IDENTIFICATION

PRODUCT CODE	MAINDEC-Ø8-DIDFB-A-D REPLACES: MAINDEC-Ø8-D5BC
PRODUCT NAME	DF32 DISCLESS LOGIC TEST, MINIDISC
DATE CREATED	MARCH 12, 1973
MAINTAINER	DIAGNOSTIC GROUP
AUTHOR	E. FORTMILLER

ADDENDUM

1. DUE TO DF32 ECO'S 43 AND 47, AND DS32 ECO'S 9 AND 1Ø WHICH MADE CHANGES TO THE "PHOTO CELL" LOGIC IN THE DF32 AND DS32, THE ABSENCE OF "PHOTO CELL" CAN NO LONGER BE CHECKED BY THE PROGRAM. IF THE ABOVE ECO'S ARE INSTALLED, CHANGE LOCATION 1Ø3Ø FROM 73ØØ TO 5244.

2. THERE ARE IOT CONFLICTS BETWEEN DF32 (DS32) AND A KF12B AIP. IF THERE IS A KF12B AIP INSTALLED ON THE SYSTEM, MAKE THE FOLLOWING PROGRAM TOGGLES:

LOCATION	FROM	TO
1343	6Ø22	6Ø32
1345	6Ø12	574Ø

- Insert patch 1Ø3Ø = 5244
- If no light card → SR 4 = 1

1. ABSTRACT

Discless is a test of the DF32 DISC LOGIC and its computer interface. This Program does not test the disc, nor associated analog interface circuits.

(The disc is not needed for these routines. If it is connected, the disc motor should be turned off. For a complete test of the Disc system use DF32 DISC DATA TEST.)

2. REQUIREMENTS

2.1 Equipment

PDP-8 Standard

DF32 DISC LOGIC

Light Card (for testing track selector)

2.2 Storage

2.2.1 Program Storage - The program uses most of memory from address 100 to 3400 and locations 0, 1 and 2.

3. LOADING PROCEDURES

3.1 Methods

Procedures of normal binary tapes should be followed.

4. STARTING PROCEDURE

Patch Loc 1030 7300 → 5244 (NOT REQUIRED)

4.1 For normal operation all switches should be down, unless PDP-8E or PDP-12 then SR11 should be up.

4.2 Starting Address

The starting address for DF32 DISCLESS is 100. (For PDP-8S SA=77)

	Special Address
76	Start for abnormal Print Out check
101	Start of Register Test
102	Start of shift, interrupt, error
103	DISC Memory Address Test SR=Address

104	DISC and Computer Extended Address Test SR=Address
105	DISC Data Memory Buffer SR=Data
106	Scope Loop SAD "FF"
107	Scope Loop SAP Pulse
110	Scope Loop ADC "FF"
111	Scope Loop SDP Pulse
112	Scope Loop DEP Pulse
113	Scope Loop TCR "FF"
114	Scope Loop IOT 66XX, SR=XX
115	Scope Loop Light Box AC 8, 9, 10 and 11=Track

4.3 Program and/or Operator Action

Turn Disc Motor off.

Load Discless into memory.

Select EM0 (DISC ZERO). (All other units to off).

Write Inhibit Switches off.

Connect Light Card if tracks are to be tested (not necessary for test).

Set the Switch Register to 100.

Load Address.

Set the Switch Register to all zero (down), unless PDP-8E or PDP-12

Press Start.

Program will run; if the light card is used, lights will light from 0 to 17_8 in sequence and the program will loop upon completion.

5. OPERATING PROCEDURE

5.1 Operational Switch Settings

SW0	UP	Delete Print Out
SW1	UP	Halt After Error
SW2	UP	Sub Test Scope Loop
SW3	UP	Do not Exit Section
SW4	UP	Delete Light Box
SW11	UP	PDP-8/E or PDP-12

5.2 There are three basic sections to loop on INTERFACE Test, Register test, SHIFT and ERRORS test.

5.3 When it is necessary to scope a detected error, place SW1 UP to halt on the error, SW2 UP to loop on it, and SW0 UP to DELETE PRINT OUTS.

6. ERRORS

Logic hardware malfunctions detected by the program result in a type out, and a halt if SW2 is up.

(If the light card is used, operator observance is necessary to detect an error.)

6.1 Error Halts and Description

Address Tag	Function Tested	Good (AC)	Bad (AC)	Corrective Action
603	START KEY CL(TRC)	0000	N/A	A15/B5/B19/B20
611	DSAC, 0 ⟶ AC	0000	7777	B18/D22
615	START KEY CL(ADC)	0000	N/A	B16/B5/B19/B18
622	START KEY CL(EMA)	0000	N/A	A21/B5/B19/see 1023
627	START KEY CL(EA)	0000	N/A	A21/B5/B19/see 1027
641	DOES WC BREAK	0000	7777	B29/A13/C15/C16/D22
641	DOES WC BREAK	0000	XXXX	B29/A13
645	DOES CA BREAK	0000	7777	C18 pin K
654	DMAW, 0 ⟶ AC	0000	7777	B18
663	DMAR, 0 ⟶ AC	0000	7777	B21/D10/D22
670	DMAC NOT SKIP	0000	N/A	B20/B19
676	DMAC, 0 ⟶ AC	0000	7777	B21
704	NO DRL STATUS	0000	0004	D20/A13
712	NO NED STATUS	0000	0002	B22/C20/B18/B20/D18/D19
723	NO FLAG AFTER WRITE	0000	N/A	A19/B22
726	NO FLAG AFTER WRITE	0000	N/A	A19/B22/A15
740	ADDRESS ACCEPT CL(DBR)	0000	0001	A13/B29
740	ADDRESS ACCEPT CL(DBR)	0000	XXXX	A13/B29
744	ADDRESS ACCEPT CL(DBR)	0000	XXXX	A13/B29
1010	NO FLAG AFTER READ	0000	N/A	A19
1013	NO FLAG AFTER READ	0000	N/A	A19

Address Tag	Function Tested	Good (AC)	Bad (AC)	Corrective Action
1023	DISC EXT. ADDRESS 0	0000	XX00	B4/B1/B2/B3
1027	COMPUTER EXT. ADDRESS = 0	0000	0070	CD/23
1027	COMPUTER EXT. ADDRESS = 0	0000	00X0	B27/D20
1043*	NO SYNC (PSM)	0000	400X	B18/D18/A30
1050	NO PARITY STATUS	0000	0001	A12/B15
1205	SEL ERROR STATUS	0000	N/A	B18/D19/D18/C20
1214	NO WLO (LOWER)	0000	N/A	A17/A12/C20/CHECK WLO SWITCHES
1225	NO WLO (UPPER)	0100	N/A	A17/A12/C20/CHECK WLO SWITCHES
1234	EM3 RAISE NEX	3000	N/A	D18/D19/B18/A30
1243	EM2 RAISE NEX	2000	N/A	D19/B2
1252	EM1 RAISE NEX	1000	N/A	D19/B1
1267	DISC EXT. ADDRESS = SEVEN	3700	0000	CD/23
1267	DISC EXT. ADDRESS = SEVEN	3700	XX00	B1/B2/B3/B4
1303	COMPUTER EXT. ADDRESS	0070	0000	CD/23
1303	COMPUTER EXT. ADDRESS	0070	00X0	D20/B27
1310	SKIP ON NO ERROR (READ)	0000	N/A	B20/C20/A20/B15/B26
1327	NO INTERRUPT	0000	N/A	D20/B22/A15
1405	SKIP ON NO ERROR (READ)	0000	N/A	DIODE ON EM SELECT SW
1413	SKIP ON NO ERROR (WRITE)	0402	N/A	DIODE ON EM SELECT SW
1420	SKIP ON NO ERROR (WRITE)	0000	N/A	DIODE ON EM SELECT SW
1534	RAISE (NED) STATUS	7002	7000	B22/B18/C20
1522	INTERRUPT ON (NED)	3000	N/A	D20/B22
1534	CL PAR FF	3000	N/A	A20
1551	WILL (NED) SET (TRC)	7002	N/A	A19/A15/B19/B24
1616	DMA TEST	0000	XXXX	CD22/CD24/B5
1616	DMA BITS 0,1			B6/B12
1616	DMA BITS 2,3			B7/B12
1616	DMA BITS 4,5			B8/B12
1616	DMA BITS 6,7			B9/B13
1616	DMA BITS 8,9			B10/B13
1616	DMA BITS 10,11			B11/B13
1636	EMA TEST			

*If light card is used (Sync) switch should be off.

Address Tag	Function Tested	Good (AC)	Bad (AC)	Corrective Action
1636	EMA BIT 1	XX00	XX00	B1/B4
1636	EMA BITS 2,3	XX00	XX00	B2/B4
1636	EMA BITS 4,5	XX00	XX00	B3/B4
1636	EMA BITS 6, 7, 8	XX00	XX00	B27/D20
1663	DMB TEST	XXXX	ALL	B19/A17/A22/B17/A21
		XXXX	0 to 5	B23
		XXXX	6 to 11	B24
1663	DMB BITS 0,1	XXXX	XXXX	A23/B23
1663	DMB BITS 2,3	XXXX	XXXX	A24/B23
1663	DMB BITS 4,5	XXXX	XXXX	A25/B23
1663	DMB BITS 6,7	XXXX	XXXX	A26/B24
1663	DMB BITS 8,9	XXXX	XXXX	A27/B24
1663	DMB BITS 10, 11	XXXX	XXXX	A28/B24
2223	SHIFT DMA	1252	2525	A29/B5/B17/A16/A15/B30
2223	SHIFT DMA	1252	XX52	B6/B7/B8
2223	SHIFT DMA	1252	12XX	B9/B10/B11
2244	SHIFT DMA	6525	XXXX	SAME AS 2223
2261	SHIFT DMA	7252	XXXX	SAME AS 2223
2301	SHIFT DMA	5525	XXXX	SAME AS 2223
2310	SKIP ON (ADC)	N/A	N/A	B16/A17/B15/B18
2341	SHIFT DMB	7777	ALL	A18/A21/A17
2341	SHIFT DMB	7777	XX77	A23/A24/A25/B23
2341	SHIFT DMB	7777	77XX	A26/A27/A28/B24
2430	SHIFT DMB	4000	XXXX	SAME AS 2341
2462	SHIFT DMB	5252	XXXX	SAME AS 2341
2515	SHIFT DMB	2525	XXXX	SAME AS 2341
2617	SHIFT DMA	5777	7777	B14/B15
2635	RAISE (DRL) STATUS	0004	0000	D20/A13
2640	SKIP ON DRL	0004	0004	C20
2645	WILL (DEP) SET (TRC)	N/A	N/A	A19
2656	INTERRUPT ON TRC	N/A	N/A	D20
2701	TRACK COUNTER (EMA)	3702	0000	B16/B19/B23
2701	TRACK COUNTER (EMA)	3702	XX00	B1/B2/B3
2711	TRACK COUNTER (EMA)	0000	XX00	

Light Card Test

Function Tested	Corrective Action
NO LIGHTS	A6/A7
2nd & 4th FOUR	A6/A20/A19
1st & 3rd FOUR	A6/A20/A17/A21/B21/B25
TK 0, 10	A3
TK 1, 11	A3
TK 2, 12	A3
TK 3, 13	A3
TK 4, 14	A2
TK 5, 15	A2
TK 6, 16	A2
TK 7, 17	A2

Printouts created by abnormal switch conditions.

