PDP - 15
ALLGEMEIN

IDENTIFICATION

PRODUCT CODE:	MAINDEC-15-DAQAA-A-D
PRODUCT NAME:	PDP-15 SYSTEM EXERCISER
MAINTAINER:	DIAGNOSTIC GROUP
REPLACES:	MAINDEC-15-D7CC-D

31

TABLE OF CONTENTS

CONTENTS (CON'T)

MONITOR DESCRIPTION

AND

OPERATING PROCEDURES

SECTION I

The System Exerciser Program is an exerciser designed to run all I/O Devices simultaneously and run Central Processor Tests in the BACKGROUND when no I/O Test is actively running. Prerequisites are that the PDP-9/15 have at least 8K of Memory, one DECtape Transport and Tape Control. The system is resident on DECtape Unit Ø and is loaded via either the DECtape Bootstrap Loader (DEC-9U-LBAA or DEC-15-LBAB). The system consists of one resident and eight non-resident sections.

The first part is a Resident Monitor that includes a User Program Directory; a User Program Link Table; and common monitor subroutines (TTY and DECTAPE) used by the various non-resident programs. The Resident Monitor will run on initial loading and also is called by typing Control "C" on the keyboard.

The directory can hold up to 30 (10) users programs. Each user program takes four locations in the directory. The first two are for the title in .SIXBT. The third is the starting block number and the fourth contains the total word count. A user program can be added to or deleted from the directory to configure the system to a machine configuration. The directory can be listed on the teletype.

The Link table contains the first address of all user programs an can be printed on the Teleprinter.

The second part is a program to add User Programs to the User File. This program will input a User Program Tape in relocatable format from the high speed reader to DECtape Unit Ø and update the Directory. The Adder Program will accept a tape generated by MACRO-15 or bank relocatable MACRO-9. A maximum of 30 User Programs can be entered in the User File.

To add a user program to the file, type Control "A" and carriage return. Put the binary tape in the reader and write enable DECtape unit Ø. Type the title and terminate with carriage return.

There are several errors that could be flagged by the adder program. They are:

1. Directory full.
2. Too much leader on paper tape or no reader flag.
3. Reader no tape.
4. Wrong paper tape. The title statement on the paper tape is in radix 50.code. There are some characters that cannot be used in radix 50. This will require renaming the file and a reassembly. The other alternative is the operator called the tape in the reader by another name. Remove the tape from the reader and start again.
5. Check sum error exists on the paper tape. Mark the paper tape position and start again. Either the Reader is marginal or the tape was punched incorrectly.
6. Program two large. The maximum assembled size is limited to 4096.
7. Once the data is written on DECtape, the entire file is checksummed. If the checksum is non-zero then the error message "CHECK SUM ERROR DATA ON DT WRONG" will be printed.
8. After file is written on tape correctly, the directory is then updated, and checked for being correct. If the directory is incorrect, then a directory compare error message will be printed.

The third part will delete User Programs from the Directory and tape, and move all succeeding programs toward the beginning of the tape.

To delete a program, type Control "D" and carriage return. Write enable DECtape unit Ø and type the title of the program to be deleted. Delete program errors are as follows:

1. Not in directory. The title typed in doesn't match anything in the directory.
2. Write error. All files transferred are double buffered and are checked for being correct. All data errors will be re-written and checked up to 10 times. If this fails, then the program will abort.
3. After the programs are transferred, then the directory is updated on tape and checked for accuracy. If this fails, the directory will probably be bad.

The fourth part will list the User Program Directory. It is called by typing "D" carriage return. The directory will be read from tape. The program number, title, and starting block number will be printed. The last item will be remaining free blocks on the tape. There is automatic return to the resident monitor upon completion. Control "C" will abort the operation.

The fifth part will list the User Program core map loaded by the loader. Type "A" and carriage return. The program will search the link table, and print the title and the first address of the User program. Automatic return to the resident monitor will occur upon completion. Control "C" will abort the operation.

The sixth part is the Loader Program. Entrance to the program is by typing "L" carriage return. The Loader is used to load programs for the Interactive Mode Operating System. The default assumption is page relocateable (.DBREL). The mode is controlled by the pseudo-ops .DBREL and .EBREL. A parameter that must be determined, is memory size. Acceptable inputs are 8K, 12K, 16K, 20K, 24K, 28K, or 32K. Then type all User Programs that are wanted. A terminator of carriage returns with no title typed will start the loading process. A terminator of ALT MODE will start the loading process and print the link table after loading. If no memory size is typed in, then the Loader will return to the Monitor. If no programs are entered after the memory statement, the Chain Mode (Non-Interactive) Operation will result.

The following are possible errors for the loader program:

1. Program typed not in the directory.
2. Program already entered. This prevents multiple loadings of the same program.
3. Not enough core for programs wanted.
4. Check sum error on loading.
5. Illegal .LOC statement.

