

TEXT LISTING

068-000474-02

PROGRAM

4300 DG/DAC DIGITAL
DIAGNOSTIC/EXERCISER

TEXT TAPE

097-000474-02

ABSTRACT

THIS PROGRAM IS A GATE BY GATE HARDWARE DIAGNOSTIC FOR THE 4300 DG/DAC PROGRAMMED I/O SYSTEM. DUE TO THE MANY VARIATIONS OF USER MODULES, AND CONFIGURATIONS THERE ARE SEVERAL SEPARATE PROGRAM OPTIONS AVAILABLE TO THE FIELD ENGINEER WHICH ARE DESCRIBED IN SECTION 5. REFER TO SECTION 6 FOR AN OVERVIEW OF THESE PROGRAMS AND NECESSARY CONFIGURATION DATA.

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; NAME: DGDAD.TX          PART NUMBER: 097-000474
;
; DESCRIPTION: 4300 DGDAC DIGITAL DIAGNOSTIC/EXERCISEM
;
; REVISION HISTORY:
;
; REV.          DATE
; 00           02/06/77
; 01           01/13/78
; 02           01/27/79
;
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PROGRAM NAME: DGDAD.SR, 4300 DGDAC PROGRAMMED I/O DIAGNOSTIC
REVISION HISTORY:
REV.02 WAS CREATED FOR THE FOLLOWING:
1. TO ALLOW THE PROGRAMS TO RUN SUCCESSFULLY ON
SYSTEMS WITH A SOFT CONSOLE;
2. TO ENABLE THE USE OF I/O MODULES;
3. TO ALLOW THE PROGRAMS TO RUN SUCCESSFULLY ON
BOTH THE DGC AND M6UOL SYSTEMS;
4. TO STANDARDIZE PROGRAM SWITCHES, STARTING
ADDRESSES, SIZING ROUTINES, ETC.;
5. TO ENABLE THE PROGRAMS TO RUN IN A REMOTE
DIAGNOSTIC MODE IN THE FUTURE.
6. TO ENABLE THE PROGRAMS TO RUN WITH A 1K AND
4K DCU.

MACHINE REQUIREMENTS:
1. NOVA CENTRAL PROCESSOR WITH AT
LEAST 8K READ/WRITE MEMORY
2. 4300 CHASSIS CONTROL CARD
3. 4300 I/O CHASSIS
4. BASIC I/O TELETYPE OR CRT AND 4010 CONTROL

3.1 OPTIONAL EQUIPMENT TABLE
BOARD TYPE ID BOARD #
TTL INPUT 11 4291
PULSE OUTPUT 05 4293
TTL OUTPUT 01 4299
RELAY OUTPUT 04 4296,7
OPTICAL OUTPUT 02 4292
TRIAC OUTPUT 06 4294
G.P. INPUT 12 4290
A/D CONVERTER 41 4280(SA'S 504,505)
A/D MUX 42 4281( ONLY )

3.2 THIS PROGRAM MAY BE RUN IN A HOST/DCU-50 COMPUTER
CONFIGURATION.

4. TEST REQUIREMENTS: N/A

5. SUMMARY:
THIS PROGRAM IS A GATE BY GATE HARDWARE DIAGNOSTIC
FOR THE 4300 DGDAC PROGRAMMED I/O SYSTEM. DUE TO THE
MANY VARIATIONS OF USER MODULES AND CONFIGURATIONS
THERE ARE SEVERAL SEPARATE PROGRAM OPTIONS AVAILABLE
TO THE FIELD ENGINEER WHICH ARE DESCRIBED IN SECTION 7.
REFER TO SECTION 6 FOR AN OVERVIEW OF THESE PROGRAMS,
AND NECESSARY CONFIGURATION DATA.

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RESTRICTIONS:

THERE ARE FOUR MAJOR MODES OF TEST AVAILABLE WITH THIS DIAGNOSTIC:

MODE 1.
 THE SYSTEM IS INSTALLED WITH CUSTOMER HOOKUPS COMPLETED. THE STANDALONE MODE (MONITOR INPUTS AND SWITCH OUTPUTS) CAN BE USED TO OPERATE INDIVIDUAL CHANNELS WITH THE CUSTOMER LOADS ATTACHED. THE CHANNEL OPERATION CAN BE VERIFIED BY OBSERVING THE CUSTOMER EQUIPMENT OPERATION OR BY ELECTRICAL OBSERVATION OF THE LINES WITH A TEST METER OR OSCILLOSCOPE.

MODE 2.
 CUSTOMER HOOKUPS ON APPLICABLE MODULES ARE DISCONNECTED. THIS MODE IS TYPICALLY USED DURING DSC TEST OR UPON INSTALLATION VERIFICATION AT THE CUSTOMER SITE. AN OUTPUT CARD IS LOOPED AROUND, VIA LOOP AROUND CABLES AND AN ADAPTER CARD (1124A) TO A MATCHING INPUT CARD AND THE DIAGNOSTIC IS RUN IN THE LOOP AROUND MODE(SA 500). THIS WILL DYNAMICALLY TEST THE PARTICULAR I/O SETUP. AS OTHER I/O CARD COMBINATIONS ARE TO BE TESTED, THE LOOP AROUND SETUP IS MOVED TO OTHER CARDS. IT SHOULD BE NOTED THAT THIS IS A FULL TEST OF ALL OF THE CONTROL LOGIC ASSOCIATED WITH A SET OF I/O CARDS, BUT IT IS NOT A COMPLETE TEST OF FULL LOAD CAPABILITIES OF THE I/O CARD USED WITH THE TEST. THE WORST CASE CAPABILITIES CAN BE VERIFIED USING MODE 4 BELOW. THE FOLLOWING IS A CHART OF THE BASIC LOOP AROUND HOOKUPS THAT CAN BE CONFIGURED.

