

IDENTIFICATION

PRODUCT CODE	MAINDEC-08-DIDFB-A-D REPLACES: MAINDEC-08-D5BC
PRODUCT NAME	DF32 DISCLESS LOGIC TEST, MINIDISC
DATE CREATED	MARCH 12, 1973
MAINTAINER	DIAGNOSTIC GROUP
AUTHOR	E. FORTMILLER

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ADDENDUM

1. DUE TO DF32 ECO'S 43 AND 47, AND DS32 ECO'S 9 AND 10 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 1030 FROM 7300 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:

<u>LOCATION</u>	<u>FROM</u>	<u>TO</u>
1343	6022	6032
1345	6012	5740

- Insert patch 1030 = 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 7370 → 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

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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 17₈ 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

<u>Address Tag</u>	<u>Function Tested</u>	<u>Good (AC)</u>	<u>Bad (AC)</u>	<u>Corrective Action</u>
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

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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.

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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

<u>Function Tested</u>	<u>Corrective Action</u>
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"

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

All switches Normal Except

<u>EM OFF</u>	<u>EM 1</u>	<u>EM 2</u>	<u>EM 3</u>	<u>AC</u>	<u>Function Tested</u>	<u>If No Print Out</u>
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

<u>EM OFF</u>	<u>EM 1</u>	<u>EM 2</u>	<u>EM 3</u>	<u>AC</u>	<u>Function Tested</u>	<u>If No Print Out</u>
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

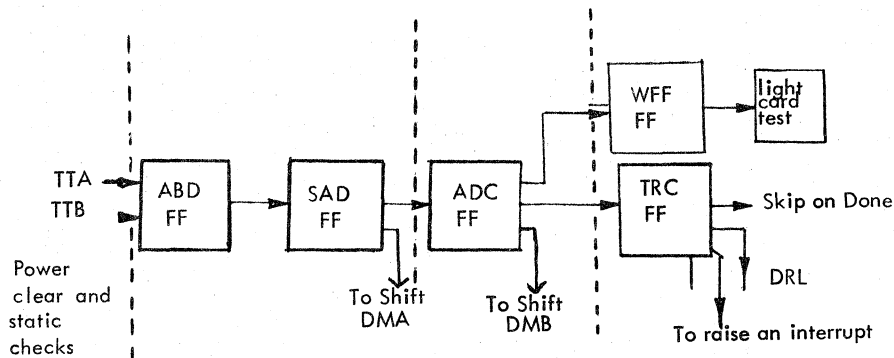
6634=DBR

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 butts, 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.



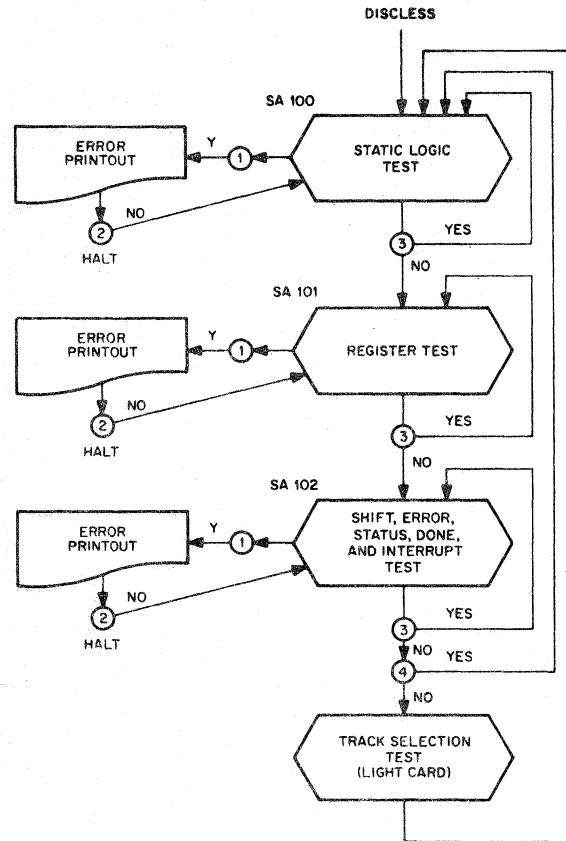
Each disc has 16₍₁₀₎ tracks, in order to verify the correct track selection a light card indicator is needed. This card is inserted into location A5. With the program running, the lights or the card should rotate from 0 to 16₍₁₀₎ each pass of the program. (If the light card is not used it will not affect 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

