

IDENTIFICATION

PRODUCT NAME: AD8E, AM8E A/D CONVERTER AND
MULTIPLEXER DIAGNOSTIC
PRODUCT CODE: MAINDEC-8E-D68B-D-(D)
DATE CREATED: JULY 14, 1971
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: MATT TAFFEL

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READ THIS DOCUMENT PRIOR TO RUNNING PROGRAM:

1. ABSTRACT

This program performs basic tests on the Input/Output control logic and multiplexer. The analog tests are designed to provide a means of calibrating the converter and checking conversion parameters.

2. REQUIREMENTS

2.1 Equipment

PDP-8/E with 4K core, ASR33 teletype, AD8E A/D Converter, (AM8E Multiplexer optional), Adjustable High Quality Voltage Source (0.01% or better, Z out <1.0ohm).

NOTE: To run MONOTONICITY TEST, a wave form generator, sine or ramp, must be used.

2.2 Storage

Maindec resides in locations 0000-4177.

2.3 Preliminary Programs

All basic CPU and teletype Maindecs must have been run successfully.

NOTE: If external enable utilizing the DK8-E REAL TIME CLOCK is to be run, the Maindec for the DK8-E must be successfully run first. In addition, VC8-E Control Tests must be run prior to special LAB-E SYSTEM CHECK routine.

3. LOADING PROCEDURE

The binary loader is used to load the program.

4. USAGE PROCEDURE

SEE SPECIFICATIONS FOR MAXIMUM VOLTAGE INPUTS!

INSURE THAT TELETYPE IS ON=LINE,

A. CONTROL SWITCHES

- SW0 = Suppress error messages and "END LOGIC TEST" message
- SW1 = Halt on error with PC displayed in AC.
- SW2 = Scope loop override to exit from loop on error and permit continuance of test. Also halts with converted word in AC for EXTERNAL ENABLE when there is no error.
- SW3 = Enables halt during calibration routine. Converted word is displayed in AC.
- SW4 = Must be set to run EXTERNAL ENABLE test.
- SW5 = Allows operator to explicitly select any one of the logic routines.

B. Normal start for control logic tests.

1. LOAD 200.
2. Press CLEAR then CONTINUE. HALT will occur.
3. Select options from switches 0,1,2,5.
4. If SW5 is present (1), select test from SW8-11.
5. Press CONTINUE.

NOTE: With SW5 down and SW2 up, any error will be reported once, then program will continue to next test.

C. IOT Scope Loop

1. LOAD 201.
2. Place low order six bits of IOT 65xx in SW6-11.
3. Press CLEAR, then CONTINUE.

NOTE: IOT may be reselected while running.

D: Display Converted Value Is AC:

- 1: Apply voltage to A-D converter Input or preamplifiers.
- 2: LOAD 202.
- 3: If a HALT after conversion is desired, select SW3.
- 4: Select MPX channel from SW8-11.
- 5: Press CLEAR, then CONTINUE.
- 6: When SW3 halt select is engaged, operator may change channels, if desired, then press CONTINUE to loop. SW3 may be deselected at this time.

E: External Enable with Real Time Clock

- 1: Apply voltage to A-D Converter Input or preamplifiers, if desired.
- 2: LOAD 203.
- 3: Set SW4.
- 4: Select switches 0 or 2 as desired.
- 5: Select channel with SW 8-11.
- 6: Press CLEAR, then CONTINUE.

NOTE: Channel may be changed while running test.

F: Manometric Test

NOTE: Ramp Speed of function generator must be slower than slow rate of converter, See ENGINEERING SPECIFICATIONS.

- 1: LOAD 204
- 2: Select SW0 if desired.
- 3: Press CLEAR, then CONTINUE.
- 4: Program will halt.
- 5: Select Stall time between tests iterations by setting SW0-11. The larger the number in the switch register, the greater the stall time.

6. Press CONTINUE.

7. If error occurs, program will halt with word "N" in AC. Pressing CONTINUE will display "N+1" word in AC. Pressing CONTINUE again will restart test.

G. Resolution Accuracy Test

1. Apply a known voltage to A-D converter input.

2. LOAD 205.

3. Select SW0,1 if desired.

4. Select channel with SW8-11.

5. Press CLEAR, then CONTINUE.

6. If error occurs, program will timeout non-comparing words on TTY then continue with test.

7. If no error occurs, TTY bell will ring once then, program will recycle.

H. Successive Reads Test

1. Apply any voltage to A-D converter inputs or preamplifier.

2. LOAD 206.

3. Select SW0 if desired.

4. Select channel from SW8-11.

5. Press CLEAR, then CONTINUE.

6. If error occurs, program will halt with first read in AC. Press CONTINUE to get second read into AC.

7. To restart, press continue.

8. If no error occurs, TTY bell will ring once, then program will recycle.

J. Multiplexer noise test

1. LOAD 207.

2. Select channel in SW8-11 and apply voltage to that channel.

3. Select SW0 If desired.
4. Press CLEAR, then CONTINUE.
5. If error occurs, message will be typed on TTY, then routine will recycle.

K. LAB00-E SYSTEM TEST

1. LOAD 205
2. Press CLEAR, then CONTINUE.
3. Program will HALT.
4. Load CLOCK FREQUENCY into SW3=5.
5. Press CONTINUE, then follow TTY instructions.
6. Press CONTINUE.

5. PROGRAM DESCRIPTION

5.1 Control Logic Tests

- TST0 = Checks that A=D DONE and TIMING ERROR flags are cleared by Initialize.
- TST1 = Checks that A=D DONE flag can be set then cleared.
- TST2 = Checks that TIMING ERROR flag can be set then cleared.
- TST3 = Tests for unexpected Interrupt request.
- TST4 = Tests to see if ADRB Jam transfers to AC.
- TST5 = Tests to see if ADRS Jam transfers to AC.
- TST6 = Tests to see if enable register can be loaded and read back.
- TST7 = Tests to see if A=D DONE will generate interrupt.
- TST10 = Tests to see if TIMING ERROR will generate interrupt.

- TST11= Tests that MPX Register can be loaded and read back,
- TST12= Tests that all channels can be loaded into MPX register and read back,
- TST13= Tests auto-Increment mode of MPX register,
- TST14= Tests to see if conversion can be made in specified time,

5.2 Miscellaneous Tests

- A. IOT Scope Loop Test = enables IOT to be repeated for troubleshooting.
- B. External Enable Test = utilizes DK8/E Real Time Clock to start conversion. NOTE: This test can be used only if DK8/E is present in system.
- C. Display Converted Value In AC = used to calibrate converter. (See setup procedure of AD8E).>
- D. LAB8-E SYSTEM CHECKS = assures reliability of system as homogeneous unit.

5.3 Analog Tests

- A. Successive Reads Tests = checks for noise in A-D buffer logic.
- B. Monotonicity Test = checks that all specified values can be converted.
- C. Resolution Accuracy Test = samples a known voltage 64 times and checks that resolution is within specification.
- D. Multiplexer Noise Test = checks for noise in MPX, ENABLE, and STATUS REGISTER.

6. ERROR REPORTS

6.1 Logic Errors

Message will be typed out once per error on teletypewriter stating test number and nature of failure.

6.2 Other Errors

Message will be typed out on teletypewriter stating nature of failure.

/MAINDEC-8E-D68B-L-(D) A TO D CONVERTER AND MULTIPLEXER DIAGNOSTIC
 /AD8EA,AM8EA,AM8EB
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 /AUTHOR: MATT TAFFEL
 /DATE: 14 JUL 71

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/IOT DEFINITIONS

4520	ADCL=	JMS I	XADCL	/CLEAR ALL
4521	ADLM=	JMS I	XADLM	/LOAD MPX REG FROM AC8-11
4522	ADST=	JMS I	XADST	/CLEAR FLAGS, START CONVERSION
4523	ADRB=	JMS I	XADRB	/CLEAR DONE, READ A-D BUFFER INTO AC,
4524	ADSK=	JMS I	XADSK	/SKIP ON A-D DONE, DO NOT CLEAR FLAG,
4525	ADSE=	JMS I	XADSE	/SKIP ON TMG ERROR, DO NOT CLEAR FLAG,
4526	ADLE=	JMS I	XADLE	/LOAD ENAB REG FROM AC 2-5. CLA,
4527	ADRS=	JMS I	XADRS	/READ STATUS, ENAB, MPX REG INTO AC,
4530	CLOE=	JMS I	XCLOE	/AC TO CLOCK ENABLE
4531	CLSK=	JMS I	XCLSK	/SKIP ON CLOCK OVERFLOW
4532	CLZE=	JMS I	XCLZE	/ONES IN AC CLEAR CLOCK ENABLE REGISTER
4533	CLSA=	JMS I	XCLSA	/CLOCK STATUS TO AC, AC ONES CLEAR CLOCK STATUS REGISTER
4534	CLED=	JMS I	XCLED	/CLOCK ENABLE TO AC
4535	CLAB=	JMS I	XCLAB	/AC ONES TO CLOCK BUFFER
4536	DISD=	JMS I	XDISD	/SKIP ON DISPLAY DONE
4537	DILX=	JMS I	XDILX	/LOAD X
4540	DILY=	JMS I	XDILY	/LOAD Y
4541	DIXY=	JMS I	XDIXY	/INTENSIFY
4542	DILE=	JMS I	XDILE	/LOAD DISPLAY ENABLE FROM AC
6007	CAF=	6007		
7002	BSW=	7002		

/MPX, ENABLE, STATUS REGISTER

/ 0 AD DONE
 / 1 TIMING ERROR
 / 2 ENABLE INTERRUPT ON AD DONE
 / 3 ENABLE INTERRUPT ON TIMING ERROR
 / 4 ENABLE EXTERNAL AD START
 / 5 AUTO-INCREMENT MODE
 / 6,7 NOT USED
 / 8-11 MPX CHANNEL 0-17 OCTAL