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TABLE 6.1

OUTPUT MODULE	PLUG	INPUT MODULE	PLUG	V+	V-	OFFSET	INVERT	DATA
TTL	J1	TTL	J2	5	0	NO	NO	NO
ISO	J1	GP	J2	15	0	NO	NO	NO
ISO	J1	TTL	J2	5	5	YES	YES	YES
PULSE	J1	GP	J2	15	5	YES	YES	YES
PULSE	J1	TTL	J2	5	5	YES	YES	YES
TRIAC	J1	GP	J2	24 AC	5	YES	YES	YES
FORM A	J1	GP	J2	15	0	NO	NO	YES
FORM A	J2	GP	J1	15	0	NO	NO	YES
NO - FORM C	J3	TTL	J2	5	0	NO	NO	YES
NO - FORM C	J3	GP	J2	15	0	NO	NO	YES
NC - FORM C	J3	TTL	J2	5	0	NO	NO	NO
NC - FORM C	J3	GP	J2	15	0	NO	NO	NO

NOTES:

- 1) ALL VOLTAGES ARE DC EXCEPT FOR TRIAC +24 AC. THE CURRENT REQUIREMENTS FOR THE V+7V- VOLTAGES ARE AS FOLLOWS:
 + 5 VDC @ .1 A
 +15 VDC @ .2 A
 +24 VAC @ .3 A
- 2) NO AND NC (NORMALLY OPEN AND NORMALLY CLOSED) INDICATE THE SETTING OF THE FORM C SWITCH. THE POSITION OF THE SWITCH INDICATES THE CONTACT PAIR OF THE FORM C RELAY UNDER TEST.
- 3) NO INTERRUPT WILL BE GENERATED FOR THE ISOLATED OUT TO TTL IN, OR FOR THE PULSE OUT TO TTL IN, AS THE "EXT INT" LINES DOES NOT BECOME ASSERTED DURING TESTING.
- 4) THE PULSE OUT TO TTL IN/GP IN MUST BE RUN USING STARTING ADDRESS 507.
- 5) TEST CABLE (DIGITAL) PART # IS 005-7013
- 6) TEST ADAPTER IS MODEL 1124A (PART # 005-8418)

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MODE 3.
CUSTOMER HOOKUPS ON THE APPLICABLE MODULES ARE DISCONNECTED. THIS MODE USES THE STANDALONE CAPABILITIES OF THE DIAGNOSTIC (SA'S 501,502,503) TO DRIVE AN OUTPUT MODULE OR DETECT CHANGES ON AN INPUT MODULE. TYPICALLY USED WHEN THERE IS NO MATCHING MODULE AVAILABLE OR SINGLE MODULE OPERATION IS DESIRED FOR TEST PURPOSES. THE 1124A ADAPTER IS HOOKED UP TO THE I/O CABLE OF THE SUBJECT MODULE WITH THE POWER APPLIED AS PER TABLE 6.1. THE 2ND I/O CABLE IS NOT HOOKED IN TO THE ADAPTER. CIRCUIT OPERATION CAN BE VERIFIED AS FOLLOWS:
INPUT CARDS-
INPUT PINS CAN BE SHORTED TO GROUND
ONE CHANNEL AT A TIME, WITH THE CHANGE BEING DETECTED BY THE DIAGNOSTIC. !CAUTION! USE +5VDC FOR +V ON THE ADAPTER.
OUTPUT CARDS-
OUTPUT PINS CAN BE MONITORED WITH TWO OR EITHER OF TWO METHODS:
-AS CURRENT IS PASSED THROUGH THEM OR WITH A TEST METER OR OSCILLOSCOPE WHICH CAN MONITOR OUTPUT DEVICE PULSES OR SWITCHING VOLTAGE LEVELS AS THE CHANNELS ARE COMMANDED TO OPERATE VIA THE CPU SWPAK.
MODE 4.
CUSTOMER HOOKUPS ARE DISCONNECTED ON THE APPLICABLE MODULE. THIS MODE ALSO USES THE STANDALONE CAPABILITIES OF THE DIAGNOSTIC (SA'S 501,502,503) AS IN MODES 1 AND 3. THIS MODE IS USED WHEN NO TEST ADAPTERS ARE AVAILABLE OR WHEN VERIFICATION OF THE WORST CASE CAPABILITIES OF A CHANNEL IS DESIRED. A TEST VOLTAGE IS APPLIED VIA A LOAD RESISTOR TO THE CHANNEL INPUT OR OUTPUT PIN, (NOTE THAT FORM C RELAYS HAVE TWO SIGNAL PINS TO CHECK OUT) AND THE RETURN PIN IS GROUNDING; WHEN TRIACS ARE BEING CHECKED OUT, THE TEST AC VOLTAGE MUST ALSO BE APPLIED TO THE SYNC INPUT (PINS 21&46) OF THE TRIAC CARD.
TO VERIFY OUTPUT CARDS, THE CHANNEL IS OPERATED VIA THE CPU SWITCHES AND THE VOLTAGE ACROSS THE OUTPUT SHOULD DROP CLOSE TO, OR BELOW, A SPECIFIED VOLTAGE (SEE TABLE 6.2) WHEN THERE IS CURRENT THROUGH THE DEVICE. IT SHOULD ALSO BE NOTED THAT THE RELAY CARD OPERATIONS CAN BE VERIFIED WITH AN OHM METER.
TO VERIFY INPUT CARDS, THE INPUT PIN IS GROUNDING AND THE CHANGE SHOULD BE DETECTED BY THE DIAGNOSTIC.
TABLE 6.2 DESCRIBES TEST VOLTAGES AND RESISTORS THAT CAN BE USED TO VERIFY CHANNEL OPERATION. NOTE THAT THE CUSTOMER SHOULD SUPPLY THE HEAVY WATTAGE RESISTORS IF HE WANTS TO RUN A WORST CASE TEST OF HIS OWN. THE GENERAL TEST USES ONE (OR TWO IN SERIES) 1.2K 5 WATT RESISTOR. P/N 102-592.