The seventh part is the Parameter Mode. This allows the operator to modify run parameters of some User Programs. Enter by "P" carriage return. The run parameters are a function of the user test. They are the first four locations of the user test. Commands to Parameter mode are altmode, carriage return, and up arrow (shift N). After the title is printed, a carriage return will go to the next user. To backup to the preceeding user type up arrow (shift N). To open the first word for examination and possible modification type altmode. Then the first word will be typed.

Typing any octal number will erase the previous contents of the typed word and replace it with the keyboard input. Leading zeroes are not required. Typing altmode again will close the open word and open the next one. Typing successive altmodes will open and close words in succession with no modification. Control "C" will abort to the resident monitors.

The eignth part is the Interactive Operating System entered by typing "X" carriage return. The operating system will run all programs loaded with the loader program.

See Switch register settings before starting. All Central Processor tests will run with the Program Interrupt on. All Input Output tests will run with the Program Interrupt off or disabled by an API level. Control "C" will abort to the resident monitor.

The ninth part is Chain Mode Operation. To run Chain Mode, simply type "X" and carriage return without loading any programs. After determining the 4K memory field to run in, the programs will be loaded one at a time and run until completion of one pass. Then the next program in the directory will be loaded and run. If set, the console switch associated with the user test will cause that test not to be run.

SYSTST OPERATION CODES

SYSTST VXX
$[CHARACTER CODE]

CHARACTER CODE	OPERATION DESCRIPTION
D	Type Directory of current programs in user file.
↑ D (Control D)	Delete named programs from user file.
↑ A (Control A)	Add named programs from high speed paper tape reader.
L	Load named user files into core.
A	Print User Program Core Map.
P	Parameter Mode-Modify UODSW's in named program.
X	Execute Programs loaded in Link Table.
↑ C (Control C)	Return to the Monitor.
\ (Rubout)	Delete previously typed character.

MONITOR ERROR CODES

ERROR NUMBERS	ERROR DESCRIPTION
1	API wanted by operator but is non-existant or won't turn on.
2	Unidentified program interrupt.
3	API break to an unused channel.
4	Memory Parity error

ERROR DISPLAY FORMAT

ERROR #1	ERROR#	IORS		
ERROR #2	ERROR#	IORS		
ERROR #3	ERROR#	IORS	API STATUS	API CHANNEL ENTERED
ERROR #4	ERROR#	PC		

EXERCISER/MONITOR COMMUNICATION CODES

DEVICE ERROR CODE TO MONITOR FROM EXERCISER MODULE

ERROR CODE	DESCRIPTION
0	No error found.
-1	Error found, new I/O oper. initiated, re-enter thru service entrance on flag.
-2	Error found, no new I/O oper. initiated, re-enter artificially thru service entrance.
-3	Error found, no new I/O operation initiated re-enter via initialization entrance.
-4	Test terminated. If error word count not equal zero, print error.
-5	No error, no new I/O oper. initiated, re-enter artificially thru service entrance.
-6	Used by Real Time Clock to print time.
-7	No error, no new I/O oper. initiated, re-enter thru initialization entrance.

SWITCH REGISTER SETTINGS

SWØØ	API Present and Desired for ALL I/O Tests. This applies only for devices that can use API.
SWØ1	Print Device Error and System status in the first four words and return to the Resident Monitor. Requires "X" to start again.
SWØ2	Don't Print Completion of each test.
SWØ3	Eliminate User Error Typeouts.
SW4-17	Temporarily Halt operation of an individual peripheral. See switch list.

TEST SWITCH SETTINGS FOR HALTING EACH TEST (S.W. UP HALTS TEST)

SW NO.	TEST
4	LT1519, DCØ1EB
5	AD15
6	XRLR
7	VT15
8	TIME, TIME5, CRO3B, CR15
9	RP15
10	VP15A, FPPT 1 & 2
11	LP15F, LP15C
12	EAEPT1, EAEPT2
13	RDRTST
14	PUNTST, BD15
15	RSØ915
16	DECTAP, DECTPI, DECTPS
17	MAGTAP, MAGTPS, XY15

