000040000001   0
474            464    1100014400010055   2   MX
475   OKAY     465    5010000642000000   1
477   ROUND    466    1002000000000000   1
500            467    6200010040010061   2   OLDR
501            470    6020502000010000   0
503            471    1001000000000000   0
504            472    1010000040010036   2   FIXR
505            473    1051500040010016   2   TEN
506            474    1217000500177734   2   TENTH
507            475    1200012040010054   2   TEMP
510            476    5106010000010053   2   TEMP
511            477    6061500000010052   2   TEMP
512            500    1010000040177774   0
513            501    1025100000010050   2   TEMP
514            502    1010000040010002   2   FIVE
515            503   11104010000000006   0
516            504    1010000040010024   2   FIXR
517   FIVE     505    1217000000010044   3   TEMP
520            506    1106000500177721   2   DFIV
521            507    5021100000000006   0
522            510    5104010000000005   0
523            511    5010000640010017   2   FIXR
524   TEN      512    1217000500010015   3   DTEN
```

```
526                 514     5106010000010035    2   TEMP
527                 515     6025100000100034    2   TEMP
530                 516     1010000040017774    0
531                 517     1217000000100032    2   TEMP
532                 520     1107000500017770 7  2   DFIV
533                 521     5065500000000006    0
534                 522     5010000640010006    2   FIXR
535                 523     1217000000100026    2   TEMP
536                 524     1107000500017740    2   ROUND
537                 525     1021100000000006    0
540                 526     1217000500010023    2   TEMP
541                 527     5010000640010001    2   FIXR
543   DTEN          530     1012000000000000    1
544   FIXR          531     6105000000100017    3   OLDR
545                 532     1107000500017732    2   ROUND
546                 533     4501000474200000 0  0
550                 534                   0     0
551                 535                   0     0
552                 536                   0     0
553                 537                   0     0
554                 540                   0     0
555                 541                   0     0
556                 542                   0     0
557                 543                   0     0
560                 544                   0     0
561                 545                   0     0
562                 546                   0     0
563                 547                   0     0
564                 550                   0     0
565                 551                   0     0
566                 552                   0     0
```

SCOPE Oscilloscope Plotter

SCOPE is the Genie-compatible version of the API subroutine GRAPH, #123. All the options of GRAPH are available in SCOPE, and are specified in a Genie EXECUTE command (rather than through a control word in T7). The parameters, some of which may be omitted, are described below; for details of their interpretation refer to the mimeographed explanation of #123, GRAPH.

or EXECUTE 1st tab SCOPE (XVEC, +RxRyPD, +AGLxLy, YVEC, XMIN, XMAX, YMIN, YMAX, i) 2nd tab

XVEC: name of X vector if two vectors are to be plotted against each other; omit if Y vector is to be plotted against its index.

+RxRyPD: a 4-digit octal number specifying ranges of X and Y, and plotting of projections and/or data.

+AGLxLy: a 4-digit octal number specifying plotting of axes and/or grid, and labels of X and Y ranges.

YVEC: name of Y vector to be plotted.

XMIN, XMAX: numerical values giving range of X, if Rx = 3 or 7; must be integers if XVEC is omitted. If Rx ≠ 3 or 7, omit XMIN and XMAX.

YMIN, YMAX: numerical values giving range of Y, if Ry = 3 or 7; omit if Ry ≠ 3 or 7.

i: a positive decimal integer 3, 4, ..., 8 indicating the number of parameters preceding i.

Examples

```
EXECUTE   SCOPE (+1101, +3033, YVEC, 3)
LET       L=+3201, M=+3301, N=+3133
EXECUTE   SCOPE (XVEC, M, N, YVEC, -5.5, 2.5, -3.0, 5.0, 8)
EXECUTE   SCOPE (M, N, YVEC, 2, 9, -10.0, 10.0, 7)
EXECUTE   SCOPE (XVEC, +2201, N, YVEC, 4)
EXECUTE   SCOPE (L, N, YVEC, 1, 15, 5)
EXECUTE   SCOPE (XVEC, L, N, YVEC, -1.0, 1.0, 6)
```

Note: If labels are requested, program #120 FIGOSP must be loaded along with SCOPE. If labels are not desired #120 may be omitted.

```
123                ORG       Z, 600                                    2
SOOPE      T7      STO       TSEV, R→Z                                 3
           PF      RPA,WTG   EXEX, R→T7                                4
           Z       LDR       *B6-1, R→PF                               5
           -PF     RPA,WTG   SIXFIX, U→PF                              6
           -PF     IF(ODD)TRA CC+1, B6=1                               7
                   LDR+70    B6+PF, CC+1                               10
                   NOP       Z, PF-1                                   11
                   CLA       PF+B6+3                                   12
                   LRS       ad15                                      13
                   CLA       *PF+B6+2                                  14
                   LRS       ad12                                      15
                   CLA       *PF+B6+1                                  16
                   LRS       ad12                                      17
           T7      LRS       ad15, R→T7                                20
                   TSR       CC+4                                      21
SIXFIX             AB6       Z                                         22
                   CLA       TSEV, U→T7                                23
EXEX               SPF       Z, I→CC                                   24
TSEV               OCT       Z                                         25
GRAPH      -Z      TRA       *136, U→R                                 26
                   CLA       77771, R→Z                                27
                   RPA,WTG   EXIT+1, R→PF                              30
           T7      STO       R, U→B2                                   31
           Z       LLS       ad15, U→B1                                32
           Z       LLS       a3, U→B3                                  33
           Z       LLS       a3, U→B4                                  34
                   LDR       Z+B2, R→B2                                35
           B2      RPA,WTG   BTEST+2                                   36
           Z       LLS       ad15, U→T4                                37
           Z       LLS       ad15, U→B5                                40
           B5      LUR       a3, U→B5                                  41
           B5      RPA,WTG   BASE                                      42
           T4      AB2       aB5, U→B5                                 43
           B4      IF(EVN)TRA MAXY                                     44
           B4      LUR       a1, R→Z                                   45
                   IF(EVN)TRA ABSY, R→T5                               46
                   LDR+50    *B6-13, PF-1                              47
                   LDR+60    *B6-14, PF-1                              50
                   TRA       YSET                                      51
ABSY       T5      IF(POS)SKP |Z+B2+B5=11|, B5-1                       52
                   CLA       |Z+B2+B5|, U→T5                           53
           B5      IF(NZE)TRA CC-3                                     54
           -T5     TRA       YSET, U→T6                                55
MAXY               LDR+50    Z+B2+B5-1, B5-1                           56
           T5      IF(POS)SKP Z+B2+B5-1, B5-1                          57
                   CLA       Z+B2+B5, U→T5                             60
           B5      IF(NZE)TRA CC-3                                     61
           B4      LUR       a1, R→Z                                   62
                   IF(EVN)TRA YSET, R→T6                               63
           T5      SBS       a*T4, U→T6                                64
           T6      IF(NEG)SKP Z+B2+B5-1, B5-1                          65
                   CLA       Z+B2+B5, U→T6                             66
           B5      IF(NZE)TRA CC-3                                     67
YSET       T5      STO       MY                                        70
           T6      STO       NY                                        71
           T5      FSB*      T6, R→Z                                   72
           B4      IF(NNZ)SKP a4, R→T5                                 73
           PF      TSR       ROUND+1, U→B5                             74
           T5      FAD*      MY                                        75
           B4      IF(ZER)SKP a4                                       76
           -T5     FAD*      NY, CC+1                                  77
           T5      FAD*      MY                                        100
           T6      VDF       DTWO, U→T6                                101
                   STO       YFAC                                      102
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                    FAD         NY                          104
                    FDV         ROUND                       105
                    STO         YPLUS                       106
                -U  FMP         YFAC                        107
                    STO         YSUM, U→R                   110
                R   FAD+60      SHIFT, U→R                  111
                R   STO         YNOR                        112
XVEC            B1  IF(ZER)TRA  BASE                        113
                    LDR         Z+B1, R→B1                  114
                Z   LLS         ad15, U→B4                  115
                    IF(POS)SKP  a*T4                        116
                B4  NOP         Z, U→T4                     117
                Z   LLS         ad15, U→B5                  120
                B5  LUR         a3, U→B5                    121
                B4  ABI         aB5, U→B5                   122
                B3  IF(EVN)TRA  XMAX                        123
                B3  LUR         a1, R→Z                     124
                    IF(EVN)TRA  ABSX, R→T5                  125
                    LDR+50      *B6+PF-13                   126
                    LDR+60      *B6+PF-14                   127
                    TRA         XSET                        130
ABSX            T5  IF(POS)SKP  |Z+B1+B4-11, B4-1           131
                    CLA         |Z+B1+B41, U→T5             132
                B4  IF(NZE)TRA  CC-3                        133
                -T5 TRA         XSET, U→T6                  134
XMAX                LDR+50      Z+B1+B4-1, B4-1             135
                T5  IF(POS)SKP  Z+B1+B4-1, B4-1             136
                    CLA         Z+B1+B4, U→T5               137
                B4  IF(NZE)TRA  CC-3                        140
                B3  LUR         a1, R→Z                     141
                    IF(EVN)TRA  XSET, R→T6                  142
                T5  SB4         aB5, U→T6                   143
                T6  IF(NEG)SKP  Z+B1+B4-1, B4-1             144
                    CLA         Z+B1+B4, U→T6               145
                B4  IF(NZE)TRA  CC-3                        146
XSET            T5  STO         MX                          147
                T6  STO         NX                          150
                T5  FSB→        T6, R→Z                     151
                B3  IF(NNZ)SKP  a4, R→T5                    152
                PF  TSR         ROUND+1, U→B5               153
                T5  FAD→        MX                          154
                B3  IF(ZER)SKP  a4                          155
                -T5 FAD→        NX, CC+1                    156
                T5  FAD→        MX                          157
                T6  VDF         DTWO, U→T6                  160
                    STO         XFAC                        161
                    CLA         MX                          162
                    FAD         NX                          163
                    FDV         ROUND, U→T6                 164
                -U  FMP         XFAC                        165
                    STO         XSUM, U→R                   166
                R   FAD+60      SHIFT, U→R                  167
                R   STO         XNOR                        170
DRONE           T7  LUL         ad21, U→R                   171
                Z   LLS         ad6                         172
                    IF(NUL)TRA  AXIS, U→B3                  173
                T4  LDR+50      YPLUS, U→B5                 174
                    CLA         DONE, U→T4                  175
                T4  IF(POS)SKP  |YSUM|                      176
                B3  AND         a67, U→B3                   177
                T4  IF(POS)SKP  |XSUM|                      200
                B3  AND         a57, U→B3                   201
                B3  IF(NUL)TRA  AXIS                        202
                B5  TRA         TEST, U→B4                  203
LOOP            -T5 FAD         Z+B2, B2+1                  204
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                -T6     FAD         Z+B1, B1+1                  206
                        FMP         XFAC, U+R                   207
                R       STO         RSTO, B5-1                  210
                IR1     IF(NEG)SKP  DONE                        211
                        TRA         TEST                        212
                IT41    IF(NEG)SKP  DONE                        213
                        TRA         TEST                        214
                T4      FAD+60      SHIFT, U+T4                 215
                        CLA         RSTO, U+R                   216
                R       FAD+60      SHIFT, U+R                  217
                B3      IF(EVN)TRA  CC+1                        220
                R       67000       T4                          221
PROJ            B3      LUR         a3                          222
                        IF(ZER)TRA  TEST                        223
                        IF(EVN)TRA  VERT                        224
                R       67000       YNOR                        225
                B3      LUR         a4                          226
                        IF(NUL)TRA  TEST                        227
VERT                    CLA         XNOR                        230
                        67000       T4                          231
TEST            B5      IF(NZE)TRA  LOOP                        232
                        TRA         AXIS                        233
BASE            T4      SB1         aZ, U+B5                    234
                IB11    SB4         aB1+B5-1, U+R               235
                IB11    IF(POS)SKP  a1B41                       236
                IB41    NOP         Z, U+R                      237
                B3      AND         a3, U+B2                    240
                        TRA         CC+B2                       241
                Z       TRA         FOUR, U+B1                  242
                -R      SB4         a*R, U+B1                   243
                        TRA         FOUR                        244
                        CLA         *B6+PF-13, U+B4             245
                        CLA         *B6+PF-14, U+B1             246
FOUR            B4      STO         MX                          247
                B1      STO         NX                          250
                B4      SUB         aB1, U+T6                   251
                B3      IF(NNZ)SKP  a4                          252
                        TSR         FIXRD, U+B4                 253
                T6      BEU         TENTH, U+T4                 254
                        FMP         SIX, U+T6                   255
                T6      VDF         DTWO, U+T6                  256
                        STO         XFAC                        257
                T4      BMU         aB1+B4                      260
                        FMP         SIX                         261
                        FDV         ROUND                       262
                -U      FMP         XFAC                        263
                        STO         XSUM                        264
                        FAD+60      SHIFT                       265
                        STO         XNOR                        266
DPTWO           T7      LUL         ad21, U+R                   267
                Z       LLS         ad6, U+R                    270
                        IF(NUL)TRA  AXIS                        271
                        CLA         DONE, U+T4                  272
                -U      STO         XPLOT, R+B3                 273
                B3      SB3         a*BASE, U+R                 274
                B4      IF(NEG)SKP  aB3+B5-1                    275
                        SB4         aB3+B5-1                    276
                R       LDR+50      YPLUS, U+B3                 277
                T4      IF(POS)SKP  !YSUM!                      300
                B3      AND         a67, U+B3                   301
                T4      IF(POS)SKP  !XSUM!                      302
                B3      AND         a57, U+B3                   303
                B3      IF(NUL)TRA  AXIS                        304
BTEST           B1      IF(POS)SKP  a*BASE                      305
                        TRA         LTEST, B1+1                 306
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                FMP         YFAC, U→T4                  310
        IT41    IF(NEG)SKP  DONE                        311
                TRA         LTEST                       312
        T4      FAD+60      SHIFT, U→T4                 313
                CLA         XPLOT, U→R                  314
        B3      IF(EVN)TRA  PRON                        315
        R       67000       T4                          316
PRON    B3      LUR         a3                          317
                IF(ZER)TRA  LTEST                       320
                IF(EVN)TRA  YLINE                       321
        R       67000       YNOR                        322
        B3      LUR         a4                          323
                IF(NUL)TRA  LTEST                       324
YLINE           CLA         XNOR                        325
                67000       T4                          326
LTEST   B1      IF(NEG)SKP  aB4                         327
                TRA         AXIS                        330
        T6      FAD+61      XPLOT                       331
                TRA         BTEST                       332
AXIS    T7      LUL         ad27, U→R                   333
        Z       LLS         ad3, U→B3                   334
                IF(NUL)TRA  GRID, R→T5                  335
                CLA         -DONE, U→T4                 336
                CLA         XNOR, U→T6                  337
        IT41    IF(POS)SKP  |YSUM|                      340
        B3      AND         a6, U→B3                    341
        IT41    IF(POS)SKP  |XSUM|                      342
        B3      AND         a5, U→B3                    343
        T5      IF(NMO)TRA  CC, U→R                     344
        B3      IF(NUL)TRA  GRID-1, CC+1                345
DELTA           OCT         0000400000000000            346
XAXIS   B3      IF(EVN)TRA  YAXIS                       347
        T4      67000       YNOR                        350
YAXIS   B3      IF(NNZ)SKP  a2                          351
        T6      67000       T4                          352
        T4      ADD         DELTA, U→T4                 353
        T5      IF(NMO)TRA  XAXIS, U→R                  354
GRID    Z       LLS         ad3, R→T6                   355
                IF(NUL)TRA  LABEL, R→Z                  356
                CLA         DONE, U→T5                  357
                FDV         DFIV, U→T4                  360
        T5      IF(PNZ)SKP  |XSUM|                      361
                TRA         XSTO                        362
        -T4     FAD         XSUM                        363
        IU1     IF(NEG)SKP  T5                          364
                TRA         SAME                        365
        -T4     FAD→        XSUM                        366
                TRA         CC-5                        367
XSTO    T5      STO         XSUM                        370
SAME    T5      IF(PNZ)SKP  |YSUM|                      371
                TRA         YSTO                        372
        -T4     FAD         YSUM                        373
        IU1     IF(NEG)SKP  T5                          374
                TRA         MABSV                       375
        -T4     FAD→        YSUM                        376
                TRA         CC-5                        377
YSTO    T5      STO         YSUM                        400
MABSV           CLA→        -|YSUM|                     401
                IF(NMO)TRA  CC+5, I→CC                  402
                CLA         -|XSUM|, U→T5               403
        T5      67000       YSUM                        404
        T5      ADD         T4, U→T5                    405
                IF(NMO)TRA  MABSV+3                     406
        T4      ADD→        YSUM, CC+1                  407
        Z       RPR         T4                          410
```

```
LABEL           SB4     a3, I→B1                                412
          T6    LUL     ad3, B1+1                               413
                CRL     ad3, R→B5                               414
          B5    IF(ZER)TRA  LSUBX                               415
                IF(EVN)TRA  HIY                                 416
                SB2     ad24                                    417
                SB3     ad15                                    420
                CLA     NY, U→T7                                421
                TSR     *120, B5=1                              422
          B5    IF(ZER)TRA  LSUBX                               423
HIY       Z     SB3     ad15, U→B2                              424
                CLA     MY, U→T7                                425
                TSR     *120, B2+1                              426
LSUBX     T6    SB2     ad12, U→R                               427
          Z     LLS     ad3, I→B3                               430
                IF(ZER)TRA  EXIT, B3=1                          431
                IF(EVN)TRA  HIX, U→B5                           432
                CLA     NX, U→T7                                433
          IT7I  LRS     ad7, B3-1                               434
                IF(NZE)TRA  CC+5                                435
          IT7I  IF(PNZ)SKP  ad99                                436
          IT7I  IF(PNZ)SKP  ad9, CC+1                           437
                TRA     CC+2                                    440
                SB3     a77771, CC+1                            441
                SB3     a77772                                  442
                TSR     *120, B5=1                              443
          B5    IF(ZER)TRA  EXIT                                444
HIX             SB3     ad28                                    445
                CLA     MX, U→T7                                446
                TSR     *120                                    447
EXIT            ILF     a77777                                  450
                ILN     aZ                                      451
                TRA     *137                                    452
                TRA     PF                                      453
DONE            OCT     7737777777777777777                     454
DTWO            OCT     0100177777777777777                     455
DFIV            DEC     5.0                                     456
TENTH           OCT     7703146314631463146314                  457
SHIFT           OCT     7700000000000000000                     460
SIX             OCT     0620000000000000000                     461
FIXRD           CLA     ad10, U→T5                              462
          T6    IF(NZE)SKP  T5                                  463
                TRA     FIXLM                                   464
                IF(NNZ)TRA  TWFV                                465
          T5    MPY     ad10, R→T5                              466
                TRA     CC-5                                    467
TWFV      T5    LUR     a1, U→R                                 470
                IF(NZE)SKP  T6                                  471
                TRA     FIXLM, R→T5                             472
                IF(NNZ)TRA  FIXLM                               473
          T5    IDV     a5, U→R                                 474
                IF(NNZ)SKP  T6                                  475
                TRA     FIXLM, R→T5                             476
          T5    LUR     a1, U→T5                                477
FIXLM     T5    SUB     T6, U→T6                                500
          B4    IF(NZE)TRA  CC+2                                501
          IT6I  ADD→    MX, U→B4                                502
                TRA     OKAY                                    503
          IT6I  LUR     a1, U→R                                 504
          R     ADD→    MX, U→B4                                505
          -R    ADD→    NX, U→B1                                506
          IT6I  IF(EVN)TRA  OKAY                                507
                CLA     a1                                      510
                ADD→    MX, U→B4                                511
OKAY      T5    TRA     PF, U→T6                                512
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                T6      STO     OLDR                                    514
                T6      IF(NZE)SKP  CC+Z, CC+1                          515
                        OCT     0100100000000000                        516
                        TRA     FIXR                                    517
                        IF(PNZ)TRA  TEN                                 520
                        CLA     TENTH, U+T5                             521
                        STO     TEMP, CC+1                              522
                T5      FMP+    TEMP                                    523
                T6      IF(PNZ)SKP  TEMP                                524
                        TRA     CC-3                                    525
                U       IF(NEG)SKP  TEMP                                526
                        TRA     FIVE                                    527
                -U      FAD+    T6                                      530
                        TRA     FIXR                                    531
FIVE                    CLA     TEMP                                    532
                        FMP     DFIV, U+T5                              533
                T5      IF(POS)SKP  T6                                  534
                T5      FAD+    T5                                      535
                T5      TRA     FIXR, U+T6                              536
TEN                     CLA     DTEN, U+T5                              537
                        STO     TEMP, CC+1                              540
                T5      FMP+    TEMP                                    541
                T6      IF(NEG)SKP  TEMP                                542
                        TRA     CC-3                                    543
                        CLA     TEMP                                    544
                        FDV     DFIV, U+T5                              545
                T5      IF(NNZ)SKP  T6                                  546
                T5      TRA     FIXR, U+T6                              547
                        CLA     TEMP                                    550
                        FDV     ROUND, U+T5                             551
                        IF(POS)SKP  T6                                  552
                        CLA     TEMP, U+T5                              553
                T5      TRA     FIXR, U+T6                              554
DTEN                    DEC     10.0                                    555
FIXR            T6      FSB     OLDR                                    556
                        FDV     ROUND, U+T5                             557
                B5      TRA     PF, IU+PF                               560
                        END                                             561
                                                                        562
                                                                        563
```

220	SCOPE	0	1	0	20000000000000	0
221	TSEV	0	23	0	25000000000000	0
222	EXEX	0	22	0	23000000000000	0
223	SIXFIX	0	20	0	21000000000000	0
224	GRAPH	0	24	0	26000000000000	0
225	EXIT	0	446	0	45100000000000	0
226	BTEST	0	303	0	30500000000000	0
227	BASE	0	232	0	23400000000000	0
230	MAXY	0	54	0	5600000000000	0
231	ABSY	0	50	0	5200000000000	0
232	YSET	0	66	0	7000000000000	0
233	MY	0	557	0	57400000000000	0
234	NY	0	560	0	57500000000000	0
235	ROUND	0	511	0	52300000000000	0
236	DTWO	0	453	0	46000000000000	0
237	YFAC	0	561	0	57600000000000	0
240	YPLUS	0	562	0	57700000000000	0
241	YSUM	0	563	0	60000000000000	0
242	SHIFT	0	456	0	46600000000000	0
243	YNOR	0	564	0	60100000000000	0
244	XVEC	0	111	0	11300000000000	0
245	XMAX	0	133	0	13500000000000	0
246	ABSX	0	127	0	13100000000000	0
247	XSET	0	145	0	14700000000000	0
250	MX	0	565	0	60200000000000	0
251	NX	0	566	0	60300000000000	0
252	XFAC	0	567	0	60400000000000	0
253	XSUM	0	570	0	60500000000000	0
254	XNOR	0	571	0	60600000000000	0
255	DPONE	0	167	0	17100000000000	0
256	AXIS	0	331	0	33300000000000	0
257	DONE	0	452	0	45600000000000	0
260	TEST	0	230	0	23200000000000	0
261	LOOP	0	202	0	20400000000000	0
262	RSTO	0	572	0	60700000000000	0
263	PROJ	0	220	0	22200000000000	0
264	VERT	0	226	0	23000000000000	0
265	FOUR	0	245	0	24700000000000	0
266	FIXRD	0	460	0	47100000000000	0
267	TENTH	0	455	0	46400000000000	0
270	SIX	0	457	0	47000000000000	0
271	DPTWO	0	265	0	26700000000000	0
272	XPLOT	0	573	0	61000000000000	0
273	LTEST	0	325	0	32700000000000	0
274	PRON	0	315	0	31700000000000	0
275	YLINE	0	323	0	32500000000000	0
276	GRID	0	353	0	35600000000000	0
277	DELTA	0	344	0	34700000000000	0
300	XAXIS	0	345	0	35000000000000	0
301	YAXIS	0	347	0	35200000000000	0
302	LABEL	0	410	0	41300000000000	0
303	DFIV	0	454	0	46200000000000	0
304	XSTO	0	366	0	37100000000000	0
305	SAME	0	367	0	37200000000000	0
306	YSTO	0	376	0	40100000000000	0
307	MABSV	0	377	0	40200000000000	0
310	LSURX	0	425	0	43000000000000	0
311	HIY	0	422	0	42500000000000	0
312	HIX	0	443	0	44600000000000	0
313	FIXLM	0	476	0	50700000000000	0
314	TWFV	0	466	0	47700000000000	0
315	OKAY	0	510	0	52100000000000	0
316	OLDR	0	574	0	61100000000000	0
317	FIXR	0	554	0	57000000000000	0

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1320     TEN      0   1535    0        5300000000000000     0
1321     TEMP     0   1575    0        6120000000000000     0
1322     FIVE     0   1530    0        5430000000000000     0
1323     DTEN     0   1553    0        5670000000000000     0
      2   SCOPE        1     72000110400100021          TSEV
      3                2     472164117000100017         EXEX
      4                3       5040057050077776
      5                4     572164147000100013         SIXFIX
      6                5     570106066400100001
      7                6      1504702003000000 0
     10                7      1200406700000000 0
     11               10      1217000003000000 3
     12               11      1450150040000001 7
     13               12      1217000007000000 2
     14               13      1450150040000001 4
     15               14      1217000007000000 1
     16               15      1450150040000001 4
     17               16      7450151740000001 7
     20               17      1400000040010000 4
     21   SIXFIX      20      1410060040000000 0
     22               21      1217000700010000 1        TSEV
     23   EXEX        22      1400077040000000 0
     25   TSEV        23                      0
     26   GRAPH       24     10010000244000013 6
     27               25      1217001000007777 1
     30               26      1216415700010042 0        EXIT
     31               27      7200014240000000 2
     32               30       450624140000001 7
     33               31       450624340000000 3
     34               32       450624440000000 3
     35               33      1504005200040000 0
     36               34     42216410000010025 0        BTEST
     37               35       450620440000001 7
     40               36       450624540000001 7
     41               37     45450104540000000 3
     42               40     45216410000010017 1        BASE
     43               41      4410024540400000 0
     44               42     44010200040010001 1        MAXY
     45               43     44450101040000000 1
     46               44      1010201540010000 3        ABSY
     47               45      1504506705007776 4
     50               46      1504606705007776 3
     51               47      1010000040010001 6        YSET
     52   ABSY        50      5021106520447777 6
     53               51      1217000520440000 0
     54               52     45010500040017777 4
     55               53     15010000640010001 2        YSET
     56   MAXY        54      1504506500447777 6
     57               55      5021106500447777 6
     60               56      1217000500440000 0
     61               57     45010500040017777 4
     62               60     44450101040000000 1
     63               61      1010201640010000 4        YSET
     64               62      5400050644000000 4
     65               63      6025106500447777 6
     66               64      1217000600440000 0
     67               65     45010500040017777 4
     70   YSET        66      5200010040010047 0        MY
     71               67      6200010040010047 0        NY
     72               70      5105011000000000 6
     73               71     44065501540000000 4
     74               72     47400004540010041 7        ROUND
     75               73      5104010000010046 3        MY
     76               74     44020100040000000 4
     77               75     15104012000010046 2        NY
    100               76      5104010000010046 0        MY
```

```
        100    12000100400100460    YFAC
        101    12170000000100455    MY
        102    11040000000100455    NY
        103    11070000000100405    ROUND
        104    12000100400100455    YPLUS
        105   111060000000100453    YFAC
        106    12000102400100454    YSUM
        107    21046002000100346    SHIFT
        110    22000100400100453    YNOR
XVEC    111   410101000400100120    BASE
        112    15040051000200000
        113      450624440000017
        114    10211000440000004
        115   442004004000000000
        116      450624540000017
        117   454501045400000003
        120   444100145404000000
        121   430102000400100011    XMAX
        122   434501010400000001
        123    10102015400100003    ABSX
        124    15045000070077764
        125    15046000070077763
        126    10100000400100016    XSET
ABSX    127    50211064202277776
        130    12170005202200000
        131   440105000400177774
        132   150100006400100012    XSET
XMAX    133    15045064002277776
        134    50211064002277776
        135    12170005002200000
        136   440105000400177774
        137   434501010400000001
        140    10102016400100004    XSET
        141    54000406404000000
        142    60251064002277776
        143    12170006002200000
        144   440105000400177774
XSET    145    52000100400100417    MX
        146    62000100400100417    NX
        147    51050110000000006
        150   430655015400000004
        151   474000045400100340    ROUND
        152    51040100000100412    MX
        153   430201000400000004
        154   151040120000100411    NX
        155    51040100000100407    MX
        156    61670006000100274    DTWO
        157    12000100400100407    XFAC
        160    12170000000100404    MX
        161    11040000000100404    NX
        162    11070006000100326    ROUND
        163   111060000000100403    XFAC
        164    12000102400100403    XSUM
        165    21046002000100270    SHIFT
        166    22000100400100402    XNOR
DPONE   167    74502002400000025
        170      450620040000006
        171    10104043400100137    AXIS
        172    45045045000100367    YPLUS
        173    12170004000100256    DONE
        174    40211000200100366    YSUM
        175   435031443400000067
        176    40211000200100371    XSUM
        177   435031443400000057
        200   430104000400100130    AXIS
```

```
LOOP    202   151040022000400000
        203    11060004000100355   YFAC
        204   161040021000200000
        205    11060002000100361   XFAC
        206    22000165400100363   RSTO
        207   230251000000100242   DONE
        210    10100000400100017   TEST
        211   240251000000100240   DONE
        212    10100000400100015   TEST
        213    41046004000100242   SHIFT
        214    12170002000100355   RSTO
        215    21046002000100240   SHIFT
        216   430102000400100001
        217    26700000000000004
PROJ    220   434501000400000003
        221    10101000400100006   TEST
        222    10102000400100003   VERT
        223    26700000000100340   YNOR
        224   434501000400000004
        225    10104000400100002   TEST
VERT    226    12170000000100342   XNOR
        227    16700000000000004
TEST    230   430105000400177750   LOOP
        231    10100000400100077   AXIS
BASE    232    44000145400000000
        233   614000402404277776
        234   610211000602000000
        235   642004002000000000
        236   435031442400000003
        237    10100000400500000
        240      100041400100004   FOUR
        241   124000441440000002
        242    10100000400100002   FOUR
        243    12170044070077764
        244    12170041070077763
FOUR    245   442000100400100317   MX
        246   412000100400100317   NX
        247   441010006400200000
        250   430655000400000004
        251    14000044400100206   FIXRD
        252    52100004000100202   TENTH
        253    11060006000100203   SIX
        254    51670006000100176   DTWO
        255    12000100400100311   XFAC
        256    42070000402200000
        257    11060000000100177   SIX
        260    11070000000100230   ROUND
        261   111060000000100305   XFAC
        262    12000100400100305   XSUM
        263    11046000000100172   SHIFT
        264    12000100400100304   XNOR
DPTWO   265    74502002400000025
        266     4506202400000006
        267    10104000400100041   AXIS
        270    12170004000100161   DONE
        271   112000153400100301   XPLOT
        272   434000302440177736   BASE
        273   440251000405077776
        274    14000400405077776
        275    25045043000100264   YPLUS
        276    40211000200100264   YSUM
        277   435031443400000067
        300    40211000200100267   XSUM
        301   435031443400000057
        302   430104000400100026   AXIS
```

```
306             304    10100021400100020     LTEST
307             305    151040021000200000
310             306    110600040001 00252    YFAC
311             307    240251000000100142    DONE
312             310    10100000400100014     LTEST
313             311    41046004000100144     SHIFT
314             312    12170002000100260     XPLOT
315             313    430102000400100001    PRON
316             314    2670000000000004
317    PRON     315    434501000400000003
320             316    10101000400100006     LTEST
321             317    10102000400100003     YLINE
322             320    2670000000100243      YNOR
323             321    434501000400000004
324             322    10104000400100002     LTEST
325    YLINE    323    12170000000100245     XNOR
326             324    1670000000000004
327    LTEST    325    410251000402000000
330             326    10100000400100002     AXIS
331             327    610461000000100243    XPLOT
332             330    10100000400177751     BTEST
333    AXIS     331    745020024000000033
334             332    4506243400000003
335             333    10104015400100017     GRID
336             334    12170004100100115     DONE
337             335    12170006000100233     XNOR
340             336    240211000200100224    YSUM
341             337    435031443400000006
342             340    240211000200100227    XSUM
343             341    435031443400000005
344             342    50160002400100000
345             343    430104020400100006    GRID
347    DELTA    344    40000000000000
350    XAXIS    345    430102000400100001    YAXIS
351             346    4670000000100215      YNOR
352    YAXIS    347    430655000400000002
353             350    5670000000000004
354             351    41000004000177771     DELTA
355             352    50160002400177771     XAXIS
356    GRID     353    4506216400000003
357             354    10104010400100033     LABEL
360             355    12170005000100074     DONE
361             356    11070004000100075     DFIV
362             357    30615000200100210     XSUM
363             360    10100000400100005     XSTO
364             361    141040000000100206    XSUM
365             362    210251000000000005
366             363    10100000400100003     SAME
367             364    141040100000100203    XSUM
370             365    10100000400177772
371    XSTO     366    52000100400100201     XSUM
372    SAME     367    50615000200100173     YSUM
373             370    10100000400100005     YSTO
374             371    141040000000100171    YSUM
375             372    210251000000000005
376             373    10100000400100003     MABSV
377             374    141040100000100166    YSUM
400             375    10100000400177772
401    YSTO     376    52000100400100164     YSUM
402    MABSV    377    12170100300100163     YSUM
403             400    10160070400100005
404             401    12170005300100166     XSUM
405             402    5670000000100160      YSUM
406             403    5100000500000004
407             404    10160000400177774     MABSV
```

