

DataGeneral

**TECHNICAL
STATEMENT**

TEXT LISTING

068-000249-06

PROGRAM

I/O TESTER FOR
ECLIPSE PROCESSOR
PART B

TEXT TAPE

097-000249-05

ABSTRACT

THIS IS THE SECOND OF TWO PROGRAMS DESIGNED TO VERIFY THE OPERATION OF THE I/O FEATURE OF THE ECLIPSE PROCESSOR. THE AREAS WHICH EACH PROGRAM CHECKS ARE AS FOLLOWS: PART A - I/O BUS, INTERRUPT AND DATA CHANNEL. PART B - VCT INSTRUCTION. IT SHOULD BE NOTED THAT PART A IS A PREREQUISITE TO PART B.

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; NAME: EIOB.TX          PART NUMBER: 097-000249
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; DESCRIPTION: I/O TESTER FOR ECLIPSE PROCESSOR, PART B
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; REVISION HISTORY:
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; REV.          DATE
; 00          08/02/74
; 01          08/30/74
; 02          12/20/74
; 03          07/03/75
; 04          08/08/75
; 05          08/06/76
; 06          10/06/78
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; ALL RIGHTS RESERVED.
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; REVISION HISTORY
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; REV. 06 WAS CREATED TO
; IMPLEMENT THE STANDARDS PROVIDED
; BY DLIB.
; THIS HAS NOT CHANGED THE PHILOSOPHY
; OR TEST PROCEDURES IN THIS PROGRAM.
; ALL UNNECESSARY "FORST" HAVE BEEN
; DELETED FROM THIS FILE.
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; I/O.0
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; THIS DIAGNOSTIC IS DESIGNED TO RUN IN AN
; AUTO-LOAD AUTO-RUN ENVIRONMENT.
;
; I/O.0
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; ABSTRACT
;
; THIS IS THE SECOND OF TWO PROGRAMS DESIGNED
; TO VERIFY THE OPERATION OF THE I/O
; FEATURE OF THE ECLIPSE PROCESSOR. THE AREAS
; WHICH EACH PROGRAM CHECKS ARE AS FOLLOWS.
;
; PROGRAM EIOA
;
; I/O BUS
; INTERRUPT
; DATA CHANNEL
;
; PROGRAM EIOB
;
; VCT INSTRUCTION
;
; IT SHOULD BE NOTED THAT PROGRAM EIOA IS
; A PREREQUISITE TO EIOB.
;
; A COMPLETE TEST REQUIRES THAT AN I-O
; TESTER BE PRESENT IN THE SYSTEM. IF
; AN I-O TESTER IS NOT PRESENT, A
; PARTIAL TEST WILL BE PERFORMED.
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MACHINE REQUIREMENTS
2.1 ECLIPSE PROCESSOR
2.2 4K OF READ/WRITE MEMORY
2.3 TTY OR CRT
2.4 I-O TESTER (OPTIONAL)

3.0 OPERATING PROCEDURE
3.1 LOADING
3.2 LOAD PROGRAM VIA THE BINARY LOADER.
3.2 START ADDRESS
3.2 SET SWITCHES TO 200 OCTAL.
3.2 PRESS START.
SMPD 3.3

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3.3. SWITCH SETTINGS

LOCATION "SMREG" 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. 3.3.2

3.3.1 SWITCH OPTIONS

DIFFERENT BITS AND THEIR INTERPRETATION AT LOCATION "SMREG" IS AS FOLLOWS:

BIT	OCTAL VALUE	BINARY VALUE	INTERPRETATION
1	40000	1	LOOP ON ERROR SKIP LOOPING ON ERROR
2	20000	0	PRINT TO CONSOLE ABORT PRINT OUT TO CONSOLE
3	10000	0	DO NOT PRINT % FAILURE PRINT % FAILURE
4	04000	1	ALLOW END OF PASS PRINT OUT SUPPRESS END OF PASS PRINT OUT
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
7	0	0	DO NOT PRINT SUMMARY AND/OR

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PASSING OF EACH SUBTEST
PRINT SUMMARY AND/OR
PASSING OF EACH SUBTEST
PRINT ONLY THE FIRST ERROR
PRINT EVERY ERROR

00400 1
00200 0

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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 AFFILIATED WITH IT, THUS BIT 4 CAN BE ALTERED BY HITTING KEY 4. SETTING OF ANY BIT OF LOCATION "SMREG" WILL SET BIT 0. (DEFAULT MODE IS DEFINED AS ALL BITS OF SMREG SET TO 0) THE PROGRAM CAN BE LOCKED INTO SWITCH MODIFICATION MODE BY TYPING A 0, IN WHICH CASE MORE THAN ONE BIT CAN BE CHANGED BEFORE CONTROL IS ALLOWED TO RETURN TO THE MAIN PROGRAM.

