IDENTIFICATION

PRODUCT CODE: MAINDEC-08-D6UB-D

PRODUCT NAME: AD01-A DIAGNOSTIC

DATE CREATED: MARCH 11, 1971

MAINTAINER: DIAGNOSTIC GROUP

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1. ABSTRACT

FOR THE AD01-A, THIS IS A I/O INSTRUCTION TEST AND A LIMITED TEST OF CALIBRATION AND REPEATABILITY

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-8I AD01-A STANDARD COMPUTER
G735 TEST CARD (OPTIONAL)
APPLY .625 VDC TO CHANNEL 0
OF THE MULTIPLEXER

2.2 STORAGE

2.2.1 PROGRAM STORAGE - THE ROUTINE USES MEMORY FROM 0000 TO 3000.

3. LOADING PROCEDURE

3.1 METHOD

PROCEDURE FOR NORMAL BINARY TAPES SHOULD BE FOLLOWED.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTING

STARTING AT SA 200 ALL SWITCHES SHOULD BE DOWN OR ZERO.

4.2 STARTING ADDRESS OR ADDRESSES

(A) 200 = NORMAL STARTING ADDRESS
AT 1ST HALT-LOAD INITIAL CHANNEL TO BE TESTED,
AT 2ND HALT-LOAD LAST CHANNEL TO BE TESTED
AND GAIN TO BE USED FOR WAS-IS TEST,
SET SR TO 0YXX, WHERE Y=0,1,2,3 FOR
GAINS OF 1,2,4,8 AND XX=NUMBER OF CHANNELS
1-37.

Continue
Continue
continue

(B) 201 = RESTART START, USING VALUES SELECTED IN SA 200

(C) 202 = DISPLAYS CONVERTED VALUE IN AC (FOR CHECKING CALIBRATION), ALSO BITS 4 AND 5 CONTROL GAIN

(D) 203 = IOT SCOPE LOOP 65XX,XX EQUALS SR-6-11

(E) 204 = SWITCH REGISTER CONTROLS CONVERSION RATE.

(F) 205 = SWITCH REGISTER BIT 7-11 EQUALS MULTIPLEXER CHANNEL, 4 AND 5 EQUAL GAIN OF AMPLIFIER

(G) 206 = READ A-D BUFFER TWICE
SWITCH REGISTER 0-11 EQUALS DELAY BETWEEN
READINGS

2

4.3 PROGRAM AND/OR OPERATOR ACTION

LOAD PROGRAM INTO MEMORY.
SET SWITCH REGISTER TO STARTING ADDRESS.
LOAD ADDRESS.
PRESS START.
THE PROGRAM WILL STAY IN SECTION AND LOOP.

5. OPERATING PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

5.1.1 AT SA 200 .. THE INSTRUCTION AND LOGIC TEST.
WITH ALL SWITCHES DOWN THE PROGRAM WILL PRINT
OUT ON ERRORS AND CONTINUE IN TEST.

5.1.2 SWITCH SETTINGS ARE

SW0 = 1 OR UP .., HALT ON ERROR
SW1 = 1 OR UP .., SCOPE LOOP

SW2 = 1 OR UP .., INHIBIT PRINTOUT
SW3 = 1 OR UP...INHIBIT "0R" 1LSB TESTING
SW4 = GAIN
SW5 = GAIN
SW6 = 1 OR UP .., INHIBIT AVERAGING
SW7-SW11 = CHANNELS TO BE TESTED (AT 1ST AND 2ND HALT)

5.1.3

5.2 SUBROUTINE ABSTRACTS

5.2.1 BEGIN SA 200

5.2.2

5.2.3 SCOPE

THIS SUBROUTINE CALL IS PLACED BETWEEN EACH SUBTEST
IN THE INSTRUCTION SECTION, IT RECORDS THE STARTING
ADDRESS OF EACH SUB-TEST AS IT IS BEING ENTERED.
IF A SCOPE LOOP IS REQUESTED, IT WILL JUMP TO THE
START OF THE SUBTEST THAT THE SCOPE LOOP IS RE
QUESTED FOR.

5.2.4 HALT

IS A ROUTINE THAT PRINTS-OUT AN ADDRESS THAT TAGS
THE FAILING SUBTEST, AND THE INCORRECT DATA AT
THE TIME OF THE FAILURE.

(5. OPERATING PROCEDURE CONT'D)

5.3 PROGRAM AND/OR OPERATOR ACTION

5.3.1 LOADING AND STARTING AT 200 WITH ALL SWITCHES DOWN IS THE INSTRUCTION AND LOGIC TEST. IF AN ERROR IS DETECTED HERE, THERE WILL BE A PRINTOUT. WHEN AN ERROR IS DETECTED AND IT IS NECESSARY TO SCOPE ON IT, PLACE SW0 UP TO HALT ON ERROR, THEN SW1 UP TO LOOP ON ERROR, THEN SW2 UP TO DELETE PRINTOUTS.

6. ERRORS

6.1 ERROR PRINTOUT
REFER TO LISTING

6.2 ERROR RECOVERY
DEPRESS CONTINUE KEY TO RESUME TESTING AFTER AN ERROR HALT

DEPRESS CONTINUE TO RESTART SECTION

7. RESTRICTIONS

7.1 STARTING RESTRICTION

POLARITY, INITIAL CHANNEL AND NUMBER OF CHANNELS MUST BE SET INITIALLY

7.2 OPERATIONAL RESTRICTION

NONE

8. MISCELLANEOUS

8.1 EXECUTION TIME

NOT APPLICABLE

9. PROGRAM DESCRIPTION

FOR THE AD01-A, THERE ARE ONLY A LIMITED NUMBER OF CHECKS THAT CAN BE PERFORMED DUE TO THE NATURE OF ANALOG TO DIGITAL CONVERTERS; THESE CONSIST OF TESTING THE FLAG AND THE INTERRUPT AND THE PROGRAMMABLE GAIN. A VOLTAGE SOURCE IS NEEDED TO CHECK THE CALIBRATION AND REPEATABILITY. THE PRINCIPLE OF THE TEST IS THAT THERE SHOULD BE A VOLTAGE APPLIED TO EACH CHANNEL OF THE MULTIPLEXER, (GROUND IS CONSIDERED A VOLTAGE). IT IS DESIRABLE THAT EACH CHANNEL OF THE MULTIPLEXER HAVE A UNIQUE VOLTAGE. THE MULTIPLEXER IS SET TO THE INITIAL CHANNEL AND A CONVERSION IS MADE ON THAT CHANNEL AND THE RESULTS OF THAT CONVERSION IS STORED IN OUR "INITIAL TABLE" (ITABLE). THE MULTIPLEXER IS SET TO THE NEXT CHANNEL AND A CONVERSION MADE. THE RESULTS OF THAT CONVERSION IS STORED IN THE (ITABLE) AND REPEATED UNTIL THE VOLTAGE FOR EACH SELECTION CHANNEL HAS BEEN STORED IN THE TABLE. NEXT A NEW TABLE (NTABLE), IS MADE UP USING THE SET MULTIPLEXER INSTRUCTION. WHEN THE CONVERSIONS HAVE BEEN MADE ON EACH CHANNEL, THE CONTENTS OF THE TWO TABLES ARE COMPARED. IF A POSITION (CHANNEL) IN THE TABLES IS FOUND THAT DOES NOT COMPARE, A PRINTOUT OCCURS SHOWING THE CHANNEL AND THE TWO VOLTAGES. NEXT (NTABLE) IS TRANSFERRED TO (ITABLE) AND (NTABLE) IS NOW UPDATED USING THE INCREMENT INSTRUCTION; THE TABLES ARE COMPARED AND A PRINTOUT OCCURS IF THEY DO NOT AGREE. TRANSFER (NTABLE) TO (ITABLE), UPDATE (NTABLE) USING THE SET MULTIPLEXER INSTRUCTION; THIS SEQUENCE IS REPEATED UNTIL THE PROGRAM IS HALTED BY OPERATOR INTERVENTION. THE BELL WILL RING AFTER 4096 PASSES THRU THIS SEQUENCE.