411		406	21401000000000004	
412		407	10160010400177770	MABSV
413	LABEL	410	14000471400000003	
414		411	64502021400000003	
415		412	14506655400000003	
416		413	45010100040010001 1	LSUBX
417		414	10102000400100005	HIY
420		415	14000200400000030	
421		416	14000300400000017	
422		417	12170007000100140	NY
423		420	14000065440000120	
424		421	45010100040010 0003	LSUBX
425	HIY	422	4000342400000017	
426		423	12170007000100133	MY
427		424	14000022440000120	
430	LSUBX	425	64000202400000014	
431		426	4506273400000003	
432		427	10101063400100016	EXIT
433		430	10102045400100012	HIX
434		431	12170007000100134	NX
435		432	27450156340000007	
436		433	10105000400100005	
437		434	27061500040000143	
440		435	27061502040000011	
441		436	10100000400100002	
442		437	14000320400077771	
443		440	14000300400077772	
444		441	14000065440000120	
445		442	45010100040010 0003	EXIT
446	HIX	443	14000300400000034	
447		444	12170007000100120	MX
450		445	14000000440000120	
451	EXIT	446	14200500400077777	
452		447	14200100400000000	
453		450	10100000440000137	
454		451	10100000420000000	
456	DONE	452	77377777777777777	
460	DTWO	453	10017777777777777	
462	DFIV	454	10050000000000000	
464	TENTH	455	77031463146314631 4	
466	SHIFT	456	77000000000000000	
470	SIX	457	62000000000000000	
471	FIXRD	460	12170005400000012	
472		461	60205000000000005	
473		462	10100000400100013	FIXLM
474		463	10555000400100002	TWFV
475		464	51020015400000012	
476		465	10100000400177772	
477	TWFV	466	54501002400000001	
500		467	10205000000000006	
501		470	10100015400100005	FIXLM
502		471	10555000400100004	FIXLM
503		472	51330002400000005	
504		473	10655000000000006	
505		474	10100015400100001	FIXLM
506		475	54501005400000001	
507	FIXLM	476	51010006000000006	
510		477	44010500040010000 2	
511		500	26100014400010006 4	MX
512		501	10100000400100006	OKAY
513		502	26450100240000000 1	
514		503	21000144000100061	MX
515		504	12100014100010006 1	NX
516		505	26010200040010000 2	OKAY
517		506	12170000400000001	

```
521     OKAY    510     501000064200000000
523     ROUND   511     100200000000000000
524             512     620001004001000061      OLDR
525             513     602050200001000000
527             514     100100000000000000
530             515     101000004001000036      FIXR
531             516     105150004001000016      TEN
532             517     121700050001777734      TENTH
533             520     120001204001000054      TEMP
534             521     510601000001000053      TEMP
535             522     506150000001000052      TEMP
536             523     101000004001777774
537             524     102510000001000050      TEMP
540             525     101000004001000002      FIVE
541             526     111040100000000006
542             527     101000004001000024      FIXR
543     FIVE    530     121700000001000044      TEMP
544             531     110600050001777721      DFIV
545             532     602110000000000006
546             533     510401000000000005
547             534     501000064001000017      FIXR
550     TEN     535     121700050001000015      DTEN
551             536     120001204001000036      TEMP
552             537     510601000001000035      TEMP
553             540     602510000001000034      TEMP
554             541     101000004001777774
555             542     121700000001000032      TEMP
556             543     110700050001777707      DFIV
557             544     506550000000000006
560             545     501000064001000006      FIXR
561             546     121700000001000026      TEMP
562             547     110700050001777740      ROUND
563             550     102110000000000006
564             551     121700050001000023      TEMP
565             552     501000064001000001      FIXR
567     DTEN    553     101200000000000000
570     FIXR    554     610500000001000017      OLDR
571             555     110700050001777732      ROUND
572             556     450100047420000000
574             557                     0
575             560                     0
576             561                     0
577             562                     0
600             563                     0
601             564                     0
602             565                     0
603             566                     0
604             567                     0
605             570                     0
606             571                     0
607             572                     0
610             573                     0
611             574                     0
612             575                     0
```

224 SCOPE STEREO PLOT

STEREO PLOT (*224)

PURPOSE: To plot on the scope stereoscopic projections with persepctive of any function of two variables in matrix form.

INPUT: The matrix must be a standard, rectangular, two dimensional, B1 x B2, Spirel matrix of floating point elements.

OUTPUT: This program plots two separate images from the input function. The first is the surface viewed from the right, and the second is from the left. A HTR occurs after the first plot to allow the camera to be changed.

CALLING SEQUENCE: B1 is set to the codeword address of the matrix. B2 is set to the degree of interpolation refinement which must a power of two, i.e., 2,4,16, etc. The interpolation is done between all quadruplettes of nearest neigh ors in the function matrix. B3 is set to the inclination of the viewing plane, (in degrees). If B3 is zero, then the view is from the front. If B3 is 90, then the view is directly from the top. If sense light #13 is on, a reversal of the plot will take place.

RESTRICTIONS: If B2 is less than two, it will be set to two internally since interpolation is mandatory. Because of the second order interpolation used, (F=ax+by+cxy+d), discontinuities in the first derivatives at the main grid boundaries of the function may occur. It is advised that B2 be sufficiently large as to cause between 50 and 200 points total, after interpolation, to be available to plot in each direction.

WORKING STORAGE: A (B2+1)X(B2+1) matrix is set up to store the interpolated points at each quadruplette. This space is properly deactivated afterwards.

REGISTERS USED: All registers are saved and unsaved by *136 and *137. *126 is also used by the program. The library sine-cosine routine, *230, must be loaded too.

Gary Sitton
September 1964

```
                                                                    1
224             ORG                                                 2
                REM             STEREOSCOPIC PROJECTION             3
                REM             SURFACE PLOT OF *B1,                4
                REM             B2 = DEGREE OF REFINEMENT,          5
                REM             B3 = INCLINATION (DEREES).          6
          Z     BAU+2           X,B6+1                              7
                BAU+2           SL,B6+1                            10
         -Z     TRA             a*136,U+R                          11
         -B3    CPL             aZ                                 12
                FMP             TW047                              13
                FMP             RADCON,U+T6                        14
                TSR             *230                               15
         T6     STO             aSINE                              16
         T7     STO             aCOSINE                            17
                FAD             T6                                 20
                STO             aNORM                              21
         B2     IF(PNZ)SKP      a1,B2+1                            22
                SB2             a3                                 23
         B2     LDR             CODWD1,U+B4                        24
                LRS             ad30                               25
         B2     RPA             R                                  26
                LLS             ad15                               27
         R      BAU             aMATRX,U+T7                        30
                SLN             a2                                 31
                TSR             a*126                              32
         B6     RPA             SAVE                               33
                SB6             aB1                                34
                LDR             B6,R+PF                            35
                LLS             ad15,U+B1                          36
                LDR             PF+1                               37
                LLS             ad15,U+B2                          40
         B1     LT6             B6,U+B5                            41
         B2     LT4             *T6,U+B6                           42
                LT5             *T6,B1-1                           43
SCAN            LT7             *T6,B1-1                           44
         T4     IF(POS)SKP      T7                                 45
                LT4             T7                                 46
         T5     IF(NEG)SKP      T7                                 47
                LT5             T7                                 50
         B1     IF(PNZ)TRA      aSCAN                              51
                SB1             aB5,B2-1                           52
         B2     IF(PNZ)TRA      aSCAN                              53
         T4     FSB             T5                                 54
                STO             aSCALE,B6-1                        55
         -T5    STO             aLOWER                             56
         -I     LDR             aB4-1,U+B3                         57
POWTST          LRR             a1,B3+1                            60
         R      IF(NZE)TRA      aPOWTST                            61
         B6     LUL             aB3,B6+1                           62
                ADD             a2,B5-1                            63
                STO             aXMAX                              64
         B5     LUL             aB3,B5+1                           65
                ADD             a2,I+B1                            66
                STO             aYMAX                              67
                SLN             a1                                 70
                CLA             MATRX,U+PF                         71
         B6     RPA             COLMB                              72
         B5     RPA             ENDTST                             73
```

```
                B1      STX             a77774,U→B5                     74
INTERP          B6      SB1             aB5,U→B2                        75
                        LT4             *T6,B2-1                        76
                T4      FSB             *T6                             77
                        DMR             aB3,U→T7                        100
                        SB1             aB4,I→B2                        101
BOTROW          T4      STO             a*PF+B1,B2-1                    102
                        FSB             T7,U→T4                         103
                B2      IF(PNZ)TRA      aBOTROW                         104
                B6      SB1             aB5-1,U→B2                      105
                        LT4             *T6,B2-1                        106
                T4      FSB             *T6                             107
                        DMR             aB3,U→T7                        110
                I       SB2             aB4,U→B1                        111
TOPROW          T4      STO             a*PF+B1,B2-1                    112
                        FSB             T7,U→T4                         113
                B2      IF(PNZ)TRA      aTOPROW                         114
                B6      SB1             aB5,U→B2                        115
                        LT4             *T6,B1-1                        116
                T4      FSB             *T6                             117
                        DMR             aB3,U→T7                        120
                B4      SB1             aB4-1,U→B2                      121
RITCOL          T4      FSB             T7,U→T4                         122
                        STO             a*PF+B1,B1-1                    123
                B1      IF(PNZ)JMP      a1                              124
                B5      SB2             aB6-1,U→B1                      125
                        LT4             *T6,B1-1                        126
                T4      FSB             *T6                             127
                        DMR             aB3,U→T7                        130
                I       SB1             aB4-1,U→B2                      131
LFTCOL          T4      FSB             T7,U→T4                         132
                        STO             a*PF+B1,B1-1                    133
                B1      IF(PNZ)JMP      a1                              134
                B4      SB1             aB4-1,U→B2                      135
FLLMOR          I       LT4             *PF+B1,U→B2                     136
                T4      FSB             *PF+B1                          137
                        DMR             aB3+1,U→T7                      140
                T4      DMR             a1,U→T4                         141
                        SB2             aB4-1                           142
FILLAT          T4      FSB             T7,U→T4                         143
                        STO             a*PF+B1,B2-1                    144
                B2      IF(PNZ)JMP      a1                              145
                        SB2             aB4,B1-1                        146
                B1      IF(NEG)SKP      a1                              147
                        TRA             aFLLMOR                         150
                B4      SB2             aB4-1,U→B1                      151
FLVMOR          I       LT4             *PF+B1,U→B1                     152
                T4      FSB             *PF+B1                          153
                        DMR             aB3+1,U→T7                      154
                T4      DMR             a1,U→T4                         155
                        SB1             aB4-1                           156
FILVRT          T4      FSB             T7,U→T4                         157
                        FAD→            *PF+B1,B1-1                     160
                B1      IF(PNZ)JMP      a1                              161
                        SB1             aB4,B2-1                        162
                B2      IF(NEG)SKP      a1                              163
                        TRA             aFLVMOR                         164
                        SB2             aB4                             165
                T6      STO             aCODSAV                         166
```

```
                B6      IF(ZER)SKP      a*COLMB                 167
                        AB2             a77776                  170
SRCASE          B5      IF(ZER)SKP      a*ENDTST                171
                        AB1             a77776                  172
PLOT                    CLA             LOWER,B5-1              173
                        FAD             *PF+B1,B5-1             174
                        FDV             SCALE,U→T5              175
                        FMP             COSINE,U→T7             176
                IB51    LUL             aB3,B5+1                177
                        ADD             aB1,B5+1                200
                        12300           YMAX,B1-1               201
                        BEU             d0.5,U→T4               202
                        FMP             SINE                    203
                        FAD             T7,B6-1                 204
                        FDV             NORM,U→T7               205
                T5      FMP             SINE,U→T5               206
                T4      FMP             COSINE,B6-1             207
                        FSB             T5                      210
                        FAD             SINE                    211
                        FDV             NORM,U→T5               212
                IB61    LUL             aB3,B6+1                213
                        ADD             aB2,B6+1                214
                        12300           XMAX                    215
                        SUB             d0.5                    216
                        BEU             S,U→T4                  217
                T5      FSB             S                       220
                        FMP             d0.05                   221
                        IF(SLN)SKP      a1                      222
                -U      FAD             T4,CC+1                 223
                        FAD             T4                      224
                        FDV             d1.05,U→T6              225
                T4      FMP             d0.05                   226
                        FAD             T5                      227
                        FAD             d0.05                   230
                        FDV             d1.05                   231
                        FMP             d0.05,U→T4              232
                        FMP             T7                      233
                        FSB             T7                      234
                        FAD             U                       235
                        FAD             d1.0                    236
                        FAD+40          EXP77,U→T7              237
                T4      FMP             T6                      240
                        FSB             T6                      241
                        FAD             U                       242
                        FAD+40          EXP77,U→T4              243
                        IF(SLF)SKP      a4                      244
                -T7     PLT             T4,CC+1                 245
                T7      PLT             T4                      246
                B1      IF(PNZ)TRA      aPLOT                   247
                        SB1             aB4,B2-1                250
                B2      IF(PNZ)TRA      aSPCASE                 251
                        LT6             CODSAV                  252
                B6      IF(NEG)SKP      a2,B6-1                 253
                        TRA             aINTERP                 254
COLMB                   SB6             a(Z),B5+1               255
ENDTST          B5      IF(PNZ)SKP      a(Z)                    256
                        TRA             aINTERP                 257
                        IF(SLN)SKP      a1                      260
                        TRA             aSAVE                   261
```

```
                    SLF         a1,I→B5                          262
                    SB6         a*COLMB,B5+1                     263
              Z     HTR         aINTERP                          264
SAVE                SB6         a(Z)                             265
              Z     BLU         100                              266
                    IF(NUL)TRA  aNOSTEX                          267
                    CLA         DEACT                            270
                    BAU         aMATRX,U→T7                      271
                    TSR         a*126                            272
                    TRA         aLEAVE                           273
NOSTEX        B4    IMP         U                                274
                    ADD         aB4                              275
              -U    ADD→        100                              276
LEAVE               TRA         a*137                            277
                    SLF         a2,B6-1                          300
                    SLN         a*B6,B6-1                        301
              PF    STX         a*B6,U→CC                        302
CODWD1              OCT         0420000000000000                 303
TWO47               OCT         0620000000000000                 304
EXP77               OCT         7700000000000000                 305
DEACT               OCT         0000011700000000                 306
RADCON              DEC         0.0174533                        307
SINE                OCT         Z                                310
COSINE              OCT         Z                                311
NORM                OCT         Z                                312
SCALE               OCT         Z                                313
LOWER               OCT         Z                                314
CODSAV              OCT         Z                                315
XMAX                OCT         Z                                316
YMAX                OCT         Z                                317
MATRX               OCT         Z                                320
                    END                                          321
                                                                 322
```

301	TW047	0	276	0	3210000000000000	0
302	RADCON	0	301	0	3270000000000000	0
303	SINE	0	302	0	3310000000000000	0
304	COSINE	0	303	0	3330000000000000	0
305	NORM	0	304	0	3350000000000000	0
306	CODWD1	0	275	0	3170000000000000	0
307	MATRX	0	312	0	3510000000000000	0
310	SAVE	0	257	0	3000000000000000	0
311	SCAN	0	36	0	570000000000000	0
312	SCALE	0	305	0	3370000000000000	0
313	LOWER	0	306	0	3410000000000000	0
314	POWTST	0	52	0	730000000000000	0
315	XMAX	0	310	0	3450000000000000	0
316	YMAX	0	311	0	3470000000000000	0
317	COLMB	0	247	0	2700000000000000	0
320	ENDTST	0	250	0	2710000000000000	0
321	INTERP	0	67	0	1100000000000000	0
322	BOTROW	0	74	0	1150000000000000	0
323	TOPROW	0	104	0	1250000000000000	0
324	RITCOL	0	114	0	1350000000000000	0
325	LFTCOL	0	124	0	1450000000000000	0
326	FLLMOR	0	130	0	1510000000000000	0
327	FILLAT	0	135	0	1560000000000000	0
330	FLVMOR	0	144	0	1650000000000000	0
331	FILVRT	0	151	0	1720000000000000	0
332	CODSAV	0	307	0	3430000000000000	0
333	SPCASE	0	163	0	2040000000000000	0
334	PLOT	0	165	0	2060000000000000	0
335	0	0	313	0	3530000000000000	0
336	0	0	314	0	3540000000000000	0
337	0	0	315	0	3550000000000000	0
340	0	0	316	0	3560000000000000	0
341	EXP77	0	277	0	3230000000000000	0
342	NOSTEX	0	266	0	3070000000000000	0
343	DEACT	0	300	0	3250000000000000	0
344	LEAVE	0	271	0	3120000000000000	0

```
STEREOSCOPIC PROJECTION
SURFACE PLOT OF *B1,
B2 = DEGREE OF REFINEMENT,
B3 = INCLINATION (DEREES).
   22              1     00 20102 26 0000 77775
   23              2     01 20102 26 0000 77770
   24              3     10 01000 02 4400 00136
   25              4     53 50100 00 4000 00000
   26              5     01 10600 00 0001 00270     TW047
   27              6     01 10600 06 0001 00272     RADCON
   30              7     01 40000 00 4400 00330
   31             10     06 20001 00 4001 00271     SINE
   32             11     07 20001 00 4001 00271     COSINE
   33             12     01 10400 00 0000 00006
   34             13     01 20001 00 4001 00270     NORM
   35             14     42 06150 22 4000 00001
   36             15     01 40002 00 4000 00003
   37             16     42 50400 44 0001 00256     CODWD1
   40             17     01 45013 00 4000 00036
   41             20     42 21601 00 0000 00002
   42             21     01 45062 00 4000 00017
   43             22     02 20100 07 4001 00267     MATRX
   44             23     01 42000 00 4000 00002
   45             24     01 40000 00 4400 00126
   46             25     46 21601 00 0001 00231     SAVE
   47             26     01 40006 00 4002 00000
   50             27     01 50400 57 0100 00000
```

```
52              31      01 50400 00 0200 00001
53              32      01 45063 42 4000 00017
54              33      41 50460 45 0100 00000
55              34      42 50440 46 0400 00006
56              35      01 50450 61 0400 00006
57      SCAN    36      01 50470 61 0400 00006
60              37      04 02110 00 0000 00007
61              40      01 50440 00 0000 00007
62              41      05 02510 00 0000 00007
63              42      01 50450 00 0000 00007
64              43      41 05150 00 4001 77771  SCAN
65              44      01 40001 62 4040 00000
66              45      42 05150 00 4001 77767  SCAN
67              46      04 10500 00 0000 00005
70              47      01 20001 66 4001 00235  SCALE
71              50      15 20001 00 4001 00235  LOWER
72              51      30 50400 43 4020 77776
73      POWTST  52      01 45001 23 4000 00001
74              53      02 01050 00 4001 77775  POWTST
75              54      46 45020 26 4010 00000
76              55      01 10000 65 4000 00002
77              56      01 20001 00 4001 00231  XMAX
100             57      45 45020 25 4010 00000
101             60      01 10000 71 4000 00002
102             61      01 20001 00 4001 00227  YMAX
103             62      01 42000 00 4000 00001
104             63      01 21700 47 0001 00226  MATRX
105             64      46 21601 00 0001 00162  COLMB
106             65      45 21601 00 0001 00162  ENDTST
107             66      41 43005 45 4000 77774
110     INTERP  67      46 40001 42 4040 00000
111             70      01 50440 62 0400 00006
112             71      04 10500 00 0400 00006
113             72      01 44000 07 4010 00000
114             73      01 40001 72 4020 00000
115     BOTROW  74      04 20001 62 4602 00000
116             75      01 10500 04 0000 00007
117             76      42 05150 00 4001 77774  BOTROW
120             77      46 40001 42 4040 77776
121             100     01 50440 62 0400 00006
122             101     04 10500 00 0400 00006
123             102     01 44000 07 4010 00000
124             103     20 40002 41 4020 00000
125     TOPROW  104     04 20001 62 4602 00000
126             105     01 10500 04 0000 00007
127             106     42 05150 00 4001 77774  TOPROW
130             107     46 40001 42 4040 00000
131             110     01 50440 61 0400 00006
132             111     04 10500 00 0400 00006
133             112     01 44000 07 4010 00000
134             113     44 40001 42 4020 77776
135     RITCOL  114     04 10500 04 0000 00007
136             115     01 20001 61 4602 00000
137             116     41 07150 00 4000 00001
140             117     45 40002 41 4100 77776
141             120     01 50440 61 0400 00006
142             121     04 10500 00 0400 00006
143             122     01 44000 07 4010 00000
144             123     20 40001 42 4020 77776
145     LFTCOL  124     04 10500 04 0000 00007
146             125     01 20001 61 4602 00000
147             126     41 07150 00 4000 00001
150             127     44 40001 42 4020 77776
151     FLLMCR  130     20 50440 42 0602 00000
152             131     04 10500 00 0602 00000
```

```
154                133  04 44000 04 4000 00001
155                134  01 40002 00 4020 77776
156   FILLAT       135  04 10500 04 0000 00007
157                136  01 20001 62 4602 00000
160                137  42 07150 00 4000 00001
161                140  01 40002 61 4020 00000
162                141  41 02510 00 4000 00001
163                142  01 01000 00 4001 77764      FLLMOR
164                143  44 40002 41 4020 77776
165   FLVMOR       144  20 50440 41 0602 00000
166                145  04 10500 00 0602 00000
167                146  01 44000 07 4010 00001
170                147  04 44000 04 4000 00001
171                150  01 40001 00 4020 77776
172   FILVRT       151  04 10500 04 0000 00007
173                152  01 10401 61 0602 00000
174                153  41 07150 00 4000 00001
175                154  01 40001 62 4020 00000
176                155  42 02510 00 4000 00001
177                156  01 01000 00 4001 77764      FLVMOR
200                157  01 40002 00 4020 00000
201                160  06 20001 00 4001 00126      CODSAV
202                161  46 02010 00 4401 00065      COLMB
203                162  01 41002 00 4000 77776
204   SPCASE       163  45 02010 00 4401 00064      ENDTST
205                164  01 41001 00 4000 77776
206   PLOT         165  01 21700 65 0001 00120      LOWER
207                166  01 10400 65 0602 00000
210                167  01 10700 05 0001 00115      SCALE
211                170  01 10600 07 0001 00112      COSINE
212                171  65 45020 25 4010 00000
213                172  01 10000 25 4002 00000
214                173  01 12300 61 0001 00115      YMAX
215                174  01 21000 04 0001 00116           0
216                175  01 10600 00 0001 00104      SINE
217                176  01 10400 66 0000 00007
220                177  01 10700 07 0001 00104      NORM
221                200  05 10600 05 0001 00101      SINE
222                201  04 10600 66 0001 00101      COSINE
223                202  01 10500 00 0000 00005
224                203  01 10400 00 0001 00076      SINE
225                204  01 10700 05 0001 00077      NORM
226                205  66 45020 26 4010 00000
227                206  01 10000 26 4004 00000
230                207  01 12300 00 0001 00100      XMAX
231                210  01 10100 00 0001 00102           0
232                211  01 21000 04 0000 00003
233                212  05 10500 00 0000 00003
234                213  01 10600 00 0001 00100           0
235                214  01 02030 00 4000 00001
236                215  11 10400 20 0000 00004
237                216  01 10400 00 0000 00004
240                217  01 10700 06 0001 00075           0
241                220  04 10600 00 0001 00073           0
242                221  01 10400 00 0000 00005
243                222  01 10400 00 0001 00071           0
244                223  01 10700 00 0001 00071           0
245                224  01 10600 04 0001 00067           0
246                225  01 10600 00 0000 00007
247                226  01 10500 00 0000 00007
250                227  01 10400 00 0000 00001
251                230  01 10400 00 0001 00065           0
252                231  01 10440 07 0001 00045      EXP77
253                232  04 10600 00 0000 00006
254                233  01 10500 00 0000 00006
```

```
:256                    :235    01 10440 04 0001 00041    EXP77
:257                    :236    01 02070 00 4000 00004
:260                    :237    17 67000 20 0000 00004
:261                    :240    07 67000 00 0000 00004
:262                    :241    41 05150 00 4001 77722    PLOT
:263                    :242    01 40001 62 4020 00000
:264                    :243    42 05150 00 4001 77716    SPCASE
:265                    :244    01 50460 00 0001 00042    CODSAV
:266                    :245    46 02510 66 4000 00002
:267                    :246    01 01000 00 4001 77617    INTERP
:270    COLMB           :247    01 40006 25 4000 00000
:271    ENDTST          :250    45 06150 00 4000 00000
:272                    :251    01 01000 00 4001 77614    INTERP
:273                    :252    01 02030 00 4000 00001
:274                    :253    01 01000 00 4001 00003    SAVE
:275                    :254    01 42004 75 4000 00001
:276                    :255    01 40006 25 4401 77770    COLMB
:277                    :256    00 00000 00 4001 77607    INTERP
:300    SAVE            :257    01 40006 00 4000 00000
:301                    :260    00 21400 00 0000 00100
:302                    :261    01 01040 00 4001 00004    NOSTEX
:303                    :262    01 21700 00 0001 00015    DEACT
:304                    :263    01 20100 07 4001 00026    MATRX
:305                    :264    01 40000 00 4400 00126
:306                    :265    01 01000 00 4001 00003    LEAVE
:307    NOSTEX          :266    44 10220 00 0000 00001
:310                    :267    01 10000 00 4020 00000
:311                    :270    11 10001 00 0000 00100
:312    LEAVE           :271    01 01000 00 4400 00137
:313                    :272    01 42004 66 4000 00002
:314                    :273    01 42000 66 4500 00000
:315                    :274    47 43006 40 4500 00000
:317    CODWD1          :275    04 20000 00 0000 00000
:321    TWO47           :276    06 20000 00 0000 00000
:323    EXP77           :277    77 00000 00 0000 00000
:325    DEACT           :300    00 00011 70 0000 00000
:327    RADCON          :301    77 00436 75 0710 55210
:331    SINE            :302    00 00000 00 0000 00000
:333    COSINE          :303    00 00000 00 0000 00000
:335    NORM            :304    00 00000 00 0000 00000
:337    SCALE           :305    00 00000 00 0000 00000
:341    LOWER           :306    00 00000 00 0000 00000
:343    CODSAV          :307    00 00000 00 0000 00000
:345    XMAX            :310    00 00000 00 0000 00000
:347    YMAX            :311    00 00000 00 0000 00000
:351    MATRX           :312    00 00000 00 0000 00000
:353                    :313    77 20000 00 0000 00000
:354                    :314    77 01463 14 6314 63146
:355                    :315    01 00103 14 6314 63146
:356                    :316    01 00100 00 0000 00000
```

225 / 226 SCOPE & PRINTER CONTOUR PLOT

CONTOUR PLOTTERS *225 and *226

PURPOSE: Given a matrix of values of some function of two variables calculated at equal intervals of both variables, to plot level curves of this function on the printer (*226), or on the scope (*225). The position of an element thus implies the relative values of the two variables at that point.