OTHER COMMANDS
"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 "SMREG" 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)
M THIS COMMAND GIVEN AT ANY TIME WILL PRINT THE CURRENT OPERATING MODES.

NOTE: SWITCH 12 (1) = SET IF I/O BUS SWITCH IN SYSTEM NORMAL OPERATION
3.4 PROGRAM WILL EXECUTE ALL TESTS IN SEQUENCE AND AUTOMATICALLY LOOP. IF SWITCH 4 IS NOT SET A MESSAGE "PASS XXXX" WILL BE PRINTED AT THE END OF EACH PASS. XXXX IS THE PASS COUNT IN DECIMAL. IF SWITCH 4 IS SET, THE PASS COUNT WILL BE ACCUMULATED, BUT NOT PRINTED.
ACCOMPANYING THE PASS COUNT WILL BE A MESSAGE REGARDING THE EXISTENCE OF THE I-O TESTER.

070TD 3.5
OCTAL DEBUG TOOL (ODT)
THE DIAGNOSTIC IS EQUIPED WITH A BUILT IN ODT WHICH CAN

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BE ACCESSED BY HITTING CONTROL 0 ("O) 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.

3.5.1 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.

3.5.2 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
SEPARATED 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

3.5.3 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.

3.5.3.1 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
THE EVENT OF A "P" COMMAND.
5 CPU AND I/O STATUS
BIT INTERPRETATION
15 STATUS OF I/O DONE FLAG
14 STATUS OF INTERRUPTS (ION FLAG)
13 STATUS OF CARRY BIT
12 ADDRESS OF THE LOCATION HAVING THE BREAK POINT (IF
ANY)
7 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
- "ADR"/ AND PRINT ITS CONTENTS. 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.
"LF" LINE FEED IS USED TO CLOSE THE OPEN CELL WITH OR
WITHOUT MODIFICATION AND TO OPEN THE SUCCEEDING
CELL.
^ CLOSE THE OPEN CELL WITH OR WITHOUT MODIFICATION
AND OPEN THE PRECEDING CELL

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CLOSE THE OPEN CELL WITHOUT MODIFICATION, AND
OPEN THE CELL POINTED TO BY ITS CONTENTS.
* "ADR"/ OPEN THE OPEN CELL WITHOUT MODIFICATION, AND
- "ADR"/ OPEN THE OPEN CELL WITHOUT MODIFICATION, AND
OPEN THE CELL POINTED TO BY ITS CONTENTS - "ADR".

3.5.3.2 MODIFICATION OF A CELL
ONCE A CELL HAS BEEN OPENED ITS CONTENTS CAN BE MODIFIED
BY TYPING THE NEW VALUE THE CELL IS TO CONTAIN IN THE
FORM OF AN OCTAL EXPRESSION FOLLOWED BY "CR" OR "LF".
IF A + OR - IS TYPED AS THE FIRST CHARACTER OF THE EX-
PRESSION THEN THE VALUE OF THE EXPRESSION IS ADDED TO OR
SUBTRACTED FROM THE OLD CONTENTS OF THE CELL. THE
ADDRESS ITSELF OR AN EXPRESSION RELATIVE TO THE ADDRESS
CAN BE DEPOSITED BY TYPING A "." OR ".*"/-OCTAL EXPRESS-
ION". A RUBOUT COMMAND GIVEN RIGHT AFTER OPENING A CELL
ALLOWS THE MODIFICATION OF ITS CONTENTS AS IF THEY WERE
TYPED IN JUST BEFORE THE COMMAND WAS ISSUED.