TABLE 6.2
WORST CASE VOLTAGES/NECESSARY LOAD RESISTORS

BOARD #	+V	LOAD (TERMINAL PANEL)	MAX LOW OUTPUT VOLTAGE
4299	24 VDC	NONE	.5 VDC
4292	48 VDC	33 OHM,100W	2.5 VDC
4293	48 VDC	33 OHM,100W	2.5 VDC
4294	120 VAC	62 OHM,500W	1.2 VDC
4296	120 VDC	560 OHM,50W	.5 VDC
4297	100 VDC	1.3 KOHM,10W	.5 VDC

***NOTE- FORM C RELAY BOARD (4297) HAS TWO OUTPUT PINS TO VERIFY. WHEN THE TRIAC BOARD (4294) IS CHECKED THE TEST AC VOLTAGE MUST BE ALSO APPLIED TO THE SYNC INPUT (PINS 21 AND 46).
MAX LOW OUTPUT VOLTAGE REFERS TO THE VOLTAGE MEASURED AT THE OUTPUT PIN WHEN THE CHANNEL IS IN THE ON STATE VIA THE STAND ALONE TEST SA 501.
IF NO TEST ADAPTERS ARE AVAILABLE AND WORST CASE LOADS ARE NOT DESIRED, THE FOLLOWING VOLTAGE/RESISTOR COMBINATIONS MUST BE USED TO CHECK OUTPUTS.
THE OUTPUT VOLTAGES OBSERVED SHOULD BE NO GREATER THAN THE MAX LOW OUTPUT VOLTAGES SHOWN ABOVE.

BOARD #	+V	LOAD RES.
4299	NONE	NONE
4292	+24 VDC	1.2K,5W
4293	+24 VDC	1.2K,5W
4294	120 VAC	2.4K,10W(2-1.2K'S IN SERIES)
4296	+24 VDC	1.2K,5W
4297	+24 VDC	1.2K,5W

SEE ALSO SECTION 7.0

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10008 .MAIN

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:7. PROGRAM DESCRIPTIONS/THEORY OF OPERATION:
:7.1 STARTING ADDRESS (500): BASIC I/O LOOP DIAGNOSTIC
PROGRAM ASSUMES THAT ONE OUTPUT MODULE IS LINKED
VIA CABLE'S AND NECESSARY ADAPTER TO ONE INPUT
MODULE SUCH THAT A 16 BIT DATA WORD PROGRAMMED
FOR OUTPUT WILL CAUSE OR ALLOW AN IDENTICAL 16 BIT WORD
TO BE INPUT ON THE CORRESPONDING INPUT MODULE.

THE OUTPUT PROCESS SHOULD CAUSE AN INTERRUPT VIA
THE INPUT BOARD EITHER BY AN OUTPUT STROBE CONNECTED
TO AN INPUT EXTERNAL INT LINE OR BY THE G.P. INPUT
BOARD.

IF A GP INPUT IS BEING TESTED, A PASS IS PRINTED EACH
COMPLETION OF TESTS. IF A TTL INPUT IS IN TEST, PASS
IS PRINTED AFTER 1ST PASS AND AFTER EVERY 16 THEREAFTER.

IT SHOULD BE NOTED THAT WHILE THE LOOP TEST (SA 500)
IS INTENDED TO FULLY CHECK THE LOGIC OF ALL CARDS
INVOLVED, IT DOES NOT VERIFY SUCH SPECIFICATIONS AS
CLOSED CONTACT RESISTANCE OR MAX LOW OUTPUT VOLTAGES.
THESE WOULD HAVE TO BE MEASURED VIA THE STAND ALONE
TESTS SA'S 501 AND 502.

:7.2 STARTING ADDRESS (501): OUTPUT DUMP
OPERATOR SIMPLY SELECTS AN OUTPUT MODULE AND
A TRANSFER DELAY IN MS.
NOTE -THE TTL OUTPUT STROBE IS FACTORY SET TO 7 MS.

THE PROGRAM THEN CONTINUOUSLY MONITERS THE TTY
FOR ANY NEW OCTAL INPUTS, AND OUTPUTS THE OCTAL VALUES
WITH THE SPECIFIED DELAY BETWEEN TRANSFERS
UNTIL THE OPERATOR RESETS THE PROGRAM.

:7.3 STARTING ADDRESS (502): INTERRUPT INPUT SCAN
PROGRAM STARTS ALL INPUT DEVICES AND THEN
REPORTS THE ADDRESS AND DATA INPUT FROM ALL SUCCEEDING
INTERRUPTS. IT IS UP TO THE OPERATOR, HOWEVER, TO
MANUALLY INITIATE ANY SUCH INTERRUPTS.

:7.4 STARTING ADDRESS (503): INPUT SCAN PLUS OUTPUT DUMP
COMBINES FUNCTIONS DESCRIBED IN 7.2 AND 7.3

:7.5 STARTING ADDRESS (504) MULTIPLE LOOP EXERCISER
PROGRAM CONTINUOUSLY SENDS RANDOM NUMBERS ACROSS
APPROPRIATELY ENTERED LOOPS(SEE TABLE 6.1).
IF THE REAL TIME CLOCK OPTION IS PRESENT,MULTIPLE
A/D HISTOGRAMS MAY BE RUN. THE PROGRAM WILL REPORT
ALL DATA AND TIMEOUT ERRORS. AN ASCII L INPUT WILL
GET A PRINTOUT OF LOOP ADDRESSES AND RESPECTIVE ERRORS
AND TRANSFERS AS WELL AS HISTOGRAM INFORMATION IF
A/D'S ARE INCLUDED. ALL COUNTS WILL BE IN DECIMAL WHILE
ALL ADDRESS INFORMATION WILL BE IN OCTAL. THE HISTOGRAM
INFORMATION WILL BE THE 15. BIN COUNTS, AROUND A CENTER
VALUE INPUT TO THE PROGRAM, IN D.P. DECIMAL.

UP TO 16. LOOPS RESIDING IN UP TO 2 CHASSIS MAY
BE ENTERED.

ALL DATA IN WORDS NOT MATCHING THE SEND WORD ARE
IMMEDIATELY FLAGGED AS DATA ERRORS FOR THE TTL IN
CARD ONLY!. DUE TO LINE RINGING AND SKEWING ASSOCIATED
WITH THE GP INPUT LOOPS, THE FOLLOWING SCHEME IS USED:

THE PROGRAM DIVIDES ITS NON-INTERRUPT PROCESSING TIME
INTO 10. 300.MS TIMESLOTS. DURING THE FIRST 9, OUTPUTS
ARE RE-STIMULATED AS SOON AS A DATA MATCH OCCURS AT THE
RESPECTIVE INPUT. DURING THE 10TH TIMESLOT, NO NEW
OUTPUTS ARE STARTED AND ALL LOOPS ARE ALLOWED
TO SETTLE. IF A REAL TIME CLOCK IS PRESENT, IT IS
USED TO GENERATE THESE INTERVALS. OTHERWISE A PROGRAM
TIMING LOOP IS USED.