INPUT: The matrix must be a standard, rectangular, two-dimensional, B1 x B2, Spire1 matrix of floating point elements.

OUTPUT: The contours plotted on the scope are not identified as to which level each point belongs. On the printer, each level has an assigned upper-case letter as a plotting symbol. If 10 levels are specified, the lowest contour would be plotted with "A"'s and the highest and last with "J"'s. The lower and upper limit as well as the level spacing are printed out by both programs.

CALLING SEQUENCE: B1 is set to the codeword address of the matrix. B2 is set to the degree of interpolation refinement which must be an ~~positive even one~~ INTEGER, i.e., 2,4,16,21etc. B3 is set to the number of contour levels. These levels start at the minimum of the function and end at its maximum. The level spacing is Range/B3-1. B4 is set to the percent plotting criterion based on this spacing. If a point on the interpolation grid is within this tolerance, it is plotted. The interpolation is done between all quadruplets of nearest neighbors in the function matrix. If a reversal of the scope plot is desired, Sense Light #12 should be on. (B6 list input option.)

RESTRICTIONS: If B2 is less than 2, it will be set to 2 internally since interpolation is mandatory. Because of the second order interpolation used, (F=ax+by+cxy+d), discontinuities in the first derivatives at the main grid boundaries of the function matrix may occur. It is advised that B2 be sufficiently large as to cause between 100 and 200 points total, after interpolation, to be available to plot in each direction. The printer plotter has a 100 x 100 resolution where the scope has 256 x 256. The boundary of plots yeilded by both programs are square.

WORKING STORAGE: Both programs set up a (B2+1) x (B2+1) matrix to store the interpolated points at each quadruplet. *226, the printer version, sets up an additional matrix for printer hexad storage. Its size is $\left(\frac{100}{\#ROWS-1}\right)$ + 1 x 12.

All storage space is deactivated whether stex is activated or not.

REGISTERS USED: All registers are saved and unsaved by *136 and *137. *126 and *127 are also used by both programs.

LENGTH: *226 - 406 Octal, *225 - 306 Octal.

Gary Sitton
August 1964

```
                                                                    1
226             ORG                                                 2
                REM     LABEL EACH CONTOUR LEVEL                    3
                REM     CONTOUR PLOT MATRIX *B1,                    4
                REM     B2 = DEGREE OF REFINEMENT,                  5
                REM     B3 = NUMBER OF PLANES,                      6
                REM     B4 = PERCENT TOLERANCE.                     7
                IF(SLN)SKP      a10                                 10
                TRA             aNOMNMX                             11
                CLA             B6-1,B6-1                           12
                STO             aMINLIM                             13
                CLA             B6-1,B6-1                           14
                STO             aMAXLIM                             15
NOMNMX      Z   BAU+2           X,36+1                              16
                BAU+2           SL,B6+1                             17
                SLF             a4                                  20
            -Z  TRA             a*136,U+R                           21
                LDR             B1,R+T6                             22
            T6  LUR             a+39,R+PF                           23
                LDR             PF+1,U+B5                           24
            7   LLS             a+15,U+T5                           25
            B5  LDR             aB5-1,U+B1                          26
            R   VDI             a+100,U+PF                          27
                LDR             CODWD2,PF+1                         30
                SLN             a2,PF+1                             31
            PF  RPA             LENGTH                              32
                LRS             a+15                                33
            R   BAU             aHXDMAT,U+T7                        34
                TSR             a*126                               35
            P4  IF(NZE)TRA      aNOCOMP                             36
            T5  IF(POS)SKP      a35,I+PF                            37
                SPF             a*T5                                40
                CLA             aPF-1                               41
                VDI             a+100,U+PF                          42
                SB2             aPF+1                               43
                SB4             aB3+1                               44
NOCOMP          53100           aB4-144                             45
                FMP             TWO47                               46
                FDV             a200.0                              47
                STO             aTEST                               50
            B2  IF(PNZ)SKP      a1,B2+1                             51
                SB2             a3                                  52
                53100           -aB2-1                              53
                FMP             TWO47                               54
                VDF             a1.0                                55
                STO             aINFAC                              56
            B2  LDR             CODWD1,U+B4                         57
                LRS             a+30                                60
            P2  RPA             R                                   61
                LLS             a+15                                62
            R   BAU             aMATRX,U+T7                         63
            T5  TSR             a*126,U+B2                          64
            P6  RPA             SAVE                                65
            P2  IF(SLF)SKP      a10,U+B6                            66
                TRA             aNOSCAN                             67
                LT4             *T6                                 70
                LT5             *T6,B1-1                            71
SCAN            LT7             *T6,B1-1                            72
            T4  IF(POS)SKP      T7                                  73
```

```
                 LT4            T7
         T5      IF(NEG)SKP     T7
                 LT5            T7
         B1      IF(PNZ)TRA     @SCAN
                 SB1            @B5,B2-1
         B2      IF(PNZ)TRA     @SCAN
         T4      STO            @MAXLIM,CC+1
NOSCAN           LT5            MINLIM
                 LT4            MAXLIM
         T4      FSB            T5,U→T7
                 53100          -@B3-1
                 FMP            TWO47
                 FAD            U,I→B1
                 VDF            T7,B1+1
                 STO            @DELTAF,B6-1
         B6      IMP            @B4-1,B6+1
                 STO            @XMAX,B5-1
         B5      IMP            @B4-1,B5+1
                 STO            @YMAX
                 CLA            MATRX,U→PF
         Z       RPA            LAST
         B6      RPA            COLMB
         B5      RPA            ENDTST
         B1      STX            @77774,U→B5
                 SB6            @*SAVE
         -Z      TRA            @*136,U→R
                 PAG            @3,I→B5
                 SPA            @WORD,I→B2
         I       LT7            B2,U→B1
                 TSR            @*127,U→B3
                 LT7            B2+1
                 TSR            @*127
         B5      SB3            @20,U→B1
         T5      TSR            @*127,U→T7
         I       LT7            B2+2,U→B1
                 TSR            @*127
                 LT7            B2+3
                 TSR            @*127
         T4      AB3            @X,U→T7
         B5      TSR            @*127,U→B1
         I       LT7            B2+4,U→B1
                 TSR            @*127
                 LT7            B2+5
                 TSR            @*127
                 CLA            DELTAF
                 FAD            U,U→T7
         B5      TSR            @*127,U→B1
                 TSR            @*127,B1-1
                 TRA            @*137
                 SPA            @*COLMB,I→B6
                 MLN            @2000
INTERP   B6      SB1            @B5,U→B2
                 LT4            *T6,B1-1
         T4      FSB            *T6
                 FMP            INFAC,U→T7
                 SB1            @B4,I→B2
RITCOL   T4      STO            @*PF+B1,B1-1
                 FSB            T7,U→T4
         B1      IF(PNZ)TRA     @RITCOL
```

```
                P5      SB2         aB6=1,U→B1                  167
                        LT4         *T6,B1-1                    170
                T4      FSB         *T6                         171
                        FMP         INFAC,U→T7                  172
                I       SB1         aB4,U→B2                    173
LFTCOL          T4      STO         a*PF+B1,B1-1                174
                        FSB         T7,U→T4                     175
                P1      IF(PNZ)TRA  aLFTCOL                     176
                        SB1         aB4,I→B2                    177
FILLAT          I       LT4         *PF+B1,U→B2                 200
                T4      FSB         *PF+B1                      201
                        FMP         INFAC,U→T7                  202
                        SB2         aB4=1                       203
                T4      FSB         T7,U→T4                     204
                        STO         a*PF+B1,B2-1                205
                B2      IF(PNZ)JMP  a1                          206
                B1      IF(NEG)SKP  a1,B1-1                     207
                P4      TRA         aFILLAT,U→B2                210
                B6      IF(ZER)SKP  a*COLMB                     211
                        TRA         aNOSTO                      212
                I       LT4         SPACES,U→B1                 213
                I       SB3,ERM     a12,U→B2                    214
                T4      STO         a*HXDMAT,B3-1               215
LENGTH          P1      IF(NNZ)JMP  a(Z),B1+1                   216
                        SB2         aB4,CC+1                    217
NOSTO                   SB2         aB4=1                       220
                B4      LT4         MAXLIM,U→B1                 221
ENDTST          B5      IF(NZE)SKP  a(Z)                        222
                        SLN         a4                          223
CONTUR          T4      IF(POS)SKP  *PF+B1                      224
                        TRA         aNOPLOT,B1-1                225
                T5      IF(NEG)SKP  *PF+B1                      226
                        TRA         aNOPLOT,B1-1                227
                -U      FDV         DELTAF,U→T7                 230
                        FAD+60      EXP06                       231
                R       BEU         a0.5                        232
                        FSB         S                           233
                |U|     IF(POS)SKP   TEST                       234
                        TRA         aNOPLOT,B1-1                235
                T7      FAD         a0.5,B6-1                   236
                        FAD+40      EXP06,U→T7                  237
                B2      RPA         BTWO,B6-1                   240
                P1      RPA         BWUN,U→B3                   241
                |B6|    IMP         aB4=1,B6+1                  242
                        ADD         aB2=1,B6+1                  243
                        IMP         a499,B5-1                   244
                        IDV         XMAX,B5-1                   245
                        ADD         a2                          246
                        IDV         a499,U→B2                   247
                R       IMP         a6,U→B1                     250
                |B5|    IMP         aB4=1,B5+1                  251
                        ADD         aB3=1,B5+1                  252
                        IMP         a499,B2+1                   253
                        IDV         YMAX                        254
LAST                    SUB         a(Z),U→B3                   255
                -T7     BUS         a40,R→Z                     256
                        LRS         aB1+6,R→T7                  257
                -Z      STO         aR,B3+1                     260
                        CRR         aB1,U→R                     261
```

```
                T7      SB1     a3                              262
                        XTR+    *HXDMAT                         263
BTWO                    SB2     a(Z)                            264
BWUN                    SB1     a(Z),B1-1                       265
NOPLOT          B1      IF(PNZ)TRA aCONTUR                      266
                        SB1     a34,B2-1                        267
                B2      IF(PNZ)TRA aENDTST                      270
                B6      IF(NEG)SKP a2,B6-1                      271
                        TRA     aINTERP                         272
                        CLA     a35=2                           273
                IU1     IMP     a34=1                           274
                        ADD     a34=1                           275
                        IMP     a#99                            276
                        IDV     YMAX,U+B2                       277
                        SUB     a*LAST,U+B1                     300
                B2      RPA     LAST                            301
                        SB6     a*SAVE                          302
                        IF(SLF)SKP a4                           303
                        SB1     a*LENGTH                        304
                B1      LDR     PRINT                           305
                        LRS     a#15                            306
                R       BAU     aHXDMAT,U+T7                    307
                PF      TSR     a*126,U+B2                      310
COLMB                   SB6     a(Z),B5+1                       311
                        IF(SLN)SKP a4                           312
                B2      TRA     aINTERP,U+PF                    313
SAVE                    SB6     a(Z)                            314
                        MLF     a2000                           315
                Z       BLU     100                             316
                        IF(NUL)TRA aNOSTEX                      317
                        CLA     DEACT,U+T5                      320
                        BAU     aMATRX,U+T7                     321
                        TSR     a*126                           322
                T5      BAU     aHXDMAT,U+T7                    323
                        TSR     a*126                           324
                        TRA     aLEAVE                          325
NOSTEX          B4      IMP     U                               326
                        ADD     a34,U+B4                        327
                        SB3     a*LENGTH                        330
                B3      IMP     a#12                            331
                        ADD     a33+B4                          332
                -U      ADD+    100                             333
LEAVE                   TRA     a*137                           334
                        SLF     a6,B6-1                         335
                        SLN     a*36,B6-1                       336
                PF      STX     a*36,U+CC                       337
CODWD1                  OCT     042000000000000000              340
CODWD2                  OCT     042000140000000000              341
PRINT                   OCT     441000140000000000              342
SPACES                  OCT     252525252525252525              343
TWO47                   OCT     062000000000000000              344
EXP06                   OCT     060000000000000000              345
DEACT                   OCT     000001170000000000              346
WORD                    BCD      LOWER LIMIT =                  347
                        BCD     , UPPER LIMIT =                 350
                        BCD     , LEVEL SPACING =               351
MAXLIM                  OCT     Z                               352
MINLIM                  OCT     Z                               353
INFAC                   OCT     Z                               354
```

```
DELTAF      OCT     Z                   355
XMAX        OCT     Z                   356
YMAX        OCT     Z                   357
TEST        OCT     Z                   360
MATRX       OCT     Z                   361
HXDMAT      OCT     Z                   362
            END                         363
                                        364
```

```
                    1  01 02030 00 4000 00010
                    2  01 01000 00 4001 00004      NOMNMX
                    3  01 21700 55 0100 77776
                    4  01 20001 00 4001 00342      MINLIM
                    5  01 21700 66 0100 77776
                    6  01 20001 00 4001 00337      MAXLIM
NOMNMX              7  00 20102 26 0000 77775
                   10  01 20102 26 0000 77770
                   11  01 42004 00 4000 00004
                   12  10 01000 02 4400 00136
                   13  01 50400 16 0002 00000
                   14  06 45010 57 4000 00047
                   15  01 50400 45 0200 00001
                   16  00 45062 05 4000 00017
                   17  45 50400 41 4040 77776
                   20  02 17300 47 4000 00144
                   21  01 50400 27 0001 00310      CODWD2
                   22  01 42000 27 4000 00002
                   23  47 21601 00 0001 00163      LENGTH
                   24  01 45015 00 4000 00017
                   25  02 20100 07 4001 00330      HXDMAT
                   26  01 40000 00 4400 00126
                   27  44 01050 00 4001 00006      NOCOMP
                   30  05 02110 77 4040 00000
                   31  01 40007 00 4400 00005
                   32  01 21700 00 4200 77776
                   33  01 17300 47 4000 00144
                   34  01 40002 00 4200 00001
                   35  01 40004 00 4010 00001
NOCOMP             36  01 53100 00 4020 77633
                   37  01 10600 00 0001 00275      TWO47
                   40  01 10700 00 0001 00316      +0000A
                   41  01 20001 00 4001 00312      TEST
                   42  42 06150 22 4000 00001
                   43  01 40002 00 4000 00003
                   44  01 53100 00 5004 77776
                   45  01 10600 00 0001 00267      TWO47
                   46  01 16700 00 0001 00311      +0000B
                   47  01 20001 00 4001 00300      INFAC
                   50  42 50400 44 0001 00260      CODWD1
                   51  01 45015 00 4000 00036
                   52  42 21601 00 0000 00002
                   53  01 45062 00 4000 00017
                   54  02 20100 07 4001 00300      MATRX
                   55  05 40000 42 4400 00126
                   56  46 21601 00 0001 00226      SAVE
                   57  42 02070 46 4000 00010
                   60  01 01000 00 4001 00013      NOSCAN
                   61  01 50440 00 0400 00006
                   62  01 50450 61 0400 00006
SCAN               63  01 50470 61 0400 00006
                   64  04 02110 00 0000 00007
                   65  01 50440 00 0000 00007
                   66  05 02510 00 0000 00007
                   67  01 50450 00 0000 00007
                   70  41 05150 00 4001 77771      SCAN
                   71  01 40001 62 4040 00000
                   72  42 05150 00 4001 77767      SCAN
                   73  04 20001 20 4001 00252      MAXLIM
NOSCAN             74  01 50450 00 0001 00252      MINLIM
                   75  01 50440 00 0001 00250      MAXLIM
                   76  04 10500 07 0000 00005
                   77  01 53100 00 5010 77776
                  100  01 10600 00 0001 00234      TWO47
```

```
                102   01 16700 21 0000 00007
                103   01 20001 66 4001 00245      DELTAF
                104   46 10220 26 4020 77776
                105   01 20001 65 4001 00244      XMAX
                106   45 10220 25 4020 77776
                107   01 20001 00 4001 00243      YMAX
                110   01 21700 47 0001 00244      MATRX
                111   00 21601 00 0001 00134      LAST
                112   46 21601 00 0001 00167      COLMB
                113   45 21601 00 0001 00077      ENDTST
                114   41 43005 45 4000 77774
                115   01 40006 00 4401 00167      SAVE
                116   10 01000 02 4400 00136
                117   01 61070 75 4000 00003
                120   01 61010 72 4001 00217      WORD
                121   20 50470 41 0004 00000
                122   01 40000 43 4400 00127
                123   01 50470 00 0004 00001
                124   01 40000 00 4400 00127
                125   45 40003 41 4000 00020
                126   05 40000 07 4400 00127
                127   20 50470 41 0004 00002
                130   01 40000 00 4400 00127
                131   01 50470 00 0004 00003
                132   01 40000 00 4400 00127
                133   04 41003 07 4000 77775
                134   45 40000 41 4400 00127
                135   20 50470 41 0004 00004
                136   01 40000 00 4400 00127
                137   01 50470 00 0004 00005
                140   01 40000 00 4400 00127
                141   01 21700 00 0001 00207      DELTAF
                142   01 10400 07 0000 00001
                143   45 40000 41 4400 00127
                144   01 40000 61 4400 00127
                145   01 01000 00 4400 00137
                146   01 61010 76 4401 00133      COLMB
                147   01 42002 00 4000 02000
INTERP          150   46 40001 42 4040 00000
                151   01 50440 61 0400 00006
                152   04 10500 00 0400 00006
                153   01 10600 07 0001 00174      INFAC
                154   01 40001 72 4020 00000
RITCOL          155   04 20001 61 4602 00000
                156   01 10500 04 0000 00007
                157   41 05150 00 4001 77774      RITCOL
                160   45 40002 41 4100 77776
                161   01 50440 61 0400 00006
                162   04 10500 00 0400 00006
                163   01 10600 07 0001 00164      INFAC
                164   20 40001 42 4020 00000
LFTCOL          165   04 20001 61 4602 00000
                166   01 10500 04 0000 00007
                167   41 05150 00 4001 77774      LFTCOL
                170   01 40001 72 4020 00000
FILLAT          171   20 50440 42 0602 00000
                172   04 10500 00 0602 00000
                173   01 10600 07 0001 00154      INFAC
                174   01 40002 00 4020 77776
                175   04 10500 04 0000 00007
                176   01 20001 62 4602 00000
                177   42 07150 00 4000 00001
                200   41 02510 61 4000 00001
                201   44 01000 42 4001 77766      FILLAT
                202   46 02010 00 4401 00077      COLMB
```

```
                204   20 50440 41 0001 00127      SPACES
                205   20 40023 42 4000 00014
                206   04 20001 63 4401 00147      HXDMAT
LENGTH          207   41 07550 21 4000 00000
                210   01 40002 20 4020 00000
NOSTO           211   01 40002 00 4020 77776
                212   44 50440 41 0001 00133      MAXLIM
ENDTST          213   45 02050 00 4000 00000
                214   01 42000 00 4000 00004
CONTUR          215   04 02110 00 0602 00000
                216   01 01000 61 4001 00040      NOPLOT
                217   05 02510 00 0602 00000
                220   01 01000 61 4001 00036      NOPLOT
                221   11 10700 07 0001 00127      DELTAF
                222   01 10460 00 0001 00113      EXP06
                223   02 21000 00 0001 00135      +0000C
                224   01 10500 00 0000 00003
                225   21 02110 00 0001 00126      TEST
                226   01 01000 61 4001 00030      NOPLOT
                227   07 10400 66 0001 00131      +0000C
                230   01 10440 07 0001 00105      EXP06
                231   42 21601 66 0001 00023      BTWO
                232   41 21601 43 0001 00023      BWUN
                233   66 10220 26 4020 77776
                234   01 10000 26 4004 77776
                235   01 10250 65 4000 00143
                236   01 13300 65 0001 00113      XMAX
                237   01 10000 00 4000 00002
                240   01 13300 42 4000 00011
                241   02 10220 41 4000 00006
                242   65 10220 25 4020 77776
                243   01 10000 25 4010 77776
                244   01 10220 22 4000 00143
                245   01 13300 00 0001 00105      YMAX
LAST            246   01 10100 43 4000 00000
                247   17 14100 10 4000 00040
                250   01 45015 17 4002 00006
                251   10 20001 23 4000 00002
                252   01 45055 02 4002 00000
                253   07 40001 00 4010 00000
                254   01 50021 00 0401 00101      HXDMAT
BTWO            255   01 40002 00 4000 00000
BWUN            256   01 40001 61 4000 00000
NOPLOT          257   41 05150 00 4001 77734      CONTUR
                260   01 40001 62 4020 00000
                261   42 05150 00 4001 77730      ENDTST
                262   46 02510 66 4000 00002
                263   01 01000 00 4001 77663      INTERP
                264   01 21700 00 4040 77775
                265   21 10220 00 4020 77776
                266   01 10000 00 4020 77776
                267   01 10220 00 4000 00143
                270   01 13300 42 0001 00062      YMAX
                271   01 10100 41 4401 77753      LAST
                272   42 21601 00 0001 77752      LAST
                273   01 40006 00 4401 00011      SAVE
                274   01 02070 00 4000 00004
                275   01 40001 00 4401 77710      LENGTH
                276   41 50400 00 0001 00034      PRINT
                277   01 45015 00 4000 00017
                300   02 20100 07 4001 00055      HXDMAT
                301   47 40000 42 4400 00126
COLMP           302   01 40006 25 4000 00000
                303   01 02030 00 4000 00004
                304   42 01000 47 4001 77642      INTERP
```

```
                    306   01 42006 00 4000 02000
                    307   00 21400 00 0000 00100
                    310   01 01040 00 4001 00006      NOSTEX
                    311   01 21700 05 0001 00025      DEACT
                    312   01 20100 07 4001 00042      MATRX
                    313   01 40000 00 4400 00126
                    314   05 20100 07 4001 00041      HXDMAT
                    315   01 40000 00 4400 00126
                    316   01 01000 00 4001 00006      LEAVE
          NOSTEX    317   44 10220 00 0000 00001
                    320   01 10000 44 4020 00000
                    321   01 40053 00 4401 77664      LENGTH
                    322   43 10220 00 4000 00014
                    323   01 10000 00 4030 00000
                    324   11 10001 00 0000 00100
          LEAVE     325   01 01000 00 4400 00137
                    326   01 42004 66 4000 00006
                    327   01 42000 66 4500 00000
                    330   47 43005 40 4500 00000
          CODWD1    331   04 20000 00 0000 00000
          CODWD2    332   04 20001 40 0000 00000
          PRINT     333   44 10001 40 0000 00000
          SPACES    334   25 25252 52 5252 52525
          TWO47     335   06 20000 00 0000 00000
          EXP06     336   06 00000 00 0000 00000
          DEACT     337   00 00011 70 0000 00000
          WORD      340   25 53566 64 4612 55350
                    341   54 50632 53 6252 52525
                    342   37 25645 75 7446 12553
                    343   50 54506 32 5362 52525
                    344   37 25534 46 5445 32562
                    345   57 40425 05 5462 53625
          MAXLIM    346   00 00000 00 0000 00000
          MINLIM    347   00 00000 00 0000 00000
          INFAC     350   00 00000 00 0000 00000
          DELTAF    351   00 00000 00 0000 00000
          XMAX      352   00 00000 00 0000 00000
          YMAX      353   00 00000 00 0000 00000
          TEST      354   00 00000 00 0000 00000
          MATRX     355   00 00000 00 0000 00000
          HXDMAT    356   00 00000 00 0000 00000
*********
          *0000A    357   01 31000 00 0000 00000
          *0000B    360   01 00100 00 0000 00000
          *0000C    361   77 20000 00 0000 00000
```

```
316       NOMNMX    0     7     1     340000000000000     0
317       MINLIM    0   347     1     410000000000000     0
320       MAXLIM    0   346     1     406000000000000     0
321       CODWD2    0   332     1     361000000000000     0
322       LENGTH    0   207     1     234000000000000     0
323       HXDMAT    0   356     1     426000000000000     0
324       NOCOMP    0    36     1      63000000000000     0
325       TWO47     0   335     1     367000000000000     0
326       *0000A    0   357     1     430000000000000     0
327       TEST      0   354     1     422000000000000     0
330       *0000B    0   360     1     431000000000000     0
```