10. LISTING

11. FLOW CHART(S)

```
                0020    *20
                        /MAINDEC-08-D6UB
                        /DIAGNOSTIC FOR AD01A, 32 CHANNEL MUX, 10 BIT CONVERTER
                        /JUNE 1969
                        /COPYRIGHT 1969, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
                        /CONSTANTS
          0020  0000    STALL,  0               /WAIT COUNT
          0021  0000    TAPNTB, 0               /TABLE POINTER
          0022  2000    XTI,    TABLEI          /INITAL OR PREVIOUS TABLE
          0023  2000    XTIA,   TABLEI
          0024  2100    XTN,    TABLEN          /CURRENT TABLE
          0025  0000    MC,     0               /MAXIMUM CHANNEL
          0026  0000    PNT,    0               /POINTER
          0027  1653    XTEXTC, TEXTC
          0030  1626    XTEXTA, TEXTA
          0031  1600    XTEXTB, TEXTB
          0032  1411    XPRINT, PRINTI          /PRINT CHANNEL
          0033  1432    XCOMA,  COMA            /COMPARE
          0034  1473    XXFER,  XFER            /TRANSFER
          0035  1400    XHOWM,  HOWM
          0036  1225    XSETMU, SETMUX
          0037  0000    LOW,    0
          0040  0000    HIGH,   0
          0041  0001    K0001,  0001
          0042  0017    K0017,  0017
          0043  0034    K0034,  0034
          0044  0037    K0037,  0037
          0045  6000    K6000,  6000
          0046  7777    K7777,  7777
          0047  6500    K6500,  6500
          0050  0077    K0077,  0077
          0051  7776    K7776,  7776
          0052  0400    K0400,  0400
          0053  0300    K0300,  0300
          0054  2000    K2000,  2000
          0055  0007    K0007,  0007
          0056  7740    K7740,  7740
          0057  7760    K7760,  7760
          0060  7761    K7761,  7761
          0061  0000    SAVE1,  0
          0062  0000    SAVE2,  0
          0063  0000    SAVE3,  0
          0064  0000    SAVE4,  0
          0065  0000    CNT,    0               /COUNTER
          0066  0000    CC,     0               /CURRENT CHANNEL
          0067  0000    CV,     0               /CURRENT VOLTAGE
          0070  1777    CI,     TABLEI-1
          0071  2077    CN,     TABLEN-1
          0072  0000    GD,     0               /GOOD DATA
          0073  0000    BD,     0               /BAD DATA
                6535    ADSC=6535               /SET MUX, GAIN, CLR FLAG, CONVERT, CLR AC
                6534    ADCV=6534               /START CONVERT.
                6531    ADSF=6531               /SKIP ON FLAG
                6532    ADRB=6532               /READ BUFFER, CLEAR AC
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                6536    ADRC=6536               /READ BUFFER, START CONVERT
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                6537    ALL=6537                /CHANNEL, GAIN, READ BUFFER, START CONVERT
                7402    XX=7402
          0074  2271    XSCOPE, SCOPEA
                4474    SCOPE=JMS I XSCOPE
          0075  2200    XSIXTY, SIXTY
          0076  2303    XIPRIN, IPRINT          /INHIBIT PRINTOUT
          0077  2400    XTYPE,  MESAGE
          0100  1251    XAVERAG,        AVERAGE
          0101  2520    XDISP,  DISP
          0102  2523    XDISP3, DISP+3
          0103  2510    XINST,  INST
          0104  2501    XCONVE, CONVER
          0105  2474    XSMUX,  SMUX
          0106  2324    XERADD, ERADD           /ADDRESS TAG
                4506    HALT=JMS I XERADD
          0107  0000    AC,     0
          0110  0000    CNTR,   0
          0111  2530    XREAD,  REREAD
          0112  0000    FIRST,  0
          0113  0452    XSETUP, SETUP
                0061    TEMP1=SAVE1
                0062    TEMP2=SAVE2


                        /SR0=1-HALT ON ERROR
                        /SR1=1-SCOPE LOOP
                        /SR2=1-INHIBIT PRINTOUT
                        /SR3=1-INHIBIT PLUS OR MINUS 1LSB TESTING
                        /SR4=GAIN
                        /SR5=GAIN
                        /       00=1
                        /       01=2
                        /       10=4
                        /       11=8
                        /SR6=1-INHIBIT AVERAGING
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                0200    *, 177+1
                        /SETUP FOR NUMBER TO BE TESTED
          0200  5207            JMP ADD1A
          0201  5221            JMP BEGIN
          0202  5501            JMP I XDISP     /DISPLAY CONVERTER VALUE
          0203  5503            JMP I XINST     /INST SCOPE LOOP
          0204  5504            JMP I XCONVER   /SR.=CONVERSION TIME
          0205  5505            JMP I XSMUX     /SR=MULTIPLEXER
          0206  5511            JMP I XREAD     /DO DOUBLE BUFFER READ
          0207  7402    ADD1A,  HLT
          0210  7604            LAS             /LOAD INITAL CHANNEL
          0211  0044            AND K0037
          0212  3112            DCA FIRST
          0213  7402            HLT
          0214  7604            LAS             /LOAD LAST CHANNEL
          0215  0044            AND K0037
          0216  3056            DCA K7740
          0217  4513            JMS I XSETUP
          0220  5213            JMP .-5
                        /TEST FOR NO FLAG
          0221  6531    BEGIN,  ADSF            /SKIP ON FLAG
          0222  7410            SKP
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0223  4506          HALT            /FLAG NOT CLEARED BY ST KEY
0224  4474          SCOPE
                /WILL CONVERT  INSTRUCTION SET FLAG
0225  6536          ADRC            /START CONVERT
0226  7300          CLA CLL
0227  3020          DCA STALL
0230  2020          ISZ STALL
0231  5230          JMP .-1         /FLAG SHOULD BE SET
0232  6531          ADSF            /SKIP ON FLAG
0233  4506          HALT            /FLAG NOT SET
0234  4474          SCOPE
                /WILL READ BUFFER CLEAR FLAG
0235  6532          ADRB            /CLEAR FLAG
0236  6531          ADSF            /FLAG SHOULD BE CLEARED
0237  7410          SKP
0240  4506          HALT            /FLAG SET OR SKIP FAILED
0241  4474          SCOPE
                /WILL ADSC SET FLAG
0242  6535          ADSC            /CONVERT
0243  7300          CLA CLL
0244  3020          DCA STALL
0245  2020          ISZ STALL       /TIME FOR CONVERSION
0246  5245          JMP .-1
0247  6531          ADSF            /CHECK FLAG
0250  4506          HALT            /ADSC DID NOT SET FLAG
0251  4474          SCOPE
                /WILL ADSC CLEAR AC
0252  7350          CLL CLA CMA RAR /ALL ONE EXCEPT FOR INTERRUPT ENABLE
0253  6535          ADSC            /SET CHANNEL, CONVERT, CLEAR AC
0254  6531          ADSF
*20   PAL10  V141   9-MAR-71    17:55   PAGE 3

0255  5254          JMP .-1
0256  7440          SZA
0257  4506          HALT            /ADSC DID NOT CLEAR AC
0260  4474          SCOPE
                /TEST FOR NO INTERRUPT
0261  7200          CLA
0262  1273          TAD .+11        /INTERRUPT SET UP
0263  3001          DCA 1
0264  1274          TAD .+10
0265  3002          DCA 2
0266  6001          ION             /INTERRUPT ON
0267  7410          SKP
0270  4506          HALT            /INTERRUPT SHOULD NOT BE UP
0271  6002          IOF
0272  5275          JMP .+3
0273  5402          JMP I 2
0274  0270          .-4
0275  4474          SCOPE
                /RAISE AN INTERRUPT WITH DONE FLAG
0276  7330          CLA STL RAR     /AC=4000
0277  6537          ALL             /SET ENABLE START CONVERT
0300  7200          CLA
0301  6534          ADCV            /START CONVERT
0302  6531          ADSF            /SKIP ON FLAG
0303  5302          JMP .-1         /WAIT FOR FLAG
0304  1313          TAD .+7
0305  3002          DCA 2           /INTERRUPT SET UP
0306  6001          ION             /INTERRUPT ON
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0307  7000            NOP             /SHOULD INTERRUPT HERE
0310  6002            IOF             /INTERRUPT OFF
0311  4506            HALT            /FAILED TO INTERRUPT
0312  7410            SKP
0313  0314            .+1
0314  4474            SCOPE
0315  6532            ADRB            /CLEAR FLAG
                /TEST FOR NO INTERRUPT, WITH FLAG SET, ENABLE CLEARED
0316  7200            CLA                                    CLR AC.
0317  6537            ALL             /CLEAR INT, ENABLE, CONVERT
0320  6531            ADSF
0321  5320            JMP .-1         /WAIT FOR FLAG
0322  1333            TAD .+11
0323  3001            DCA 1
0324  1334            TAD .+10
0325  3002            DCA 2
0326  6001            ION
0327  7410            SKP
0330  4506            HALT            /INTERRUPT FOUND WITH ENABLE CLEARED
0331  6002            IOF
0332  5335            JMP .+3
0333  5402            JMP I 2
0334  0330            .-4
0335  4474            SCOPE
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                /TEST THAT ADRB JAM TRANSFERS TO AC
0336  7240            CLA CMA         /AC=7777
0337  6532            ADRB            /IF CLEARS FAILS=7777