ONLY IF THE REAL TIME CLOCK IS PRESENT, MAY THE A/D
HISTOGRAMS BE RUN.

GP INPUTS WITH DATA WORDS NOT MATCHING THE SEND WORD ARE
SIMPLY RE-STARTED UNTIL A MATCH DOES OCCUR OR UNTIL THE
END OF THE TENTH TIMESLOT. AT THIS TIME, ALL
INPUTS ARE CHECKED ANY DATA MISMATCHES ARE FLAGGED
AS EITHER A DATA ERROR OR TIMEOUT.
*****
NOTE-IF THE REAL TIME CLOCK OPTION IS NOT PRESENT;
IF TTL OUT/IN LOOPS WITH TTL OUT STROBES ALTERED;
FOR VERY SHORT STROBE TIMES (<1 MS) ARE MIXED WITH
SLOWER GPIN LOOPS, THE TIMEOUT CONDITION FOR THE GPIN
LOOP MAY NEVER OCCUR.
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IF THIS PROGRAM IS TIMED, THE # OF TRANSFERS PER LOOP
MAY BE CONVERTED TO DATA RATES TO GIVE A ROUGH MEASURE
OF SETTLING AND SKEW TIMES.

HISTOGRAM OPERATION

ASSUMING A DC VOLTAGE, WITH AN EXPECTED DIGITAL INPUT
(AFTER A/D CONVERSION) EQUAL TO THE ENTERED CENTER
VALUE (QUESTION 4), IS CONNECTED TO THE SELECTED MUX
CARD, THE PROGRAM DOES THE FOLLOWING:

A RANDOM CONVERSION COUNT IS LOADED
INTO THE DCH CONVERSION COUNTER, AND A
DATA BLOCK STARTING ADDRESS INTO THE DCH
ADDRESS REGISTER. THE DCH CYCLE IS STARTED
AND CONTINUES UNTIL ALL OF THE CONVERSION
SPECIFIED BY THE RANDOM COUNT ARE DONE. THE
DATA IS STORED CONTIGUOUSLY IN THE DATA
BLOCK. ON COMPLETION, THE DATA BLOCK IS
SORTED INTO THE HISTOGRAM, AFTER SORTING,
A NEW SAMPLE COUNT IS GENERATED AND THE
CYCLE REPEATS.

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THEORY OF OPERATION:

THE HISTOGRAM RESULTS ARE PRINTED OUT AS
FOLLOWS:

CO=XXXXXX # OF SAMPLES=(#)

--: (DECIMAL #)

--: "

--: "

-3: "

-2: "

-1: "

CO: "

+1: "

+2: "

+3: "

+4: "

+5: "

++: "

WHERE: XXXXX IS THE OCTAL HISTOGRAM CENTER VALUE,
OF SAMPLES IS THE TOTAL # OF CONVERSIONS
TAKEN AND SORTED IN DECIMAL.

THE HISTOGRAM SORTS DATA BY COMPARING EACH DATUM
RECEIVED AGAINST THE CENTER VALUE. IF THEY ARE
EQUAL, THE COUNT CORRESPONDING TO THE
HISTOGRAM "CO" IS INCREMENTED. IF THE DATUM IS
1 TO 5 BITS GREATER THAN THE CENTER VALUE, THEN
ITS RESPECTIVE "X" BIN COUNT IS INCREMENTED. IF
THE DATUM IS MORE THAN 5 LSB'S GREATER THAN
CENTER, THEN THE "++" BIN COUNT IS INCREMENTED.
SIMILARLY THE "--" BINS ARE INCREMENTED IF THE
DATUM IS 1 TO 5 LSB'S LESS AND "--" IS
INCREMENTED IF MORE 5 LSB'S LESS THAN THE
CENTER VALUE.

THEREFORE THE SAMPLE COUNTS NEXT TO THE
HISTOGRAM BIN LABELS REPRESENT THE # OF
RECEIVED DATA THAT EQUATED THE CORRESPONDING
OF BITS ABOVE, BELOW OR EQUAL TO THE
CENTER VALUE. FOR EXAMPLE "11349"
INDICATES THAT 349 OF THE TOTAL SAMPLES
TAKEN WAS 1 LEAST SIGNIFICANT BIT GREATER
THAN THE CENTER VALUE.

BY LOOKING AT THE HISTOGRAM RESULTS ONE
CAN GET A FEEL FOR THE A/D CONVERTER
STABILITY. A STABLE A/D SHOULD HAVE A
MAJOR PERCENTAGE OF THE TOTAL SAMPLES
TAKEN EQUAL TO THE CENTER VALUE WITH
RELATIVELY SMALL DISTRIBUTION AROUND IT,
AND WITH THE SAMPLE COUNTS DECREASING
RAPIDLY AS THE LSB DEVIATION INCREASES.