332	CODWD1	0	331	1	3570000000000000	0
333	MATRX	0	355	1	4240000000000000	0
334	SAVE	0	305	1	3220000000000000	0
335	NOSCAN	0	74	1	1210000000000000	0
336	SCAN	0	63	1	1100000000000000	0
337	DELTAF	0	351	1	4140000000000000	0
340	XMAX	0	352	1	4160000000000000	0
341	YMAX	0	353	1	4200000000000000	0
342	LAST	0	246	1	2730000000000000	0
343	COLMB	0	302	1	3270000000000000	0
344	ENDTST	0	213	1	2400000000000000	0
345	WORD	0	340	1	3750000000000000	0
346	INTERP	0	150	1	1750000000000000	0
347	RITCOL	0	156	1	2020000000000000	0
350	LFTCOL	0	165	1	2120000000000000	0
351	FILLAT	0	171	1	2160000000000000	0
352	NOSTO	0	211	1	2360000000000000	0
353	SPACES	0	334	1	3650000000000000	0
354	CONTUR	0	215	1	2420000000000000	0
355	NOPLOT	0	257	1	3040000000000000	0
356	EXP06	0	326	1	3710000000000000	0
357	=0000C	0	341	1	4320000000000000	0
360	BTWO	0	255	1	3020000000000000	0
361	BWUN	0	256	1	3030000000000000	0
362	PRINT	0	335	1	3630000000000000	0
363	NOSTEX	0	317	1	3440000000000000	0
364	DEACT	0	337	1	3730000000000000	0
365	LEAVE	0	325	1	3520000000000000	0

```
                                                                    1
225             ORG                                                 2
                REM     CONTOUR PLOT MATRIX *B1,                    3
                REM     B2 = DEGREE OF REFINEMENT,                  4
                REM     B3 = NUMBER OF PLANES,                      5
                REM     B4 = PERCENT TOLERANCE,                     6
        Z       BAU+2   X,B6+1                                      7
                BAU+2   SL,B6+1                                     10
        -Z      TRA     a*136,U+R                                   11
                53100   aB4-144                                     12
                FMP     TM047                                       13
                FDV     d200.0                                      14
                STO     aTEST                                       15
        B2      IF(PNZ)SKP  a1,B2+1                                 16
                SB2     a2                                          17
        B2      LDR     CODWD1,U+B4                                 20
                LRS     ad30                                        21
        B2      RPA     R                                           22
                LLS     ad15                                        23
        R       BAU     aMATRX,U+T7                                 24
                SLN     a2                                          25
                TSR     a*126                                       26
        B6      RPA     SAVE                                        27
                SB6     aB1                                         30
                LDR     B6,R+PF                                     31
                LLS     ad15,U+B1                                   32
                LDR     PF+1                                        33
                LLS     ad15,U+B2                                   34
        B1      LT6     B6,U+B5                                     35
        B2      LT4     *T6,U+B6                                    36
                LT5     *T6,B1-1                                    37
SCAN            LT7     *T6,B1-1                                    40
        T4      IF(POS)SKP  T7                                      41
                LT4     T7                                          42
        T5      IF(NEG)SKP  T7                                      43
                LT5     T7                                          44
        B1      IF(PNZ)TRA  aSCAN                                   45
                SB1     aB5,B2-1                                    46
        B2      IF(PNZ)TRA  aSCAN                                   47
        T4      FSB     T5,U+T7                                     50
                53100   -AB3-1                                     51
                FMP     TM047                                       52
                FAD     U                                           53
                VDF     T7,B6-1                                     54
                STO     aDELTAF                                     55
        T4      STO     aUPPER                                      56
        -I      LDR     aB4-1,U+B3                                  57
POWTST          LRR     a1,B3+1                                     60
        R       IF(NZE)TRA  aPOWTST                                 61
        B6      LUL     aB3,B6+1                                    62
                ADD     a2,B5-1                                     63
                STO     aXMAX                                       64
        B5      LUL     aB3,B5+1                                    65
                ADD     a2,I+B1                                     66
                STO     aYMAX                                       67
                CLA     MATRX,U+PF                                  70
        B6      RPA     COLMB                                       71
        B5      RPA     ENDTST                                      72
        B1      STX     a77774,U+B5                                 73
```

```
INTERP    B6      SB1             a#B5,U+B2                       74
                  LT4             *T6,B2-1                        75
          T4      FSB             *T6                             76
                  DMR             a#B3,U+T7                       77
                  SB1             a#4,I+B2                        100
BOTROW    T4      STO             a*PF+B1,B2=1                    101
                  FSB             T7,U+T4                         102
          B2      IF(PNZ)TRA      a#OTROW                         103
          B6      SB1             a#5-1,U+B2                      104
                  LT4             *T6,B2=1                        105
          T4      FSB             *T6                             106
                  DMR             a#B3,U+T7                       107
          I       SB2             a#4,U+B1                        110
TOPROW    T4      STO             a*PF+B1,B2=1                    111
                  FSB             T7,U+T4                         112
          B2      IF(PNZ)TRA      a#OPROW                         113
          B6      SB1             a#5,U+B2                        114
                  LT4             *T6,B1=1                        115
          T4      FSB             *T6                             116
                  DMR             a#B3,U+T7                       117
          B4      SB1             a#4=1,U+B2                      120
RITCOL    T4      FSB             T7,U+T4                         121
                  STO             a*PF+B1,B1-1                    122
          B1      IF(PNZ)JMP      a1                              123
          B5      SB2             a#6=1,U+B1                      124
                  LT4             *T6,B1=1                        125
          T4      FSB             *T6                             126
                  DMR             a#B3,U+T7                       127
          I       SB1             a#4=1,U+B2                      130
LFTCOL    T4      FSB             T7,U+T4                         131
                  STO             a*PF+B1,B1=1                    132
          B1      IF(PNZ)JMP      a1                              133
          B4      SB1             a#4=1,U+B2                      134
FLLMOR    I       LT4             *PF+B1,U+B2                     135
          T4      FSB             *PF+B1                          136
                  DMR             a#B3+1,U+T7                     137
          T4      DMR             a1,U+T4                         140
                  SB2             a#4=1                           141
FILLAT    T4      FSB             T7,U+T4                         142
                  STO             a*PF+B1,B2=1                    143
          B2      IF(PNZ)JMP      a1                              144
                  SB2             a#4,B1=1                        145
          B1      IF(NEG)SKP      a1                              146
                  TRA             aFLLMOR                         147
          B4      SB2             a#4=1,U+B1                      150
FLVMOR    I       LT4             *PF+B1,U+B1                     151
          T4      FSB             *PF+B1                          152
                  DMR             a#B3+1,U+T7                     153
          T4      DMR             a1,U+T4                         154
                  SB1             a#4=1                           155
FILVRT    T4      FSB             T7,U+T4                         156
                  FAD+            *PF+B1,B1-1                     157
          B1      IF(PNZ)JMP      a1                              160
                  SB1             a#4,B2=1                        161
          B2      IF(NEG)SKP      a1                              162
                  TRA             aFLVMOR                         163
          B4      LT4             d0.5,U+B2                       164
          B6      IF(ZER)SKP      a*COLMB                         165
                  AB2             a77776                          166
```

```
SPCASE      B5      IF(ZER)SKP      a*ENDTST                167
                    ABI             a77776                  170
CONTUR      -T5     FAD             *PF+B1                  171
                    FDV             DELTAF                  172
                    12460           EXP06                   173
            R       BEU             T4                      174
                    FSB             T4                      175
            IU1     IF(POS)SKP      TEST                    176
                    TRA             aNOPLOT,B1-1            177
                    CLA             a*6-2                   200
            IU1     LUL             aB3                     201
                    ADD             aB2                     202
                    12300           XMAX,B5-1               203
                    SUB             T4,B5-1                 204
                    LUL             a1,U-T7                 205
            IB51    LUL             aB3,B5+1                206
                    ADD             aB1,B5+1                207
            -U      12300           YMAX                    210
                    ADD             T4,B1-1                 211
                    LUL             a1                      212
                    IF(SLF)SKP      a1C                     213
            -U      PLT             T7,CC+1                 214
                    PLT             T7                      215
NOPLOT      B1      IF(PNZ)TRA      aCONTUR                 216
                    SB1             aB4,B2-1                217
            B2      IF(PNZ)TRA      aSPCASE                 220
            B6      IF(NEG)SKP      a2,B6-1                 221
                    TRA             aINTERP                 222
COLMB               SB6             a(Z),B5+1               223
ENDTST      B5      IF(PNZ)SKP      a(Z)                    224
                    TRA             aINTERP                 225
SAVE        I       SB6             a(Z),U-B5               226
                    SPA             aWORD,I-B5              227
            I       LT7             B2,U-B1                 230
                    TSR             a*127,U-B3              231
                    LT7             B2+1,B5+1               232
                    TSR             a*127,B5+1              233
            B5      SB3             a20,U-B1                234
            T5      TSR             a*127,U-T7              235
            I       LT7             B2+2,U-B1               236
                    TSR             a*127                   237
                    LT7             B2+3                    240
                    TSR             a*127                   241
                    ABS             aX                      242
                    LT7             UPPER                   243
            B5      TSR             a*127,U-B7              244
            I       LT7             B2+4,U-B1               245
                    TSR             a*127                   246
                    LT7             B2+5                    247
                    TSR             a*127                   250
                    CLA             DELTAF                  251
                    FAD             U,U-T7                  252
            B5      TSR             a*127,U-B1              253
                    TSR             a*127,B1-1              254
                    SPA             a2                      255
            Z       BLU             100                     256
                    IF(NUL)TRA      aPOSTEX                 257
                    CLA             DEACT                   260
                    BAU             aMATRX,U-T7             261
```

```
                        TSR     a*126                                   262
                        TRA     aLEAVE                                  263
NOSTEX          B4      IMP     U                                       264
                        ADD     aB4                                     265
                -U      ADD-    100                                     266
LEAVE                   TRA     a*137                                   267
                        SLF     a2,B6-1                                 270
                        SLN     a*B6,B6-1                               271
                PF      STX     a*B6,U+CC                               272
CODWD1                  OCT     0420000000000000000                     273
TWC47                   OCT     0420000000000000000                     274
EXP06                   OCT     0600000000000000000                     275
DEACT                   OCT     0000011700000000000                     276
WORD                    BCD      LOWER LIMIT =                          277
                        BCD     , UPPER LIMIT =                         300
                        BCD     , LEVEL SPACING =                       301
UPPER                   OCT     Z                                       302
DELTAF                  OCT     Z                                       303
XMAX                    OCT     Z                                       304
YMAX                    OCT     Z                                       305
TEST                    OCT     Z                                       306
MATRX                   OCT     Z                                       307
                        END                                             310
                                                                        311
```

301	TWO47	0	266	0	3110000000000000	0
302	0	0	305	0	3440000000000000	0
303	TEST	0	303	0	3400000000000000	0
304	CODWD1	0	265	0	3070000000000000	0
305	MATRX	0	304	0	3420000000000000	0
306	SAVE	0	220	0	2410000000000000	0
307	SCAN	0	32	0	5300000000000000	0
310	DELTAE	0	300	0	3320000000000000	0
311	UPPER	0	277	0	3300000000000000	0
312	POWTST	0	52	0	7300000000000000	0
313	XMAX	0	301	0	3340000000000000	0
314	YMAX	0	302	0	3360000000000000	0
315	COLMB	0	215	0	2360000000000000	0
316	ENDTST	0	216	0	2370000000000000	0
317	INTERP	0	66	0	1070000000000000	0
320	BOTROW	0	73	0	1140000000000000	0
321	TOPROW	0	103	0	1240000000000000	0
322	RITCOL	0	113	0	1340000000000000	0
323	LFTCOL	0	123	0	1440000000000000	0
324	FLLMOR	0	127	0	1500000000000000	0
325	FILLAT	0	134	0	1550000000000000	0
326	FLVMOR	0	143	0	1640000000000000	0
327	FILVRT	0	150	0	1710000000000000	0
330	0	0	306	0	3450000000000000	0
331	SPCASE	0	161	0	2020000000000000	0
332	CONTUR	0	163	0	2040000000000000	0
333	EXP06	0	267	0	3130000000000000	0
334	NOPLOT	0	210	0	2310000000000000	0
335	WORD	0	271	0	3170000000000000	0
336	NOSTEX	0	256	0	2770000000000000	0
337	DEACT	0	270	0	3150000000000000	0
340	LEAVE	0	261	0	3020000000000000	0

CONTOUR PLOT MATRIX *B1,
B2 = DEGREE OF REFINEMENT,
B3 = NUMBER OF PLANES,
B4 = PERCENT TOLERANCE,

```
   22                1     00 20102 26 0000 77775
   23                2     01 20102 26 0000 77770
   24                3     10 01000 02 4400 00136
   25                4     01 53100 00 4020 77433
   26                5     01 10600 00 0001 00260      TWO47
   27                6     01 10700 00 0001 00276           0
   30                7     01 20001 00 4001 00273      TEST
   31               10     42 06130 22 4000 00001
   32               11     01 40003 00 4000 00003
   33               12     42 50400 44 0001 00252      CODWD1
   34               13     01 45013 00 4000 00036
   35               14     42 21601 00 0000 00002
   36               15     01 45062 00 4000 00017
   37               16     02 20100 07 4001 00265      MATRX
   40               17     01 42000 00 4000 00002
   41               20     01 40000 00 4400 00126
   42               21     46 21601 00 0001 00176      SAVE
   43               22     01 40006 00 4002 00000
   44               23     01 50400 57 0100 00000
   45               24     01 45062 41 4000 00017
   46               25     01 50400 00 0200 00001
   47               26     01 45062 42 4000 00017
   50               27     41 50460 45 0100 00000
   51               30     42 50440 46 0400 00006
   52               31     01 50450 61 0400 00006
   53   SCAN        32     01 50470 61 0400 00006
   54               33     04 02110 00 0000 00007
```

```
 56                 35      05 02510 00 0000 00007
 57                 36      01 50450 00 0000 00007
 60                 37      41 05150 00 4001 77771      SCAN
 61                 40      01 40001 62 4040 00000
 62                 41      42 05150 00 4001 77767      SCAN
 63                 42      04 10500 07 0000 00005
 64                 43      01 53100 00 5010 77775
 65                 44      01 10600 00 0001 00021      TWO47
 66                 45      01 10400 00 0000 00001
 67                 46      01 16700 66 0000 00007
 70                 47      01 20001 00 4001 00330      DELTAF
 71                 50      04 20001 00 4001 00326      UPPER
 72                 51      30 50401 43 4020 77776
 73      POWTST     52      01 45001 23 4000 00001
 74                 53      02 01050 00 4001 77775      POWTST
 75                 54      46 45020 26 4010 00000
 76                 55      01 10000 65 4000 00002
 77                 56      01 20001 00 4001 00322      XMAX
100                 57      45 45020 25 4010 00000
101                 60      01 10000 71 4000 00002
102                 61      01 20001 00 4001 00320      YMAX
103                 62      01 21701 47 0001 00321      MATRX
104                 63      46 21601 00 0001 00131      COLMB
105                 64      45 21601 00 0001 00131      ENDTST
106                 65      41 43003 45 4000 77774
107     INTERP      66      46 40001 42 4040 00000
110                 67      01 50440 62 0400 00006
111                 70      04 10500 00 0400 00006
112                 71      01 44000 07 4010 00000
113                 72      01 40001 72 4020 00000
114     BOTROW      73      04 20001 62 4602 00000
115                 74      01 10500 04 0000 00007
116                 75      42 05150 00 4001 77774      BOTROW
117                 76      46 40001 42 4040 77776
120                 77      01 50440 62 0400 00006
121                100      04 10500 00 0400 00006
122                101      01 44000 07 4010 00000
123                102      20 40003 41 4020 00000
124     TOPROW     103      04 20001 62 4602 00000
125                104      01 10500 04 0000 00007
126                105      42 05150 00 4001 77774      TOPROW
127                106      46 40001 42 4040 00000
130                107      01 50440 61 0400 00006
131                110      04 10500 00 0400 00006
132                111      01 44000 07 4010 00000
133                112      44 40001 42 4020 77776
134     RITCOL     113      04 10500 04 0000 00007
135                114      01 20001 61 4602 00000
136                115      41 07150 00 4000 00001
137                116      45 40003 41 4100 77776
140                117      01 50440 61 0400 00006
141                120      04 10500 00 0400 00006
142                121      01 44000 07 4010 00000
143                122      20 40001 42 4020 77776
144     LFTCOL     123      04 10500 04 0000 00007
145                124      01 20001 61 4602 00000
146                125      41 07150 00 4000 00001
147                126      44 40001 42 4020 77776
150     FLLMOR     127      20 50440 42 0602 00000
151                130      04 10500 00 0602 00000
152                131      01 44000 07 4010 00001
153                132      04 44000 04 4000 00001
154                133      01 40003 00 4020 77776
155     FILLAT     134      04 10500 04 0000 00007
156                135      01 20001 62 4602 00000
```

```
160                 137     01 40003 61 4020 00000
161                 140     41 02510 00 4000 00001
162                 141     01 01003 00 4001 77764      FLLMOR
163                 142     44 40003 41 4020 77776
164     FLVMOR      143     20 50440 41 0602 00000
165                 144     04 10503 00 0602 00000
166                 145     01 44003 07 4010 00001
167                 146     04 44003 04 4000 00001
170                 147     01 40001 00 4020 77776
171     FILVRT      150     04 10503 04 0000 00007
172                 151     01 10401 61 0602 00000
173                 152     41 07150 00 4000 00001
174                 153     01 40001 62 4020 00000
175                 154     42 02510 00 4000 00001
176                 155     01 01003 00 4001 77764      FLVMOR
177                 156     44 50440 42 0001 00127            0
200                 157     46 02010 00 4401 00035      COLMB
201                 160     01 41003 00 4000 77776
202     SPCASE      161     45 02010 00 4401 00034      ENDTST
203                 162     01 41001 00 4000 77776
204     CONTUR      163     15 10400 00 0602 00000
205                 164     01 10703 00 0001 00113      DELTAF
206                 165     01 12463 00 0001 00101      EXP06
207                 166     02 21003 00 0000 00004
210                 167     01 10503 00 0000 00004
211                 170     21 02113 00 0001 00112      TEST
212                 171     01 01003 61 4001 00016      NOPLOT
213                 172     01 21703 00 4100 77775
214                 173     21 45023 00 4010 00000
215                 174     01 10003 00 4004 00000
216                 175     01 12303 65 0001 00103      XMAX
217                 176     01 10103 65 0000 00004
220                 177     01 45023 07 4000 00001
221                 200     65 45023 25 4010 00000
222                 201     01 10003 25 4002 00000
223                 202     11 12303 00 0001 00077      YMAX
224                 203     01 10003 61 0000 00004
225                 204     01 45023 00 4000 00001
226                 205     01 02073 00 4000 00010
227                 206     11 67003 20 0000 00007
230                 207     01 67003 00 0000 00007
231     NOPLOT      210     41 05153 00 4001 77751      CONTUR
232                 211     01 40001 62 4020 00000
233                 212     42 05153 00 4001 77745      SPCASE
234                 213     46 02513 66 4000 00002
235                 214     01 01003 00 4001 77650      INTERP
236     COLMB       215     01 40006 25 4000 00000
237     ENDTST      216     45 06153 00 4000 00000
240                 217     01 01003 00 4001 77645      INTERP
241     SAVE        220     20 40006 45 4000 00000
242                 221     01 61013 72 4001 00047      WORD
243                 222     20 50473 41 0004 00000
244                 223     01 40003 43 4400 00127
245                 224     01 50473 25 0004 00001
246                 225     01 40003 25 4400 00127
247                 226     45 40003 41 4000 00020
250                 227     05 40003 07 4400 00127
251                 230     20 50473 41 0004 00002
252                 231     01 40003 00 4400 00127
253                 232     01 50473 00 0004 00003
254                 233     01 40003 00 4400 00127
255                 234     01 41003 00 4000 77775
256                 235     01 50473 00 0001 00041      UPPER
257                 236     45 40003 41 4400 00127
260                 237     20 50473 41 0004 00004
```

```
:262                 241    01 50470 00 0004 00005
:263                 242    01 40000 00 4400 00127
:264                 243    01 21700 00 0001 00034    DELTAF
:265                 244    01 10400 07 0000 00001
:266                 245    45 40000 41 4400 00127
:267                 246    01 40000 61 4400 00127
:270                 247    01 61010 00 4000 00000
:271                 250    00 21400 00 0000 00100
:272                 251    01 01040 00 4001 00004    NOSTEX
:273                 252    01 21700 00 0001 00015    DEACT
:274                 253    01 20100 07 4001 00030    MATRX
:275                 254    01 40000 00 4400 00126
:276                 255    01 01000 00 4001 00003    LEAVE
:277    NOSTEX       256    44 10220 00 0000 00001
:300                 257    01 10000 00 4020 00000
:301                 260    11 10001 00 0000 00100
:302    LEAVE        261    01 01000 00 4400 00137
:303                 262    01 42004 66 4000 00002
:304                 263    01 42000 66 4500 00000
:305                 264    47 43003 40 4500 00000
:307    CODWD1       265    04 20000 00 0000 00000
:311    TWO47        266    06 20000 00 0000 00000
:313    EXP06        267    06 00001 00 0000 00000
:315    DEACT        270    00 00011 70 0000 00000
:317    WORD         271    25 53566 64 4612 55350
:320                 272    54 50633 53 6252 52525
:322                 273    37 25643 75 7446 12553
:323                 274    50 54506 32 5362 52525
:325                 275    37 25534 46 5445 32562
:326                 276    57 40423 05 5462 53425
:330    UPPER        277    00 00001 00 0000 00000
:332    DELTAF       300    00 00001 00 0000 00000
:334    XMAX         301    00 00001 00 0000 00000
:336    YMAX         302    00 00001 00 0000 00000
:340    TEST         303    00 00001 00 0000 00000
:342    MATRX        304    00 00001 00 0000 00000
:344                 305    01 31001 00 0000 00000
:345                 306    77 20001 00 0000 00000
```

252 PRINTER GENERAL PLOT

Plotter *252

Purpose: To plot the two rows of a two rowed matrix against each other or to plot a vector versus its index.

Input: B1=codeword address of an ordinary [redacted] two rowed matrix or an ordinary [redacted] vector, with initial index of 1.
For a vector, the index is plotted across the page; for a matrix, the first row is plotted across the page.
In the usual terminology of Y vs X with X plotted across the page, the index of vector is considered X, the first row of a matrix is considered X.

Restrictions: Length (*252) $\approx (500)_8$ orders.
Also requires [redacted] space to make a copy of the matrix or two copies of the vector being plotted. Uses the X register, interrogates sense lights 1-7, will inactivate extra space taken if STEX is activated. The resolution is 2 and the plotter is 100 × 100.

Options:
SL1: plot axes if within range of data
SL2: open grid
SL3: closed grid
SL4: border
SL5: title: if SL5 is off, the title "Y vs X" if printed at the top of the page. If SL5 is on, the plotter assumes that the page has been restored and a one-line title has been printed by the calling program.
SL6: maximum Y = T4, minimum Y = T5
SL7: maximum X = T6, minimum X = T7

NOTE: Scaled values of the variables plotted are printed at the left and the bottom of the plot at 10 equal intervals. In order to get the printed values to be round numbers of some sort, it is generally necessary to make use of the SL6 and SL7 options. The scale factors for each variable are printed at the very bottom of the plot.

Modified C.S.

```
252                     ORG
                        REM          OPTION PLOTER
            -Z          TRA          *SAVE,U→R
                        CLA+2        T7,B6+1
            Z           BAU+2        SL,B6+1
                        BAU+2        X,B6+1
                        STX          a2
                        IF(SLF)JMP   a01000
            T4          STO          YMAX
            T5          STO          YMIN
                        IF(SLF)JMP   a00400
            T6          STO          XMAX
            T7          STO          XMIN
            Z           STO          ABS1
                        STO          ABS2
                        LDR          B1,R→B5
            R           AND          STRBIT
                        IF(NUL)TRA   NOMTRX,U→T5
                        CLA+2        B5+1,B6+1
                        CLA+2        B5+2,B6+1
                        LT4          INFLC
            T4          RPI          B5+1
            T4          RPI          B5+2
                        LDR          B5+1
NOMTRX      Z           LLS          ad15,U→B4
                        LUL          ad15
                        ORU          MSPACE
                        BAU          aM,U→T7
                        SLN          a2
            I           TSR          *XCWD,U→B1
            B4          STO          LENGTH,U→B2
            T5          IF(NUL)TRA   COPYV,R→Z
COPYM                   CLA          *B5+B1
                        STO          *M,B1+1
                        CLA          *B5+B1
                        STO          *M,B2-1
            B2          IF(PNZ)TRA   COPYM,B1-1
                        TRA          SORT,B1+1
COPYV                   SB2          a1
LOOP1       R           FAD          d1.0,U→R
            R           STO          *M,B4-1
            B4          IF(PNZ)TRA   LOOP1,B2+1
                        AB1          a1,B2-1
LOOP2       B2          SB2          a31,U→B1
                        LDR          B5+B1
            B2          SB2          a31,U→B1
            R           STO          *M,B2-1
            B2          IF(PNZ)TRA   LOOP2
SORT        I           SB1          a2,U→B2
            -I          ADD          a*M
                        STO          MADD
                        RPA,WTG      MTEST
            T5          IF(NUL)TRA   NOFIX
                        CLA          B6-1,B6-1
                        STO          aB5+2
                        CLA          B6-1,B6-1
                        STO          aB5+1
NOFIX                   IF(SLF)SKP   a01000
```

```
                    TRA       YCALC                                  74
               I    SB1       a2,U→B2                                75
                    LT5       *M                                     76
                    LT4       *M,B2+1                                77
LUPYAX         T5   IF(POS)SKP *M                                     100
                    LT5       *M                                     101
               T4   IF(NEG)SKP *M                                     102
                    LT4       *M                                     103
               B2   IF(POS)SKP LENGTH                                 104
                    TRA       LUPYAX,B2+1                            105
               T5   STO       YMAX                                   106
               T4   STO       YMIN                                   107
YCALC                LT5       YMAX                                   110
               T5   FSB       YMIN                                   111
                    STO       YDIF                                   112
                    FDV       a10.                                   113
               IUI  STO       YSCALE                                 114
               T5   STO       YSTART                                 115
               IT5I IF(POS)SKP IYMINI                                 116
                    LT6       IYMINI,CC+1                            117
                    LT6       IT5I                                   120
               CC   TRA       TENSCL,U→B4                            121
               T5   STO       YRANGE                                 122
                    IF(SLF)SKP a00400                                 123
                    TRA       XCALC                                  124
               I    SB2       *LENGTH,U→B1                           125
                    LT5       *M                                     126
                    LT4       *M,B2-1                                127
LUPXIN         T4   IF(NEG)SKP *M                                     130
                    LT4       *M                                     131
               T5   IF(POS)SKP *M                                     132
                    LT5       *M                                     133
               B2   IF(NEG)SKP a1                                     134
                    TRA       LUPXIN,B2-1                            135
               T5   STO       XMAX                                   136
               T4   STO       XMIN                                   137
XCALC                LT4       XMIN                                   140
               T4   STO       XSTART                                 141
               T4   BSF       XMAX                                   142
                    STO       XDIF                                   143
                    FDV       a10.                                   144
               IUI  STO       XSCALE                                 145
               IT4I IF(POS)SKP IXMAXI                                 146
                    LT6       IXMAXI,CC+1                            147
                    LT6       IT4I                                   150
               CC   TRA       TENSCL,U→B4                            151
               T5   STO       XRANGE                                 152
               I    SB2       *LENGTH,U→B1                           153
                    LT4       YMIN,B1+1                              154
                    LT6       YDIF                                   155
LOOP4                CLA       *M                                     156
                    FSB       T4                                     157
                    FDV       T5                                     160
                    FMP       a200.                                  161
                    FAD       a1.                                    162
                    FAD+60    060 000 000 000 000 000,U→B4
               B4   STO       *M,B2-1                                164
               B2   IF(PNZ)TRA LOOP4                                  165
               I    LT4       XMIN,U→B1                              166
```

```
                    LT6         XDIF                                    167
                    SB2         *LENGTH                                 170
LOOP5               CLA         *-1                                     171
                    FSB         T4                                      172
                    FDV         T5                                      173
                    FMP         d200.                                   174
                    FAD         d1.                                     175
                    FAD+60      060 000 000 000 000 000,U+B4
                P4  STO         *-1,B2-1                                177
                B2  IF(PNZ)TRA  LOOP5                                   200
                -I  ADD         a*116                                   201
                    RPA,WTG     CLEAR,U+B4                              202
                    IF(SLF)SKP  a02000,B4+1                             203
                    TRA         RUN                                     204
                    PAG         Z                                       205
                    LT7         CC,CC+1                                 206
                    BCD         Y VS X                                  207
                I   SB3         a455,U+B1                               210
                    TSR         *127                                    211
                    TSR         *127,B1+1                               212
RUN             I   MLN         a02000,U+B1                             213
                    SB2         *LENGTH,B1+1                            214
                    CLA,STI+    *-1                                     215
                    SB2         a1                                      216
                    SB3         a-100                                   217
                    IF(SLN)SKP  a10000                                  220
                    TRA         BORDER                                  221
                    CLA         002 001 000 400 200 100                 222
                    ORU+        ABS1                                    223
                    CLA         040 020 010 004 002 001                 224
                    ORU+        ABS2                                    225
BORDER              IF(SLN)SKP  a04000                                  226
                    TRA         AXTEST                                  227
                    CLA         002 000 000 000 000 000                 230
                    ORU+        ABS1                                    231
                I   ORU+        ABS2                                    232
AXTEST              IF(SLN)SKP  a40000,R+Z                              233
                    TRA         LOOP10                                  234
                    CLA         XSCALE,R+B5                             235
                    FDV         d10.,U+T4                               236
                    FDV         d2.,U+T5                                237
                    LT6         XSTART                                  240
ZTEST           IT6I IF(PNZ)SKP T5,R+Z                                  241
                B3  TRA         XZSET,U+PF                              242
                T4  FAD+        T6,B5+1                                 243
                B5  IF(PNZ)SKP  a-100,I+PF                              244
                    TRA         ZTEST                                   245
                    TRA         YZSET,R+Z                               246
XZSET           I   LRS         B5+56                                   247
                    ORU+        ABS1                                    250
                R   ORU+        ABS2                                    251
YZSET               CLA         YSCALE                                  252
                    FDV         d10.,U+T4                               253
                    FDV         d2.,U+T5                                254
                    LT6         YSTART                                  255
YZTEST          IT6I IF(PNZ)SKP T5                                      256
                    TRA         YSET                                    257
                T4  BSF+        T6,PF-1                                 260
                PF  IF(POS)TRA  YZTEST                                  261
```

```
YSET        PF      STO             YZNO                                    262
                                                                            263
                                                                            264
LOOP10      B3      IDV             a410                                    265
            R       IF(NZE)TRA      AXES                                    266
                    LT4             YSTART                                  267
            Z       IF(ZER)SKP      YRANGE                                  270
            T4      FDV             YRANGE,U→T4                             271
                    TSR             DECIMAL                                 272
                    LDR             a70                                     273
                    TRA             *SAVE                                   274
            I       SB3             a77775,U→B1                             275
                    TSR             *127                                    276
                    TRA             *UNSAVE                                 277
                    CLA             YSCALE                                  300
                    BSF→            YSTART                                  301
                    IF(SLN)SKP      a04000                                  302
                    TRA             CLOGRI                                  303
            B3      IF(ZER)SKP      a4100                                   304
            B3      IF(NZE)TRA      CLOGRI                                  305
                    TRA             MINUS                                   306
CLOGRI              IF(SLN)SKP      a10000                                  307
                    TRA             OPGRID                                  310
MINUS               CLA             001 776 777 377 577 677                 311
                    ORU→            B4+42                                   312
                    CLA             737 757 767 773 775 776                 313
                    ORU→            B4+43,CC+1                              314
OPGRID              IF(SLF)SKP      a20000                                  315
                    CLA             002 001 000 400 200 100,CC+1
                    TRA             AXES                                    317
                    ORU→            B4+40,R→Z                               320
                    CLA             040 020 010 004 002 001,R→T4
                    ORU→            B4+41,R→T5                              322
AXES                IF(SLN)SKP      a40000                                  323
                    TRA             NOLINE                                  324
            B3      IF(ZER)SKP      YZNO                                    325
                    TRA             NOLINE                                  326
            -I      STO             YZNO                                    327
                    TRA             MINUS                                   330
NOLINE              ERM,SB1         a1,R→Z                                  331
MTEST       B3      IF(ZER)SKP      (M)+B1,I→PF                             332
                    TRA             SETUP                                   333
            PF      SUB             MADD,U→B2                               334
            I       ADD             *M,U→B5                                 335
                    AND             a-177,R→Z                               336
                    IF(NZE)TRA      CC+1,R→U                                337
            I       LRS             B5→57                                   340
                    ORU→            B4+62,U→T4                              341
            R       ORU→            B4+63,U→T5                              342
            PF      RPA,WTG         MTEST                                   343
                    IF(NT1)TRA      NOLINE                                  344
SETUP               CLA             ABS1                                    345
                    ORU→            B4+64                                   346
                    CLA             ABS2                                    347
                    ORU→            B4+65,R→Z                               350
            T4      50215           B4+40                                   351
            S       AND→            B4+64                                   352
            T5      50215           B4+41                                   353
            S       AND→            B4+65                                   354
```

```
                T4      50215           B4+42                                   355
                T5      50215           B4+43                                   356
                I       PRN             *116,U+B2                               357
                        SPF,ERM         a100                                    360
CLEAR           Z       STO             (Z)+B2,PF-1                             361
                        CLA             MADD                                    362
                        RPA,WTG         MTEST                                   363
                        ILF             a40000                                  364
                B3      IF(PNZ)TRA      LOOP10,B3-1                             365
                        SB4             a411                                    366
                        SPA             a77776,I+B3                             367
XLINE           I       LT4             XSTART,U+B1                             370
                Z       IF(ZER)SKP      XRANGE,B4-1                             371
                T4      FDV             XRANGE,U+T4                             372
                        TSR             DECIMAL                                 373
                        TSR             *127,B3+1                               374
                        CLA             XSCALE                                  375
                        FAD+            XSTART                                  376
                        MLF             a02000                                  377
                B4      IF(NZE)TRA      XLINE                                   400
                        TSR             *127,B1+1                               401
                        SPA             YRANGE                                  402
                S       TSR             *155,U+T4                               403
                T4      STO             Y1                                      404
                T5      STO             Y2                                      405
                        LT4             XRANGE                                  406
                        TSR             *155                                    407
                T4      STO             X1                                      410
                T5      STO             X2                                      411
                Z       BAU             aRANGEL                                 412
                        BLU             RANGEP,U+T7                             413
                        TSR             *XCWD                                   414
                        SB1             aM                                      415
                Z       TSR             *135,U+B2                               416
                        SLF             a2                                      417
                        STX             a*B6-1,B6-1                             420
                        SLN             a*B6-1,B6-1                             421
                        LT7             B6-1,B6-1                               422
                        TRA             *UNSAVE                                 423
                        TRA             PF                                      424
TENSCL                  LT4             d10.                                    425
                        LT5             d1.                                     426
                Z       STX             X,U+B2                                  427
                T6      IF(POS)SKP      T6,B2-1                                 430
                T4      FMP+            T6,CC+X                                 431
                T6      IF(NNZ)SKP      d9,9995,B2+1                            432
                T4      VDF+            T6,CC+X                                 433
                B4      TSR             *152,U+PF                               434
DECIMAL                 LT7             25 25 25 25 25 25 25 25 00              435
                T4      IF(POS)TRA      CC+1                                    436
                        LDR             a21,CC+1                                437
                        LDR             a20                                     440
                R       ORU+            T7                                      441
                IT41    FAD             d.0005                                  442
                        FAD+66          060 000 000 000 000 000                 443
                        DML             a1,R+T4                                 444
                        LRS             a6,U+B5                                 445
                T7      LLS             a6,U+T7                                 446
                        LDR             a62                                     447
```

```
                T7      45061   a6,U→T7                         450
                Z       RPE     T4                              451
                T7      LUL     a6,U→T7                         452
                T4      MPY     a10,R→T4                        453
                        ORU     T7                              454
                        LUL     a6,U→T7                         455
                T4      MPY     a10,R→T4                        456
                        ORU     T7                              457
                        LUL     a6,U→T7                         460
                T4      MPY     a10                             461
                        ORU→    T7                              462
                        TRA     PE                              463
RANGEL                  BCD                                     464
                                MULTIPLY                        465
                                VERTICAL                        466
                                SCALE BY                        467
Y1                      OCT     Z                               470
Y2                      OCT     Z                               471
                        BCD             MULTIPLY                472
                                HORIZONTAL                      473
                                SCALE BY                        474
X1                      OCT     Z                               475
X2                      OCT     Z                               476
RANGEP                  OCT     00014 4010 0000 00000           477
M                       OCT     Z                               500
INFLC                   OCT     400000                          501
SIRRIT                  OCT     400000000                       502
UNSAVE                  EQU     137                             503
SAVE                    EQU     136                             504
XCWD                    EQU     136                             505
MSPACE                  OCT     0000204200000000000             506
LENGTH                  OCT     Z                               507
                        END                                     510
                                                                511
```

