

IDENTIFICATION

PRODUCT CODE: MAINDEC 12-D6CC-D (D)
PRODUCT NAME: A TO D TEST
DATE CREATED: 9-21-70
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: RAYMOND SHOOP

ADTST

1. ABSTRACT:

THIS PROGRAM MAY BE USED TO TEST THE KNOBS FOR CONTINUITY, THE BASIC A-D FOR MONOTONICITY, AND TO TEST AND CALIBRATE THE PREAMPS FOR GAIN AND OFFSET, A PROVISION FOR TESTING SIXTEEN ADDITIONAL A-D CHANNELS IS INCLUDED FOR THE AM12-AG12 MULTIPLEX EXTENSION.

THREE METHODS ARE PROVIDED FOR TESTING THE KNOBS AND ADJUSTING THE PREAMPS. (NOTE: ADJUSTMENT OF THE LATCHING DIFFERENTIAL AMPLIFIER OR THE SAMPLE AND HOLD IS NOT NORMALLY REQUIRED. FOR ADJUSTMENT OF THESE MODULES SEE THE APPROPRIATE MAINTENANCE MANUAL.)

2. REQUIREMENTS:

2.1 EQUIPMENT

- A) A PDP-12 WITH A-D AND VR12 DISPLAY.
- B) AN ASR-33 OR EQUIVALENT.

2.2 PRELIMINARY PROGRAMS:

- A) INSURE THAT THE BINARY LOADER IS OPERATING PROPERLY.
- B) ALL BASIC PROCESSOR TESTS MUST HAVE BEEN RUN SUCCESSFULLY BEFORE ATTEMPTING TO EXECUTE ADTST.

3. LOADING PROCEDURES

3.1 METHOD

THIS PROGRAM MAY BE LOADED WITH THE BINARY LOADER. IF YOU ARE UNFAMILIAR WITH THE PROPER BINARY LOADING PROCEDURES REFER TO "APPENDIX A" OF THIS PROGRAM, OTHERWISE PROCEED WITH THE FOLLOWING:

- A) SET THE TELETYPE READER SWITCH TO FREE.
- B) OPEN THE TELETYPE READER AND INSERT THE PROGRAM TAPE SO THAT THE ARROWS ON THE TAPE ARE VISIBLE TO AND POINTING TOWARD THE OPERATOR.
- C) CLOSE THE READER AND SET THE READER SWITCH TO START.
- D) SET THE TELETYPE FRONT PANEL SWITCH TO ON LINE.
- E) SET THE LEFT SWITCHES TO 7777.
- F) SET THE RIGHT SWITCHES TO 4000.
- G) SET THE MODE SWITCH TO 8 MODE.
- H) DEPRESS I/O PRESET.
- I) DEPRESS START LS.
- J) WHEN THE PROGRAM TAPE HAS BEEN READ THE ACCUMULATOR MUST BE 0000 IF IT IS NOT, A READ-IN ERROR HAS OCCURRED AND ONE MIGHT TRY RELOADING THE BINARY LOADER.
- K) REMOVE THE PROGRAM TAPE FROM THE READER.

4. STARTING PROCEDURES.

- A) TURN THE VR12 ON, AND ALLOW TO WARM UP AT LEAST ONE MINUTE.
- B) SET THE BRIGHTNESS POT ON THE VR12 TO 3/4 MAXIMUM.
(NOTE! IF A BRIGHT DOT APPEARS ON THE VR12, SHUT DOWN THE INTENSITY IMMEDIATELY TO PREVENT BURNING THE PHOSPHOR)
- C) SET THE MODE SWITCH ON THE CONSOLE TO L MODE.
- D) DEPRESS I/O PRESET.
- E) SET ALL SWITCHES TO 0'S.
(THIS WILL SET UP THE PROGRAM FOR THE FIRST DISPLAY)
- F) ROTATE ANALOG CHANNEL 00 TO FULL COUNTER CLOCKWISE AND ROTATE ANALOG CHANNEL 01 TO FULL CLOCKWISE (THIS IS TO INSURE THAT THEY ARE UNEQUAL FOR THE FAST SAMPLE TEST. THEY MAY BE CHANGED AFTER STARTING THE PROGRAM).
- G) DEPRESS START 20.
- H) THE PROGRAM IS NOW RUNNING. ADJUST THE INTENSITY ON THE VR12 TO GIVE A COMFORTABLE VIEWING LEVEL. IF ANY DIFFICULTY IS ENCOUNTERED, IT IS A HARDWARE PROBLEM AND MUST BE CORRECTED BEFORE PROCEEDING.
- I) THIS PROGRAM DOES USE FAST SAMPLE MODE.

