TEXT LISTING

068-001713-00

PROGRAM

MICRONOVA MICRODAC I/O
DIAGNOSTIC & EXERCISER

TEXT TAPE

097-001713-00

ABSTRACT

MDAC (THE MICRONOVA MP100/MP200 4335-S A/D,D/A DIGITAL INTERFACE DIAGNOSTIC AND EXERCISER) CONSISTS OF SEVERAL PROGRAMS THAT AID THE TECHNICIAN IN TESTING AND REPAIRING THE MICRODAC I/O INTERFACE. THESE PROGRAMS ARE LISTED ON PAGE TWO, SECTION 4 OF THIS LISTING.

NOTICE

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 0001  .MAIN    AOS ASSEMBLER REV 02.05         16:20:11 08/22/79
01
02
03              ;*************************************************************
04              ;
05              ; NAME: MDAC.TX                              PART NUMBER: 097-001713
06              ;
07              ;
08              ; DESCRIPTION:  MICRO-NOVA MP100/MP200 4335-S A/D, D/A, DIGITAL
09              ;               INTERFACE (MICRODAC) DIAGNOSTIC/EXERCISER
10              ;
11              ;
12              ; REVISION HISTORY:
13              ;
14              ;       REV.            DATE
15              ;
16              ;       00               8/21/79
17              ;
18              ;
19              ; © DATA GENERAL CORPORATION, 1979
20              ; ALL RIGHTS RESERVED.
21              ; FOR MAINTENANCE PURPOSES ONLY
22              ;
23              ; THE AFFIXATION OF A COPYWRITE NOTICE ON THIS
24              ; DIAGNOSTIC MATERIAL IS NOT INTENDED BY ITSELF
25              ; TO RENDER THE DISTRIBUTION OF THIS DIAGNOSTIC
26              ; MATERIAL A PUBLICATION.
27              ;
28              ;               NOTICE
29              ;
30              ; DATA GENERAL CORPORATION (DGC) HAS PREPARED
31              ; THIS DIAGNOSTIC MATERIAL FOR USE BY DGC PER-
32              ; SONNEL AND CUSTOMERS AS A GUIDE TO THE PROPER
33              ; MAINTENANCE OF DGC EQUIPMENT AND SOFTWARE.
34              ; THE DIAGNOSTIC MATERIALS CONTAINED HEREIN ARE
35              ; THE PROPERTY OF DGC AND SHALL NEITHER BE RE-
36              ; PRODUCED IN WHOLE OR IN PART WITHOUT DGC'S
37              ; PRIOR WRITTEN APPROVAL NOR BE IMPLIED TO GRANT
38              ; ANY LICENSE TO MAKE, USE, OR SELL EQUIPMENT OR
39              ; SOFTWARE MANUFACTURED IN ACCORDANCE HEREWITH.
40              ;*************************************************************
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!0002  .MAIN
01
02              ;*****************************************************
03              ; TEXT CONTENTS:
04              ;1.     PROGRAM NAME
05              ;2.     MACHINE REQUIREMENTS
06              ;3.     TEST REQUIREMENTS
07              ;4.     SUMMARY
08              ;5.     RESTRICTIONS
09              ;6.     PROGRAM DESCRIPTION/THEORY OF OPERATION
10              ;6.1     GENERAL DESCRIPTION/INFORMATION
11              ;6.2     PROGRAM DESCRIPTION: * DIAGNOSTIC *
12              ;6.2.1    NON-LOOPBACK
13              ;6.2.2    LOOPBACK
14              ;6.3     PROGRAM DESCRIPTION: * CALIBRATION *
15              ;6.4     PROGRAM DESCRIPTION: * A/D HISTOGRAM *
16              ;6.4.1    THEORY OF OPERATION
17              ;6.4.2    OUTPUT FORMAT
18              ;6.4.3    SETUP SUMMARY REPORT
19              ;6.4.4    ANALOOP DISCUSSION
20              ;6.4.5    CAT/KITTEN NOTES
21              ;7.     OPERATING MODES/SWITCH COMMANDS
22              ;7.1     SWITCH OPTIONS
23              ;7.2     SWITCH COMMANDS
24              ;7.2.1    OTHER COMMANDS
25              ;8.     OPERATING PROCEDURE/OPERATOR INPUTS
26              ;8.1     DIAGNOSTIC
27              ;8.2     CALIBRATION
28              ;8.2.1    DAC CALIBRATION
29              ;8.2.2    A/D CALIBRATION
30              ;8.3     A/D HISTOGRAM
31              ;9.     PROGRAM OUTPUT/ERROR DESCRIPTION
32              ;9.1     ERROR DESCRIPTIONS: GENERAL
33              ;9.2     ERROR DESCRIPTIONS: * DIAGNOSTIC *
34              ;9.2.1    ERROR FORMAT
35              ;9.2.2    ERROR SUMMARY REPORT
36              ;9.3     ERROR DESCRIPTIONS: * CALIBRATION *
37              ;9.4     ERROR DESCRIPTIONS: * A/D HISTOGRAM *
38              ;9.4.1    ERROR SUMMARY REPORT
39              ;10.    DEBUG HELP
40              ;10.1    CONVENTIONS AND SYMBOLS
41              ;10.2    COMMAND STRUCTURE
42              ;10.3    ODT COMMANDS
43              ;10.3.1   OPENING INTERNAL CELLS
44              ;10.3.2   MODIFICATION OF A CELL
45              ;10.3.3   OTHER ODT COMMANDS
46              ;10.4    PROGRAM SUBROUTINES
47              ;11.    SPECIAL NOTES/SPECIAL FEATURES
48              ;11.1    USER/TEST CONNECTIONS
49              ;11.2    LOOPBACK CONNECTOR
50              ;12.    RUNTIME
51              ;*****************************************************
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10003  .MAIN
01
02
03              ;1.     PROGRAM NAME:
04              ;       ------------
05              ;       MMMDAC - MICRO-NOVA MP100/MP200 MICRODAC DIAGNOSTIC/
06              ;                EXERCISER
07
08              ;2.     MACHINE REQUIREMENTS:
09              ;       --------------------
10              ;       1.  MICRO-NOVA MP100/MP200 CENTRAL PROCESSOR WITH AT
11              ;           LEAST 8K READ/WRITE (RAM) MEMORY
12              ;           (12K IF USING CATS/KITTEN DCH EXERCISER)
13              ;       2.  MICRO-NOVA MP100/MP200 TTY INTERFACE
14              ;       3.  TELETYPE OR CRT TERMINAL
15              ;       4.  PAPER TAPE READER AND/OR DISKETTE DRIVE
16
17              ;3.     TEST REQUIREMENTS:
18              ;       -----------------
19              ;       1.  MICRO-NOVA MP100/MP200 4335-S MICRODAC INTERFACE
20              ;       2.  MICRODAC DIAGNOSTIC/CALIBRATION/HISTOGRAM PROGRAM
21              ;           - AB TAPE PART # 095 - 001713
22              ;           - LISTING PART # 096 - 001713
23              ;       3.  DIAGNOSTIC LOOPBACK CONNECTOR (SEE SEC. 11.3)
24              ;       4.  FOR ACCURATE A/D CONVERTER CALIBRATION, A PRECISION
25              ;           VOLTAGE SOURCE WILL BE NECESSARY.
26              ;       5.  FOR ACCURATE DAC CALIBRATION A 4 DIGIT DIGITAL
27              ;           MULTIMETER (OR VOLTMETER) WILL BE NECESSARY.
28
29              ;4.     SUMMARY:
30              ;       -------
31              ;         MDAC CONSISTS OF SEVERAL PROGRAMS THAT AID THE
32              ;       TECHNICIAN IN TESTING/REPAIRING THE MICRODAC I/O
33              ;       INTERFACE. THESE INCLUDE:
34              ;
35              ;       - MICRODAC DIAGNOSTIC
36              ;         (LOGIC LEVEL TEST ALLOWING ISOLATION OF FAULTS)
37              ;       - A/D AND DAC CALIBRATION
38              ;         (ALLOWS EASY METHOD OF THE A/D AND DAC CALIBRATION)
39              ;       - A/D HISTOGRAM & HISTOGRAM WITH DATA CHANNEL EXERCISER
40              ;         (READS AND SORTS ONE MUX CHANNELS'S VALUES INTO A
41              ;          HISTOGRAM FOR A/D CONVERTER TESTING)
42
43              ;5.     RESTRICTIONS:
44              ;       ------------
45              ;       1.  THIS PROGRAM CAN TEST ONE MICRODAC AT A TIME.
46              ;
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10004  .MAIN
01
02
03              ;6.     PROGRAM DESCRIPTION/THEORY OF OPERATION:
04              ;       ---------------------------------------
05
06              ;6.1    GENERAL DESCRIPTION & INFORMATION:
07
08              ;        THIS PROGRAM CONSISTS OF SEVERAL DIFFERENT ROUTINES
09              ;       THAT ARE USED TO 1)TEST TO THE LOGIC LEVEL ALL FUNCTIONS
10              ;       2)CALIBRATE THE A/D AND DAC MODULES, 3)TEST A/D & DAC
11              ;       CONVERTER STABILITY UNDER DIFFERENT OPERATING MODES AND
12              ;       CONDITIONS AND 4)EVALUATE OVERALL A/D AND DAC CONVERTER
13              ;       PERFORMANCE. IT IS A VERY FLEXIBLE PROGRAM THAT ALLOWS
14              ;       SELECTING TESTS FROM A SINGLE STARTING ADDRESS, ENTERING
15              ;       AN INTERNAL OCTAL DEBUGGER FOR ERROR ISOLATION, AND
16              ;       OTHER FUNCTIONS.