(This test should not be made until program runs in normal). (Starting Address = 76)

DISK 0 (EM0) SELECTED, EM0 WLO "ON"

Lower Write Lock Switch "ON"

Address Tag	AC	Function Tested	If No Printout
1214	0000	WRITE LOCK OFF	A17/A12/C20
1301	0000	SKIP ON NO ERROR	C20
		Upper Write Lock Switch "ON"	
1225	0100	WRITE LOCK OFF	
1413	0402	SKIP ON NO ERROR	
		Sync Switch Light Card "ON"	
1043	4000	NO SYNC, NO DISC	A30

All switches Normal Except

EM OFF	EM 1	EM 2	EM 3	AC	Function Tested	If No Print Out
0712	0712	0712	0712	0002	NO NED STATUS	D19
0723	0723	0723	0723	0000	NO FLAG ON WRITE	A19
0726	0726	0726	0726	0000	NO FLAG ON WRITE	A19
0740	0740	0740	0740	0001	ADDRESS ACCEPT (0 DBR)	A13/B29
0744	0744	0744	0744	0001	ADDRESS ACCEPT (0 DBR)	A13/B29
1043	1043	1043	1043	4002	NO SYNC	UNIT SELECT SW.
1205	1205	1205	1205	1000	SELECT ERROR STATUS	C20/B18
1214	1214	1214	1214	1000	NO WLO	A12/A17/C20

EM OFF	EM 1	EM 2	EM 3	AC	Function Tested	If No Print Out
1225	1225	1225	1225	1100	NO WLO	A12/A17/C20
			1234	3002	EM3 RAISE NEX	D19
		1243		2002	EM2 RAISE NEX	D19
	1252			1002	EM1 RAISE NEX	D19
1327	1327	1327	1327	0000	NO INTERRUPT	D20
2223	2223	2223	2223	2525	SHIFT DMA	B17/D18
2244	2244	2244	2244	5252	SHIFT DMA	B17/D18
2261	2261	2261	2261	5252	SHIFT DMA	B17/D18
2301	2301	2301	2301	5252	SHIFT DMA	B17/D18
2310	2310	2310	2310	0000	SKIP ON ADC	A17/B18
2430	2430	2430	2430	0000	SHIFT DMB	A17/A21
2462	2462	2462	2462	2525	SHIFT DMB	A17/A21
2617	2617	2617	2617	7777	SHIFT DMB	A17/A21
2635	2635	2635	2635	0000	DRL STATUS	A17/B17/A29
2640	2640	2640	2640	0000	SKIP ON (DRL)	A17/B17/A29
2645	2645	2645	2645	0000	(DEP) SET (TRC)	A19
2701	2701	2701	2701	XXXX	TRACK COUNTER (EMA)	B6
2711	2711	2711	2711	3700	TRACK COUNTER (EMA)	B6
0622	0622	0622	0622	0100	CL STATUS REQ	

6.2 Error Recovery

Press Continue, or Restart at 100.

7. RESTRICTIONS

(None)

8. MISCELLANEOUS

An extra IOT maintenance package has been incorporated in the design of the logic. While this IOT package is not needed for operational use of the disc, it must be in if Discless is to run. (Coded to 663X)

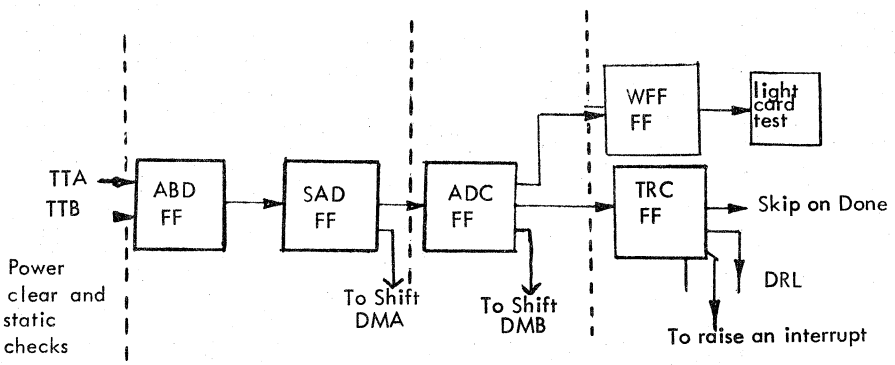
6631=TAS=TTA 6632=TTB 6634=DBR

9. PROGRAM DESCRIPTION

9.1 Discussion

Discless is an incremental test of the DF32 DISC LOGIC. Starting with basic conditions, such as, does start key clear the error and done logic? Can all control flip-flops be set and cleared and can all registers be set and cleared? Will the track counter increment, will all register shift data? Does the Data break work, can we raise an interrupt, check for all status buts, such as write lock out and non-existent disc? With the use of the light card test for correct track selection.

There is a chain of flip-flops which must be working if these tests are to pass.



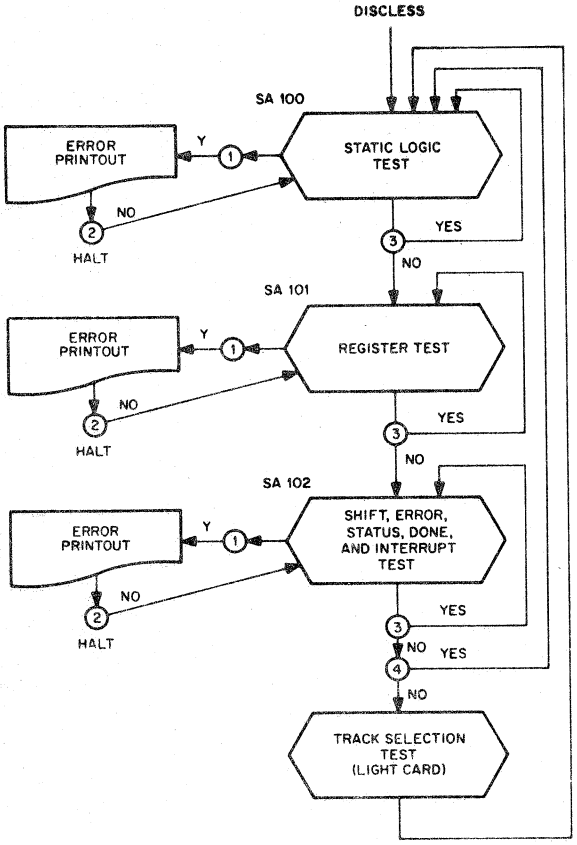
Each disc has $16_{(10)}$ tracks, in order to verify the correct track selection a light card indicator is needed. This card is inserted into location A5. With the program running, the lights or the card should rotate from 0 to $16_{(10)}$ each pass of the program. (If the light card is not used it will not affect the operation of the test. There is a switch on the card that simulates the photo cell on Disc.)

If this test runs and the "abnormal" switch settings on the Disc hardware are used to create printouts and the proper one occurs, any failure that occurs using the DF32 DATA DISC TEST should be location on the heads, R/W Amplifiers, the Disc or associated analog circuits.