5. OPERATING PROCEDURES

5.1 SWITCH SETTINGS

- A) SSW=00: CHANNELS 00-17(8) ARE SAMPLED AND DISPLAYED.
- B) SSW=40: CHANNELS 20-37(8) ARE SAMPLED AND DISPLAYED.
THESE CHANNELS ARE OPTIONAL ON THE PDP-12;
IF NOT INSTALLED, THE VALUE DISPLAYED FOR EACH CHANNEL WILL BE -777(8).
- C) SSW=20: THE CHANNEL SELECTED BY BITS 07-11 OF THE LEFT SWITCHES WILL BE DISPLAYED AS A FULL OSCILLOSCOPE TYPE DISPLAY. THE ROUTINE USED FOR DISPLAY WILL TRIGGER (SYNC) TO THE INPUT IF IT IS AN AC SIGNAL WITH AT LEAST 2 BITS (.4 MV) OF CHANGE WITHIN 15 MS.
- D) SSW=10: CHANNELS 0-7 ARE SAMPLED AND DISPLAYED AS A SEGMENTED OSCILLOSCOPE DISPLAY. EACH CHANNEL HAS TRIGGERING CAPABILITY AS IN (C) ABOVE.
- E) SSW=04: CHANNELS 10-17 ARE SAMPLED AND DISPLAYED AS A SEGMENTED OSCILLOSCOPE DISPLAY. EACH CHANNEL HAS TRIGGERING CAPABILITY AS IN (C) ABOVE.
- F) SSW=02: CHANNELS 20-27 ARE SAMPLED AND DISPLAYED AS A SEGMENTED OSCILLOSCOPE DISPLAY. EACH CHANNEL HAS TRIGGERING CAPABILITY AS IN (C) ABOVE.
- G) SSW=01: CHANNELS 30-37 ARE SAMPLED AND DISPLAYED AS A SEGMENTED OSCILLOSCOPE DISPLAY. EACH CHANNEL HAS TRIGGERING CAPABILITY AS IN (C) ABOVE.

5.2 ADJUSTMENT PROCEDURES

FOR ADJUSTMENT OF THE AD12/AM12/AG12 A TO D CONVERTER, REFER
TO THE CHECKS AND ADJUSTMENTS SECTION OF THE PDP-12 MAINTENANCE
MANUAL.

5.3 ERROR ROUTINE

THIS TEST HAS NO ERROR ROUTINES ONLY A HALT ON FAST SAMPLE
ERROR). IF DIFFICULTY IS ENCOUNTERED WITH THE SAM
INSTRUCTION, CHECK THE A TO D CONTROL. IF DIFFICULTY IS
ENCOUNTERED WITH THE POTENTIOMETERS, IT WILL MOST LIKELY
BE EITHER THE MULTIPLEXER OR THE POTS THEMSELVES. IF
DIFFICULTY IS ENCOUNTERED WITH THE EXTERNAL ANALOG
CHANNELS, CHECK THE PREAMPLIFIERS.

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1 /PDP-12 A TO D TEST, MAINDEC 12-D6CC
2 /COPYRIGHT 1970, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
3 /THIS TEST IS DESIGNED TO DISPLAY ALL AVAILABLE
4 /ANALOG INPUT CHANNELS ON THE VR12 DISPLAY
5 /
6 /SENSE SWITCH 0 DETERMINES WHAT CHANNELS TO DISPLAY
7 /
8 /SENSE SWITCH 1 GIVES AN OSCILLOSCOPE DISPLAY
9 /FOR THE CHANNEL ENTERED IN THE LEFT SW
10 /
11 /SENSE SWITCHES 2 THRU 5 GIVE AN OVERALL
12 /OSCILLOSCOPE OF CHANNELS 0-7, 10-17, 20-27,
13 /AND 30-37, RESPECTIVELY.
14 /
15 /I/O PRESET, START 20 LINC MODE,
16 /
17 /TYPING CTL="D" RETURNS USER TO DIAL
18 /
19 /MAJOR START 4020
20 /
21 /TAGS AND CONSTANTS
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4001	*0001	0000	/HORIZONTAL COORDINATE STORAGE
4001	H1,		
4016	*0016		
4016	DIAL,	RCG	
4017	7300		
			EJECT

