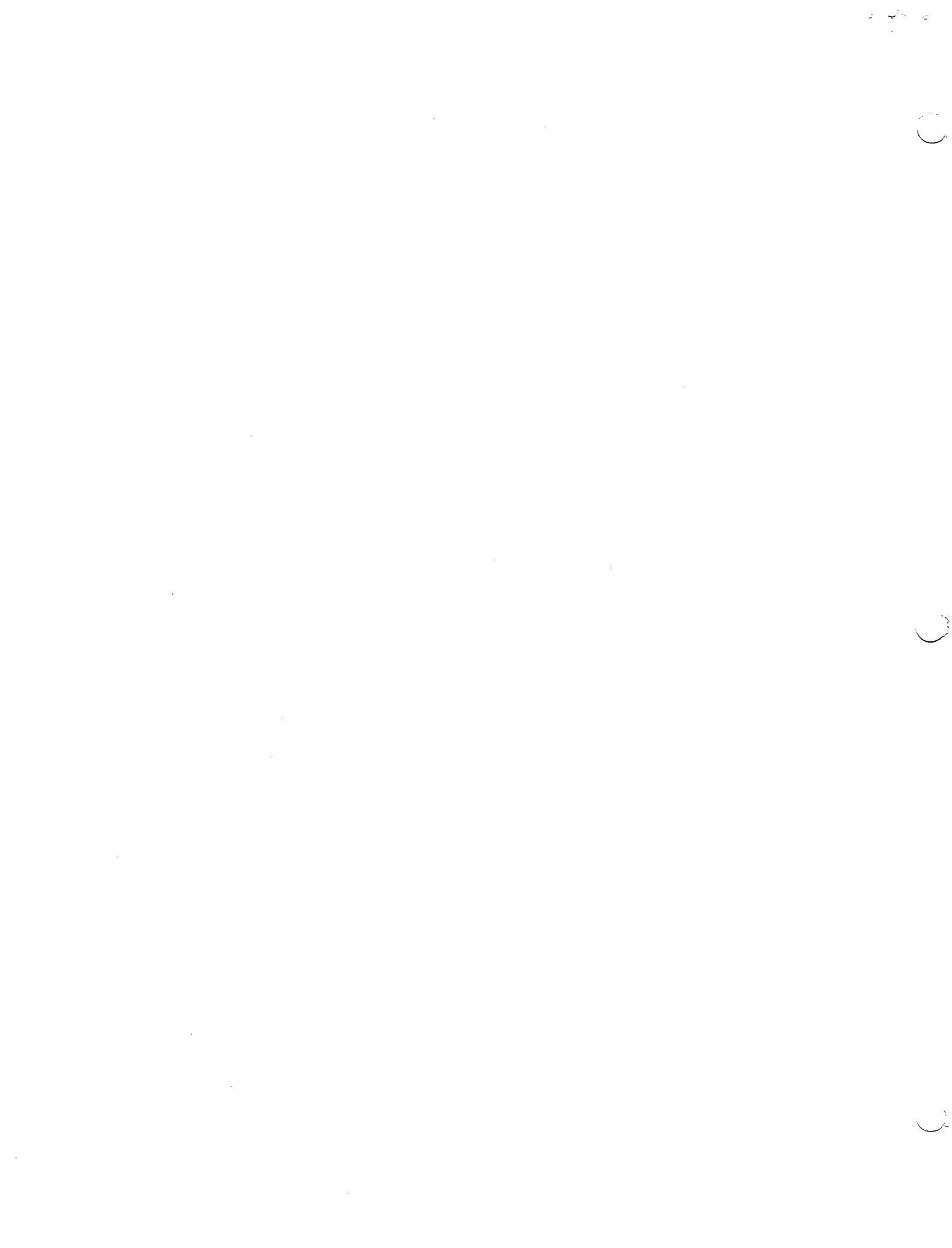


IDENTIFICATION

PRODUCT CODE: MAINDEC-14-D8AB-D
PRODUCT NAME: ABE-14
DATE CREATED: JUNE 18, 1970
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: EDWARD P. STEINBERGER



1. ABSTRACT

The purpose of ABE-14 (Accessory Box Test) is to test and diagnose the operation of the contents of an "Accessory Box" connected to a PDP-14 controller. The PDP-14 is in turn connected to a PDP-8I or 8L which contains the program that performs the tests. Among other tests, the Timers and Retentive Memories in the "A-Box" are timed to determine how long it takes for an output to "set" (turn on). This time is printed out to the operator via the PDP-8 teletype.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-8I or 8L
 PDP-14 to PDP 8I/L Interface Module (M745)
 PDP-14 Controller
 PDP-14 Accessory Box

2.2 STORAGE

The program occupies the first 3000 (octal) locations of PDP-8 memory.

2.3 PRELIMINARY PROGRAMS

TEST-14 should be run upon the PDP-14 successfully before this program is run.

3. LOADING PROCEDURE

3.1 METHOD

This program is loaded into PDP-8 memory using the "standard" PDP-8 Binary Loader technique.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

The following is a table of switch register settings and their operation upon the program:

SR	SET AS	ACTION
0	1	Loop on Current Test
	0	Don't Loop
1	1	Don't Halt on Error
	0	Halt on Error
2	1	Don't Print Errors
	0	Print Errors
3	1	Repeat Time Current Output (T0004 Only)
	0	Don't Repeat Time Current Output

4.2 STARTING ADDRESSES

Start the program at location $\emptyset 2\emptyset\emptyset$ if it is desired to interrogate the operator about the "A-Box" and its configuration.

Start the program at location $\emptyset 2\emptyset 1$ if the "A-Box" and its configuration has been previously defined to the program.

4.3 PROGRAM AND/OR OPERATOR ACTION

4.3.1 Connect the PDP-14 to be used for testing to the PDP-8L/I using the appropriate cables and revision of the M745 interface module. Install INPUT and OUTPUT and Register modules (four M746's).

4.3.2 Connect the PDP-14 A-Box to be tested to the appropriate Output slot in the PDP-14 (normally this is the slot which the user is going to use for the A-Box). Remember the "letter designation" of the Output slot (ref. page A2 of the "Users Guide").

4.3.3 Power up the PDP-8I/L and PDP-14 computers

4.3.4 Load the binary program into the 8I/L using the PDP-8 Binary Loader.

4.3.5 Start the program at location $\emptyset 2\emptyset\emptyset$. Set switch register per 4.1

4.3.6 Answer the questions asked by the program via the Teletype Keyboard [Answer A to S (only 1 letter) except I, O, or Q for "slot letter", answer T for Timer, M for Retentive memory for the contents of each address in the A-Box]

4.3.7 If the PDP-14 is not running, depress PDP-14 "START"

4.3.8 Program will now run to completion (assuming no errors) and will ring the bell on the Teletype Printer when 1 pass of the program has been completed.

5. OPERATING PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS (See 4.1 above)

5.2 SUBROUTINE ABSTRACTS

None

5.3 PROGRAM AND/OR OPERATOR ACTION

If Retentive Memories are being tested in the A-Box, it is necessary to simulate a power failure in the PDP-14 by powering down the PDP-14 so that the retentive ability

of the R.M.'s may be tested. Given below is the proper procedure to use:

- 5.3.1 After receiving the "Power-Down" printout, power-down the PDP-14 by turning the PDP-14 power switch "OFF"
- 5.3.2 Turn PDP-14 power switch "ON"
- 5.3.3. Depress PDP-8 "CONTINUE"

6. ERRORS

6.1 ERROR HALTS AND DESCRIPTION

Most of the error halts in the program are preceded by error type outs. However, if in doubt about the cause of the error halt, consult the program listing.

6.2 ERROR RECOVERY

To 'scope an error condition after an error halt, set the switch register per 4.1 and depress "CONTINUE"

6.3 ERROR MESSAGES

The error messages output by the program (with a very few exceptions) will contain an error designator (a 2 letter error number) followed by a description of the test being performed and/or a description of the failing error condition. If desired, the operator can use the 2 letter error designator to go directly to the module call list to see which module(s) should be replaced. Or, if he desires, he may set up a program 'scope loop and probe the A-Box (and maybe the PDP-14) to determine the failing condition, then replace the failing module.

6.4 ERROR IDENTIFIER - MODULE CALL

IDENTIFIER	MODULE TYPES
BL	K207, K161, K135
BN	See BL
BQ	See BL
BX	See BL
BY	See BL
CB	See BL
CF	K302
CG	K302
CH	K272, D302, K207, K161, K135

7. RESTRICTIONS

7.1 STARTING RESTRICTIONS

None

7.2 OPERATING RESTRICTIONS

INPUT and OUTPUT Register Modules (M746's) must be installed.

8. MISCELLANEOUS

8.1 EXECUTION TIME

The execution time of the program is dependent upon the settings of the timer modules in the A-Box. The bell on the teletype printer will ring at program completion.

9. PROGRAM DESCRIPTION

9.1 Test 3 (SA = 0416)

Checks a TYD "N" status word with the "TEST" flop cleared and output off.