/STARTING ADDRESS

TEST

/	
/200	NORMAL START FOR CONTROL LOGIC TESTS
/201	IOT SCOPE LOOP
/202	DISPLAY CONVERTED VALUE IN AC
/203	EXTERNAL ENABLE TEST
/204	MONOTONICITY TEST
/205	RESOLUTION ACCURACY TEST
/206	SUCCESSIVE READS TEST
/207	MULTIPLEXER NOISE TEST
/212	SYSTEM CHECK FOR LABR-E

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0000 0020 *0
0001 0020 0
0001 5422 JMP I ,+1
0002 0020 0
0003 5424 JMP I ,+1
0004 0020 0
0005 0020 0
    
```

```

0017 0017 *17
0017 0145 MSGPNT, ERMSG
    
```

```

0020 0020 *20
0020 4020 SW0, 4020 /SWITCH REG 0 INHIBIT TYPEOUT
0021 2020 SW1, 2020 / 1 HALT ON ERROR
0022 1020 SW2, 1020 / 2 SCOPE LOOP OVERRIDE
0023 0420 SW3, 0420 / 3 CALIBRATION TEST HALT
0024 0220 SW4, 0220 / 4 EXTERNAL ENABLE
0025 0120 SW5, 0120 / 5 SELECT TEST
0026 0020 TEMP0, 0 /STORAGE BUFFER 0
0027 0020 TEMPA, 0 /STORAGE BUFFER A
0030 0020 TEMPB, 0 / B
0031 0020 TEMPC, 0 / C
0032 0020 CNTR1, 0 /MONOTONICITY COUNTER
0033 0020 TALLY, 0
0034 1226 ERR, ERTYP /ERROR REPORT ROUTINE
0035 1020 XCONVT, CONVT /DISPLAY CONVERTED VALUE
0036 1420 XINSTR, INSTR /IOT SCOPE LOOP
0037 2020 XMONCT, MONOT /MONOTONICITY TEST
0040 0227 K207, 207 /BELL CODE
0041 0212 K212, 212 /LINE FEED
0042 0215 K215, 215 /CARRIAGE RETURN
0043 6520 K6500, 6500
0044 7777 M1, 7777
0045 7776 M2, 7776
0046 7774 M4, 7774
0047 1020 K1000, 1000
0050 0077 K77, 0077
0051 1220 XMOVE, MOVE
0052 1024 EXTBL, EXTL
0053 2267 XSTOR, STORAG-1
0054 2420 XCOMPR, COMPAR
0055 2220 XRESOL, RESOL
0056 2051 XNOISE, NOISE
0057 2123 XGLIT, GLITCH
0060 2622 XSYST, SYST
0061 7777 ERSWIT, 7777
0062 0020 CHAN, 0
0063 1620 TAL, XTAL
0064 1647 SELECT, XSELEC
0065 1552 SETUP, XSETUP
0077 0020 *77
0077 0020 CHNL, 0
0100 0021 1
    
```

0101	0002	2
0102	0003	3
0103	0004	4
0104	0005	5
0105	0006	6
0106	0007	7
0107	0010	10
0110	0011	11
0111	0012	12
0112	0013	13
0113	0014	14
0114	0015	15
0115	0016	16
0116	0017	17
0117	0000	0

0120 *120

/IOT LINKS

0120	1410	XADCL,	XXADCL
0121	1414	XADLM,	XXADLM
0122	1420	XADST,	XXADST
0123	1424	XADRB,	XXADRB
0124	1430	XADSK,	XXADSK
0125	1436	XADSE,	XXADSE
0126	1444	XADLE,	XXADLE
0127	1450	XADRS,	XXADRS
0130	1454	XCLOE,	XXCLOE
0131	1460	XCLSK,	XXCLSK
0132	1466	XCLZE,	XXCLZE
0133	1472	XCLSA,	XXCLSA
0134	1476	XCLED,	XXCLED
0135	1502	XCLAB,	XXCLAB
0136	1506	XDISD,	XXDISD
0137	1514	XDILX,	XXDILX
0140	1520	XDILY,	XXDILY
0141	1524	XDIXY,	XXDIXY
0142	1530	XDILE,	XXDILE

0145 *145

/ERROR MESSAGE LINKS

0145	3200	ERMSG,	EMSG0
0146	3244		EMSG1
0147	3322		EMSG2
0150	3344		EMSG3
0151	3372		EMSG4
0152	3422		EMSG5
0153	3452		EMSG6
0154	3503		EMSG7
0155	3540		EMSG10
0156	3601		EMSG11

0157	3637	EMSG12
0160	3677	EMSG13
0161	3744	EMSG14

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0200 0200 *200
0200 5211 JMP START /NORMAL START
0201 5436 JMP I XINSTR /IOT SCOPE LOOP OPTION
0202 5435 JMP I XCONVT /DISPLAY CONVERTED VALUE OPTION
0203 5452 JMP I EXTBL /EXTERNAL ENABLE TEST
0204 5437 JMP I XMONOT /MONOTONICITY TEST
0205 5455 JMP I XRESOL /RESOLUTION ACCURACY TEST
0206 5456 JMP I XNOISE /SUCCESSIVE READS TEST
0207 5457 JMP I XGLIT /MPX NOISE TEST
0210 5460 JMP I XSYST /LAB8-E SYSTEM CHECK
0211 7402 START, HLT
0212 7604 LAS
0213 0025 AND SW5 /SELECT SPECIFIC TEST?
0214 7440 SZA /SKIP IF NO
0215 4464 JMS I SELECT /YES

/HOUSEKEEPING
0216 7300 INITL, CLA CLL
0217 4777 JMS MESSAGE
0220 4161 XLABEL
0221 1376 TAD (-144
0222 3017 DCA MSGPNT /INITIALIZE ERROR POINTER
0223 4465 JMS I SETUP
0224 6007 TST0, CAF
0225 4524 ADSK /CHECK FOR DONE FLAG - SHOULD BE CLEARED BY INIT
0226 5231 JMP ,+3
0227 4434 JMS I ERR /DONE FLAG NOT CLEARED
0230 0224 TST0
0231 4525 ADSE /CHECK FOR TIMING ERROR FLAG - SHOULD BE CLEARED BY INIT
0232 5237 JMP ,+5
0233 4434 JMS I ERR /TIMING ERROR FLAG NOT CLEARED
0234 0224 TST0
0235 5240 JMP TST1-1
0236 5224 JMP TST0
0237 4463 JMS I TAL

/CHECK TO SET DONE FLAG AND CLEAR DONE FLAG
0240 4465 JMS I SETUP
0241 7200 TST1, CLA
0242 4522 ADST /CONVERT, RESULTS NOT NEEDED
0243 1177 TAD [-100
0244 3026 DCA TEMP0
0245 2026 ISZ TEMP0
0246 5245 JMP , -1
0247 4524 ADSK
0250 7410 SKP
0251 5255 JMP ,+4
0252 4434 JMS I ERR /FLAG NOT SET
0253 0241 TST1
0254 5265 JMP TST2-1
0255 4520 ADCL /CLEAR FLAG
0256 4524 ADSK /CHECK FOR FLAG
0257 5264 JMP ,+5 /FLAG CLEARED

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0260 4434      JMS I   ERR           /FLAG NOT CLEARED
0261 0241      TST1
0262 5265      JMP     TST2-1
0263 5241      JMP     TST1
0264 4463      JMS I   TAL

/CHECK TO SET TIMING ERROR FLAG AND CLEAR TIMING ERROR FLAG
0265 4465      JMS I   SETUP
0266 7200      TST2,  CLA
0267 4522      ADST           /TWO A-D STARTS TO PRODUCE TIMING ERROR
0270 4522      ADST
0271 4525      ADSE           /CHECK FOR TIMING ERROR FLAG
0272 7410      SKP
0273 5276      JMP     ,+3
0274 4434      JMS I   ERR           /FLAG NOT SET
0275 0266      TST2
0276 4520      ADCL           /CLEAR FLAG
0277 4525      ADSE           /CHECK FLAG
0300 5305      JMP     ,+5
0301 4434      JMS I   ERR           /FLAG NOT CLEARED
0302 0266      TST2
0303 5306      JMP     TST3-1
0304 5266      JMP     TST2
0305 4463      JMS I   TAL

/TEST FOR UNEXPECTED INTERRUPT REQUEST
0306 4465      JMS I   SETUP
0307 7200      TST3,  CLA
0310 1176      TAD     [TST3S
0311 3004      DCA     4
0312 1317      TAD     ,+5           /ERROR TRAP
0313 3001      DCA     1
0314 6001      ION           /TURN INT ON
0315 7000      NOP
0316 5322      JMP     ,+4
0317 4434      JMS I   ERR           /UNEXPECTED INTERRUPT OCCURRED
0320 0307      TST3
0321 5326      JMP     TST4-1
0322 6002      TST3S, IOF           /TURN INT OFF
0323 7410      SKP
0324 5307      JMP     TST3
0325 4463      JMS I   TAL

/TEST THAT ADRB JAM TRANSFERS TO AC
0326 4465      JMS I   SETUP
0327 7240      TST4,  CLA CMA           /AC=7777
0330 4523      ADRB           /SHOULD CLEAR AC
0331 3027      DCA     TEMPA        /SAVE AC
0332 7040      CMA
0333 4523      ADRB           /READ WITH AC=0
0334 7041      CIA
0335 1027      TAD     TEMPA
0336 7440      SZA           /EQUAL?
0337 7410      SKP

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0340 5345      JMP      .+5
0341 4434      JMS I   ERR          /NO-ERROR
0342 2327      TST4
0343 5346      JMP      TST5-1
0344 5327      JMP      TST4
0345 4463      JMS I   TAL
    
```

/TEST THAT ADRS JAM TRANSFERS TO AC

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0346 4465      JMS I   SETUP
0347 4520      TST5,  ADCL
0350 4521      ADLM
0351 4522      ADST
0352 4524      ADSK
0353 5352      JMP      .-1
0354 7340      CLA CMA CLL          /AC=7777
0355 4527      ADRS
0356 3027      DCA      TEMPA          /SAVE AC, SHOULD BE 4000
0357 1027      TAD      TEMPA
0360 7004      RAL
0361 7440      SZA          /DID ADRS CLEAR AC?
0362 7410      SKP
0363 5370      JMP      .+5
0364 4434      JMS I   ERR          /NO
0365 0347      TST5
0366 5775      JMP      TST6-1
0367 5347      JMP      TST5
0370 4463      JMS I   TAL
0371 5775      JMP      TST6-1
    