0340  3061            DCA TEMP1       /SAVE READING
0341  6532            ADRB            /READ BUFFER WITH AC=0
0342  7041            CIA             /NEGATE
0343  1061            TAD TEMP1       /SUBRTACT FIRST READING, IF DIFFERENT
0344  7440            SZA             /THEN WOULD NOT SKIP
0345  4506            HALT            /ADRB DID NOT CLEAR AC.
0346  4474            SCOPE
                /WILL SET MULTIPLEXER, SET DONE FLAG?
0347  7200            CLA
0350  6537            ALL             /START CONVERT
0351  7300            CLA CLL
0352  3020            DCA STALL
0353  2020            ISZ STALL
0354  5353            JMP .-1
0355  6531            ADSF            /SKIP ON FLAG
0356  4506            HALT            /ADSC DID NOT SET DONE FLAG
0357  6532            ADRB            /CLEAR FLAG
0360  4474            SCOPE
                /WILL ALL CLEAR THE AC
0361  7350            CLL CLA CMA RAR /3777
0362  6537            ALL
0363  6531            ADSF
0364  5363            JMP .-1         /WAIT FOR DONE
0365  1177            TAD [4000       /4000+3777=7777
0366  7040            CMA             /IF CLR FAILS WOULD=0
0367  7450            SNA
0370  4506            HALT            /ALL DID NOT CLEAR AC
0371  4474            SCOPE
                /WILL ADRC JAM TRANSFER TO AC
0372  7300            CLA CLL
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0373  6532          ADRB            /READ BUFFER
0374  3061          DCA TEMP1       /SAVE DATA
0375  7240          CLA CMA         /SET AC=7777
0376  6536          ADRC            /READ BUFFER, CONVERT AGAIN
0377  6531          ADSF            /WITH AC=0
0400  5777'         JMP .-1         /WAIT FOR FLAG
0401  7041          CIA             /NEGATE
0402  1061          TAD TEMP1       /SUBTRACT FIRST READING, IF DIFFERENT
0403  7440          SZA             /THEN WOULD NOT SKIP
0404  4506          HALT            /.ADRC DID NOT CLEAR AC
0405  4474          SCOPE
                /WILL ADCV RAISE A DONE FLAG
0406  6534          ADCV            /RAISE A FLAG
0407  2020          ISZ STALL
0410  5207          JMP .-1         /TIME FOR THE FLAG
0411  6531          ADSF            /CHECK FOR FLAG
0412  4506          HALT            /ADCV DID NOT RAISE A FLAG
0413  6532          ADRB            /CLR FLAG
0414  4474          SCOPE

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                /DOES ADCV ZERO THE FLAG
0415  6534          ADCV            /RAISE A FLAG
0416  6531          ADSF
0417  5216          JMP .-1
0420  6534          ADCV            /SHOULD CLAER THE FLAG
0421  6531          ADSF            /TEST FOR NO FLAG
0422  7410          SKP
0423  4506          HALT            /FLAG FOUND TOO SOON
0424  4474          SCOPE
                /DOES ADSC ZERO THE FLAG
0425  6534          ADCV            /RAISE A FLAG
0426  6531          ADSF
0427  5226          JMP .-1
0430  6535          ADSC            /CLEAR THE FLAG
0431  6531          ADSF            /TEST FOR NO FLAG
0432  7410          SKP
0433  4506          HALT            /FLAG FOUND TOO SOON
0434  4474          SCOPE

                /DOES ADRC ZERO THE DONE FLAG
0435  6534          ADCV            /RAISE A FLAG
0436  6531          ADSF
0437  5236          JMP .-1
0440  6536          ADRC            /CLEAR THE FLAG
0441  6531          ADSF            /TEST FOR NO FLAG
0442  7410          SKP
0443  4506          HALT            /FLAG FOUND TOO SOON
0444  6531          ADSF
0445  5244          JMP .-1         /WAIT FOR FINAL FLAG
0446  6532          ADRB            /CLEAR FLAG
0447  4474          SCOPE
0450  5651          JMP I .+1
0451  0600      , 177+1
                /TEST FOR CORRECT INPUTS FROM SWITCHES
0452  0000      SETUP,  0
0453  1112          TAD FIRST       /GET FIRST CHANNEL
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0454  7041          CIA
0455  1056          TAD K7740       /SUBTRACT LAST CHANNEL
0456  7510          SPA             /IS FIRST > LAST
0457  5652          JMP I SETUP     /YES, TRY AGAIN
0460  7040          CMA
0461  3056          DCA K7740       /NUMBER OF CHANNELS
0462  1112          TAD FIRST
0463  1023          TAD XTIA
0464  3022          DCA XTI
0465  2252          ISZ SETUP
0466  5652          JMP I SETUP
0577  0377
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      0600    *. 177+1
              /COMPARE ONE CONVERSION WITH THE AVERAGE 100(8) CONVERSIONS
0600  4474          SCOPE
0601  6537          ALL             /CHANGE ZERO, CONVERT
0602  6531          ADSF
0603  5202          JMP .-1         /WAIT FOR FLAG
0604  6532          ADRB            /READ BUFFER
0605  3061          DCA SAVE1       /SAVE IT
0606  4500          JMS I XAVERAG
0607  3062          DCA SAVE2       /SAVE AVERAGE OF 100 CONVERSIONS
0610  1062          TAD SAVE2
0611  7041          CIA
0612  1061          TAD SAVE1
0613  7650          SNA CLA
0614  5226          JMP OUT         /GOOD EXIT
0615  1062          TAD SAVE2
0616  7040          CMA
0617  1061          TAD SAVE1
0620  7450          SNA
0621  5226          JMP OUT         /GOOD EXIT
0622  7001          IAC
0623  7040          CMA
0624  7440          SZA
0625  4506          HALT            /NOT EQUAL PLUS OR MINUS ONE
0626  4474    OUT,  SCOPE
              /CHECK SWITCH GAIN AMPLIFER
0627  7200          CLA
0630  6537          ALL             /CONVERT GAIN X1
0631  6531          ADSF            /WAIT FOR FLAG
0632  5231          JMP .-1
0633  4500          JMS I XAVERAG   /AVERAGE 100(8) CONVERSION
0634  3061          DCA SAVE1
0635  1176          TAD [100        /GAIN OF X2
0636  6537          ALL             /CONVERT, GAIN X2
0637  6531          ADSF
0640  5237          JMP .-1
0641  4500          JMS I XAVERAG
0642  3062          DCA SAVE2
0643  1175          TAD [200        /GAIN OF X4
0644  6537          ALL             /CONVERT GAIN TIMES 4
0645  6531          ADSF
0646  5245          JMP .-1
0647  4500          JMS ! XAVERAG
0650  3063          DCA SAVE3
0651  1174          TAD [300        /GAIN OF X8
0652  6537          ALL             /CONVERT GAIN TIMES 8
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Was 5320

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          0653  6531            ADSF
          0654  5253            JMP .-1
          0655  4500            JMS I XAVERAG
          0656  3064            DCA SAVE4
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                          /TAKE HIGHEST GAIN DIVIDE THEN COMPARE
          0657  1064            TAD SAVE4
          0660  7100            CLL
          0661  7510            SPA             /SIGN TO LINK
          0662  7120            STL
          0663  7010            RAR             /DIVIDE BY TWO
          0664  7041            CIA
          0665  1063            TAD SAVE3
          0666  4777'           JMS LIMIT       /CHECK FOR PLUS OR MINUS ONE
          0667  5313            JMP HALTA
          0670  1063            TAD SAVE3
          0671  7100            CLL
          0672  7510            SPA             /SIGN TO LINK
          0673  7120            STL
          0674  7010            RAR             /DIVIDE BY TWO
          0675  7041            CIA
          0676  1062            TAD SAVE2
          0677  4777'           JMS LIMIT       /CHECK FOR +/-1
          0700  5313            JMP HALTA
          0701  1062            TAD SAVE2
          0702  7100            CLL
          0703  7510            SPA             /SIGN TO LINK
          0704  7120            STL
          0705  7010            RAR             /DIVIDE BY 2
          0706  7041            CIA
          0707  1061            TAD SAVE1
          0710  4777'           JMS LIMIT       /CHECK FOR +/-
          0711  7000            NOP
          0712  5327            JMP HALTB
          0713  1061    HALTA,  TAD SAVE1       /PRINT THE FOUR GAIN AVERAGES
          0714  4506            HALT            /ON A ERROR COMPARE
          0715  7200            CLA             /GAIN OF ONE
          0716  1062            TAD SAVE2
          0717  4506            HALT            /GAIN OF TWO
          0720  7200            CLA
          0721  1063            TAD SAVE3
          0722  4506            HALT            /GAIN OF FOUR
          0723  7200            CLA
          0724  1064            TAD SAVE4
          0725  4506            HALT            /GAIN OF EIGHT
          0726  4474            SCOPE
          0727  6532    HALTB,  ADRB            /CLEAR FLAG FOR LOOPING
          0730  7610            CLA SKP
          0731  7700            7700
          0732  2331            ISZ .-1
          0733  5337            JMP .+4
          0734  1060            TAD K7761
          0735  3331            DCA .-4
          0736  5741            JMP I .+3       /MUX TEST
          0737  5740            JMP I .+1
          0740  0221            BEGIN
          0741  1200            GIN
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                        /TEST FOR PLUS OR MINUS ONE
        0777  1000