57	4043	1000	/	DISPLAY CHANNEL NO.	
58	4044	0245	/	E1,	
59	4045	1040		LDA	/GET CHANNEL NUMBER
60	4046	0246		A1	/SAVE IT
61	4047	0241		STA	
62	4048	1540		T1	/GET LAST BIT
63	4049	0250		ROL 1	/SAVE BITS 8,9,10
64	4050	0247		BCL	
65	4051	0247		M1	/ADD POINTER
66	4052	0247		ADD G1	/SAVE FIRST ADDRESS AND CLEAR AC
67	4053	0246		STC 11	/ADD BASIC CHANNEL NUMBER
68	4054	0302		ADD T1	
69	4055	1540		ROR 2	/SAVE BITS 8,9,10
70	4056	0250		BCL	
71	4057	0247		M1	/ADD POINTER
72	4058	0247		ADD G1	/SAVE SECOND ADDRESS AND CLEAR AC
73	4059	0247		STC 10	/PICK UP VERTICAL COORDINATE
74	4060	0251		ADD V1	/DISPLAY HALF CHARACTER
75	4061	1750		DSC 10	/DISPLAY SECOND HALF CHARACTER
76	4062	1770		DSC I 10	/GO INSERT SPACE BETWEEN CHARACTERS
77	4063	6217		JMP X1	/DISPLAY HALF CHARACTER
78	4064	1751		DSC 11	/DISPLAY SECOND HALF CHARACTER
79	4065	1771		DSC I 11	/DECREMENT HORIZONTAL COORDINATE
80	4066	1020		LDA I	
81	4067	7737		-40	
82	4068	1140		ADM	
83	4069	0001		H1	
84	4070			EJECT	
85	4071				
86	4072				

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/SAMPLE CHANNEL JUST LABELED

4074 CLR
4075 ADD A1
4076 BSE I
4077 100
4100 STC .41
4101 1000
4101 0000

/GET CHANNEL NUMBER
/SET FOR SAM X
/STORE FOR EXECUTION
/EXECUTE SAM X

/CONVE SAMPLE

4102
4103
4104
4105
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4107
4110
4111
4112
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APR
JMP :4
SET I 10
T2+20 FSAH+15
JMP :4
SET I 10
T2+22 FSAH+15
COM
STA
T1
ROL 1
BCL
M1
ADD G1
STC 13
ADD T1
ROR 2
STA
T1
BCL
M1
ADD G1
STC 12
ADD T1
ROR 3
BCL
M1
ADD G1
STC 11
EJECT

/POSITIVE?
/NO, SET POINTER FOR NEGATIVE PREFIX
/YES, SET POINTER FOR POSITIVE PREFIX
/COMPLEMENT NEGATIVE SAMPLE
/SAVE SAMPLE
/FIND AND STORE TABLE ADDRESSES FOR DISPLAY
/LAST DIGIT
/SECOND DIGIT
FIRST DIGIT

Line	Address	Operation	Comment
130	4137	1120	
131	4140	7737	
132	4141	2251	
133	4142	1750	
134	4143	1770	
135	4144	6217	
136	4145	1751	
137	4146	1771	
138	4147	6217	
139	4150	1752	
140	4151	1772	
141	4152	6217	
142	4153	1753	
143	4154	1773	
144			
145			
146			
147			
148			
149			
150			
151	4155	1000	
152	4156	0245	
153	4157	1560	
154	4160	7774	
155	4161	1460	
156	4162	0003	
157	4163	6225	
158			
159			
160			
161	4164	1000	
162	4165	0245	
163	4166	1560	
164	4167	7760	
165	4170	1460	
166	4171	0017	
167	4172	6236	
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1020 4173
0300 4174
STC V1 4175
STC H1 4176
SNS 0 4177
JMP 1+4 4200
LDA I 4201
0020 4202
JMP 1+2 4203
CLR 4204
STC A1 4205
KST 4206
JMP B7 4207
IOB 4210
6036 4211
SAE I 4212
0204 4213
JMP B7 4214
LDF 03 4215
JMP DIAL 4216
XSK I H1 4217
XSK I H1 4220
XSK I H1 4221
XSK I H1 4222
NOP 4223
JMP 0 4224
EJECT 6000