SYSTEM EXERCISER MODULES CURRENTLY AVAILABLE

PROGRAM NAME	DEVICE CONTROLLER	COMMENTS
DECTAP	TCØ2, TC15 DECTAPE	4ØØØ WORD BUFFER
DECTPI		14ØØ WORD BUFFER
DECTPS		4ØØ WORD BUFFER
MAGTAP	TC59 MAGTAPE CONTROLLER	4ØØØ WORD BUFFER
MAGTPS		4ØØ WORD BUFFER
RSØ915	RFØ9/RF15 DISK CONTROLLER	
LP15F		80 COLUMN PRINTER
LP15C		132 COLUMN PRINTER
RDRTS1		HIGH SPEED READER
PUNTST		HIGH SPEED PUNCH
EAEPT1		SHIFTS AND NORMALIZE
EAEPT2		MULTIPLY AND DIVIDE
XRLR		INDEX AND LIMIT REGISTER TEST TO 131K
RP15	RPØ9, RP15 CONTROLLER	
TIME		60 CYCLE CLOCK
TIME5		50 CYCLE CLOCK
LT1519	LT15, LT19	TO 16 TELETYPES
AD15	AD15	SEE AD 15 SECTION FOR OPERATING PROCEDURES
VT15	VT15	
VP15A	VP15A CONTROLLER	TYPE 611 STORAGE SCOPE
DCØ1EB	DCØ1EB CONTROLLER	TO 32 TELETYPES
CRØ3B		AC TRANSFER CARD READER
CR15		1ØØØ CPM DCH CARD READER
XY15		12 INCH AND 31 INCH
BD15	INTERFACE TO UDC AND FLYING CAPACITOR SCANNER	
FP15T1	FLOATING POINT PROCESSOR FIXED DATA TEST	
FP15T2	FLOATING POINT PROCESSOR RANDOM DATA TEST	

1.1 FORMAT REQUIRED FOR WRITING AN EXERCISER MODULE FOR THE SYSTEM

1.1.1 GENERAL RULES

1. Assembled Program Size less than 4Ø97 locations.
   Relocatable Format; No. .ABS or .FULL statement.
2. Data Buffers must be internal.
3. No Auto-Indexing allowed.
4. Prohibited Instructions are:
   CAL
   HLT
   LAW FOR ADDRESS CALCULATION
   CAF
   IOF
   ION
   EBI
   DBI
   ISA
   EEM
   LEM
5. Monitor Devices are Keyboard, Teleprinter,
   DECtape Unit Ø, API and PI.

PROGRAM FORMAT

The Program Format must start and end in this manner to be able to interface into the Monitor.

```
                .EBREL
                .TITLE          XX-------XX
                /

UODSW           YYYYYY              /UNIT ORGANIZATION AND DESIGNATION WORD
                Ø                   /ADDITIONAL LOCATIONS
                Ø                   /FOR USER PROGRAM
                Ø                   /PARAMETERS
                .DSA  SERV          /SERVICE ENTRANCE ADDRESS
                .DSA  INIT          /INITIALIZATION ENTRANCE ADDRESS
                .SIXBT 'TITLEA'     /FILL IN WITH SPACES TO MAKE 6 CHARACTERS
                Ø                   /MASK FOR CHAIN MODE
                .BLOCK 7            /MOVE DATA LOCATIONS PAST AUTO-INDEX
SYSERR          Ø                   /ERROR INDICATOR FOR MONITOR
ERCODE          Ø                   /WORD COUNT FOR DATA WORDS TO BE PRINTED
                Ø                   /ERROR CODE FOR SOME ERROR
                /
                Ø                   /UP TO EIGHT DATA WORDS TO BE
                Ø                   /PRINTED FOR AN ERROR
                Ø                   /LOADING ERCODE WITH MINUS 1
                Ø                   /WILL CAUSE THE CONTENTS OF ERCODE+1
                Ø                   /TO BE PRINTED.
                Ø                   /
                Ø                   /
                /
                /
INIT            Ø                   /INITIALIZE SUBROUTINE ENTERED
                                    /ARTIFICIALLY BY THE MONITOR.

                JMP* INIT           /EXIT TO MONITOR.
                /
SERV            Ø                   /SERVICE ROUTINE.  IF API DRIVEN SAVE
                                    /THE AC. IF PI AND FLAG SET,
                                    /EXIT TO MONITOR WITH AC=Ø; IF PI AND
                                    /NO FLAG; EXIT TO MONITOR WITH AC=-1

                JMP* SERV           /EXIT

                .END UODSW          /END STATEMENT TO ALLOW MONITOR
                                    /TO FIND BEGINNING OF USER PROGRAM.
```

EXPLANATION OF UODSW FORMAT

UODSW

The first word of actual code is the Unit Organization Designation Word. This word is the principle communication cell between the Monitor and Module and is used by the Monitor to determine the type of test that has been loaded. Bit assignment is as follows:

BIT ØØ: This bit describes the type of test. Set indicates the User Diagnostic is an I/O Test. Clear indicates a CP Test. The Monitor will execute the CP Test as a BACKGROUND Test. If BIT Ø is set, the address of UODSW+4 will be entered in either a Program Interrupt Dispatch Table or an API Dispatch Table.