9.2 Test 4 (SA = 0600)

Turns on output "N", times it, and types out time to set it on teleprinter in milliseconds (time output will be within 10% of actual value - variation is due to Family-of-8 timing tolerances and response times). If SR3 = 1, program will loop, typing out the current output setting, so that timers may be adjusted to their approximate final settings.

9.3 Test 5 (SA = 1000)

Checks that with output "N" on, only TYN "N" sets the "TEST" flop.

9.4 Test 6 (SA = 1200)

Checks a TYD "N" status word with the "TEST" flop set and output on.

9.5 Test 7 (SA = 1400)

Checks that with output "N" on, only TYF "N" does not set the "TEST" flop

9.6 Test 8 (SA = 1600)

Checks that only SYF "N" clears output "N" and that SYF 377 clears output "N" only if "N" is a timer.

9.7 Test 10 (SA = 2000)

Checks Retentive Memory's ability to "remember" a 0 after power shut-down.

9.8 Test 11 (SA = 2200)

Checks Retentive Memory's ability to "remember" a 1 after power shut-down.

```

1
2
3 /ABE-14
4 /PROGRAM TO TEST ACCESSORY BOXES
5 /CONNECTED TO THE PDP-14 COMPUTER
6 /WHICH IS IN TURN CONNECTED TO A
7 /PDP-8L OR 8I
8
9 /COPYRIGHT 1969, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
10
11 /DEFINITION OF INTERFACE IOT'S
12 /
13 6161 SIOF=6161 /SKIP ON INSTRUCTION ONE FLAG
14 6162 LDIN=6162 /LOAD THE PDP-14 INPUT REGISTER FROM PDP-8 AC
15 6164 LOEX=6164 /LOAD AND EXECUTE INSTRUCTION IN PDP-14
16 6165 ILEX=6165 /INTERRUPT THE PDP-14, LOAD AND EXECUTE INSTRUCTION
17 6167 CIOF=6167 /CLEAR INSTRUCTION ONE FLAG
18 6171 SOTF=6171 /SKIP IF PDP-14 OUTPUT REGISTER LOADED
19 6172 COTF=6172 /CLEAR OUTPUT FLAG
20 6173 STFF=6173 /SKIP IF PDP-14 TEST FLOP SET
21 4174 CTFF=4174 /CLEAR TEST FLOP
22 6175 SCRPF=6175 /SKIP IF PDP-14 IS RUNNING
23 6176 ROTR=6176 /CLEAR AC, READ OUTPUT REGISTER INTO PDP-8 AC
24
25 0040 *40
26 /CONSTANTS, VARIABLES, ETC.
27 0040 0000 BCNTR, 0 /POINTER TO CURRENT OUTPUT STATUS WORD
28 0041 0000 BPNTR, 0 /COUNTER TO COUNT STATUS WORDS
29 0042 0000 CNTR, 0
30 0043 0000 CHAR, 0
31 0044 0000 HEADER, 0 /HOLD HEADER TYPEOUT ADDRESS
32 0045 0000 INOW, 0 /CURRENT INSTRUCTION
33
34 0046 0017 K0017, 17
35 0047 0020 K0020, 20
36 0050 0240 K0240, 240
37 0051 0377 K0377, 377
38 0052 4252 K4252, 4252
39 0053 7400 K7400, 7400
40
41 0054 0000 LCNTR, 0 /TEST LOOP COUNTER
42 0055 0000 LTEMP, 0
43 0056 0000 LTEMP1, 0
44
45 0057 7771 M0007, -7
46 0060 7761 M0017, -17
47 0061 7760 M0020, -20
48 0062 7500 M0300, -300
49 0063 7467 M0311, -311
50 0064 7463 M0315, -315
51 0065 7461 M0317, -317
52 0066 7457 M0321, -321
53 0067 7454 M0324, -324
54 0070 0000 ONOW, 0 /CURRENT 0-ADDRESS
55 0071 0000 PNTR, 0

```


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56 0072 0000
57 0073 0000
58

SLOT, 0
TSTNOW, 0

/SLOT USED FOR A-BOX
/CURRENT ADDRESS BEING TESTED

59				
60			/	
61	0074	1000	TYF,	1000
62	0075	1400	TYN,	1400
63	0076	3000	SYF,	3000
64	0077	3400	SYN,	3400
65	0100	5000	JFF,	5000
66	0101	7400	TYD,	7400
67			/	
68	0102	2445	PMESAG,	MESAG
69	0103	2512	PPRINT,	PRINT
70	0104	2400	PINTER,	INTER
71	0105	2537	TSTFLP,	FLPERR
72	0106	1203	TYDTST,	TSTTYD

```

73
74
75
76 0107 0000  EXTERN, 0
77 0110 6175  SCRF
78 0111 5110  JMP
79 0112 7200  CLA
80 0113 1116  TAD K0600
81 0114 4504  JMS I PINTER /FORCE PDP-14 INTO EXTERNAL MODE
82 0115 5507  JMP I EXTERN /EXIT
83 0116 0600  K0600, 600
84
85
86 /TYPE SUBROUTINE
87
88 0117 0000  TYPE, 0
89 0120 6046  TLS
90 0121 6041  TSF
91 0122 5121  JMP
92 0123 7200  CLA
93 0124 5517  JMP I TYPE
94
95
96 /CR-LF SUBROUTINE
97
98 0125 0000  CRLF, 0
99 0126 1133  TAD K0215
100 0127 4117  JMS TYPE
101 0130 1134  TAD K0212
102 0131 4117  JMS TYPE
103 0132 5525  JMP I CRLF
104 0133 0215  K0215, 215
105 0134 0212  K0212, 212
106 0135 0007  K0007, 7
107 0136 0260  K0260, 260
108
109 0137 0000  GETCHR, 0
110 0140 6031  KSF
111 0141 5140  JMP
112 0142 6036  KRB
113 0143 3043  DCA CHAR
114 0144 1043  TAD CHAR
115 0145 4117  JMS TYPE
116 0146 1043  TAD CHAR
117 0147 5537  JMP I GETCHR
118
119 0174 *174
120 0174 0000  0
121 0175 1100  TAD JFF
122 0176 4504  JMS I PINTER
123 0177 5574  JMP I 174