/END OF DISPLAY
/RESET COORDINATES
/VERTICAL TOP OF FRAME
/HORIZONTAL LEFT EDGE
/WHICH SET?
/CHANNELS 20-37
/CHANNELS 0-17
/RESET CHANNEL NUMBER
/KEYBOARD?
/BACK TO START
/READ DEYBOARD
/CONTROL 0?
/RESET DATA FIELD
/YES, BACK TO DIAL
/INCREMENT HORIZONTAL TO SPACE CHARACTERS

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200 /
201 /NOT END OF ROW
202 /
203 /
204 P1, LDA I /INCREMENT HORIZONTAL TO SPACE CHANNELS
205 0077
206 ADM
207 H1
208 /
209 /INDEX CHANNEL NUMBER
210 /
211 Q1, LDA I /INCREMENT CHANNEL NUMBER (NOT END OF ROW
212 0001 /OR NOT END OF DISPLAY)
213 ADM
214 A1
215 JMP E1 /GET NEXT CHANNEL AND DISPLAY
216 /
217 /NOT END OF DISPLAY
218 /
219 U1, LDA /DECREMENT VERTICAL TO SPACE ROWS
220 V1
221 ADA I
222 -200
223 STC V1
224 STC H1
225 JMP Q1 /GO INCREMENT CHANNEL NUMBER
226 /
227 /TAGS AND REGISTERS
228 /
229 A1, 0000 /CONTAINS CHANNEL NUMBER
230 T1, 0000 /TEMPORARY STORAGE
231 G1, T2 /MATRIX POINTER
232 M1, 7761 /BCL CONSTANT
233 V1, 0 /VERTICAL COORDINATE STORAGE
234 EJECT

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/DISPLAY MATRICIES

4252	4136	4136	/ZERO
4253	3641	3641	/ONE
4254	2101	2101	/TWO
4255	0177	0177	/THREE
4256	4523	4523	/FOUR
4257	2151	2151	/FIVE
4260	4122	4122	/SIX
4261	2651	2651	/SEVEN
4262	2414	2414	/PLUS EIGHT
4263	0477	0477	/MINUS NINE
4264	5172	5172	
4265	0651	0651	
4266	1506	1506	
4267	4225	4225	
4270	4443	4443	
4271	6050	6050	
4272	0404	0404	
4273	0437	0437	
4274	0404	0404	
4275	0404	0404	
	EJECT	EJECT	

260	/	/TRIGGERED SCOPE DISPLAY	
261	/		
262	/		
263		D5,	
264		LSW	/FIND CHANNEL NUMBER
265		BCL I	
266		7740	
267		STA	
268		A1	/CHANNEL NO. TO A1
269		BSE I	/SET FOR SAMPLE
270		0100	
271		STC E6	/STORE FOR EXECUTION
272		LDA I	/GET FLOW TAG
273		SET I 4	
274		STC C5-2	/SAM SET-UP
275		LDA I	/GET FLOW TAG
276		JMP A5	
277		STC E1+25	/REINITIALIZE AFTER CHANNEL NUMBER DISPLAY
278		LDA I	/CHANNEL NUMBER HORIZONTAL COORDINATE
279		100	
280		STA	
281		H1	
282		COM	/CHARACTER DISPLAY VERTICAL COORDINATE
283		STC V1	/SET V,H
284		JMP E1	
285		6043	
286	/	/TRIGGERING ROUTINE (EQUIVALENT TO AUTO TRIG. INTERNAL SYNC, DC POSITIVE),	
287	/		
288		A5,	
289		SET I 14	/START TIMER
290		1000	
291		JMP E6	/GO SAMPLE CHANNEL
292		AP0	/POSITIVE?
293		JMP +3	/NO, TRY AGAIN
294		XSK I 14	/INCREMENT TIMER
295		JMP -4	/WAIT
296		SET I 14	
297		1000	
298		JMP E6	/SAMPLE CHANNEL
299		AP0 I	/NEGATIVE?
300		JMP +3	/NO, TRIGGER NOW FIRES
301		XSK I 14	/WAIT SOME MORE
302		JMP -4	
303		EJECT	