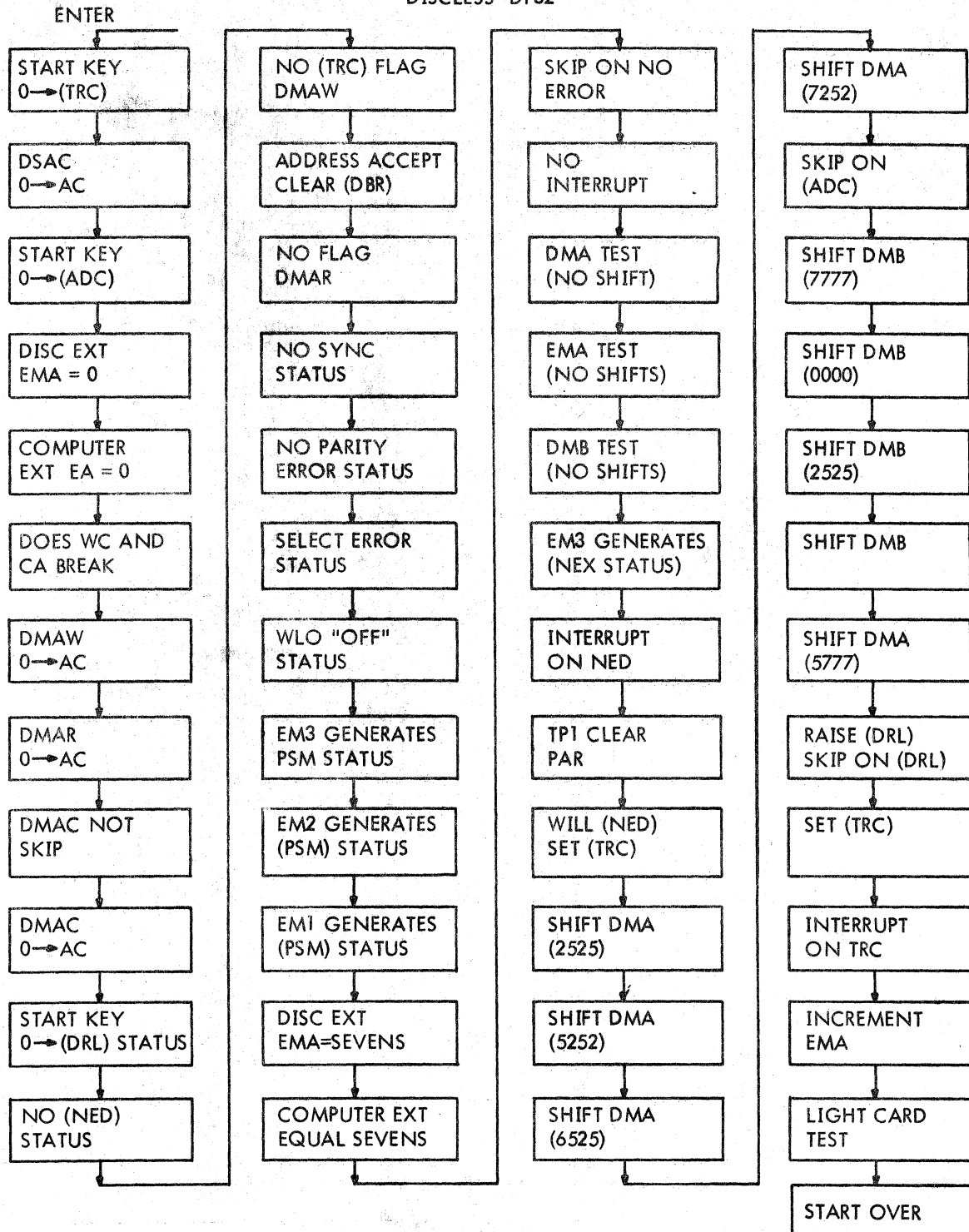
11. FLOW CHARTS

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 HITTTELL
/ED FORTMILLER

/EQUATE STATEMENTS:
HLT=7402
LAS=7604
OSR=7404
ION=6001
IOF=6002

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

0200	*200	JMP	BEGIN	/SET C(AC)=1
0201	5777	MESSAGE,	0	/ADD LOCATION
0202	0000		CLA CMA	/AUTO-INDEX REGISTER
0203	7240		TAD MESSAGE	/FETCH FIRST WORD
0204	1201		DCA 10	/SAVE IT
0205	3010		TAD 1 10	
0206	1410		DCA MSRGHT	
0207	3217		TAD MSRGHT	
0208	1217		RTR	/ROTATE 6 BITS RIGHT
0209	7012		RTR	
0210	7012		RTR	/TYPE IT
0211	4220		JMS TYPECH	/GET DATA AGAIN
0212	1217		TAD MSRGHT	/TYPE RIGHT HALF
0213	4220		JMS TYPECH	/CONTINUE
0214	1217		JMP MESSAGE+4	/TEMPORARY STORAGE
0215	5205		0	
0216	5205	MSRGHT,		
0217	0000			

0220	0000	TYPECH,	0	/TYPE CHARACTER IN CIAC)6-11
0221	0251		AND MASK77	
0222	7450		SNA	/IS IT END OF MESSAGE?
0223	5410		JMP 1 10	/YES! EXIT
0224	1252		TAD M40	/SUBTRACT 40
0225	7500		SMA	/K40?
0226	5231		JMP 1+3	/NO
0227	1253		TAD C340	/YES! ADD 300
0228	5244		JMP MTP	/TO CODES <40
0229	1254		TAD M3	/SUBTRACT 3
0230	7440		SZA	/IS IT ZERO?
0231	5236		JMP 1+3	/NO
0232	5236		TAD C212	/YES! CODE 43 IS
0233	5244		JMP MTP	/LINE-FEED (212)
0234	5244		TAD M2	/SUBTRACT 2
0235	1256			
0236	1256			

0237	7440	SZA	/IS IT ZERO?
0240	5243	JMP I,+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	TLS	/TRANSMIT CHARACTER
0245	6041	TSF	/WAIT FOR FLAG
0246	5245	JMP I,-1	/NOT SET YET
0247	7200	CLA	/SET! CLEAR C(AC)
0250	5620	JMP I TYPECH	/RETURN

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

0261	7402	HLT	/STORE INIT NEXT TIME
0262	7000	NOP	
0263	7000	NOP	
0264	7200	CLA	/ADDRESS OF OPERAND
0265	1661	TAD I I,-4	
0266	3270	DCA I,+2	
0267	5671	JMP I 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 00X0
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
0328	3344	DCA MASKD	/TEMP STORAGE
0329	2261	ISZ SIXTY	/INCREMENT FOR STORAGE
0330	4271	JMS SIXTY+10	/FIND STORAGE ADDRESS
0331	1344	TAD MASKD	/6X6X
0332	3670	DCA I SIXTY+7	/STORE OPERAND AS SPECIFIED
0333	1372	TAD (SIXTY+12	/HOUSE KEEPING
0334	3271	DCA SIXTY+10	
0335	2261	ISZ SIXTY	/INCREMENT FOR RETURN
0336	5661	JMP I SIXTY	/RETURN