10. LISTINGS

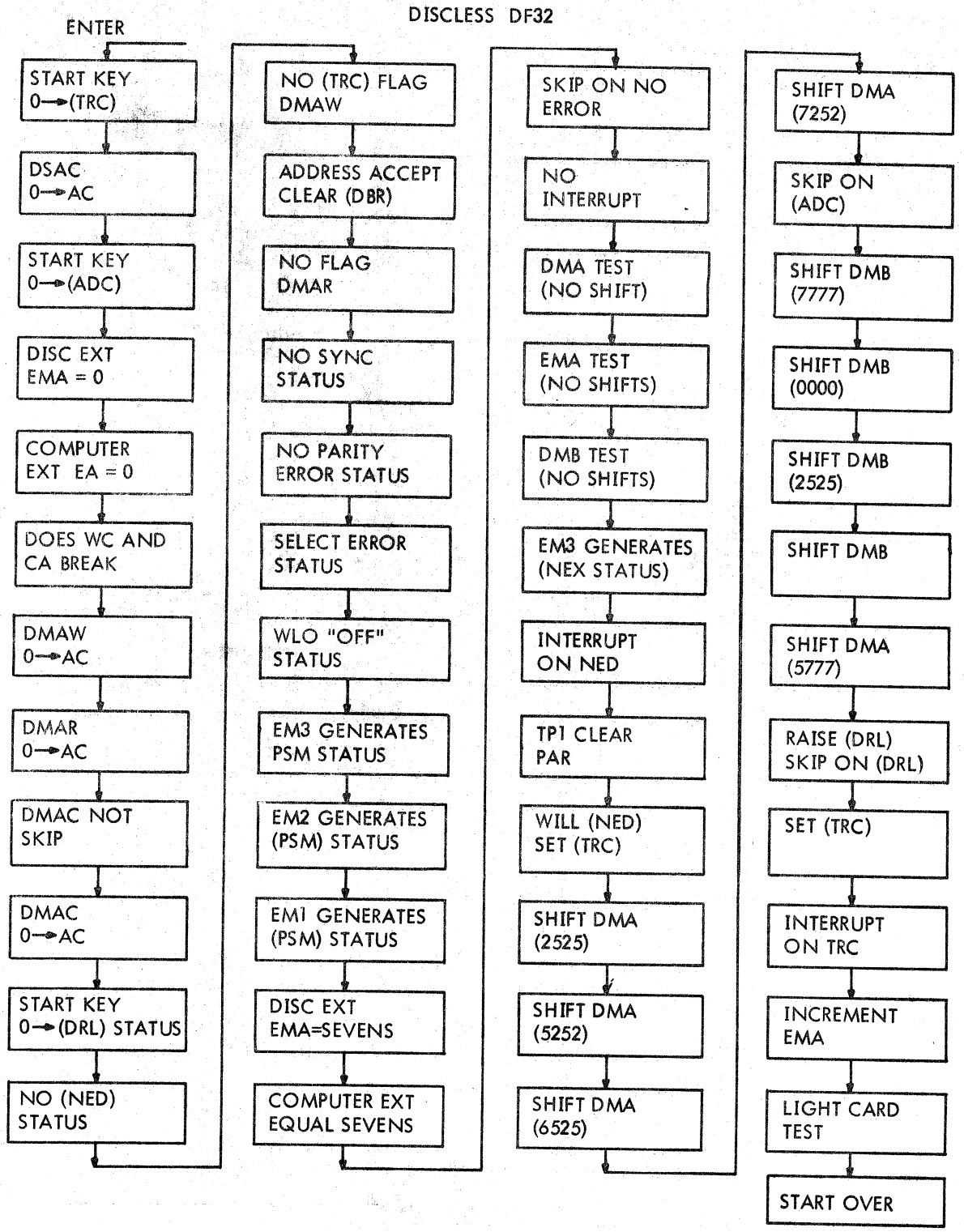
11. FLOW CHARTS

11.1 Basic Flow



11.2 Detail Flow

DISCLESS DF32



```
                    /DF32 DISKLESS  MAINDEC-08-DIDFB
                    /
                    /COPYRIGHT 1973 DIGITAL EQUIPMENT CORP., MAYNARD, MASS., 01754
                    /
                    /PROGRAMMER'S:
                    /       JOHN HITTELL
                    /       ED FORTMILLER
                    /
                    /EQUATE STATEMENTS:
          7402      HLT=7402
          7604      LAS=7604
          7404      OSR=7404
          6001      ION=6001
          6002      IOF=6002

                    /DIGITAL 8-18-U
                    /MESSAGE TYPE=OUT
                    /CALL WITH A JMS MESAGE
                    /WITH DATA FOLLOWING
                    /RETURN FOLLOWING END OF MESSAGE
                    /CODE(00)

          0200      *200
0200      5777'               JMP     BEGIN
0201      0000      MESAGE,     0
0202      7240                CLA CMA             /SET C(AC)=-1
0203      1201                TAD MESAGE            /ADD LOCATION
0204      3010                DCA 10              /AUTO-INDEX REGISTTER
0205      1410                TAD I 10            /FETCH FIRST WORD
0206      3217                DCA MSRGHT          /SAVE IT
0207      1217                TAD MSRGHT
0210      7012                RTR
0211      7012                RTR                 /ROTATE 6 BITS RIGHT
0212      7012                RTR
0213      4220                JMS TYPECH          /TYPE IT
0214      1217                TAD MSRGHT          /GET DATA AGAIN
0215      4220                JMS TYPECH          /TYPE RIGHT HALF
0216      5205                JMP MESAGE+4        /CONTINUE
0217      0000      MSRGHT,   0                   /TEMPORARY STORAGE

0220      0000      TYPECH,   0                   /TYPE CHARACTER IN C(AC)6-11
0221      0251                AND MASK77
0222      7450                SNA                 /IS IT END OF MESSAGE?
0223      5410                JMP I 10            /YES: EXIT
0224      1252                TAD M40             /SUBTRACT 40
0225      7500                SMA                 /<40?
0226      5231                JMP .+3             /NO
0227      1253                TAD C340            /YES: ADD 300
0230      5244                JMP MTP             /TO CODES <40
0231      1254                TAD M3              /SUBTRACT 3
0232      7440                SZA                 /IS IT ZERO?
0233      5236                JMP .+3             /NO
0234      1255                TAD C212            /YES: CODE 43 IS
0235      5244                JMP MTP             /LINE-FEED (212)
0236      1256                TAD M2              /SUBTRACT 2
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0237  7440            SZA                 /IS IT ZERO?
0240  5243            JMP .+3             /NO
0241  1257            TAD C215            /YES; CODE 45 IS
0242  5244            JMP MTP             /CARRIAGE-RETURN (215)
0243  1260            TAD C245            /ADD 200 TO OTHERS >40
0244  6046  MTP,      TLS                 /TRANSMIT CHARACTER
0245  6041            TSF                 /WAIT FOR FLAG
0246  5245            JMP .-1             /NOT SET YET
0247  7200            CLA                 /SET; CLEAR C(AC)
0250  5620            JMP I TYPECH        /RETURN

                /CONSTANTS
0251  0077  MASK77,   77
0252  7740  M40,      -40
0253  0340  C340,     340
0254  7775  M3,     -3
0255  0212  C212,   212
0256  7776  M2,       -2
0257  0215  C215,     215
0260  0245  C245,     245



0261  7402  SIXTY,  HLT
0262  7000          NOP
0263  7000          NOP               /STORE INIT NEXT TIME
0264  7200          CLA
0265  1661          TAD I .-4                 /ADDRESS OF OPERAND
0266  3270          DCA .+2
0267  5671          JMP I .+2
0270  0000          0                 /ADDRESS OF OPERAND
0271  0273          SIXTY+12                  /CHANGING REFERENCE (P)
0272  5264          JMP SIXTY+3
0273  1670          TAD I SIXTY+7     /AC (OPERAND)
0274  0376          AND (0007
0275  3341          DCA MASKA                 /000X
0276  1670          TAD I SIXTY+7     /AC (OPERAND)
0277  0375          AND (0070
0300  3342          DCA MASKB                 /00X0
0301  1670          TAD I SIXTY+7     /AC (OPERAND)
0302  0374          AND (0700
0303  3343          DCA MASKC                 /0X00
0304  1670          TAD I SIXTY+7     /AC (OPERAND)
0305  0373          AND (7000
0306  3344          DCA MASKD                 /X000
0307  1343          TAD MASKC                 /0X00
0310  7112          RTR CLL
0311  7010          RAR               /0X00 RS3 00X0
0312  1344          TAD MASKD                 /X0X0
0313  7012          RTR
0314  7010          RAR
0315  1345          TAD MASKD+1       /X0X0 RS3 0X0X
0316  3343          DCA MASKC                 /TEMP STORAGE
0317  2261          ISZ SIXTY                 /INCREMENT FOR STORAGE
```

```
0320  4271          JMS SIXTY+10    /FIND STORAGE ADDRESS
0321  1343          TAD MASKC               /6X6X
0322  3670          DCA I SIXTY+7   /STORE OPERAND AS SPECIFIED
0323  1342          TAD MASKB               /00X0
0324  7004          RAL
0325  7006          RTL             /00X0 SL3 0X00
0326  1341          TAD MASKA               /0X00+000X=0X0X
0327  1345          TAD MASKD+1     /0X0X+6060=6X6X
0330  3344          DCA MASKD               /TEMP STORAGE
0331  2261          ISZ SIXTY       /INCREMENT FOR STORAGE
0332  4271          JMS SIXTY+10    /FIND STORAGE ADDRESS
0333  1344          TAD MASKD               /6X6X
0334  3670          DCA I SIXTY+7   /STORE OPERAND AS SPECIFIED
0335  1372          TAD (SIXTY+12   /HOUSE KEEPING
0336  3271          DCA SIXTY+10
0337  2261          ISZ SIXTY               /INCREMENT FOR RETURN
0340  5661          JMP I SIXTY     /RETURN

0341  0000    MASKA,  0
0342  0000    MASKB,  0
0343  0000    MASKC,  0
0344  0000    MASKD,  0
0345  6060            6060
                PAUSE

0372  0273
0373  7000
0374  0700
0375  0070
0376  0007
0377  0600
      0400      PAGE
                /PRINT OUT ROUTINES
                /ROUTINE TO PRINT OUT FAILING TEST ADDRESS
                /AND CONTENTS OF AC

                /XXXX  XXXX ---- ADDRESS  (AC)

0400  7402    ERADD,  XX
0401  4777/            JMS IPRINT
0402  6002            IOF
0403  4776/            JMS SIXTY
0404  0400            ERADD
0405  0411            .+4
0406  0412            .+4
0407  4775/            JMS MESAGE              /ADDRESS
0410  4543            4543
0411  6060            6060
0412  6060            6060
0413  4000            4000
0414  4776/            JMS SIXTY
0415  3404            AC
0416  0422            .+4
0417  0423            .+4
0420  4775/            JMS MESAGE              /CONTENTS OF AC
```

```
0421  4040            4040
0422  6060            6060
0423  6060            6060
0424  0000            0000
0425  7604            LAS
0426  0374            AND (2000
0427  7650            SNA CLA
0430  5600            JMP I ERADD
0431  1773'           TAD AC          /AC
0432  7402            HLT
0433  5600            JMP I ERADD


                  /COMPARISON ERROR PRINT OUT
                  /GDXXXX  BDXXXX
0434  7402        BADCOM, XX
0435  4777'           JMS IPRINT
0436  4776'           JMS SIXTY
0437  0434            BADCOM
0440  0444            .+4
0441  0445            .+4
0442  4775'           JMS MESAGE
0443  4543            4543
0444  6060            6060
0445  6060            6060
0446  0000            0000
0447  4776'           JMS SIXTY
0450  3420            GD              /GOOD
0451  0463            .+12
0452  0464            .+12
0453  4776'           JMS SIXTY
0454  3417            BD              /BAD
0455  0467            .+12
0456  0470            .+12
0457  4775'           JMS MESAGE
0460  4040            4040            /CRLF
0461  0704            0704            /GOOD DATA
0462  4040            4040
0463  6060            6060
0464  6060            6060
0465  4002            4002
0466  0440            0440            /BAD DATA
0467  6060            6060
0470  6060            6060
0471  0000            0000
0472  7604            LAS
0473  0374            AND (2000
0474  7650            SNA CLA
0475  7410            SKP
0476  7402            HLT
0477  5634            JMP I BADCOM    /EXIT


0500  7402        BADADD, XX
0501  4777'           JMS IPRINT
```

```
0502  4776'          JMS SIXTY
0503  0500           BADADD
0504  0510           ,+4
0505  0511           ,+4
0506  4775'          JMS MESAGE
0507  4543           4543
0510  6060           6060
0511  6060           6060
0512  0000           0000
0513  4776'          JMS SIXTY
0514  3416           GA
0515  0527           ,+12
0516  0530           ,+12
0517  4776'          JMS SIXTY
0520  3415           BA
0521  0533           ,+12
0522  0534           ,+12
0523  4775'          JMS MESAGE
0524  4040           4040
0525  0701           0701
0526  4040           4040
0527  6060           6060
0530  6060           6060
0531  4002           4002
0532  0140           0140
0533  6060           6060
0534  6060           6060
0535  0000           0000
0536  7604           LAS
0537  0374           AND (2000
0540  7650           SNA CLA
0541  7410           SKP
0542  7402           HLT
0543  5700           JMP I BADADD

                PAUSE

                /PDP-8 INTERFACE TEST NO DISC  RMX5  3/6/67
                /EM0 SHOULD BE SELECTED

0573  3404
0574  2000
0575  0201
0576  0261
0577  3124
      0600      PAGE 3
                DEFINE SCOPE
                        <       JMS SCOPEA>

                DEFINE HALT
                        <       JMS ERADD>
                DEFINE NPAGE
                        <       JMP I (,+200&7600)>

                /FLAG TEST (CLEAR)
```

```
0600  6622    BEGIN,  DFSC            /SKIP ON FLAG
0601  7410            SKP
                      HALT            /FLAG SHOULD HAVE BEEN CLEARED BY START
0602  4777'           JMS ERADD
                      SCOPE
0603  4776'           JMS SCOPEA