311	SAVE	0	136	0	5170000000000000	2
312	YMAX	0	501	0	5260000000000000	0
313	YMIN	0	502	0	5270000000000000	0
314	XMAX	0	503	0	5300000000000000	0
315	XMIN	0	504	0	5310000000000000	0
316	ABS1	0	505	0	5320000000000000	0
317	ABS2	0	506	0	5330000000000000	0
320	STRBIT	0	476	0	5150000000000000	0
321	NOMTRX	0	27	0	3300000000000000	0
322	INFLC	0	475	0	5130000000000000	0
323	MSPACE	0	477	0	5220000000000000	0
324	M	0	474	0	5110000000000000	0
325	XCWD	0	126	0	5200000000000000	2
326	LENGTH	0	500	0	5240000000000000	0
327	COPYV	0	45	0	5100000000000000	0
330	COPYM	0	37	0	4300000000000000	0
331	SORT	0	57	0	6300000000000000	0
332	LOOP1	0	46	0	5200000000000000	0
333	0	0	507	0	5340000000000000	0
334	LOOP2	0	52	0	5600000000000000	0
335	MADD	0	510	0	5350000000000000	0
336	MTEST	0	325	0	3320000000000000	0
337	NOFIX	0	70	0	7400000000000000	0
340	YCALC	0	105	0	1110000000000000	0
341	LUPYAX	0	75	0	1010000000000000	0
342	YDIF	0	511	0	5360000000000000	0
343	0	0	512	0	5370000000000000	0
344	YSCALE	0	513	0	5400000000000000	0
345	YSTART	0	514	0	5410000000000000	0
346	TENSCL	0	420	0	4250000000000000	0
347	YRANGE	0	515	0	5420000000000000	0
350	XCALC	0	135	0	1410000000000000	0
351	LUPXIN	0	125	0	1310000000000000	0
352	XSTART	0	516	0	5430000000000000	0
353	XDIF	0	517	0	5440000000000000	0
354	XSCALE	0	520	0	5450000000000000	0
355	XRANGE	0	521	0	5460000000000000	0
356	LOOP4	0	153	0	1570000000000000	0
357	0	0	522	0	5470000000000000	0
360	0	0	523	0	5500000000000000	0
361	LOOP5	0	166	0	1720000000000000	0
362	CLEAR	0	354	0	3610000000000000	0
363	RUN	0	210	0	2150000000000000	0
364	BORDER	0	223	0	2300000000000000	0
365	0	0	524	0	5510000000000000	0
366	0	0	525	0	5520000000000000	0
367	AXTEST	0	230	0	2350000000000000	0
370	0	0	526	0	5530000000000000	0
371	LOOP10	0	240	0	2650000000000000	0
372	0	0	527	0	5540000000000000	0
373	ZTEST	0	236	0	2430000000000000	0
374	XZSET	0	244	0	2510000000000000	0
375	YZSET	0	247	0	2540000000000000	0
376	YZTEST	0	253	0	2600000000000000	0
377	YSET	0	257	0	2640000000000000	0
400	YZNO	0	530	0	5550000000000000	0
401	AXES	0	316	0	3230000000000000	0
402	DECIMA	0	430	0	4350000000000000	0
403	UNSAVE	0	137	0	5160000000000000	2
404	CLOGRI	0	302	0	3070000000000000	0
405	MINUS	0	304	0	3110000000000000	0
406	OPGRID	0	310	0	3150000000000000	0
407	0	0	531	0	5560000000000000	0
410	0	0	532	0	5570000000000000	0

412	SETUP	0	340	0	345000000000000	0
413	XLINE	0	363	0	370000000000000	0
414	Y1	0	463	0	472000000000000	0
415	Y2	0	464	0	474000000000000	0
416	X1	0	471	0	503000000000000	0
417	X2	0	472	0	505000000000000	0
420	RANGEL	0	457	0	465000000000000	0
421	RANGEP	0	473	0	507000000000000	0
422	0	0	533	0	560000000000000	0
423	0	0	534	0	561000000000000	0
424	0	0	535	0	562000000000000	0

```
OPTION PLOTER
    5              1     10 01000 02 4400 00136      SAVE
    6              2     01 21702 26 0000 00007
    7              3     00 20102 26 0000 77770
   10              4     01 20102 26 0000 77775
   11              5     01 43005 00 4000 00002
   12              6     01 03070 00 4000 01000
   13              7     04 20001 00 4001 00471      YMAX
   14             10     05 20001 00 4001 00471      YMIN
   15             11     01 03070 00 4000 00400
   16             12     06 20001 00 4001 00470      XMAX
   17             13     07 20001 00 4001 00470      XMIN
   20             14     00 20001 00 4001 00470      ABS1
   21             15     01 20001 00 4001 00470      ABS2
   22             16     01 50400 55 0002 00000
   23             17     02 50314 00 0001 00456      STRBIT
   24             20     01 01040 05 4001 00006      NOMTRX
   25             21     01 21702 26 0040 00001
   26             22     01 21702 26 0040 00002
   27             23     01 50440 00 0001 00451      INFLC
   30             24     04 21501 00 0040 00001
   31             25     04 21501 00 0040 00002
   32             26     01 50400 00 0040 00001
   33   NOMTRX    27     00 45062 44 4000 00017
   34             30     01 45020 00 4000 00017
   35             31     01 50010 00 0001 00445      MSPACE
   36             32     01 20100 07 4001 00441      M
   37             33     01 42000 00 4000 00002
   40             34     20 40000 41 4400 00126      YCWD
   41             35     44 20001 42 4001 00442      LENGTH
   42             36     05 01040 10 4001 00006      COPYV
   43   COPYM     37     01 21700 00 0442 00000
   44             40     01 20001 21 4401 00433      M
   45             41     01 21700 00 0442 00000
   46             42     01 20001 62 4401 00431      M
   47             43     42 05150 61 4001 77772      COPYM
   50             44     01 01000 21 4001 00012      SORT
   51   COPYV     45     01 40002 00 4000 00001
   52   LOOP1     46     02 10400 02 0001 00440            0
   53             47     02 20001 64 4401 00424      M
   54             50     44 05150 22 4001 77774      LOOP1
   55             51     01 41001 62 4000 00001
   56   LOOP2     52     42 40002 41 4002 00000
   57             53     01 50400 00 0042 00000
   60             54     42 40002 41 4002 00000
   61             55     02 20001 62 4401 00416      M
   62             56     42 05150 00 4001 77772      LOOP2
   63   SORT      57     20 40001 42 4000 00002
   64             60     30 10000 00 4401 00413      M
   65             61     01 20001 00 4001 00426      MADD
   66             62     01 21641 00 0001 00242      MTEST
   67             63     05 01040 00 4001 00004      NOFIX
   70             64     01 21700 66 0100 77776
```

```
 72                    66  01 21700 66 0100 77776
 73                    67  01 20001 00 4040 00001
 74   NOFIX            70  01 02070 00 4000 01000
 75                    71  01 01000 00 4001 00013      YCALC
 76                    72  20 40001 42 4000 00002
 77                    73  01 50450 00 0401 00400      M
100                    74  01 50440 22 0401 00377      M
101   LUPYAX           75  05 02110 00 0401 00376      M
102                    76  01 50450 00 0401 00375      M
103                    77  04 02510 00 0401 00374      M
104                   100  01 50440 00 0401 00373      M
105                   101  42 02110 00 0001 00376      LENGTH
106                   102  01 01000 22 4001 77771      LUPYAX
107                   103  05 20001 00 4001 00375      YMAX
110                   104  04 20001 00 4001 00375      YMIN
111   YCALC           105  01 50450 00 0001 00373      YMAX
112                   106  05 10500 00 0001 00373      YMIN
113                   107  01 20001 00 4001 00401      YDIF
114                   110  01 10700 00 0001 00401           0
115                   111  21 20001 00 4001 00401      YSCALE
116                   112  05 20001 00 4001 00401      YSTART
117                   113  25 02110 00 2001 00366      YMIN
120                   114  01 50460 20 2001 00365      YMIN
121                   115  01 50460 00 2000 00005
122                   116  40 01000 44 4001 00301      TENSCL
123                   117  05 20001 00 4001 00375      YRANGE
124                   120  01 02070 00 4000 00400
125                   121  01 01000 00 4001 00013      XCALC
126                   122  20 40002 41 4401 00355      LENGTH
127                   123  01 50450 00 0401 00350      M
130                   124  01 50440 62 0401 00347      M
131   LUPXIN          125  04 02510 00 0401 00346      M
132                   126  01 50440 00 0401 00345      M
133                   127  05 02110 00 0401 00344      M
134                   130  01 50450 00 0401 00343      M
135                   131  42 02510 00 4000 00001
136                   132  01 01000 62 4001 77771      LUPXIN
137                   133  05 20001 00 4001 00347      XMAX
140                   134  04 20001 00 4001 00347      XMIN
141   XCALC           135  01 50440 00 0001 00346      XMIN
142                   136  04 20001 00 4001 00357      XSTART
143                   137  04 14500 00 0001 00343      XMAX
144                   140  01 20001 00 4001 00356      XDIF
145                   141  01 10700 00 0001 00350           0
146                   142  21 20001 00 4001 00355      XSCALE
147                   143  24 02110 00 2001 00337      XMAX
150                   144  01 50460 20 2001 00336      XMAX
151                   145  01 50460 00 2000 00004
152                   146  40 01000 44 4001 00251      TENSCL
153                   147  05 20001 00 4001 00351      XRANGE
154                   150  20 40002 41 4401 00327      LENGTH
155                   151  01 50440 21 0001 00330      YMIN
156                   152  01 50460 00 0001 00336      YDIF
157   LOOP4           153  01 21700 00 0401 00320      M
160                   154  01 10500 00 0000 00004
161                   155  01 10700 00 0000 00006
162                   156  01 10600 00 0001 00343           0
163                   157  01 10400 00 0001 00327           0
164                   160  01 10460 44 0001 00342           0
165                   161  44 20001 62 4401 00312      M
166                   162  42 05150 00 4001 77767      LOOP4
167                   163  20 50440 41 0001 00320      XMIN
170                   164  01 50460 00 0001 00332      XDIF
171                   165  01 40002 00 4401 00312      LENGTH
172   LOOP5           166  01 21700 00 0401 00305      M
```

```
174             170     01 10700 00 0000 00006
175             171     01 10600 00 0001 00330          0
176             172     01 10400 00 0001 00314          0
177             173     01 10460 44 0001 00327          0
200             174     44 20001 62 4401 00277  M
201             175     42 05150 00 4001 77767  LOOP5
202             176     30 10000 00 4400 00116
203             177     01 21641 44 0001 00154  CLEAR
204             200     01 02070 24 4000 02000
205             201     01 01000 00 4001 00006  RUN
206             202     01 41070 00 0000 00000
207             203     01 50470 20 0001 00000
211             204     70 25654 22 5672 52525
212             205     20 40002 41 4000 00067
213             206     01 40000 00 4400 00127
214             207     01 40000 21 4400 00127
215     RUN     210     20 42002 41 4000 02000
216             211     01 40002 21 4401 00266  LENGTH
217             212     01 21711 00 0401 00261  M
220             213     01 40002 00 4000 00001
221             214     01 40002 00 4000 00144
222             215     01 02030 00 4000 10000
223             216     01 01000 00 4001 00004  BORDER
224             217     01 21700 00 0001 00304          0
225             220     01 50011 00 0001 00264  ABS1
226             221     01 21700 00 0001 00303          0
227             222     01 50011 00 0001 00263  ABS2
230     BORDER  223     01 02030 00 4000 04000
231             224     01 01000 00 4001 00003  AXTEST
232             225     01 21700 00 0001 00300          0
233             226     01 50011 00 0001 00256  ABS1
234             227     20 50011 00 0001 00256  ABS2
235     AXTEST  230     01 02030 10 4000 40000
236             231     01 01000 00 4001 00026  LOOP10
237             232     01 21700 55 0001 00265  XSCALE
240             233     01 10700 04 0001 00256          0
241             234     01 10700 05 0001 00272          0
242             235     01 50460 00 0001 00260  XSTART
243     ZTEST   236     26 06150 10 0000 00005
244             237     43 01000 47 4001 00004  XZSET
245             240     04 10401 25 0000 00006
246             241     45 06150 77 4000 00144
247             242     01 01000 00 4001 77772  ZTEST
250             243     01 01000 10 4001 00003  YZSET
251     XZSET   244     20 45015 00 4040 77721
252             245     01 50011 00 0001 00237  ABS1
253             246     02 50011 00 0001 00237  ABS2
254     YZSET   247     01 21700 00 0001 00243  YSCALE
255             250     01 10700 04 0001 00241          0
256             251     01 10700 05 0001 00255          0
257             252     01 50460 00 0001 00241  YSTART
260     YZTEST  253     26 06150 00 0000 00005
261             254     01 01000 00 4001 00002  YSET
262             255     04 14501 67 0000 00006
263             256     47 01110 00 4001 77773  YZTEST
264     YSET    257     47 20001 00 4001 00250  YZNO
265     LOOP10  260     43 13300 00 4000 00012
266             261     02 01050 00 4001 00034  AXES
267             262     01 50440 00 0001 00231  YSTART
270             263     00 02010 00 0001 00231  YRANGE
271             264     04 10700 04 0001 00230  YRANGE
272             265     01 40000 00 4001 00142  DECIMA
273             266     01 50400 00 4000 00070
274             267     01 01000 00 4400 00136  SAVE
275             270     20 40002 41 4000 77775
```

```
277                 272     01 01000 00 4400 00137      UNSAVE
300                 273     01 21700 00 0001 00217      YSCALE
301                 274     01 14501 00 0001 00217      YSTART
302                 275     01 02030 00 4000 04000
303                 276     01 01000 00 4001 00003      CLOGRI
304                 277     43 02010 00 4000 00144
305                 300     43 01050 00 4001 00001      CLOGRI
306                 301     01 01000 00 4001 00002      MINUS
307   CLOGRI        302     01 02030 00 4000 10000
310                 303     01 01000 00 4001 00004      OPGRID
311   MINUS         304     01 21700 00 0001 00224            0
312                 305     01 50011 00 0020 00042
313                 306     01 21700 00 0001 00223            0
314                 307     01 50011 20 0020 00043
315   OPGRID        310     01 02070 00 4000 20000
316                 311     01 21700 20 0001 00212            0
317                 312     01 01000 00 4001 00003      AXES
320                 313     01 50011 10 0020 00040
321                 314     01 21700 14 0001 00210            0
322                 315     01 50011 15 0020 00041
323   AXES          316     01 02030 00 4000 40000
324                 317     01 01000 00 4001 00004      NOLINE
325                 320     43 02010 00 0001 00207      YZNO
326                 321     01 01000 00 4001 00002      NOLINE
327                 322     30 20001 00 4001 00205      YZNO
330                 323     01 01000 00 4001 77757      MINUS
331   NOLINE        324     01 40021 10 4000 00001
332   MTEST         325     43 02010 77 0002 00000
333                 326     01 01000 00 4001 00011      SETUP
334                 327     47 10100 42 0001 00160      MADD
335                 330     20 10000 45 0401 00143      M
336                 331     01 50314 10 5000 00177
337                 332     01 01050 11 4001 00001
340                 333     20 45015 00 4040 77720
341                 334     01 50011 04 0020 00062
342                 335     02 50011 05 0020 00063
343                 336     47 21641 00 0001 77765      MTEST
344                 337     01 01005 00 4001 77763      NOLINE
345   SETUP         340     01 21700 00 0001 00144      ABS1
346                 341     01 50011 00 0020 00064
347                 342     01 21700 00 0001 00143      ABS2
350                 343     01 50011 10 0020 00065
351                 344     04 50215 00 0020 00040
352                 345     03 50215 00 0020 00064
353                 346     05 50215 00 0020 00041
354                 347     03 50315 00 0020 00065
355                 350     04 50215 00 0020 00042
356                 351     05 50215 00 0020 00043
357                 352     20 41110 42 4400 00116
360                 353     01 40027 00 4000 00100
361   CLEAR         354     00 20001 67 4004 00000
362                 355     01 21700 00 0001 00132      MADD
363                 356     01 21641 00 0001 77745      MTEST
364                 357     01 42005 00 4000 40000
365                 360     43 05150 63 4001 77676      LOOP10
366                 361     01 40004 00 4000 00013
367                 362     01 61010 73 4000 77776
370   XLINE         363     20 50440 41 0001 00132      XSTART
371                 364     00 02010 64 0001 00134      XRANGE
372                 365     04 10700 04 0001 00133      XRANGE
373                 366     01 40000 00 4001 00041      DECIMA
374                 367     01 40000 23 4400 00127
375                 370     01 21700 00 0001 00127      XSCALE
376                 371     01 10401 00 0001 00124      XSTART
377                 372     01 42006 00 4000 02000
```

```
401             374     01 40000 21 4400 00127
402             375     01 61010 00 0001 00117      YRANGE
403             376     03 40000 04 4400 00155
404             377     04 20001 00 4001 00063      Y1
405             400     05 20001 00 4001 00063      Y2
406             401     01 50440 00 0001 00117      XRANGE
407             402     01 40000 00 4400 00155
410             403     04 20001 00 4001 00065      X1
411             404     05 20001 00 4001 00065      X2
412             405     00 20100 00 4001 00051      RANGEL
413             406     01 21400 07 0001 00064      RANGEP
414             407     01 40000 00 4400 00126      XCWD
415             410     01 40001 00 4001 00063      M
416             411     00 40000 42 4400 00135
417             412     01 42004 00 4000 00002
420             413     01 43005 66 4500 77776
421             414     01 42000 66 4500 77776
422             415     01 50470 66 0100 77776
423             416     01 01000 00 4400 00137      UNSAVE
424             417     01 01000 00 4200 00000
425     TENSCL  420     01 50440 00 0001 00071          0
426             421     01 50450 00 0001 00065          0
427             422     00 43005 42 4000 77775
430             423     06 02110 62 0000 00005
431             424     04 10601 30 0000 00006
432             425     06 06550 22 0001 00105          0
433             426     04 16701 30 0000 00006
434             427     44 40000 47 4400 00152
435     DECIMA  430     01 50470 00 0001 00103          0
436             431     04 01110 00 4001 00001
437             432     01 50400 20 4000 00021
440             433     01 50400 00 4000 00020
441             434     02 50011 00 0000 00007
442             435     24 10400 00 0001 00077          0
443             436     01 10460 00 0001 00064          0
444             437     01 44010 14 4000 00001
445             440     01 45015 45 4000 00006
446             441     07 45062 07 4000 00006
447             442     01 50400 00 4000 00062
450             443     07 45061 07 4000 00006
451             444     00 20701 00 0000 00004
452             445     07 45020 07 4000 00006
453             446     04 10200 14 4000 00012
454             447     01 50010 00 0000 00007
455             450     01 45020 07 4000 00006
456             451     04 10200 14 4000 00012
457             452     01 50010 00 0000 00007
460             453     01 45020 07 4000 00006
461             454     04 10200 00 4000 00012
462             455     01 50011 00 0000 00007
463             456     01 01000 00 4200 00000
465     RANGEL  457     25 25252 52 5252 52525
466             460     54 64536 35 0575 37025
467             461     65 44616 35 0424 05325
470             462     62 42405 34 4254 17025
472     Y1      463     00 00000 00 0000 00000
474     Y2      464     00 00000 00 0000 00000
476             465     25 25252 52 5252 55464
477             466     53 63505 75 3702 54756
500             467     61 50715 65 5634 05325
501             470     62 42405 34 4254 17025
503     X1      471     00 00000 00 0000 00000
505     X2      472     00 00000 00 0000 00000
507     RANGEP  473     00 01440 10 0000 00000
511     M       474     00 00000 00 0000 00000
```

```
515   STRBIT   476      00 00000 00 4000 00000
522   MSPACE   477      00 00204 20 0000 00000
524   LENGTH   500      00 00000 00 0000 00000
526            501      00 00000 00 0000 00000
527            502      00 00000 00 0000 00000
530            503      00 00000 00 0000 00000
531            504      00 00000 00 0000 00000
532            505      00 00000 00 0000 00000
533            506      00 00000 00 0000 00000
534            507      01 00100 00 0000 00000
535            510      00 00000 00 0000 00000
536            511      00 00000 00 0000 00000
537            512      01 01200 00 0000 00000
540            513      00 00000 00 0000 00000
541            514      00 00000 00 0000 00000
542            515      00 00000 00 0000 00000
543            516      00 00000 00 0000 00000
544            517      00 00000 00 0000 00000
545            520      00 00000 00 0000 00000
546            521      00 00000 00 0000 00000
547            522      01 31000 00 0000 00000
550            523      06 00000 00 0000 00000
551            524      00 20010 00 4002 00100
552            525      04 00200 10 0040 02001
553            526      00 20000 00 0000 00000
554            527      01 00200 00 0000 00000
555            530      00 00000 00 0000 00000
556            531      00 17767 77 3775 77677
557            532      73 77577 67 7737 75776
560            533      01 01177 75 7473 31055
561            534      25 25252 52 5252 52500
562            535      76 04061 11 5645 70651
```

216 PRINTER BAR GRAPH

224 / 225 STRIP CHART PLOTS

FLOVC (*224) and FIXVC (*225)

Floating Point Vector Chart

Fixed Point Vector Chart

PURPOSE: To plot a vector at high speed on the strip-chart recorder.

OUTPUT: A printed decimal statement of the minimum and maximum values of the vector; and a strip-chart record at any speed. The points are brought out at an interval given in msec by the indicator lights. The present version starts and stops the strip chart recorder automatically. The chart speed must be set manually.

CALLING SEQUENCE: B1 must be set to the codeword address of the vector to be plotted. The strip-chart recorder should be in motion before executing the program.

REGISTERS USED: Uses all A and B registers. Restores B1,2,3,4,5, 6.PF, T4,5,6.