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77.6 STARTING ADDRESS (505) MULTIPLE LOOP WITH CATS
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; !IF! STANDALONE CATS PROGRAM (DTOS MH DISK DCH EXERCISER)
; HAS BEEN LOADED PREVIOUSLY AND RELOCATED TO HIGH CORE,
; THIS STARTING ADDRESS PROVIDES THE LINK BETWEEN THE
; DCH EXERCISER AND THE MULTILoop PROGRAM (SA 504).
; ***SEE PART NUMBER 094-0782 FOR INFORMATION ON THE
; DTOS MH DISK DCH EXERCISER.
;
77.7 STARTING ADDRESS (506) SLOT/ID PRINTOUT
;
; PROGRAM SIMPLY PRINTS THE SLOT VS ID INFORMATION
; FOR THE CHASSIS UNDER TEST THEN HALTS.
;
77.8 STARTING ADDRESS (507) PULSE OUTPUT TO TTL/G.P. INPUT
; LOOP TEST (SINGLE LOOP)
;
; THIS PROGRAM ALLOWS A SINGLE TEST LOOP CONSISTING OF A
; PULSE OUTPUT BOARD (MODEL 4293) LOOPED BACK TO EITHER
; A TTL INPUT BOARD (MODEL 4291) OR A GENERAL PURPOSE
; INPUT BOARD (MODEL 4290) VIA AN 1124A DIGITAL TEST
; ADAPTER. HOOKUP PROCEDURES AND ADAPTER TEST VOLTAGES
; ARE GIVEN IN SECTION 6.
;
; TEST INITIALIZATION:
; "OUTPUT SLOT # = "
; INPUT THE PULSE OUTPUT BOARD'S SLOT # (0 - 17 OCTAL).
;
; "INPUT SLOT AND ID #'S = "
; INPUT THE TTL OR G.P INPUT SLOT # (0 - 17 OCTAL) AND
; ITS ID CODE (TTL IN = 11, GPIN = 12 OCTAL), SEPERATED
; WITH A COMMA OR SPACE.
;
; ALL RESPONSES MUST BE CORRECT OR THE QUESTIONS ARE
; ASKED AGAIN. IF OUTPUT SLOT = INPUT SLOT, BOTH WILL BE
; RE-ASKED.
;
; TEST PROCEDURES:
;
; THIS TEST SIMPLY SENDS DATA TO THE PULSE OUTPUT AND
; RETRIEVES IT FROM THE INPUT BOARD. THE DATA IS THEN
; CHECKED. IF THE DATA IS RETURNED INCORRECTLY, A
; DATA ERROR IS REPORTED. THE TEST DATA USED IS AS
; FOLLOWS:
;
; IF TTL INPUT/G.P. INPUT TYPE LOOP:
; A "1" IS FLOATED FROM CHANNEL 17 TO CHANNEL 0
; IF TTL INPUT TYPE LOOP:
; A "0" IS FLOATED FROM CHANNEL 0 TO CHANNEL 17
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; THE TEST DOES THE ABOVE 2048. TIMES FOR TTL TYPE LOOP
; AND 16. TIMES FOR G.P INPUT TYPE LOOP. IF NO DATA ERROR
; IS DETECTED IN THIS TIME, "PASS" IS PRINTED. IF A
; DATA ERROR OCCURS, YOU CAN LOOP ON THE BAD DATA
; PATTERN BY SETTING SWPAK1 = 0, OR
; CONTINUE WITH THE NEXT DATA PATTERN BY SETTING THE
; SWPAK1 = 1. SWPAK2 INHIBITS ERROR PRINTOUT.
;
; ONE PASS TAKES APPROX 1 - 1.5 MINUTES.
;
; THE METHOD OF TRANSFER DEPENDS ON THE TYPE OF INPUT
; BOARD IN THE LOOP. (NOTE THAT THE PULSE OUTPUT BOARD
; INVERTS THE DATA SENT TO IT).
;
; TTL INPUT TYPE:
;
; THE DATA IS SENT TO THE PULSE OUTPUT BOARD. AFTER
; A DELAY OF 5 MS, THE DATA IS STROBED INTO THE
; INPUT REGISTER. THE DATA IS READ AND THEN CHECKED
; AGAINST THE COMPLEMENT OF THE SEND DATA. AN ERROR
; IS REPORTED IF THE DATA IS INCORRECT. NOTE THAT
; SINCE THE "EXT IN" LINE DOES NOT BECOME ACTIVE,
; "DONE" WILL NOT SET, AND NO INTERRUPT WILL BE
; GENERATED (NO TIMEOUTS REPORTED).
;
; G.P. INPUT TYPE:
;
; THE FRONT END SECTION OF THE G.P. INPUT HAS A FILTER
; NETWORK FOR NOISE REJECTION. THE TYPICAL RISE TIME
; IS FROM 15 - 100. MS, AND THE TYPICAL FALL TIME IS
; FROM 30 - 200. MS. THE MINIMUM OUTPUT PULSE DURATION
; IS FROM 2 - 10. MS. THEREFORE, THE DATA IS OUTPUT TO THE
; PULSE BOARD 256. TIMES (EACH TIME FOLLOWED BY A 1 MS
; DELAY) TO INSURE THAT THE DATA WILL ASSERT ITSELF. AN
; INTERRUPT SHOULD BE GENERATED (INDICATING A DATA CHANGE).
; A TIMEOUT IS REPORTED IF NO INTERRUPT IS DETECTED. THE
; DATA IS READ AND CHECKED AGAINST THE COMPLEMENT OF THE
; SEND DATA. A DATA ERROR IS REPORTED IF INCORRECT.
; THE DATA LINES SHOULD THEN RETURN TO THEIR QUIESCENT
; STATE (ALL 1'S). ANOTHER INTERRUPT SHOULD BE DETECTED.
; A DATA ERROR IS REPORTED IF THE LINE DOES NOT RETURN
; TO THIS STATE, AND A TIMEOUT IS REPORTED IF AN INTERRUPT
; IS NOT DETECTED.
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10013 .MAIN
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18. OPERATING MODES/SWITCH SETTINGS:
18.1 SWITCH SETTINGS
LOCATION "SWREG" IS USED TO SELECT THE PROGRAM OPTIONS
(NOT SYSTEM CONFIGURATION). WHILE RUNNING UNDER DTOS,
THIS LOCATION WILL BE LOADED BY THE MONITOR.
HOWEVER UNDER STAND ALONE AND PROGRAM LOAD MODES THIS
LOCATION WILL BE SET ACCORDING TO THE ANSWERS SUPPLIED
BY THE OPERATOR. IN ANY CASE THE OPTIONS CAN BE CHANGED
OR VERIFIED BY USING ONE OF THE COMMANDS GIVEN IN SEC.
8.3

18.2 SWITCH OPTIONS
DIFFERENT BITS AND THEIR INTERPRETATION AT LOCATION
"SWREG" IS AS FOLLOWS:
BIT OCTAL BINARY INTERPRETATION
VALUE VALUE
1 40000 1 LOOP ON ERROR
SKIP LOOPING ON ERROR
2 20000 1 PRINT TO CONSOLE
ABORT PRINT OUT TO CONSOLE
3 10000 1 DO NOT PRINT % FAILURE
PRINT % FAILURE
5 02000 1 DO NOT PRINT ON THE LINE PRINTER
PRINT ON THE LINE PRINTER
6 01000 1 DO NOT HALT ON ERROR
HALT ON ERROR