                /DOES 6612 CLEAR THE AC? (DSAC)
0604  7240            CLA CMA         /AC SET TO SEVENS
0605  6612            DSAC
0606  7000            NOP
0607  7440            SZA
                      HALT            /HALT BECAUSE AC NOT ZERO
0610  4777'           JMS ERADD
                      SCOPE
0611  4776'           JMS SCOPEA

                /WAS ADC "FF" CLEARED BY START KEY
0612  6612            DSAC            /SKIP ON ADC
0613  7410            SKP
                      HALT            /ADC SET ,,, START SHOULD CL ADC "FF"
0614  4777'           JMS ERADD
                      SCOPE
0615  4776'           JMS SCOPEA
                /
                /DOES START CLEAR THE DISK EXT ADDRESS
0616  6614            DEAC-2          /READ STATUS REGISTER
0617  0375            AND (3700               /MASK DISC EXT ADDRESS
0620  7440            SZA
                      HALT            /START KEY DID NOT CLEAR EMA
0621  4777'           JMS ERADD
                      SCOPE
0622  4776'           JMS SCOPEA
                /
                /DOES START CLEAR THE COMPUTER EXT ADDRESS REGISTER
0623  6614            DEAC-2
0624  0374            AND (0070               /MASK FOR COMPUTER EXT ADDRESS
0625  7440            SZA
                      HALT            /START KEY DID NOT CLEAR EA
0626  4777'           JMS ERADD
                      SCOPE
0627  4776'           JMS SCOPEA


                /DOES DISK BREAK TO RIGHT LOC
0630  7240            CLA CMA
0631  3773'           DCA WC
0632  7240            CLA CMA
0633  3772'           DCA IACW                /WRITE ONE WORD
0634  6605            DMAW
0635  7200            CLA
0636  1773'           TAD WC
0637  7440            SZA
                      HALT            /WORD COUNT NOT CORRECT
0640  4777'           JMS ERADD
```

```
0641  7200          CLA
0642  1772'         TAD IACW
0643  7440          SZA
                    HALT            /ADDRESS CONTROL WORD NOT CORRECT
0644  4777'         JMS ERADD
                    SCOPE
0645  4776'         JMS SCOPEA

                /IS AC CLEARED BY DMAW?
0646  7240          CLA CMA
0647  3773'         DCA WC            /ONE WORD
0650  7240          CLA CMA
0651  6605          DMAW              /IOT SHOULD CLEAR AC
0652  7440          SZA
                    HALT              /AC NOT CLEARED
0653  4777'         JMS ERADD
                    SCOPE
0654  4776'         JMS SCOPEA
                /
                /IS AC CLEARED BY DMAR
0655  7240          CLA CMA
0656  3773'         DCA WC            /ONE WORD
0657  7240          CLA CMA
0660  6603          DMAR              /IOT SHOULD CLEAR AC
0661  7440          SZA
                    HALT              /AC NOT CLEARED
0662  4777'         JMS ERADD
                    SCOPE
0663  4776'         JMS SCOPEA


                /DMAC SHOULD NOT SKIP
0664  6611          DCEA
0665  6626          DMAC
0666  7410          SKP
                    HALT              /DMAC SKIPPED
0667  4777'         JMS ERADD
                    SCOPE
0670  4776'         JMS SCOPEA
                /
                /WILL DMAC CLEAR AC
0671  6601          DCMA              /CLEAR DMAR
0672  7240          CLA CMA
0673  6626          DMAC
0674  7440          SZA               /MAR TO AC
                    HALT              /AC NOT CLEARED BY DSAC
0675  4777'         JMS ERADD
                    SCOPE
0676  4776'         JMS SCOPEA
                /
                /STATUS REGISTER TEST (NO DRL)
0677  6611          DCEA
0700  6616          DEAC              /EM0
0701  0371          AND (4            /MASK FOR DRL
0702  7440          SZA
```

```
                        HALT                /DRL UP
0703  4777'             JMS ERADD
                        SCOPE
0704  4776'             JMS SCOPEA
                /
                /STATUS REGISTER TEST (NO NED FF)
0705  6611              DCEA                /EM0
0706  6616              DEAC
0707  0370              AND (2
0710  7440              SZA
                        HALT                /WRITE LOOK OUT OR NED SET
0711  4777'             JMS ERADD
                        SCOPE
0712  4776'             JMS SCOPEA
                /
                /
                /CHECK FOR NO FLAG AFTER WRITE
                /           (DMAW) (DFSC)
0713  7240              CLA CMA
0714  3772'             DCA IACW                    /MEMORY LOATION ZERO
0715  7240              CLA CMA             /AC=7777
0716  3773'             DCA WC              /WORD COUNT=7777
0717  6605              DMAW                /START WRITE ONE WORD
0720  6622              DFSC                /SKIP ON FLAG
0721  7410              SKP
                        HALT                /FLAG UP
0722  4777'             JMS ERADD
0723  6622              DFSC                /SKIP ON FLAG
0724  7410              SKP
                        HALT                /FLAG UP
0725  4777'             JMS ERADD
                        SCOPE
0726  4776'             JMS SCOPEA
                /
                /WILL ADDRESS ACCEPT CLEAR DATA BREAK REQUEST FF?
0727  6605              DMAW                /WRITE SET DBR FF
0730  7200              CLA
0731  3773'             DCA WC
0732  3772'             DCA IACW
0733  6603              DMAR                /SHOULD NOT SET DBR "FF"
0734  7000              NOP
0735  1773'             TAD WC
0736  7440              SZA
                        HALT                /WORD COUNT SHOULD BE ZERO
0737  4777'             JMS ERADD
0740  7200              CLA
0741  1772'             TAD IACW
0742  7440              SZA
                        HALT                /IACW SHOULD BE ZERO
0743  4777'             JMS ERADD
                        SCOPE
0744  4776'             JMS SCOPEA
                NPAGE
0745  5767              JMP I (,+200&7600)
```

```
0767  1000
0770  2002
0771  0004
0772  7751
0773  7750
0774  0070
0775  3700
0776  3242
0777  0400
      1000    PAGE
              /DISK MEMORY ADDRESS READ
1000  7240            CLA CMA
1001  3777'           DCA WC              /READ ONE WORD
1002  7240            CLA CMA
1003  3776'           DCA IACW                    /MEMORY LOCATION ZERO
1004  6603            DMAR                /START READ ONE WORD
1005  6622            DFSC                /SKIP ON FLAG
1006  7410            SKP
                      HALT                /FLAG UP
1007  4775'           JMS ERADD
1010  6622            DFSC                /SKIP ON FLAG
1011  7410            SKP
                      HALT                /FLAG UP
1012  4775'           JMS ERADD
                      SCOPE
1013  4774'           JMS SCOPEA
                      /
                      /STATUS REGISTER CHECK EXTENDED ADDRESS
1014  7200            CLA
1015  6615            DEAL
1016  7200            CLA                 /LOAD EXTENDED ADDRESS WITH ZEROS
1017  6616            DEAC
1020  0373            AND (3700
1021  7440            SZA
                      HALT                /DISC EXTENDED ADDRESS NOT CLEAR
1022  4775'           JMS ERADD
1023  6616            DEAC
1024  0372            AND (0070
1025  7440            SZA
                      HALT                /COMPUTER EXTENDED ADDRESS NOT CLEAR
1026  4775'           JMS ERADD
                      SCOPE
1027  4774'           JMS SCOPEA

                      /
                      /DEAC READ DISK EXTENDED ADDRESS
                      /CHECK FOR NO SYNC MARK
1030  7300            CLA CLL
1031  3771'           DCA CTD
1032  6616            DEAC
1033  7000            NOP
1034  7500            SMA                 /SYNC
1035  7410            SKP                 /NO
```

```
1036  5242          JMP .+4          /YES
1037  2771'         ISZ CTD          /LOOP
1040  5232          JMP .-6
1041  7410          SKP              /NO SYNC PULSE OR NO DISC SELECTED
                    HALT             /FOUND SYNC PULSE
1042  4775'         JMS ERADD
                    SCOPE
1043  4774'         JMS SCOPEA
                /
                /PARITY STATUS BIT TEST
1044  6616          DEAC
1045  0370          AND (0001                /MASK FOR PARITY STATUS
1046  7440          SZA
                    HALT             /PARITY STATUS UP
1047  4775'         JMS ERADD
                    SCOPE
1050  4774'         JMS SCOPEA
                /
                NPAGE
1051  5767          JMP I (.+20087600)


1167  1200
1170  0001
1171  3412
1172  0070
1173  3700
1174  3242
1175  0400
1176  7751
1177  7750
      1200    PAGE

                /TEST WRITE LOCK OUT SWITCH OR NO DISC
1200  6602          6602             /READ MODE INHIBIT WRITE LOCK OUT SWITCHES
1201  6616          DEAC
1202  7012          RTR
1203  7430          SZL
                    HALT             /NO DISC NED SET
1204  4777'         JMS ERADD
                    SCOPE
1205  4776'         JMS SCOPEA
                /
                /CHECK TO SEE IF WRITE LOCK OUT SWITCHES OFF (LOWER)
1206  6604          6604             /WRITE MODE
1207  6616          DEAC             /READ STATUS
1210  7000          NOP
1211  7012          RTR              /AC10 TO LINK
1212  7430          SZL
                    HALT             /AC1 UP WRITE LOCK OUT SWITCH
1213  4777'         JMS ERADD
                    SCOPE
1214  4776'         JMS SCOPEA
                /CHECK TO SEE IF WRITE LOCK SWITCH OFF (UPPER)
1215  1377          TAD (0400        /UPPER TRACK
```

```
1216  6615          DEAL
1217  6604          DMAW-1          /WRITE MODE
1220  6616          DEAC
1221  7000          NOP
1222  7012          RTR             /AC10 TO LINK
1223  7430          SZL
                    HALT            /AC1 UP WRITE LOCK OUT SWITCH
1224  4777'         JMS ERADD
                    SCOPE
1225  4776'         JMS SCOPEA
                /
                /RAISE STATUS BIT AC0/NEX
                /EM3 SHOULD NOT BE SELECTED

1226  1375          TAD (3000
1227  6615          DEAL            /SELECT DISC/EM3
1230  6616          DEAC            /READ STATUS
1231  7000          NOP
1232  7500          SMA
                    HALT            /NEX DID NOT RAISE PSM