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0375 0400
0376 0144
0377 1274
0400
    
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PAGE

/CHECKS THAT ENABLE REGISTER CAN BE LOADED AND READ BACK

```

0400 4465      JMS I   SETUP
0401 7300      TST6,  CLA CLL
0402 1175      TAD      [17          /GET BITS AND
0403 7002      BSW          /PLACE IN AC 2-5
0404 4526      ADLE          /LOAD
0405 7440      SZA
0406 7410      SKP
0407 5212      JMP      .+3
0410 4434      JMS I   ERR          /AC NOT CLEARED BY ADLE
0411 0401      TST6
0412 7040      CMA
0413 4527      ADRS          /READ BACK
0414 7002      BSW
0415 1174      TAD      [7761          /CHECK FOR ONLY AC 2-5 SET
0416 7440      SZA
0417 7410      SKP
0420 5225      JMP      .+5
0421 4434      JMS I   ERR          /WRONG BITS
    
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0422 0401          TST6
0423 5226          JMP      TST7-1
0424 5201          JMP      TST6
0425 4463          JMS I   TAL          /DONE?

/GENERATE INTERRUPT WITH A-D DONE FLAG
0426 4465          JMS I   SETUP
0427 7200          TST7,  CLA
0430 4522          ADST          /CONVERT
0431 4524          ADSK          /DONE?
0432 5231          JMP      , -1        /WAIT
0433 1173          TAD      [DON1
0434 3002          DCA      2          /RETURN POINTER
0435 1047          TAD      K1000
0436 4526          ADLE          /LOAD INTERRUPT ENABLE
0437 6001          ION
0440 7000          NOP
0441 6002          IOF
0442 4434          JMS I   ERR          /DID NOT INTERRUPT
0443 0427          TST7
0444 5251          JMP      TST10-1
0445 4520          DON1,  ADCL          /CLEAR WORLD
0446 7410          SKP
0447 5227          JMP      TST7
0450 4463          JMS I   TAL

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/GENERATE INTERRUPT WITH TIMING ERROR FLAG
0451 4465          JMS I   SETUP
0452 7200          TST10, CLA
0453 1172          TAD      [TMG1
0454 3002          DCA      2
0455 4522          ADST          /CAUSE ERROR HERE
0456 4522          ADST
0457 4524          ADSK          /DONE?
0460 5257          JMP      , -1
0461 4525          ADSE          /TIMING ERROR?
0462 5261          JMP      , -1
0463 7300          CLA CLL
0464 1047          TAD      K1000
0465 7010          RAR
0466 4526          ADLE          /LOAD INTERRUPT ENABLE
0467 6001          ION          /INT ON
0470 7000          NOP
0471 6002          IOF          /INT OFF
0472 4434          JMS I   ERR          /DID NOT INTERRUPT
0473 0452          TST10
0474 5301          JMP      TST11-1
0475 4520          TMG1, ADCL          /CLEAR WORLD
0476 7410          SKP
0477 5252          JMP      TST10
0500 4463          JMS I   TAL

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/LOAD AND READ MPX REG

```

0501 4465      JMS I  SETUP
0502 7240      TST11, CLA CMA
0503 4521      ADLM
0504 7450      SVA          /CHECK IF AC CLEARED
0505 5311      JMP          ,+4
0506 4434      JMS I  ERR          /AC WAS NOT CLEARED BY ADLM
0507 0502      TST11
0510 7200      CLA
0511 4521      ADLM          /LOAD MPX REG WITH 00
0512 4527      ADRS          /READ MPX REG
0513 0175      AND          [17          /MASK FOR MPX REG
0514 7440      SZA
0515 7410      SKP
0516 5321      JMP          ,+3
0517 4434      JMS I  ERR          /MPX REG NOT 0
0520 0502      TST11
0521 7040      CMA
0522 0175      AND          [17
0523 4521      ADLM          /MPX REG SET TO 17
0524 4527      ADRS          /READ MPX REG
0525 0175      AND          [17
0526 1171      TAO          [7760          /MASK
0527 7040      CMA
0530 7440      SZA
0531 7410      SKP
0532 5337      JMP          ,+5
0533 4434      JMS I  ERR          /MPX REG NOT 17
0534 0502      TST11
0535 5777'     JMP          TST12-1
0536 5302      JMP          TST11
0537 4463      JMS I  TAL
0540 5777'     JMP          TST12-1

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0577 0600
0600

PAGE

/LOAD MPX REG WITH EACH CHANNEL

```

0600 4465      JMS I  SETUP
0601 7300      TST12, CLA CLL
0602 3026      DCA  TEMP0
0603 1026      TAO  TEMP0          /CHANNEL INTO AC
0604 7040      CMA
0605 3027      DCA  TEMP1          /COMPLEMENTED CHANNEL
0606 1026      TAO  TEMP0
0607 4521      ADLM          /LOAD IT
0610 4527      ADRS          /READ MPX REG
0611 0175      AND          [17          /MASK 8-11
0612 3030      DCA  TEMP2          /STORE IT
0613 1027      TAO  TEMP1          /CHECK IT
0614 1030      TAO  TEMP2
0615 7001      IAC
0616 7440      SZA
0617 7410      SKP
0620 5224      JMP          ,+4
0621 4434      JMS I  ERR          /WRONG CHANNEL

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0622 0601      TST12
0623 5236      JMP      TST13-1
0624 1171      TAD      [7760
0625 1226      TAD      TEMP2
0626 7021      IAC
0627 7440      SZA
0630 7410      SKP
0631 5235      JMP      .+4
0632 7300      CLA CLL
0633 2026      ISZ      TEMP0
0634 5203      JMP      TST12+2
0635 4463      JMS I    TAL

```

/DONE WITH ALL CHANNELS?
/NO
/YES

/SET NEXT CHANNEL

/DONE WITH TEST?

```

0636 4465      /AUTO-INCREMENT MODE TEST
0637 7300      JMS I    SETUP
TST13,  CLA CLL
0640 1170      TAD      [76
0641 3010      DCA      10
0642 4520      ADCL
0643 7200      AUTO1,  CLA
0644 1410      TAD I    10
0645 3027      DCA      TEMPA
0646 1027      TAD      TEMPA
0647 7040      CMA
0650 3030      DCA      TEMPB
0651 1025      TAD      SW5
0652 4526      ADLE
0653 1027      TAD      TEMPA
0654 4521      ADLM
0655 4522      ADST
0656 4524      ADSK
0657 5256      JMP      .-1
0660 4527      ADRS
0661 0175      AND      [17
0662 3031      DCA      TEMPC
0663 1027      TAD      TEMPA
0664 1174      TAD      [7761
0665 7640      SZA CLA
0666 5272      JMP      .+4
0667 1410      TAD I    10
0670 1031      TAD      TEMPC
0671 5274      JMP      AUTO2
0672 1031      TAD      TEMPC
0673 1230      TAD      TEMPB
0674 7440      AUTO2,  SZA
0675 7410      SKP
0676 5302      JMP      .+4
0677 4434      JMS I    ERR
0700 0637      TST13
0701 5310      JMP      TST14-1
0702 1031      TAD      TEMPC
0703 7440      SZA
0704 5243      JMP      AUTO1
0705 7410      SKP

```

/CHANNEL N

/AUTO-INCREMENT BIT
/LOAD ENABLE REG
/CHANNEL N
/LOAD MPX REG
/START CONVERSION
/WAIT FOR
/DONE FLAG
/READ STATUS
/MASK OUT ALL BUT MPX REG

/CHECK IF CHANNEL 17 INCREMENTED TO 0

/IF CHANNEL 17 SKIP

/AC SHOULD = 0

/CHECK FOR CHANNEL N+1

/WRONG CHANNEL

/LAST CHANNEL?
/NO

```

0706 5237      JMP      TST13
0707 4463      JMS I   TAL

```

/ROUTINE TO CHECK THAT CONVERSION CAN BE MADE IN 20 MICROSECS

```

0710 4465      JMS I   SETUP
0711 7300      TST14,  CLA  CLL
0712 1377      TAD      (-6
0713 3026      DCA      TEMP0
0714 4520      ADCL
0715 4522      ADST
0716 2026      ISZ      TEMP0
0717 5316      JMP      .-1
0720 4524      ADSK
0721 7410      SKP
0722 5327      JMP      .+5
0723 4434      JMS I   ERR      /TIME OUT ERROR
0724 0711      TST14
0725 5330      JMP      FINIS
0726 5311      JMP      TST14
0727 4463      JMS I   TAL
0730 7604      FINIS,  LAS
0731 0020      AND      SW0      /SWITCH SET TO DELETE
0732 7640      SZA  CLA      /TYPEOUT OF END LOGIC TEST
0733 5337      JMP      .+4
0734 4776'     JMS      MESSAGE
0735 4146      XEND
0736 7200      CLA
0737 1040      TAD      K207
0740 4775'     JMS      PRLP
0741 5774'     JMP      TST0-3      /RETURN TO BEGINNING OF LOGIC TESTS,

```

```

0774 0221
0775 1534
0776 1274
0777 7772
1000

```

PAGE

```

1000 4520      /ROUTINE TO DISPLAY CONVERTED VALUE IN AC,
CONVT, ADCL      /CLEAR WORLD
1001 3026      DCA      TEMP0
1002 7604      LAS      /LOAD CHANNEL
1003 4521      ADLM      /LOAD MPX REG
1004 4522      ADST      /CONVERT
1005 4524      ADSK      /DONE?
1006 5205      JMP      .-1      /WAIT
1007 4523      ADRH      /READ A-D BUFFER
1010 2026      ISZ      TEMP2      /STALL TO DISPLAY
1011 5210      JMP      .-1      /CONVERTED VALUE
1012 2026      ISZ      TEMP3      /IN AC FOR
1013 5212      JMP      .-1      /33 MILLISECOND
1014 3031      DCA      TEMP0
1015 7624      LAS      /CHECK IF HALT DESIRED
1016 0023      AND      SW3