18.3 SWITCH COMMANDS
ONCE THE PROGRAM STARTS EXECUTING THE STATE OF ANY OF
THE BITS CAN BE CHANGED BY HITTING KEYS 1-9, A-F. THE
PROGRAM WILL CONTINUE RUNNING AFTER UPDATING THE OPTIONS.
EACH KEY WILL COMPLEMENT THE STATE OF THE BIT AFFILIAT-
ED WITH IT, THUS BIT 4 CAN BE ALTERED BY HITTING KEY 4.
SETTING OF ANY BIT OF LOCATION "SWREG" WILL SET BIT 0.
(DEFAULT MODE IS DEFINED AS ALL BITS OF SWREG SET TO 0)

18.4 OTHER COMMANDS (* = CONTROL KEY)
"CR" A "RETURN" CAN BE TYPED TO CONTINUE THE PROGRAM
AFTER ITS LOCKED IN A SWITCH MODIFICATION MODE
"D" THIS COMMAND GIVEN AT ANY TIME WILL RESET "SWREG"
TO DEFAULT MODE AND RESTART THE PROGRAM.
"R" THIS COMMAND GIVEN AT ANY TIME WILL RESTART THE
PROGRAM. SWITCHES ARE LEFT WITH THE VALUES THEY
HAD BEFORE THE COMMAND WAS ISSUED.
"O" THIS COMMAND GIVEN AT ANY TIME WILL CAUSE THE
PROGRAM CONTROL TO GO TO ODT (NOTE: THIS IS AN
OPTIONAL COMMAND AND IS AVAILBLE ONLY IF
ODTPK IS PRESENT)
THIS COMMAND GIVEN AT ANY TIME WILL PRINT THE
CURRENT OPERATING MODES.
THIS COMMAND GIVEN AT ANY TIME WILL LOCK THE
PROGRAM INTO SWITCH MODIFICATION MODE WHERE
MORE THAN 1 BIT CAN BE CHANGED.

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0014 .MAIN
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10015 .MAIN
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19. OPERATING PROCEDURE/OPERATOR INPUT:
19.1
GENERAL
1.A LOAD PROGRAM VIA BINARY LOADER
1.B MAKE NECESSARY HARDWARE CONNECTIONS
PERTAINING TO THE INPUT/OUTPUT TYPES AND OR
SYSTEM CONFIGURATION.
***REFER TO SECTION 6. FOR HARDWARE/CONFIGURATION DATA.
1.C SET SWITCHES EQUAL TO ONE OF THE STARTING
ADDRESSES SHOWN BELOW
PRESS START
1.D STARTING ADDRESS
70 ODT DIRECT ENTRY ONLY
200 BASIC I/O (1 INPUT / 1 INPUT DIAGNOSTIC)
500 BASIC I/O (1 OUTPUT / 1 INPUT DIAGNOSTIC)
501 OUTPUT DUMP (OUTPUTS SWITCHES TO DESIGNATED
OUTPUT SLOT)
502 INPUT SCAN - STARTS ALL INPUT DEVICES
AND REPORTS ADDRESS AND DATA RECEIVED FOR
ALL GENERATED INTERRUPTS
503 INPUT SCAN PLUS OUTPUT DUMP
504 COMBINES 501,502 FUNCTIONS
505 MULTILoop WITH CATS
506 CHASSIS SLOT/ID PRINTOUT
507 PULSE OUTPUT TO TTL/G.P. INPUT LOOP
19.2 OPERATOR INPUTS (IN PARENTHESIS)
GENERAL
110 BAUD RATE ? (DDD) -DEVICE BAUD RATE RE-
QUESTED IN ABSENSE OF
RTC FOR TIMING.
INITIALIZE ? (YES,NO,ESC KEY) - YES TO SETUP SYSTEM
CONFIGURATION.
- NO TO RETAIN PREVIOUS
CONFIGURATION/START TEST
- ESCAPE KEY BYPASSES
CHAS INFO TO SLOT INFO
NOTE-ESC FOLLOWED BY CR
IF YES TO ABOVE
CHASSIS DEVICE SELECT -(NN) -2 OCT DIGIT SELECT CODE
DEFAULT IS 40 **
CHASSIS MASK BIT -(NN) - 0-17, -DEFAULT IS 5

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10016 .MAIN
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DCU ? (YES OR NO)
IF YES TO ABOVE
DCU DEVICE SELECT -(NN) -2 OCT DIGIT SELECT CODE
DEFAULT IS 34 **
IF SA 500
OUTPUT SLOT AND ID#'S (N,N) - 2 OCTAL NO.'S
INPUT SLOT AND ID#'S (N,N) -2 OCTAL NO.'S
## SEE 2.1 FOR ID #'S
DOES ADAPTER (# NN) INVERT DATA(YES,NO) - SEE TABLE 6.1
IF SA 501,503
OUTPUT SLOT AND DELAY IN MS (N,N) - 2 OCTAL NO.'S
SEPERATED BY ,
DELAY MAY BE 0
IF SA 504,505
INPUT SLOT, ID, AND SELECT (N,N,N) - 3 OCTAL NO.'S
CR ENDS INPUT
***IF AN OUTPUT ONLY IS DESIRED/ANSWER NO TO ABOVE***
*** SELECT REFER'S TO CHAS DEVICE CODE***
***IF ID 41(A/D) IS ENTERED, QUESTIONS(1-4)
***NEXT PAGE ARE ASKED FOR A/D SETUP(HISTOGRAM)
OUTPUT SLOT, ID, SELECT (N,N,N) - 3 OCTAL NO.'S
DOES ADAPTER INVERT DATA (YES OR NO) - SEE TABLE 6.1
SEQUENCE REPEATS UNTIL CR TO FIRST QUESTION
BASIC A/D HISTOGRAM INITIALIZATION SEQUENCE
***NOTE -TO EXERCISE THE A/D BOARDS, THE CPU
***!MUST! HAVE THE REAL TIME CLOCK OPTION.
1) "A/D INPUT TYPE (POLARITY,RANGE) = "
RESPOND USING THE FOLLOWING CODES:
POLARITY = U FOR UNIPOLAR (DEFAULT)
RANGE = L FOR 0-5 UNIPOLAR, +/- 5 BIPOLAR (DEFAULT)
= H FOR 0-10 UNIPOLAR, +/- 10 BIPOLAR
2) "A/D TRIGGERING, MUX SLOT # ="
RESPOND USING THE FOLLOWING CODES:
TRIGGERING = 1 FOR DCHI
= 2 FOR INTERNAL CLOCK
= 3 FOR INTERNAL CLOCK
"MUX SLOT # =" (0-17 OCTAL)
(MUX SLOT # MUST BE > A/D SLOT #)