              1000      *. 177+1
        1000  7402      LIMIT,  XX
        1001  7450              SNA
        1002  5212              JMP OK                  /EQUAL TO EACH
        1003  7040              CMA
        1004  7450              SNA
        1005  5212              JMP OK                  /PLUS ONE
        1006  7001              IAC
        1007  7040              CMA
        1010  7640              SZA CLA
        1011  5777'             JMP HALTA               /NOT EQUAL OR PLUS OR MINUS ONE
        1012  7200      OK,     CLA                     /MINUS ONE
        1013  2200              ISZ     LIMIT
        1014  5600              JMP I   LIMIT
*20   PAL10   V141    9-MAR-71        17:55   PAGE 9


        1177  0713
              1200      *. 177+1
                        /CONTROL FOR ADO1A
                        GIN,
        1200  7300              CLA CLL
        1201  3110              DCA CNTR          /CLEAR PASS COUNTER
        1202  1022              TAD XTI           /TABLE I
        1203  3021              DCA TAPNTB
        1204  4436              JMS I XSETMU      /FILL TABLE I
        1205  1022              TAD XTI
        1206  3021              DCA TAPNTB
        1207  4435              JMS I XHOWM       /HOW MANY CHANNELS
        1210  4432              JMS I XPRINT      /PRINT TABLE I
        1211  1024              TAD XTN           /TABLE N
        1212  3021              DCA TAPNTB
        1213  4436      GIN1,   JMS I XSETMU      /FILL TABLE N (NEW)
        1214  4433              JMS I XCOMA       /TABLE N=TABLE I
        1215  4434              JMS I XXFER       /TRANSFER N TO I
        1216  4436              JMS I XSETMU      /WITH INCREMENT MUX
        1217  4433              JMS I XCOMA       /COMPARE
        1220  4434              JMS I XXFER       /TABLE N TO TABLE I
        1221  2110              ISZ CNTR          /PASS.COUNT
        1222  5213              JMP GIN1          /LOOP
        1223  4320              JMS BELL          /RING BELL
        1224  5213              JMP GIN1

                        /FILL TABLE WITH SET MULTIPLEXER INSTRUCTION
        1225  7402      SETMUX, XX
        1226  1021              TAD TAPNTB        /TABLE POINTER
        1227  3026              DCA PNT           /POINTER
        1230  1056              TAD K7740         /MINUS 32
        1231  3065              DCA CNT           /COUNTER
        1232  1026      SMUX1,  TAD PNT           /POINTER
        1233  0044              AND K0037
        1234  3000              DCA 0             /SAVE CH
        1235  7604              LAS               /READ SW FOR GAIN
        1236  0053              AND K0300         /MASK GAIN
        1237  1000              TAD 0             /MERGE WITH CHANNEL
        1240  6535              ADSC               /MASK CHANNELS
        1241  6531              ADSF              /SKIP ON FLAG
```

```
          1242  5241            JMP .-1          /WAIT FOR FLAG
          1243  4251            JMS AVERAGE      /-----NOP FOR NO AVERAGING
          1244  3426            DCA I PNT        /STORE IN TABLE
          1245  2026            ISZ PNT          /INCREMENT POINTER
          1246  2065            ISZ CNT          /DONE
          1247  5232            JMP SMUX1        /NO-LOOP
          1250  5625            JMP I SETMUX     /YES-EXIT

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                        /AVERAGE 100(8) CONVERSIONS
          1251  7402    AVERAG, XX
          1252  7604            LAS
          1253  0173            AND     [0040           /INHIBIT AVERAGE
          1254  7650            SNA CLA                 /YES-SKIP
          1255  5260            JMP     .+3
          1256  6532            ADRB                    /REREAD BUFFER
          1257  5651            JMP I   AVERAGE
          1260  7300            CLA CLL
          1261  3037            DCA LOW         /INITIALIZE LOW AND HIGH
          1262  3040            DCA HIGH
          1263  1172            TAD [-100       /64 DECIMAL
          1264  3171            DCA [XX /LOOP COUNTER
          1265  6536    AV1,    ADRC            /READ BUFFER, CONVERT
          1266  6531            ADSF            /WAIT FOR FLAG
          1267  5266            JMP .-1
          1270  7100            CLL             /CLEAR LINK
          1271  1054            TAD     K2000
          1272  7104            CLL RAL
          1273  1037            TAD LOW
          1274  3037            DCA LOW         /SAVE UPDATED AVERAGE
          1275  7430            SZL             /SKIP ON NO OVERFLOW
          1276  2040            ISZ HIGH        /INCREMENT HIGH VALUE
          1277  2171            ISZ [XX         /100 TIMES
          1300  5265            JMP AV1         /LOOP
          1301  7300            CLA CLL         /NOW DIVIDE BY 200(8)-128(10)
          1302  1170            TAD [-7         /BY DOUBLE WORD ROTATE, RIGHT SEVEN TIMES
          1303  3171            DCA [XX
          1304  7300    AV2,    CLA CLL
          1305  1040            TAD HIGH
          1306  7010            RAR             /FROM HIGH TO LINK TO LOW
          1307  3040            DCA HIGH
          1310  1037            TAD LOW
          1311  7010            RAR             /PARTIAL AVERAGE
          1312  3037            DCA LOW
          1313  2171            ISZ [XX         /DONE?
          1314  5304            JMP AV2         /NO--GO BACK AND START
          1315  1037            TAD LOW         /AVERAGE OF 100 CONVERSIONS
          1316  1045            TAD     K6000
          1317  5651            JMP I AVERAG
                                /END OF PASS BELL
          1320  0000    BELL,   0
          1321  7300            CLA CLL
          1322  1330            TAD DING
          1323  6046            TLS
          1324  6041            TSF
          1325  5324            JMP .-1
          1326  7300            CLA CLL
          1327  5720            JMP I BELL
```

```
                1330  0207    DING,   207
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                1400            *. 177+1
                                /HOW MANY CHANNELS ARE BEING TESTED
                1400  7402    HOWM,   XX
                1401  1021            TAD TAPNTB      /TABLE POINTER
                1402  3026            DCA PNT         /POINTER
                1403  1056            TAD K7740       /NUMBER OF CHANNELS
                1404  7041            CIA
                1405  3025            DCA MC
                1406  4431    HOW2,   JMS I XTEXTB    /NUMBER OF CHANNELS
                1407  7200            CLA
                1410  5600            JMP I HOWM      /EXIT
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                                /PRINT TABLE I FOR REFERENCE
                1411  7402    PRINTI, XX
                1412  1022            TAD XTI         /TABLE I
                1413  3026            DCA PNT         /POINTER
                1414  1056            TAD K7740       /MAXIMUM CHANNEL
                1415  3065            DCA CNT         /COUNTER
                1416  1022            TAD XTI
                1417  0044            AND K0037
                1420  3066            DCA CC          /CURRENT CHANNEL
                1421  1426            TAD I PNT
                1422  7000            NOP
                1423  3072            DCA GD
                1424  4430    PRINT2, JMS I XTEXTA
                1425  2066            ISZ CC          /CH XX=XXXX
                1426  2026            ISZ PNT         /VOLTAGE POINTER
                1427  2065            ISZ CNT         /DONE?
                1430  5221            JMP PRINT2-3    /NO
                1431  5611            JMP ! PRINTI    /YES

                                /COMPARE TWO TABLES FOR EQUALITY OR +1-1LSB.
                                /TEST TABLE I EQUAL TABLE N
                1432  7402    COMA,   XX
                1433  1070            TAD CI          /I OLD TABLE
                1434  3011            DCA 11
                1435  1071            TAD CN          /NEW TABLE
                1436  3012            DCA 12
                1437  1025            TAD MC          /NUMBER OF CHANNELS
                1440  7041            CIA
                1441  3065            DCA CNT
                1442  1411    COMA1,  TAD I 11
                1443  3072            DCA GD          /WAS
                1444  1412            TAD I 12
                1445  3073            DCA BD          /IS
                1446  1072            TAD GD
                1447  7041            CIA
                1450  1073            TAD BD
                1451  7650            SNA CLA
                1452  5270            JMP COMA2+1
                1453  7604            LAS
                1454  0052            AND K0400
                1455  7640            SZA CLA
                1456  5267            JMP COMA2       /NO LIMITS
                1457  1072            TAD GD
```