BIT Ø1: This Bit indicates that the device uses API. If this Bit is set, and API is active, then the address in UODSW+4 will be entered in an API Dispatch Table with the API Trap Location set to a JMS* through the Table to the device service address. If the device service routine is entered, and the User is capable of using API, then the user must save the accumulator. The user then determines if API is active with the SPI or RPL Instruction. If API is active, then the user must restore the AC prior to exiting. If API is not active, then Program Interrupt or artificial entrance by the Monitor caused the entry.

BIT Ø2: If set, this tells the user to loop in a portion of the test determined by Bits 7 to 11 of the UODSW Word. This Bit is set and cleared only by the operator via parameter mode.

BITS 3,4, &5: These bits tell the user to exercise the unit specified if bit Ø2 is set. Otherwise these bits indicate the transport or unit that is currently under test. These bits mean nothing for a CP Test.

BIT Ø6: Bit Ø6 is used to indicate multiple API trap addresses. The next three locations can be used for up to three additional API trap addresses. A terminator of Ø in bits 13 to 17 is used to indicate no more API traps.

BITS 7 to 11: Bits Ø7 to 11 are the portion of the test to run if bit Ø2 is set. Otherwise they should indicate the portion of the test the user is currently in.

BIT 12: This bit is set and cleared only by the operator in parameter mode. If set, the Operating System will not initialize this test. It is a no operation bit.

BITS 13 to 17: These indicate to the monitor the API Channel used by the device (If applicable). If API can be used and desired by the operator, then the Monitor will put a JMS* to the API Dispatch Table in the Memory Location equal to API Channel plus forty (octal).

A typical UODSW Word for DECtape would be 6ØØØØ4. To loop on DECtape Unit 3, the operator should change the UODSW to 73ØØØ4; loop unit 3 on Test Ø. The first four words for LT1519, are 6Ø4Ø32, ØØØØ35, Ø, and Ø. Bit 6 of the first word indicates extra API trap addresses. The word of Ø in bits 13 to 17 terminates loading of API trap addresses.

The three locations following UODSW are for additional parameters for user programs. This use will depend on the user program. The UODSW location and the three locations after UODSW can be modified by Parameter Mode.

UODSW+4 contains the address of the service entrance of the user. If the user is API Driven, the Monitor will set up in the Trap Address a JMS* to the service entrance. If the user is Program Interrupt driven, or a Central Processor test, the service address will be put in a Program Interrupt Dispatch Table. All Central Processor Tests are run as a BACKGROUND Job.

Location UODSW+5 contains the address of the initialization entrance. All tests will initialize through this address.

The sixth and seventh locations following the UODSW will contain the four to six character title. Fill in with trailing spaces to make the six characters. It will be used by the Monitor for error typeouts, completion messages, and printing the core map.

UODSW+20 is the error indicator to the Operating System. There are eight codes that can be set up by the user. They are -7 to Ø.

Zero as a device error indicator means no error.

Minus 1 as an error indicator tells the Monitor, that an error exists in the tests error table. The Monitor will get the title and the data table. Then the Monitor will clear the error indicator only, and start printing the title and the data words as determined by the word count location in the data table. The device will continue by initiating a new I/O operation. This means that the device will continue to be flag driven. If the device gets a second error before the Monitor can process the first error, then the device test can set the error indicator to minus two if desired, save the second error in a save table, initiate no I/O operation and exit. The Monitor will then process the first error and enter the test artificially via the service entrance. The device

test must, on all entries to his service entrance determine the status of his save table, set the error indicator to -1, initiate a new I/O operation and exit. Now the device will be flag driven again.

A possibility might exist where the user test might want to be entered via the initialization entrance. Setting the error indicator to minus three and initiating no I/O operation will cause the monitor to print an error and enter via the initialization entrance.

A test should be designed to run about 4 or 5 minutes for one pass. After one pass, the test should initiate no new I/O operation, if flag driven, and set the error indicator to -4. The monitor will look at the word count location (UODSW+21) and if non-zero will print the error. The monitor will then get the title from UODSW+6 and 7 and print 'TITLE DONE' if desired by the operator. Then either reinitialize the test if in interactive mode or dismiss the test if in chain mode.

An error indicator of -5 will cause the monitor to enter the test via the service entrance with no error printout.

An error indicator of -6 issued by the real time clock to print the time. It is handled like -1 except that no error halt (SWØ1=1) will occur.

An error indicator of -7 is used to cause the monitor to enter via the initialization entrance with no error typeout.
Any other indicator is invalid.

An example of Monitor Interface coding appears in the listings under the program name DOCUM. Care should be taken in using the coding as an example to make sure that it is adapted properly to any new user program to which it is applied.

MODULE DESCRIPTIONS

FOR

SYSTEM EXERCISER

SECTION II

DEC TAPE EXERCISER MODULE

GENERAL DESCRIPTION

The purpose of this test is to operate up to seven DECtape transports, randomly selecting each and using random data so as to simulate system operation. They vary only in the buffer size used. DECTAP has a 4000 word buffer; DECTPI has a 1400 word buffer; and DECTPS has a 400 word buffer. Determination of the availability of specific transports is done by polling during initialization. Placing a particular transport in the ready state with write lock off will cause its inclusion in the group to be tested. Any errors which occur during operation of the test are transmitted to the system monitor for display on the console teleprinter in standard system format. The test terminates automatically after 440 (octal) operations per transport.