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19.2A:

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10017 .MAIN
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3) "(SELECT #,CHANNEL #,GAIN) OF MUX - "
   SELECT #/CHANNEL # BOTH 0-17 OCTAL;
   GAIN = 0,1,2,3 CORRESPONDS TO GAIN X 1,2,4,8
   (GAIN USED ONLY BY PROGRAMMABLE MUX'S)

NOTE: FOR QUESTIONS REQUIRING MULTIPLE INPUTS
      (QUESTIONS 1,2,3), RESPONSES MUST BE
      SEPERATED BY A COMMA OR SPACE.

4) "SAMPLE CENTER VALUE"-
   THIS IS A 6- DIGIT OCTAL CODE
   REPRESENTING THE HISTOGRAM CENTER
   VALUE THE 12- BIT A/D DATA WORD
   CORRESPONDING TO THIS VALUE SHOULD BE
   INPUT, LEFT JUSTIFIED, WITH ALL UNUSED
   BITS EQUAL TO 0. FOR EXAMPLE 1 LSB IS
   REPRESENTED AS OCTAL 20, AND A FULL COUNT
   CORRESPONDS TO OCTAL 17760. LEADING
   ZEROS ARE NOT NECESSARY.

   FOR HISTOGRAM EXPLANATION REFER TO SECTION 7.5B.
   PROGRAM OUTPUT/ERROR DESCRIPTION:

WHEN AN ERROR IS DETECTED, THE PROGRAM PRINTS THE
VALUE OF THE PC ON THE CALL TO EHALT AND THE
CONTENTS OF AC'S 0-2, AND THEN LOOPS ALLOWING THE
OPERATOR TO SET SWPAK (SEE SWITCH SETTING).

THE PROGRAM MAY EITHER CONTINUE
ON TO THE NEXT TEST OR STAY IN THE SCOPE LOOP BETWEEN
THE LAST CALLS TO .LOOP AND .SETUP, DEPENDING ON SWPAK
SETTINGS.

THE PARTICULAR SIGNIFICANCE OF AC'S 0-2 IS EXPLAINED IN
THE LISTING FOR THE PARTICULAR TEST INVOLVED.

   DEBUG HELP:

10018 .MAIN
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OCTDTU 11
OCTAL DEBUG TUOL (ODT)

THE DIAGNOSTIC IS EQUIPPED WITH A BUILT IN ODT WHICH CAN
BE ACCESSED BY HITTING CONTROL 0 ("0) AT ANY TIME DURING
THE EXECUTION OF THE PROGRAM (AFTER SETTING THE PARA-
METERS).
ON ENTERING ODT THE ADDRESS OF THE LOCATION HAVING THE
NEXT INSTRUCTION TO BE EXECUTED WILL BE TYPED-OUT.

CONVENTIONS AND SYMBOLS
THE FOLLOWING CONVENTIONS ARE USED BY THE ODT:
?   PRESSING ANY ILLEGAL KEY CAUSES THE ODT TO RES-
    POND WITH A "?".
@   ODT IS READY AND AT YOUR SERVICE.

COMMAND STRUCTURE
AN ODT COMMAND HAS THE FOLLOWING FORMAT:
(ARGUMENT) (COMMAND)
AN ARGUMENT MAY BE ONE OF THE FOLLOWING:
"EXP" AN OCTAL EXPRESSION CONSISTING OF OCTAL NUMBERS
SEPERATED BY PLUS (+) OR MINUS (-) SIGNS. LEAD-
ING ZEROS NEED NOT BE TYPED.
"ADR" AN ADDRESS IS THE SAME AS AN EXPRESSION EXCEPT
THAT BIT 0 IS NEGLECTED.
A COMMAND IS A SINGLE TELETYPE CHARACTER

ODT COMMANDS
THE LOCATIONS THAT CAN BE EXAMINED AND MODIFIED BY THE
USER ARE CALLED CELLS. THESE CELLS ARE OF TWO TYPES:
INTERNAL CPU CELLS AND MEMORY LOCATIONS.

11.3.1 OPENING INTERNAL CELLS
THE COMMAND TO OPEN ONE OF THE INTERNAL REGISTERS IS OF
THE FORM "NA" WHERE N IS ANY OCTAL EXPRESSION BETWEEN
0 AND 7
0-3   FOR ACCUMULATORS 0-3
4     FOR PC OF THE NEXT INSTRUCTION TO BE EXECUTED IN
5     CPU AND I/O STATUS
6     STATUS OF TIO DONE FLAG
7     STATUS OF INTERRUPTS (ION FLAG)
8     STATUS OF CARRY BIT
9     ADDRESS OF THE LOCATION HAVING THE BREAK POINT (IF
    ANY)
10    INSTRUCTION AT THE BREAK POINT LOCATION

OTHER COMMANDS TO OPEN CELLS ARE:
"ADR"/   OPEN THE CELL AND PRINT ITS CONTENTS
./      OPEN THE CELL CURRENTLY POINTED TO BY THE POINTER
AND PRINT ITS CONTENTS.
.*"ADR"/  ADD "ADR" TO THE POINTER, OPEN THE CELL
AND PRINT ITS CONTENTS.
.-"ADR"/  SUBTRACT "ADR" FROM THE POINTER, OPEN
THE CELL AND PRINT ITS CONTENTS.
"CR"     THE RETURN KEY IS USED TO CLOSE THE OPEN CELL
WITH OR WITHOUT MODIFICATION.