1233  4777'         JMS ERADD
                    SCOPE           /DISC 0
1234  4776'         JMS SCOPEA


                /EM2 SHOULD NOT BE SELECTED
                /
1235  1374          TAD (2000               /SELECT EM1
1236  6615          DEAL
1237  6616          DEAC
1240  7000          NOP
1241  7500          SMA
                    HALT            /NEX NOT UP
1242  4777'         JMS ERADD
                    SCOPE
1243  4776'         JMS SCOPEA
                /
                /EM1 SHOULD NOT BE SELECTED
                /
1244  1373          TAD (1000               /SELECT EM1
1245  6615          DEAL
1246  6616          DEAC
1247  7000          NOP
1250  7500          SMA
                    HALT            /NEX NOT UP
1251  4777'         JMS ERADD
                    SCOPE
1252  4776'         JMS SCOPEA
1253  6611          DCEA


                /WILL EXTENDED ADDRESS HOLD SEVENS
1254  7240          CLA CMA
```

```
1255  6615            DEAL
1256  0372            AND (3700               /DISC EXT ADDRESS MASK
1257  3771'           DCA BA
1260  1771'           TAD BA                  /STORE BA
1261  7041            CIA
1262  1372            TAD (3700
1263  7650            SNA CLA                 /TEST
1264  5267            JMP .+3                 /GOOD
1265  1771'           TAD BA                  /BAD
                      HALT                    /AC SHOULD =3700
1266  4777'           JMS ERADD
1267  7000            NOP
1270  7240            CLA CMA
1271  6615            DEAL
1272  0370            AND (0070               /COMPUTER EXT ADDRESS
1273  3771'           DCA BA                  /STORE
1274  1771'           TAD BA
1275  7041            CIA
1276  1370            TAD (0070
1277  7650            SNA CLA                 /TEST
1300  5303            JMP .+3                 /GOOD
1301  1771'           TAD BA                  /BAD
                      HALT                    /AC SHOULD=0070
1302  4777'           JMS ERADD
                      SCOPE
1303  4776'           JMS SCOPEA
                /
                /SKIP ON NO ERROR DFSE
1304  6611            DCEA
1305  6603            DMAR                    /READ STATE
1306  6621            DFSE                    /SKIP ON NO ERROR
                      HALT                    /DATA REQUEST LATE, PARITY OR NO DISE SET
1307  4777'           JMS ERADD
                      SCOPE
1310  4776'           JMS SCOPEA



                /WILL THE DISK HONOR AN INTERRUPT
1311  4340            JMS CLFLAG
1312  7200            CLA                     /SET UP FOR INTERRUPT
1313  1367            TAD (IOF
1314  3001            DCA 0001
1315  1366            TAD (JMP I 0003
1316  3002            DCA 0002
1317  1365            TAD (.+7
1320  3003            DCA 0003
1321  7240            CLA CMA
1322  3764'           DCA WC
1323  6605            DMAW
1324  6001            ION                     /DID NOT INTERRUPT
1325  7410            SKP
                      HALT                    /INTERRUPT UP OR NO DISC
1326  4777'           JMS ERADD
1327  6002            IOF
```

```
                            SCOPE
          1330  4776'       JMS SCOPEA
          1331  6611        DCEA
          1332  6601        DCMA
          1333  7604        LAS
          1334  0377        AND (400
          1335  7440        SZA             /LOOP ON STATIC TEST
          1336  5763'       JMP BEGIN
                      NPAGE
          1337  5762        JMP I (.+200&7600)

                      /ROUTINE TO CLEAR FLAGS
          1340  7402  CLFLAG, XX
          1341  6601        6601
          1342  6002        6002
          1343  6022        6022
          1344  6042        6042
          1345  6012        6012
          1346  6072        6072
          1347  6502        6502
          1350  6032        6032
          1351  6762        6762
          1352  5740        JMP I CLFLAG

          1353  7402  RANDOM, XX
          1354  2761'       ISZ CTD
          1355  7200        CLA
          1356  1761'       TAD CTD
          1357  5753        JMP I RANDOM



          1361  3412
          1362  1400
          1363  0600
          1364  7750
          1365  1326
          1366  5403
          1367  6002
          1370  0070
          1371  3415
          1372  3700
          1373  1000
          1374  2000
          1375  3000
          1376  3242
          1377  0400
                1400  PAGE
                      /
                      /SKIP ON NO ERROR WLO UPPER (READ)
          1400  6603        DMAR            /READ STATE
          1401  1377        TAD (400        /UPPER HALF
          1402  6615        DEAL
          1403  6621        DFSE            /SKIP ON NO ERROR
                            HALT
```

```
1404  4777'           JMS ERADD
                      SCOPE
1405  4776'           JMS SCOPEA
                /
                /SKIP ON NO ERROR (WRITE) WLO (UPPER)
1406  6605            DMAW            /WRITE STATE
1407  1377            TAD (400
1410  6615            DEAL
1411  6621            DFSE            /SKIP ON NO ERROR
                      HALT            /WIRE LOCK OUT ON
1412  4777'           JMS ERADD
                      SCOPE
1413  4776'           JMS SCOPEA
                /
                /SKIP ON NO ERROR (WRITE) WLO LOWER
1414  6611            DCEA            /LOWER
1415  6605            DMAW            /WRITE STATE
1416  6621            DFSE            /SKIP ON NO ERROR
                      HALT            /WRITE LOCK OUT ON
1417  4777'           JMS ERADD
                      SCOPE
1420  4776'           JMS SCOPEA

                /EXECUTE DMA TEST
1421  7200      RTEST,  CLA
1422  6002            IOF
1423  3775'           DCA CTA
1424  4774'           JMS DMA
1425  7240            CLA CMA
1426  4774'           JMS DMA
1427  4773'           JMS RANDOM
1430  4774'           JMS DMA
1431  2775'           ISZ CTA
1432  5227            JMP .-3
                      SCOPE
1433  4776'           JMS SCOPEA
                /
                /EXECUTE EMA TEST
1434  7240            CLA CMA
1435  6615            DEAL
1436  7000            NOP
1437  7000            NOP
1440  7000            NOP
1441  7200            CLA
1442  3775'           DCA CTA
1443  4772'           JMS EMA
1444  7240            CLA CMA
1445  4772'           JMS EMA
1446  4773'           JMS RANDOM
1447  2775'           ISZ CTA
1450  5245            JMP .-3
                      SCOPE
1451  4776'           JMS SCOPEA
                /
                /EXECUTE DMB TEST
```

```
1452  7200          CLA
1453  6611          DCEA
1454  3775'         DCA CTA
1455  4771'         JMS DMB
1456  7240          CLA CMA
1457  4771'         JMS DMB
1460  4773'         JMS RANDOM
1461  4771'         JMS DMB
1462  2775'         ISZ CTA
1463  5260          JMP .-3
                    SCOPE
1464  4776'         JMS SCOPEA
1465  7604          LAS
1466  0377          AND (400
1467  7440          SZA
1470  5221          JMP RTEST

                /
                /RAISE STATUS BIT AC 10
                /EM3 SHOULD NOT BE SELECTED
1471  7200      DYA,  CLA
1472  1370          TAD (3000
1473  6615          DEAL              /SELECT DISC/EM3/RAISE NEX
1474  6631          TTA               /SET NED
1475  6616          DEAC
1476  0367          AND (2
1477  1366          TAD (-2
1500  7450          SNA
1501  5304          JMP .+3
1502  6616          DEAC
                    HALT              /NEX DID NOT RAISE AC 10
1503  4777'         JMS ERADD
1504  7200          CLA
1505  6615          DEAL              /DISC 0
                    SCOPE
1506  4776'         JMS SCOPEA


                /FORCE AN INTERRUPT WITH NED
1507  7200          CLA
1510  1365          TAD (JMP I 0002
1511  3001          DCA 0001
1512  1364          TAD (.+11
1513  3002          DCA 0002
1514  1370          TAD (3000
1515  6615          DEAL              /SEL NON EXISTANT DISC
1516  6001          ION
1517  7000          NOP
1520  6002          IOF
                    HALT              /NED DID NOT RAISE AN INTERRUPT
1521  4777'         JMS ERADD
1522  7200          CLA
                    SCOPE
1523  4776'         JMS SCOPEA
```

```
                    /DOES TP1 CLEAR PAR "FF"
1524  6601          DCMA            /CLEAR PER
1525  6632          TTB
1526  6632          TTB             /TP1 CL PAR
1527  1370          TAD (3000
1530  6615          DEAL            /GEN DEP VIA NED
1531  6631          TTA             /SET NED *** PER IF PAR SET
1532  6621          DFSE            /SKIP ON NO ERROR
                    HALT
1533  4777'         JMS ERADD
                    SCOPE
1534  4776'         JMS SCOPEA

                    /WILL NED SET DONE (TRC)?
1535  6611          DCEA            /CLEAR EXT ADDRESS
1536  6601          DCMA
1537  7240          CLA CMA
1540  3763'         DCA WC
1541  6605          DMAW            /SET WORD COUNT OVERFLOW
1542  1370          TAD (3000
1543  6615          DEAL            /LOAD EXT ADDRESS & RAISE NEX
1544  6631          TTA             /SET NED GENERATE DEP
1545  6616          DEAC            /READ STATUS
1546  7000          NOP
1547  6622          DFSC            /DID NED SET DONE?
                    HALT            /NO
1550  4777'         JMS ERADD
                    SCOPE
1551  4776'         JMS SCOPEA
                    NPAGE
1552  5762          JMP I (.+20087600)


1562  1600
1563  7750
1564  1523
1565  5402
1566  7776
1567  0002
1570  3000
1571  1640
1572  1620
1573  1353
1574  1601
1575  3411
1576  3242
1577  0400
      1600    PAGE
              NPAGE
1600  5777          JMP I (.+20087600)

                    /STATIC ADDRESS REGISTER TEST (DISK MOTOR OFF)
                    /JMS DMA, AC=DATA
1601  7402    DMA,      XX
1602  3776'           DCA GA
```

```
1603  3775'          DCA IACW
1604  1776'          TAD GA
1605  6603           6603            /LOAD ADDRESS REG
1606  7200           CLA
1607  6624           6624            /READ ADDRESS REG
1610  3774'          DCA BA
1611  1774'          TAD BA
1612  7041           CIA
1613  1776'          TAD GA