3.5.3.3 OTHER ODT COMMANDS
THIS KEY IS USED TO DELETE ERRONEOUSLY TYPED
DIGITS. EACH TIME THE KEY IS PRESSED THE RIGHT MOST
DIGIT IS DELETED AND ECHOED ON THE TERMINAL. IF
THE RUBOUT KEY IS PRESSED RIGHT AFTER OPENING A
CELL THEN IT DELETES THE RIGHT MOST DIGIT OF THE CELLS
CONTENTS. THIS ALLOWS THE MODIFICATION OF THE CELL
AS IF ITS CONTENTS WERE TYPED IN JUST BEFORE THE
KEY WAS PRESSED.
INSERT A BREAK POINT AT LOCATION "ADR".
ONLY ONE BREAK POINT CAN BE INSERTED AND ANY
ENTRY TO ODT AFTER EXECUTING A BREAK POINT WILL
CAUSE IT TO BE DELETED.
DELETE THE BREAK POINT IF ANY.
RESTART THE EXECUTION OF THE PROGRAM AT LOCATION
POINTED BY "A".
START EXECUTING THE PROGRAM AT "ADR" AFTER AN
I/O-RESET.
KILL THE STRING TYPED SO FAR. THE ODT RESPONDS
WITH A "?". AND THE OPEN CELL IS CLOSED WITHOUT
MODIFICATION.
PRINT THE OCTAL VALUE OF THE INPUT ONLY.
THIS WILL CLOSE ANY OPEN CELLS WITHOUT
MODIFICATION AND WILL NOT OPEN A CELL

NOTE: IN PROGRAMS WHICH RELOCATE THEMSELVES THE
USER SHOULD PLACE BREAK POINTS ONLY IN THE
ORIGINAL PROGRAM AREA. IF A BREAK POINT IS
PLACED OUTSIDE THIS AREA THE RESULTS WILL
BE UNPREDICTABLE.

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4.0 ERROR DESCRIPTION
4.1 NORMAL
IF THE PROGRAM IS IN AUTO MODE, AND AN
ERROR OCCURS, THE PROGRAM WILL PRINT THE
PC OF THE ERROR AND THE CONTENTS OF THE
AC'S BEFORE RETURNING TO DTOS.

IF RUNNING STANDALONE, THE ERROR PC AND
THE AC'S ARE OUTPUT THEN THE
PROGRAM LOOPS ON THE FAILING TEST.
4.2 ABNORMAL
UNEXPECTED FAILURES
WHICH WILL CAUSE A JSR TO ODT PACK:
(WITH RESTART VIA P CR )
UNEXPECTED INTERRUPT
STACK OVERFLOW OR UNDERFLOW
THE CAUSE OF ANY OF THESE FAILURES SHOULD BE
CORRECTED BEFORE RESUMING TESTING.

5.0 PROGRAM DESCRIPTION
THE DIAGNOSTIC IS COMPRISED OF A SERIES OF
SHORT TESTS. BASICALLY, EACH TEST CONSISTS
OF A SETUP PROCEDURE, ONE OR MORE EVALUATING
CASES WITH ERROR CALLS, AND A LOOP CAPABILITY.
EACH PARTICULAR TEST CASE IS DESCRIBED IN THE
LISTING. THE COMMON ROUTINES FOR SETUP (SETUP),
ERROR CALLS (EHALT), AND LOOP (LOOP) ARE
DESCRIBED HERE.

SETUP
EACH TEST BEGINS WITH A CALL TO SETUP. THIS
ROUTINE ISSUES AN IORST, SETS THE LOOP ADDRESS
RESETS CERTAIN ERROR SWITCHES AND ITERATION
COUNTS. THE USER STACK AND VECTOR STACKS ARE
ALSO INITIALIZED.

EHALT
THIS ROUTINE IS CALLED WHEN AN ERROR
IS DETECTED. IT WILL THEN PERFORM
SPECIFIC FUNCTIONS AS SELECTED VIA
THE SWITCH REGISTER, OR LOOP ON ERROR.

LOOP
THIS ROUTINE IS CALLED AT THE END OF EACH TEST
SEQUENCE. IT IS USED TO ITERATE THE SEQUENCE
100 TIMES IF NO ERROR HAS BEEN DETECTED.
IF AN ERROR HAS BEEN DETECTED, IT IS USED TO
MAINTAIN THE SCOPE LOOP, INTERROGATE SWITCHES 1 + 3,
IF 3 IS PRESELECTED AND
INITIALIZE THE USER AND VECTOR STACKS.