MASKA: 0000
MASKB: 0000
MASKC: 0000
MASKD: 0000
PAUSE 6060

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)

ERADD,	XX	JMS IPRINT	/ADDRESS
7402	JMS		
0400	IOF		
0401	JMS SIXTY		
0402	ERADD		
0403	104		
0404	104		
0405	JMS MESSAGE		
0406	4543		
0407	6060		
0410	6060		
0411	6060		
0412	6060		
0413	4000		
0414	JMS SIXTY		
0415	AC		
0416	104		
0417	104		
0423	JMS MESSAGE		
0420	4775		

```

0421 4040
0422 6060
0423 6060
0424 0000
0425 7604
0426 0374
0427 7650
0430 5600
0431 1773
0432 7402
0433 5600

                                /AC
                                /BAD DATA
                                /BAD DATA
                                /EXIT

```

/COMPARISON ERROR PRINT OUT

```

/GDXXXX BDXXXX
BADCOM, XX
JMS IPRINT
JMS SIXTY
BADCOM
I+4
I+4
JMS MESSAGE
4543
6060
6060
0000
JMS SIXTY
GD
I+12
I+12
JMS SIXTY
BD
I+12
I+12
JMS MESSAGE
4040
0704
4040
6060
6060
4002
0440
6060
6060
0000
LAS
AND (2000
SNA CLA
SKP
HLT
JMP I BADCOM

                                /GOOD
                                /BAD
                                /CRLF
                                /GOOD DATA
                                /BAD DATA
                                /EXIT

```

```

0500 7402
0501 4777

```

```

0502 4776' JMS SIXTY
0503 0500 BADADD
0504 2510 I+4
0505 2511 I+4
0506 4775' JMS MESSAGE
0507 4543 4543
0510 6060 6060
0511 6060 6060
0512 0000 0000
0513 4776' JMS SIXTY
0514 3416 GA
0515 2527 I+12
0516 2530 I+12
0517 4776' JMS SIXTY
0520 3415 BA
0521 2533 I+12
0522 2534 I+12
0523 4775' JMS MESSAGE
0524 4040 4040
0525 2701 2701
0526 4040 4040
0527 6060 6060
0530 6060 6060
0531 4002 4002
0532 2140 2140
0533 6060 6060
0534 6060 6060
0535 0000 0000
0536 7604 LAS
0537 2374 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 0201
0577 3124
0600 0600
    
```

```

PAGE 3
DEFINE SCOPE < JMS SCOPE>
DEFINE HALT < JMS ERADD>
DEFINE NPAGE < JMP I (+20087600)>
/FLAG TEST (CLEAR)
    
```

0600	0622	BEGIN,	DFSC						
0601	7410		SKP		/SKIP ON FLAG				
0602	4777'		HALT		/FLAG SHOULD HAVE BEEN CLEARED BY START				
0603	4776'		JMS ERADD						
			SCOPE						
			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						
0610	4777'		HALT		/HALT BECAUSE AC NOT ZERO				
			JMS ERADD						
			SCOPE						
0611	4776'		JMS SCOPEA						
/WAS ADC "FFF" CLEARED BY START KEY									
0612	6612		DSAC		/SKIP ON ADC				
0613	7410		SKP						
0614	4777'		HALT		/ADC SET ... START SHOULD CL ADC "FFF"				
			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						
0621	4777'		HALT		/START KEY DID NOT CLEAR EMA				
			JMS ERADD						
			SCOPE						
0622	4776'		JMS SCOPEA						
/DOES START CLEAR THE COMPUTER EXT ADDRESS REGISTER									
0623	6614		DEAC=2		/MASK FOR COMPUTER EXT ADDRESS				
0624	0374		AND (0070						
0625	7440		SZA						
0626	4777'		HALT		/START KEY DID NOT CLEAR EA				
			JMS ERADD						
			SCOPE						
0627	4776'		JMS SCOPEA						
/DOES DISK BREAK TO RIGHT LOC									
0630	7240		CLA CMA						
0631	3773'		DCA WQ						
0632	7240		CLA CMA		/WRITE ONE WORD				
0633	3772'		DCA IACW						
0634	6605		DMAW						
0635	7200		CLA						
0636	1773'		TAD WQ						
0637	7440		SZA						
			HALT		/WORD COUNT NOT CORRECT				
			JMS ERADD						
0640	4777'								

0641	7230	CLA	
0642	1772'	TAD IACH	
0643	7440	SEA	
		HALT	
0644	4777'	JMS ERADD	
		SCOPE	
0645	4776'	JMS SCOPEA	
		/IS AC CLEARED BY DMAN?	
0646	7240	CLA CMA	
0647	3773'	DCA WC	/ONE WORD
0650	7240	CLA CMA	
0651	6605	DMAN	/NOT SHOULD CLEAR AC
0652	7440	SEA	/AC NOT CLEARED
		HALT	
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	/NOT SHOULD CLEAR AC
0661	7440	SEA	/AC NOT CLEARED
		HALT	
0662	4777'	JMS ERADD	
		SCOPE	
0663	4776'	JMS SCOPEA	
		/DMAC SHOULD NOT SKIP	
0664	6611	DCEA	
0665	6626	DMAC	
0666	7410	SKP	/DMAC SKIPPED
		HALT	
0667	4777'	JMS ERADD	
		SCOPE	
0670	4776'	JMS SCOPEA	
		/WILL DMAC CLEAR AC	
0671	6601	DCMA	
0672	7240	CLA CMA	/CLEAR DMAR
0673	6626	DMAC	
0674	7440	SEA	/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	/EMO
0701	0371	AND (4	/MASK FOR DRL
0702	7440	SEA	