17
18              ;       THIS EXERCISER CONTAINS THE FOLLOWING ROUTINES, THAT
19              ;       WILL BE DESCRIBED IN FULL:
20
21              ;       1) LOGIC LEVEL DIAGNOSTIC
22              ;       2) A/D AND DAC CALIBRATION
23              ;       3) A/D HISTOGRAM (WITH OR WITHOUT DCH EXERCISER)
24
25              ;        THE DIAGNOSTIC PROGRAM TESTS TO THE FUNCTIONAL BLOCK
26              ;       LEVEL ASSORTED MICRODAC FUNCTIONS. WHEN AN ERROR OCCURS
27              ;       INFORMATION IS GIVEN TO ALLOW ISOLATION OF THE PROBLEM.
28              ;
29              ;        THE CALIBRATION PROGRAM ENABLES ACCURATE OFFSET AND
30              ;       GAIN ADJUSTMENTS ON THE CONVERTER MODULES TO BE MADE.
31              ;       ACCURATE CALIBRATION IS NECESSARY TO INSURE A/D AND DAC
32              ;       DATA VALIDITY.
33              ;
34              ;        THE A/D HISTOGRAM IS A TEST OF STABILITY AND NOISE
35              ;       CHARACTERISTICS FOR THE A/D (AND DAC) CONVERTER AND
36              ;       MULTIPLEXOR SECTIONS. THE OPTION OF RUNNING THE DATA
37              ;       CHANNEL (DCH) EXERCISER IS PROVIDED TO ALLOW CHECKING
38              ;       OF SYSTEM BEHAVIOR IN THE PRESENCE OF OTHER SYSTEM
39              ;       ACTIVITY (NOISE).
40
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10005  .MAIN
01
02
03              ;6.2    PROGRAM DESCRIPTION: *** DIAGNOSTIC ***
04              ;
05              ;        THIS PROGRAM CONSISTS OF:(1)SUBTESTS THAT WILL RUN
06              ;       EITHER WITH OR WITHOUT THE LOOPBACK AND (2) SUBTESTS
07              ;       THAT WILL ONLY RUN WITH THE LOOPBACK CONNECTOR IN PLACE
08              ;       (SEE SEC. 11.2 FOR A DESCRIPTION OF THIS CONNECTOR).
09              ;
10              ;        THE PROGRAM WILL EXECUTE EITHER ALL (LOOPBACK) OR
11              ;       SOME (NON-LOOPBACK) OF THE SUBTESTS. UPON COMPLETION,
12              ;       A PASS MESSAGE WILL BE PRINTED AND THE PROGRAM WILL
13              ;       CONTINUE RUNNING THOSE TESTS (SEE SECTION 9.2 FOR
14              ;       ERROR REPORTING DESCRIPTION).
15              ;        HITTING A CONTROL-R (^R) WILL STOP EXECUTION AND
16              ;       RETURN TO THE TEST SELECT PROMPT.
17
18              ;6.2.1  THE NON-LOOPBACK DIAGNOSTIC PORTION :
19              ;
20              ;       WILL TEST ABOUT TWO-THIRDS OF THE ON-BOARD LOGIC.
21              ;       THE DIAGNOSTIC EDGECARD CONNECTOR NEED NOT BE INSTALLED.
22              ;       THE DIGITAL OUTPUT PORT (DOP), DIGITAL INPUT PORT (DIP),
23              ;       EXTERNAL A/D MULTIPLEXOR CHANNELS (4), AND HANDSHAKING
24              ;       LINES CANNOT BE TESTED BY THIS PART OF THE PROGRAM DUE
25              ;       TO THEIR OPEN-ENDED NATURE.
26
27              ;6.2.2  THE LOOPBACK DIAGNOSTIC PORTION :
28              ;
29              ;       WILL TEST MOST OF THE REMAINING ON-BOARD LOGIC (99+ %).
30              ;       THE DIAGNOSTIC EDGECARD CONNECTOR MUST BE INSTALLED
31              ;       TO USE THIS PORTION OF THE DIAGNOSTIC. THIS CONNECTOR
32              ;       LOOPS THE 32 DOP/DIP LINES TOGETHER, TIES THE DAC TO
33              ;       THE 4 EXTERNAL A/D CHANNELS THROUGH A RESISTOR NETWORK,
34              ;       AND ALSO TIES HANDSHAKING LINES TOGETHER IN A WAY THAT
35              ;       ALLOWS THE DIAGNOSTIC TO TEST THEIR ASSOCIATED LOGIC.
36              ;       THE A/D "RESULT STATUS" HANDSHAKING SIGNAL(OUTPUT ONLY)
37              ;       IS NOT LOOPED BACK BY THE TEST CONNECTOR. THE LOGIC NOT
38              ;       CHECKED IS 1 O.C.AND-GATE AND 1 PULLUP RESISTOR.
39              ;       THE A/D "CONV STATUS" BI-DIRECTIONAL LINE IS LOOPED TO
40              ;       THE OUTPUT ONLY DAC "DATA VALID" LINE. ANOTHER O.C.AND-
41              ;       GATE (BUFFERING A/D EOC) IS MISSED AS A RESULT.
42              ;       NO PROVISION HAS BEEN MADE TO TIME THE FOUR MICRODAC
43              ;       ONE-SHOTS (THE PROGRAM DOES VERIFY FUNCTIONALITY).
44
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10006  .MAIN
01
02
03              ;6.3    PROGRAM DESCRIPTION: *** CALIBRATION ***
04              ;
05              ;         THIS PROGRAM PROVIDES A SIMPLE METHOD OF CALIBRATING
06              ;       BOTH THE DAC AND A/D CONVERTER.
07
08              ;       * DAC CALIBRATION *
09              ;
10              ;         SEE SECTION 8.2.1 FOR A DESCRIPTION OF THE DAC
11              ;       CALIBRATION ROUTINE.
12
13              ;       * A/D CALIBRATION *
14              ;
15              ;         A/D CALIBRATION BASICALLY INVOLVES THE SELECTION
16              ;       OF A VOLTAGE HALF-WAY BETWEEN TWO DISCERNIBLE AND
17              ;       BORDERING VALUES (CALLED VAL1 & VAL2). THE A/D CONVERTER
18              ;       IS THEN ADJUSTED UNTIL ABOUT HALF OF THE SAMPLES TAKEN
19              ;       FALL ON EITHER SIDE OF THIS HALF-WAY VOLTAGE.
20              ;         THE PROGRAM STARTS BY TAKING 256. SAMPLES OF THE
21              ;       CHANNEL SPECIFIED. IT THEN CALCULATES THE AVERAGE AND
22              ;       CHECKS IF EITHER VAL1 OR VAL2 IS EQUAL TO IT.
23              ;         IF THE AVERAGE DOESN'T EQUAL VAL1 OR VAL2, THE #
24              ;       OF BITS DIFFERENCE ( GREATER THAN VAL2 OR LESS THAN
25              ;       VAL1) IS CALCULATED AND OUTPUT.
26              ;         IF THE AVERAGE DOES EQUAL VAL1 OR VAL2, THE 256.
27              ;       VALUES ARE SORTED INTO TWO BINS: THOSE GREATER THAN
28              ;       OR EQUAL TO VAL2, AND THOSE LESS THAN OR EQUAL TO
29              ;       VAL1. THESE TWO NUMBERS ARE THEN OUTPUT.
30              ;
31              ;         SEE SECTION 6.2.2 FOR A DESCRIPTION OF A/D CONVERTER
32              ;       CALIBRATION PROCEDURE.
33
```

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10007  .MAIN
01
02
03              ;6.4    PROGRAM DESCRIPTION: *** A/D HISTOGRAM ***
04
05              ;        THIS PROGRAM IS INTENDED TO BE USED AS A MEANS OF CHECK-
06              ;       ING A/D CONVERTER NOISE AND STABILITY CHARACTERISTICS.
07              ;       THE PROGRAM CONTINUALLY SAMPLES A SINGLE, SPECIFIED
08              ;       MULTIPLEXOR CHANNEL, STORES THE DATA IN A BLOCK, THEN
09              ;       SORTS THE CONVERTED DATA INTO A HISTOGRAM. THE CYCLE
10              ;       THEN REPEATS. THE HISTOGRAM RESULTS CAN BE SEEN AT ANY
11              ;       TIME BY HITTING THE 'SPACE' BAR.
12              ;        THIS PROGRAM MAY ALSO BE USED AS A CROSSTALK CHECK BY
13              ;       ATTACHING ASSORTED VOLTAGES/WAVEFORMS TO THE UNUSED A/D
14              ;       INPUTS AND MONITORING ANY DEGRADATION OF THE RESULTANT
15              ;       HISTOGRAM.