```

```

124
125      0200      0200      *200
126      0200      7410      ABXTST, SKP          /GO TO INTERROGATION ROUTINE
127      0201      5777      JMP          STRTST
128      0202      4125      JMS          CRLF          /CR-LF
129      0203      1324      QUES1, TAD          PMES1
130      0204      4502      JMS I       PMESAG        /TYPE OUT FIRST QUESTION
131      0205      4137      JMS          GETCHR        /GET ANSWER
132      0206      3072      DCA          SLOT          /AND SAVE
133      0207      4125      JMS          CRLF          /CR-LF
134      0210      1072      TAD          SLOT          /CHECK FOR GOOD CHARACTER
135      0211      1062      TAD          M0300
136      0212      7710      SPA CLA          /IS IT >300?
137      0213      5203      JMP          QUES1         /NO
138      0214      1072      TAD          SLOT
139      0215      1063      TAD          M0311
140      0216      7650      SNA CLA          /IS IT 1?
141      0217      5203      JMP          QUES1         /YES
142      0220      1072      TAD          SLOT
143      0221      1065      TAD          M0317
144      0222      7650      SNA CLA          /IS IT 0?
145      0223      5203      JMP          QUES1         /YES
146      0224      1072      TAD          SLOT
147      0225      1066      TAD          M0321
148      0226      7650      SNA CLA          /IS IT 0?
149      0227      5203      JMP          QUES1         /YES
150      0230      1072      TAD          SLOT
151      0231      1067      TAD          M0324
152      0232      7700      SMA CLA          /IS IT <324?
153      0233      5203      JMP          QUES1         /NO
154      0234      1776      QUES2, TAD          PMES2
155      0235      4502      JMS I       PMESAG        /MAKE SECOND STATEMENT
156      0236      4125      JMS          CRLF
157      0237      1775      TAD          PMES2A
158      0240      4502      JMS I       PMESAG
159      0241      1061      TAD          M0020
160      0242      3042      DCA          CNTR
161      0243      1047      TAD          K0020
162      0244      3071      DCA          PNTR
163      0245      4125      QUESN, JMS          CRLF          /CR-LF
164      0246      1071      TAD          PNTR
165      0247      0046      AND          K0017
166      0250      4503      JMS I       PPRINT        /TYPE OUT ADDRESS
167      0251      1050      TAD          K0240
168      0252      4117      JMS          TYPE          /AND A SPACE
169      0253      4137      JMS          GETCHR
170      0254      1067      TAD          M0324
171      0255      7640      SZA CLA          /T?
172      0256      5261      JMP          ,+3          /NO
173      0257      7001      IAC          /SET AC TO 1
174      0260      5265      JMP          ,+5
175      0261      1043      TAD          CHAR
176      0262      1064      TAD          M0315
177      0263      7650      SNA CLA          /M?
178      0264      7330      CLA GLL CML RAR        /SET AC TO 4000

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179	0265	3471
180	0266	2071
181	0267	2042
182	0270	5245
183	0271	4125
184	0272	5201

DCA	I
ISE	
ISE	
JMP	
JMS	
JMP	

PNTR
PNTR
CNTR
QUESN
CRLF
201

/DONE ALL ADDRESSES?
/NO
/YES

185				
186	0301		*301	
187			/TABLE TO CONVERT FROM SLOT LETTER TO ADDRESS	
188	0301	0000	0	/A
189	0302	0020	20	/B
190	0303	0040	40	/C
191	0304	0060	60	/D
192	0305	0100	100	/E
193	0306	0120	120	/F
194	0307	0140	140	/G
195	0310	0160	160	/H
196	0311	0000	0	/I
197	0312	0200	200	/J
198	0313	0220	220	/K
199	0314	0240	240	/L
200	0315	0260	260	/M
201	0316	0300	300	/N
202	0317	0000	0	/O
203	0320	0320	320	/P
204	0321	0000	0	/Q
205	0322	0340	340	/R
206	0323	0360	360	/S
207				
208	0324	0325	PMES1, +1	
209	0325	0135	0135	/A,-
210	0326	0217	0217	/B,0
211	0327	3040	3040	/X,SP
212	0330	1123	1123	/I,S
213	0331	4003	4003	/SP,C
214	0332	1716	1716	/O,N
215	0333	1605	1605	/N,E
216	0334	0324	0324	/C,T
217	0335	0504	0504	/E,D
218	0336	4024	4024	/SP,T
219	0337	1740	1740	/O,SP
220	0340	2314	2314	/S,L
221	0341	1724	1724	/O,T
222	0342	4000	4000	/SP,END

223
 224 0375 2745
 225 0376 2705
 226 0377 0400
 227
 228
 229
 230 0400 7300
 231 0401 4107
 232 0402 1472
 233 0403 3070
 234 0404 1047
 235 0405 3041
 236 0406 1061
 237 0407 3040
 238 0410 1441
 239 0411 7050
 240 0412 5777
 241 0413 4222
 242 0414 4776
 243 0415 4174
 244
 245
 246
 247
 248
 249 0416 4506
 250 0417 0400
 251 0420 5775
 252 0421 4000
 253
 254 0422 0000
 255 0423 7200
 256 0424 1053
 257 0425 3054
 258 0426 1076
 259 0427 3045
 260 0430 1045
 261 0431 4504
 262 0432 2045
 263 0433 7000
 264 0434 2054
 265 0435 5230
 266 0436 5022

*400
 /AFTER INTERROGATION, THE PROGRAM COMES HERE
 /TO SET UP FOR TESTING
 STRTST, CLA CLL
 JMS EXTERN /PUT 14 IN EXTERNAL MODE
 TAD I SLOT /DERIVE FIRST O-ADDRESS
 DCA ONOW /FROM SLOT USED FOR A-BOX
 TAD K0020 /SET UP POINTER
 DCA BPNTR
 TAD M0020 /AND COUNTER FOR 20 OUTPUTS
 DCA BCNTR
 TSTLUP, TAD I BPNTR /PICK UP ADDRESS STATUS WORD
 SNA CLA /TIMER OR RETENTIVE MEMORY?
 JMP INGADD /NO
 JMS CLRDT /SET ALL OUTPUTS OFF
 JMS D120MS /DELAY 120 MS
 CTFF /CLEAR TEST FLOP

/NEXT ISSUE A TYD N AND CHECK THE STATUS WORD
 T0003, JMS I TYDST /EXECUTE A TYD N
 0400 /MOST SIGNIFICANT BITS OF STATUS WORD
 JMP T0004
 4000
 /SET ALL OUTPUTS OFF SUBROUTINE
 CLRDT, 0
 CLA
 TAD K7400
 DCA LCNTR /SET UP LOOP COUNT
 TAD SYF
 DCA INOW /SET UP INSTRUCTION TO BE EXECUTED
 TAD INOW
 JMS I PINTER /EXECUTE THE SYF
 ISE INOW /INCREMENT THE SYF
 NDP
 ISE LCNTR /DONE?
 JMP 5 /NO
 JMP I CLRDT /YES

267
 268 0575 0600
 269 0576 2557
 270 0577 1675
 0600

*600
 /SET CURRENT OUTPUT DN, TIME HOW LONG IT TAKES
 /TO THE NEAREST MILLISECOND (LOW)
 /ALLOW A MAXIMUM OF 1 MINUTE (ACTUALLY 61.5 SECONDS)

271
 272
 273
 274
 275 0600 7300
 276 0601 1070
 277 0602 1077
 278 0603 4504
 279 0604 7604
 280 0605 7710
 281 0606 5200
 282 0607 4174
 283 0610 1060
 284 0611 3016
 285 0612 3017
 286 0613 4345
 287 0614 6173
 288 0615 5246
 289 0616 4125
 290 0617 1275
 291 0620 4502
 292 0621 1070
 293 0622 4503
 294 0623 1302
 295 0624 4502
 296 0625 1016
 297 0626 1046
 298 0627 3016
 299 0630 4777
 300 0631 0016
 301 0632 1314
 302 0633 4502
 303 0634 4125
 304
 305
 306 0635 7604
 307 0636 0274
 308 0637 7650
 309 0640 5776
 310 0641 1070
 311 0642 1076
 312 0643 4504
 313 0644 4775
 314 0645 5200
 315 0646 2017
 316 0647 5213
 317 0650 2016
 318 0651 5213
 319 0652 7604
 320 0653 7006

```

T0004: CLA CLL
      TAD   ONDW
      TAD   SYN
      JMS I PINTER /EXECUTE SYN N
      LAS
      SFA CLA /LOOP?
      JMP T0004 /YES
      CTF: /CLEAR TEST FLOP
      TAD M0017 /SET UP FOR 1 MINUTE
      DCA 16
      DCA 17
L0004: JMS TIMEIT
      STFF /IS TEST FLOP SET?
      JMP TIME /NO
      JMS CRLF /YES TYPE OUT TIME
      TAD PM4A
      JMS I PHESAG /TYPE "OUTPUT"
      TAD ONDW
      JMS I PPRINT /TYPE OUTPUT NUMBER
      TAD PM4B
      JMS I PHESAG /TYPE OUT REST OF MESSAGE
      TAD 16
      TAD K0017
      DCA 16
      JMS UDPRNT /TYPE OUT NUMBER OF MS
      16
      TAD PM4C
      JMS I PHESAG /TYPE OUT "MILLISEC NOS"
      JMS CRLF
/THIS LOOP IS FOR SETTING TIMERS
/(TIMER SETTING WILL BE TYPED OUT
      LAS
      AND K0400 /SR 3*1
      SNA CLA /LOOP THIS OUTPUT?
      JMP T0005 /NO
      TAD ONDW /YES
      TAD SYF
      JMS I PINTER /TURN OUTPUT OFF
      JMS D120MS /DELAY 120 MS
      JMP T0004 /LOOP
TIME, ISZ 17
      JMP L0004
      ISZ 16
      JMP L0004
      LAS /HERE IF TIMED OUT
      RTL
    