0703	4777'	HALT	/OKL UP
0704	4776'	JMS ERADD	
		SCOPE	
		JMS SCOPEA	
0705	6611	/STATUS REGISTER TEST (NO NED FF)	
0706	6616	DCEA	/EMO
0707	0370	DEAC	
0710	7440	AND (2	
		SZA	
0711	4777'	HALT	/WRITE LOOK OUT OR NED SET
0712	4776'	JMS ERADD	
		SCOPE	
		JMS SCOPEA	
0713	7240	/CHECK FOR NO FLAG AFTER WRITE	
0714	3772'	(DMAW) (DFSC)	
0715	7240	CLA CMA	
0716	3773'	DCA IACH	/MEMORY LOCATION ZERO
0717	6605	CLA CMA	/AC=7777
0720	6622	DCA WC	/WORD COUNT=7777
0721	7410	DMAW	/START WRITE ONE WORD
		DFSC	/SKIP ON FLAG
		SKP	/FLAG UP
0722	4777'	HALT	
0723	6622	JMS ERADD	
0724	7410	DFSC	/SKIP ON FLAG
		SKP	/FLAG UP
0725	4777'	HALT	
0726	4776'	JMS ERADD	
		SCOPE	
		JMS SCOPEA	
0727	6605	/WILL ADDRESS ACCEPT CLEAR DATA BREAK REQUEST FF?	
0730	7200	DMAW	/WRITE SET DBR FF
0731	3773'	CLA WC	
0732	3772'	DCA IACH	
0733	6603	DMAW	/SHOULD NOT SET DBR "FF"
0734	7000	NOP	
0735	1773'	TAD WC	
0736	7440	SZA	/WORD COUNT SHOULD BE ZERO
0737	4777'	HALT	
0740	7200	JMS ERADD	
0741	1772'	CLA	
0742	7440	TAD IACH	
		SZA	/IACH SHOULD BE ZERO
0743	4777'	HALT	
0744	4776'	JMS ERADD	
		SCOPE	
		JMS SCOPEA	
0745	5767	NPAGE	
		JMP 1 (+20087600)	

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		/READ ONE WORD	
1001	3777	DCA WC			
1002	7240	CLA CMA			
1003	3776	DCA IACH		/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		/LOAD EXTENDED ADDRESS WITH ZEROS	
1016	7200	CLA			
1017	6616	DEAC			
1020	0373	AND (3700			
1021	7440	SEA		/DISC EXTENDED ADDRESS NOT CLEAR	
		HALT			
1022	4775	JMS ERADD			
1023	6616	DEAC			
1024	0372	AND (0070			
1025	7440	SEA		/COMPUTER EXTENDED ADDRESS NOT CLEAR	
		HALT			
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 CID			
1032	6616	DEAC			
1033	7000	NOP			
1034	7500	SMA		/SYNC	
1035	7410	SKP		/NO	

1036 5242 JMP ,+4 /YES
 1037 2771' ISZ CID /LOOP
 1040 5232 JMP ,+6 /NO SYNC PULSE OR NO DISC SELECTED
 1041 7410 SKP /FOUND SYNC PULSE
 1042 4775' HALT
 1043 4774' JMS ERADD
 SCOPE
 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
 /READ MODE INHIBIT WRITE LOCK OUT SWITCHES

1200 6602
 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
 1207 6616 DEAC /WRITE MODE
 1210 7000 NOP /READ STATUS
 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	DMAM-1	
1220	6616	DEAC	/WRITE MODE
1221	7000	NOP	
1222	7012	RTR	/AC10 IO 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
CLA CMA

1254 7240

1255	6615	DEAL	
1256	0372	AND (3720	
1257	3771'	DCA BA	/DISC EXT ADDRESS MASK
1260	1771'	TAD BA	
1261	7041	CIA	/STORE BA
1262	1372	TAD (3700	
1263	7650	SNA CLA	/TEST
1264	5267	JMP ;+5	/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	/COMPUER EXT ADDRESS
1273	3771'	DCA BA	
1274	1771'	TAD BA	/STORE
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	/READ STATE
1305	6603	DMAR	/SKIP ON NO ERROR
1306	6621	DFSE	/DATA REQUEST LATE, PARITY OR NO DISC SET
		HALT	
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 (I+7	
1320	3003	DCA 0003	
1321	7240	CLA CMA	
1322	3764'	DCA WC	
1323	6605	DMAR	/DID NOT INTERRUPT
1324	6001	ION	
1325	7410	SKP	/INTERRUPT UP OR NO DISC
		HALT	
1326	4777'	JMS ERADD	
1327	6002	IOF	

```

1330 4776'
1331 6611
1332 6601
1333 7604
1334 0377
1335 7440
1336 5763'
1337 5762

SCOPE
JMS SCOPEA
DCEA
DCMA
LAS
AND (400)
SEA
JMP BEGIN

NPAGE
JMP I (+20087600)

```

/LOOP ON STATIC TEST

/ROUTINE TO CLEAR FLAGS

```

1340 7402
1341 6601
1342 6002
1343 6022
1344 6042
1345 6012
1346 6072
1347 6502
1350 6032
1351 6762
1352 5740

CLFLAG, XX
6601
6002
6022
6042
6012
6072
6502
6032
6762
JMP I CLFLAG

```

```

1353 7402
1354 2761'
1355 7200
1356 1761'
1357 5753

RANDOM, XX
ISE CID
CLA
TAD CID
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