16
17
18              ;6.4.1  THEORY OF OPERATION:
19
20              ;        THE PROGRAM WILL DETERMINE THE CENTER VALUE (C0) BY
21              ;       TAKING 64. SAMPLES FROM THE CHANNEL SPECIFIED, AND USING
22              ;       THEIR AVERAGE AS THE CENTER VALUE (NOTE THAT THIS MEANS
23              ;       THE FULLEST BIN ISN'T NECESSARILY THE C0 VALUE).
24
25              ;       THE HISTOGRAM SORTS DATA BY COMPARING EACH DATUM
26              ;       RECEIVED AGAINST THE CENTER VALUE. IF THEY ARE
27              ;       EQUAL, THE COUNT CORRESPONDING TO THE
28              ;       HISTOGRAM "C0" IS INCREMENTED. IF THE DATUM IS
29              ;       1 TO 5 BITS GREATER THAN THE CENTER VALUE, THEN
30              ;       ITS RESPECTIVE "+" BIN COUNT IS INCREMENTED.  IF
31              ;       THE DATUM IS MORE THAN 5 LSB'S GREATER THAN
32              ;       CENTER, THEN THE "++" BIN COUNT IS INCREMENTED.
33              ;       SIMILARLY THE "-" BINS ARE INCREMENTED IF THE
34              ;       DATUM IS 1 TO 5 LSB'S LESS AND "--" IS
35              ;       INCREMENTED IF MORE THAN 5 LSB'S LESS THAN THE
36              ;       CENTER VALUE.
37              ;
38              ;       THEREFORE THE SAMPLE COUNTS NEXT TO THE HISTOGRAM
39              ;       BIN LABELS REPRESENT THE # OF RECEIVED DATA THAT
40              ;       EQUALED THE CORRESPONDING # OF BITS ABOVE, BELOW
41              ;       OR EQUAL TO THE CENTER VALUE. FOR EXAMPLE, "+1:349"
42              ;       INDICATES THAT 349. OF THE TOTAL NUMBER OF SAMPLES
43              ;       TAKEN WERE 1 LSB (LEAST SIGNIFICANT BIT) GREATER
44              ;       THAN THE CENTER VALUE.
45
46              ;       ASSUMING A STABLE SIGNAL SOURCE, WE CAN GET A FEEL
47              ;       FOR THE A/D CONVERTER STABILITY BY LOOKING AT THE
48              ;       HISTOGRAM RESULTS. A STABLE A/D SHOULD HAVE A MAJOR
49              ;       PERCENTAGE OF THE TOTAL SAMPLES TAKEN EQUAL TO THE
50              ;       CENTER VALUE WITH RELATIVELY SMALL DISTRIBUTION
51              ;       AROUND IT, AND WITH THE SAMPLE COUNTS DECREASING
52              ;       RAPIDLY AS THE LSB DEVIATION INCREASES.
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10008  .MAIN
01
02
03              ;6.4.2  OUTPUT FORMAT:
04
05              ;       HISTOGRAM RESULTS ARE PRINTED OUT AS FOLLOWS:
06
07              ;       C0=XXXX          MV=YYYY    # OF SAMPLES=(#)
08              ;       MUX CHANNEL = (#)        CLK TYPE = NNNN
09
10              ;       --:     (DECIMAL #)
11              ;       -5:         "
12              ;       -4:         "
13              ;       -3:         "
14              ;       -2:         "
15              ;       -1:         "
16              ;       C0:         "
17              ;       +1:         "
18              ;       +2:         "
19              ;       +3:         "
20              ;       +4:         "
21              ;       +5:         "
22              ;       ++:         "
23
24              ;       WHERE: XXXX   IS THE OCTAL HISTOGRAM CENTER VALUE
25              ;              YYYY   IS THE MILLIVOLT EQUIVALENT OF THE
26              ;                     CENTER VALUE (+/- 1 LSB).
27              ;              NNNN   IS THE A/D CLOCK TYPE
28              ;              # OF SAMPLES IS THE TOTAL # OF CONVERSIONS
29              ;                     TAKEN AND SORTED IN DECIMAL.
30              ;              THE MUX CHANNEL NUMBER IS OCTAL.
31
32              ;6.4.3  SET-UP SUMMARY REPORT:
33
34              ;        THIS CAN BE OBTAINED ANY TIME BY ENTERING A ^S
35              ;       (CNTRL S). ITS FORMAT IS:
36
37              ;       "CLOCK TYPE =" (CPU/INT/EXT CLK)
38              ;       "CHANNEL ="    (0-7 OCTAL)
39              ;       "HISTO MODE =" (AUTO/MANUAL)
40              ;       "** CAT RUNNING **"      -(ONLY IF CAT IS RUNNING)
41
42              ;6.4.4  ANALOOP DISCUSSION:
43              ;
44              ;       PROVIDED IS A SPECIAL TEST CHANNEL (#5) THAT ALLOWS
45              ;       THE A/D CONVERTER TO READ THE DAC'S OUTPUT VOLTAGE.
46              ;       THE NAME GIVEN TO THIS LOOP-AROUND OF DAC TO A/D
47              ;       CONVERTER IS "ANALOOP".
48              ;       THE HISTOGRAM PROGRAM ALLOWS SELECTION OF THE ANALOOP
49              ;       AS A REGULAR INPUT.
50              ;
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```
10009  .MAIN
01
02
03              ;6.4.5  CAT/KITTEN :"I/O ADDR ERROR" DURING OUTPUT REQUEST
04
05              ;       ** ONLY APPLIES IF THE DDOS REV IS 4.0 OR GREATER **
06              ;       USE ONLY I/O TESTER AS CAT/KITTEN DEVICE BEFORE REV 4
07              ;
08              ;       WHEN RUNNING THIS PROGRAM WITH THE DCH EXERCISER (CATS),
09              ;       DURING AN OUTPUT REQUEST, THE DCH EXERCISER MAY REPORT
10              ;       AN "I/O ADDR ERROR" FOLLOWED BY TWO OCTAL NUMBERS.
11              ;       THIS ERROR, IF IT OCCURS, SHOULD ONLY BE REPORTED WHEN
12              ;       AN OUTPUT REQUEST IS MADE (I.E. HISTOGRAM RESULTS
13              ;       PRINTOUT TO THE TTY), AND WILL BE REPORTED MORE OFTEN
14              ;       FOR CONSOLES THAT HAVE SLOW BAUD RATES. THIS ERROR
15              ;       INDICATES THAT AN INTERRUPT WAS NOT RECEIVED FROM THE
16              ;       DISK WITHIN 20 MS FROM INITIATION OF A DISK DCH CYCLE
17              ;       (DUE TO DISABLED INTERRUPTS DURING THIS TIME PERIOD
18              ;       IN THE A/D EXERCISER PROGRAM). THESE ERRORS SHOULD NOT,
19              ;       HOWEVER, BE REPORTED DURING NORMAL HISTOGRAM OPERATION
20              ;       (I.E. DURING CONTINUOUS PERIODS OF A/D SAMPLING WITHOUT
21              ;       ANY OUTPUT REQUESTS). IF ALLOWED TO RUN LONG ENOUGH
22              ;       WITHOUT OUTPUT REQUESTS, THE DCH EXERCISER SHOULD
23              ;       INDICATE A PASS BY PRINTING "P" ON THE OUTPUT DEVICE
24              ;       (UNLESS A HARD ERROR ACTUALLY EXISTS IN THE DISK). THE
25              ;       FIRST "P" SHOULD OCCUR WITHIN APPROXIMATELY 5 MINUTES
26              ;       FROM THE STARTING OF THE DCH EXERCISER.
27
28              ;       NOTE: SEE DGC PART # 094-782 FOR INFORMATION PERTAINING
29              ;       TO THE DTOS MOVING HEAD DISK DCH EXERCISER PROGRAM.
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10010  .MAIN
01
02
03              ;7.     OPERATING MODES/SWITCH COMMANDS:
04              ;       ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
05              ;       LOCATION "SWREG" IS USED TO SELECT THE PROGRAM OPTIONS
06              ;       (AND SPECIAL OPTIONS). WHILE RUNNING UNDER DTOS,
07              ;       THIS LOCATION WILL BE LOADED BY THE MONITOR.
08              ;       HOWEVER UNDER STAND ALONE AND PROGRAM LOAD MODES THIS
09              ;       LOCATION WILL BE SET ACCORDING TO THE ANSWERS SUPPLIED
10              ;       BY THE OPERATOR. IN ANY CASE THE OPTIONS CAN BE CHANGED
11              ;       OR VERIFIED BY USING ONE OF THE COMMANDS GIVEN IN SEC.