```


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321	0654	7710	SPA	CLA	/TYPE OUT ERRORS?
322	0655	5264	JMP	E0004-3	/NO
323	0656	4123	JMS	CRLF	
324	0657	1324	TAD	PM4D	
325	0660	4902	JMS I	PMESAG	/TYPE OUT ERROR MESSAGE
326	0661	1070	TAD	ONOW	
327	0662	4503	JMS I	PPRINT	/TYPE OUT ADDRESS
328	0663	4123	JMS	CRLF	
329	0664	7604	LAS		
330	0665	7004	RAL		
331	0666	7700	SMA	CLA	/HALT ON ERROR?
332	0667	7402	HLT		/YES
333	0670	7604	LAS		
334	0671	7710	SPA	CLA	/LOOP?
335	0672	5200	JMP	T0004	/YES
336	0673	5776	JMP	T0003	/NO
337	0674	0400	K0400,	400	

338	0675	0676	PM4A,	.+1	
339	0676	1725		1725	/O,U
340	0677	2420		2420	/T,P
341	0700	2524		2524	/U,T
342	0701	4000		4000	/SP,END
343					
344	0702	0703	PM4B,	.+1	
345	0703	4023		4023	/SP,S
346	0704	0524		0524	/E,T
347	0705	4017		4017	/SP,O
348	0706	1640		1640	/N,SP
349	0707	1116		1116	/I,N
350	0710	4001		4001	/SP,A
351	0711	0217		0217	/B,O
352	0712	2524		2524	/U,T
353	0713	4000		4000	/SP,END
354					
355	0714	0715	PM4C,	.+1	
356	0715	4015		4015	/SP,M
357	0716	1114		1114	/I,L
358	0717	1411		1411	/L,I
359	0720	2305		2305	/S,E
360	0721	0317		0317	/C,O
361	0722	1604		1604	/N,D
362	0723	2300		2300	/S,END
363					
364	0724	0725	PM4D,	.+1	
365	0725	5252		5252	/*,*
366	0726	0310		0310	/C,H
367	0727	5252		5252	/*,*
368	0730	4024		4024	/SP,T
369	0731	1115		1115	/I,M
370	0732	0540		0540	/E,SP
371	0733	1725		1725	/O,U
372	0734	2440		2440	/T,SP
373	0735	0522		0522	/E,R
374	0736	2217		2217	/R,U
375	0737	2254		2254	/R,,
376	0740	4017		4017	/SP,O
377	0741	2524		2524	/U,T
378	0742	2025		2025	/P,U
379	0743	2440		2440	/T,SP
380	0744	0000		0	/END

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381 0745 0000
382 0746 7300
383 0747 1070
384 0750 1075
385 0751 4504
386 0752 1362
387 0753 3010
388 0754 6173
389 0755 7410
390
391 0756 5745
392 0757 2010
393 0760 5354
394 0761 5745
395 0762 7640

TIMEIT, 0 /EXIT IN 1 MS OR WITH TEST FLOP SET
CLA CLL
TAD ONOW
TAD TYN
JMS I PINTER /EXECUTE TYN N
TAD TIMCON
DCA 10
STFF
SKP
JMP I TIMEIT
ISE 10
JMP r=4
JMP I TIMEIT
TIMCON, -140

396 0775 2557
 397 0776 1000
 398 0777 2600
 1000

*1000
 /ALL TYN INSTRUCTIONS WILL BE ISSUED
 /ONLY TYN N SHOULD SET THE TEST FLOP

399
 400
 401
 402 1000 7300
 403 1001 1053
 404 1002 3054
 405 1003 1075
 406 1004 3045
 407 1005 4174
 408 1006 1045
 409 1007 0051
 410 1010 3073
 411 1011 1045
 412 1012 4504
 413 1013 7604
 414 1014 7710
 415 1015 5205
 416 1016 1073
 417 1017 7041
 418 1020 1070
 419 1021 7640
 420 1022 5230
 421 1023 1247
 422 1024 3044
 423 1025 6173
 424 1026 4505
 425 1027 5235
 426 1030 1271
 427 1031 3044
 428 1032 6173
 429 1033 7410
 430 1034 4505
 431 1035 7604
 432 1036 7710
 433 1037 5205
 434 1040 2045
 435 1041 2054
 436 1042 5205
 437 1043 1070
 438 1044 1075
 439 1045 4504
 440 1046 5777

T0005, CLA CLL
 TAD K7400
 DCA LCNTR /SET UP LOOP COUNTER
 TAO TYN
 DCA INOW /SET UP TEST INSTRUCTION TO BE EXECUTED
 L0005, CTFF /CLEAR TEST FLOP
 TAO INOW
 AND K0377
 DCA TSTNOW
 TAO INOW
 JMS I PINTER /EXECUTE THE TYN
 LAS
 SPA CLA /LOOP?
 JMP L0005 /YES
 TAD TSTNOW
 CIA
 TAO ONOW
 SEA CLA /ADDRESSING CURRENT OUTPUT?
 JMP ,+6 /NO
 TAD PMSA
 DCA HEADER
 STFF /TEST FLOP SET?
 JMS I TSTFLP /NO, ERROR
 JMP ,+6
 TAD PMSB
 DCA HEADER
 STFF /TEST FLOP SET?
 SKP /NO
 JMS I TSTFLP /YES, ERROR
 LAS
 SPA CLA /LOOP?
 JMP L0005 /YES
 ISE INOW /INCREMENT TO NEXT INSTRUCTION
 ISE LCNTR /DONE ALL INSTRUCTIONS?
 JMP L0005 /NO
 TAD ONOW
 TAO TYN
 JMS I PINTER /EXIT WITH TEST FLOP SET
 JMP T0006

441
442 1047 1050
443 1050 5252
444 1051 0230
445 1052 5252
446 1053 4024
447 1054 0523
448 1055 2440
449 1056 0614
450 1057 1720
451 1060 4016
452 1061 1724
453 1062 4023
454 1063 0524
455 1064 4002
456 1065 3140
457 1066 2431
458 1067 1640
459 1070 0000
460
461 1071 1072
462 1072 5252
463 1073 0221
464 1074 5252
465 1075 4024
466 1076 0523
467 1077 2440
468 1100 0614
469 1101 1720
470 1102 4023
471 1103 0524
472 1104 4002
473 1105 3140
474 1106 2431
475 1107 1640
476 1110 0000

/**BX** TEST FLOP NOT SET BY TYN
PMSA, ,*1

5252
0230
5252
4024
0523
2440
0614
1720
4016
1724
4023
0524
4002
3140
2431
1640
0

/**BQ** TEST FLOP SET BY TYN
PMSB, ,*1

5252
0221
5252
4024
0523
2440
0614
1720
4023
0524
4002
3140
2431
1640
0

```

477 1177 1200
      1200 *1200
478 /ISSUE ANOTHER TYD N AND CHECK THE STATUS WORD
479
480 1200 4506 T0006, JMS I TYDTST /EXECUTE A TYD N
481 1201 6400      6400 /MOST SIGNIFICANT BITS OF STATUS WORD
482 1202 5777      JMP T0007
483 /TYD INSTRUCTION TEST SUBROUTINE
484
485 1203 0000 TSTTYD, 0
486 1204 7200      CLA
487 1205 1070 TYDLUP, TAD ONOW
488 1206 1101      TAD TYD
489 1207 4904      JMS I PINTER /EXECUTE A TYD N
490 1210 7604      LAS
491 1211 7710      SPA CLA /LOOP?
492 1212 5205      JMP TYDLUP /YES
493 1213 6171      SOTF /OUTPUT REGISTER FLAG SET?
494 1214 7402      HLT /NO
495 1215 1070      TAD ONOW
496 1216 1603      TAD I TSTTYD
497 1217 3055      DCA LTEMP /FORM EXPECTED RESULT AND STORE
498 1220 6176      ROTR /READ OUTPUT REGISTER
499 1221 3056      DCA LTEMP1
500 1222 1056      TAD LTEMP1
501 1223 7041      CIA
502 1224 1055      TAD LTEMP
503 1225 7640      SZA CLA /CORRECT STATUS WORD?
504 1226 4234      JMS TYDERR /NO
505 1227 7604      LAS
506 1230 7710      SPA CLA /LOOP?
507 1231 5205      JMP TYDLUP /YES
508 1232 2203      ISZ TSTTYD /NO
509 1233 5603      JMP I TSTTYD /EXIT

```

510
 511
 512 1234 0000
 513 1235 7604
 514 1236 7006
 515 1237 7710
 516 1240 5261
 517 1241 4125
 518 1242 1274
 519 1243 4502
 520 1244 1070
 521 1245 4503
 522 1246 4125
 523 1247 1266
 524 1250 4502
 525 1251 4125
 526 1252 1055
 527 1253 4503
 528 1254 1050
 529 1255 4117
 530 1256 1056
 531 1257 4503
 532 1260 4125
 533 1261 7604
 534 1262 7004
 535 1263 7700
 536 1264 7402
 537 1265 5634
 538
 539 1266 1267
 540 1267 0717
 541 1270 1704
 542 1271 4002
 543 1272 0104
 544 1273 0000
 545
 546 1274 1275
 547 1275 5252
 548 1276 0216
 549 1277 5252
 550 1300 4023
 551 1301 2401
 552 1302 2425
 553 1303 2340
 554 1304 0522
 555 1305 2217
 556 1306 2254
 557 1307 4024
 558 1310 3104
 559 1311 4000

```

/TYD ERROR SUBROUTINE

TYDERR, 0
    LAS
    RTL
    SPA CLA /TYPE OUT ERRORS?
    JMP ERRTYD=3 /NO
    JMS CRLF
    TAD TYDMES
    JMS I PMESAG /TYPE OUT HEADING
    TAD DNOH
    JMS I PPRINT /TYPE OUT ADDRESS
    JMS CRLF
    TAD PGDBD2
    JMS I PMESAG /TYPE OUT "GOOD BAD"
    JMS CRLF
    TAD LTEMP
    JMS I PPRINT /TYPE OUT GOOD DATA
    TAD K0240
    JMS TYPE /1 SPACE
    TAD LTEMP1
    JMS I PPRINT /TYPE OUT BAD DATA
    JMS CRLF
    LAS
    RAL
    SMA CLA /HALT ON ERROR?
    HLT /YES
    JMP I TYDERR

PGDBD2, +1
    0717 /G,D
    1704 /D,D
    4002 /SP,B
    0104 /A,D
    0 /END

/**BN** STATUS ERRDR, TYD
TYDMES, +1
    5252
    0216
    5252
    4023
    2401
    2425
    2340
    0522
    2217
    2254
    4024
    3104
    4000
    