OPERATION

Initialization of the Exerciser includes polling all 7 possible transport "Rewinding" each one found to be present to block 3 and finally writing a single 400 word record. Successful completion of this operation requires that the transport selected be on-line and with the write-lock-out switch off. Continuous operation of the exerciser module involves writing or reading variable length strings of DECtape blocks. The method of selecting operations (read or writes) and the lengths of the strings of blocks to be operated upon is as follows: Bit maps are kept, one for each transport, to keep track of those blocks which have been written in as the test progresses. Using the starting block no. of the string previously operated upon this transport and

a randomly selected offset of from -1 to 6, the start block for the new string is selected. The corresponding bit map locations are examined to see if this new start block had been previously written into. If so, a read is selected as the next operation. If not, a write is selected. In any event, the length of the string of blocks which is to be operated on, will be no longer than either a randomly selected length from 1 to 10 or the number of consecutive blocks of the same type as the first as indicated by the bit map, which ever is smaller. As more and more blocks become written in, the Exerciser switches over from predominately write to predominately read operations. As each block is written, a block no. is written as the first word in the block and a two's complement sumcheck are included. These are checked when the block is re-read later. If a discrepancy is found, and error is displayed.

DECTAPE ERROR CODES

ERROR NO.	ERROR DESCRIPTION	ERROR FORMAT NO.
1	No transports available for test	Ø
2	Select error	1
3	WC/CA inconsistency after read or write	2
4	Other status B errors	2
5	API error - API entry with no DECTAPE flag	0
6	Illegal block no. read from DEC TAPE	3
7	Sum check or recorded block no. error.	4
1Ø	Parity error and amount of failing retrys in bits 0, 1, 2 of WD1	2

ERROR FORMATS

ERROR FORMAT NO.	FORMAT DESCRIPTION
0	Error no. only (abort operation)
1	WD 1 Error no. WD 2 Status A Reg. WD 3 Status B Reg. WD 4 Block no. read from DEC Tape.
2	WD 1 Error no. WD 2 Status A Reg. WD 3 Status B Reg. WD 4 Initial WC. WD 5 Final CA WD 6 Initial CA WD 7 Final CA WD 8 For ER. 4 last block no. read from tape
3.	WD 1 Error no. WD 2 Status A Reg. WD 3 Status B Reg. WD 4 Error block no. read from tape.
4	WD 1 Error no. WD 2 Status A. Reg. WD 3 Block no. read from tape WD 4 Max. no. of blocks in this operation WD 5 Buffer index at error. WD 6 Sum check difference value.

STATUS REGISTER A CODES

BIT NO.	DESCRIPTION
0 1 2	Unit selection no. (0-7)
3	Direction: 0=forward, 1=reverse
4	Motion: 0=stop, 1=go
5	Mode: 0=normal, 1=continuous
6 7 8	Command: 0 Move, 1 Search, 2 Read Data, 3 Read all, 4 Write Data, 5 Write All, 6 Write timing & Mark Track, 7 Unused.
9	Interrupt enable flag: 0=disable, 1=enable.
10	Error flag: 0=clear it, 1=undisturbed
11	DECtape flag: 0=clear it, 1=undisturbed

STATUS REGISTER B CODES

BIT NO.	DESCRIPTION (IF SET)
0	Error flag
1	Mark Track Error
2	End of Tape
3	Select Error
4	Parity Error
5	Timing Error
6	
7	
8	Unused
9	
10	
11	Dectape flag

PARAMETER MODE

MODE NO.	OPERATION
0	RANDOM EXERCISER
1	READ TEST
2	WRITE TEST

PARAMETER MODE INPUT WORDS

UODSW+1 = Data Patterns used for read or write test

UODSW+2 = REC Length

UODSW+3 = Run length in bits Ø1-17. If zero then 440 operations will be done before a done statement. If non-zero, the contents of Bit Ø1-17 will be the total operations before done statement. Bit ØØ is to suppress timing error typeouts. If a system is run on Program Interrupt, and many I/O devices are running, then a DECtape timing error could occur. This could also happen with API if there are other devices with higher effective priority. To suppress this error typeout, set bit ØØ in UODSW+3.