```

1400 6603
1401 1377
1402 6615
1403 6621

DMAR
TAD (400)
DEAL
DFSE
HALT

/SKIP ON NO ERROR WLO UPPER (READ)
/READ STATE
/UPPER HALF
/SKIP ON NO ERROR

```

```

1404 4777' JMS ERADD
SCOPE
1405 4776' JMS SCOPEA

/ /SKIP ON NO ERROR (WRITE) WLO (UPPER) /WRITE STATE
DMAW
TAD (400)
DEAL
DFSE
HALT
/ /SKIP ON NO ERROR
/ /WIRE LOCK OUT ON

1406 6605
1407 1377
1410 6615
1411 6621
1412 4777' JMS ERADD
SCOPE
1413 4776' JMS SCOPEA

/ /SKIP ON NO ERROR (WRITE) WLO LOWER
DCEA
DMAW
DFSE
HALT
/ /LOWER STATE
/ /WRITE STATE
/ /SKIP ON NO ERROR
/ /WRITE LOCK OUT ON

1414 6611
1415 6605
1416 6621
1417 4777' JMS ERADD
SCOPE
1420 4776' JMS SCOPEA

/EXECUTE DMA TEST
RTEST, CLA
IOF
DCA CTA
JMS DMA
CLA CMA
JMS DMA
JMS RANDOM
JMS DMA
ISE CTA
JMP ,=3
SCOPE
JMS SCOPEA

1421 7200
1422 6002
1423 3775'
1424 4774'
1425 7240
1426 4774'
1427 4773'
1430 4774'
1431 2775'
1432 5227
1433 4776'

/EXECUTE EMA TEST
CLA CMA
DEAL
NOP
NOP
NOP
CLA CTA
DCA CMA
JMS EMA
CLA CMA
JMS EMA
JMS RANDOM
ISE CTA
JMP ,=3
SCOPE
JMS SCOPEA

1434 7240
1435 6615
1436 7000
1437 7000
1440 7000
1441 7200
1442 3775'
1443 4772'
1444 7240
1445 4772'
1446 4773'
1447 2775'
1450 5245
1451 4776'

/EXECUTE DMB TEST

```

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

1471	7200	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 I=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	

1507	7200	CLA	
1510	1365	TAD (JMP I 0002	
1511	3001	DCA 0001	
1512	1364	TAD (I=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	

```

1524 6601 /DOES TP1 CLEAR PAR "FF" /CLEAR PER
1525 6632 DCMA
1526 6632 TTB
1527 1370 TTB /TP1 CL PAR
1530 6615 TAD (3000) /GEN DEP VIA NED
1531 6631 DEAL /SET NED == PER IF PAR SET
1532 6621 TTA /SKIP ON NO ERROR
1533 4777 DFSE
1534 4776 HALT
1535 6611 JMS ERADD
1536 6601 SCOPE
1537 7240 JMS SCOPEA
1540 3763 DCMA
1541 6605 DCA WC
1542 1370 DMAH
1543 6615 TAD (3000)
1544 6631 DEAL
1545 6616 TTA
1546 7000 DEAC
1547 6622 NOP
1550 4777 DFSC
1551 4776 HALT
1552 5762 JMS ERADD
1553 4776 SCOPE
1554 4776 JMS SCOPEA
1555 5762 NPAGE
1556 5762 JMP I (,+20087600)

/WILL NED SET DONE (TRC)? /CLEAR EXT ADDRESS
DCEA
DCMA
CLA CMA
DCA WC
DMAH
TAD (3000)
DEAL
TTA
DEAC
NOP
DFSC
HALT
JMS ERADD
SCOPE
JMS SCOPEA
NPAGE
JMP I (,+20087600)

/SET WORD COUNT OVERFLOW
/LOAD EXT ADDRESS = RAISE NEX
/SET NED GENERATE DEP
/READ STATUS
/DID NED SET DONE?
/NO

```

```

PAGE
NPAGE
JMP I (,+20087600)

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

```

1603 3775' DCA IACH
 1604 1776' TAD GA
 1605 6603 /LOAD ADDRESS REG
 1606 7200 CLA
 1607 6624 /READ ADDRESS REG
 1610 3774' DCA BA
 1611 1774' TAD BA
 1612 7041 CIA
 1613 1776' TAD GA
 1614 7440 SEA
 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

EMA, XX
 1620 7402 AND (3770
 1621 0372 DCA GA
 1622 3776' TAD GA
 1623 1776' DEAL
 1624 6615 /LOAD EXT ADDRESS
 1625 7200 CLA
 1626 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 SEA
 1635 4773' JMS BADADD
 1636 7200 CLA
 1637 5620 JMP I EMA

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

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

Set data break request FF stat. log. test.

1661 7440
1662 4766'
1663 7200
1664 5640
1766 0434
1767 3417
1770 7750
1771 3420
1772 3770
1773 0500
1774 3415
1775 7751
1776 3416
1777 2000
2000

SZA
JMS BADCOM
CLA
JMP I DMB

PAGE

/JMP AROUND SCOPE LOOPS

2000 5215
2001 7200
2002 7604
2003 4777'
2004 5201

JMP ,+15
CLA
LAS
JMS DMB
JMP SWDMB

2005 7200
2006 7604
2007 4776'
2010 5205

SWDMA:
CLA
LAS
JMS DMA
JMP SWDMA

2011 7200
2012 7604
2013 4775'
2014 4211
2015 5774

SWEMA:
CLA
LAS
JMS EMA
JMS SWEMA

NPAGE
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

2200 4777'
2201 6601
2202 6611
2203 4776'
2204 7200
2205 1375
2206 6605
2207 6632
2210 6632
2211 4774'
2212 6626
2213 3773'

SCOPE
JMS SCOPEA
DCMA
6611 XGER
JMS SAD /SET SAD
CLA
TAD (2525 /DATA TO DMA
DMAW /LOAD DMA
TTB
TTB /GEN TP1, CLEAR SAD, SET MAD
JMS SAP /SHIFT DMA
DMAC /READ DMAC
DCA BA

/WHAT DATA SHOULD BE