```

560 1377 1400
 1400
 561
 562
 563 1400 7300
 564 1401 1053
 565 1402 3054
 566 1403 1074
 567 1404 3045
 568 1405 4174
 569 1406 1045
 570 1407 0051
 571 1410 3073
 572 1411 1045
 573 1412 4504
 574 1413 7604
 575 1414 7710
 576 1415 5205
 577 1416 1073
 578 1417 7041
 579 1420 1070
 580 1421 7650
 581 1422 5230
 582 1423 1244
 583 1424 3044
 584 1425 6173
 585 1426 4505
 586 1427 5235
 587 1430 1266
 588 1431 3044
 589 1432 6173
 590 1433 7410
 591 1434 4505
 592 1435 7604
 593 1436 7710
 594 1437 5205
 595 1440 2045
 596 1441 2054
 597 1442 5205
 598 1443 5777

*1400
 /TEST ALL TYF INSTRUCTIONS; ALL SHOULD SET TEST FLOP EXCEPT TYF N

T0007: CLA CLL
 TAD K7400
 DCA LCNTR /SET UP LOOP COUNTER
 TAD TYF
 DCA INOW /SET UP INSTRUCTION TO BE EXECUTED
 L0007: CTFF /CLEAR THE TEST FLOP
 TAD INOW
 AND K0377
 DCA TSTNOW
 TAD INOW
 JMS I PINTER /EXECUTE THE TYF
 LAS
 SPA CLA /LOOP?
 JMP L0007 /YES
 TAD TSTNOW
 CIA
 TAD ONOW
 SNA CLA /ADDRESSING CURRENT OUTPUT?
 JMP ,+6 /YES
 TAD PM7A
 DCA HEADER
 STFF /TEST FLOP SET?
 JMS I TSTFLP /NO, ERROR
 JMP ,+6 /YES, OK
 TAD PM7B
 DCA HEADER
 STFF /TEST FLOP SET?
 SKP /NO
 JMS I TSTFLP /YES, ERROR
 LAS
 SPA CLA /LOOP?
 JMP L0007 /YES
 ISZ INOW /INCREMENT TO NEXT INSTRUCTION
 ISZ LCNTR /DONE ALL INSTRUCTIONS?
 JMP L0007 /NO
 T0008

599
600 1444 1445
601 1445 5252
602 1446 0214
603 1447 5252
604 1450 4024
605 1451 0523
606 1452 2440
607 1453 0614
608 1454 1720
609 1455 4016
610 1456 1724
611 1457 4023
612 1460 0524
613 1461 4002
614 1462 3140
615 1463 2431
616 1464 0640
617 1465 0000
618
619
620 1466 1467
621 1467 5252
622 1470 0231
623 1471 5252
624 1472 4024
625 1473 0523
626 1474 2440
627 1475 0614
628 1476 1720
629 1477 4023
630 1500 0524
631 1501 4002
632 1502 3140
633 1503 2431
634 1504 0640
635 1505 0000

/**BL** TEST FLOP NOT SET BY TYF
PM7A,

,*1
5252
0214
5252
4024
0523
2440
0614
1720
4016
1724
4023
0524
4002
3140
2431
0640
0

/**BY** TEST FLOP SET BY TYF
PM7B,

,*1
5252
0231
5252
4024
0523
2440
0614
1720
4023
0524
4002
3140
2431
0640
0

```

636 /ONLY SYF "N" SHOULD CLEAR OUTPUT "N" IF "N" IS A TIMER,
637
638 /TAPE 2
639 1577 1600
        1600
640 *1600
641 /TEST SYF 0 TO 377 (EXCEPT "N" AND 377) TO NOT AFFECT OUTPUT "N"
642 /SYF "N" AND SYF 377 SHOULD CLEAR OUTPUT "N" IF "N" IS A TIMER,
643 /ONLY SYF "N" SHOULD CLEAR OUTPUT "N" IF "N" IS A MEMORY
644 1600 7300 T0008, CLA CLL
645 1601 1053 TAD K7400
646 1602 3054 DCA LONTR /SET UP LOOP COUNTER
647 1603 1076 TAD SYF
648 1604 3045 DCA INOW /SET UP INSTRUCTION TO BE EXECUTED
649 1605 4174 L0008, CTFF /CLEAR TEST FLOP
650 1606 1070 TAD ONOW
651 1607 1075 TAD TYN
652 1610 4504 JMS I PINTER /EXECUTE TYN N
653 1611 6173 STFF /IS OUTPUT "N" ON?
654 1612 7410 SKP / NO
655 1613 5224 JMP ,+11 /YES
656 1614 1070 TAD ONOW
657 1615 1077 TAD SYN
658 1616 4504 JMS I PINTER /SET OUTPUT "N"
659 1617 1070 TAD ONOW /WAIT
660 1620 1075 TAD TYN /FOR
661 1621 4504 JMS I PINTER /OUTPUT
662 1622 6173 STFF /TO TURN
663 1623 5217 JMP ,=4 /ON
664 1624 1045 TAD INOW
665 1625 4504 JMS I PINTER /TURN OFF OUTPUT "Y"
666 1626 4777 JMS 0120MS /DELAY 120 MS
667 1627 7604 LAS
668 1630 7710 SPA CLA /LODP?
669 1631 5205 JMP L0008 /YES
670 1632 4174 CTFF /CLEAR TEST FLOP
671 1633 1070 TAD ONOW
672 1634 1074 TAD TYF
673 1635 4504 JMS I PINTER /EXECUTE TYF "N"
674 1636 1045 TAD INOW
675 1637 0051 AND K0377
676 1640 7041 CIA
677 1641 1070 TAD ONOW
678 1642 7650 SNA CLA /CURRENT OUTPUT?
679 1643 5263 JMP OUTCLR /YES
680 1644 1045 TAD INOW
681 1645 0051 AND K0377
682 1646 7041 CIA
683 1647 1051 TAD K0377
684 1650 7640 SZA CLA /OUTPUT 377?
685 1651 5255 JMP OUTSET /NO
686 1652 1441 TAD I BPNTR /YES
687 1653 7700 SMA CLA /R.M.?
688 1654 5263 JMP OUTCLR /NO

```

689					
690	1655	1367	OUTSET, TAD	PM8A	
691	1656	3044	OCA	HEADER	
692	1657	6173	STFF		/TEST FLOP SET?
693	1660	7410	SKP		/NO, OK
694	1661	4314	JMS	ERR8	/YES, ERROR
695	1662	5267	JMP	10008-3	
696	1663	1341	OUTCLR, TAD	PM8B	
697	1664	3044	OCA	HEADER	
698	1665	6173	STFF		/TEST FLOP SET?
699	1666	4314	JMS	ERR8	/NO, ERROR
700	1667	7604	LAS		/YES, OK
701	1670	7710	SPA CLA		/LOOP?
702	1671	5205	JMP	L0008	/YES
703	1672	2045	10008, ISE	INOW	/INCREMENT INSTRUCTION TO BE EXECUTED
704	1673	2054	ISE	LCNTR	/DONE ALL INSTRUCTIONS?
705	1674	5205	JMP	L0008	/NO
706					
707			/PROGRAM COMES HERE TO INCREMENT TO NEXT OUTPUT ADDRESS		
708	1675	2070	INCA00, ISE	ONOW	/INCREMENT OUTPUT ADDRESS
709	1676	2041	ISE	BPNTR	/INCREMENT STATUS WORD POINTER
710	1677	2040	ISE	BCNTR	/DONE ALL OUTPUTS
711	1700	5776	JMP	TSTLUP	/NO
712					
713			/AFTER TESTING ALL OUTPUTS, CHECK TO SEE		
714			/IF THE RETENTIVE MEMORY POWER TESTS SHOULD BE RUN		
715	1701	1047	TAD	K0020	/SET UP
716	1702	3041	OCA	BPNTR	/SCAN POINTER
717	1703	1061	TAD	M0020	
718	1704	3040	OCA	BCNTR	/AND COUNTER
719	1705	1441	TAD I	BPNTR	/GET OUTPUT STATUS
720	1706	7710	SPA CLA		/R.M.?
721	1707	5775	JMP	T0010	/YES
722	1710	2041	ISE	BPNTR	/NO
723	1711	2040	ISE	BCNTR	
724	1712	5305	JMP	,=5	/TRY NEXT OUTPUT
725	1713	5774	JMP	10011+4	/NO R.M.'S CONNECTED

726
727
728
729 1714 0000
730 1715 7604
731 1716 7006
732 1717 7710
733 1720 5334
734 1721 4125
735 1722 1356
736 1723 4502
737 1724 1070
738 1725 4503
739 1726 1044
740 1727 4502
741 1730 1045
742 1731 0051
743 1732 4503
744 1733 4125
745 1734 7604
746 1735 7004
747 1736 7700
748 1737 7402
749 1740 5714
750
751
752 1741 1742
753 1742 4016
754 1743 1724
755 1744 4024
756 1745 2522
757 1746 1605
758 1747 0440
759 1750 1706
760 1751 0640
761 1752 0231
762 1753 4023
763 1754 3106
764 1755 4000
765
766 1756 1757
767 1757 5252
768 1760 0302
769 1761 5252
770 1762 4017
771 1763 2524
772 1764 2025
773 1765 2440
774 1766 0000
775 1767 1744

/SUBROUTINE TO HANDLE CLEAR OUTPUT CROSSTALK ERRORS

```

ERR8, 0
      LAS
      RTL
      SPA CLA          /TYPE OUT ERRORS?
      JMP E0008-3     /NO
      JMS CRLF        /YES
      TAD PM8C
      JMS I PMESAG    /TYPE OUT ERROR CODE AND "OUTPUT"
      TAD ONOW
      JMS I PPRINT    /TYPE OUTPUT NUMBER
      TAD HEADER
      JMS I PMESAG    /TYPE REST OF MESSAGE
      TAD INOW
      AND K0377
      JMS I PPRINT    /TYPE OUT OTHER NUMBER
      JMS CRLF
      LAS
      RAL
      SMA CLA          /HALT DN ERROR?
E0008, HLT           /YES
      JMP I ERR8

```

/NOT TURNED OFF BY SYF