1614  7440           SZA
1615  4773'          JMS BADADD
1616  7200           CLA
1617  5601           JMP I DMA


               /STATIC TEST OF EXTENDED ADDRESS REGISTER (DISK MOTOR OFF)
               /JMS EMA AC=DATA

1620  7402     EMA,  XX
1621  0372           AND (3770
1622  3776'          DCA GA
1623  1776'          TAD GA
1624  6615           DEAL            /LOAD EXT ADDRESS
1625  7200           CLA
1626  6614           6614            /READ EXT ADDRESS
1627  0372           AND (3770
1630  3774'          DCA BA
1631  1774'          TAD BA
1632  7041           CIA
1633  1776'          TAD GA
1634  7440           SZA
1635  4773'          JMS BADADD
1636  7200           CLA
1637  5620           JMP I EMA

               /STATIC DATA REGISTER TEST (DISK MOTOR OFF)
               /JMS DMB, AC=DATA

1640  7402     DMB,  XX
1641  3771'          DCA GD
1642  7240           CLA CMA
1643  3770'          DCA WC
1644  1367           TAD (GD-1
1645  3775'          DCA IACW
1646  6604           6604            /LOAD DMB
1647  7240           CLA CMA
1650  3770'          DCA WC
1651  1376           TAD (BD-1
1652  3775'          DCA IACW
1653  6602           6602            /READ
1654  6634           6634            /RAISE A REQUEST   Set data break request FF stat. logic test.
1655  7200           CLA
1656  1771'          TAD GD
1657  7041           CIA
1660  1767'          TAD BD
```

```
1661  7440            SZA
1662  4766'           JMS BADCOM
1663  7200            CLA
1664  5640            JMP I DMB
1766  0434
1767  3417
1770  7750
1771  3420
1772  3770
1773  0500
1774  3415
1775  7751
1776  3416
1777  2000
      2000    PAGE


2000  5215            JMP .+15        /JMP AROUND SCOPE LOOPS
2001  7200    SWDMB,  CLA
2002  7604            LAS
2003  4777'           JMS DMB
2004  5201            JMP SWDMB

2005  7200    SWDMA,  CLA
2006  7604            LAS
2007  4776'           JMS DMA
2010  5205            JMP SWDMA

2011  7200    SWEMA,  CLA
2012  7604            LAS
2013  4775'           JMS EMA
2014  4211            JMS SWEMA
                NPAGE
2015  5774            JMP I (.+200&7600)

2174  2200
2175  1620
2176  1601
2177  1640
      2200    PAGE
              /INTERFACE USING SPECIAL IOTS
              /CAN WE SHIFT DISC MEMORY ADDRESS WITH DMA
                      SCOPE
2200  4777'           JMS SCOPEA
2201  6601            DCMA
2202  6611            6611 jcm
2203  4776'           JMS SAD /SET SAD
2204  7200            CLA
2205  1375            TAD (2525       /DATA TO DMA
2206  6605            DMAW            /LOAD DMA
2207  6632            TTB
2210  6632            TTB     /GEN TP1, CLEAR SAD, SET MAD
2211  4774'           JMS SAP /SHIFT DMA
2212  6626            DMAC    /READ DMAC
2213  3773'           DCA BA
```

```
2214  1372          TAD (1252               /WHAT DATA SHOULD BE
2215  7041          CIA
2216  1773'         TAD BA
2217  7650          SNA CLA /TEST
2220  5223          JMP .+3
2221  1773'         TAD BA  /LOAD AC WITH BA
                    HALT            /ACI = 2525, ACF = 1252
2222  4771'         JMS ERADD
                    SCOPE
2223  4777'         JMS SCOPEA


                /CAN WE SHIFT DMA WITH MAD SET
2224  4776'         JMS SAD /SET SAD
2225  7200          CLA
2226  1370          TAD (5252       /DATA TO DMA
2227  6605          DMAW    /LOAD DMA AND SET ACH
2230  6632          TTB     /GEN TP1, CLEAR SAD SET MAD
2231  6632          TTB
2232  4774'         JMS SAP /SHIFT DMA
2233  6626          DMAC    /READ DMA
2234  3773'         DCA BA  /TEMP STORE
2235  1367          TAD (6525               /WHAT DATA SHOULD BE
2236  7041          CIA
2237  1773'         TAD BA
2240  7650          SNA CLA /TEST
2241  5244          JMP .+3
2242  1773'         TAD BA  /LOAD AC WITH BA
                    HALT
2243  4771'         JMS ERADD
                    SCOPE
2244  4777'         JMS SCOPEA
                /
                /TO PASS THIS,  THE PREVIOUS TEST MUST BE GOOD
                /SHIFT DMA WITH MAD CLEARED
2245  1366          TAD (7252               /MAD AND ACH SHOULD BE CLEARED
2246  3765'         DCA CA
2247  6631          TTA             /WITH SAD SET-SAP
2250  6626          DMAC            /READ DMA
2251  3773'         DCA BA
2252  1773'         TAD BA
2253  7041          CIA
2254  1765'         TAD CA          /SHOULD BE 7252
2255  7650          SNA CLA         /COMPARED
2256  5261          JMP .+3         /GOOD
2257  1773'         TAD BA          /BAD
                    HALT            /BAD IS IN AC
2260  4771'         JMS ERADD
2261  7604          LAS             /SCOPE LOOP SET UP
2262  0364          AND (1000
2263  7640          SZA CLA
2264  5763'         JMP RETURN+1
                /
                /TO PASS THIS THE PREVIOUS TEST MUST BE GOOD
2265  1362          TAD (5525               /MAD AND ACH SHOULD BE CLEARED
```

```
2266  3765'           DCA GA
2267  6631            TTA             /WITH SAD SET-SAP-SHIFT DMA
2270  6626            DMAC            /READ DMA
2271  3773'           DCA BA
2272  1773'           TAD BA
2273  7041            CIA
2274  1765'           TAD GA          /SHOULD BE 5525
2275  7650            SNA CLA         /COMPARE
2276  5301            JMP .+3         /GOOD
2277  1773'           TAD BA          /BAD
                      HALT            /BAD IS IN AC
2300  4771'           JMS ERADD
2301  7604            LAS             /SCOPE LOOP SET UP
2302  0364            AND (1000
2303  7640            SZA CLA
2304  5763'           JMP RETURN+1


                /INTERFACE USING SPECIAL TIMING PULSES
                /SKIP ON ADC PULSE
2305  4761'           JMS ADC
2306  6612            DSAC
                      HALT    /ADC NOT SET
2307  4771'           JMS ERADD
                      SCOPE
2310  4777'           JMS SCOPEA
                /
                /SHIFT MEMORY BUFFER/SHIFTS SEVENS
2311  6601            DCMA
2312  6611            DCEA
2313  7240            CLA CMA
2314  3760'           DCA GD
2315  7240            CLA CMA
2316  3757'           DCA WC
2317  1356            TAD (GD-1
2320  3755'           DCA IACW
2321  4754'           JMS SDP /SHIFT DATA PULSE/LOAD DMB
2322  7240            CLA CMA
2323  3757'           DCA WC
2324  1365            TAD (BD-1
2325  3755'           DCA IACW
2326  4753'           JMS CLADC
2327  6602            6602            /READ
2330  6634            6634            /RAISE A REQUEST
2331  7200            CLA
2332  1352            TAD (7777
2333  7041            CIA
2334  1756'           TAD BD
2335  7650            SNA CLA
2336  5341            JMP .+3
2337  1756'           TAD BD
                      HALT    /FAILED SHIFTING DMB
2340  4771'           JMS ERADD
                      SCOPE
2341  4777'           JMS SCOPEA
```

```
                        NPAGE
2342  5751              JMP I (.+200&7600)

                  PAUSE

                  /PDP-8 DISCLESS RMX5  -  TAPE 4
2351  2400
2352  7777
2353  3030
2354  3024
2355  7751
2356  3417
2357  7750
2360  3420
2361  3017
2362  5525
2363  3253
2364  1000
2365  3416
2366  7252
2367  6525
2370  5252
2371  0400
2372  1252
2373  3415
2374  3013
2375  2525
2376  3000
2377  3242
      2400        PAGE
                  /SHIFT MEMORY BUFFER SHIFT ZERO
2400  6601              DCMA
2401  6611              DCEA
2402  7200              CLA
2403  3777'             DCA GD
2404  7240              CLA CMA
2405  3776'             DCA WC
2406  1375              TAD (GD-1
2407  3774'             DCA IACW
2410  4773'             JMS SDP /SHIFT DATA PULSE/LOAD DMB
2411  7240              CLA CMA
2412  3776'             DCA WC
2413  1372              TAD (BD-1
2414  3774'             DCA IACW
2415  4771'             JMS CLADC
2416  6602              6602
2417  6634              6634
2420  7200              CLA
2421  1370              TAD (4000               /WHAT DATA SHOULD BE AFTER SHIFT
2422  7041              CIA
2423  1775'             TAD BD
2424  7650              SNA CLA
2425  5230              JMP .+3
2426  1775'             TAD BD
                        HALT    /FAILED TEST DMB SHIFT
```

```
2427  4767'           JMS ERADD
                      SCOPE
2430  4766'           JMS SCOPEA

                /SHIFT MEMORY BUFFERS (2525) ONE SHIFT
2431  7200            CLA
2432  6601            DCMA
2433  6611            DCEA
2434  1365            TAD (2525
2435  3777'           DCA GD
2436  7240            CLA CMA
2437  3776'           DCA WC
2440  1375            TAD (GD-1
2441  3774'           DCA IACW
2442  4773'           JMS SDP           /MDP ALSO SET NOW/SHIFT DATA
2443  7240            CLA CMA
2444  3776'           DCA WC
2445  1372            TAD (BD-1
2446  3774'           DCA IACW
2447  4771'           JMS CLADC
2450  6602            6602              /READ
2451  6634            6634              /RAISE A REQUEST
2452  7200            CLA
2453  1364            TAD (5252
2454  7041            CIA
2455  1775'           TAD BD
2456  7650            SNA CLA
2457  5262            JMP .+3
2460  1775'           TAD BD
                      HALT
2461  4767'           JMS ERADD
                      SCOPE
2462  4766'           JMS SCOPEA


                /SHIFT MEMORY BUFFER (2525) 2 SHIFTS
2463  6601            DCMA
2464  6611            DCEA
2465  7200            CLA
2466  1365            TAD (2525
2467  3777'           DCA GD
2470  7240            CLA CMA
2471  3776'           DCA WC
2472  1375            TAD (GD-1
2473  3774'           DCA IACW
2474  4773'           JMS SDP           /SHIFT DATA MDP ALSO SET
2475  6631            TTA               /EXTRA SHIFT MDP SHOULD BE CLEARED
2476  7240            CLA CMA
2477  3776'           DCA WC
2500  1372            TAD (BD-1
2501  3774'           DCA IACW
2502  4771'           JMS CLADC
2503  6602            6602              /READ
2504  6634            6634              /RAISE A REQUEST
```

```
2525  7200          CLA
2526  1365          TAD (2525
2527  7041          CIA
2510  1775'         TAD BD
2511  7650          SNA CLA
2512  5315          JMP .+3
2513  1775'         TAD BD