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/ /DISPLAY A TRACE TO HERE IF TRIGGERED, OR NOT TRIGGERED AND
/
    SET I 4
    1000
    /START DISPLAY AT LEFT SIDE
    C5,
    JMP E6
    /SAMPLE CHANNEL
    DIS 4
    /DISPLAY CHANNEL
    CLR
    /DISPLAY 0V REFERENCE
    DIS 4
    LDA I
    377
    /DISPLAY 0.5V REFERENCE
    DIS 4
    COM
    /DISPLAY 0.5V REFERENCE
    DIS 4
    /INCREMENT HORIZONTAL
    XSK I 4
    /CONTINUE TRACE
    JMP C5
    /GO CHECK KEYBOARD
    JMP X1-11
/ /TRIGGERED PREAMP DISPLAY
/
    CLR
    /TO HERE IF SSW2=1
    JMP K6
    LDA I
    10
    /TO HERE IF SSW3=1
    JMP K6
    LDA I
    20
    /TO HERE IS SSW4=1
    JMP K6
    LDA I
    30
    /TO HERE IF SSW5=1
    STA
    /STORE CHANNEL NUMBER
    A1
    /WE NOW HAVE CHANNEL
    STC B6
    LDA I
    /SET FLOW TAG
    JMP A6
    STC E1+25
    LDA I
    -177
    /INITIALIZE DISPLAY
    STC V1
    LDA I
    14
    /SET VERTICAL COORDINATE FOR CHANNEL NUMBER DISPLAY
    STC H1
    /SET HORIZONTAL COORDINATE FOR LEFT SIDE
    SET I 4
    1000
    /RESET HORIZONTAL FOR SAMPLE DISPLAY
    JMP E1
    EJECT
    /GO DISPL CHANNEL NUMBER

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/ /DISPLAY CHANNEL NUMBERS
/
/ A6, LDA I /INCREMENT CHANNEL NUMBER
1 ADM
A1 BCL I /SAVE LOW-ORDER 3 BITS
7770
AZE I /IF 0, WE JUST DISPLAYED LAST CHANNEL IN FRAME
JMP D6 /NOW DISPLAY ANALOG INPUTS
LDA I /INCREMENT HORIZONTAL
34
ADM
H1
JMP E1 /DISPLAY NEXT CHANNEL NUMBER
LDA I /BEGIN DISPLAY
D6, JMP F6 /SET FLOW TAG TO PREVENT OVERLAP OF CHANNELS
STC C5-2
ADD B6 /GET CHANNEL
BSE I /SET FOR SAM X
100
STC E6 /INITIALIZED
SET I 15 /SET WIDTH OF CHANNEL DISPLAY
-100
JMP A5 /GO LOOK FOR TRIGGER IF AVAILABLE
JMP E6 /GO SAMPLE CHANNEL
DIS 4 /DISPLAY CHANNEL
LDA I /DISPLAY +.5V REFERENCE
377
DIS 4 /DISPLAY -.5V REFERENCE
COM 4
DIS 4 /DISPLAY 0V REFERENCE
CLR 4
XSK I 15 /END OF SAMPLE DISPLAY?
JMP H6 /NO, GO INCREMENT HORIZONTAL
LDA I /END OF SEGMENT
1 ADM /INCREMENT CHANNEL NUMBER
B6 /INCREMENT HORIZONTAL
XSK I 4 /DISPLAY NEXT SAMPLE
JMP G6

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0100

0200
0300

0400
0500

0600
0700

1000
1100

1200
1300

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700

4000	010000000	00000011	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4100	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4200	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4300	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4400	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4500	11111111	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

RECEIVED FOR DEPT. OF JUSTICE

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

A1 4245
A3 4323
A6 4410
B6 4465
B7 4021
C5 4343
D5 4276
D6 4425
DIAL 4016
E1 4043
E6 4463
F6 4437
FSAM 4466
G1 4247
G6 4431
H1 4001
H6 4460
J6 4357
K6 4371
M1 4250
P1 4225
Q1 4231
T1 4246
T2 4252
U1 4236
V1 4251
X1 4217

ERRORS DETECTED: 0
LINKS GENERATED: 0
RUN-TIME: 4 SECONDS
2K CORE USED