12              ;       7.2
13              ;
14              ;7.1    SWITCH OPTIONS - STANDARD (DTOS) SWITCHES:
15              ;       DIFFERENT BITS AND THEIR INTERPRETATION AT LOCATION
16              ;       "SWREG" IS AS FOLLOWS:
17              ;
18              ;       BIT     OCTAL   BINARY  INTERPRETATION
19              ;               VALUE   VALUE
20              ;
21              ;       1               0       LOOP ON ERROR
22              ;               40000   1       DO NOT LOOP ON ERROR
23              ;
24              ;       2               0       PRINT TO CONSOLE
25              ;               20000   1       DO NOT PRINT OUT TO CONSOLE
26              ;
27              ;       5               0       DO NOT PRINT ON THE LINE PRINTER
28              ;               02000   1       PRINT ON THE LINE PRINTER
29              ;
30              ;       6               0       DO NOT HALT ON ERROR
31              ;               01000   1       HALT ON ERROR
32              ;
33              ;       7               0       DO NOT PRINT ERROR SUMMARY
34              ;               00400   1       PRINT ERROR SUMMARY
35              ;
36              ;       E               0       DO NOT CLEAR HISTOGRAM ON OUTPUT
37              ;               00002   1       START NEW HISTOGRAM ON OUTPUT
38              ;                               (** MANUAL MODE ONLY **)
39              ;
40              ;
41              ;7.2    SWITCH COMMANDS
42              ;       ONCE THE PROGRAM STARTS EXECUTING THE STATE OF ANY OF
43              ;       THE BITS CAN BE CHANGED BY HITTING KEYS 1-9, A-F. THE
44              ;       PROGRAM WILL CONTINUE RUNNING AFTER UPDATE OF OPTIONS.
45              ;       EACH KEY WILL COMPLEMENT THE STATE OF THE BIT AFFILIAT-
46              ;       ED WITH IT, THUS BIT 4 CAN BE ALTERED BY HITTING KEY 4.
47              ;       SETTING OF ANY BIT OF LOCATION "SWREG" WILL SET BIT 0.
48              ;       (DEFAULT MODE IS DEFINED AS ALL BITS OF SWREG SET TO 0)
49              ;       THE PROGRAM CAN BE LOCKED INTO SWITCH MODIFICATION MODE
50              ;       BY TYPING A 0, IN WHICH CASE MORE THAN ONE BIT CAN BE
51              ;       CHANGED BEFORE  CONTROL IS ALLOWED TO RETURN TO THE
52              ;       MAIN PROGRAM.
53              ;
```

```
10011  .MAIN
01
02
03              ;7.2.1  OTHER COMMANDS
04              ;       "CR"    A "RETURN" CAN BE TYPED TO CONTINUE THE PROGRAM
05              ;               AFTER ITS LOCKED IN A SWITCH MODIFICATION MODE
06              ;
07              ;       ^D      THIS COMMAND GIVEN AT ANY TIME WILL RESET "SWREG"
08              ;               TO DEFAULT MODE AND RESTART THE PROGRAM.
09              ;
10              ;       ^R      THIS COMMAND GIVEN AT ANY TIME WILL RESTART THE
11              ;               PROGRAM. SWITCHES ARE LEFT WITH THE VALUES THEY
12              ;               HAD BEFORE THE COMMAND WAS ISSUED.
13              ;
14              ;       ^O      THIS COMMAND GIVEN AT ANY TIME WILL CAUSE THE
15              ;               PROGRAM TO GO TO THE OCTAL DEBUG TOOL (ODT).
16              ;
17              ;       M       THIS COMMAND GIVEN AT ANY TIME WILL PRINT THE
18              ;               CURRENT VALUE OF THE SWITCHES (OPERATING MODES).
19
20
21              ;8.     OPERATING PROCEDURE/OPERATOR INPUTS:
22              ;       ----------------------------------
23              ;       NOTE: THE POWER SHOULD ALWAYS BE OFF DURING INSERTION
24              ;       AND REMOVAL OF THE MICRODAC (OR ANY BOARD)
25              ;       INTO MICRO NOVA CHASSIS.
26              ;
27              ;       TO RUN THIS PROGRAM :
28              ;
29              ;       1.  INSERT MICRODAC INTO AN I/O SLOT WITH THE
30              ;           INTERRUPT PRIORITY (/INTP/) AND DEVICE CODE
31              ;           PROPERLY JUMPERED.
32              ;       2.  INSTALL LOOP-AROUND CONNECTOR, IF AVAILABLE,
33              ;           ON THE BACKPLANE A-PAD.
34              ;       3.  LOAD THE PROGRAM VIA PAPER TAPE OR DDOS DISKETTE.
35              ;       4.  STARTING ADDRESS IS 200 (OR 500) OCTAL
36              ;       5.  AFTER THE PROGRAM TITLE IS PRINTED, ANSWER
37              ;           THE FOLLOWING QUESTIONS:
38              ;
39              ;               "DEVICE CODE = "
40              ;
41              ;               ENTER 6-BIT DEVICE CODE OF THE MICRODAC IN OCTAL.
42              ;               (MUST BE < 77 OCTAL).
43              ;               A (CR) SELECTS LAST # ENTERED (INITIAL DEFAULT=40)
44              ;
45              ;               "TEST(D=DIAGNOSTIC,C=CALIBRATION,H=HISTOGRAM)?"
46              ;
47              ;               ENTER D,C,OR H TO SELECT WHICH TEST TO RUN.
48              ;               A (CR) SELECTS LAST TEST RUN (INITIAL DEFAULT=D).
49              ;
50              ;       6. FROM HERE CONSULT THE FOLLOWING SECTIONS DEPENDING
51              ;          ON TEST SELECTED:
52              ;
53              ;                   D...SEC. 8.1
54              ;                   C...SEC. 8.2
55              ;                   H...SEC. 8.3
```

```
10012  .MAIN
01
02
03              ;8.1    OPERATOR PROCEDURE: DIAGNOSTIC
04              ;
05              ;       THE DIAGNOSTIC WILL PROMPT WITH :
06              ;
07              ;       "IS THE LOOPBACK CONNECTOR INSTALLED (CR=YES) ?"
08              ;
09              ;         IF THE DIAGNOSTIC LOOPBACK CONNECTOR IS INSTALLED,
10              ;       HIT "CR". OTHERWISE, HIT "N" FOR NO.
11              ;
12              ;         THE PROGRAM RUNS CONTINUOUSLY, OUTPUTTING "PASS #N"
13              ;       EVERY PASS OR AN ERROR MESSAGE (SEE SEC. 9.2 FOR ERROR
14              ;       DESCRIPTION).
15              ;         HITTING A CONTROL-R (^R) WILL RETURN YOU TO THE TEST
16              ;       SELECTION QUESTION.
17
18
19              ;8.2    OPERATING PROCEDURE: CALIBRATION
20              ;
21              ;       *NOTE: ALLOW BOARD TO THERMALLY STABILIZE BEFORE USING
22              ;              THIS PROGRAM.
23
24              ;       UPON ENTRY THE FOLLOWING QUESTION IS ASKED:
25              ;
26              ;         CALIBRATE WHICH MODULE(1=DAC,2=A/D) ?
27              ;
```

```
10013  .MAIN
01
02
03              ;8.2.1  **DAC CALIBRATION**
04              ;
05              ;         CALIBRATION OF THE DAC INVOLVES THE FINE TUNING OF TWO
06              ;       15-TURN VARIABLE RESISTORS (MARKED 'DAC OFFSET' AND 'DAC
07              ;       SPAN') AND REQUIRES A 4 DIGIT DVM.
08              ;         THE PROCEDURE FOR DAC CALIBRATION IS STRAIGHTFORWARD.
09              ;       WHEN THE USER SELECTS DAC CALIBRATION, THE PROGRAM WILL
10              ;       AUTOMATICALLY OUTPUT THE PROPER CODE FOR 0.000 VOLTS ON
11              ;       THE DAC. PROGRAM OUTPUT WILL PROCEED AS FOLLOWS:
12              ;
13              ;        "1)REMOVE LOOPBACK CONNECTOR.
14              ;         2)ATTACH DVM TO DAC OUTPUT.
15              ;         3)ADJUST 'DAC OFFSET' TRIM POT UNTIL DVM READS
16              ;           0.000 VOLTS
17              ;         4)THEN HIT 'CR' KEY"
18              ;
19              ;       AFTER THE "CR" KEY IS HIT THE PROGRAM WILL OUTPUT -5.000
20              ;       VOLTS FROM THE DAC. PROGRAM THEN PRINTS:
21              ;
22              ;         5)NOW ADJUST 'DAC SPAN' TRIM POT SO THAT DVM
23              ;           READS -5.000 VOLTS.
24              ;         6)THEN HIT 'CR' KEY.
25              ;
26              ;       AFTER THE 'CR' KEY IS STRUCK, THE FINAL VALUE OF +4.990
27              ;       WILL BE OUTPUT. PROGRAM THEN PRINTS:
28              ;
29              ;         7)QUICK CHECK: DVM SHOULD NOW READ +4.985 TO +4.995
30              ;           VOLTS. HIT 'CR' TO EXIT TEST.
31              ;
32              ;       NOTE THAT THE FINAL READING CAN BE FROM 4.985 TO 4.995
33              ;       VOLTS.
34              ;
35              ;         THE ACTUAL DAC OUTPUT AND ANALOG GROUND PIN LOCATIONS
36              ;       CAN BE FOUND IN SECTION 11.1.1
37              ;        IF THE TRIM POTS WILL NOT ADJUST THE DAC OUTPUT TO THE
38              ;       PROPER VALUES (OR IF QUICK CHECK FAILS) THEN A PROBLEM
39              ;       EXISTS WITH THE DVM, USER CONNECTION, OR CONVERTER.