This program runs in two modes-

1. Exercise all disks (normal mode)
2. Exercise disk and track with test number as indicated by the UODSW (looping mode)

This program exercises each disk that is plugged on line. A 2048 word record is written, write checked and read. The first disk is selected and the "Non-Existant Disk" bit is tested for zero. If the NED bit is not zero the next disk is selected. When the NED bit is zero the program selects each track in turn, and writes then write checks a 2Ø48 word record of random data. When the disk is filled, the next disk is selected and written on. After all of the disks have been written each disk is selected and each track is read. The random data is recreated for each record to verify its accuracy. The random data is generated using as the first word, the track and disk number (TTTTTT ØØØØØ DDD ØØØ). The data for each track is different and recreatable. After all of the disks have been read and write checked on each track of each disk. When Bit 2 of the UODSW is a one the program operates one track of a disk a given number of times. The disk track and test are selectable by inserting the appropriate numbers in the UODSW's with Parameter mode (see UODSW's description). The random data records are generated the same way as for the normal test sequence. The same error typeouts are used for both modes.

Bit Ø = 1 I/O test
Bit 1 = 1 Device uses API
Bit 2 = Ø normal, test all disks
= 1 looping test one track
Bit 3, 4, 5 when Bit 2 = Ø program inserts disk number currently being tested.

when Bit 2 = 1 operator inserts disk number to be tested.

Bit 6 = Ø

Bit 7-11 when Bit 2 = Ø program inserts number to indicate test being done.

1 = WRITE random record
2 = WRITE check
3 = READ
4 = WRITE pattern record
5 = WRITE check

When Bit 2 = 1 operator inserts test number to be used.

Ø Repeat normal test sequence----write, write check, read and compare random record, write and write check pattern record.
1 Create random record, loop on write record.
2 Create and write random record, loop on write check.
3 Create and write random record, loop on read and compare.
4 Create pattern record, loop on write
5 Create and write pattern record, loop on write check.
6 Loop on read record.
7 Create and write pattern record, loop on read.

Bit 12 = Ø run

= 1 don't run program.

Bit 13-17 = 23 API channel (addresses location 63 in API dispatch table)

UOD 1

Bit Ø-6	indicate track number to loop on when UODSW Bit 2=1
Bit 7-16	not used.
Bit 17	Suppress DCH error typeout.

UOD 2

Bits Ø-17	data pattern to generate pattern records when UODSW Bit 2=1

UOD 3

Bits Ø-17	number of times to loop when UODSW Bit 2=1 Ø = 1 time 1 = 2 times etc. 777777 = max number of times.

PARAMETER MODE OPERATIONS

MODE NO.	DESCRIPTION
0	Perform normal test sequence: Write, Write check, Read and Compare Random Record Write and Write Check Pattern Record.
1	Create Random Data Record, Loop on Write Record.
2	Create and Write Random Data Record, Loop on Write Check
3	Create and Write Random Data Record, Loop on Read and Compare.
4	Create Pattern Record, Loop on Write.
5	Create and Write Pattern Record, Loop on Write Check
6	Loop on Read Record.
7	Create and Write Pattern Record, Loop on Read.

RSØ915 ERROR CODES

ERROR NO.	ERROR DESCRIPTION	ERROR FORMAT
1	HDW, MXF, DCH	Ø
2	WRITE CHECK	Ø
3	PARITY (DATA OR ADDRESS)	Ø
4	DATA COMPARISON DIFFERENCE BETWEEN CALCULATED DATA AND DATA READ FROM DISK.	1
5	WRITE LOCK OUT (FIRST OCCURANCE)	Ø
6	API ENTRY AND NO DISK FLAG	Ø

ERROR FORMATS

ERROR FORMAT NO.	FORMAT DESCRIPTION	
ø	WD1	DTTTØE
	WD2	STATUS REGISTER
1	WD1	DTTTØE
	WD2	STATUS REGISTER
	WD3	WORD READ FROM DISK
	WD4	WORD COMPUTED TO BE CORRECT
	WD5	WORD POSITION IN BUFFER

D = Disk number

TTT = Track number

E = Error number

ø = Number of failures during retrys.
On a Write check or Parity error five retrys will be made and the number of failures during those retrys will be in bits 12, 13, and 14 of the status registers.

STATUS REGISTER

BIT ØØ	Error Flag	
BIT Ø1	Disk Hardware Error (HDW)	
BIT Ø2	Address Parity Error (APE)	
BIT Ø3	Missed Transfer Address (MXF)	
BIT Ø4	Write Check Error (WDE)	
BIT Ø5	Data Parity Error (DPE)	
BIT Ø6	Write Lockout (WLO)	
BIT Ø7	Non-Existant Disk (NED)	
BIT Ø8	DCH Timing Error (DCH)	
BIT Ø9	Program error (PGE)	
BIT 1Ø	Transfer Complete (XFC)	
VIT 15, 16, 17	ØØX	No Effect
	Ø1X	Read
	1ØX	Write
	11X	Write-Check