```

```

1017 7650      SNA CLA
1020 5223      JMP      ,+3
1021 1031      TAD      TEMPC
1022 7402      HLT
1023 5220      JMP      CONV
                    /PRESS CONTINUE IF NOT DONE ADJUSTING
                    /LOOP
    
```

/ROUTINE TO CHECK FOR EXTERNAL ENABLE FROM REAL TIME CLOCK

```

1024 4465      EXTL,  JMS I  SETUP
1025 4520      ADCL
1026 7604      LAS
1027 0024      AND      SW4
1030 7450      SNA
1031 7402      HLT
1032 7604      EXTL,  LAS
1033 0024      AND      SW4
1034 4526      ADLE
1035 7604      LAS
1036 0175      AND      [17
1037 4521      ADLM
1040 1377      TAD      (4340
1041 4530      CLOE
1042 7040      CMA
1043 4532      CLZE
1044 4531      CLSK
1045 5244      JMP      .-1
1046 4533      CLSA
1047 7240      CLA CMA
1050 4532      CLZE
1051 7200      CLA
1052 2026      ISZ      TEMP0
1053 5252      JMP      .-1
1054 4524      ADSK
1055 4776      JMS      ERPT3
1056 4523      ADRB
1057 3027      DCA      TEMPA
1060 7604      LAS
1061 0022      AND      SW2
1062 7650      SNA CLA
1063 5266      JMP      EXTTE
1064 1027      TAD      TEMPA
1065 7402      HLT
1066 4465      EXTTE, JMS I  SETUP
1067 4520      ADCL
1070 7604      LAS
1071 0024      AND      SW4
1072 4526      ADLE
1073 7240      CLA CMA
1074 4535      CLAB
1075 7200      CLA
1076 1375      TAD      (164)
1077 4532      CLOE
1100 7000      NOP
                    /CLEAR ALL
                    /CHECK FOR EXT'L ENABLE SWITCH
                    /SWITCH NOT SET, STOP!
                    /LOAD CHANNEL FROM SW8-11
                    /LOAD CLOCK ENABLE REG
                    /TRIGGER FROM RTC
                    /OCCURS ON OVERFLOW
                    /STOP CLOCK
                    /TIME OUT
                    /CONVERSION NOT MADE
                    /STORE CONVERSION
                    /LOOP?
                    /YES
                    /HALT WITH CONVERTED
                    /VALUE IN AC.
                    /CLOCK BUFFER = 7777
                    /TO GIVE TIMING ERROR ON NEXT CLOCK
    
```

1101	4525	ADSE		/TIMING ERROR SEEN HERE
1122	4776'	JMS	ERPT3	/DID NOT RAISE FLAG
1103	7240	CLA	CMA	
1104	4532	CLPE		
1125	7200	CLA		
1106	4520	ADCL		
1107	1024	TAD	SW4	
1110	4526	ADLE		
1111	7240	CLA	CMA	
1112	4535	CLAB		
1113	7200	CLA		
1114	4535	CLAR		
1115	1374	TAD	(-6	
1116	3031	DCA	TEMPC	
1117	2031	ISZ	TEMPC	
1120	5317	JMP	.-1	
1121	4524	ADSK		
1122	5325	JMP	.+3	
1123	4776'	JMS	ERPT3	
1124	4520	ADCL		
1125	7200	CLA		
1126	1040	TAD	K207	
1127	4773'	JMS	PRLP	
1130	5232	JMP	EXT1	

1173 1534
 1174 7772
 1175 1640
 1176 1732
 1177 4340
 1200

PAGE

/SUBROUTINE TO MOVE VARIABLE LENGTH DATA FIELDS

1200	0000	MOVE,	0	
1201	7300		CLA CLL	
1202	1600		TAD I	MOVE /GET "FROM ADDR" AND
1203	3223		DCA FADDR	/STORE
1204	2200		ISZ	MOVE
1205	1600		TAD I	MOVE /GET "TO ADDR" AND
1206	3224		DCA TADDR	/STORE
1207	2200		ISZ	MOVE
1210	1600		TAD I	MOVE /GET "MOVE COUNT" AND
1211	3225		DCA MCTR	/STORE
1212	2200		ISZ	MOVE /SETUP FOR EXIT
1213	7200	MOVEA,	CLA	
1214	1623		TAD I	FADDR /GET "FROM" WORD
1215	3624		DCA I	TADDR /STORE AT "TO" LOCATION
1216	2223		ISZ	FADDR /+1 TO "FROM" ADDR
1217	2224		ISZ	TADDR /+1 TO "TO" ADDR
1220	2225		ISZ	MCTR /ALL WORDS MOVED?
1221	5213		JMP	MOVEA /NO, RETURN
1222	5600		JMP I	MOVE /YES, EXIT

1223 0000 FADDR, 0
 1224 0002 TADDR, 2
 1225 0002 MCTR, 2

/ERROR TYPEOUT ROUTINE

1226 0000 ERTYP, 0
 1227 7200 CLA
 1230 1346 TAD IND
 1231 7640 SZA CLA
 1232 5243 JMP EOUT+1 /TYPE ERROR MESSAGE ONE TIME ONLY
 1233 7604 LAS
 1234 0020 AND SW0 /SUPPRESS TYPEOUT?
 1235 7710 SPA CLA
 1236 5247 JMP EOUT+5 /YES
 1237 1417 TAD I MSGPNT /GET POINTER FOR ERROR MESSAGE
 1240 3242 DCA EOUT
 1241 4274 JMS MESSAGE
 1242 7402 EOUT, HLT
 1243 7200 CLA
 1244 1346 TAD IND
 1245 7640 SZA CLA
 1246 5250 JMP .+2
 1247 2346 ISZ IND
 1250 7604 LAS
 1251 0021 AND SW1 /HALT ON ERROR SWITCH ON?
 1252 7650 SNA CLA /SKIP IF ON
 1253 5257 JMP SCOPE
 1254 1226 TAD ERTYP
 1255 1044 TAD M1
 1256 7402 HLT /HALT WITH ERROR P.C. IN AC.
 1257 7604 SCOPE, LAS
 1260 0022 AND SW2 /OVERRIDE LOOP?
 1261 7640 SZA CLA
 1262 5272 JMP .+10
 1263 1626 TAD I ERTYP /NO
 1264 3271 DCA EXIT
 1265 1017 TAD MSGPNT
 1266 1044 TAD M1
 1267 3017 DCA MSGPNT
 1270 5671 JMP I EXIT
 1271 7422 EXIT, HLT
 1272 2226 ISZ ERTYP /YES
 1273 5626 JMP I ERTYP

/MESSAGE ROUTINE FOR LOGIC ERRORS

1274 0002 MESSAGE, 0
 1275 7240 CLA CMA
 1276 1674 TAD I MESSAGE
 1277 3012 DCA 12
 1300 2274 ISZ MESSAGE

1301	1410	TAD I	10
1302	3313	DCA	MSRGHT
1303	1313	TAD	MSRGHT
1304	7212	DTR	
1305	7012	RTR	
1306	7212	RTR	
1307	4314	JMS	TYPECH
1310	1313	TAD	MSRGHT
1311	4314	JMS	TYPECH
1312	5321	JMP	MESSAGE+5
1313	0020	MSRGHT, 0	
1314	0020	TYPECH, 0	
1315	0050	AND	K77
1316	7452	SNA	
1317	5674	JMP I	MESSAGE
1320	1377	TAD	(-40
1321	7510	SPA	
1322	5325	JMP	+.3
1323	1376	TAD	(240
1324	5340	JMP	MTP
1325	7021	IAC	
1326	7442	SZA	
1327	5332	JMP	+.3
1330	1042	TAD	K215
1331	5342	JMP	MTP
1332	7021	IAC	
1333	7442	SZA	
1334	5337	JMP	+.3
1335	1041	TAD	K212
1336	5342	JMP	MTP
1337	1375	TAD	(336
1340	6046	MTP, TLS	
1341	6041	TSP	
1342	5341	JMP	.-1
1343	6042	TCF	
1344	7220	CLA	
1345	5714	JMP I	TYPECH
1346	0020	IND, 0	

1375 0336
 1376 0240
 1377 7742
 1420

PAGE
 /SCOPE LOOP FOR IOTS 65XX.
 INSTR, NOP

1401	7624	LAS	
1402	0052	AND	K77
1403	1043	TAD	K6520
1404	3225	DCA	+.1
1405	7422	HLT	
1406	7222	NOP	
1407	5211	JMP	INSTR+1