```

```
10014  .MAIN
01
02              ;8.2.2  ** A/D CALIBRATION **
03              ;
04              ;       UPON ENTRY THEW FOLLOWING QUESTION IS ASKED:
05              ;
06              ;       VOLTAGE SOURCE ON CHANNEL: 0-3, 6(TP1), OR 7(TP2)?
07
08              ;         AFTER SELECTING A CHANNEL, THE FOLLOWING INSTRUCTIONS
09              ;       ARE GIVEN:
10
11              ;      "1)ATTACH SOURCE TO CHANNEL AND ADJUST TO +0.005 VOLTS
12              ;       2)TURN 'A/D OFFSET' TRIM POT UNTIL DOUBLE NUMBERS APPEAR
13              ;         WITH EACH GREATER THAN 100.
14              ;        (HIT 'CR' TO START/STOP OUTPUT AND 'SPACE' TO PROCEED)"
15
16              ;         AFTER STARTING THE TTY OUTPUT ("CR"), EITHER TWO #S
17              ;       OR "HI/LO # BITS" WILL BE PRINTED. THE 'A/D OFFSET' POT.
18              ;       SHOULD BE ADJUSTED UNTIL THE OUTPUT IS TWO THREE-DIGIT
19              ;       NUMBERS (THEY TOTAL 256.). THE 'SPACE' BAR IS THEN
20              ;       STRUCK TO CONTINUE:
21              ;
22              ;      "3)NOW ADJUST SOURCE TO -4.917 VOLTS.
23              ;       4)TURN 'A/D SPAN' TRIM POT UNTIL DOUBLE NUMBERS AGAIN
24              ;         APPEAR WITH EACH GREATER THAN 100.
25              ;        (HIT 'CR' TO START/STOP OUTPUT AND 'SPACE' BAR TO END)"
26              ;
27              ;         THE PROCEDURE OUTLINED ABOVE SHOULD AGAIN BE DONE.
28              ;         A SAMPLE TTY OUTPUT (W/COMMENTS ADDED) IS SHOWN BELOW:
29              ;
30              ;               "LO 21  BITS"           -BEGIN TURNING.
31              ;               "LO 25  BITS"           -WRONG DIRECTION.
32              ;               "LO 18  BITS"           -NOW RIGHT DIRECTION
33              ;               "LO 5   BITS"
34              ;               "LO 3   BITS"
35              ;               "0      256 "           -DOUBLE NUMBERS
36              ;               "30     226 "
37              ;               "80     176 "           -GETTING CLOSE
38              ;               "180    76  "
39              ;               "256    0   "
40              ;               "HI 15  BITS"           -TURNED TOO FAR
41              ;               "HI 4   BITS"
42              ;               "256    0   "
43              ;               "199    57  "           -GETTING CLOSE
44              ;               "166    90  "
45              ;               "140    116 "           -OK: STOP TURNING
46              ;               "134    122 "           (VALUES WILL DRIFT
47              ;               "120    136 "            AROUND BUT SHOULD
48              ;               "104    152 "            BOTH BE GREATER THAN
49              ;               "113    143 "            100.)
```

```
0015  .MAIN
01
02
03              ;8.3    OPERATING PROCEDURE: HISTOGRAM
04              ;
05              ;        THE PROGRAM WILL REQUEST THE FOLLOWING:
06              ;
07              ;>>       "HISTOGRAM TYPE (A=AUTO,M=MANUAL) ?"
08              ;         *INITIAL DEFAULT=M
09              ;
10              ;        IN MANUAL MODE (M): THE HISTOGRAM RUNS CONTINUOUSLY
11              ;       AND DISPLAYS RESULTS ONLY WHEN THE "SPACE" BAR IS HIT.
12              ;       IN THIS MODE SWITCH "E" IS USED TO SELECT CONTINUOUS
13              ;       OR RESTARTING HISTOGRAM (SEE SEC. 7.1).
14              ;        IN AUTO MODE (A): THE HISTOGRAM RUNS UNTIL A SPECIFIED
15              ;       NUMBER OF SAMPLES HAS BEEN TAKEN. IT THEN DISPLAYS THE
16              ;       RESULT, CLEARS ITSELF, AND RUNS AGAIN. HITTING "SPACE"
17              ;       BAR DISPLAYS THE RESULTS UP TO THAT TIME, THEN IT
18              ;       CONTINUES NORMALLY. AUTO MODE GETS ITS SAMPLE # FROM
19              ;       THE FOLLOWING QUESTION:
20              ;
21              ;>        "K SAMPLES/HISTOGRAM (1=1000,ETC.) & CR :"
22              ;         *INITIAL DEFAULT=50 (IE 50,000 SAMPLES)
23              ;
24              ;       MAXIMUM ENTRY IS 32,767 (IE: 32,767,000 SAMPLES).
25              ;
26              ;>>       "CLOCK TYPE (1=CPU, 2=INT, 3=EXT) ?"
27              ;         *INITIAL DEFAULT=1
28              ;
29              ;        IF THE CAT/KITTEN EXERCISER WAS LOADED WITH THIS
30              ;       PROGRAM (IE: CLOAD), IT WILL ASK THIS QUESTION:
31              ;
32              ;>        "RUN DCH EXERCISER (Y=YES) ?"
33              ;         *INITIAL DEFAULT=NO
34              ;
35              ;        RUN CAT/KITTEN ONLY IF: (1)DDOS REV# = 4+ OR
36              ;       (2)CAT/KITTEN DEVICE IS AN I/O TESTER BOARD
37              ;
38              ;       THE FOLLOWING QUESTIONS ARE ALWAYS ASKED:
39              ;
40              ;>>       "WHICH CHANNEL (0-3,4=AGND,5=ANALOOP,6=TP1,7=TP2) ?"
41              ;         *INITIAL DEFAULT=0
42              ;
43              ;>>       "OPTIONAL DAC OUTPUT (0-1777 OCTAL) AND (CR): "
44              ;         *INITIAL DEFAULT=0000 (NEG.FULL.SCALE)
45              ;
46              ;        THE EFFECT OF THIS OUTPUT ON CHANNELS 0-3 (IF LOOP-
47              ;       BACK CONNECTOR INSTALLED) IS EXPLAINED IN SEC. 11.3
48              ;       "LOOPBACK CONNECTOR - HISTOGRAM CONSIDERATIONS".
49              ;        IF NO LOOPBACK CONNECTOR, THEN IT SHOULD ONLY AFFECT
50              ;       CHANNEL #5 (ANALOOP).
51              ;
52              ;        IF CAT/KITTEN IS RUNNING, THE PROGRAM WILL PRINT:
53              ;
54              ;>        "OVERRUN ERRORS NOT CHECKED IN CAT MODE"
55              ;
56              ;       (SEE SEC. 6.4.2 FOR HISTOGRAM OUTPUT DESCRIPTION)
57              ;
58              ;       *NOTE: TYPING ONLY (CR) IN RESPONSE TO ANY QUESTION
59              ;              WILL SELECT THE PREVIOUSLY GIVEN PARAMETER (OR
60              ;              INITIAL DEFAULT IF NO PREVIOUS ANSWER GIVEN).
```

```
0016  .MAIN
01
02
03              ;9.     PROGRAM OUTPUT/ERROR DESCRIPTION:
04              ;       --------------------------------
05              ;       ALL PROGRAM OUTPUTS, BOTH MESSAGES AND ERROR
06              ;       REPORTS, ARE CONTROLLED BY THE VALUE OF "SWREG"
07              ;       (SEE SECTION 8) SWITCHES 2 AND 5 AS FOLLOWS:
08              ;
09              ;       SWITCH          PRINTOUT TO
10              ;       2    5          TTY/CRT  LPT
11              ;       -----           ------------
12              ;       0    0          YES      NO
13              ;       0    1          YES      YES
14              ;       1    0          NO       NO
15              ;       1    1          NO       YES
16              ;
17              ;
18              ;9.1    ERROR DESCRIPTIONS - GENERAL
19              ;
20              ;         THE FOLLOWING THREE ERRORS ARE COMMON TO ALL
21              ;       PROGRAMS:
22              ;
23              ;       1)  "FATAL STACK BOUNDARY VIOLATION. SP = (XXXXXX)"
24              ;           IS REPORTED, FOLLOWED BY A HALT, IF A
25              ;           STACK BOUNDARY IS CROSSED (256 WDS). XXXXXX
26              ;           IS THE VALUE OF THE STACK POINTER (OCTAL).
27              ;           IF CONTINUED, THE PROGRAM WILL RESTART (200).
28              ;
29              ;       2)  "*** RTC FAILURE ****" IS REPORTED, FOLLOWED
30              ;           BY A HALT IF THE REAL-TIME CLOCK FAILS TO
31              ;           CAUSE INTERRUPTS DURING TIMER VALUE CALCULATIONS.
32              ;
33              ;       3)  "UNIDENTIFIED INTERRUPT - (DVC)"
34              ;           IS REPORTED IF ANY DEVICE OTHER THAN THE A/D
35              ;           INTERFACE REQUESTS AN INTERRUPT DURING EXER-
36              ;           CISER OPERATION. DVC = THE OCTAL DEVICE CODE
37              ;           OF THE DEVICE REQUESTING THE INTERRUPT. ALSO,
38              ;           THE PROGRAM WILL ATTEMPT TO CLEAR THE INTERRUPT
39              ;           BY ISSUING AN 'NIOC' INSTRUCTION TO THE DEVICE.