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          1460  7040            CMA
          1461  1073            TAD BD
          1462  7450            SNA
          1463  5270            JMP COMA2+1
          1464  7001            IAC
          1465  7040            CMA
          1466  7440            SZA
          1467  4427    COMA2,  JMS I XTEXTC    /TEST CH X WAS---IS----
          1470  2065            ISZ CNT         /DONE
          1471  5242            JMP COMA1       /NO LOOP
          1472  5632            JMP I COMA      /YES EXIT
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                        /TRANSFER TABLE "N" TO TABLE "I"
          1473  7402    XFER,   XX
          1474  1070            TAD CI
          1475  3011            DCA 11
          1476  1071            TAD CN
          1477  3012            DCA 12
          1500  1025            TAD MC          /NUMBER OF CHANNELS
          1501  7041            CIA
          1502  3065            DCA CNT
          1503  1412    XFER1,  TAD I 12
          1504  3411            DCA I 11
          1505  2065            ISZ CNT
          1506  5303            JMP XFER1
          1507  5673            JMP I XFER
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          1600          *. 177+1
                        /HOW MANY CHANNELS
          1600  7402    TEXTB,  XX
          1601  4476            JMS I XIPRIN
          1602  4475            JMS I XSIXTY
          1603  0025            MC              /MAXIMUM CHANNEL
          1604  1615            XB1
          1605  1615            XB1
          1606  4477            JMS I XTYPE     /THERE ARE XX CHANNELS
          1607  4543            4543
          1610  2410            2410
          1611  0522            0522
          1612  0540            0540
          1613  0122            0122
          1614  0540            0540
          1615  6060    XB1,    6060
          1616  4050            4050
          1617  7051            7051
          1620  4003            4003
          1621  1001            1001
          1622  1616            1616
          1623  0514            0514
          1624  2300            2300
          1625  5600            JMP I TEXTB
                        /INITIAL TABLE PRINT OUT
          1626  7402    TEXTA,  XX
          1627  4476            JMS I XIPRIN
          1630  4475            JMS I XSIXTY
          1631  0066            CC              /CURRENT CHANNEL
          1632  1644            XTA1
```