SUPPORTING ROUTINES:

PM	(*116)
SETPM	(*127)
SAVE	(*136)
UNSAVE	(*137)

LENGTH:

*224	56 octal
*225	53 octal

Pat Groves
Garry Sitton
July 1963

DeBremaecker
November 1965

```
                                                                    1
224             ORG                                                 2
                REM             FLOATING POINT VECTOR CHART         3
                REM             SET IL = NO. OF MSEC. DELAYS.
                REM             GROVES, SITTON, SIBERT              5
                                                                    6
          Z     BAU+2           SL,B6+1                             7
FLOVC     -Z    TRA             *SAVE,U→R                           10
                LDR             B1,R→B2                             11
                LLS             a+15,U→B5                           12
                LLS             a+15,U→PF                           13
          PF    LDR             a3,U→PF                             14
                AB2             aPF=1                               15
          B5    SLN             a3,U→B1                             16
                LT4             B1+B2                               17
                LT5             B1+B2,B1=1                          20
SCAN            LT6             B1+B2,B1=1                          21
          T4    IF(POS)SKP      T5                                  22
          T6    STO             T4                                  23
          T5    IF(NEG)SKP      T5                                  24
          T6    STO             T5                                  25
          P1    IF(PNZ)TRA      SCAN                                26
                71010           a7                                  27
          T4    STO             B6,B6+1                             30
          T5    STO             B6,B6+1                             31
          IZI   SB1             3,U→B3                              32
          T5    TSR             *SETPM,U→T7                         33
          IZI   61010           RANGE,U→B1                          34
          S     TSR             *SETPM,U→T7                         35
                LT7             B6-2,B1+1                           36
                TSR             *SETPM,B1+1                         37
                TSR             *SETPM,B1-1                         40
                LT5             B6-1,B6-1                           41
                LT4             B6-1,B6-1                           42
          IZI   61010           a7,U→B1                             43
          T4    FAD             T5,U→T6                             44
          T4    FSB             T5                                  45
                FMP             a1.0001,U→T5                        46
          Z     BAU             IL                                  47
                AND             a77,U→B4                            50
                IF(NZE)TRA      aCC+1                               51
                SB4             a1                                  52
PLOT            CLA             B2+B1                               53
                FAD             U                                   54
                FSB             T6                                  55
                FDV             T5                                  56
                FAD+40          MZEXP                               57
                SB3,ERM         a34                                 60
                WAT             a7,B3-1                             61
                PLT             a7                                  62
          P1    IF(POS)SKP      a35,B1+1                            63
                TRA             PLOT                                64
                TRA             *UNSAVE                             65
                71001           a7                                  66
                SLF             a3,B6-1                             67
          FF    SLN             a+36,U→CC                           70
                                                                    71
MZEXP           OCT             770000000000000000                  72
RANGE           BCD             ≤ RANGE ≤                           73
```

```
SAVE                EQU     136                                     74
SETPM               EQU     137                                     75
UNSAVE              EQU     137                                     76
                                                                    77
                    END                                             100
                                                                    101
```

FLOATING POINT VECTOR CHART
SET IL = NO. OF MSEC. DELAYS.
GROVES, SITTON, SIBERT

```
                    1     00 20100 26 0000 77770
        FLOVC       2     10 01000 02 4400 00136      SAVE
                    3     01 50400 52 0002 00000
                    4     01 45062 45 4000 00017
                    5     01 45062 47 4000 00017
                    6     47 45010 47 4000 00003
                    7     01 41002 00 4200 77776
                   10     45 42000 41 4000 00002
                   11     01 50440 00 0006 00000
                   12     01 50450 61 0006 00000
        SCAN       13     01 50460 61 0006 00000
                   14     04 02110 00 0000 00006
                   15     06 20001 00 4000 00004
                   16     05 02510 00 0000 00006
                   17     06 20001 00 4000 00005
                   20     41 05150 00 4001 77771      SCAN
                   21     01 71010 00 4000 00000
                   22     04 20001 26 4100 00000
                   23     05 20001 26 4100 00000
                   24     20 40001 43 4000 00003
                   25     05 40000 07 4400 00127      SETPM
                   26     20 61010 41 0001 00035      RANGE
                   27     03 40000 07 4400 00127      SETPM
                   30     01 50470 21 0100 77775
                   31     01 40000 21 4400 00127      SETPM
                   32     01 40000 61 4400 00127      SETPM
                   33     01 50450 66 0100 77776
                   34     01 50440 66 0100 77776
                   35     20 61010 41 4000 00000
                   36     04 10400 06 0000 00005
                   37     04 10500 00 0000 00005
                   40     01 10600 05 0001 00024      +0000A
                   41     00 20100 00 0000 77771
                   42     01 50314 44 4000 00077
                   43     01 01050 00 4001 00001
                   44     01 40004 00 4000 00001
        PLOT       45     01 21700 00 0006 00000
                   46     01 10400 00 0000 00001
                   47     01 10500 00 0000 00006
                   50     01 10700 00 0000 00005
                   51     01 10440 00 0001 00011      MZEXP
                   52     01 40023 00 4020 00000
                   53     01 71100 63 4000 00000
                   54     01 67000 00 4000 00000
                   55     41 02110 21 4040 00000
                   56     01 01000 00 4001 77765      PLOT
                   57     01 01000 00 4400 00137      UNSAVE
                   60     01 71001 00 4000 00000
                   61     01 42004 66 4000 00002
                   62     47 42000 40 4500 00000
        MZEXP      63     77 00000 00 0000 00000
        RANGE      64     73 25414 05 5464 42573
*****
        +0000A     65     01 00100 00 3215 56135
```

314	FLOVC	0	2	3	2000000000000000	0
315	SAVE	0	136	0	1050000000000000	0
316	SCAN	0	13	1	3100000000000000	0
317	SETPM	0	127	0	1060000000000000	0
320	RANGE	0	64	1	1040000000000000	0
321	+0000A	0	65	1	1110000000000000	0
322	PLOT	0	45	1	6300000000000000	0
323	MZEXP	0	63	1	1020000000000000	0
324	UNSAVE	0	137	0	1070000000000000	0

FLOATING POINT VECTOR CHART
SET IL = NO. OF MSEC. DELAYS.
GROVES, SITTON, SIBERT

```
                    1     00 20102 26 0000 77770
        FLOVC       2     10 01000 02 4400 00136      SAVE
                    3     01 50400 52 0002 00000
                    4     01 45062 45 4000 00017
                    5     01 45062 47 4000 00017
                    6     47 45010 47 4000 00003
                    7     01 41002 00 4200 77776
                   10     45 42000 41 4000 00002
                   11     01 50440 00 0006 00000
                   12     01 50450 61 0006 00000
        SCAN       13     01 50460 61 0006 00000
                   14     04 02110 00 0000 00006
                   15     06 20001 00 4000 00004
                   16     05 02510 00 0000 00006
                   17     06 20001 00 4000 00005
                   20     41 05150 00 4001 77771      SCAN
                   21     01 71010 00 4000 00000
                   22     04 20001 26 4100 00000
                   23     05 20001 26 4100 00000
                   24     20 40001 43 4000 00003
                   25     05 40000 07 4400 00127      SETPM
                   26     20 61010 41 0001 00035      RANGE
                   27     03 40000 07 4400 00127      SETPM
                   30     01 50470 21 0100 77775
                   31     01 40000 21 4400 00127      SETPM
                   32     01 40000 61 4400 00127      SETPM
                   33     01 50450 66 0100 77776
                   34     01 50440 66 0100 77776
                   35     20 61010 41 4000 00000
                   36     04 10400 06 0000 00005
                   37     04 10500 00 0000 00005
                   40     01 10600 05 0001 00024      +0000A
                   41     00 20100 00 0000 77771
                   42     01 50314 44 4000 00077
                   43     01 01050 00 4001 00001
                   44     01 40004 00 4000 00001
        PLOT       45     01 21700 00 0006 00000
                   46     01 10400 00 0000 00001
                   47     01 10500 00 0000 00006
                   50     01 10700 00 0000 00005
                   51     01 10440 00 0001 00011      MZEXP
                   52     01 40023 00 4020 00000
                   53     01 71100 63 4000 00000
                   54     01 67000 00 4000 00000
                   55     41 02110 21 4040 00000
                   56     01 01000 00 4001 77765      PLOT
                   57     01 01000 00 4400 00137      UNSAVE
                   60     01 71001 00 4000 00000
                   61     01 42004 66 4000 00002
                   62     47 42000 40 4500 00000
        MZEXP      63     77 00000 00 0000 00000
        RANGE      64     73 25614 05 5464 42573
*********
        +0000A     65     01 00100 00 3215 56135
```

314	FLOVC	0	2	3	2000000000000000	0
315	SAVE	0	126	0	1050000000000000	0
316	SCAN	0	13	1	3100000000000000	0
317	SETPM	0	127	0	1060000000000000	0
320	RANGE	0	64	1	1040000000000000	0
321	+0000A	0	65	1	1110000000000000	0
322	PLOT	0	45	1	6300000000000000	0
323	MZEXP	0	63	1	1020000000000000	0
324	UNSAVE	0	127	0	1070000000000000	0

FIXED POINT VECTOR CHART
SET IL = NO. OF MSEC. DELAYS.
GROVES, SITTON

```
          1      00 20102 26 0000 77770
FLOVC     2      10 01000 02 4400 00136     SAVE
          3      01 50400 52 0002 00000
          4      01 45062 45 4000 00017
          5      01 45062 47 4000 00017
          6      47 45010 47 4000 00003
          7      01 41002 00 4200 77776
         10      45 42000 41 4000 00002
         11      01 50440 00 0006 00000
         12      01 50450 61 0006 00000
SCAN     13      01 50460 61 0006 00000
         14      04 02110 00 0000 00006
         15      06 20001 00 4000 00004
         16      05 02510 00 0000 00006
         17      06 20001 00 4000 00005
         20      41 05150 00 4001 77771     SCAN
         21      01 71010 00 4000 00000
         22      04 20001 26 4100 00000
         23      05 20001 26 4100 00000
         24      20 40001 43 4000 00003
         25      05 40000 07 4400 00127     SETPM
         26      20 61010 41 0001 00033     RANGE
         27      03 40000 07 4400 00127     SETPM
         30      01 50470 21 0100 77775
         31      01 40000 21 4400 00127     SETPM
         32      01 40000 61 4400 00127     SETPM
         33      01 50450 66 0100 77776
         34      01 50440 66 0100 77776
         35      20 61010 41 4000 00000
         36      04 10000 06 0000 00005
         37      04 10100 00 0000 00005
         40      01 10000 05 4000 00001
         41      00 20100 00 0000 77771
         42      01 50314 44 4000 00077
         43      01 01050 00 4001 00001
         44      01 40004 00 4000 00001
PLOT     45      01 21700 00 0006 00000
         46      01 10000 00 0000 00001
         47      01 10100 00 0000 00006
         50      01 10300 00 0000 00005
         51      01 40023 00 4020 00000
         52      01 71100 63 4000 00000
         53      01 67000 00 4000 00000
         54      41 02110 21 4040 00000
         55      01 01000 00 4001 77766     PLOT
         56      01 01000 00 4400 00137     UNSAVE
         57      01 71001 00 4000 00000
         60      01 42004 66 4000 00002
         61      47 42000 40 4500 00000
RANGE    62      73 25414 05 5464 42573
*********
```

314	FLUVC	0	2	3	1700000000000000	0
315	SAVE	0	136	0	1010000000000000	0
316	SCAN	0	13	1	3000000000000000	0
317	SETPM	0	127	0	1020000000000000	0
320	RANGE	0	42	1	1000000000000000	0
321	PLOT	0	45	1	6200000000000000	0
322	UNSAVE	0	137	0	1030000000000000	0

251 / 255 HEXAD LISTER

April 29, 1963

HEXAD LISTER
for use with AP1 editor, reproducer, and verifier

*253, PRINT

PRINT offers a listing facility compatible with the AP1 lister system. Execution of *253 produces a HTR for loading of a tape to be processed. A "CONTINUE" from this point causes the tape to be read and listed with every hexad accounted for as outlined below. The following characters print normally:

Numerals	×	*
Upper case letters	=	,
+	<	→
-	≤	(
/	|	)

Lower case letters print as the corresponding upper case letters.

∘ prints as ,	λ prints as 4
# prints as 3	σ prints as 5
∏ prints as ←PI←	α prints as 6
π prints as ←PI←	β prints as 7
Σ prints as ×	γ prints as 8
	Δ prints as 9

carriage return	causes printing of t line and true return to the left margin (lines longer than 108 characters return to print position 28)

tab	prints as	←TAB←
backspace	prints as	←BKSP←
space	prints as	←SP←
upper case	prints as	←UC←
lower case	prints as	←LC←
subscript	prints as	←SUB←
superscript	prints as	←SUP←
stop code	prints as	←STPCODE←

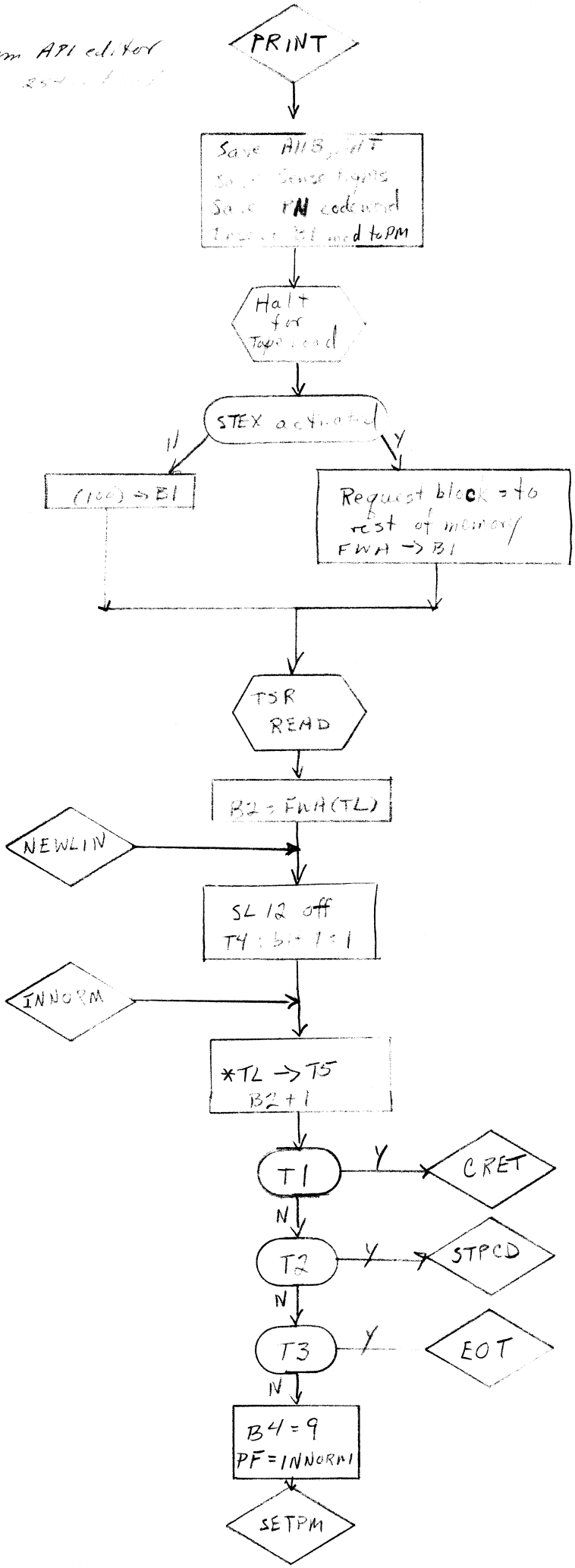
Any other hexas prints as its triad pair bracketed by arrows. Thus, the hexad 30 prints as ←30←.

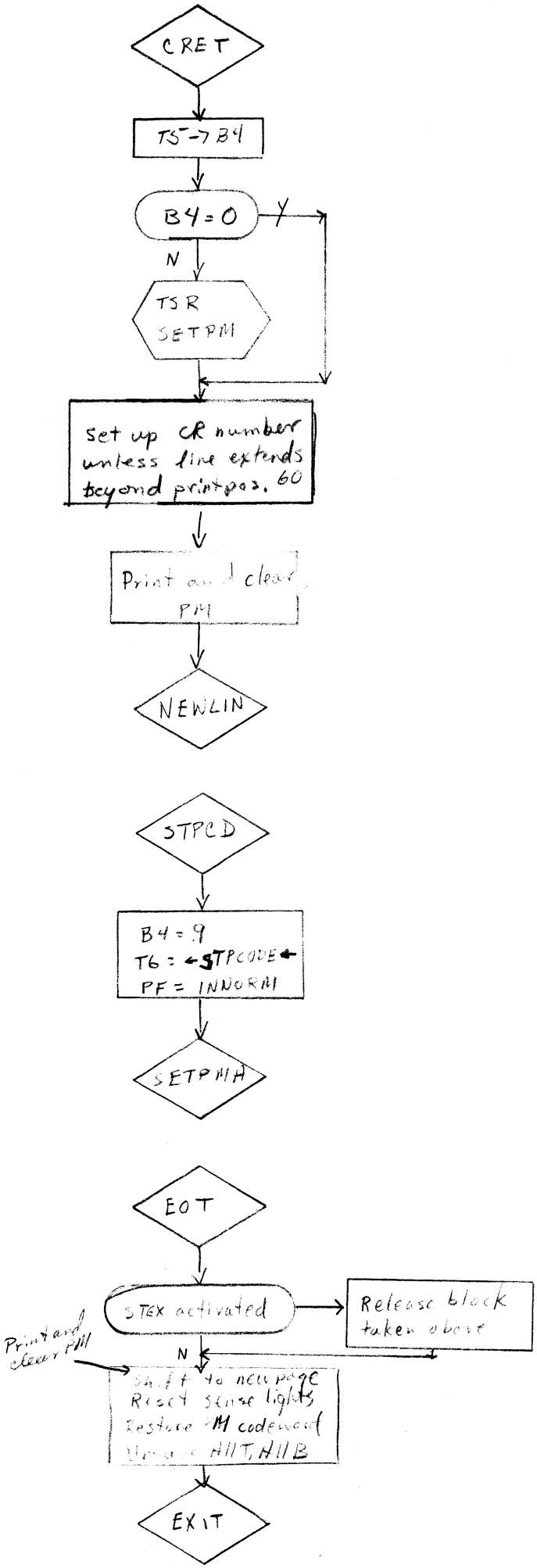
PRINT is compatible with activated STEX. It assumes upper case until the first case punch is encountered unless SL 11 is turned on when the tape to be listed is loaded.

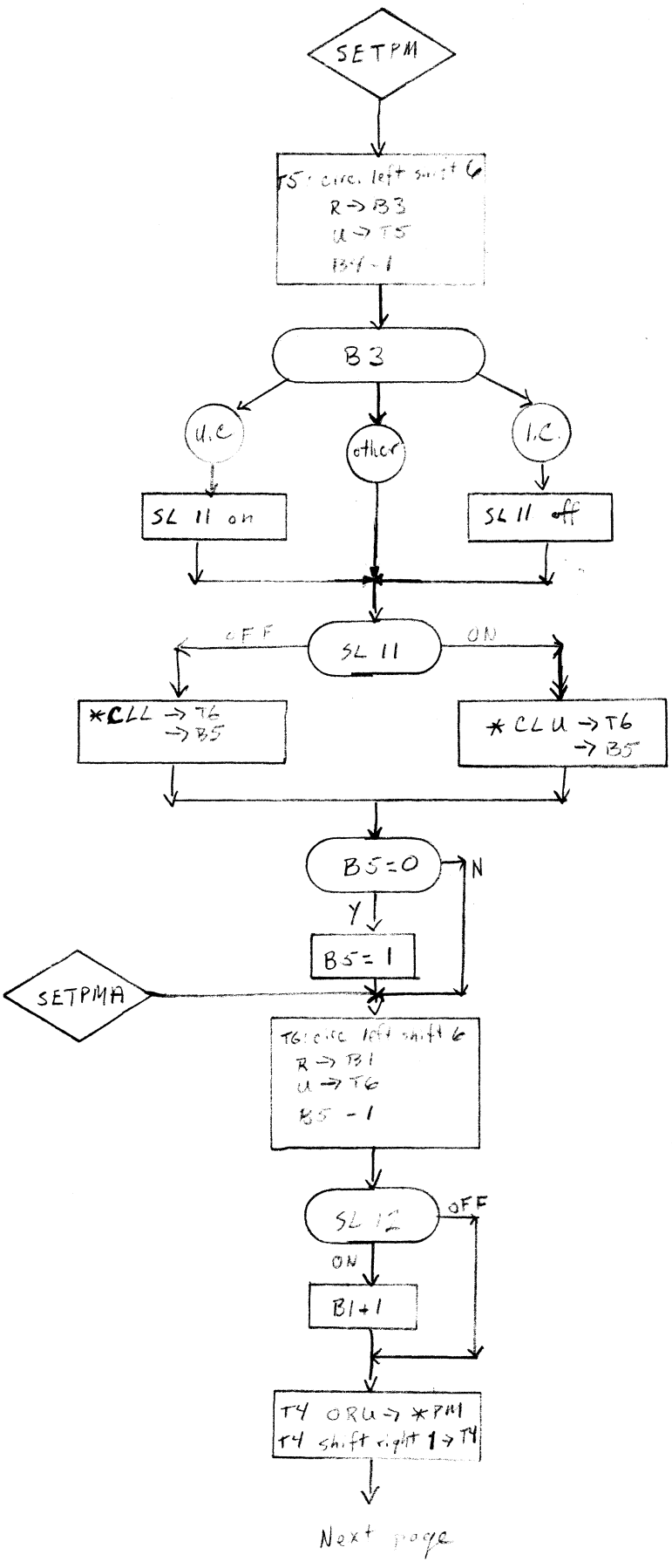
The routine uses the read routine from the AP1 editor (*251) and its own character tables (*254 and *255).

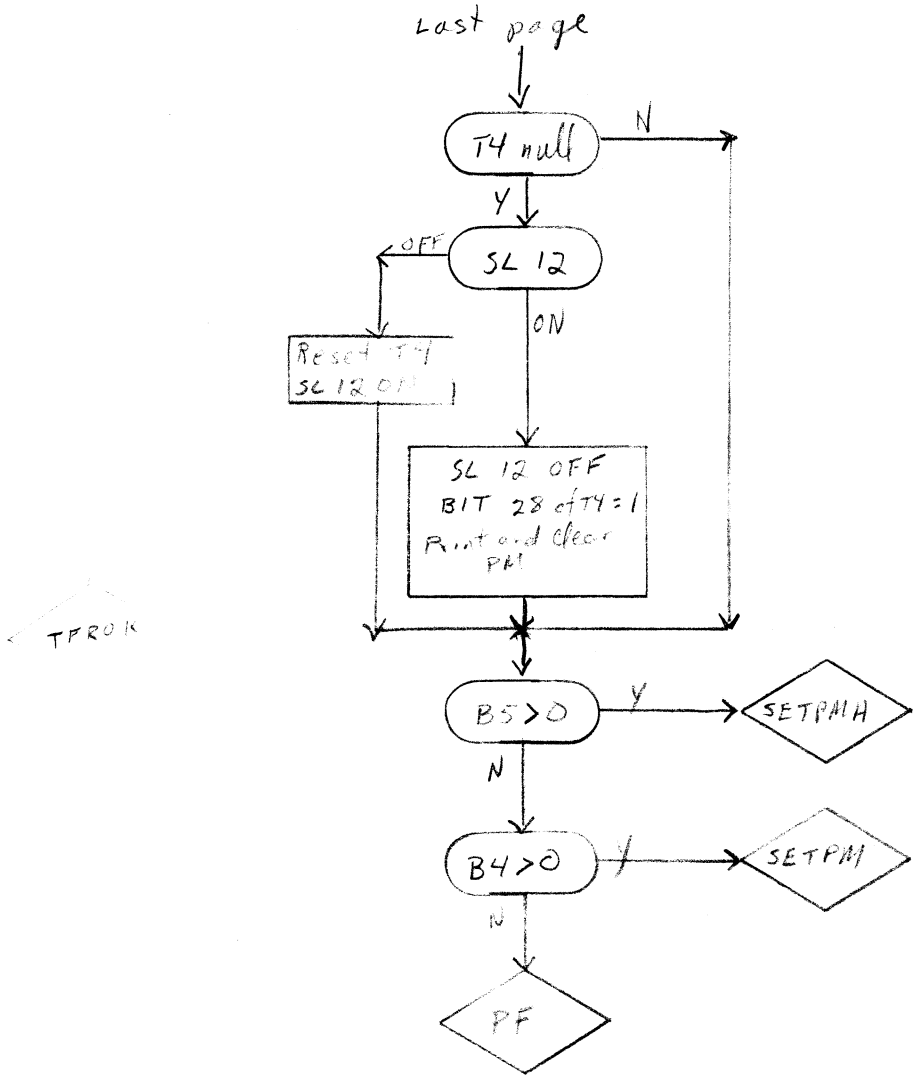
* 253, PRINT

Uses *251, READ from API editor




CRET
TS⁻→B4
B4=0
Y
N
TSR
SETPM
set up CR number unless line extends beyond printpos. 60
Print and clear PM
NEWLIN
STPCD
B4=9
T6=←STPCODE←
PF=INNORM
SETPMH
EOT
STEX activated
Release block taken above
Print and clear PM
N
Shift to new page
Reset sense lights
Restore PM codeword
Update HIIT, HIIB
EXIT


SETPM
T5 circ. left shift 6
R → B3
U → T5
B4 - 1
B3
U.C
other
I.C.
SL 11 on
SL 11 off
OFF
SL 11
ON
*CLL → T6
→ B5
*CLU → T6
→ B5
B5=0
N
Y
B5 = 1
SETPMA
T6 circ left shift 6
R → B1
U → T6
B5 - 1
SL 12
OFF
ON
B1+1
T4 ORU → *PM
T4 shift right 1 → T4
Next page


Last page
T4 null
N
Y
OFF
SL 12
ON
Reset T4
SL 12 OFF
SL 12 OFF
BIT 28 of T4 = 1
Print and clear
PM
TPROK
B5 > 0
Y
SETPMH
N
B4 > 0
Y
SETPM
N
PF

```
00251                ORG                                                    1
                     REM                 TAPE DUPLICATOR                    2
                     REM                 READ ROUTINE                       3
READ          PF     RPA                 EXIT                               4
                     IF(NTG)TRA          CC,                                5
                     CLA                 MASK,U→T4                          6
              CC     SB1                 B1,U→PF                            7
HEXZER        Z      STX                 a77771,U→B3                        10
              Z      SB2                 Z,U→T5                             11
RDHEX         T4     STO                 T6,                                12
              T4     RHX+41              T6                                 13
                     IF(MOV)TRA          TAG3                               14
              T4     SYD                 T6,R→Z                             15
                     IF(NUL)TRA          TAG2,R→Z                           16
              T6     IF(NUL)SKP          a24,                               17
                     TRA                 ORHEX,                             20
TAG1                 IF(SLF)SKP          2                                  21
                     TRA                 ORHEX                              22
                     CLA                 TAGLST+1,U→T6                      23
                     TRA                 LFTNRM,                            24
TAG2                 CLA                 TAGLST+2,U→T6                      25
                     TRA                 LFTNRM,                            26
MASK                 OCT                 770000000000000000                 27
ORHEX         T5     LUL                 a6,R→Z                             30
                     ORU                 T6,B2+1                            31
                     STO                 T5,B3+X                            32
              B2     IF(ZER)SKP          ad9,                               33
                     TRA                 RDHEX,                             34
                     CLA                 TAGLST,U→T6                        35
                     TRA                 SENSE,                             36
LFTNRM               CLA                 a1B3+d54),U→B3                     37
              T5     LUL                 B3,U→T5                            40
              B2     ORU→                T5,                                41
SENSE                IF(SLF)SKP          a1,                                42
                     TRA                 CHECK,                             43
              T6     ORU                 STOCOD,                            44
                     STO                 STORE,                             45
STORE                OCT                 0                                  46
LOCINC               TRA                 PF,B1+1                            47
STCOOD        T5     STO                 B1,                                50
CHECK         T6     LUR                 a3,                                51
                     ORU                 TSTCOD,R→Z                         52
                     STO                 TEST                               53
TEST                 OCT                 0                                  54
                     HTR                 LOCINC                             55
TSTCOD        T5     IF(NUL×NMO)JMP      B1,                                56
TAGLST               OCT                 000004000000000000                 57
                     OCT                 000001000000000000                 60
                     OCT                 000002000000000000                 61
                     OCT                 000003000000000000                 62
TAG3                 CLA                 TAGLST+3,U→T6                      63
                     TSR                 LFTNRM                             64
EXIT                 TRA                 Z                                  65
                     END                                                    66
                                                                            67
                                                                            70
```

2220	READ	0	1	0	10000000000000	0
2221	EXIT	0	62	0	100000000000000	0
2222	MASK	0	24	0	34000000000000	0
2223	HEXZER	0	5	0	14000000000000	0
2224	RDHEX	0	7	0	16000000000000	0
2225	TAG3	0	60	0	76000000000000	0
2226	TAG2	0	22	0	31000000000000	0
2227	ORHEX	0	25	0	35000000000000	0
2230	TAG1	0	16	0	25000000000000	0
2231	TAGLST	0	54	0	67000000000000	0
2232	LFTNRM	0	34	0	44000000000000	0
2233	SENSE	0	37	0	47000000000000	0
2234	CHECK	0	46	0	57000000000000	0
2235	STOCOD	0	45	0	56000000000000	0
2236	STORE	0	43	0	54000000000000	0
2237	LOCINC	0	44	0	55000000000000	0
2240	TSTCOD	0	53	0	65000000000000	0
2241	TEST	0	51	0	63000000000000	0

TAPE DUPLICATOR
READ ROUTINE

10	READ	1	472160100000100060	3	EXIT
11		2	10100400400100000	0	
12		3	12170004000100020	2	MASK
13		4	434000147400200000	0	
14	HEXZER	5	4300543400077771	1	
15		6	4000205400000000	0	
16	RDHEX	7	42000100400000006	1	
17		10	46014100400000006	0	
20		11	10120000400100046	2	TAG3
21		12	45322010000000006	0	
22		13	10104010400100006	2	TAG2
23		14	60204000400000024	0	
24		15	10100000400100007	2	ORHEX
25	TAG1	16	10207000400000002	1	
26		17	10100000400100005	2	ORHEX
27		20	12170006000100034	2	TAGLST
30		21	10100000400100012	2	LFTNRM
31	TAG2	22	12170006000100033	3	TAGLST
32		23	10100000400100010	2	LFTNRM
34	MASK	24	770000000000000000	1	
35	ORHEX	25	54502010400000006	1	
36		26	15001022000000006	0	
37		27	12000133400000005	0	
40		30	430201000400000011	0	
41		31	10100000400177754	2	RDHEX
42		32	12170006000100021	2	TAGLST
43		33	10100000400100003	2	SENSE
44	LFTNRM	34	12170043601000066	1	
45		35	54502005401000000	0	
46		36	435001100000000005	0	
47	SENSE	37	10207000400000001	1	
50		40	10100000400100005	2	CHECK
51		41	65001000000100003	2	STOCOD
52		42	12000100400177777	2	STORE
54	STORE	43	0	1	
55	LOCINC	44	10100021420000000	1	
56	STOCOD	45	52000100400200000	1	
57	CHECK	46	64501000400000003	1	
60		47	15001010000100003	2	TSTCOD
61		50	12000100400177777	2	TEST
63	TEST	51	0	1	
64		52	10000000400177770	2	LOCINC
65	TSTCOD	53	30764000000200000	1	
67	TAGLST	54	4000000000000	1	

71		55	1000000000000	0	
73		56	2000000000000	0	
75		57	3000000000000	0	
76	TAG3	60	1217000600177775	3	TAGLST
77		61	1400000400177751	2	LFTNRM
100	EXIT	62	1010000400000000	1	

```
         +.000000000254 PRINT                 4537   100 12821
77777     0                     1

    1     0   10000000000000001
    2     0   20000000000000001
    3     0   30000000000000001
    4     0   40000000000000001
    5     0   50000000000000001
    6     0   60000000000000001
    7     0   70000000000000001
   10     0  100000000000000001
   11     0  110000000000000001
   12     0  755750750000000004
   13     0  750103750000000004
   14     0  756357750000000004
   15     0  750105750000000004
   16     0  750104750000000004
   17     0  750107750000000004
   20     0  200000000000000001
   21     0  210000000000000001
   22     0  756364577500000005
   23     0  756364417500000005
   24     0  754361750000000004
   25     0  756340417500000005
   26     0  754153625770000006
   27     0  750307750000000004
   30     0  750300750000000004
   31     0  750301750000000004

   32     0  750302750000000004
   33     0  750303750000000004
   34     0  750304750000000004
   35     0  350000000000000001
   36     0  360000000000000001
   37     0  370000000000000001
   40     0  400000000000000001
   41     0  410000000000000001
   42     0  420000000000000001
   43     0  430000000000000001
   44     0  440000000000000001
   45     0  450000000000000001
   46     0  460000000000000001
   47     0  470000000000000001
   50     0  500000000000000001
   51     0  510000000000000001
   52     0  520000000000000001
   53     0  530000000000000001
   54     0  540000000000000001
   55     0  550000000000000001
   56     0  560000000000000001
   57     0  570000000000000001
   60     0  600000000000000001
   61     0  610000000000000001
   62     0  620000000000000001

   63     0  630000000000000001
   64     0  640000000000000001
   65     0  650000000000000001
   66     0  660000000000000001
   67     0  670000000000000001
   70     0  700000000000000001
   71     0  710000000000000001
   72     0  720000000000000001
   73     0  750703750000000004
   74     0  756442750000000004
   75     0  750705750000000004
```

77 0 750707750000000004

```
77777    0 [illegible]

    1    0 [illegible]
    2    0 [illegible]
    3    0  30000000000000001
    4    0  40000000000000001
    5    0  50000000000000001
    6    0  60000000000000001
    7    0  70000000000000001
   10    0 100000000000000001
   11    0 110000000000000001
   12    0 [illegible]
   13    0 [illegible]
   14    0 [illegible]
   15    0 [illegible]
   16    0 [illegible]
   17    0 [illegible]
   20    0 [illegible]
   21    0 [illegible]
   22    0 [illegible]
   23    0 [illegible]
   24    0 [illegible]
   25    0 [illegible]
   26    0 [illegible]
   27    0 [illegible]
   30    0 [illegible]
   31    0 [illegible]

   32    0 [illegible]
   33    0 [illegible]
   34    0 [illegible]
   35    0 [illegible]
   36    0 [illegible]
   37    0 [illegible]
   40    0 [illegible]
   41    0 [illegible]
   42    0 [illegible]
   43    0 [illegible]
   44    0 [illegible]
   45    0 [illegible]
   46    0 [illegible]
   47    0 [illegible]
   50    0 [illegible]
   51    0 [illegible]
   52    0 [illegible]
   53    0 [illegible]
   54    0 [illegible]
   55    0 [illegible]
   56    0 [illegible]
   57    0 [illegible]
   60    0 [illegible]
   61    0 [illegible]
   62    0 [illegible]

   63    0 [illegible]
   64    0 [illegible]
   65    0 [illegible]
   66    0 [illegible]
   67    0 [illegible]
   70    0 [illegible]
   71    0 [illegible]
   72    0 [illegible]
   73    0 [illegible]
   74    0 [illegible]
   75    0 [illegible]
```

77 0 75070775000000004

211 DEC PRINT

ROUTINE 211 - DECPRN

Purpose: To convert floating point or integer machine numbers to decimal (fixed point to integer, respectively), set up the print matrix in a columnar format specified by the user, print, and clear the print matrix.