40
```

```
10017  .MAIN
01
02              ;9.2    ERROR DESCRIPTION:  ** DIAGNOSTIC **
03              ;
04              ;9.2.1  ERROR FORMAT:
05              ;
06              ;       ERRORS ENCOUNTERED IN THIS PROGRAM ARE OUTPUT IN
07              ;       THE FOLLOWING FORMAT:
08              ;
09              ;       1) PROGRAM NAME,REV #
10              ;       2) FAILING MODULE MESSAGE
11              ;       3) DESCRIPTIVE MESSAGE
12              ;       4) ERROR NUMBER, SUBTEST NUMBER
13              ;       5) ACCUMULATORS, PC, CARRY
14              ;       6) SIGNIFICANCE OF AC'S
15
16              ;         >> ERROR EXAMPLE #1 <<
17              ;
18              ;       PROGRAM NAME: MDAC          REV: 00
19              ;       FAILING MODULE: MICRODAC
20              ;       *** DOB=TO=DIB DATA TRANSFER ERROR ***
21              ;       ERROR NUMBER #20   ENCOUNTERED SUBTEST #10
22              ;       CRY     AC0     AC1     AC2     PC
23              ;       0       177777  177776  000077  001234
24              ;       ** AC0=DOB, AC1=DIB **
25              ;
26              ;        (INDICATES THAT A MISMATCH OCCURED IN THE LOOPING
27              ;         BACK OF THE 16 DIGITAL I/O LINES)
28
29              ;         >> ERROR EXAMPLE #2 <<
30              ;
31              ;       PROGRAM NAME: MDAC          REV: 00
32              ;       FAILING MODULE: MICRODAC
33              ;       *** ILLEGAL DEVICE CODE CHANGES MDAC DIA ***
34              ;       ERROR NUMBER #17   ENCOUNTERED SUBTEST #7
35              ;       CRY     AC0     AC1     AC2     PC
36              ;       0       000252  000050  000040  001145
37              ;       ** AC2=MDAC DVC, AC1=BAD DVC **
38
39              ;9.2.2  ERROR SUMMARY REPORT
40              ;
41              ;       THE REPORT SHOWN BELOW IS OBTAINED WHEN SWREG
42              ;       SWITCH 7 GOES FROM 0 TO 1:
43              ;
44              ;        ERROR SUMMARY REPORT FOLLOWS
45              ;        ERROR NUMBERS: (#1) (#2)  ... (#N)
46              ;        END OF SUMMARY
47              ;
48              ;       WHERE (#1) (#2) ... (#N) IS A LIST OF ALL ERROR
49              ;       NUMBERS THAT HAVE BEEN DETECTED. IF NO ERRORS
50              ;       HAVE OCCURED, THEN THE MESSAGE "NO ERRORS ENCOUN-
51              ;       TERED SINCE LAST SUMMARY" WILL BE REPORTED INSTEAD.
52
53              ;9.3    ERROR DESCRIPTION:  ** CALIBRATION **
54              ;
55              ;       IN THE CALIBRATION ROUTINE DIA STATUS/TIMEOUT ERRORS
56              ;       AND UNDEFINED INTERRUPTS ARE CONSIDERED FATAL.
57              ;       THE PROGRAM WILL RETURN TO THE TEST SELECT QUESTION
58              ;       IF AN ERROR IS ENCOUNTERED.
59              ;
```

```
10018  .MAIN
01
02
03              ;9.4    ERROR DESCRIPTION :  ** A/D HISTOGRAM **
04              ;
05              ;
06              ;       1) CONVERSION TIME OUT : REPORTED IN THE EVENT THAT
07              ;          AN INTERRUPT IS NOT RECEIVED WITHIN 60 MICRO-SECONDS
08              ;          AFTER THE STARTING OF A CPU TRIGGERED CONVERSION.
09              ;
10              ;               "CONVERSION TIME OUT"
11              ;               "DIA = "(A/D STATUS)     "CPU CLK"
12
13              ;          NO CONVERSION TIMEOUTS ARE REPORTED IF THE TRIGGERING
14              ;          MODE IS INTERNAL/EXTERNAL CLOCK. IF EITHER OF THESE
15              ;          MODES IS BEING USED, AND AN ERROR EXISTS, THE PROGRAM
16              ;          OPERATION IN AUTO-HISTOGRAM WILL APPEAR TO FREEZE.
17              ;          HITTING THE "SPACE" BAR MAY YIELD A HISTOGRAM WITH
18              ;          ZERO SAMPLES.
19
20
21              ;       2) A/D STATUS : CHECKED AT THE BEGINNING AND END OF EACH
22              ;          CONVERSION CYCLE TO INSURE PROPER A/D FUNCTIONING. IF
23              ;          A STATUS ERROR IS DETECTED DURING PROGRAM OPERATION,
24              ;          AN A/D STATUS ERROR IS REPORTED ALONG WITH THE GOOD
25              ;          (GGGGGG) AND BAD (BBBBBB) STATUS REGISTER CONTENTS
26              ;          (DIA).
27              ;
28              ;                       "A/D STATUS ERROR"
29              ;                       "GOOD/BAD"
30              ;                       GGGGGG BBBBBB
31
32
33              ;9.4.1  ERROR SUMMARY REPORT :
34              ;       (OBTAINED WHEN "SWREG" SWITCH 7 GOES FROM 0 TO 1)
35              ;
36              ;       THE REPORT FORMAT IS:
37              ;
38              ;       "CONVERSION TIME OUTS:" (#)
39              ;       "A/D STATUS ERRORS:"    (#)
40
41              ;       ALL COUNTS ARE DECIMAL.
42
```

```
10019  .MAIN
01
02
03              ;10.    DEBUG HELP:
04              ;       ----------
05              ;       *** OCTAL DEBUG TOOL (ODT) ***
06              ;
07              ;       THE DIAGNOSTIC IS EQUIPED WITH A BUILT IN ODT WHICH CAN
08              ;       BE ACCESSED BY HITTING CONTROL O (^O) AT ANY TIME DURING
09              ;       THE EXECUTION OF THE PROGRAM (AFTER SETTING THE PARA-
10              ;       METERS).
11              ;       ON ENTERING ODT THE ADDRESS OF THE LOCATION HAVING THE
12              ;       NEXT INSTRUCTION TO BE EXECUTED WILL BE TYPED-OUT.
13              ;
14              ;10.1   CONVENTIONS AND SYMBOLS
15              ;       THE FOLLOWING CONVENTIONS ARE USED BY THE ODT:
16              ;       ?       PRESSING ANY ILLEGAL KEY CAUSES THE ODT TO RES-
17              ;               POND WITH A "?".
18              ;       @       ODT IS READY AND AT YOUR SERVICE.
19              ;
20              ;10.2   COMMAND STRUCTURE
21              ;       AN ODT COMMAND HAS THE FOLLOWING FORMAT:
22              ;               [ARGUMENT][COMMAND]
23              ;       AN ARGUMENT MAY BE ONE OF THE FOLLOWING:
24              ;       "EXP"   AN OCTAL EXPRESSION CONSISTING OF OCTAL NUMBERS
25              ;               SEPARATED BY PLUS (+) OR MINUS (-) SIGNS. LEAD-
26              ;               ING ZEROS NEED NOT BE TYPED.
27              ;       "ADR"   AN ADDRESS IS THE SAME AS AN EXPRESSION EXCEPT
28              ;               THAT BIT 0 IS NEGLECTED.
29              ;       A COMMAND IS A SINGLE TELETYPE CHARACTER
30              ;
31              ;10.3   ODT COMMANDS
32              ;       THE LOCATIONS THAT CAN BE EXAMINED AND MODIFIED BY THE
33              ;       USER ARE CALLED CELLS. THESE CELLS ARE OF TWO TYPES:
34              ;       INTERNAL CPU CELLS AND MEMORY LOCATIONS.
35              ;
36              ;10.3.1 OPENING INTERNAL CELLS
37              ;       THE COMMAND TO OPEN ONE OF THE INTERNAL REGISTERS IS OF
38              ;       THE FORM "NA" WHERE N IS ANY OCTAL EXPRESSION BETWEEN
39              ;       0 AND 7
40              ;       0-3     FOR ACCUMULATORS 0-3
41              ;       4       FOR PC OF THE NEXT INSTRUCTION TO BE EXECUTED IN
42              ;               THE EVENT OF A "P" COMMAND.
43              ;       5       CPU AND TTO STATUS
44              ;               BIT     INTERPRETATION
45              ;               15      STATUS OF TTO DONE FLAG
46              ;               14      STATUS OF INTERRUPTS (ION FLAG)
47              ;               13      STATUS OF CARRY BIT
48              ;       6       ADDRESS OF THE LOCATION HAVING THE BREAK POINT
49              ;               (IF ANY)
50              ;       7       INSTRUCTION AT THE BREAK POINT LOCATION
51
```

```
10020  .MAIN
01              ;       OTHER COMMANDS TO OPEN CELLS ARE:
02              ;
03              ;       "ADR"/  OPEN THE CELL AND PRINT ITS CONTENTS
04              ;       ./      OPEN THE CELL CURRENTLY POINTED TO BY THE
05              ;               POINTER AND PRINT ITS CONTENTS.