                    HALT
2514  4767'         JMS ERADD
                    SCOPE
2515  4766'         JMS SCOPEA


              NPAGE
2516  5763          JMP I (.+200&7600)

2563  2600
2564  5252
2565  2525
2566  3242
2567  0400
2570  4000
2571  3030
2572  3416
2573  3024
2574  7751
2575  3417
2576  7750
2577  3420
      2600    PAGE
              /
              /SHIFT DMA WITH ACH ZERO
2600  7200          CLA
2601  6605          DMAW    /DMA11 TO ZERO
2602  4777'         JMS SAP /CLEAR ACH
2603  7240          CLA CMA
2604  6605          DMAW    /LOAD ALL SEVEN
2605  4777'         JMS SAP /SHIFT DMA
2606  6626          DMAC    /READ DMAC
2607  3776'         DCA BA  /TEM STORE
2610  1375          TAD (5777               /WHAT DATA SHOULD BE
2611  7041          CIA
2612  1776'         TAD BA
2613  7650          SNA CLA /TEST
2614  5217          JMP .+3
2615  1776'         TAD BA
                    HALT
2616  4774'         JMS ERADD
                    SCOPE
2617  4773'         JMS SCOPEA
              /
              /DATA REQUEST LATE/STATUS AND SKIP TEST
2620  7604          LAS
2621  7110          CLL RAR
2622  7630          SZL CLA
```

```
2623  5242          JMP TSTDF       /8F OR PDP12 WITH ECO EP00021 AND ABOVE,
2624  7410  S81,    SKP
2625  5241          JMP .+14        /BUILD FOR BSS ONLY
2626  6601          DCMA            /CLR DRL
2627  4772'         JMS ADC
2630  6604          6604            /RAISE A REQUEST
2631  6632          TTB             /GENERATE DEP
2632  6616          DEAC            /READ STATUS
2633  0371          AND (4
2634  7450          SNA
                    HALT            /DATA REQUEST LATE STATUS NOT SET
2635  4774'         JMS ERADD
2636  6621          DFSE            /SKIP ON NO ERROR
2637  7410          SKP
                    HALT            /SKIPED ON DRL
2640  4774'         JMS ERADD
                    SCOPE
2641  4773'         JMS SCOPEA
                /
                /CHECK GENERATION OF DONE FLAG
2642  4770'   TSTDF, JMS TCR /SET DONE FLAG
2643  6622          DFSC    /SKIP ON FLAG
                    HALT    /NO DONE FLAG
2644  4774'         JMS ERADD
                    SCOPE
2645  4773'         JMS SCOPEA


                /FORCE AN INTERRUPT WITH TRC
2646  7200          CLA
2647  1367          TAD (JMP I 0002
2650  3001          DCA 0001
2651  1366          TAD (.+6
2652  3002          DCA 0002
2653  4770'         JMS TCR         /SET TRC
2654  6001          ION
2655  7000          NOP
                    HALT            /TRC DID NOT RAISE IN INTERRUPT
2656  4774'         JMS ERADD
                    SCOPE
2657  4773'         JMS SCOPEA
                /
                /INCREMENT EXTERNAL MEMORY ADDRESS/EMA
2660  6611          DCEA
2661  7200          CLA
2662  1365          TAD (-37
2663  3364          DCA (XX
2664  6615          DEAL    /CLEAR EXT ADDRESS
2665  7240          CLA CMA
2666  4763'         JMS DEP /LOAD DMA SET ACH
2667  6601          DCMA    /INCREMENT EMA
2670  2364          ISZ (XX /COUNTER
2671  5265          JMP .-4
2672  6616          DEAC    /READ EMA
2673  0362          AND (3700
```

```
2674  1361          TAD (-3700
2675  7450          SNA     /TEST
2676  5301          JMP .+3
2677  6616          DEAC    /READ EMA
                    HALT    /AC = 37
2700  4774'         JMS ERADD
                    SCOPE
2701  4773'         JMS SCOPEA
2702  7240          CLA CMA
2703  4763'         JMS DEP           /LOAD DMA SET ACH
2704  6601          DCMA              /INCREMENT EMA
2705  6616          DEAC
2706  0362          AND (3700
2707  7440          SZA
                    HALT
2710  4774'         JMS ERADD
                    SCOPE
2711  4773'         JMS SCOPEA


                /LOOP ON ROUTINE
2712  4760'         JMS CLADC
2713  7604          LAS
2714  0374          AND (400                /LOOP ON SHIFT AND STATUS REG TEST
2715  7640          SZA CLA
2716  5757'         JMP DYA           /SHIFT AND STATUS TEST
                /
                /
                /TEST FOR SKIPING LIGHT BOX TEST
                /
2717  4760'         JMS CLADC
2720  6611          DCEA
2721  6601          DCMA
2722  7604          LAS
2723  0356          AND (200
2724  7640          SZA CLA           /SKIP LIGHT BUT
2725  5755'         JMP BEGIN               /YES
                /
                /AUTOMATIC CONTROL FOR LIGHT BOX
2726  7200          CLA
2727  6611          DCEA
2730  1354          TAD (7760               /NUMBER OF TRACKS
2731  3753'         DCA CTA
2732  3752'         DCA KA            /TRACK NUMBER
2733  4751'         JMS LGBOX               /LIGHT BOX ROUTINE
2734  2752'         ISZ KA
2735  7200          CLA
2736  1752'         TAD KA            /TRACK NUMBER INCREMENTED
2737  2753'         ISZ CTA           /DONE
2740  5333          JMP .-5           /NO
2741  6611          DCEA              /YES
2742  6601          DCMA              /CLEAR DISC
                    SCOPE
2743  4773'         JMS SCOPEA
2744  4760'         JMS CLADC
```

```
2745  5755          JMP BEGIN       /GO TO START OF PROGRAM


2751  3051
2752  3400
2753  3411
2754  7760
2755  0600
2756  0200
2757  1471
2760  3030
2761  4100
2762  3700
2763  3044
2764  7402
2765  7741
2766  2657
2767  5402
2770  3034
2771  0004
2772  3017
2773  3242
2774  0400
2775  5777
2776  3415
2777  3013
      3000    PAGE
              /COMMANDS TO BE GENERATED WITH SPECIAL IOTS
              /ROUTINE TO SET SEARCH ADDRESS/SAD

3000  7402    SAD,    XX
3001  6606            6606    /SET MRS WITH LAD
3002  6632            TTB     /SET ABD
3003  6632            TTB             /SET TCA
3004  6632            TTB             /CL TCA, SET TCB
3005  6632            TTB             /SET TCA
3006  6632            TTB             /CL TCA, CL TCB, SET MWR
3007  6631            TTA     /CL ABD TO SYNC DRS
3010  6632            TTB     /DRS=SET WCE
3011  6631            TTA     /SET SAD
3012  5600            JMP I SAD       /EXIT

              /ROUTINE TO SET SHIFT ADDRESS PULSE/SAP

3013  7402    SAP,    XX
3014  4200            JMS SAD
3015  6631            TTA     /SHIFT DMA
3016  5613            JMP I SAP       /EXIT

              /ROUTINE FOR SETTING ADDRESS CONFIRMED/ADC
3017  7402    ADC,    XX
3020  4200            JMS SAD /SAD AND ABC SHOULD BE SET
3021  6632            TTB
3022  6632            TTB     /SET ADC CL SAD
3023  5617            JMP I ADC       /EXIT
```

```
                    /ROUTINE TO SHIFT MEMORY BUFFER/SDP

3024  7402    SDP,  XX
3025  4217          JMS ADC
3026  6631          TTA     /SHIFT DMB
3027  5624          JMP I SDP

                    /ROUTINE TO CLEAR ADC "FF"
3030  7402    CLADC, XX
3031  6632          TTB
3032  6632          TTB
3033  5630          JMP I CLADC


                    /ROUTINE TO SET TRANSFER COMPLETE TCR

3034  7402    TCR,  XX
3035  6601          DCMA
3036  7240          CLA CMA
3037  3777          DCA WC
3040  7240          CLA CMA
3041  3776          DCA IACW                /WRITE ONE WORD WCO SHOULD BE SET
3042  4244          JMS DEP
3043  5634          JMP I TCR

                    /ROUTINE FOR DATA END PULSE/DEP

3044  7402    DEP,  XX
3045  4217          JMS ADC
3046  6632          TTB
3047  6632          TTB     /GENERATE TP1
3050  5644          JMP I DEP

                    /LIGHT BOX USED TO TEST TRACK SELECTION
                    /SET OR CLEAR "WFF"?

3051  7402    LGBOX, XX
3052  6601          DCMA
3053  3375          DCA (XX         /STORE SWITCH
3054  1375          TAD (XX
3055  0374          AND (4          /MASK FOR "WFF"
3056  7450          SNA             /SET OR CLEAR
3057  5264          JMP .+5         /CLEAR
3060  4267          JMS KWFF                /LOAD DMB, DMA CLEAR WFF
3061  6631          TTA             /GEN DPS SET WFF
3062  4311          JMS STALL
3063  5651          JMP I LGBOX
3064  4267          JMS KWFF                /LOAD DMB, DMA AND CLEAR WFF
3065  4311          JMS STALL
3066  5651          JMP I LGBOX


                    /ROUTINE TO CLEAR WFF
3067  7402    KWFF,  XX
```

```
3070  7200            CLA
3071  1373            TAD (7777           /DATA FOR MB
3072  3772'           DCA GD
3073  1371            TAD (GD-1
3074  3776'           DCA IACW
3075  1375            TAD (XX             /SWITCH REG
3076  7012            RTR
3077  6611            6611                /CL TRACK
3100  6631            6631
3101  6632            6632
3102  4217            JMS ADC
3103  1375            TAD (XX             /SWITCH
3104  7104            RAL CLL
3105  7006            RTL
3106  7006            RTL
3107  6615            DEAL                /LOAD EXT ADDRESS
3110  5667            JMP I KWFF                  /EXIT

3111  7402    STALL,  XX
3112  7240            CLA CMA
3113  1370            TAD (7740
3114  3322            DCA .+6
3115  2323            ISZ .+6
3116  5315            JMP .-1
3117  2322            ISZ .+3
3120  5315            JMP .-3
3121  5711            JMP I STALL
3122  0000            0
3123  0000            0

3124  7402    IPRINT, XX
3125  3767'           DCA AC
3126  7604            LAS
3127  0366            AND (4000
3130  7650            SNA CLA
3131  5337            JMP .+6
3132  1324            TAD IPRINT
3133  1365            TAD (-2
3134  3324            DCA IPRINT
3135  1724            TAD I IPRINT
3136  3324            DCA IPRINT
3137  1767'           TAD AC
3140  5724            JMP I IPRINT


3165  7776
3166  4000
3167  3404
3170  7740
3171  3417
3172  3420
3173  7777
3174  0004
3175  7402
3176  7751
```

```
3177  7750
      3200      PAGE
                /MAINTENANCE SCOPE LOOPS
                /SEARCH ADDRESS
3200  6611      SA,       DCEA
3201  4777'               JMS SAD
3202  6632                TTB
3203  6632                TTB
3204  5200                JMP .-4
                /SHIFT ADDRESS PULSE
3205  6611      SB,       DCEA
3206  4776'               JMS SAP
3207  5205                JMP .-2
                /ADDRESS CONFIRMED
3210  6611      SC,       DCEA
3211  4775'               JMS ADC
3212  5210                JMP .-2