```
          1633  1644            XTA1
          1634  4475            JMS I XSIXTY
          1635  0072            GD
          1636  1647            XTA2
          1637  1650            XTA2+1
          1640  4477            JMS I XTYPE       /CH YY=XXXX
          1641  4543            4543
          1642  0310            0310              /Y=CHANNEL
          1643  4040            4040              /X=VOLTAGE
          1644  6060  XTA1,     6060
          1645  4075            4075
          1646  4040            4040
          1647  6060  XTA2,     6060
          1650  6060            6060
          1651  0000            0
          1652  5626            JMP I TEXTA
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                                /CHANNEL ERROR PRINTOUT
          1653  7402  TEXTC,    XX
          1654  4476            JMS I XIPRIN      /CH XX WAS "YY" IS "ZZ"
          1655  1072            TAD GD
          1656  3072            DCA GD
          1657  1073            TAD BD
          1660  3073            DCA BD
          1661  4475            JMS I XSIXTY
          1662  0011            11
          1663  1700            XTC1
          1664  1700            XTC1
          1665  4475            JMS I XSIXTY
          1666  0072            GD
          1667  1704            XTC2
          1670  1705            XTC2+1
          1671  4475            JMS I XSIXTY
          1672  0073            BD
          1673  1710            XTC3
          1674  1711            XTC3+1
          1675  4477            JMS I XTYPE
          1676  4543            4543
          1677  0310            0310
          1700  6060  XTC1,     6060              /CH
          1701  4027            4027
          1702  0123            0123
          1703  4040            4040
          1704  6060  XTC2,     6060              /WAS
          1705  6060            6060
          1706  4011            4011
          1707  2340            2340
          1710  6060  XTC3,     6060              /IS
          1711  6060            6060
          1712  0000            0
          1713  5653            JMP I TEXTC

                2000  *. 177+1
          2000  0000  TABLEI, 0

                2100  *TABLEI+100
          2100  0000  TABLEN, 0

                      PAUSE
```

```
                2200    *. 177+1

          2200  7402    SIXTY,  HLT
          2201  7000            NOP
          2202  7000            NOP             /STORE INIT NEXT TIME
          2203  7200            CLA
          2204  1600            TAD I .-4       /ADDRESS OF OPERAND
          2205  3207            DCA .+2
          2206  5610            JMP I .+2
          2207  0000            0               /ADDRESS OPERAND
          2210  2212            SIXTY+12        /CHANGING REFERENCE (P)
          2211  5203            JMP SIXTY+3
          2212  1607            TAD I SIXTY+7   /AC (OPERAND)
          2213  0055            AND K0007
          2214  3260            DCA MASKA       /000X
          2215  1607            TAD I SIXTY+7   /AC (OPERAND)
          2216  0265            AND K0070
          2217  3261            DCA MASKB       /00X0
          2220  1607            TAD I SIXTY+7   /AC (OPERAND)
          2221  0266            AND K0700
          2222  3262            DCA MASKC       /0X00
          2223  1607            TAD I SIXTY+7   /AC (OPERAND)
          2224  0267            AND K7000
          2225  3263            DCA MASKD       /X000
          2226  1262            TAD MASKC       /0X00
          2227  7112            RTR CLL
          2230  7010            RAR             /0X00 RS3 00X0
          2231  1263            TAD MASKD       /X0X0
          2232  7012            RTR
          2233  7010            RAR
          2234  1264            TAD MASKD+1     /X0X0 RS3 0X0X
          2235  3262            DCA MASKC       /TEMP STORAGE
          2236  2200            ISZ SIXTY       /INCREMENT FOR STORAGE
          2237  4210            JMS SIXTY+10    /FIND STORAGE ADDRESS
          2240  1262            TAD MASKC       /6X6X
          2241  3607            DCA I SIXTY+7   /STORE OPERAND AS SPECIFIED
          2242  1261            TAD MASKB       /00X0
          2243  7004            RAL
          2244  7006            RTL             /00X0 SL3 0X00
          2245  1260            TAD MASKA       /0X00+000X=0X0X
          2246  1264            TAD MASKD+1     /0X0X+6060=6X6X
          2247  3263            DCA MASKD       /TEMP STORAGE ADDRESS
          2250  2200            ISZ SIXTY       /INCREMENT FOR STORAGE
          2251  4210            JMS SIXTY+10    /FIND STORAGE ADDRESS
          2252  1263            TAD MASKD       /6X6X
          2253  3607            DCA I SIXTY+7   /STORE OPERAND AS SECIFIED
          2254  1270            TAD SIX12       /HOUSE KEEPING
          2255  3210            DCA SIXTY+10
          2256  2200            ISZ SIXTY       /INCREMENT FOR RETURN
          2257  5600            JMP I SIXTY     /RETURN
```