06              ;       .+"ADR"/ADD "ADR" TO THE POINTER, OPEN THE CELL AND
07              ;               PRINT ITS CONTENTS.
08              ;       .-"ADR"/SUBTRACT "ADR" FROM THE POINTER, OPEN THE CELL
09              ;               AND PRINT ITS CONTENTS.
10              ;       "CR"    THE RETURN KEY IS USED TO CLOSE THE OPEN CELL
11              ;               WITH OR WITHOUT MODIFICATION.
12              ;       "LF"    LINE FEED IS USED TO CLOSE THE OPEN CELL WITH OR
13              ;               WITHOUT MODIFICATION AND TO OPEN THE SUCCEEDING
14              ;               CELL.
15              ;       ^       CLOSE THE OPEN CELL WITH OR WITHOUT MODIFICATION
16              ;               AND OPEN THE PRECEDING CELL
17              ;       /       CLOSE THE OPEN CELL WITHOUT MODIFICATION, AND
18              ;               OPEN THE CELL POINTED TO BY ITS CONTENTS.
19              ;       +"ADR"/ CLOSE THE OPEN CELL WITHOUT MODIFICATION, AND
20              ;               OPEN THE CELL POINTED TO BY ITS CONTENTS+"ADR".
21              ;       -"ADR"/ CLOSE THE OPEN CELL WITHOUT MODIFICATION, AND
22              ;               OPEN THE CELL POINTED TO BY ITS CONTENTS-"ADR".
23              ;
24              ;10.3.2 MODIFICATION OF A CELL
25              ;       ONCE A CELL HAS BEEN OPENED ITS CONTENTS CAN BE MODIFIED
26              ;       BY TYPING THE NEW VALUE THE CELL IS TO CONTAIN IN THE
27              ;       FORM OF AN OCTAL EXPRESSION FOLLOWED BY "CR" OR "LF".
28              ;       IF A + OR - IS TYPED AS THE FIRST CHARACTER OF THE EX-
29              ;       PRESSION THEN THE VALUE OF THE EXPRESSION IS ADDED TO OR
30              ;       SUBTRACTED FROM THE OLD CONTENTS OF THE CELL. THE
31              ;       ADDRESS ITSELF OR AN EXPRESION RELATIVE TO THE ADDRESS
32              ;       CAN BE DEPOSITED BY TYPING A "." OR ".+/-OCTAL EXPRESS-
33              ;       ION". A RUBOUT COMMAND GIVEN RIGHT AFTER OPENING A CELL
34              ;       ALLOWS THE MODIFICATION OF ITS CONTENTS AS IF THEY WERE
35              ;       TYPED IN JUST BEFORE THE COMMAND WAS ISSUED.
36              ;
37              ;10.3.3 OTHER ODT COMMANDS
38              ;       RUBOUT  THIS KEY IS USED TO DELETE ERRONEOUSLY TYPED
39              ;               DIGITS. EACH TIME THE KEY IS PRESSED THE RIGHT
40              ;               MOST DIGIT IS DELETED AND ECHOED ON THE TERMINAL.
41              ;               IF THE RUBOUT KEY IS PRESSED RIGHT AFTER OPENING
42              ;               A CELL THEN IT DELETES THE RIGHT MOST DIGIT OF
43              ;               THE CELLS CONTENTS. THIS ALLOWS THE MODIFICATION
44              ;               OF THE CELL AS IF ITS CONTENTS WERE TYPED IN JUST
45              ;               BEFORE THE KEY WAS PRESSED.
46              ;       "ADR"B  INSERT A BREAK POINT AT LOCATION "ADR".
47              ;               ONLY ONE BREAK POINT CAN BE INSERTED AND ANY
48              ;               ENTRY TO ODT AFTER EXECUTING A BREAK POINT WILL
49              ;               CAUSE IT TO BE DELETED.
50              ;       U       DELETE THE BREAK POINT IF ANY.
51              ;       P       RESTART THE EXECUTION OF THE PROGRAM AT LOCATION
52              ;               POINTED BY 4A.
53              ;       "ADR"R  START EXECUTING THE PROGRAM AT "ADR" AFTER AN
54              ;               IO-RESET.
55              ;       K       KILL THE STRING TYPED SO FAR. THE ODT RESPONDS
56              ;               WITH A "?" AND THE OPEN CELL IS CLOSED WITHOUT
57              ;               MODIFICATION.
58              ;       =       PRINT THE OCTAL VALUE OF THE INPUT ONLY.
59              ;               THIS WILL CLOSE ANY OPEN CELLS WITHOUT
60              ;               MODIFICATION AND WILL NOT OPEN A CELL
```

```
 0021  .MAIN
01              ;10.4   PROGRAM SUBROUTINE DESCRIPTIONS:
02
03              ;       NOTE: THESE ARE THE DESCRIPTIONS OF SOME OF THE MOST
04              ;             COMMONLY USED SUBROUTINES.
05
06
07              ;       1) CALL SCAN = HISTOGRAM SAMPLER/SCANNER
08
09              ;          INIT THESE BEFORE ENTERING:
10
11              ;          COUNT= # OF CONVERSIONS
12              ;          BSTRT= BLOCK STARTING ADDRESS
13              ;          CDOA=  A/D COMMAND WORD
14              ;          GDIA=  A/D STATUS WORD
15
16              ;          RETURNS TO: "SCANR" (CALL+1 WHEN CALL = "SCAN")
17
18              ;       2) CALL CHKTTY = PROCESS HISTOGRAM TTY INPUTS
19
20              ;          VALID INPUTS ARE:
21              ;          0-9, A-F      SET/CLEAR SELECTED "SWREG" SWITCH
22              ;          M             DISPLAY "SWREG" SWITCHES
23              ;          CNTRL - O     ENTER OCTAL DEBUG TOOL (ODT)
24              ;          CNTRL - R     RESTART PROGRAM (NO SWREG CHANGE)
25              ;          CNTRL - D     RESTART PROGRAM (DEFAULT SWREG)
26              ;          CNTRL - S     PRINT HISTOGRAM SET-UP SUMMARY
27              ;          ESC           RETURN TO TEST SELECT QUESTION
28              ;          SPACE         REQUEST HISTOGRAM
29              ;          ?             PRINT A LIST OF POSSIBLE COMMANDS
30
31              ;          ALL INPUTS ARE ECHOED. ANY INVALID INPUT CAUSES
32              ;          THE MESSAGE "TYPE ? FOR HELP" TO BE PRINTED.
33
34              ;          RETURNS TO : CALL +1
35
36              ;       3) CALL NOTTY (JSR @INTTY)
37
38              ;          MASK OUT TTY INPUT & OUTPUT (TTI/TTO) INTERRUPTS
39              ;          (PRIORITY MASK BITS: TTI = 14, TTO = 15)
40
41              ;       4) CALL READC = READ FROM TTY INPUT DEVICE
42              ;
43              ;          RETURNS:
44              ;          ODT      IF CHARACTER IS CONTROL "O"
45              ;          START    IF CHARACTER IS ESCAPE
46              ;          CALL+1   IF CHARACTER IS CARRIAGE RETURN
47              ;          CALL+2   IF ANY OTHER CHARACTER => AC0
48              ;                   (7 - BIT ASCII W/PARITY REMOVED)
49              ;                   (AC0 DESTROYED)
50
51              ;       5) CALL STDOA
52              ;
53              ;          FORMS THE COMPOSITE A/D COMMAND WORD (DOA) FROM THE
54              ;          PAGE 0 A/D SWITCHES (AUTOS, TRIG, MUXC) AND PUTS
55              ;          RESULT IN PAGE 0 WORD "CDOA".OVRN INTEN ALSO SET.
56              ;
57              ;          RETURNS : CALL+1 (ALL AC'S SAVED)
```

```
10022  .MAIN
01
02
03              ;       6) CALL STDIA
04              ;
05              ;          FORMS THE EXPECTED A/D STATUS WORD (DIA) FROM THE
06              ;          PAGE 0 A/D SWITCHES (AUTOS, TRIG, MUXC) AND PUTS
07              ;          RESULT IN PAGE 0 WORD "GDIA".OVRN INTEN ALSO SET.