Storage: 156_8 words.

Supporting Routines: S- or M-SPIREL.

Registers Used: B3, T7, Sense Light 14 and 15.

Sense Light Options:

SL14 OFF — Clear print matrix, convert numbers and print with PRN order, clear print matrix.

ON — Do not clear print matrix upon entrance, set up one line of data, do not print, exit.

SL15 ON — Restore page upon entrance.

Columnar Format Control: Three triads of information are required for each column:

Two triads giving the number (in octal) of printer positions to space the right-most-integer position (r.m.i.p.) of the column relative to the r.m.i.p. of the previous column to the left. For column 1, the r.m.i.p. of the previous column is taken to be printer position one.

One triad giving the number of decimal places, with rounding, to be printed (0,1,...,7).

This information is to be stored, six columns to a word in the body of the user's program, immediately following the transfer to *211. The last word of this information must be all zeroes.

Thus, the CALLING SEQUENCE is:

```
SB3     no. of columns specified by format
CLA     codeword of vector to be dumped, U→T7
TSR     *211
(FORMAT)
```

If the data to be dumped is not a vector, enter with bits 1-15 of T7 equal to the number of pieces to be dumped and bits 40-54 of T7 equal to the first word address - 1 of the data.

Thus, to restore the page and print vector *232 with columns, 1 decimal place, 10 spaces between columns, beginning 20 spaces to the right of position one, the calling sequence will be:

```
        SB3     7
        CLA     232, U→T7
        SLN     00001
        TSR     *211
        OCT     201 101 101 101 101 101
        OCT     101 000 000 000 000 000
        OCT     000 000 000 000 000 000
[Control returns here]
```

To set up, but not print the first 10 words of this vector only, with the same format:

```
        SB3     12
B3      LUL     d39
        BAU     232, U→T7
        SLN     00002
        TSR     *211
        OCT     201 101 101 101 101 101
        OCT     101 101 101 101 000 000
        OCT     Z
```

Notes: Floating point numbers will always be printed with a decimal point (even if the format specifies zero decimal places), unless sense light 13 is locked on.

The numerical conversion portion of DECPRN was written by Dr. J.E. Kilpatrick.

Author: Peter A. Freeman
July 20, 1962

```
                                                                        1
211                 ORG                                                 2
                    REM             DECPRN                              3
                -Z  TRA             a*136,U→R                           4
                Z   STO             SAVWD,R→Z                           5
                    BAU+2           77770,R→B2                          6
MORE                CLA             PF+B2,B2+1                          7
                    IF(NUL)TRA      aJUMP                               10
                    TRA             aMORE                               11
JUMP            B2  RPA             ENDD,B6+1                           12
                T7  RPA             DATA                                13
                T7  LUR             a39,U→T5                            14
                    IDV             a3,U→B2                             15
                T5  RPA             ENDTST                              16
                R   IF(ZER)SKP      aZ                                  17
                    AB2             a1                                  20
                B2  STO             ROW                                 21
                Z   IF(SLF)SKP      a1,U→B1                             22
                    PAG             aZ                                  23
                    CLA             116,R→Z                             24
                    RPA             SETPM,R→B5                          25
                    SUB             a1                                  26
                    RPA             ZSTO1                               27
                    RPA             ZSTO2                               30
                1Z1 IF(SLF)SKP      a2,U→B2                             31
                    TRA             aNOCLR                              32
                Z   SB4,ERM         a200,I→B3                           33
ZSTO1               STO             B2+Z,B4-1                           34
                B3  TRA             aCC+1                               35
START               CLA             a50                                 36
                    RPA             CLEAR                               37
NOCLR               CLA             SAVWD                               40
                    IF(NUL)TRA      aCC-1,CC+1                          41
                    CLA             PF+B2-1,B2+1                        42
                    IF(NUL)TRA      aFINISH,U→R                         43
                Z   LLS             a6                                  44
                    ADD             a35,U→B5                            45
                Z   LLS             a3,U→B3                             46
                R   STO             SAVWD,B1+1                          47
ENDTST          B1  IF(NEG)SKP      a(Z)                                50
                    TRA             aFINISH                             51
                B3  LT4             *DATA,U→B4                          52
                T4  SLF             a14,U→R                             53
                    IF(PSN)TRA      aPOSINT                             54
                1T41 IF(ZER)TRA     aPOSINT,U→T4                        55
                    SLN             a10                                 56
POSINT          Z   LLS             a6                                  57
                    IF(NZE)TRA      aNONZER                             60
                    SLN             a4                                  61
                    TRA             aZERO                               62
NONZER              LT7             HALF                                63
TEST            B3  IF(ZER)TRA      aSKIP                               64
                T7  FMP             TENTH,U→T7                          65
                    TRA             aTEST,B3-1                          66
SKIP                SB3             aB4                                 67
                T7  FAD+            T4,U→R                              70
                Z   LLS             a6                                  71
                    LUL             a3,U→B4                             72
                    SUB             a400                                73
                    IF(POS)TRA      aLEAP                               74
                Z   LLS             aB4+1,U→T4                          75
                    LRR             a7,R→T5                             76
                    TRA             aZERO                               77
LEAP            B4  LUL             a6,U→B4                             100
                -B4 LUR             a6,U→B4                             101
```

```
ZERO        IZI     LT5         R+U+R                   103
            Z       CRR         aB5+1,R+T7              104
                    STO         T6                      105
STOLP       T4      IDV         a12,U+T4                106
                    LRL         a1,R+B4                 107
            T6      ORU+        *SETPM,B4+1             110
            T7      ORU+        *SETPM                  111
                    LDR         T7                      112
            T6      LLS         a1,U+T6                 113
            T4      IF(NZE)TRA  aSTOLP,R+T7             114
                    IF(SLN)SKP  a10                     115
                    TRA         aNONEG                  116
                    SB4         a42                     117
            T6      ORU+        *SETPM,B4+1             120
            T7      ORU+        *SETPM                  121
NONEG               IF(SLF)SKP  a4                      122
                    TRA         aNOCLR                  123
            IZI     SB4         a46,U+R                 124
            Z       CRR         aB5+2,U+T6              125
                    ORU+        *SETPM,B4+1             126
            R       ORU+        *SETPM,R+T7             127
AGAIN       B3      IF(ZER)TRA  aNOCLR                  130
            T5      MPY         a12,R+T5                131
                    LUL         a1,U+B4                 132
            T6      LDR         T7,B3-1                 133
                    LRS         a1,U+T6                 134
                    ORU+        *SETPM,B4+1             135
            R       ORU+        *SETPM,R+T7             136
                    TRA         aAGAIN                  137
FINISH      B2      IF(SLF)SKP  a2,U+T7                 140
                    TRA         aLEAVE                  141
            IZI     PRN         *116,U+B2               142
CLEAR       Z       SB4,ERM     a(Z),U+B5               143
ZSTO2               STO         B2+Z,B4-1               144
            -IZI    ADD+        ROW                     145
                    SLF         a14                     146
                    IF(PNZ)TRA  aSTART                  147
LEAVE               SLF         a77777                  150
                    SLN         a*B6-1,B6-1             151
                    TRA         a*137                   152
ENDD                TRA         aPF+Z                   153
HALF                DEC         0.5                     154
TENTH               DEC         0.1                     155
SETPM               OCT         2000000                 156
DATA                OCT         200000                  157
ROW                 OCT         Z                       160
SAVWD               OCT         Z                       161
                    END                                 162
                                                        163
```

301	SAVWD	0	156	0	1670000000300000	0
302	MORE	0	4	0	700000003000000	0
303	JUMP	0	7	0	1200000003000000	0
304	ENDD	0	150	0	1530000000300000	0
305	DATA	0	154	0	1630000000300000	0
306	ENDTST	0	45	0	500000000300000	0
307	ROW	0	155	0	1650000000300000	0
310	SETPM	0	153	0	1610000000300000	0
311	ZSTO1	0	31	0	340000000300000	0
312	ZSTO2	0	141	0	1440000000300000	0
313	NOCLR	0	35	0	400000000300000	0
314	START	0	33	0	360000000300000	0
315	CLEAR	0	140	0	1430000000300000	0
316	FINISH	0	135	0	1400000000300000	0
317	POSINT	0	54	0	570000000300000	0
320	NONZER	0	60	0	630000000300000	0
321	ZERO	0	100	0	1030000000300000	0
322	HALF	0	151	0	1550000000300000	0
323	TEST	0	61	0	640000000300000	0
324	SKIP	0	64	0	670000000300000	0
325	TENTH	0	152	0	1570000000300000	0
326	LEAP	0	75	0	1000000000300000	0
327	STOLP	0	103	0	1060000000300000	0
330	NONEG	0	117	0	1220000000300000	0
331	AGAIN	0	125	0	1300000000300000	0
332	LEAVE	0	145	0	1500000000300000	0

DECPRN

4		1	1001000024400000136	
5		2	2000110400100153	SAVWD
6		3	1201025200007770	
7	MORE	4	1217002202040000	
10		5	1010400040010000	JUMP
11		6	1010000040017777	MORE
12	JUMP	7	4221601260001001	ENDD
13		10	7216010000010014	DATA
14		11	7450100540000004	
15		12	1133004240100000	
16		13	5216010000010003	ENDTST
17		14	2020100040000000	
20		15	1410020040000000	
21		16	4220001004001013	ROW
22		17	2070414000000001	
23		20	1610700040000000	
24		21	1217001000000011	
25		22	1216015500010013	SETPM
26		23	1101000040000000	
27		24	1216010000010000	ZSTO1
30		25	1216010000010011	ZSTO2
31		26	2002070424000000	
32		27	1010000040010000	NOCLR
33		30	4002473400000200	
34	ZSTO1	31	1200016440040000	
35		32	4301000004001000	
36	START	33	1217000040000050	
37		34	1216010000010010	CLEAR
40	NOCLR	35	1217000000010012	SAVWD
41		36	1010402040017777	
42		37	1217002202047777	
43		40	1010400240010007	FINISH
44		41	4506200400000006	
45		42	1100004540400000	
46		43	4506243400000003	
47		44	2200012140010011	SAVWD
50	ENDTST	45	4102510004000000	

```
        47    4350440440400100104    DATA
        50    4420040240000000014
        51    1011000040010000002    POSINT
        52    2401010044001000001    POSINT
        53    1420000040000000010
POSINT  54    4506200400000000006
        55    1010500040010000002    NONZER
        56    1420000040000000004
        57    1010000040010000020    ZERO
NONZER  60    1504700000010000070    HALF
TEST    61    4301010004001000002    SKIP
        62    7106000700010000067    TENTH
        63    1010006340017777774    TEST
SKIP    64    1400030040200000000
        65    7104010200000000004
        66    4506200400000000006
        67    1450204440000000003
        70    1101000040000000400
        71    1011100040010000003    LEAP
        72    4506204402000000001
        73    1450011540000000007
        74    1010000040010000003    ZERO
LEAP    75    4445020444000000006
        76    5445010444000000006
        77    4500104402077777776
ZERO   100    2050450020000000002
       101    4505517404000000001
       102    1200010040000000006
STOLP  103    4133000440000000012
       104    1450025440000000001
       105    6500112404010000045    SETPM
       106    7500110004010000044    SETPM
       107    1504000000000000007
       110    6450620640000000001
       111    4010501740017777770    STOLP
       112    1020300040000000010
       113    1010000040010000003    NONEG
       114    1400040040000000042
       115    6500112404010000035    SETPM
       116    7500110004010000034    SETPM
NONEG  117    1020700040000000004
       120    1010000040017777713    NOCLR
       121    2040004024000000046
       122    4505506404000000002
       123    1500112404010000027    SETPM
       124    2500111704010000026    SETPM
AGAIN  125    4301010004001777706    NOCLR
       126    5102001540000000012
       127    1450204440000000001
       130    6504006300000000007
       131    1450150640000000001
       132    1500112404010000020    SETPM
       133    2500111704010000017    SETPM
       134    1010000040017777767    AGAIN
FINISH 135    4202070074000000002
       136    1010000040010000006    LEAVE
       137    2061110420400000116
CLEAR  140    4002445400000000000
ZSTO2  141    1200016440040000000
       142    3010001000001000012    ROW
       143    1420040040000000014
       144    1051500040017777665    START
LEAVE  145    1420040040007777777
       146    1420006645007777776
       147    1010000044000000137
```

155	HALF	151	7720000000000000
157	TENTH	152	7703146314631463 14
161	SETPM	153	2000000
163	DATA	154	200000
165	ROW	155	0
167	SAVWD	156	0

230 FX PRINT

*230, FX PRINT

To set PM (*116) for fixed pt decimal.

Input: (T4) = number to convert & set up
(B1) = number of fractional decimal places
(B3) = printer column for dec. pt.

Advances B3

Uses: B1235, T4567.

231 EXACT INTEGER PRINT

EXACT INTEGER CONVERSION *231

INPUT

Floating point number in ~~T4~~ T7

OUTPUT

(~~T4~~ T7) set up in the Spirel print matrix, *116, as follows:

~~T4~~ T7 EXPONENT	RESULT
06 to 37	Exact decimal equivalent
01 to 05	Integral part, converted exactly
00	0.
40 to 77 (-37 to -0)	Hangs up on a Class 5 with U all ones. Reset and start from 3 (Auxiliary) to exit with nothing set up.

A decimal point is placed in print position 93 with up to 75 digits and a minus sign, when appropriate, immediately to the left. Print positions 1-6 and 94-108 are not affected.

Note that any floating point number with exponent ≥06 represents an even integer. Numbers with exponents in the range 77-06 (not necessarily integers) may be converted exactly with FIXPRN, *230, which allows quite flexible format control.

REGISTERS, LIGHTS USED

T7. Sense light 15 and indicator light 4 (MOV) are turned off. SAVE and UNSAVE are used to restore the other fast registers.

LENGTH

~~128~~ 102

RUNNING TIME

An approximate upper bound is

$\frac{1}{150}$ $\frac{92}{75}$ X(number of digits in result) sec.

E. E. Sibert
June, 1963

```
231                     ORG
EXINT       -Z          TRA             *136,U+R
CONVRT      T7          IF(POS)TRA      CHECKS,R+Z
                        SLN             a00001,CC+1
CHECKS                  SLF             a00001
            IT7I        SBS             a*116,U+T7
                        45026           a6
            R           IF(NNZ)SKP      a40
            Z           50140           aLEAVE,I+CC
            Z           DIV             a6,U+B4
                        LRL             a3,R+B2
            T7          BEU             aZ,U+R
            Z           DML             aB4+B2
                        STO             aB4+A1
            R           STO             aB4+A1-1
                        ILF             a04000
                        CLA             PTWD
                        ORU+            B5+47
            Z           LDR+70          MASK,U+T6
                        CLA             aC1-1
                        RPA             CLR1
CLRC        IZI         SB2,ERM         a6,U+B1
CLR1        Z           STO             B1+(C1-1),B2-1
            Z           SB1             aB4,U+T4
DLOOP       T4          LDR             B1+A1
                        DIV             a12,R+T4
                        STO             B1+C1,B1=1
            B1          IF(POS)TRA      DLOOP
            T4          LUL             a1,U+B3
TNULL       Z           STO             T4,U+PF
NLOOP       T4          ORU             PF+C1,U+T4
            S           STO             PF+A1
            PF          IF(ZER)SKP      aB4
                        TRA             NLOOP,PF+1
            T6          ORU+            B5+B3
            T7          ORU+            B5+B3+1
            T6          LDR             T7
                        LLS             a1,U+T6
            T4          IF(NUL)TRA      SIGN,R+T7
                        TRA             CLRC
SIGN                    IF(SLM)SKP      a00001
                        TRA             LEAVE
            T6          ORU+            B5+42
            T7          ORU+            B5+43
LEAVE                   TRA             *137
            PF          SLF             a00001,U+CC
PTWD                    OCT             00000000000100000
MASK                    OCT             00000000000200000
GARBGE                  OCT             0
A1                      BSS             6
C1                      BSS             6
                        END
```

220	EXINT	0	1	0	2000000000000	0
221	CONVRT	0	2	0	3000000000000	0
222	CHECKS	0	4	0	5000000000000	0
223	LEAVE	0	54	0	5500000000000	0
224	A1	0	61	0	6600000000000	0
225	PTWD	0	56	0	6000000000000	0
226	MASK	0	57	0	6200000000000	0
227	C1	0	67	0	7500000000000	0
230	CLR1	0	26	0	2700000000000	0
231	CLRC	0	25	0	2600000000000	0
232	DLOOP	0	30	0	3100000000000	0
233	TNULL	0	35	0	3600000000000	0
234	NLOOP	0	36	0	3700000000000	0
235	SIGN	0	50	0	5100000000000	0
236	GARBGE	0	60	0	6400000000000	0

2	EXINT	1	1001000024400000136	1	
3	CONVRT	2	7011101040010000001	3	CHECKS
4		3	1420002040000000001	0	
5	CHECKS	4	1420040040000000001	1	
6		5	2740005074400000116	0	
7		6	1450260040000000006	0	
10		7	3065500040000000040	0	
11		10	501407040010000043	2	LEAVE
12		11	103004440000000006	0	
13		12	1450025240000000003	0	
14		13	7210000240000000000	0	
15		14	440100040240000000	0	
16		15	1200010040210000043	2	A1
17		16	3200010040210000041	2	A1
20		17	1420050040000004000	0	
21		20	1217000000010000035	2	PTWD
22		21	1500110000400000047	0	
23		22	504700600010000034	2	MASK
24		23	1217000040010000042	2	C1
25		24	1216010000010000001	2	CLR1
26	CLRC	25	2040022414000000006	1	
27	CLR1	26	200016240020000000	1	
30		27	400010440200000000	0	
31	DLOOP	30	4504000000030000030	3	A1
32		31	1103001440000000012	0	
33		32	1200016140030000034	2	C1
34		33	4101110004001777773	2	DLOOP
35		34	4450204340000000001	0	
36	TNULL	35	200014740000000004	1	
37	NLOOP	36	4500100402010000030	3	C1
40		37	3200010042010000021	2	A1
41		40	4702010004020000000	0	
42		41	1010002740017777773	2	NLOOP
43		42	6500110000500000000	0	
44		43	7500110000500000001	0	
45		44	6504000000000000007	0	
46		45	1450620640000000001	0	
47		46	4010401740010000001	2	SIGN
50		47	1010000040017777754	2	CLRC
51	SIGN	50	1020300040000000001	1	
52		51	1010000040010000002	2	LEAVE
53		52	6500110000400000042	0	
54		53	7500110000400000043	0	
55	LEAVE	54	1010000044000000137	1	
56		55	4742004404000000001	0	
60	PTWD	56	100000	1	
62	MASK	57	200000	1	
64	GARBGE	60	0	1	
66	A1	61	0	1	

70		43	0	0
71		44	0	0
72		45	0	0
73		46	0	0
75	C1	47	0	1
76		70	0	0
77		71	0	0
100		72	0	0
101		73	0	0
102		74	0	0

BINOM COEFFS

BINOM

BINOM (MATRIX, N) generates lower triangular matrix of N+1 rows at MATRIX. Each row has initial index = 7777_8. MATRIX contains binomial coefficients such that

$$MATRIX_{I,K} = \binom{I}{K} \text{ for } 0 \le I \le N,\ 0 \le K \le I.$$

Method: Pascal's identity

$$\binom{n}{k} = \binom{n-1}{k-1} + \binom{n-1}{k} \text{ where } \binom{n}{0} = 1,\ \binom{n}{n} = 1.$$

Normal exit: U, T7 = TRUE
Error exit for insufficient core: U, T7 = FALSE

Length: 57 (octal)

W. Hicks

225 HISTOGRAM

HISTO (*225)

PURPOSE: To compute a histogram from any linear array of numbers, not necessarily ordered.

INPUT: The numbers may be in the form of any floating point Spirel vector.

OUTPUT: The histogram is stored in *B3, B1 modified.

CALLING SEQUENCE: B1 is set to the codeword address of the vector, B2 is set to the number of points in the histogram, and B3 is set to the desired codeword address of the storage vector.

PARAMETERS: The panel width is equal to the range of the numbers in*B1 divided by B2.

REGISTERS USED: B1,2,3,4,5,PF,T4,5,6,7 are used but are saved by *136 and *137.

LENGTH: 47 octal.

Gary Sitton
March 1964

```
                                                                    1
235             ORG                                                 2
                REM     COMPUTE HISTOGRAM OF *B1,                   3
                REM     SB2 = NUMBER OF POINTS,                     4
                REM     SB3 = CODEWORD ADDRESS                      5
                REM     OF HISTOGRAM VECTOR,...                     6
        Z       BAU+2   SL,B6+1                                     7
        -Z      TRA     *136,U→R                                    10
                LDR     B1,R→B1                                     11
                LLS     a@15,U→B4                                   12
                SLN     a2,U→B5                                     13
                LLS     a@15,U→PF                                   14
        PF      LUR     a3,U→PF                                     15
                AB1     aPF-1                                       16
        B2      LDR     CODEWD                                      17
                LRS     a@15                                        20
        R       BAU     a@3,U→T7                                    21
                TSR     *126                                        22
                LT4     B1+B4                                       23
                LT5     B1+B4,B4-1                                  24
SCAN            LT6     B1+B4,B4-1                                  25
        T4      IF(POS)SKP  T6                                      26
                LT4     T6                                          27
        T5      IF(NEG)SKP  T6                                      30
                LT5     T6                                          31
        B4      IF(PNZ)TRA  aSCAN                                   32
        T4      FSB     T5,U→T7                                     33
        -B2     CPL     aZ                                          34
                FMP     TW047                                       35
                FDV     T7                                          36
                FMP     a1,9999999999,U→T7                          37
                CLA     B3,U→B3                                     40
                LT6     EXP06,B3+1                                  41
                LT4     a1,0                                        42
HISTO   -T5     FAD     B1+B5                                       43
                FMP     T7                                          44
                FAD+40  T6,U→B2                                     45
        T4      FAD→    B3+B2,B5-1                                  46
        B5      IF(PNZ)TRA  aHISTO                                  47
                TRA     *137                                        50
                SLF     a2,B6-1                                     51
        PF      SLN     a*B6,U→CC                                   52
CODEWD          OCT     022000000000000000                          53
TW047           OCT     062000000000000000                          54
EXP06           OCT     060000000000000000                          55
                END                                                 56
                                                                    57
```

```
0301        CODEWD    0     45     0     5700000000000000     0
0302        SCAN      0     17     0     4000000000000000     0
0303        TW047     0     46     0     7100000000000000     0
0304              0   0     50     0     7500000000000000     0
0305        EXP06     0     47     0     7300000000000000     0
0306              0   0     51     0     7600000000000000     0
0307        HISTO     0     35     0     5600000000000000     0

COMPUTE HISTOGRAM OF *B1,
S82 = NUMBER OF POINTS,
S83 = CODEWORD ADDRESS
OF HISTOGRAM VECTOR....
   22              1     00 20102 26 0000 77770
   23              2     10 01002 02 4400 00136
   24              3     01 50402 51 0002 00000
   25              4     01 45062 44 4000 00017
   26              5     01 42002 45 4000 00002
   27              6     01 45062 47 4000 00017
   30              7     47 45012 47 4000 00003
   31             10     01 41001 00 4200 77776
   32             11     42 50402 00 0001 00033     CODEWD
   33             12     01 45012 00 4000 00017
   34             13     02 20102 07 4010 00000
   35             14     01 40002 00 4400 00126
   36             15     01 50442 00 0022 00000
   37             16     01 50452 64 0022 00000
   40   SCAN      17     01 50462 64 0022 00000
   41             20     04 02112 00 0000 00006
   42             21     01 50442 00 0000 00006
   43             22     05 02512 00 0000 00006
   44             23     01 50452 00 0000 00006
   45             24     44 05152 00 4001 77771     SCAN
   46             25     04 10502 07 0000 00005
   47             26     52 50102 00 4000 00000
   50             27     01 10602 00 0001 00016     TW047
   51             30     01 10702 00 0000 00007
   52             31     01 10602 07 0001 00016           0
   53             32     01 21702 43 0010 00000
   54             33     01 50462 23 0001 00013     EXP06
   55             34     01 50442 00 0001 00014           0
   56   HISTO     35     15 10402 00 0042 00000
   57             36     01 10602 00 0000 00007
   60             37     01 10442 42 0000 00006
   61             40     04 10401 65 0014 00000
   62             41     45 05152 00 4001 77772     HISTO
   63             42     01 01002 00 4400 00137
   64             43     01 42004 66 4000 00002
   65             44     47 42002 40 4500 00000
   67   CODEWD    45     02 20002 00 0000 00000
   71   TW047     46     06 20002 00 0000 00000
   73   EXP06     47     06 00002 00 0000 00000
   75             50     01 00177 77 7777 77711
   76             51     01 00102 00 0000 00000
```

226 SORT

Sort (*226)

PURPOSE: To sort and numerically order any linear array of numbers.

INPUT: The numbers may be in the form of any M-Spirel vector.

OUTPUT: The sorted array is stored in the place of the vector that was sorted. (Smallest first).

CALLING SEQUENCE: B1 is set to the codeword address of the vector to be sorted, and then *226 is executed.

RESTRICTIONS: *B1 must contain no tag 1 words at all.

RUNNING TIME: The running time is approximately equal to $N^2 \times 10^{-4}$ seconds, where N is the number of elements in *B1.

REGISTERS USED: B1,2,3,4,5,6,PF,T4,5,6,7, and X. All are saved except T7 and X. *136 and *137 are the only supporting subroutines.

LENGTH: 64 words octal.