```

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

```

```

2224 4776 /CAN WE SHIFT DMA WITH MAD SET
2225 7200 JMS SAD /SET SAD
2226 1370 CLA
2227 6605 TAD (5252 /DATA TO DMA
2228 6632 DMAN /LOAD DMA AND SET ACH
2229 6632 TTB /GEN TPI, CLEAR SAD SET MAD
2230 6632 TTB
2231 4774 JMS SAP /SHIFT DMA
2232 4774 DMAC /READ DMA
2233 6626 DCA BA /TEMP STORE
2234 3773 TAD (5525 /WHAT DATA SHOULD BE
2235 1367 CIA
2236 7041 TAD BA
2237 1773 SNA CLA /TEST
2238 7650 JMP +3
2239 5244 TAD BA /LOAD AC WITH BA
2240 1773 HALT
2241 4771 JMS ERADD
2242 4777 SCOPE
JMS SCOPEA

```

/TO PASS THIS, THE PREVIOUS TEST MUST BE GOOD
/SHIFT DMA WITH MAD CLEARED /MAD AND ACH SHOULD BE CLEARED

```

2243 1366 TAD (7252
2244 3765 DCA CA
2245 6631 TTA /WITH SAD SET SAP
2246 6626 DMAC /READ DMA
2247 3773 DCA BA
2248 1773 TAD BA
2249 7041 CIA
2250 1765 TAD CA
2251 7650 SNA CLA
2252 5261 JMP +3 /SHOULD BE 7252
2253 1773 TAD BA /COMPARED
2254 4771 HALT /GOOD
2255 7604 JMS ERADD /BAD
2256 0364 LAS /BAD IS IN AC
2257 7640 AND (1000 /SCOPE LOOP SET UP
2258 5763 SZA CLA
2259 1362 JMP RETURN+1

```

/TO PASS THIS THE PREVIOUS TEST MUST BE GOOD
/MAD AND ACH SHOULD BE CLEARED

2266	3765'	DCA CA	
2267	6631	TTA	
2270	6626	DMAC	/WITH SAD SET=SAP=SHIFT DMA
2271	3773'	DCA BA	/READ DMA
2272	1773'	TAD BA	
2273	7041	CIA	
2274	1765'	TAD GA	/SHOULD BE 5525
2275	7650	SNA CLA	/COMPARE
2276	5301	JMP I+S	/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 IACH	
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 IACH	
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 I+S	
2337	1756'	TAD BD	
		HALT	/FAILED SHIFTING DMB
2340	4771'	JMS ERADD	
		SCOPE	
2341	4777'	JMS SCOPEA	

NPAGE
JMP I (+200&7600)

2342 5751

PAUSE

/PDP-8 DISCLESS RMX5 - TAPE 4

2351 2400
2352 7777
2353 3030
2354 3024
2355 7751
2356 3417
2357 7750
2358 3420
2359 3017
2360 5525
2361 3253
2362 1000
2363 3416
2364 7252
2365 6525
2366 5252
2367 0400
2368 1252
2369 3415
2370 3013
2371 2525
2372 3000
2373 3242
2374 2400

PAGE /SHIFT MEMORY BUFFER SHIFT ZERO

2400 6601
2401 6611
2402 7200
2403 3777
2404 7240
2405 3776
2406 1375
2407 3774
2408 4773
2409 7240
2410 3776
2411 1372
2412 3774
2413 4771
2414 6602
2415 6634
2416 7200
2417 1370
2418 7041
2419 1775
2420 7650
2421 5230
2422 1775

DCMA
DCEA
CLA GD
CLA CMA
DCA WC
TAD (9D-1)
DCA IACW
JMS SDP /SHIFT DATA PULSE/LOAD DMB
CLA CMA
DCA WC
TAD (8D-1)
DCA IACW
JMS CLADC
6602
6634
CLA
TAD (4000)
CIA BD
SNA CLA
JMP I+3
TAD BD
HALT

/WHAT DATA SHOULD BE AFTER SHIFT

/FAILED TEST DMB SHIFT

2427 4767' JMS ERADD
SCOPE
2430 4766' JMS SCOPEA

/SHIFT MEMORY BUFFERS (2525) ONE SHIFT

2431 7200
2432 6601
2433 6611
2434 1365
2435 3777'
2436 7240
2437 3776'
2440 1375
2441 3774'
2442 4773'
2443 7240
2444 3776'
2445 1372
2446 3774'
2447 4771'
2450 6602
2451 6634
2452 7200
2453 1364
2454 7041
2455 1775'
2456 7650
2457 5262
2460 1775'

2461 4767'
2462 4766'

/MDP ALSO SET NOW/SHIFT DATA

/READ
/RAISE A REQUEST

/SHIFT MEMORY BUFFER (2525) 2 SHIFTS

2463 6601
2464 6611
2465 7200
2466 1365
2467 3777'
2470 7240
2471 3776'
2472 1375
2473 3774'
2474 4773'
2475 6631
2476 7240
2477 3776'
2500 1372
2501 3774'
2502 4771'
2503 6602
2504 6634

/SHIFT DATA MDP ALSO SET
/EXTRA SHIFT MDP SHOULD BE CLEARED

/READ
/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
 2514 4767 HALT
 2515 4766 JMS ERADD
 SCOPE
 JMS SCOPEA

NPAGE JMP 1 (,-20067600)

2516 5763
 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

2600 7200 /SHIFT DMA WITH ACH ZERO
 2601 6605 CLA
 2602 4777 DMAW /DMA11 TO ZERO
 2603 7240 JMS SAP /CLEAR ACH
 2604 6605 CLA CMA
 2605 4777 DMAW /LOAD ALL SEVEN
 2606 6626 JMS SAP /SHIFT DMA
 2607 3776 DMAC /READ DMAC
 2610 1375 DCA BA /TEM STORE
 2611 7041 TAD (5777
 2612 1776 CIA
 2613 7650 TAD BA
 2614 5217 SNA CLA /TEST
 2615 1776 JMP ,+3
 HALT
 JMS ERADD
 SCOPE
 JMS SCOPEA

/WHAT DATA SHOULD BE

2616 4774 /DATA REQUEST LATE/STATUS AND SKIP TEST
 2617 4773 LAS
 2620 7604 CLL RAR
 2621 7110 SZL CLA
 2622 7630