```
          2260  0000    MASKA,  0
          2261  0000    MASKB,  0
          2262  0000    MASKC,  0
          2263  0000    MASKD,  0
```

```
          2264  6060              6060
          2265  0070    K0070,    0070
          2266  0700    K0700,    0700
          2267  7000    K7000,    7000
          2270  2212    SIX12,    SIXTY+12
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                        /SCOPE LOOP CHECK
                        /SCOPE WITH SWITCH BIT 1=1 (2000)
          2271  7402    SCOPEA,   XX
          2272  7604              LAS
          2273  0054              AND K2000
          2274  7640              SZA CLA
          2275  5701              JMP I RETURN
          2276  1271              TAD SCOPEA
          2277  3301              DCA RETURN
          2300  5671              JMP I SCOPEA

          2301  0221    RETURN,   BEGIN
          2302  5701              JMP I RETURN

                        /INHIBIT PRINT OUT WHEN BIT 2=1 (1000)

          2303  7402    IPRINT,   XX
          2304  3107              DCA AC                  /SAVE AC
          2305  7604              LAS
          2306  7006              RTL
          2307  7700              SMA CLA
          2310  5316              JMP .+6
          2311  1303              TAD IPRINT
          2312  1051              TAD K7776               /MINUS 2
          2313  3303              DCA IPRINT
          2314  1703              TAD I IPRINT
          2315  3303              DCA IPRINT
          2316  5703              JMP I IPRINT
          2317  7402    WAIT,     XX
          2320  2323              ISZ .+3
          2321  5320              JMP .-1
          2322  5717              JMP I WAIT
          2323  0000              0
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                        /PRINTOUT CONTENTS OF AC AND ERROR ADDRESS
          2324  7402    ERADD,    XX
          2325  4476              JMS I XIPRIN            /TEST FOR INHIBIT PRINT
          2326  6002              IOF
          2327  4475              JMS I XSIXTY
          2330  2324              ERADD
          2331  2335              .+4
          2332  2336              .+4
          2333  4477              JMS I XTYPE             /TYPE ERROR ADDRESS
          2334  4543              4543
          2335  6060              6060
          2336  6060              6060
          2337  4000              4000
          2340  4475              JMS I XSIXTY
          2341  0107              AC
          2342  2346              .+4
          2343  2347              .+4
```

```
          2344  4477            JMS I XTYPE             /TYPE  AC
          2345  4040            4040
          2346  6060            6060
          2347  6060            6060
          2350  0000            0000
          2351  6042            TCF
          2352  6032            KCC
          2353  7604            LAS                     /TEST FOR HALT
          2354  7700            SMA CLA
          2355  5724            JMP I ERADD
          2356  1107            TAD AC
          2357  7402            HLT
          2360  5724            JMP I ERADD
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                          /DIGITAL 8-18-U
                          /MESSAGE TYPE-OUT
                          /CALL WITH A JMS MESAGE
                          /WITH DATA FOLLOWING
                          /RETURN FOLLOWING END OF MESSAGE
                          /CODE(00)

               2400       *. 177+1
          2400 0000       MESAGE,   0
          2401 7240                 CLA CMA               /SET C(AC)=-1
          2402 1200                 TAD MESAGE            /ADD LOCATION
          2403 3010                 DCA 10                /AUTO-INDEX REGISTER
          2404 1410                 TAD I 10              /FETCH FIRST WORD
          2405 3216                 DCA MSRGHT            /SAVE IT
          2406 1216                 TAD MSRGHT
          2407 7012                 RTR
          2410 7012                 RTR                   /ROTATE 6 BITS RIGHT
          2411 7012                 RTR
          2412 4217                 JMS TYPECH            /TYPE IT
          2413 1216                 TAD MSRGHT            /GET DATA AGAIN
          2414 4217                 JMS TYPECH            /TYPE RIGHT HALF
          2415 5204                 JMP MESAGE+4          /CONTINUE
          2416 0000       MSRGHT,   0                     /TEMPORARY STORAGE

          2417 0000       TYPECH,   0                     /TYPE CHARACTER IN C(AC)6-11
          2420 0250                 AND MASK77
          2421 7450                 SNA                   /IS IT END OF MESSAGE?
          2422 5410                 JMP I 10              /YES: EXIT
          2423 1251                 TAD M40               /SUBTRACT 40
          2424 7500                 SMA                   /<40?
          2425 5230                 JMP .+3               /NO
          2426 1252                 TAD C340              /YES: ADD 300
          2427 5243                 JMP MTP               /TO CODES <40
          2430 1253                 TAD M3                /SUBTRACT 3
          2431 7440                 SZA                   /IS IT ZERO?
          2432 5235                 JMP .+3               /NO
          2433 1254                 TAD C212              /YES: CODE 43 IS
          2434 5243                 JMP MTP               /LINE-FEED (212)
          2435 1255                 TAD M2                /SUBTRACT 2
          2436 7440                 SZA                   /IS IT ZERO?
          2437 5242                 JMP .+3               /NO
          2440 1256                 TAD C215              /YES: CODE 45 IS
          2441 5243                 JMP MTP               /CARRIAGE-RETURN (215)
          2442 1257                 TAD C245              /ADD 200 TO OTHERS >40
```

```
2443  6046  MTP,    TLS                 /TRANSMIT CHARACTER
2444  6041          TSF                 /WAIT FOR FLAG
2445  5244          JMP .-1             /NOT SET YET
2446  7200          CLA                 /SET: CLEAR C(AC)
2447  5617          JMP I TYPECH        /RETURN

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                    /CONSTANTS
2450  0077  MASK77,  77
2451  7740  M40,    -40
2452  0340  C340,   340
2453  7775  M3,     -3
2454  0212  C212,   212
2455  7776  M2,     -2
2456  0215  C215,   215
2457  0245  C245,   245

2460  7402  LSTALL, XX
2461  2020          ISZ STALL
2462  5261          JMP .-1
2463  2020          ISZ STALL
2464  5263          JMP .-1
2465  2020          ISZ STALL
2466  5265          JMP .-1
2467  2020          ISZ STALL
2470  5267          JMP .-1
2471  2020          ISZ STALL
2472  5271          JMP .-1
2473  5660          JMP I LSTALL
                    /SET TEST FOR MULTIPLEXER SR SHOULD EQUAL MULTIPLEXER LIGHTS
2474  7604  SMUX,   LAS             /LOAD CHANNEL AND GAIN
2475  6537          ALL             /SET MULTIPLEXER
2476  2020          ISZ STALL
2477  5276          JMP .-1         /DISPLAY TIME
2500  5274          JMP SMUX        /LOOP
                    /SCOPE SET UP FOR CONVERSION ST=TIME
2501  6536  CONVER, ADRC            /START CONVERSION
2502  7604          LAS             /READ SW REGISTER
2503  7040          CMA             /COMPLEMENT NUMBER
2504  3020          DCA STALL
2505  2020          ISZ STALL       /CONVERSION TIME=
2506  5305          JMP .-1
2507  5301          JMP CONVER      /LOOP
                    /SCOPE LOOP FOR INSTRUCTIONS
                    /IOT INSTRUCTION 65XX, XX=SR BITS 6 TO 11
2510  7000  INST,   NOP
2511  7604          LAS             /READ SWITCH
2512  0050          AND K0077
2513  1047          TAD K6500       /CREATE INSTRUCTION
2514  3315          DCA .+1
2515  7402          HLT             /LOCATION OF INSTRUCTION
2516  7000          NOP             /IN CASE OF SKIP
2517  5311          JMP INST+1      /LOOP
                    /DISPLAY CONVERTED VALUE IN A.C.
2520  7604  DISP,   LAS             /LOAD SW REGISTER
2521  6537          ALL             /SET MUX CHANNEL
2522  6531          ADSF
2523  5322          JMP .-1
```