/SELECT IOT FROM SR 6-11
 /MASK OUT AC 2-5
 /CREATE IOT
 /LOCATION OF IOT
 /POSSIBLE SKIP
 /LOOP

/IOT SUBROUTINES

1410	0000	XXADCL, 0		
1411	6530	6530		/CLEAR ALL
1412	5610	JMP I	XXADCL	
1413	7402	HLT		
1414	0000	XXADLM, 0		
1415	6531	6531		/LOAD MPX REG
1416	5614	JMP I	XXADLM	
1417	7402	HLT		
1420	0000	XXADST, 0		
1421	6532	6532		/START CONVERSION
1422	5620	JMP I	XXADST	
1423	7402	HLT		
1424	0000	XXADRB, 0		
1425	6533	6533		/READ A-D BUFFER
1426	5624	JMP I	XXADRB	
1427	7402	HLT		
1430	0000	XXADSK, 0		
1431	6534	6534		/SKIP ON A-D DONE
1432	7410	SKP		
1433	2230	ISZ	XXADSK	
1434	5630	JMP I	XXADSK	
1435	7402	HLT		
1436	0000	XXADSE, 0		
1437	6535	6535		/SKIP ON TIMING ERROR
1440	7410	SKP		
1441	2236	ISZ	XXADSE	
1442	5636	JMP I	XXADSE	
1443	7402	HLT		
1444	0000	XXADLE, 0		
1445	6536	6536		/LOAD ENABLE REGISTER
1446	5644	JMP I	XXADLE	
1447	7402	HLT		
1450	0000	XXADRS, 0		
1451	6537	6537		/READ STATUS REGISTER
1452	5650	JMP I	XXADRS	
1453	7402	HLT		
1454	0000	XXCLOE, 0		
1455	6132	6132		/LOAD CLOCK ENABLE
1456	5654	JMP I	XXCLOE	
1457	7402	HLT		
1460	0000	XXCLSK, 0		
1461	6131	6131		/SKIP ON CLOCK OVERFLOW
1462	7410	SKP		
1463	2260	ISZ	XXCLSK	

```

1464 5660      JMP I   XXCLSK
1465 7402      HLT

1466 0000      XXCLZE, 0
1467 6130      6130      /ONES IN AC CLEAR CLOCK ENABLE REG
1470 5666      JMP I   XXCLZE
1471 7402      HLT

1472 0000      XXCLSA, 0
1473 6135      6135      /CLOCK STATUS TO AC, AC ONES CLR CLK STATUS REG
1474 5672      JMP I   XXCLSA
1475 7402      HLT

1476 0000      XXCLED, 0
1477 6134      6134      /CLOCK ENABLE TO AC
1500 5676      JMP I   XXCLED
1501 7402      HLT

1502 0000      XXCLAB, 0
1503 6133      6133      /AC ONES TO CLOCK BUFFER
1504 5702      JMP I   XXCLAB
1505 7402      HLT

1506 0000      XXDISD, 0
1507 6052      6052      /SKIP ON DISPLAY DONE
1510 7410      SKP
1511 2306      ISZ   XXDISD
1512 5706      JMP I   XXDISD
1513 7402      HLT

1514 0000      XXDILX, 0
1515 6053      6053      /LOAD X
1516 5714      JMP I   XXDILX
1517 7402      HLT

1520 0000      XXDILY, 0
1521 6054      6054      /LOAD Y
1522 5720      JMP I   XXDILY
1523 7402      HLT

1524 0000      XXDIXY, 0
1525 6055      6055      /INTENSIFY
1526 5724      JMP I   XXDIXY
1527 7402      HLT

1530 0000      XXDILE, 0
1531 6056      6056      /LOAD ENABLE FROM AC, CLEAR AC
1532 5732      JMP I   XXDILE
1533 7402      HLT

```

```

1534 0000      /PRINT ROUTINE
                PRLP, 0

```

```

1535 6046      TLS           /XMIT CHARACTER
1536 6041      TSF           /WAIT FOR FLAG
1537 5336      JMP           ,-1
1540 7200      CLA
1541 5734      JMP I    PRLP          /RETURN
    
```

/CARRIAGE RETURN LINE FEED ROUTINE

```

1542 0000      CRLF, 0
1543 7240      CLA CMA
1544 0042      AND           K215          /CARRIAGE RETURN CODE
1545 4334      JMS           PRLP          /PRINT ROUTINE
1546 7240      CLA CMA
1547 0041      AND           K212          /LINE FEED CODE
1550 4334      JMS           PRLP          /PRINT ROUTINE
1551 5742      JMP I    CRLF          /RETURN
    
```

/ROUTINE TO CLEAR WORKING BUFFERS PRIOR TO TEST

```

1552 0000      XSETUP, 0
1553 4451      JMS I    XMOVE          /CLEAR WORK AREA
1554 0026      TEMP0
1555 0027      TEMP A
1556 7773      -5
1557 6002      IOF
1560 6007      CAF
1561 1167      TAD           [5402
1562 3001      DCA           1
1563 7040      CMA
1564 3061      DCA           ERSWIT
1565 3767      DCA I    XIND
1566 5752      JMP I    XSETUP
1567 1346      XIND,  IND
    
```

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/ROUTINE TO CHECK IF TEST COMPLETED ITERATION

```

1600 0000      XTAL, 0
1601 7604      LAS
1602 0022      AND           SW2          /LOOP OVERRIDE?
1603 7640      SZA CLA
1604 5230      JMP           XTAL1        /YES
1605 7604      LAS
1606 0025      AND           SW5          /TEST SELECTED?
1607 7640      SZA CLA
1610 5214      JMP           ,+4
1611 2033      ISZ           TALLY        /DONE WITH TEST?
1612 7410      SKP
1613 5230      JMP           XTAL1        /YES
1614 1061      TAD           ERSWIT      /CHECK FOR ERROR
1615 7640      SZA CLA          /ERROR THIS PASS?
1616 5224      JMP           ,+6
1617 1017      TAD           MSGPNT      /GET MESSAGE POINTER
    
```

```

1620 1044 TAD M1 /DECREMENT POINTER
1621 3017 DCA MSGPNT /RESTORE POINTER
1622 1044 TAD M1
1623 3061 DCA ERSWIT /RESTORE ERROR INDICATOR
1624 1200 TAD XTAL /SET RETURN ADDRESS
1625 1045 TAD M2
1626 3200 DCA XTAL /STORE RETURN ADDRESS
1627 5600 JMP I XTAL
1630 2017 XTAL1, ISZ MSGPNT
1631 5620 JMP I XTAL

```

/POINTER FOR SELECTED TEST OPTION

```

1632 0223 XTEST, TST0-1
1633 0240 TST1-1
1634 0265 TST2-1
1635 0306 TST3-1
1636 0326 TST4-1
1637 0346 TST5-1
1640 0400 TST6-1
1641 0426 TST7-1
1642 0451 TST10-1
1643 0501 TST11-1
1644 0600 TST12-1
1645 0636 TST13-1
1646 0710 TST14-1

```

/ROUTINE TO SELECT SPECIFIC LOGIC TEST SUBROUTINE

```

1647 0000 XSELEC, 0
1650 7604 LAS /GET TEST
1651 0175 AND [17
1652 3026 DCA TEMP0 /STORE TEST
1653 1026 TAD TEMP0
1654 1044 TAD M1
1655 1166 TAD [140
1656 3017 DCA 17 /MESSAGE POINTER SET NOW
1657 1026 TAD TEMP0 /GET TEST
1660 1266 TAD JMPLOC /DEVELOP POINTER
1661 0050 AND K77
1662 1267 TAD JMPINS /DEVELOP INSTRUCTION
1663 3264 DCA JMPPTR
1664 7402 JMPPTR, HLT /DO IT!
1665 7402 HLT /TRAP
1666 1632 JMPLOC, XTEST
1667 5620 JMPINS, 5620

```

/ERROR HANDLERS FOR OPEN LOOP TESTS

```

1670 0000 ERPT1, 0
1671 7604 LAS
1672 0020 AND SW0
1673 7710 SPA CLA
1674 5300 JMP ,+4

```

```

1675 4777'      JMS      MESSAGE
1676 4003      MSG20
1677 4776'      JMS      CRLF
1700 4775'      JMS      MESS
1701 4776'      JMS      CRLF
1702 7604      LAS
1703 0021      AND      SW1      /HALT ON ERROR?
1704 7650      SNA CLA /SKIP IF YES
1705 5670      JMP I   ERPT1
1706 7402      HLT
1707 5774'      JMP      RESOL      /RETURN TO ROUTINE

1710 0000      ERPT2, 0
1711 7604      LAS
1712 0020      AND      SW0
1713 7710      SPA CLA
1714 5320      JMP      .+4
1715 4777'      JMS      MESSAGE
1716 4034      MSG21
1717 4776'      JMS      CRLF
1720 7604      LAS
1721 0021      AND      SW1      /HALT ON ERROR?
1722 7650      SNA CLA /SKIP IF YES
1723 5710      JMP I   ERPT2
1724 1027      TAD      TEMPA
1725 7402      HLT
1726 7200      CLA
1727 1030      TAD      TEMPB
1730 7402      HLT
1731 5773'      JMP      NOISE      /RETURN TO ROUTINE

1732 0000      ERPT3, 0
1733 7604      LAS
1734 0020      AND      SW0
1735 7710      SPA CLA
1736 5342      JMP      .+4
1737 4777'      JMS      MESSAGE
1740 4056      MSG22
1741 4776'      JMS      CRLF
1742 7604      LAS
1743 0021      AND      SW1
1744 7650      SNA CLA
1745 5732      JMP I   ERPT3
1746 1332      TAD      ERPT3
1747 1044      TAD      M1
1750 7402      HLT

1751 0000      ERPT4, 0
1752 4777'      JMS      MESSAGE
1753 4105      MSG23
1754 4776'      JMS      CRLF
1755 5751      JMP I   ERPT4

1756 0000      ERPT5, 0
1757 7604      LAS

```

1760	0020	AND	SW0
1761	7710	SPA	CLA
1762	5366	JMP	,+4
1763	4777'	JMS	MESSAGE
1764	4122	EMSG24	
1765	4776'	JMS	CRLF
1766	5756	JMP I	ERPT5

1773	2051
1774	2200
1775	3000
1776	1542
1777	1274
	2000

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/MONOTONICITY TEST

2000	7300	MONOT,	CLA	CLL	
2001	3027		DCA	TEMPA	/CLEAR N AND
2002	3030		DCA	TEMPB	/N+1 CONVERSION STORAGE
2003	4520		ADCL		/CLEAR CONVERTER
2004	4522		ADST		/START CONVERSION
2005	4524		ADSK		/WAIT FOR DONE
2006	5205		JMP	.-1	
2007	4523		ADRB		/READ A-D BUFFER
2010	3027		DCA	TEMPA	/STORE NTH CONVERSION
2011	7604	CONT,	LAS		/GET SWITCHES
2012	7040		CMA		/COMPLEMENT FOR DOWN COUNT
2013	3032		DCA	CNTR1	
2014	4522		ADST		/DO N+1ST CONVERSION
2015	4524		ADSK		
2016	5215		JMP	.-1	
2017	4523		ADRB		
2020	3030		DCA	TEMPB	/SAVE
2021	1027		TAD	TEMPA	/SUBTRACT
2022	7041		CIA		
2023	1030		TAD	TEMPB	
2024	7510		SPA		/>0?
2025	7041		CIA		/NO, TAKE ABSOLUTE VALUE
2026	7450		SNA		/DIFFERENCE 0?
2027	5243		JMP	OK	/YES, OK,
2030	1044		TAD	M1	
2031	7650		SNA	CLA	/DIFFERENCE = 1?
2032	5243		JMP	OK	/YES, OK,
2033	4777'		JMS	ERPT4	
2034	7200		CLA		
2035	1027		TAD	TEMPA	/DIFFERENCE > 1, DISPLAY NTH CONVERSION
2036	7402		HLT		
2037	7300		CLA	CLL	
2040	1030		TAD	TEMPB	/DISPLAY N+1 CONVERSION
2041	7402		HLT		
2042	5200		JMP	MONOT	/RESTART TO RESYNC
2043	2032	OK,	ISZ	CNTR1	/STALL