```

PM88, .+1
      4016
      1724
      4024
      2522
      1605
      0440
      1706
      0640
      0231
      4023
      3106
      4000
      /**CB** OUTPUT
PM8C, .+1
      5252
      0302
      5252
      4017
      2524
      2025
      2440
      0
PM8A, PM88+3

```

```

776
777 1774 2260
778 1775 2000
779 1776 0410
780 1777 2557
      2000
781
782
783
784
785
786
787
788 2000 7200
789 2001 1261
790 2002 3044
791 2003 4777
792 2004 4125
793 2005 1776
794 2006 4502
795 2007 4125
796 2010 6175
797 2011 7412
798 2012 5210
799 2013 4107
800 2014 1472
801 2015 3070
802 2016 1047
803 2017 3041
804 2020 1061
805 2021 3040
806 2022 7300
807 2023 1441
808 2024 7700
809 2025 5234
810 2026 4174
811 2027 1070
812 2030 1074
813 2031 4504
814 2032 6173
815 2033 4241
816 2034 2070
817 2035 2041
818 2036 2040
819 2037 5222
820 2040 5775

```

```

*2000
/NOW TO GET TO THE TESTS WHICH ARE PARTICULAR TO
/THE RETENTIVE MEMORIES.,
/
/FIRST, ALL RETENTIVE MEMORIES WILL BE SET TO 0
/THEN THE OPERATOR WILL POWER DOWN THE PDP-14
/THEN HE WILL POWER IT BACK UP AGAIN

T0010, CLA
      TAO PM10
      OCA HEA0ER
      JMS CLR0UT /CLEAR ALL OUTPUTS
      JMS CRLF
      TAO PMES3
      JMS I PMESAG /TYPE OUT POWER DOWN MESSAGE
      JMS CRLF
      SCRFB /WAIT FOR POP-14 POWER DOWN
      SKP HLT
      JMP ,=2
      JMS EXTERN /PUT THE 14 IN EXTERNAL MODE WHEN POWER RETURNS
      TAO I SLOT
      OCA ONOW
      TAO K0020
      OCA BPNTR
      TAO M0020
      OCA BCNTR

L0010, CLA CLL
      TAO I BPNTR
      SMA CLA /RETENTIVE MEMORY?
      JMP I0010 /NO
      CTFB /CLEAR TEST FLOP
      TAO ONOW
      TAO TYF
      JMS I P1NTR /EXCUTE A TYF N
      STFB /TEST FLOP SET?

I0010, ISZ ONOW /INCREMENT OUTPUT ADDRESS
      ISZ BPNTR /INCREMENT STATUS WORD POINTER
      ISZ BCNTR /INCREMENT COUNTER
      JMP L0010 /NOT DONE
      JMP T0011

```

```

821 2041 0000 ERR10, 0
822 2042 7604 LAS
823 2043 7006 RTL
824 2044 7710 SPA CLA /TYPE OUT ERRORS?
825 2045 5254 JMP E0010-3 /NO
826 2046 4125 JMS CRLF
827 2047 1044 TAD HEADER
828 2050 4502 JMS I PMESAG /TYPE OUT ERROR
829 2051 1070 TAD ONOW
830 2052 4503 JMS I PPRINT /TYPE OUT ADDRESS
831 2053 4125 JMS CRLF
832 2054 7604 LAS
833 2055 7004 RAL
834 2056 7700 SMA CLA /HALT ON ERROR?
835 2057 7402 E0010, HLT /YES
836 2060 5641 JMP I ERR10
837
838 2061 2062 PM10, +1
839 2062 5252 5252 /*,*
840 2063 0306 0306 /C,F
841 2064 5252 5252 /*,*
842 2065 4032 4032 /SP,Z
843 2066 0522 0522 /E,R
844 2067 1740 1740 /O,SP
845 2070 1417 1417 /L,0
846 2071 2324 2324 /S,T
847 2072 4011 4011 /SP,I
848 2073 1640 1640 /N,SP
849 2074 2017 2017 /P,0
850 2075 2705 2705 /H,E
851 2076 2240 2240 /R,SP
852 2077 2310 2310 /S,H
853 2100 2524 2524 /U,T
854 2101 5504 5504 /-D
855 2102 1727 1727 /O,W
856 2103 1640 1640 /N,SP
857 2104 0231 0231 /B,Y
858 2105 4022 4022 /SP,R
859 2106 1540 1540 /M,SP
860 2107 0000 0 /END

```

861 2175 2200
 862 2176 2314
 863 2177 0422
 2200

*2200

/NOW ALL RETENTIVE MEMORIES WILL BE SET TO 1
 /THEN THE OPERATOR WILL POWER DOWN THE PDP-14
 /THEN HE WILL POWER IT BACK UP AGAIN

864
 865
 866
 867

868 2200 7200
 869 2201 1266
 870 2202 3044
 871 2203 1472
 872 2204 3070
 873 2205 1047
 874 2206 3041
 875 2207 1061
 876 2210 3040
 877 2211 7300

```

T0011,  CLA
        TAD      PM11
        DCA      HEADER
        TAD I    SLOT      /SET UP LOCATIONS
        DCA      ONOW
        TAD      K0020     /TO ENABLE SETTING
        DCA      BPNTR
        TAD      M0020     /OF ALL R.M.'S
        DCA      BCNTR

L0011A, CLA CLL
        TAD I    BPNTR
        SMA CLA   /RETENTIVE MEMORY?
        JMP      ,+4     /NO
        TAD      ONOW
        TAD      SYN
        JMS I    PINTER  /EXECUTE A SYN "N"
        ISZ     ONOW
        ISZ     BPNTR
        ISZ     BCNTR     /TURNED ON ALL R.M.'S
        JMP     L0011A   /NO
        JMS     CRLF
        TAD     PMES3
        JMS I   PMESAG  /TYPE OUT POWER DOWN MESSAGE
        JMS     CRLF
        SCRFB
        SKP HLT
        JMP     ,+2
        JMS     EXTERN
        TAD I   SLOT
        DCA     ONOW
        TAD     K0020
        DCA     BPNTR
        TAD     M0020
        DCA     BCNTR

L0011B, CLA CLL
        TAD I   BPNTR
        SMA CLA /RETENTIVE MEMORY?
        JMP     I0011 /NO
        CTFF
        TAD     ONOW
        TAD     TYN
        JMS I   PINTER /EXECUTE A TYF N
        STFF
        TAD     6173
        JMS     ERR10  /TEST FLOP SET?
                        /NO, ERROR
    
```

878 2212 1441
 879 2213 7700
 880 2214 5220
 881 2215 1070
 882 2216 1077
 883 2217 4904
 884 2220 2070
 885 2221 2041
 886 2222 2040
 887 2223 5211
 888 2224 4125
 889 2225 1314
 890 2226 4902
 891 2227 4125
 892 2230 6175
 893 2231 7412
 894 2232 5230
 895 2233 4107
 896 2234 1472
 897 2235 3070
 898 2236 1047
 899 2237 3041
 900 2240 1061
 901 2241 3040
 902 2242 7300
 903 2243 1441
 904 2244 7700
 905 2245 5254
 906 2246 4174
 907 2247 1070
 908 2250 1075
 909 2251 4904
 910 2252 6173
 911 2253 4777

912 2254 2070
 913 2255 2041
 914 2256 2040
 915 2257 5242
 916
 917 2260 7200
 918 2261 1265
 919 2262 4117
 920 2263 7402
 921 2264 5776
 922
 923 2265 0207
 924 2266 2267
 925 2267 5252
 926 2270 0307
 927 2271 5252
 928 2272 4017
 929 2273 1605
 930 2274 4014
 931 2275 1723
 932 2276 2440
 933 2277 1116
 934 2300 4020
 935 2301 1727
 936 2302 0522
 937 2303 4023
 938 2304 1025
 939 2305 2455
 940 2306 0417
 941 2307 2716
 942 2310 4002
 943 2311 3140
 944 2312 2215
 945 2313 4000
 946

I0011, ISZ ONOW /INCREMENT OUTPUT ADDRESS
 ISZ BPNT /INCREMENT STATUS WORD POINTER
 ISZ BCNTR /INCREMENT COUNTER
 JMP L0011B /NO DONE
 /PROGRAM HAS COMPLETED 1 PASS
 CLA
 TAD K0207
 JMS TYPE /RING BELL
 HLT
 JMP STRTST
 K0207, 207
 PM11, .+1
 5252 /*,*
 0307 /C,G
 5252 /*,*
 4017 /SP,O
 1605 /N,E
 4014 /SP,L
 1723 /O,S
 2440 /T,SP
 1116 /I,N
 4020 /SP,P
 1727 /O,W
 0522 /E,R
 4023 /SP,S
 1025 /H,U
 2455 /T,-
 0417 /O,O
 2716 /W,N
 4002 /SP,B
 3140 /Y,SP
 2215 /R,M
 4000 /SP,END

947	2314	2315	PMES3,	.,1	
948	2315	2017		2017	/P,O
949	2316	2705		2705	/W,E
950	2317	2255		2255	/R,-
951	2320	0417		0417	/D,O
952	2321	2716		2716	/W,N
953	2322	4024		4024	/SP,T
954	2323	1005		1005	/H,E
955	2324	4020		4020	/SP,P
956	2325	0420		0420	/D,P
957	2326	5561		5561	/-,1
958	2327	6454		6454	/4,,
959	2330	4024		4024	/SP,T
960	2331	1005		1005	/H,E
961	2332	1640		1640	/N,SP
962	2333	2017		2017	/P,O
963	2334	2705		2705	/W,E
964	2335	2240		2240	/R,SP
965	2336	1124		1124	/I,T
966	2337	4025		4025	/SP,U
967	2340	2040		2040	/P,SP
968	2341	0107		0107	/A,G
969	2342	0111		0111	/A,I
970	2343	1654		1654	/N,,
971	2344	4004		4004	/SP,D
972	2345	0520		0520	/E,P
973	2346	2205		2205	/R,E
974	2347	2323		2323	/S,S
975	2350	4020		4020	/SP,P
976	2351	0420		0420	/D,P
977	2352	5570		5570	/-,8
978	2353	4003		4003	/SP,C
979	2354	1716		1716	/O,N
980	2355	2411		2411	/T,I
981	2356	1625		1625	/N,U
982	2357	0500		0500	/E,END