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6.0 I/O TESTER HARDWARE DESCRIPTION
6.1 TEST BOARD COMMANDS
IORST - CLEARS THE TESTER (IF NEW MODE )
INTA - READ THE DATA BUFFER (NOT NEW MODE)
DATAC - READ THE PULSE DETECTORS
DATIB - READ THE DATA BUFFERS
DATIA - READ THE DCH ADDRESS BUFFER (NEW MODE)
DATOB - LOAD THE DATA BUFFER
DATOC - LOAD THE FUNCTION BUFFER
        LOAD THE DATA AND DCH ADDRESS BUFFERS

6.2 FUNCTION REGISTER BIT ASSIGNMENTS
BIT 0 SET DCH SYNC
BIT 1 SET DCH MODE0
BIT 2 SET DCH MODE1
BIT 3 SET PI SYNC
BIT 4 BUSY (IF NOT IN NEW MODE)
BIT 5 DONE (IF NOT IN NEW MODE)
BIT 6 NEW MODE
BITS 7-9 AN OCTAL # WHICH SPECIFIES THE
SUCCESSIVE DCH CYCLES. (NEW MODE ONLY)
NOTE THAT 0 SPECIFIES 1 ROENB PULSE.
BITS 10-15 # OF DCH CYCLES TO BE RUN.
        (NEW MODE ONLY)
NOTE THAT 0 SPECIFIES 1 DCH CYCLE.

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6.3 PULSE DETECTOR BIT ASSIGNMENTS

BIT 0 IOPLS
 BIT 1 INTA (INTA AND DCHP)
 BIT 2 MSKO
 BIT 3 DCHI
 BIT 4 OVFL0
 BIT 5 DCHO
 BIT 6 DCHA
 BIT 7 RGENB (COMPLEMENTS WITH EACH PULSE)
 BIT 8 DAT0A
 BIT 9 DAT0B
 BIT 10 DAT0C
 BIT 11 DAT1A
 BIT 12 DAT1B
 BIT 13 DAT1C (NOT SET IF DEV CODE = 0)
 BIT 14 STRT
 BIT 15 CLR

6.4 TEST BOARD LOGIC

THE TEST BOARD CONTAINS 16 PULSE DETECTOR FLIP FLOPS. THESE FF'S MAY BE READ BY A "DIC" WITH A DEVICE CODE OF 0. THEY MAY BE CLEARED BY IORST OR NIOC 0 (IF IN NEW MODE). A PARTICULAR FF SETS WHENEVER A PULSE OCCURS ON THE LINE TO WHICH IT IS CONNECTED.

THE TEST BOARD ALSO CONTAINS A 16 BIT DATA BUFFER. THIS BUFFER MAY BE LOADED/READ ETC. UNDER PROGRAM CONTROL. THIS BUFFER IS ALSO USED FOR DCH OPERATIONS. IT SHOULD BE NOTED THAT IN NEW MODE, ANY LOAD DATA BUFFER PROCEDURE, ACTUALLY LOADS THE EXCLUSIVE OR OF THE OUTPUT DATA AND THE DATA PREVIOUSLY STORED IN THE BUFFER.

A 15 BIT DCH ADDRESS BUFFER IS USED TO DIRECT DCH REQUESTS TO ANY LOCATION IN/OUT OF MEMORY.

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MONITOR LOCATIONS

THE FOLLOWING LOCATIONS IN PAGE 0 MAY BE MONITORED/EXAMINED TO PROVIDE ADDITIONAL INFORMATION.

LOC 200 USED BY DTOS
 LOC 201 ADDRESS OF SETUP+1 OF LAST TEST ENTERED
 LOC 202 PROGRAM STARTING ADDRESS
 LOC 203 PROGRAM PASS COUNT
 LOC 204 ITERATION COUNT

MISCELLANEOUS

IT SHOULD BE NOTED THAT THE OVFL0 PULSE DETECTOR BIT 4, IS NOT USED ON THE ECLIPSE PROCESSOR. ALSO DCHM1, DCH MODE BIT IS NOT USED.

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**00000 TOTAL ERRORS, 00000 PASS 1 ERRORS

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STMPD 000050 MC 3/20