```

/DF32 DISKLESS MAINDEC-08-D5BC PAL10 V141 27-JAN-72 23132 PAGE 1-23
2623 5242 JMP TSTDF,
2624 7410 SKP
2625 5241 JMP ,+14
2626 6601 DCMA
2627 4772 JMS ADC
2630 6604
2631 6632 TTB
2632 6616 DEAC
2633 0371 AND (4
2634 7450 SNA
2635 4774 HALT
2636 6621 JMS ERADD
2637 7410 DFSE
2640 4774 SKP
2641 4773 HALT ERADD
2642 4770 JMS SCOPE
2643 6622 JMS SCOPEA
2644 4774 /CHECK GENERATION OF DONE FLAG
2645 4773 JMS TCR /SET DONE FLAG
2646 7200 TSTDF,
2647 1367 DFSC /SKIP ON FLAG
2650 3001 HALT /NO DONE FLAG
2651 1366 JMS ERADD
2652 3002 SCOPE
2653 4770 JMS SCOPEA
2654 6001
2655 7000
2656 4774 /FORCE AN INTERRUPT WITH TRC
2657 4773 CLA (JMP I 0002
2658 4773 DCA 0001
2659 4773 TAD (1+6
2660 4773 DCA 0002
2661 4773 JMS TCR
2662 4773 ION
2663 4773 NOP
2664 4773 HALT ERADD
2665 4773 JMS SCOPE
2666 4773 JMS SCOPEA
2667 4773 /INCREMENT EXTERNAL MEMORY ADDRESS/EMA
2668 4773 DCA
2669 4773 CLA
2670 4773 TAD (1+37
2671 4773 DCA (XX
2672 4773 DEAL CMA
2673 4773 /CLEAR EXT ADDRESS
2674 4773 JMS DEP
2675 4773 JMS DEP /LOAD DMA SET ACH
2676 4773 DCMA /INCREMENT EMA
2677 4773 ISE (XX /COUNTER
2678 4773 JMP ,+4
2679 4773 DEAC /READ EMA
2680 4773 AND (3700

```

```

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

/LOAD DMA SET ACH
/INCREMENT EMA

/LOOP ON ROUTINE
JMS CLADC
LAS
AND (-400
SZA CLA
JMP DYA
/SHIFT AND STATUS TEST

/TEST FOR SKIPPING LIGHT BOX TEST
/
/
/
JMS CLADC
DCEA
DCMA
LAS
AND (-200
SZA CLA
JMP BEGIN
/SKIP LIGHT BUT
/YES

/AUTOMATIC CONTROL FOR LIGHT BOX
CLA
DCEA
TAD (-7760
DCA CIA
DCA KA
JMS LGBOX
ISZ KA
CLA KA
TAD KA
ISZ CIA
JMP ,+5
DCEA
DCMA
SCOPE
JMS SCOPEA
JMS CLADC