```

983
984      2376  0400
985      2377  2041
          2400
986
987
988      2400  0000
989      2401  6165
990      2402  4203
991      2403  0000
992      2404  6175
993      2405  5222
994      2406  6161
995      2407  7410
996      2410  5220
997      2411  2203
998      2412  5204
999      2413  4125
1000     2414  1225
1001     2415  4502
1002     2416  4125
1003     2417  7402
1004     2420  7200
1005     2421  5600
1006     2422  4125
1007     2423  1234
1008     2424  5215
1009
1010
1011     2425  2426
1012     2426  2004
1013     2427  2055
1014     2430  6164
1015     2431  4010
1016     2432  2516
1017     2433  0700
1018
1019
1020     2434  2435
1021     2435  2004
1022     2436  2055
1023     2437  6164
1024     2440  4023
1025     2441  2417
1026     2442  2020
1027     2443  0504
1028     2444  0000

```

```

*2400
/INTERRUPT THE PDP-14 AND EXECUTE 1 INSTRUCTION (IN AC)

```

```

INTER:  0
        ILEX      /INTERRUPT AND EXECUTE
        JMS      ,*1
        0
        SCRF
        JMP      NORUN
        SIOF
        SKP
        JMP      EXIT1
        ISZ      INTER+3
        JMP      INTER+4
        JMS      CRLF
        TAD      PHUNG
        JMS I    PMESAG
        JMS      CRLF
INSTER, HLT
EXIT1:  CLA
        JMP I    INTER
NORUN:  JMS      CRLF
        TAD      PNORUN
        JMP      INSTER=2

```

```

/PDP-14 HUNG
PHUNG:  ,*1
        2004
        2055
        6164
        4010
        2516
        0700

```

```

/PDP-14 STOPPED
PNORUN, ,*1
        2004
        2055
        6164
        4023
        2417
        2020
        0504
        0

```

1029
 1030
 1031
 1032
 1033 2445 0000
 1034 2446 3304
 1035 2447 1704
 1036 2450 0306
 1037 2451 7450
 1038 2452 5645
 1039 2453 7112
 1040 2454 7012
 1041 2455 7012
 1042 2456 3043
 1043 2457 1043
 1044 2460 1311
 1045 2461 7710
 1046 2462 1307
 1047 2463 1310
 1048 2464 1043
 1049 2465 4117
 1050 2466 1704
 1051 2467 0305
 1052 2470 7450
 1053 2471 5645
 1054 2472 3043
 1055 2473 1043
 1056 2474 1311
 1057 2475 7710
 1058 2476 1307
 1059 2477 1310
 1060 2500 1043
 1061 2501 4117
 1062 2502 2304
 1063 2503 5247
 1064 2504 0000
 1065 2505 0077
 1066 2506 7700
 1067 2507 0100
 1068 2510 0200
 1069 2511 7740
 1070
 1071
 1072
 1073 2512 0000
 1074 2513 3334
 1075 2514 1336
 1076 2515 3335
 1077 2516 1334
 1078 2517 7104
 1079 2520 7004
 1080 2521 7006
 1081 2522 3334
 1082 2523 1334
 1083 2524 0135

/MESSAGE PRINT SUBROUTINE
 /ENTER WITH MESSAGE ADDRESS IN AC

MESAG: 0
 DCA MPNTR
 TAD I MPNTR
 AND K7700
 SNA
 JMP I MESAG
 RTR CLL
 RTR
 RTR
 DCA CHAR
 TAD CHAR
 TAD M0040
 SPA CLA
 TAD K0100
 TAD K0200
 TAD CHAR
 JMS TYPE
 TAD I MPNTR
 AND K0077
 SNA
 JMP I MESAG
 DCA CHAR
 TAD CHAR
 TAD M0040
 SPA CLA
 TAD K0100
 TAD K0200
 TAD CHAR
 JMS TYPE
 ISE MPNTR
 JMP MESAG+2

MPNTR: 0
 K0077: 77
 K7700: 7700
 K0100: 100
 K0200: 200
 M0040: -40

/TYPE OUT THE CONTENTS OF THE AC IN OCTAL

PRINT: 0
 DCA NUMBER
 TAD M0004
 DCA PCNTR
 TAD NUMBER
 RAL CLL
 RAL
 RTL
 DCA NUMBER
 TAD NUMBER
 AND K0007

1084	2525	1136	TAD	K0260
1085	2526	4117	JMS	TYPE
1086	2527	1334	TAD	NUMBER
1087	2530	2335	ISZ	PCNTR
1088	2531	5320	JMP	,=11
1089	2532	7200	CLA	
1090	2533	5712	JMP I	PRINT
1091	2534	0000	NUMBER,	0
1092	2535	0000	PCNTR,	0
1093	2536	7774	M0004,	=4

1094
 1095
 1096
 1097 2537 0000
 1098 2540 7604
 1099 2541 7006
 1100 2542 7710
 1101 2543 5352
 1102 2544 4125
 1103 2545 1044
 1104 2546 4302
 1105 2547 1073
 1106 2550 4503
 1107 2551 4125
 1108 2552 7604
 1109 2553 7004
 1110 2554 7700
 1111 2555 7402
 1112 2556 5737
 1113
 1114
 1115
 1116
 1117 2557 0000
 1118 2560 7300
 1119 2561 1097
 1120 2562 3010
 1121 2563 3011
 1122 2564 2011
 1123 2565 5364
 1124 2566 2010
 1125 2567 5364
 1126 2570 5757
 1127
 1128 2571 0000
 1129 2572 7300
 1130 2573 1052
 1131 2574 3010
 1132 2575 2010
 1133 2576 5375
 1134 2577 5771

/TEST FLOP ERROR ROUTINE

```

FLPERR, 0
  LAS
  RTL
  SPA CLA /TYPE OUT ERRORS
  JMP EFLOR-3 /NO
  JMS CRLF /YES
  TAD HEADER
  JMS I PMESAG /TYPE OUT HEADER
  TAD TSTNOW
  JMS I PPRINT /TYPE OUT INSTRUCTION ADDRESS
  JMS CRLF
  LAS
  RAL
  SMA CLA /HALT ON ERROR?
EFLOR, HLT /YES
  JMP I FLPERR
  
```

/DELAY SUBROUTINES

```

D120MS, 0 /120 MS (ACTUALLY 120.0MS)
  CLA CLL
  TAD M0007
  DCA 10
  DCA 11
  ISZ 11
  JMP ,=1
  ISZ 10
  JMP ,=3
  JMP I D120MS