```
          2524  6532            ADRB            /READ BUFFER
          2525  4260            JMS LSTALL
          2526  5320            JMP DISP        /LOOP, SET MUX AND CONVERT
          2527  0000            Ø
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                        /DOUBLE BUFFER READ AND COMPARE
          2530  7300    REREAD, CLA CLL
          2531  3110            DCA CNTR        /CLEAR FIXED DELAY
          2532  7604            LAS             /GET VARIABLE DELAY FROM SWITCHES
          2533  7040            CMA             /SET UP
          2534  3020            DCA STALL       /VARIABLE DELAY
          2535  6535            ADSC            /SET GAIN=0,CHANNEL=Ø,CONVERT
          2536  6531            ADSF            /WAIT FOR FLAG
          2537  5336            JMP .-1
          2540  6532            ADRB            /READ BUFFER
          2541  3061            DCA TEMP1       /SAVE READING
          2542  2110            ISZ CNTR        /FIXED DELAY
          2543  5342            JMP .-1
          2544  2020            ISZ STALL       /VARIABLE DELAY
          2545  5344            JMP .-1
          2546  6532            ADRB            /READ BUFFER AGAIN
          2547  3062            DCA TEMP2       /SAVE SECOND READING
          2550  1061            TAD TEMP1       /COMPARE READINGS
          2551  7041            CIA
          2552  1062            TAD TEMP2
          2553  7650            SNA CLA         /DIFFERENCE SHOULD BE Ø
          2554  5330            JMP REREAD      /DIFFERENCE IS Ø
          2555  1061            TAD TEMP1       /DIFFERENCE NOT Ø
          2556  7402            HLT             /HALT WITH FIRST READING IN AC
          2557  7300            CLA CLL
          2560  1062            TAD TEMP2
          2561  7402            HLT             /HALT WITH SECOND READING IN AC
          2562  5330            JMP REREAD
                                $
          0170  7771
          0171  7402
          0172  7700
          0173  0040
          0174  0300
          0175  0200
          0176  0100
          0177  4000
*20     PAL10   V141    9-MAR-71        17:55   PAGE 22-1


0000  00000000  00000000  11111111  11111111  11111111  11111111  11111111  11111111
0100  11111111  11110000  00000000  00000000  00000000  00000000  00000000  11111111

0200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0400  11111111  11111111  11111111  11111111  11111111  11111111  11111110  00000000
```

22

```
0500  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000001

0600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0700  11111111  11111111  11111111  11111111  11000000  00000000  00000000  00000001

1000  11111111  11111000  00000000  00000000  00000000  00000000  00000000  00000000
1100  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000001

1200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1300  11111111  11111111  11111111  10000000  00000000  00000000  00000000  00000000

1400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1500  11111111  00000000  00000000  00000000  00000000  00000000  00000000  00000000

1600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1700  11111111  11110000  00000000  00000000  00000000  00000000  00000000  00000000

2000  10000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
2100  10000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000

2200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2300  11111111  11111111  11111111  11111111  11111111  11111111  10000000  00000000

2400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2500  11111111  11111111  11111111  11111111  11111111  11111111  11100000  00000000

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700
```



```
4000
4100

4200
4300

4400
4500

4600
4700
```

```
5000
5100

5200
5300

5400
5500

5600
5700


6000
6100

6200
6300

6400
6500

6600
6700


7000
7100

7200
7300

7400
7500

7600
#200   PAL10   V141    9-MAR-71        17:55   PAGE 22-3

AC       0107          K0700   2266          TEXTC   1653
ADCV     6534          K2000   0054          TYPECH  2417
ADO1A    0207          K6000   0045          WAIT    2317
ADRB     6532          K6500   0047          XAVERA  0100
ADRC     6536          K7000   2267          XB1     1615
ADSC     6535          K7740   0056          XCOMA   0033
ADSF     6531          K7760   0057          XCONVE  0104
ALL      6537          K7761   0060          XDISP   0101
AV1      1265          K7776   0051          XDISP3  0102
AV2      1304          K7777   0046          XERADD  0106
AVERAG   1251          LIMIT   1000          XFER    1473
BD       0073          LOW     0037          XFER1   1503
BEGIN    0221          LSTALL  2460          XHOWM   0035
BELL     1320          M2      2455          XINST   0103
C212     2454          M3      2453          XIPRIN  0076
C215     2456          M40     2451          XPRINT  0032
C245     2457          MASK77  2450          XREAD   0111
C340     2452          MASKA   2260          XSCOPE  0074
CC       0066          MASKB   2261          XSETMU  0036
CI       0070          MASKC   2262          XSETUP  0113
CN       0071          MASKD   2263          XSIXTY  0075
CNT      0065          MC      0025          XSMUX   0105
```

CNTR	0110		MESAGE	2400		XTA1	1644
COMA	1432		MSRGHT	2416		XTA2	1647
COMA1	1442		MTP	2443		XTC1	1700
COMA2	1467		OK	1012		XTC2	1704
CONVER	2501		OUT	0626		XTC3	1710
CV	0067		PNT	0026		XTEXTA	0030
DING	1330		PRINT2	1424		XTEXTB	0031
DISP	2520		PRINTI	1411		XTEXTC	0027
ERADD	2324		REREAD	2530		XTI	0022
FIRST	0112		RETURN	2301		XTIA	0023
GD	0072		SAVE1	0061		XTN	0024
GIN	1200		SAVE2	0062		XTYPE	0077
GIN1	1213		SAVE3	0063		XX	7402
HALT	4506		SAVE4	0064		XXFER	0034
HALTA	0713		SCOPE	4474			
HALTB	0727		SCOPEA	2271			
HIGH	0040		SETMUX	1225			
HOW2	1406		SETUP	0452			
HOWM	1400		SIX12	2270			
INST	2510		SIXTY	2200			
IPRINT	2303		SMUX	2474			
K0001	0041		SMUX1	1232			
K0007	0055		STALL	0020			
K0017	0042		TABLEI	2000			
K0034	0043		TABLEN	2100			
K0037	0044		TAPNTB	0021			
K0070	2265		TEMP1	0061			
K0077	0050		TEMP2	0062			
K0300	0053		TEXTA	1626			
K0400	0052		TEXTB	1600			

ERRORS DETECTED: 0

LINKS GENERATED: 5

RUN-TIME: 9 SECONDS

3K CORE USED