2044	5243	JMP	.	-1	
2045	7300	CLA	CLL		
2046	1030	TAD	TEMPB	/N+1	CONVERSION BECOMES
2047	3027	DCA	TEMPA	/N	
2050	5211	JMP	CONT	/GET	N+1 CONVERSION

/ROUTINE TO TEST FOR EQUALITY OF TWO SUCCESSIVE ADRB'S.

```

2051 7300 NOISE, CLA CLL
2052 1177 TAD [-100 /SET TALLY FOR 64 TIMES
2053 3026 DCA TEMP0
2054 1022 TAD SW2 /ENABLE DONE BIT
2055 4521 ADLM /LOAD MPX REG
2056 4522 ADST /CONVERT
2057 4524 ADSK /DONE FLAG?
2060 5257 JMP .-1 /NO
2061 4523 ADRB /YES, READ AD BUFFER
2062 3027 DCA TEMPA /STORE
2063 4523 ADRB /RE-READ
2064 3030 DCA TEMPB /STORE
2065 1027 TAD TEMPA /COMPARE FOR EQUALITY
2066 7041 CIA
2067 1030 TAD TEMPR
2070 7420 SNL /LINK SHOULD BE SET
2071 4776 JMS ERPT2 /NOT EQUAL
2072 7440 SZA
2073 4776 JMS ERPT2 /NOT EQUAL
2074 7300 CLA CLL
2075 2026 ISZ TEMP0 /CONTINUE
2076 5256 JMP NOISE+5 /YES
2077 7200 CLA
2100 1040 TAD K207
2101 4775 JMS PRLP /RING BELL
2102 5251 JMP NOISE /DO TEST AGAIN
    
```

/ROUTINE TO CHECK FOR NOISE IN MULTIPLEXER

```

2103 7300 GLITCH, CLA CLL
2104 1177 TAD [-100
2105 3026 DCA TEMP0
2106 7604 LAS /OPERATOR TO SELECT CHANNEL
2107 0175 AND [17
2110 3031 DCA TEMPC
2111 1031 TAD TEMPC
2112 4521 ADLM
2113 4522 ADST
2114 4524 ADSK
2115 5314 JMP .-1
2116 4523 ADRB
2117 3027 DCA TEMPA
2120 4344 CHNL1, JMS RANCHN /GET RANDOM CHANNEL
2121 1077 TAD CHNL
2122 4521 ADLM
2123 4527 ADRS
2124 2026 ISZ TEMP0
2125 5320 JMP CHNL1
2126 7300 CLA CLL
2127 4523 ADRB
2130 3030 DCA TEMPR
2131 1027 TAD TEMPA
    
```

2132	7041		CIA	
2133	1030		TAD	TEMPB
2134	7420		SNL	
2135	4774		JMS	ERPT5
2136	7440		SZA	
2137	4774		JMS	ERPT5
2140	7300		CLA	CLL
2141	1040		TAD	K207
2142	4775		JMS	PRLP
2143	5303		JMP	GLITCH
2144	1357	RANCHN,	TAD	FSTNO
2145	7006		RTL	
2146	3357		DCA	FSTNO
2147	1357		TAD	FSTNO
2150	1360		TAD	SECNO
2151	7006		RTL	
2152	1360		TAD	SECNO
2153	7012		RTR	
2154	0175		AND	E17
2155	3077		DCA	CHNL
2156	5744		JMP I	RANCHN
2157	0437	FSTNO,	0437	
2160	2525	SECNO,	2525	

2174 1756
 2175 1534
 2176 1710
 2177 1751
 2200

PAGE

/ROUTINE TO PERFORM 64 CONVERSIONS OF ANY GIVEN VOLTAGE ON SELECTED CHANNEL

```

2200 0065  RESOL,  SETUP
2201 1053          TAD      XSTOR
2202 3010          DCA      10
2203 3270          DCA      STORAG
2204 4451          JMS I   XMOVE      /CLEAR WORK AREA
2205 2270          STORAG
2206 2271          STORAG+1
2207 7700          -100
2210 1177          TAD      [-100
2211 3026          DCA      TEMP0
2212 4520          ADCL
2213 7604          LAS              /GET CHANNEL
2214 0175          AND      [17
2215 3062          DCA      CHAN      /STORE CHANNEL
2216 1062          TAD      CHAN
2217 4521          ADLM              /LOAD CHANNEL
2220 4522          ADST
2221 4524          ADSK
2222 5221          JMP      ,-1
2223 4523          ADRB
2224 3410          DCA I   10        /PLACE IN TABLE
2225 2026          ISZ     TEMP0     /DONE?
2226 5220          JMP      ,-6      /NO
2227 5454          JMP I   XCOMPR    /YES, NOW CHECK
    
```

/STORAGE TABLE FOR VOLTAGE COMPARISONS
 *.50

```

2270 0000  STORAG, 0      /100(8) LOCATIONS
2400 2400  PAGE
    
```

/ROUTINE TO COMPARE FOR GREATER THAN + OR - 1 LSB DIFFERENCE IN 64 CONVERSIONS

```

2400 7300  COMPAR, CLA CLL
2401 1165          TAD      [-77
2402 3026          DCA      TEMP0
2403 1053          TAD      XSTOR    /POINTER FOR FIRST WORD
2404 3010          DCA      10
2405 1410          TAD I   10
2406 3027          DCA      TEMPA
2407 7200  COMPR1, CLA
2410 1410          TAD I   10
2411 3030          DCA      TEMPB
2412 1027          TAD      TEMPA
2413 7041          CIA
2414 1030          TAD      TEMPR
2415 7440          SZA              /SKIP HERE
    
```

```

2416 5222      JMP      .+4      /AND
2417 7420      SNL      /HERE IF =
2420 5222      JMP      .+2
2421 5257      JMP      AOK
2422 7430      SZL
2423 5230      JMP      .+5
2424 7040      CMA
2425 7440      SZA      /SKIP HERE IF DIFFERENCE +1 LSB
2426 7410      SKP
2427 5257      JMP      AOK
2430 7100      CLL
2431 7010      RAR
2432 7440      SZA      /SKIP HERE
2433 5237      JMP      .+4      /AND
2434 7420      SNL      /HERE IF DIFFERENCE -1 LSB
2435 7410      SKP
2436 5257      JMP      AOK
2437 7300      CLA CLL      /CHECK FOR SPECIAL CASE OF 7777 AND 0
2440 1027      TAD      TEMP A
2441 7440      SZA      /A=0?
2442 7410      SKP      /NO
2443 5247      JMP      .+4      /YES
2444 7040      CMA      /A=7777?
2445 7440      SZA      /SKIP IF YES
2446 4777      JMS      ERPT1
2447 1030      TAD      TEMP B
2450 7440      SZA      /A =7777 OR 0
2451 5253      JMP      .+2      /B=0?
2452 5257      JMP      AOK      /NO
2453 7040      CMA      /B=7777?
2454 7440      SZA      /SKIP IF YES
2455 4777      JMS      ERPT1
2456 5257      JMP      AOK
2457 7300      AOK, CLA CLL
2460 1030      TAD      TEMP B
2461 3027      DCA      TEMP A
2462 2026      ISZ      TEMP 0
2463 5207      JMP      COMPR1      /DONE?
2464 5776      JMP      RESOL      /NO
                                /YES, REPEAT TEST

```

2576 2200
2577 1670
2600

PAGE

/LABB-E SYSTEM CHECK

```

2600 0000      SYST, 0
2601 4465      JMS I   SETUP
2602 4520      ADCL
2603 7402      HLT
2604 7604      LAS
2605 0377      AND      (730
2606 1376      TAD      (4040
2607 3031      DCA      TEMP C
2610 1031      TAD      TEMP C
                                /RATE AND ENABLE EXT'L
                                /SAVE

```

2611	4530	CLOE		
2612	7040	CMA		
2613	4532	CLZE		
2614	7200	CLA		
2615	1024	TAD	SW4	/EXT START FOR A-D
2616	3026	DCA	TEMP2	
2617	4775	JMS	MESSAGE	
2620	4215	AUTMSG		
2621	7402	HLT		
2622	7604	LAS		
2623	0025	AND	SW5	
2624	7440	SZA		/SKIP IF NOT AUTO-INCREMENT
2625	4321	JMS	LSTCHN	/CHECK FOR LAST CHANNEL
2626	7604	LAS		
2627	0175	AND	[17	
2630	4521	ADLM		/LOAD CHANNEL
2631	1026	TAD	TEMP0	
2632	4526	ADLE		/LOAD EXT ENABLE BIT IF PRESENT
2633	1026	TAD	TEMP0	
2634	7650	SNA CLA		/SKIP FOR EXTL ENABLE
2635	5245	JMP	,+10	
2636	1374	TAD	(7001	/-X(MAX)
2637	3027	DCA	TEMPA	
2640	4533	CLSA		
2641	4531	CLSK		
2642	5241	JMP	,-1	
2643	7240	CLA CMA		
2644	4532	CLZE		/STOP CLOCK
2645	7200	CLA		
2646	7410	SKP		
2647	4522	ADST		
2650	4524	ADSK		
2651	5250	JMP	,-1	
2652	4527	ADRS		
2653	0175	AND	[17	
2654	1030	TAD	TEMPB	
2655	7001	IAC		
2656	7440	SZA		
2657	5261	JMP	,+2	
2660	4521	ADLM		
2661	4523	ADRB		
2662	4540	DILY		
2663	7200	CLA		
2664	1027	TAD	TEMPA	
2665	4537	DILX		
2666	7001	IAC		
2667	3027	DCA	TEMPA	
2670	1027	TAD	TEMPA	
2671	1374	TAD	(7001	
2672	7640	SZA CLA		/SKIP IF +X(MAX)
2673	7410	SKP		
2674	5325	JMP	RESTR	
2675	4536	DISD		
2676	5275	JMP	,-1	