D10MS, 0 /10 MS
  CLA CLL
  TAD K4252
  DCA 10
  ISZ 10
  JMP ,=1
  JMP I D10MS
  
```

1135			
1136	2600	*2600	
1137		/DOUBLE PRECISION UNSIGNED DECIMAL TYPEDOUT SUBROUTINE	
1138			
1139	2600	0000	UDPRNT, 0
1140	2601	7300	CLA CLL
1141	2602	1600	TAD I UDPRNT
1142	2603	3263	DCA UDGET
1143	2604	1663	TAD I UDGET
1144	2605	3255	DCA UDHIGH
1145	2606	2263	ISE UDGET
1146	2607	1663	TAD I UDGET
1147	2610	3256	DCA UDLDW
1148	2611	1252	TAD UDLDOP
1149	2612	3254	DCA UDCNT
1150	2613	1253	TAD UDADDR
1151	2614	3264	DCA UDPTR
1152	2615	2200	ISE UDPRNT
1153	2616	1664	UDARND, TAD I UDPTR
1154	2617	2264	ISE UDPTR
1155	2620	3257	DCA UDHSUB
1156	2621	1664	TAD I UDPTR
1157	2622	2264	ISE UDPTR
1158	2623	3260	DCA UDLSUB
1159	2624	7100	UDDO, CLL
1160	2625	1260	TAD UDLSUB
1161	2626	1256	TAD UDLDW
1162	2627	3262	DCA UDTEML
1163	2630	7004	RAL
1164	2631	1257	TAD UDHSUB
1165	2632	1255	TAD UDHIGH
1166	2633	7420	SNL
1167	2634	5242	JMP UDOUT
1168	2635	2261	ISE UDBOX
1169	2636	3255	DCA UDHIGH
1170	2637	1262	TAD UDTEML
1171	2640	3256	DCA UDLDW
1172	2641	5224	JMP UDDO
1173	2642	7200	UDOUT, CLA
1174	2643	1261	TAD UDBOX
1175	2644	1136	TAD K0260
1176	2645	4117	JMS TYPE
1177	2646	3261	DCA UDBOX
1178	2647	2254	ISE UDCNT
1179	2650	5216	JMP UDARND
1180	2651	5600	JMP I UDPRNT
1181	2652	7770	UDLDOP, =10
1182	2653	2665	UDADDR, UDCON1

1183	2654	0000	UDCNT, 0
1184	2655	0000	UDHIGH, 0
1185	2656	0000	UDLOW, 0
1186	2657	0000	UDHSUB, 0
1187	2660	0000	UDLSUB, 0
1188	2661	0000	UDBOX, 0
1189	2662	0000	UDTEML, 0
1190	2663	0000	UDGET, 0
1191	2664	0000	UDPTR, 0
1192	2665	3166	UDCON1, 3166
1193	2666	4600	4600
1194	2667	7413	7413
1195	2670	6700	6700
1196	2671	7747	7747
1197	2672	4540	4540
1198	2673	7775	7775
1199	2674	4360	4360
1200	2675	7777	7777
1201	2676	6030	6030
1202	2677	7777	7777
1203	2700	7634	7634
1204	2701	7777	7777
1205	2702	7766	7766
1206	2703	7777	7777
1207	2704	7777	7777
1208			
1209			

1210	2705	2706	PMES2, .+1
1211	2706	1104	1104 /I,D
1212	2707	0516	0516 /E,N
1213	2710	2411	2411 /T,I
1214	2711	0631	0631 /F,Y
1215	2712	4024	4024 /SP,T
1216	2713	1005	1005 /H,E
1217	2714	4010	4010 /SP,H
1218	2715	0122	0122 /A,R
1219	2716	0427	0427 /O,W
1220	2717	0122	0122 /A,R
1221	2720	0540	0540 /E,SP
1222	2721	0123	0123 /A,S
1223	2722	2317	2317 /S,O
1224	2723	0311	0311 /C,I
1225	2724	0124	0124 /A,T
1226	2725	0504	0504 /E,O
1227	2726	4027	4027 /SP,W
1228	2727	1124	1124 /I,T
1229	2730	1040	1040 /H,SP
1230	2731	0501	0501 /E,A
1231	2732	0310	0310 /C,H
1232	2733	4001	4001 /SP,A
1233	2734	0404	0404 /D,O
1234	2735	2205	2205 /R,E
1235	2736	2323	2323 /S,S
1236	2737	4002	4002 /SP,B
1237	2740	3140	3140 /Y,SP

1238	2741	2431	2431	/T,Y
1239	2742	2011	2011	/P,I
1240	2743	1607	1607	/N,G
1241	2744	7200	7200	/I,END
1242	2745	2746	PMES2A, *1	
1243	2746	2440	2440	/T,SP
1244	2747	0617	0617	/F,O
1245	2750	2240	2240	/R,SP
1246	2751	2411	2411	/T,I
1247	2752	1505	1505	/M,E
1248	2753	2254	2254	/R,,
1249	2754	4015	4015	/SP,M
1250	2755	4006	4006	/SP,F
1251	2756	1722	1722	/O,R
1252	2757	4022	4022	/SP,R
1253	2760	0524	0524	/E,T
1254	2761	0516	0516	/E,N
1255	2762	2411	2411	/T,I
1256	2763	2605	2605	/V,E
1257	2764	4015	4015	/SP,M
1258	2765	0515	0515	/E,M
1259	2766	1722	1722	/O,R
1260	2767	3154	3154	/Y,,
1261	2770	4001	4001	/SP,A
1262	2771	1414	1414	/L,L
1263	2772	4005	4005	/SP,E
1264	2773	1423	1423	/L,S
1265	2774	0540	0540	/E,SP
1266	2775	0515	0515	/E,M
1267	2776	2024	2024	/P,T
1268	2777	3100	3100	/Y,END
1269				
1270				

\$

4000
4100

4200
4300

4400
4500

4600
4700

5000
5100

5200
5300

5400
5500

5600
5700

6000
6100

6200
6300

6400
6500

6600
6700

7000
7100

7200
7300

7400
7500

7600
7700

ABXTST 0200
 BCNTR 0040
 BPNTR 0041
 CHAR 0043
 CIOF 6167
 CLROUT 0422
 CNTR 0042
 COTF 6172
 CRLF 0125
 CFFF 4174
 D10MS 2571
 D120MS 2557
 E0004 0667
 E0008 1737
 E0010 2057
 EFLOP 2555
 ERR10 2041
 ERR8 1714
 ERRTYO 1264
 EXIT1 2420
 EXTERN 0107
 FLPERR 2537
 GETCHR 0137
 HEADER 0044
 I0008 1672
 I0010 2034
 I0011 2254
 ILEX 6165
 INCADD 1675
 INOW 0045
 INSTER 2417
 INTER 2400
 JFF 0100
 K0007 0135
 K0017 0046
 K0020 0047
 K0077 2505
 K0100 2507
 K0200 2510
 K0207 2265
 K0212 0134
 K0215 0133
 K0240 0050
 K0260 0136
 K0377 0051
 K0400 0674
 K0600 0116
 K4252 0052
 K7400 0053
 K7700 2506
 L0004 0613
 L0005 1005

L0007 1405
 L0008 1605
 L0010 2022
 L0011A 2211
 L0011B 2242
 LCNTR 0054
 LDEX 6164
 LDIN 6162
 LTEMP 0055
 LTEMP1 0056
 M0004 2536
 M0007 0057
 M0017 0060
 M0020 0061
 M0040 2511
 M0300 0062
 M0311 0063
 M0315 0064
 M0317 0065
 M0321 0066
 M0324 0067
 MESAG 2445
 MPNTR 2504
 NORUN 2422
 NUMBER 2534
 ONOW 0070
 OUTCLR 1663
 OUTSET 1655
 PCNTR 2535
 PG0B02 1266
 PHUNG 2425
 PINTER 0104
 PM10 2061
 PM11 2266
 PM4A 0675
 PM4B 0702
 PM4C 0714
 PM4D 0724
 PM5A 1047
 PM5B 1071
 PM7A 1444
 PM7B 1466
 PM8A 1767
 PM8B 1741
 PM8C 1756
 PMES1 0324
 PMES2 2705
 PMES2A 2745
 PMES3 2314
 PMESAG 0102
 PNORUN 2434
 PNTR 0071

PPRINT 0103
 PRINT 2512
 QUES1 0203
 QUES2 0234
 QUESN 0245
 ROTR 6176
 SCRF 6175
 SIDF 6161
 SLOT 0072
 SOTF 6171
 STFF 6173
 STRTST 0400
 SYF 0076
 SYN 0077
 T0003 0416
 T0004 0600
 T0005 1000
 T0006 1200
 T0007 1400
 T0008 1600
 T0010 2000
 T0011 2200
 TIMCON 0762
 TIME 0646
 TIMEIT 0745
 TSTFLP 0105
 TSTLUP 0410
 TSTNOW 0073
 TSTTYD 1203
 TYD 0101
 TYDERR 1234
 TYDLUP 1205
 TYDMES 1274
 TYDTST 0106
 TYF 0074
 TYN 0075
 TYPE 0117
 UDADDR 2653
 UDARN0 2616
 UDBOX 2661
 UDCNT 2654
 UDCON1 2665
 UDDO 2624
 UDGET 2663
 UDHIGH 2655
 UDHSUB 2657
 UDLOOP 2652
 UDL0W 2656
 UDLSUB 2660
 UDOUT 2642
 UDPRNT 2600
 UDPTR 2664

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ERRORS DETECTED: 0

LINKS GENERATED: 22

RUN-TIME: 10 SECONDS

3K CORE USED

UDLSUB	1158	1160	1187#			
UDOUT	1167	1173#				
UDPRNT	299	1139#	1141	1152	1180	
UDPTR	1131	1153	1154	1156	1157	1191#
UDTEML	1162	1170	1189#			
.L0375	157	224#				
.L0376	154	225#				
.L0377	127	226#				
.L0575	251	268#				
.L0576	242	269#				
.L0577	240	270#				
.L0775	313	396#				
.L0776	309	336	397#			
.L0777	299	398#				
.L1177	440	477#				
.L1377	482	560#				
.L1577	598	639#				
.L1774	725	777#				
.L1775	721	778#				
.L1776	711	779#				
.L1777	666	780#				
.L2175	820	861#				
.L2176	793	862#				
.L2177	791	863#				
.L2376	921	984#				
.L2377	911	985#				