                /SHIFT DATA PULSE
3213  6611      SD,       DCEA
3214  4774'               JMS SDP
3215  5213                JMP .-2
                /DATA END PULSE
3216  6611      SE,       DCEA
3217  4773'               JMS DEP
3220  5216                JMP .-2
                /TRANSFER COMPLETE
3221  6611      SF,       DCEA
3222  4772'               JMS TCR
3223  5221                JMP .-2


                /MAINTENANCE SCOPE LOOPES FOR IOTS
                /USE SR 8 TO 11 TO SELECT IOT
3224  7000      SG,       NOP
3225  7200                CLA
3226  3771'               DCA WC
3227  3770'               DCA IACW
3230  7604                LAS               /IOP SELECTION
3231  0367                AND (0037
3232  1366                TAD (6600
3233  3234                DCA .+1           /GENERATE IOT
3234  7402                XX
3235  7000                NOP               /EXECUTE IOT
3236  5225                JMP SG+1                  /LOOP


                /SCOPE LOOP FOR LIGHT BOX,  SR 8-11 EQUAL TRACK
3237  7604      SH,       LAS     /AC = TRACK
3240  4765'               JMS LGBOX
3241  5237                JMP .-2

                /SCOPE LOOP SETUP
3242  7402      SCOPEA,   XX
3243  7604                LAS
3244  0364                AND (1000
```

```
3245  7640          SZA CLA
3246  5652          JMP I RETURN
3247  1242          TAD SCOPEA
3250  3252          DCA RETURN
3251  5642          JMP I SCOPEA
                    /
                    /POINTER FOR SCOPE LOOP
3252  3363    RETURN, (BEGIN
3253  5652          JMP I .-1


3363  0600
3364  1000
3365  3051
3366  6600
3367  0037
3370  7751
3371  7750
3372  3034
3373  3044
3374  3024
3375  3017
3376  3013
3377  3000
      3400    PAGE
              /CONSTANTS
      6603    DMAR=6603                       /LOAD AND START READ
      6631    TTA=6631
      6632    TTB=6632
      6634    MQP=6634
      6634    DBR=6634
      6601    DCMA=6601                       /CLEAR MAR, PRITY, DONE FLAG
      6611    DCEA=6611                       /CLEAR EXT ADDRESS REGISTERS
      6612    DSAC=6612                       /CLEAR AC SKIP ON ADC
      6605    DMAW=6605                       /LOAD AND START WRITE
      6615    DEAL=6615                       /LOAD EXTENDED ADDRESS
      6616    DEAC=6616                       /READ EXTENDED ADDRESS
      6621    DFSE=6621                       /SKIP ON NO ERROR
      6622    DFSC=6622                       /SKIP ON FLAG
      6626    DMAC=6626                       /READ DISK ADDRESS
      7402    XX=7402
      7750    WC=7750
      7751    IACW=7751
      7751    CACW=IACW
3400  0000    KA,     0
3401  0000    WADD,   0               /IACW=1 FOR WRITE
3402  0000    RADD,   0               /IACW=1 FOR READ
3403  0000    CTC,    0
3404  0000    AC,     0               /SAVE AC
3405  0000    TKADD,  0
3406  0000    ERRDSK, 0               /DISK ERROR ADDRESS
3407  0000    ERRTK,  0               /DISK TRACK ERROR ADDRESS
3410  0001    NUM,    1
3411  0000    CTA,    0
3412  0000    CTD,    0
```

```
                3413  0000    WORD1,  0
                3414  0000    WORD2,  0
                3415  0000    BA,     0               /BAD ADDRESS
                3416  0000    GA,     0               /GOOD ADDRESS
                3417  0000    BD,     0               /BAD DATA
                3420  0000    GD,     0               /GOOD DATA

                      3600    PAGE
                3600  0000    OUTBUF, 0

                      4000    PAGE
                4000  0000    INBUF,  0



                      0076    *76
                              /JUMPING OFF FOR ROUTINES
                              /
                0076  5124            JMP S82+6       /FOR ABNORMAL TEST
                0077  4116            JMS S82         /8S ENTRANCE ADDRESS
                0100  5777'           JMP BEGIN       /START CR TEST
                0101  5776'           JMP RTEST       /REGISTER TEST
                0102  5775'           JMP DYA         /SHIFT TEST
                0103  5774'           JMP SWDMA       /DISC MEMORY ADDRESS
                0104  5773'           JMP SWEMA       /EXT MEMORY ADDRESS
                0105  5772'           JMP SWDMB       /DISC MEMORY BUFFER
                0106  5771'           JMP SA          /SAD FF
                0107  5770'           JMP SB          /SAP PULSE
                0110  5767'           JMP SC          /ADC "FF"
                0111  5766'           JMP SD          /SDP PULSE
                0112  5765'           JMP SE          /DEP PULSE
                0113  5764'           JMP SF          /TRC "FF"
                0114  5763'           JMP SG          /IOT 60XX  SR = XX
                0115  5762'           JMP SH          /LIGHT BOX SR 8 TO 11 = TRACK

                0116  7402    S82,    XX
                0117  1161            TAD (NOP
                0120  3760'           DCA STALL+2
                0121  1161            TAD (NOP
                0122  3757'           DCA S81
                0123  5516            JMP I S82
                0124  6605            DMAW
                0125  6605            DMAW            /CLEAR WORD COUNT
                0126  5100            JMP 100
                              /
                              $
                0157  2624
                0160  3113
                0161  7000
                0162  3237
                0163  3224
                0164  3221
                0165  3216
                0166  3213
```

```
0167  3210
0170  3205
0171  3200
0172  2001
0173  2011
0174  2005
0175  1471
0176  1421
0177  0600
```

```
0000  000000000  000000000  000000000  000000000  000000000  000000000  000000000  000000011
0100  111111111  111111111  111111110  000000000  000000000  000000001  111111111  111111111

0200  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
0300  111111111  111111111  111111111  111111111  111111100  000000000  000000000  001111111

0400  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
0500  111111111  111111111  111111111  111111111  111100000  000000000  000000000  000111111

0600  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
0700  111111111  111111111  111111111  111111111  111111100  000000000  000000001  111111111

1000  111111111  111111111  111111111  111111111  111111111  110000000  000000000  000000000
1100  000000000  000000000  000000000  000000000  000000000  000000000  000000001  111111111

1200  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
1300  111111111  111111111  111111111  111111111  111111111  111111111  011111111  111111111

1400  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
1500  111111111  111111111  111111111  111111111  111111111  111000000  001111111  111111111

1600  111111111  111111111  111111111  111111111  111111111  111111111  111110000  000000000
1700  000000000  000000000  000000000  000000000  000000000  000000000  000000111  111111111

2000  111111111  111111000  000000000  000000000  000000000  000000000  000000000  000000000
2100  000000000  000000000  000000000  000000000  000000000  000000000  000000000  000001111

2200  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
2300  111111111  111111111  111111111  111111111  111000000  011111111  111111111  111111111

2400  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
2500  111111111  111111110  000000000  000000000  000000000  000000000  000111111  111111111

2600  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
2700  111111111  111111111  111111111  111111111  111111100  011111111  111111111  111111111

3000  111111111  111111111  111111111  111111111  111111111  111111111  111111111  111111111
3100  111111111  111111111  111111111  111111111  100000000  000000000  000000111  111111111

3200  111111111  111111111  111111111  111111111  111111111  111100000  000000000  000000000
3300  000000000  000000000  000000000  000000000  000000000  000000000  000111111  111111111

3400  111111111  111111111  100000000  000000000  000000000  000000000  000000000  000000000
3500  000000000  000000000  000000000  000000000  000000000  000000000  000000000  000000000

3600  100000000  000000000  000000000  000000000  000000000  000000000  000000000  000000000
3700  000000000  000000000  000000000  000000000  000000000  000000000  000000000  000000000
```

```
4000  10000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
4100  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000

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
```

```
AC        3404
ADC       3017
BA        3415
BADADD    0500
BADCOM    0434
BD        3417
BEGIN     0600
C212      0255
C215      0257
C245      0260
C340      0253
CACW      7751
CLADC     3030
CLFLAG    1340
CTA       3411
CTC       3403
CTD       3412
DBR       6634
DCEA      6611
DCMA      6601
DEAC      6616
DEAL      6615
DEP       3044
DFSC      6622
DFSE      6621
DMA       1601
DMAC      6626
DMAR      6603
DMAW      6605
DMB       1640
DSAC      6612
DYA       1471
EMA       1620
ERADD     0400
ERRDSK    3406
ERRTK     3407
GA        3416
GD        3420
HLT       7402
IACW      7751
INBUF     4000
IOF       6002
ION       6001
IPRINT    3124
KA        3400
KWFF      3067
LAS       7604
LGBOX     3051
M2        0256
M3        0254
M40       0252
MASK77    0251
MASKA     0341
MASKB     0342
MASKC     0343
MASKD     0344
MDP       6634
MESAGE    0201
MSRGHT    0217
MTP       0244
NUM       3410
OSR       7404
OUTBUF    3600
RADD      3402
RANDOM    1353
RETURN    3252
RTEST     1421
S81       2624
S82       0116
SA        3200
SAD       3000
SAP       3013
SB        3205
SC        3210
SCOPEA    3242
SD        3213
SDP       3024
SE        3216
SF        3221
SG        3224
SH        3237
SIXTY     0261
STALL     3111
SWDMA     2005
SWDMB     2001
SWEMA     2011
TCR       3034
TKADD     3405
TSTDF     2642
TTA       6631
TTB       6632
TYPECH    0220
WADD      3401
WC        7750
WORD1     3413
WORD2     3414
XX        7402
```

ERRORS DETECTED: 0

LINKS GENERATED: 307

RUN-TIME: 15 SECONDS

2K CORE USED