/NUMBER OF TRACKS
/TRACK NUMBER
/LIGHT BOX ROUTINE
/TRACK NUMBER INCREMENTED
/DONE
/NO
/YES
/CLEAR DISC

```

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

SAD, XX /SET MRS WITH LAD
 6606 /SET ABD
 TTB /SET TCA
 TTB /CL TCA, SET TCB
 TTB /SET TCA
 TTB /CL TCA, CL TCB, SET MWR
 TTA /CL ABD TO SYNC DRS
 TTB /DRS=SET WCE
 TTA /SET SAD
 JMP I SAD /EXIT

/ROUTINE TO SET SHIFT ADDRESS PULSE/SAP

SAP, XX
 JMS SAD
 TTA /SHIFT DMA
 JMP I SAP /EXIT

/ROUTINE FOR SETTING ADDRESS CONFIRMED/ADC
 ADC, XX
 JMS SAD /SAD AND ABC SHOULD BE SET
 TTB /SET ADC CL SAD
 JMP I ADC /EXIT

3013 7402
 3014 4200
 3015 6631
 3016 5613
 3017 7402
 3020 4200
 3021 6632
 3022 6632
 3023 5617

/ROUTINE TO SHIFT MEMORY BUFFER/SDP

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

3030 7402 /ROUTINE TO CLEAR ADD "FFF"
3031 6632 CLADC, XX
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
3042 4244 JMS DEP
3043 5634 JMP I TCR

/WRITE ONE WORD WCO SHOULD BE SET

/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 /STORE SWITCH
3054 1375 TAD (XX)
3055 0374 AND (4)
3056 7450 SNA
3057 5264 JMP ,+5
3060 4267 JMS KWFF
3061 6631 TTA
3062 4311 JMS STALL
3063 5651 JMP I LGBOX
3064 4267 JMS KWFF
3065 4311 JMS STALL
3066 5651 JMP I LGBOX

/LOAD DMB, DMA CLEAR WFF
/GEN OPS SET WFF

/LOAD DMB, DMA AND CLEAR WFF

3067 7402 /ROUTINE TO CLEAR WFF
KWFF, XX

CL A /DATA FOR MB

/SWITCH REG

/CL TRACK

/SWITCH

/LOAD EXT ADDRESS
/EXIT

CLA (7777
DCA CD
TAD (GD-1
DCA IACW
TAD (XX
RTR
6611
6631
6632
JMS ADC
TAD (XX
RAL CLL
RTL
RTL
DEAL
JMP I KWFF

STALL

XX
CLA CMA
TAD (7740
DCA +6
ISE +6
JMP -1
ISE +3
JMP -3
JMP I STALL
0
0

IPRINT, XX
DCA AC
LAS
AND (4000
SNA CLA
JMP +6
TAD IPRINT
TAD (-2
DCA IPRINT
TAD I IPRINT
DCA IPRINT
TAD AC
JMP I IPRINT

3070 7200
3071 1373
3072 3772
3073 1371
3074 3776
3075 1375
3076 7012
3077 6611
3100 6631
3101 6632
3102 4217
3103 1375
3104 7104
3105 7006
3106 7006
3107 6615
3110 5667

3111 7402
3112 7240
3113 1370
3114 3322
3115 2323
3116 5315
3117 2322
3120 5315
3121 5711
3122 0000
3123 0000

3124 7402
3125 3767
3126 7604
3127 0366
3130 7650
3131 5337
3132 1324
3133 1365
3134 3324
3135 1724
3136 3324
3137 1767
3140 5724

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

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3177 7750 PAGE
3200 3200 /MAINTENANCE SCOPE LOOPS
      3200 6611 /SEARCH ADDRESS
      3201 4777 SA, DCEA
      3202 6632 JMS SAD
      3203 6632 TTB
      3204 5200 TTB
      /SHIFT ADDRESS PULSE
      3205 6611 JMP ,=4
      3206 4776 DCEA
      3207 5205 JMS SAP
      /ADDRESS CONFIRMED
      3210 6611 JMP ,=2
      3211 4775 JMS ADC
      3212 5210 JMP ,=2
      /SHIFT DATA PULSE
      3213 6611 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

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```

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

```

```

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

3252 3363 / POINTER FOR SCOPE LOOP
 3253 5652 RETURN, (BEGIN
 JMP I 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

DMAR=6603
 TTA=6631
 TTB=6632
 MDP=6634
 DBR=6634
 DCMA=6601
 DCEA=6611
 DSAC=6612
 DMAH=6605
 DEAL=6615
 DEAC=6616
 DFSE=6621
 DFSC=6622
 DMAC=6626
 XX=7402
 WC=7750
 IACH=7751
 CACH=IACH
 KA,
 WADD,
 RADD,
 CTC,
 AC,
 TKADD,
 ERRDSK,
 ERRTK,
 NUM,
 CTA,
 CID,

3400 0000
 3401 0000
 3402 0000
 3403 0000
 3404 0000
 3405 0000
 3406 0000
 3407 0000
 3410 0001
 3411 0000
 3412 0000

/LOAD AND START READ

/CLEAR MAR, PRITY, DONE FLAG
 /CLEAR EXT ADDRESS REGISTERS
 /CLEAR AC SKIP ON ADC
 /LOAD AND START WRITE
 /LOAD EXTENDED ADDRESS
 /READ EXTENDED ADDRESS
 /SKIP ON NO ERROR
 /SKIP ON FLAG
 /READ DISK ADDRESS

/IACH=1 FOR WRITE
 /IACH=1 FOR READ
 /SAVE AC
 /DISK ERROR ADDRESS
 /DISK TRACK ERROR ADDRESS

3413 0000 WORD1, 0
 3414 0000 WORD2, 0
 3415 0000 BA, 0
 3416 0000 CA, 0
 3417 0000 BD, 0
 3420 0000 CD, 0
 3600 PAGE
 3620 0000 OUTBUF, 0
 4000 PAGE
 4020 0000 INBUF, 0

/BAD ADDRESS
 /GOOD ADDRESS
 /BAD DATA
 /GOOD DATA

*76
 /JUMPING OFF FOR ROUTINES

0076 5124 JMP S82+6 /FOR ABNORMAL TEST
 0077 4116 JMS S82 /85 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 /TOT 66XX SR = XX
 0115 5762 JMP SH /LIGHT BOX SR 8 TO 11 = TRACK

S82, XX
 7402 TAD (NOP)
 0117 1161 DCA STALL+2
 0120 3760 TAD (NOP)
 0121 1161 DCA S81
 0122 3757 JMP I S82
 0123 5516 DMAW
 0124 6605 DMAW
 0125 6605 JMP 100
 0126 5100

/CLEAR WORD COUNT

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

4000 10000000 20000000 00000000 00000000 00000000 00000000

4300

4500

4700

0015

5300

5555

5700

0010

6300

0559

6700

7100

7300

7500

7700

AC 3404
 ADC 3017
 BA 3415
 BADADD 0500
 BADCOM 0434
 BD 3417
 BEGIN 0600
 C212 0255
 C215 0257
 C245 0260
 C340 0253
 CACH 7751
 CLADD 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
 DMAN 6605
 DMB 1640
 DSAC 6612
 DYA 1471
 EMA 1620
 ERADD 0400
 ERDSK 3406
 ERRTK 3407
 GA 3416
 GD 3420
 HLT 7402
 IACH 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
 MESSAGE 0201
 MSGHT 0217
 MTP 0244
 NUM 3410
 OSR 7404
 OUTBUF 3600
 RADD 3402
 RANDOM 1353
 RETURN 3252
 RTEST 1421
 SB1 2624
 SB2 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
 SWENA 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