08              ;
09              ;          RETURNS : CALL+1 (ALL AC'S SAVED)
10
11              ;       7) CALL CDATA
12              ;
13              ;          AC1 = OCTAL A/D DATA FOR CONVERSION
14              ;          RETURN:
15              ;          AC1=  CONVERTED DATA (SIGNED DEC. MILLIVOLTS)
16              ;                (ALL OTHER AC'S SAVED)
17
18              ;       8) CALL CLRBLK  = CLEAR BLOCK OF MEMORY
19              ;
20              ;          CALL+1 = START ADDRESS OF DATA BLOCK
21              ;          CALL+2 = OCTAL WORD COUNT OF DATA BLOCK
22              ;          RETURNS TO CALL + 3
23              ;           (NO AC'S SAVED)
24
25              ;       9) CALL IWAIT = (DIAGNOSTIC ONLY)
26              ;
27              ;          WAITS FOR TIME "DELAY" FOR AN INTERRUPT
28              ;
29              ;          RETURNS TO:
30              ;          CALL+1 IF NO/UNDEFINED INTERRUPT
31              ;          CALL+2 IF BD STATUS OR A/D OVERRUN INTERRUPT
32              ;          CALL+3 IF I/O INTERRUPT
33              ;
34              ;          AC'S ARE AS FOLLOWS ON RETURN:
35              ;
36              ;           TYPE          AC0      AC1      AC2
37              ;           ------------------------------------
38              ;           NONE          DVC      0        N/C
39              ;           UNDEFINED     DVC      BAD      N/C
40              ;         BRD STAT/OVRN   DVC      N/C      DIA
41              ;           I/O INTR      DVC      N/C      DIA
42              ;
43              ;          WHERE:
44              ;          DVC = MDAC DEVICE CODE
45              ;          BAD = UNDEFINED DEVICE CODE
46              ;          N/C = NO CHANGE
47              ;          DIA = A/D STATUS WORD
48              ;
49              ;          "UNDEFINED INTERRUPT - (DVC)"
50              ;          REPORTED IF ANY DEVICE OTHER THAN MICRODAC IS
51              ;          REQUESTING AN INTERRUPT.
52              ;          THE ROUTINE WILL ATTEMPT TO CLEAR THE INTERRUPT
53              ;          WITH AN 'NIOC' INSTRUCTION ISSUED TO THE DEVICE.
```

```
10023  .MAIN
01
02
03              ;       10) CALL JSR @ICDIC
04              ;
05              ;           CHECK A/D CONVERSION AGAINST EXPECTED VALUE.
06              ;
07              ;           INPUT:
08              ;           AC0=DIC
09              ;           CALL+1: EXPECTED A/D VALUE(LEFT JUSTIFIED)
10              ;           CALL+2: ALLOWABLE DEVIATION (IN LSB'S)
11              ;
12              ;           RETURN:
13              ;           CALL+3 (ERROR): AC0=DIC A/D VALUE(LEFT JUSTIFIED)
14              ;                           AC1=GOOD A/D VALUE ( L.J.)
15              ;           CALL+4 (NORMAL):AC0,AC2 ARE UNCHANGED
16              ;                           AC1,AC3 ARE DESTROYED
17
18              ;       11) CALL: JSR @I.CNL
19              ;
20              ;           CHECK A/D CHANNEL BITS IN THE DIC
21              ;
22              ;           INPUT:AC0=DIC
23              ;                 MUXC=CORRECT CHANNEL
24              ;
25              ;           RETURN:
26              ;           CALL+1 (ERROR): AC0=DIC
27              ;                           AC1=GOOD A/D CHANNEL
28              ;                           AC2=A/D CHANNEL FROM DIC
29              ;           CALL+2 (NORMAL):AC0=AC2 UNCHANGED
30              ;                           AC3 DESTROYED
31
```

```
10024  .MAIN
01
02
03              ;11.    SPECIAL NOTES/SPECIAL FEATURES:
04              ;       ------------------------------
05              ;
06              ;11.1   USER/TEST CONNECTIONS:
07              ;
08              ;11.1.1 TEST POINTS:
09              ;
10              ;         THERE ARE FIVE ANALOG TEST PINS ON THE COMPONENT SIDE
11              ;       OF THE MICRODAC PC BOARD. THEY ALLOW THE CALIBRATION AND
12              ;       HISTOGRAM PROGRAMS TO BE RUN WITHOUT A USER CONNECTOR:
13              ;
14              ;               PIN             FUNCTION
15              ;               ---             --------
16              ;               TP1             A/D CHANNEL 6
17              ;               TP2             A/D CHANNEL 7
18              ;               TP3             A/D ANALOG GROUND
19              ;               TP4             DAC OUTPUT
20              ;               TP5             DAC ANALOG GROUND
21              ;
22              ;         DURING DAC CALIBRATION, BE SURE THE "LOOP-AROUND"
23              ;       CONNECTOR IS REMOVED (DUE TO LOADING OF THE DAC OUTPUT
24              ;       BY THE CONNECTOR'S RESISTOR NETWORK.
25              ;
26              ;
27
28              ;11.1.2 USER CONNECTOR (50 PIN)
29              ;
30              ;       PIN             FUNCTION
31              ;       ---             --------
32              ;       A1-A31(ODD)     DIGITAL OUTPUT PORT (MSB=A1)
33              ;       A2-A32(EVEN)    DIGITAL INPUT PORT (MSB=A2)
34              ;       A33             DOP STATUS (HANDSHAKING)
35              ;       A34             DIP STATUS (HANDSHAKING)
36              ;       A35,A36         DIGITAL GROUND
37              ;       A37             DAC STATUS (HANDSHAKING)
38              ;       A38             BOARD STATUS (HANDSHAKING)
39              ;       A39             DAC DATA VALID STROBE
40              ;       A40             A/D CONVERTER STATUS (HANDSHAKING)
41              ;       A41             DAC OUTPUT
42              ;       A42             A/D RESULT STATUS (HANDSHAKING)
43              ;       A43             DAC ANALOG GROUND
44              ;       A44             DIGITAL GROUND
45              ;       A45             A/D INPUT CHANNEL 0
46              ;       A46             A/D INPUT CHANNEL 1
47              ;       A47,A48         A/D ANALOG GROUND
48              ;       A49             A/D INPUT CHANNEL 2
49              ;       A50             A/D INPUT CHANNEL 3
50
```

```
10025  .MAIN
01
02
03              ;11.2   LOOPBACK CONNECTOR:
04              ;
05              ;       DIAGNOSTIC CONSIDERATIONS :
06              ;
07              ;       TO FULLY TEST MICRODAC, A DIAGNOSTIC LOOPBACK CONNECTOR
08              ;       MUST BE INSTALLED. THIS CONNECTOR ALLOWS THE TESTING OF:
09              ;       THE 32 DIGITAL I/O LINES, A MAJORITY OF THE HANDSHAKING
10              ;       LINES, AND THE 4 EXTERNAL A/D INPUT CHANNELS(0-3).
11
12              ;       THE FOLLOWING LOGIC CANNOT BE TESTED WITHOUT THE SPECIAL
13              ;       LOOPBACK CONNECTOR (APPROXIMATE COUNT):
14              ;       ONE-SHOTS(1),O.C.AND-GATES(26),OCTAL LATCHES(2),
15              ;       SCHMITT-TRIG.3-STATE BUFFERS(16),3-STATE BUFFERS(3),
16              ;       NOR GATES(1),INVERTERS(2),S/R FLOPS(2),D-FLOPS(4),
17              ;       SCHMITT-TRIG INVERTERS(5),3-INPUT ANDS(3),OR GATES(2)
18              ;       8-IN NANDS(1)
19              ;
20              ;       HISTOGRAM CONSIDERATIONS:
21              ;
22              ;       THE DAC OUTPUT IS CONNECTED TO THE FOUR EXTERNAL USER
23              ;       CHANNELS (0-3) BY A RESISTOR NETWORK ON THE LOOPBACK
24              ;       CONNECTOR. THE EXPECTED VALUES ON THESE CHANNELS ARE
25              ;       GIVEN BY THE FOLLOWING EQUATIONS AND SHOULD BE WITHIN
26              ;       ABOUT 5% :
27              ;
28              ;       CH#0 = .444 X DAC OUTPUT
29              ;       CH#1 = .333 X DAC OUTPUT
30              ;       CH#2 = .222 X DAC OUTPUT
31              ;       CH#3 = .111 X DAC OUTPUT
32              ;       ( CH#5 =  DAC OUTPUT )
33              ;
34              ;       CONSTRUCTION:
35              ;
36              ;       CONNECT THE FOLLOWING MDAC "A-CONNECTOR" PINS TOGETHER:
37              ;       (A1-A31 ODD) TO (A2-A32 EVEN)
38              ;               A33  TO  A34
39              ;               A37  TO  A38
40              ;               A39  TO  A40
41              ;
42              ;       CONNECT:
43              ;       A 2.21 K RESISTOR BETWEEN A41 AND A45
44              ;       A 442 OHM RESISTOR BETWEEN A45 AND A46
45              ;       A 442 OHM RESISTOR BETWEEN A46 AND A49
46              ;       A 442 OHM RESISTOR BETWEEN A49 AND A50
47              ;       A 442 OHM RESISTOR BETWEEN A50 AND A43
48              ;       A 0.01 UF CAPACITOR BETWEEN A45 AND A43
49              ;
50              ;
51              ;       THE VIKING 3VH25/1JN5 CONNECTOR (WITH THE EARS REMOVED)
52              ;       OR EQUIVALENT MAY BE USED.
53              ;
```

```
10026  .MAIN
01
02
03
04
05              ;12.    RUN TIME:
06              ;       --------
07              ;       DIAGNOSTIC: 5 MIN FOR FIRST 2 PASSES W/LOOPBACK
08              ;                   3 MIN FOR FIRST 2 PASSES W/O LOOPBACK
09              ;       CALIBRATOR: N/A
10              ;       HISTOGRAM:  N/A
11
```

```
!0027  .MAIN
**00000 TOTAL ERRORS, 00000 FIRST PASS ERRORS
```