DISK PACK EXERCISER MODULE

This exerciser module is designed to exercise up to 8 RP15 Disc Pack units under control of the PDP-15 System Exerciser Monitor. The method used in performing the test consists of first determining thru polling, which units are available and on line. These units then are included in the set to be tested. Using random data, 5000 octal word records are written on and read from each unit in turn. Since the locations written on each disk pack are determined by the three parameters. cylinder, head, and sector address, records are written varying each of these three addressing parameters throughout its range while holding the other two constant. For example, cylinder and sector addresses are kept constant while varying the head addresses thru each of the 20 heads, etc. As each sector is written, it has included in it both a block address and a sumcheck word. After writing has been completed on a particular unit each previously written record is then re-read and its contents checked. These errors, if they occur, along with any errors reported by the Disk Pack controller are transmitted to the monitor for display on the teleprinter. Console Switch 9 allows operation to be temporarily halted. Parameter mode operation is not available with this module.

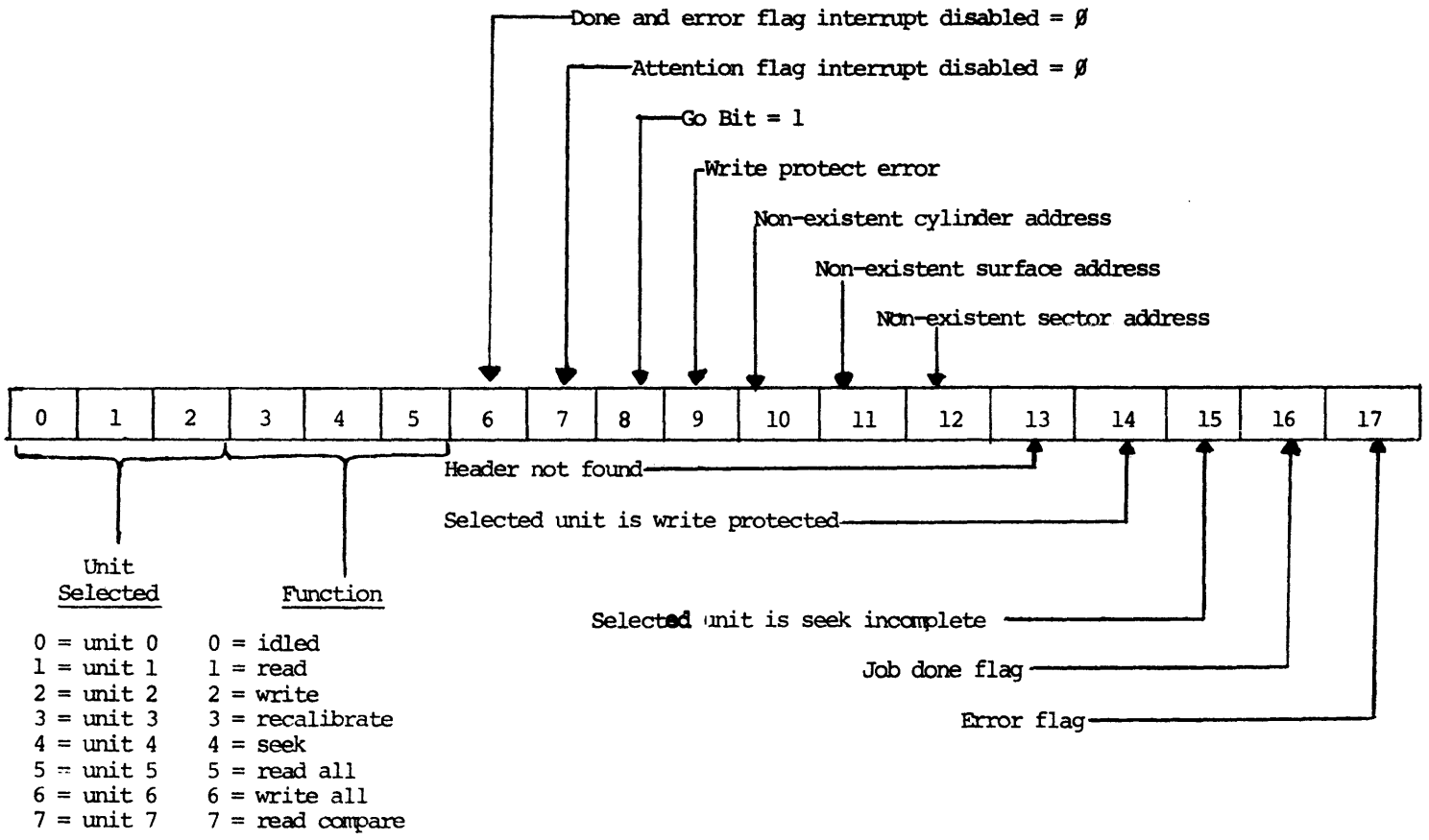
RP15-ERROR CODES

ERROR NO.	DESCRIPTION	FORMAT NO.
1	API Error	Ø
2	Block Address error found in rec. just read.	1
3	Sum check error found in rec. just read.	2
4 *	Error flag from disk pack or controller.	3
5	All out of disk packs.	Ø
6	Deleted Unit	4