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0019 .MAIN

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01 ; "LF" LINE FEED IS USED TO CLOSE THE OPEN CELL WITH OR
02 ; WITHOUT MODIFICATION AND TO OPEN THE SUCCEEDING
03 ; CELL.
04 ;
05 ; AND OPEN THE OPEN CELL WITH OR WITHOUT MODIFICATION
06 ; AND OPEN THE PRECEDING CELL
07 ; CLOSE THE OPEN CELL WITHOUT MODIFICATION, AND
08 ; OPEN THE CELL POINTED TO BY ITS CONTENTS.
09 ; + "ADR"/ CLOSE THE OPEN CELL WITHOUT MODIFICATION, AND
10 ; - "ADR"/ OPEN THE OPEN CELL WITHOUT MODIFICATION, AND
11 ; OPEN THE CELL POINTED TO BY ITS CONTENTS = "ADR".
12 ;
13 ; 11.3.2 MODIFICATION OF A CELL
14 ; ONCE A CELL HAS BEEN OPENED ITS CONTENTS CAN BE MODIFIED
15 ; BY TYPING THE NEW VALUE THE CELL IS TO CONTAIN IN THE
16 ; FORM OF AN OCTAL EXPRESSION FOLLOWED BY "CR" OR "LF".
17 ; IF A + OR - IS TYPED AS THE FIRST CHARACTER OF THE EX-
18 ; PRESSION THEN THE VALUE OF THE EXPRESSION IS ADDED TO OR
19 ; SUBTRACTED FROM THE OLD CONTENTS OF THE CELL. THE
20 ; ADDRESS ITSELF OR AN EXPRESSION RELATIVE TO THE ADDRESS
21 ; CAN BE DEPOSITED BY TYPING A ". " OR ". +/- OCTAL EXPRESS-
22 ; ION". A RUBOUT COMMAND GIVEN RIGHT AFTER OPENING A CELL
23 ; ALLOWS THE MODIFICATION OF ITS CONTENTS AS IF THEY WERE
24 ; TYPED IN JUST BEFORE THE COMMAND WAS ISSUED.
25 ;
26 ; 11.3.3 OTHER ODT COMMANDS
27 ; RUBOUT THIS KEY IS USED TO DELETE ERRONEOUSLY TYPED
28 ; DIGITS. EACH TIME THE KEY IS PRESSED THE RIGHT MOST
29 ; DIGIT IS DELETED AND ECHOED ON THE TERMINAL. IF
30 ; THE RUBOUT KEY IS PRESSED RIGHT AFTER OPENING A
31 ; CELL THEN IT DELETES THE RIGHT MOST DIGIT OF THE CELLS
32 ; CONTENTS. THIS ALLOWS THE MODIFICATION OF THE CELL
33 ; AS IF ITS CONTENTS WERE TYPED IN JUST BEFORE THE
34 ; KEY WAS PRESSED.
35 ; "ADR"B INSERT A BREAK POINT AT LOCATION "ADR".
36 ; ONLY ONE BREAK POINT CAN BE INSERTED AND ANY
37 ; ENTRY TO ODT AFTER EXECUTING A BREAK POINT WILL
38 ; CAUSE IT TO BE DELETED.
39 ; D DELETE THE BREAK POINT IF ANY.
40 ; P RESTART THE EXECUTION OF THE PROGRAM AT LOCATION
41 ; POINTED BY 4A.
42 ; "ADR"R START EXECUTING THE PROGRAM AT "ADR" AFTER AN
43 ; IO-RESET.
44 ; K KILL THE STRING TYPED SO FAR. THE ODT RESPONDS
45 ; WITH A "?" AND THE OPEN CELL IS CLOSED WITHOUT
46 ; MODIFICATION.
47 ; = PRINT THE OCTAL VALUE OF THE INPUT ONLY.
48 ; THIS WILL CLOSE ANY OPEN CELLS WITHOUT
49 ; MODIFICATION AND WILL NOT OPEN A CELL
50 ;
51 ; NOTE: IN PROGRAMS WHICH RELOCATE THEMSELVES THE
52 ; THE USER SHOULD PLACE BREAK POINTS ONLY IN THE
53 ; THE ORIGINAL PROGRAM AREA. IF A BREAK POINT IS
54 ; PLACED OUTSIDE THIS AREA THE RESULTS WILL
55 ; BE UNPREDICTABLE.
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10020 .MAIN

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:12. SPECIAL NOTES/SPECIAL FEATURES:
; SEE SECTION 9.0
; SEE SECTION 7.6 FOR "CATS" OPERATION
;13. RUN TIMES FOR #300 DIAG
;-----
; CONFIGURATIONS:
;-----
; INPUT OUTPUT S/A RUNTIME WITHOUT DCU
;-----
;1. TTL 500 1.5 MIN = 1 PASS
; TTL 504 1.0 MIN > 5000 TRANSFERS
;2. G.P. 500 8.0 MIN = 1 PASS
; G.P. 504 1.0 MIN > 2000 TRANSFERS
;3. TTL 507 1.0 MIN = 3 PASSES
;4. TTL 507 1.0 MIN = 3 PASSES
;5. G.P 500 8.0 MIN = 1 PASS
; G.P 504 1.0 MIN > 1500 TRANSFERS

10021 .MAIN

01 ;RUN TIMES FOR 4300 DIAG
02 ;

03 ;-----
04 ;CONFIGURATIONS:
05 ;-----

06 ;
07 ;INPUT OUTPUT S/A RUNTIME WITH DCU
08 ;-----

09 ;
10 ;1. TTL TTL 500 2.0 MIN = 1 PASS
11 ; TTL TTL 504 1.0 MIN > 6000 TRANSFERS

12 ;
13 ;2. G.P. ISOLATED 500 8.0 MIN = 1 PASS
14 ; G.P. ISOLATED 504 1.0 MIN > 1000 TRANSFERS

15 ;
16 ;3. TTL FORM A 507 1.0 MIN = 3 PASSES
17 ;

18 ;4. TTL FORM C 507 1.0 MIN = 3 PASSES

19 ;
20 ;5. G.P. TRIAC 500 8.0 MIN = 1 PASS
21 ; G.P. TRIAC 504 1.0 MIN > 1000 TRANSFERS

22 ;
23 ;
24 ;.EUT

0022 .MAIN

**00000 TOTAL ERRORS, 00000 PASS 1 ERRORS

0023 .MAIN
0?DTD 000454 MC 18/01