CLKST,

2677	4541		DIXY		
2700	1046		TAD	M4	
2701	3340		DCA	TEMPX	
2702	2340		ISZ	TEMPX	
2703	5302		JMP	, -1	
2704	5245		JMP	CLKST+7	
2705	1031	RESTR,	TAD	TEMPC	/TO RESTART CLOCK
2706	4530		CLOE		
2707	7040		CMA		
2710	4532		CLZE		
2711	7604		LAS		
2712	0025		AND	SW5	/A-I MODE
2713	7640		SZA CLA		/SKIP IF NO
2714	5236		JMP	CLKST	
2715	7604		LAS		
2716	0175		AND	[17	/TO CHANGE CHANNEL
2717	4521		ADLM		
2720	5236		JMP	CLKST	/GO
2721	0000	LSTCHN, 0			
2722	7604		LAS		
2723	0175		AND	[17	
2724	7040		CMA		
2725	3030		DCA	TEMPB	
2726	2321		ISZ	LSTCHN	
2727	2321		ISZ	LSTCHN	
2730	7604		LAS		
2731	0025		AND	SW5	
2732	7650		SNA CLA		
2733	5337		JMP	, +4	
2734	1024		TAD	SW4	
2735	1025		TAD	SW5	
2736	3026		DCA	TEMP0	
2737	5721		JMP I	LSTCHN	
2740	0000	TEMPX, 0			

2774	7021				
2775	1274				
2776	4040				
2777	0700				
	3000				
3000	0000	PAGE			
3001	4777	MESS, 0	JMS	CRLF	
3002	7300		CLA CLL		
3003	1027		TAD	TEMPA	
3004	2376		AND	(7000	
3005	7022		BSW		
3006	7012		RTR		
3007	7010		RAR		
3010	1375		TAD	(260	
3011	4774		JMS	PRLP	
3012	7300		CLA CLL		
3013	1027		TAD	TEMPA	
3014	7006		RTL		
3015	7024		RAL		

3016	0376	AND	(7000
3017	7002	BSW	
3020	7012	RTR	
3021	7010	RAR	
3022	1375	TAD	(260
3023	4774'	JMS	PRLP
3024	7300	CLA CLL	
3025	1027	TAD	TEMPA
3026	7012	RTR	
3027	7010	RAR	
3030	0373	AND	(7
3031	1375	TAD	(260
3032	4774'	JMS	PRLP
3033	7300	CLA CLL	
3034	1027	TAD	TEMPA
3035	0373	AND	(7
3036	1375	TAD	(260
3037	4774'	JMS	PRLP
3040	7300	CLA CLL	
3041	4777'	JMS	CRLF
3042	7300	CLA CLL	
3043	1030	TAD	TEMPB
3044	0376	AND	(7000
3045	7002	BSW	
3046	7010	RAR	
3047	7012	RTR	
3050	1375	TAD	(260
3051	4774'	JMS	PRLP
3052	7300	CLA CLL	
3053	1030	TAD	TEMPB
3054	7006	RTL	
3055	7004	RAL	
3056	0376	AND	(7000
3057	7002	BSW	
3060	7010	RAR	
3061	7012	RTR	
3062	1375	TAD	(260
3063	4774'	JMS	PRLP
3064	7300	CLA CLL	
3065	1030	TAD	TEMPB
3066	7010	RAR	
3067	7012	RTR	
3070	0373	AND	(7
3071	1375	TAD	(260
3072	4774'	JMS	PRLP
3073	7300	CLA CLL	
3074	1030	TAD	TEMPB
3075	0373	AND	(7
3076	1375	TAD	(260
3077	4774'	JMS	PRLP
3100	7300	CLA CLL	
3101	4777'	JMS	CRLF
3102	4777'	JMS	CRLF
3103	7300	CLA CLL	
3104	5600	JMP I	MESS

3173 0007
3174 1534
3175 0260
3176 7000
3177 1542
3200

PAGE

/CONTROL LOGIC ERROR MESSAGES

3200 3736
3201 2405
3202 2324
3203 4060
3204 4055
3205 4004
3206 1716
3207 0540
3210 0614
3211 0107
3212 4017
3213 2240
3214 2411
3215 1511
3216 1607
3217 4005
3220 2222
3221 1722
3222 4006
3223 1401
3224 0740
3225 1617
3226 2440
3227 0314
3230 0501
3231 2205
3232 0440
3233 1722
3234 4023
3235 1311
3236 2040
3237 0601
3240 1114
3241 2522
3242 0537
3243 3600
3244 3736
3245 2405
3246 2324
3247 4061
3250 4055
3251 4004
3252 1716
3253 0540

EMSG0, TEXT "♦♦TEST 0 - DONE FLAG OR TIMING ERROR FLAG NOT CLEARED OR SKIP FAILURE♦♦"

EMSG1, TEXT "♦♦TEST 1 - DONE FLAG NOT SET THEN CLEARED OR SKIP FAILURE♦♦"

3254 0614
3255 0107
3256 4016
3257 1724
3260 4023
3261 0524
3262 4024
3263 1005
3264 1640
3265 0314
3266 0501
3267 2205
3270 0440
3271 1722
3272 4023
3273 1311
3274 2040
3275 0601
3276 1114
3277 2522
3300 0537
3301 3600
3302 3736
3303 2405
3304 2324
3305 4062
3306 4055
3307 4024
3310 1115
3311 1116
3312 0740
3313 0522
3314 2217
3315 2240
3316 0614
3317 0107
3320 4016
3321 1724
3322 4023
3323 0524
3324 4024
3325 1005
3326 1640
3327 0314
3330 0501
3331 2205
3332 0440
3333 1722
3334 4023
3335 1311
3336 2040
3337 0601
3340 1114
3341 2522
3342 0537

EMSG2, TEXT "••TEST 2 - TIMING ERROR FLAG NOT SET THEN CLEARED OR SKIP FAILURE••"

3343 3600
3344 3736
3345 2405
3346 2324
3347 4063
3350 4055
3351 4025
3352 1605
3353 3020
3354 0503
3355 2405
3356 0440
3357 1116
3360 2405
3361 2222
3362 2520
3363 2440
3364 1703
3365 0325
3366 2222
3367 0504
3370 3736
3371 0000
3372 3736
3373 2405
3374 2324
3375 4064
3376 4055
3377 4001
3400 0422
3401 0240
3402 0601
3403 1114
3404 0504
3405 4024
3406 1740
3407 1201
3410 1540
3411 2422
3412 0116
3413 2306
3414 0522
3415 4024
3416 1740
3417 0103
3420 3736
3421 0000
3422 3736
3423 2405
3424 2324
3425 4065
3426 4055
3427 4001
3430 0422
3431 2342

EMSG3, TEXT "++TEST 3 - UNEXPECTED INTERRUPT OCCURRED++"

EMSG4, TEXT "++TEST 4 - ADRB FAILED TO JAM TRANSFER TO AC++"

EMSG5, TEXT "++TEST 5 - ADRS FAILED TO JAM TRANSFER TO AC++"

3432 0601
3433 1114
3434 0524
3435 4024
3436 1740
3437 1201
3440 1540
3441 2422
3442 0116
3443 2326
3444 0522
3445 4024
3446 1740
3447 0103
3450 3736
3451 0000
3452 3736
3453 2405
3454 2324
3455 4066
3456 4055
3457 4005
3460 1601
3461 0214
3462 0540
3463 2205
3464 0711
3465 2324
3466 0522
3467 4016
3470 1724
3471 4020
3472 2217
3473 2005
3474 2214
3475 3140
3476 1417
3477 0104
3500 0504
3501 3736
3502 0000
3503 3736
3504 2405
3505 2324
3506 4067
3507 4055
3510 4006
3511 0111
3512 1405
3513 0440
3514 2417
3515 4007
3516 0516
3517 0522
3520 0124

EMSG6, TEXT ".*TEST 6 - ENABLE REGISTER NOT PROPERLY LOADED.*"

EMSG7, TEXT ".*TEST 7 - FAILED TO GENERATE INTERRUPT WITH DONE FLAG.*"

3521 0540
3522 1116
3523 2405
3524 2222
3525 2520
3526 2440
3527 2711
3530 2410
3531 4024
3532 1716
3533 0540
3534 0614
3535 0107
3536 3736
3537 0000
3540 3736
3541 2405
3542 2324
3543 4061
3544 6040
3545 5540
3546 0601
3547 1114
3550 0504
3551 4024
3552 1740
3553 0705
3554 1605
3555 2201
3556 2405
3557 4011
3560 1624
3561 0522
3562 2225
3563 2024
3564 4027
3565 1124
3566 1040
3567 2411
3570 1511
3571 1607
3572 4025
3573 2222
3574 1722
3575 4026
3576 1401
3577 0737
3600 3620
3601 3736
3602 2405
3603 2324
3604 4061
3605 6140
3606 5540
3607 0601

MSG10, TEXT "♦♦TEST 10 - FAILED TO GENERATE INTERRUPT WITH TIMING ERROR FLAG♦♦"

MSG11, TEXT "♦♦TEST 11 - FAILED TO LOAD AND READ MPX REG AND CLEAR AC♦♦"