Gary Sitton
February 1964

```
                                                                    1
226                 ORG                                             2
                    REM             SORT *B1 AND STORE IN *B1,      3
            -Z      TRA             *136,U+R                        4
            Z       BAU+2           X                               5
                    LDR             B1,R+B2                         6
            Z       LLS             ad15,U+B4                       7
                    IF(EVN)TRA      aCC+1,U+B3                      10
                    ADD             a1                              11
                    LUR             a1                              12
                    RPA             TEST                            13
                    LLS             ad15,U+PF                       14
            PF      LUR             a3,U+PF                         15
                    AB2             aPF-1                           16
            B6      RPA             SAVE                            17
            Z       BAU             aSTORE                          20
                    STO             a15                             21
                    TLN             a40000                          22
                    CLA,ST1+        B2                              23
                    LT4             B2+B3,I+B5                      24
                    LT5             T4,B3-1                         25
RESET               STX             a77774                          26
            B5      MLN             a10000,U+B6                     27
SORT        T4      IF(NEG)SKP      B2+B3                           30
                    LT4             B2+B3,I+B6                      31
            T5      IF(POS)JMP      B2+B3,B3-1                      32
                    LT5             B2+B3+1,I+B5                    33
                    TSR             aSORT                           34
STORE               STX             a3                              35
            T4      LT6+            B2+B3+1,I+B3                    36
            T5      LT7+            B2+B4,I+B1                      37
            B5      IF(NZE)JMP      aB1                             40
            B6      IF(ZER)SKP      aB3                             41
            T6      20002           aZ                              42
                    TSR             aFINE                           43
            B5      IF(NZE)JMP      aB3                             44
            B6      IF(ZER)SKP      aB1                             45
            T7      20002           aZ                              46
                    TSR             aFINE                           47
            B6      IF(NZE)SKP      aB1                             50
            T6      STO             aB5,CC+X                        51
            B6      IF(ZER)SKP      aB3                             52
            T6      20002           aZ                              53
            T7      STO             aB5                             54
FINE                CLA,ST1+        B3,B4-1                         55
            T4      LT4             T5,U+T5                         56
TEST        B4      IF(NEG)SKP      a(Z)                            57
            B4      TSR             aRESET,U+B3                     60
            B4      TLF             a40000,U+PF                     61
                    CLA             aB2-1,PF+1                      62
                    RPA             CLRTAG,PF+1                     63
            1,Z1    MLN             a34000,U+B2                     64
CLRTAG              CLA+            B2+Z,PF-1                       65
                    MLF             a4000                           66
SAVE                SB6             a(Z)                            67
                    STX             a*B6                            70
                    TRA             *137                            71
                    IF(TG1)TRA      aPF                             72
                    END                                             73
```

```
1301        TEST      0     54     0          610000000000000     0
1302        SAVE      0     64     0          710000000000000     0
1303        STORE     0     32     0          370000000000000     0
1304        RESET     0     23     0          300000000000000     0
1305        SORT      0     25     0          320000000000000     0
1306        FINE      0     52     0          570000000000000     0
1307        CLRTAG    0     62     0          670000000000000     0

SQRT *B1 AND STORE IN *B1,
    6                1     10 01000 02 4400 00136
    7                2     00 20102 00 0000 77775
   10                3     01 50400 52 0002 00000
   11                4     00 45062 44 4000 00017
   12                5     01 01020 43 4001 00001
   13                6     01 10000 00 4000 00001
   14                7     01 45010 00 4000 00001
   15               10     01 21601 00 0001 00043     TEST
   16               11     01 45062 47 4000 00017
   17               12     47 45010 47 4000 00003
   20               13     01 41002 00 4200 77776
   21               14     46 21601 00 0001 00047     SAVE
   22               15     00 20100 00 4001 00014     STORE
   23               16     01 20001 00 4000 00015
   24               17     01 42003 00 4000 40000
   25               20     01 21711 00 0004 00000
   26               21     01 50440 75 0014 00000
   27               22     01 50450 63 0000 00004
   30   RESET       23     01 43006 00 4000 77774
   31               24     45 42002 46 4000 10000
   32   SORT        25     04 02510 00 0014 00000
   33               26     01 50440 76 0014 00000
   34               27     05 03110 63 0014 00000
   35               30     01 50450 75 0014 00001
   36               31     01 40000 00 4001 77772     SORT
   37   STORE       32     01 43006 00 4000 00003
   40               33     04 50461 73 0014 00001
   41               34     05 50471 71 0024 00000
   42               35     45 03050 00 4002 00000
   43               36     46 02010 00 4010 00000
   44               37     06 20002 00 4000 00000
   45               40     01 40000 00 4001 00011     FINE
   46               41     45 03050 00 4010 00000
   47               42     46 02010 00 4002 00000
   50               43     07 20002 00 4000 00000
   51               44     01 40000 00 4001 00005     FINE
   52               45     46 02050 00 4002 00000
   53               46     06 20001 30 4040 00000
   54               47     46 02010 00 4010 00000
   55               50     06 20002 00 4000 00000
   56               51     07 20001 00 4040 00000
   57   FINE        52     01 21711 64 0010 00000
   60               53     04 50440 05 0000 00005
   61   TEST        54     44 02510 00 4000 00000
   62               55     44 40000 43 4001 77744     RESET
   63               56     44 42007 47 4000 40000
   64               57     01 21700 27 4004 77776
   65               60     01 21601 27 0001 00001     CLRTAG
   66               61     20 42002 42 4000 34000
   67   CLRTAG      62     01 21701 67 0004 00000
   70               63     01 42006 00 4000 04000
   71   SAVE        64     01 40006 00 4000 00000
   72               65     01 43005 00 4500 00000
   73               66     01 01000 00 4400 00137
   74               67     01 01001 00 4200 00000
```

227 MERGE

Merge (*227)

PURPOSE: To merge two pre-sorted vectors, (see Sort, *226).

INPUT: The data may be in the form of any Spire1 vector.

OUTPUT: The new, sorted vector resulting from the merge is stored in a B1 modified vector.

CALLING SEQUENCE: B1 and B2 are set to the codeword address of the vectors to be merged. B3 is set to the codeword address of the output vector.

RESTRICTIONS: The two vectors must be sorted in ascending order. All storing is done with tags.

REGISTERS USED: All fast registers are used and saved except T7, [redacted]

SUBROUTINES USED: *126, *136, and *137 are the supporting subroutines used by *227.

LENGTH: 41 octal.

Gary Sitton
March 1964

```
                                                                    1
227             ORG                                                 2
                REM     MERGE *B1 WITH *B2 AND                      3
                REM     STORE IN *B3, ASSUMES                       4
                REM     BOTH ARE SORTED.                            5
          Z     BAU+2   SL,B6+1                                     6
                BAU+2   X,B6+1                                      7
         -Z     TRA     *136,U→R                                    10
                LDR     *B6-5,R→B2                                  11
                LLS     ad15,U→B4                                   12
                LLS     ad15,U→PF                                   13
          PF    LUR     a3,U→PF                                     14
          B3    AB2     aPF-1,U→B1                                  15
                LDR     *B6-6,R→B3                                  16
                LLS     ad15,U→B5                                   17
                LLS     ad15,U→PF                                   20
          PF    LUR     a3,U→PF                                     21
                AB3     aPF-1                                       22
          B4    ADD     aB5,U→T4                                    23
                LDR     CODEWD                                      24
                LRS     ad15                                        25
          R     BAU     aB1,U→T7                                    26
          B6    SLN     a2,U→T5                                     27
                TSR     *126                                        30
          T4    ADD     B1,U→B6                                     31
                STX     a5                                          32
MERGE           CLA     B2+B4                                       33
                IF(POS)JMP B3+B5                                    34
                CLA+42  B3+B5,B5-1                                  35
          B5    IF(PNZ)TRA aMERGE,B6-1                              36
LOOP1           CLA+42  B2+B4,B4-1                                  37
          B4    IF(PNZ)TRA aLOOP1,B6-1                              40
                TSR     aSAVE                                       41
                CLA+42  B2+B4,B4-1                                  42
          B4    IF(PNZ)TRA aMERGE,B6-1                              43
LOOP2           CLA+42  B3+B5,B5-1                                  44
          B5    IF(PNZ)TRA aLOOP2,B6-1                              45
SAVE      T5    TRA     *137,U→B6                                   46
                STX     a*B6-1,B6-1                                 47
                SLF     a2,B6-1                                     50
          PF    SLN     a*B6,U→CC                                   51
CODEWD          OCT     022000000000000000                          52
                END                                                 53
                                                                    54
```

1301	CODEWD	0	45	0	620000000000000 0
1302	MERGE	0	26	0	420000000000000 0
1303	LOOP1	0	32	0	460000000000000 0
1304	SAVE	0	41	0	550000000000000 0
1305	LOOP2	0	37	0	530000000000000 0

MERGE *B1 WITH *B2 AND
STORE IN *B3, ASSUMES
BOTH ARE SORTED.

```
   15              1      00 20102 26 0000 77770
   16              2      01 20102 26 0000 77775
   17              3      10 01000 02 4400 00136
   20              4      01 50400 52 0500 77772
   21              5      01 45062 44 4000 00017
   22              6      01 45062 47 4000 00017
   23              7      47 45010 47 4000 00003
   24             10      43 41002 41 4200 77776
   25             11      01 50400 53 0500 77771
   26             12      01 45062 45 4000 00017
   27             13      01 45062 47 4000 00017
   30             14      47 45010 47 4000 00003
   31             15      01 41003 00 4200 77776
   32             16      44 10000 04 4040 00000
   33             17      01 50400 00 0001 00025      CODEWD
   34             20      01 45015 00 4000 00017
   35             21      02 20100 07 4002 00000
   36             22      46 42000 05 4000 00002
   37             23      01 40000 00 4400 00126
   40             24      04 10000 46 0002 00000
   41             25      01 43005 00 4000 00005
   42  MERGE      26      01 21700 00 0024 00000
   43             27      01 03110 00 0050 00000
   44             30      01 21742 65 0050 00000
   45             31      45 05150 66 4001 77773      MERGE
   46  LOOP1      32      01 21742 64 0024 00000
   47             33      44 05150 66 4001 77775      LOOP1
   50             34      01 40000 00 4001 00004      SAVE
   51             35      01 21742 64 0024 00000
   52             36      44 05150 66 4001 77766      MERGE
   53  LOOP2      37      01 21742 65 0050 00000
   54             40      45 05150 66 4001 77775      LOOP2
   55  SAVE       41      05 01000 46 4400 00137
   56             42      01 43005 66 4500 77776
   57             43      01 42004 66 4000 00002
   60             44      47 42000 40 4500 00000
   62  CODEWD     45      02 20000 00 0000 00000
```

200 INTERVAL TIMER

*200, Interval Timer

If T7≠0, reset elapsed time counter to zero.
If T7=0, return with elapsed time in minutes since last reset in U & T7.

Uses: B234, T45

Limitations:
1) Always reset before first call for time.
2) Do not use for over 24 hour interval.

Note: Can go across midnight.

W. Hicks

HIGH SPEED DUMP

HIGH SPEED CORE & REGISTER DUMP

This tape consists of programs which load 57400-57700

Program 1. Restores the page and loads the next program

Program 2. Saves B1-PF, T4-T7, T-f tags, Lights, X, FT, and VT. Loads Program 3

Program 3. Prints the contents of the registers, as saved, with names. A small "f" appears by any T-register on which the T-flag is set. Loads Program 4

Program 4. Dumps sections of core. It stops on an HTR with a 10_8 in U. At this point upper and lower limits to be dumped may be entered. The upper limit goes into the top 5 octets of U; the lower limit is expected in the normal address portion. If no upper limit is entered, the limit 57400 is supplied. If the 10 is left, all core below 57400 will be dumped. A small a, b, or c by a word indicates a tag 1, 2, or 3, respectively. When the dump has been completed to the limit specified, the program returns to accept another set of units.

```
                    ORG     57400                                   2
              B1    STO     A                                       3
              B2    STO     A+1                                     4
              B3    STO     A+2                                     5
              B4    STO     A+3                                     6
              B5    STO     A+4                                     7
              B6    STO     A+5                                     10
              FF    STO     A+6                                     11
                    TFU     @A+7,I→B6                               12
                    LT4+2   4,B6+1                                  13
              T4    LT5+2   5,B6+1                                  14
              T5    LT6+2   6,B6+1                                  15
              T6    LT7+2   7,B6+1                                  16
              T7    20002   @Z,B6+1                                 17
                    CLA+2   SL,B6+1                                 20
                    CLA+2   IL,B6+1                                 21
                    CLA+2   ML,B6+1                                 22
                    CLA+2   TL,B6+1                                 23
                    CLA+2   X,B6+1                                  24
                    CLA+2   TT,B6+1                                 25
                    CLA+2   FT                                      26
              Z     60020   Z                                       27
A                   EQU     57655                                   30
                    TRA     57400                                   31
                    END                                             32
                                                                    33
```

```
57400   41 20001 00 4000 57655      A
57401   42 20001 00 4000 57656      A     +   1
57402   43 20001 00 4000 57657      A     +   2
57403   44 20001 00 4000 57660      A     +   3
57404   45 20001 00 4000 57661      A     +   4
57405   46 20001 00 4000 57662      A     +   5
57406   47 20001 00 4000 57663      A     +   6
57407   01 47000 76 4000 57664      A     +   7
57410   01 50442 26 0000 00004
57411   04 50452 26 0000 00005
57412   05 50462 26 0000 00006
57413   06 50472 26 0000 00007
57414   07 20002 26 4000 00000
57415   01 21702 26 0000 77770
57416   01 21702 26 0000 77771
57417   01 21702 26 0000 77772
57420   01 21702 26 0000 77773
57421   01 21702 26 0000 77775
57422   01 21702 26 0000 77776
57423   01 21702 00 0000 77777
57424   00 40020 00 0000 00000
57425   01 01000 00 +000 57400
*********
```

```
314      A          0 57655    0          270000000000000    0
```

```
                        ORG     57400                                   2
                        SB1     22                                      3
L2                      LDR     B1+TAB-1,R→B2                           4
              Z         LLS     22,U→B3                                 5
              IZI       LUL     65,U→T5                                 6
              Z         LLS     11,U→B4                                 7
              T5        ORU→    PM+B4                                   10
              T5        LUR     1,U→T5                                  11
              Z         LLS     11,U→B4                                 12
              T5        ORU→    PM+B4                                   13
              T5        LUR     3,U→T5                                  14
              Z         LLS     3,U→B4                                  15
                        CLA     A+7                                     16
                        LUR     B4=1                                    17
                        IF(EVN)TRA CC+1                                 20
              T5        ORU→    PM+36                                   21
              T5        LUR     24,U→T5                                 22
                        LDR     B2                                      23
L1            P         AND     37,U→B4                                 24
                        LRR     3,U→B5                                  25
              T5        ORU→    PM+B4+B5,B3=1                           26
              T5        LUL     1,U→T5                                  27
              P3        IF(NZE)TRA L1                                   30
                        PRA     PM,B1-1                                 31
              IZI       SB2+20  200,U→B3                                32
              Z         STO     PM-1+B3,B2=1                            33
              P1        IF(NZE)TRA L2                                   34
              Z         60020   Z                                       35
A                       EQU     57655                                   36
TAB                     OCT      5 113 146 0 57677                      37
                        OCT      5 146 146 0 57676                      40
                        OCT      5 156 052 0 57675                      41
                        OCT      5 146 126 0 57674                      42
                        OCT      5 130 126 0 57673                      43
                        OCT      5 120 126 0 57672                      44
                        OCT      5 144 126 0 57671                      45
                        OCT     22 146 016 1 57670                      46
                        OCT     22 146 014 2 57667                      47
                        OCT     22 146 012 3 57666                      50
                        OCT     22 146 010 4 57665                      51
                        OCT      5 136 112 0 57663                      52
                        OCT      5 102 014 0 57662                      53
                        OCT      5 102 012 0 57661                      54
                        OCT      5 102 010 0 57660                      55
                        OCT      5 102 006 0 57657                      56
                        OCT      5 102 004 0 57656                      57
                        OCT      5 102 002 0 57655                      60
PM            IZI       SB2+20  200,U→B1                                61
                        CLA→    PM-1+B1,B2=1                            62
                        CLA+11  PM+177                                  63
                        MLF     84000                                   64
                        LDR     857400                                  65
                        SB1+20  1                                       66
              Z         FST     PM-1+B1,R→CC                            67
                        TRA     PM                                      70
                        END                                             71
                                                                        72
```

```
                57400    01 40001 00 4000 00022
L2              57401    01 50400 52 0003 57432      TAB    -   1
                57402    00 45062 43 4000 00022
                57403    20 45020 05 4000 00065
                57404    00 45062 44 4000 00011
                57405    05 50011 00 0020 57455      PM
                57406    05 45010 05 4000 00001
                57407    00 45062 44 4000 00011
                57410    05 50011 00 0020 57455      PM
                57411    05 45010 05 4000 00003
                57412    00 45062 44 4000 00003
                57413    01 21700 00 0000 57664      A      +   7
                57414    01 45010 00 4020 77776
                57415    01 01020 00 4001 00001
                57416    05 50011 00 0000 57513      PM     +  35
                57417    05 45010 05 4000 00024
                57420    01 50400 00 0004 00000
L1              57421    02 50314 44 4000 00007
                57422    01 45001 45 4000 00003
                57423    05 50011 63 0060 57455      PM
                57424    05 45020 05 4000 00001
                57425    43 01050 00 4000 57421      L1
                57426    01 61210 61 4000 57455      PM
                57427    20 40022 43 4000 00200
                57430    00 20001 62 4010 57454      PM     -   1
                57431    41 01050 00 4000 57401      L2
                57432    00 60020 00 0000 00000
TAB             57433    00 00051 12 1460 57677
                57434    00 00051 46 1460 57676
                57435    00 00051 56 0520 57675
                57436    00 00051 46 1260 57674
                57437    00 00051 30 1260 57673
                57440    00 00051 20 1260 57672
                57441    00 00051 44 1260 57671
                57442    00 00221 46 0161 57670
                57443    00 00221 46 0143 57667
                57444    00 00221 46 0123 57666
                57445    00 00221 46 0104 57665
                57446    00 00051 36 1120 57663
                57447    00 00051 02 0140 57662
                57450    00 00051 02 0120 57661
                57451    00 00051 02 0100 57660
                57452    00 00051 02 0060 57657
                57453    00 00051 02 0040 57656
                57454    00 00051 02 0020 57655
PM              57455    20 40022 41 4000 00200
                57456    01 21701 62 0003 57454      PM     -   1
                57457    01 21711 00 0000 57654      PM     +  77
                57460    01 42006 00 4000 04000
                57461    01 50400 00 4000 57400
                57462    01 40021 00 4000 00001
                57463    00 20041 50 0003 57454      PM     -   1
                57464    01 01000 00 4000 57455      PM
*****  *****
```

314	L2	0	57401	3	3000000000000000	0
315	TAB	0	57433	3	3700000000000000	0
316	PM	0	57455	3	1020000000000000	0
317	A	0	57655	0	3500000000000000	0
320	L1	0	57421	3	2300000000000000	0

```
                        ORG             57400                       2
                        CLA             HALT                        3
                        IF(NZE+NTG)HTR  CC,U→B1                     4
                        LUR             47,U→B2                     5
                B2      IF(NZE)TRA      CC+1                        6
                        SB2             57400                       7
                B2      RWT             ENTST                      10
                B1      IF(NZE)TRA      CC+1                       11
                        SB1             10                         12
L1              P1      SB3             1,U→T7                     13
                        TSR             SP1S                       14
                7       IF(NZE×NTG)TRA  10,I→B3                    15
                        LT7             B1,B1+1                    16
                        TSR             SP1                        17
                Z       IF(NZE×NTG)TRA  40,I→B3                    20
                        LT7             B1,B1+1                    21
                        TSR             SP1                        22
                7       IF(NZE×NTG)TRA  70,I→B3                    23
                        LT7             B1,B1+1                    24
                        TSR             SP1                        25
                Z       IF(NZE×NTG)TRA  130,I→B3                   26
                        LT7             B1,B1+1                    27
                T7      TSR             SP1,U→T6                   30
                7       BAU             aB1                        31
                        IF(NEG)SKP      ENTST,R→Z                  32
                        TRA             PR→1                       33
PSKP            P1      ILF             FT,U→T5                    34
                        CLA             B1                         35
                        LT7             IL                         36
                        ILF             FT                         37
                        SYD             B1+1,U→T6                  40
                T7      SYD             IL                         41
                        ORU             T6,B1+1                    42
                        IF(NUL)TRA      CMPR                       43
NODCE                   TSR             PR                         44
                7       20101           T5                         45
                7       BAU             aB1=14                     46
                        IF(POS)SKP      T5                         47
                T5      TRA             L1,U→B1                    50
                T5      SPA             a12,I→B3                   51
                        TSR             SP1S,U→T7                  52
                        SB3             20,B1-1                    53
                P1      TSR             SP1S,U→T7                  54
                        ILF             FT                         55
                        SB3             40                         56
                        LT7             B1,B1+1                    57
                        TSR             SP1                        60
                IZI     LUL             47,U→T4                    61
                        ORU→            P1+42                      62
                        TSR             PR                         63
                Z       BAU             aB1                        64
                        IF(PNZ)SKP      ENTST                      65
                        SPA             aL1,I→CC                   66
                        SPA             aPR-1,I→CC                 67
CMPR            Z       BAU             aB1                        70
                        IF(NEG)SKP      ENTST                      71
                        TRA             NODCE                      72
                7       IF(ZER+NTG)TRA  PSKP+1                     73
```

```
SPM         FF      RWT             SPEX                                74
                    SB2             2                                   75
                    TSR             LP,R→Z                              76
                    SB2             5,B3+1                              77
                    TSR             LP,R→7                              100
                    SB2             2,B3+1                              101
                    TSR             LP,R→Z                              102
                    SB2             4,B3+1                              103
                    TSR             LP,R→7                              104
                    SB2             5,R→Z                               105
                    TSR             LP,B3+1                             106
            Z       BAU             IL                                  107
SPEX                IF(NUL)TRA      Z,R→Z                               110
                    IF(PNZ)SKP      @20000,R→Z                          111
                    IF(NNZ)TRA      G-1,CC+1                            112
                    SB2             2,CC+1                              113
                    SB2             4                                   114
RENT        IZI     LRS             B3-66                               115
                    ORJ→            PM+B2+22                            116
            P       ORJ→            PM+23+B2                            117
                    TRA             *SPEX                               120
SPMS        T7      LRS             17,R→T7                             121
                    SB2             5,R→Z                               122
LP          T7      CRL             3,R→B4                              123
                    AB4             B4,U→T7                             124
                    LDR             Z                                   125
            IZI     LRS             B3=66                               126
                    ORJ→            PM+B4,B2-1                          127
            P       ORJ→            PM+1+B4,B3+1                        130
            P2      IF(NZE)TRA      LP,R→7                              131
                    TRA             PF                                  132
G                   SB2             6                                   133
            IZI     TRA             RENT,U→T4                           134
ENTRT               OCT             Z                                   135
                    SPF             57400                               136
PR          T4      IF(NZE)TRA      CC+1                                137
                    61314           @PM,CC+1                            140
            Z       PRN             PM,U→T4                             141
            IZI     SB3+20          100,U→B2                            142
            Z       STO             PM-1+B2,B3=1                        143
                    TRA             PF                                  144
HALT                OCT             5740000000000000010                 145
PM          IZI     SB2+20          100,U→B1                            146
                    CLA→            PM-1+B1,B2=1                        147
                    MLF             4000                                150
                    LDR             @57400                              151
                    CLA+11          PM+77                               152
                    SB1+20          1                                   153
            Z       FST             B1+PM-1,R→CC                        154
                    TRA             PM                                  155
                    END                                                 156
                                                                        157
```

```
                57400     01 21700 00 0000 57542      HALT
                57401     01 00054 41 4001 00000
                57402     01 45010 42 4000 00047
                57403     42 01050 00 4001 00001
                57404     01 40002 00 4000 57400
                57405     42 21641 00 0000 57532      ENTST
                57406     41 01050 00 4001 00001
                57407     01 40001 00 4000 00010
L1              57410     41 40003 07 4000 00001
                57411     01 40000 00 4000 57516      SPMS
                57412     00 05054 73 4000 00010
                57413     01 50470 21 0002 00000
                57414     01 40000 00 4000 57471      SPM
                57415     00 05054 73 4000 00040
                57416     01 50470 21 0002 00000
                57417     01 40000 00 4000 57471      SPM
                57420     00 05054 73 4000 00070
                57421     01 50470 21 0002 00000
                57422     01 40000 00 4000 57471      SPM
                57423     00 05054 73 4000 00120
                57424     01 50470 21 0002 00000
                57425     07 40000 06 4000 57471      SPM
                57426     00 20100 00 4002 00000
                57427     01 02510 10 0000 57532      ENTST
                57430     01 01000 00 4000 57533      PR    -  1
PSKP            57431     41 4200F 05 4000 77777
                57432     01 21700 00 0002 00000
                57433     01 50470 00 0000 77771
                57434     01 4200F 00 4000 77777
                57435     01 53220 06 0002 00001
                57436     07 53220 00 0000 77771
                57437     01 50010 21 0000 00006
                57440     01 01040 00 4000 57465      CMPR
NODCE           57441     01 40000 00 4000 57534      PR
                57442     00 20101 00 0000 00005
                57443     00 20100 00 4002 77763
                57444     01 02110 00 0000 00005
                57445     05 01000 41 4000 57410      L1
                57446     05 41010 73 4000 00012
                57447     01 40000 07 4000 57516      SPMS
                57450     01 40002 61 4000 00020
                57451     41 40000 07 4000 57516      SPMS
                57452     01 4200F 00 4000 77777
                57453     01 40003 00 4000 00040
                57454     01 50470 21 0002 00000
                57455     01 40000 00 4000 57471      SPM
                57456     30 45020 04 4000 00047
                57457     01 50011 00 0000 57605      PM    +  42
                57460     01 40000 00 4000 57534      PR
                57461     00 20100 00 4002 00000
                57462     01 06150 00 0000 57532      ENTST
                57463     01 41010 70 4000 57410      L1
                57464     01 41010 70 4000 57533      PR    -  1
CMPR            57465     00 20100 00 4002 00000
                57466     01 02510 00 0000 57532      ENTST
                57467     01 01000 00 4000 57441      NODCE
                57470     00 01014 00 4000 57432      PSKP  +  1
SPM             57471     47 21641 00 0000 57505      SPEX
                57472     01 40002 00 4000 00002
                57473     01 40000 10 4000 57520      LP
                57474     01 40002 23 4000 00005
                57475     01 40000 10 4000 57520      LP
                57476     01 40002 23 4000 00002
                57477     01 40000 10 4000 57520      LP
```

```
                    57500  01 40002 23 4000 00004
                    57501  01 40000 10 4000 57520      LP
                    57502  01 40002 10 4000 00005
                    57503  01 40000 23 4000 57520      LP
                    57504  00 20100 00 0000 77771
          SPEX      57505  01 01040 10 4000 00000
                    57506  01 06150 10 4000 20000
                    57507  01 05550 20 4000 57527      G      -  1
                    57510  01 40002 20 4000 00002
                    57511  01 40002 00 4000 00004
          RENT      57512  20 45015 00 +010 77711
                    57513  01 50011 00 0004 57565      PM     + 22
                    57514  02 50011 00 0004 57566      PM     + 23
                    57515  01 01000 00 4400 57505      SPEX
          SPMS      57516  07 45015 17 4000 00017
                    57517  01 40002 10 4000 00005
          LP        57520  07 45066 54 4000 00003
                    57521  01 41004 07 4020 00000
                    57522  01 50400 00 0000 00000
                    57523  20 45015 00 4010 77711
                    57524  01 50011 62 0020 57543      PM
                    57525  02 50011 23 0020 57544      PM     +  1
                    57526  42 01050 10 4000 57520      LP
                    57527  01 01000 00 4200 00000
          G         57530  01 40002 00 4000 00006
                    57531  20 01000 04 4000 57512      RENT
          ENTST     57532  00 00000 00 0000 00000
                    57533  01 40007 00 4000 57400
          PR        57534  04 01050 00 4001 00001
                    57535  01 61314 20 4000 57543      PM
                    57536  00 61110 04 4000 57543      PM
                    57537  20 40023 42 4000 00100
                    57540  00 20001 63 4004 57542      PM     -  1
                    57541  01 01000 00 4200 00000
          HALT      57542  57 40000 00 0000 00010
          PM        57543  20 40023 41 4000 00100
                    57544  01 21701 62 0002 57542      PM     -  1
                    57545  01 42006 00 4000 04000
                    57546  01 50400 00 4000 57400
                    57547  01 21711 00 0000 57642      PM     +  77
                    57550  01 40021 00 4000 00001
                    57551  00 20041 50 0002 57542      PM     -  1
                    57552  01 01000 00 4000 57543      PM
*********
```

```
314       HALT      0 57542    3    1470000000000000    0
315       ENTST     0 57532    3    1360000000000000    0
316       L1        0 57410    3     1200000000000000   0
317       SPMS      0 57516    3    1210000000000000    0
320       SPM       0 57471    3     7400000000000000   0
321       PR        0 57534    3    1400000000000000    0
322       PSKP      0 57421    3     3300000000000000   0
323       CMPR      0 57465    3     7000000000000000   0
324       NOOCE     0 57441    3     4300000000000000   0
325       PM        0 57543    3    1500000000000000    0
326       SPEX      0 57505    3    1100000000000000    0
```

329	L[illegible]	0	57520	3	1230000000000000	0
330	G	0	57520	3	1330000000000000	0
331	RENT	0	57512	3	1150000000000000	0