3610 1114
3611 0504
3612 4024
3613 1740
3614 1417
3615 0104
3616 4001
3617 1604
3620 4022
3621 0501
3622 0440
3623 1520
3624 3040
3625 2205
3626 0740
3627 0116
3630 0440
3631 0314
3632 0501
3633 2240
3634 0123
3635 3736
3636 0000
3637 3736
3640 2405
3641 2324
3642 4061
3643 6240
3644 5040
3645 0601
3646 1114
3647 0504
3650 4024
3651 1740
3652 1417
3653 0104
3654 4001
3655 1604
3656 4022
3657 0501
3660 0440
3661 0114
3662 1440
3663 0310
3664 0116
3665 1605
3666 1423
3667 4011
3670 1624
3671 1740
3672 1520
3673 3040
3674 2205
3675 0737
3676 3600

EMSG12, TEXT "♦TEST 12 - FAILED TO LOAD AND READ ALL CHANNELS INTO MPX REG♦"

3677 3736
3700 2425
3701 2324
3702 4061
3703 6340
3704 5540
3705 0601
3706 1114
3707 0504
3710 4024
3711 1740
3712 1417
3713 0104
3714 4001
3715 1604
3716 4022
3717 0501
3720 0440
3721 0114
3722 1440
3723 0310
3724 0116
3725 1605
3726 1423
3727 4011
3730 1640
3731 0125
3732 2417
3733 5511
3734 1603
3735 2205
3736 1505
3737 1624
3740 4015
3741 1704
3742 0537
3743 3600
3744 3736
3745 2405
3746 2324
3747 4061
3750 6440
3751 5540
3752 0601
3753 1114
3754 0504
3755 4024
3756 1740
3757 0317
3760 1520
3761 1405
3762 2425
3763 4003
3764 1716
3765 2605

EMSG13, TEXT "TEST 13 - FAILED TO LOAD AND READ ALL CHANNELS IN AUTO-INCREMENT MODE"

EMSG14, TEXT "TEST 14 - FAILED TO COMPLETE CONVERSION IN SPECIFIED TIME"

3766 2223
3767 1117
3770 1640
3771 1116
3772 4023
3773 2025
3774 0311
3775 0611
3776 0504
3777 4024
4000 1115
4001 0537
4002 3600
4003 3736
4004 0601
4005 1114
4006 0504
4007 4024
4010 1740
4011 2205
4012 2317
4013 1426
4014 0540
4015 0317
4016 1626
4017 0522
4020 2311
4021 1716
4022 2340
4023 2417
4024 4053
4025 4017
4026 2240
4027 5540
4030 6140
4031 1423
4032 0237
4033 3600
4034 3736
4035 2427
4036 1740
4037 2525
4040 0303
4041 0523
4042 2311
4043 2605
4044 4022
4045 0501
4046 0423
4047 4016
4050 1724
4051 4025
4052 2125
4053 0114
4054 3736

EMSG20, TEXT "♦♦FAILED TO RESOLVE CONVERSIONS TO + OR - 1 LSB♦♦"

EMSG21, TEXT "♦♦TWO SUCCESSIVE READS NOT EQUAL♦♦"

4055 0000
4056 3736
4057 0522
4060 2217
4061 1605
4062 1725
4063 2340
4064 0530
4065 2405
4066 2216
4067 0114
4070 4005
4071 1601
4072 0214
4073 0540
4074 1722
4075 4024
4076 1115
4077 1116
4100 0740
4101 0522
4102 2217
4103 2237
4104 3600
4105 3736
4106 1517
4107 1617
4110 2411
4111 1611
4112 0311
4113 2431
4114 4006
4115 0111
4116 1425
4117 2205
4120 3736
4121 0000
4122 3736
4123 1617
4124 1123
4125 0540
4126 1116
4127 4015
4130 2514
4131 2411
4132 2014
4133 0530
4134 0522
4135 4001
4136 1604
4137 4001
4140 5504
4141 4002
4142 2506
4143 2605

EMSG22, TEXT "ERRONEOUS EXTERNAL ENABLE OR TIMING ERROR"

EMSG23, TEXT "MONOTONICITY FAILURE"

EMSG24, TEXT "NOISE IN MULTIPLEXER AND A-D BUFFER"

4144 2237
4145 3620
4146 3736
4147 0516
4150 0440
4151 1706
4152 4014
4153 1707
4154 1103
4155 4024
4156 0523
4157 2437
4160 3620

/END OF LOGIC TEST TYPESTRING
XEND, TEXT "END OF LOGIC TEST"

4161 3736
4162 0104
4163 7005
4164 4001
4165 4024
4166 1740
4167 0440
4170 0317
4171 1626
4172 0522
4173 2405
4174 2254
4175 4001
4176 1570
4177 0540
4200 1525
4201 1424
4202 1120
4203 1405
4204 3005
4205 2240
4206 0411
4207 0107
4210 1617
4211 2324
4212 1103
4213 3736
4214 0000
4215 3736
4216 2305
4217 2440
4220 2527
4221 6540
4222 5001
4223 2524
4224 1755
4225 1116
4226 0351
4227 5440
4230 4340

/HEADER MESSAGE
XLABEL, TEXT "AD8E A TO D CONVERTER, AM8E MULTIPLEXER DIAGNOSTIC"

AUTMSG, TEXT "SET SW5 (AUTO-INC), # OF CHANS IN SW8-11, OR SET SW8-11 (SINGLE CHAN)"

4231 1706
4232 4003
4233 1001
4234 1623
4235 4011
4236 1640
4237 2327
4240 7055
4241 6161
4242 5440
4243 1722
4244 4023
4245 0524
4246 4023
4247 2770
4250 5561
4251 6140
4252 5023
4253 1116
4254 0714
4255 0540
4256 0310
4257 0116
4260 5137
4261 3600

8

0165 7701
0166 0140
0167 5402
0170 0076
0171 7760
0172 0475
0173 0445
0174 7761
0175 0017
0176 0322
0177 7700

4000	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4100	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111

4200	11111111	11111111	11111111	11111111	11111111	11111111	11000000	00000000
4300	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

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

ADCL	4520	EMSG6	3452	SCOPE	1257	XCONVT	0035
ADLE	4526	EMSG7	3503	SECNO	2160	XDILE	0142
ADLM	4521	EOUT	1242	SELECT	0064	XDILX	0137
ADRB	4523	ERMSG	0145	SETUP	0065	XDILY	0140
ADRS	4527	ERPT1	1670	START	0211	XDISD	0136
ADSE	4525	ERPT2	1710	STORAG	2270	XDIXY	0141
ADSK	4524	ERPT3	1732	SW0	0020	XEND	4146
ADST	4522	ERPT4	1751	SW1	0021	XGLIT	0057
AOK	2457	ERPT5	1756	SW2	0022	XIND	1567
AUTMSG	4215	ERR	0034	SW3	0023	XINSTR	0036
AUTO1	0643	ERSWIT	0061	SW4	0024	XLABEL	4161
AUTO2	0674	ERTYP	1226	SW5	0025	XMONOT	0037
BSW	7002	EXIT	1271	SYST	2600	XMOVE	0051
CAF	6007	EXT1	1032	TADDR	1224	XNOISE	0056
CHAN	0062	EXTBL	0052	TAL	0063	XRESOL	0055
CHNL	0077	EXTL	1024	TALLY	0033	XSELEC	1647
CHNL1	2120	EXTTE	1066	TEMP0	0026	XSETUP	1552
CLAB	4535	FADDR	1223	TEMPA	0027	XSTOR	0053
CLED	4534	FINIS	0730	TEMPB	0030	XSYST	0060
CLKST	2636	FSTNO	2157	TEMPC	0031	XTAL	1600
CLOE	4530	GLITCH	2103	TEMPX	2740	XTAL1	1630
CLSA	4533	IND	1346	TMG1	0475	XTEST	1632
CLSK	4531	INITL	0216	TST0	0224	XXADCL	1410
CLZE	4532	INSTR	1400	TST1	0241	XXADLE	1444
CNTR1	0032	JMPINS	1667	TST10	0452	XXADLM	1414
COMPAR	2400	JMPLOC	1666	TST11	0502	XXADRB	1424
COMPR1	2407	JMPPTR	1664	TST12	0601	XXADRS	1450
CONT	2011	K1000	0047	TST13	0637	XXADSE	1436
CONVT	1000	K207	0040	TST14	0711	XXADSK	1430
CRLF	1542	K212	0041	TST2	0266	XXADST	1420
DILE	4542	K215	0042	TST3	0307	XXCLAB	1502
DILX	4537	K6500	0043	TST3S	0322	XXCLED	1476
DILY	4540	K77	0050	TST4	0327	XXCLOE	1454
DISD	4536	LSTCHN	2721	TST5	0347	XXCLSA	1472
DIXY	4541	M1	0044	TST6	0401	XXCLSK	1460
DON1	0445	M2	0045	TST7	0427	XXCLZE	1466
EMSG0	3200	M4	0046	TYPECH	1314	XXDILE	1530
EMSG1	3244	MCTR	1225	XADCL	0120	XXDILX	1514
EMSG10	3540	MESAGE	1274	XADLE	0126	XXDILY	1520
EMSG11	3601	MESS	3000	XADLM	0121	XXDISD	1506
EMSG12	3637	MONOT	2000	XADRB	0123	XXDIXY	1524
EMSG13	3677	MOVE	1200	XADRS	0127		
EMSG14	3744	MOVEA	1213	XADSE	0125		
EMSG2	3302	MSGPNT	0017	XADSK	0124		
EMSG20	4003	MSRGHT	1313	XADST	0122		
EMSG21	4034	MTP	1340	XCLAB	0135		
EMSG22	4056	NOISE	2051	XCLED	0134		
EMSG23	4125	OK	2043	XCLOE	0130		
EMSG24	4122	PRLP	1534	XCLSA	0133		
EMSG3	3344	RANCHN	2144	XCLSK	0131		
EMSG4	3372	RESOL	2200	XCLZE	0132		
EMSG5	3422	RESTR	2705	XCOMPR	0054		