* Five retrys will be made on parity,format, and header not found errors. The retrys that failed will be in the first digit of **WD1.**

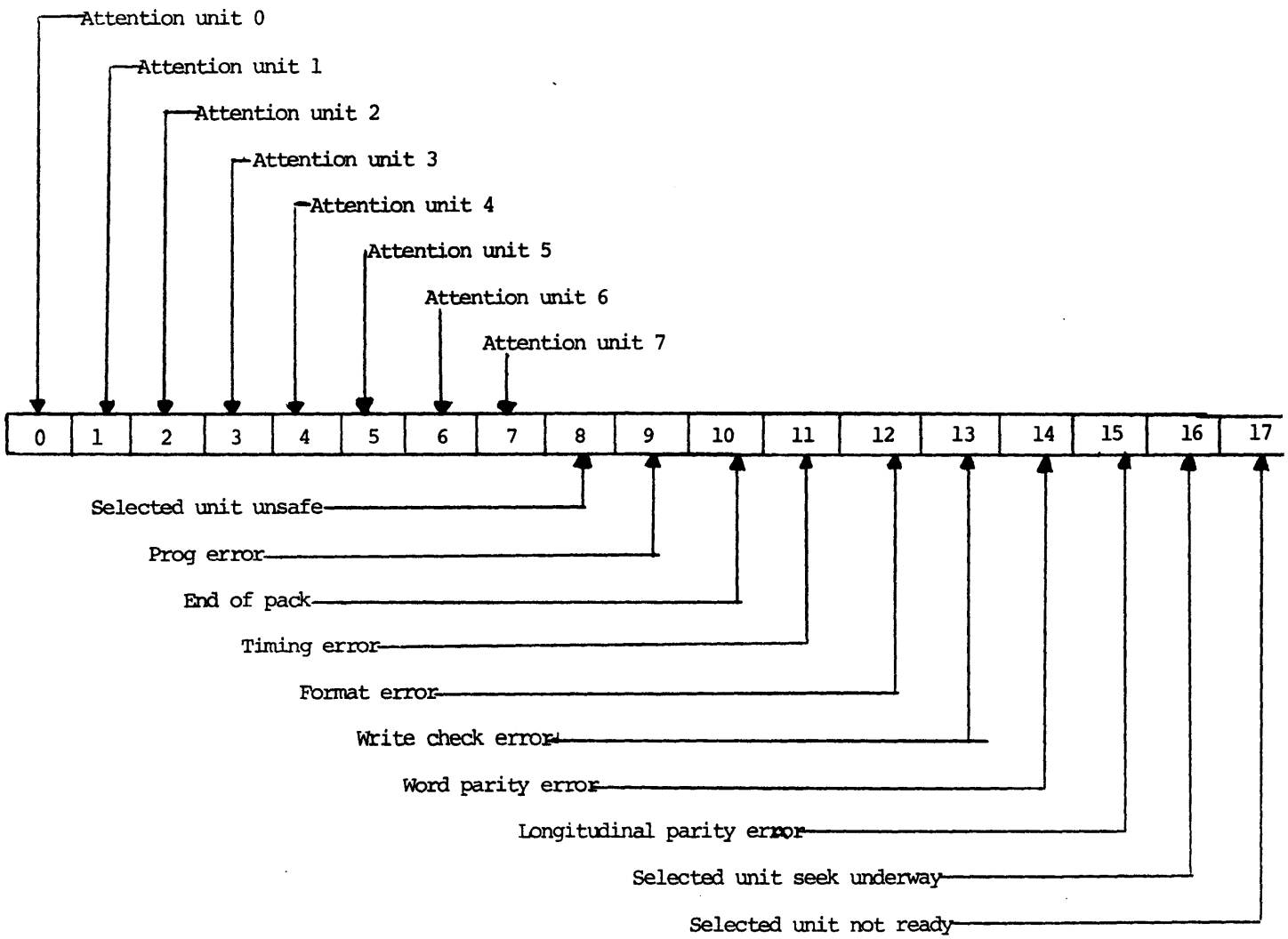
ERROR FORMATS

ERROR FORMAT NO.	FORMAT DESCRIPTION	
Ø	WD1	Error number
1	WD1	Error number
	WD2	Status A
	WD3	Status B
	WD4	Controller Address Register
	WD5	Block number from read from disk
	WD6	Block number which should have been found.
2	WD1	Error number
	WD2	Status A
	WD3	Status B
	WD4	Controller Address Register
	WD5	Difference between read and calculated sumcheck.
3	WD1	Error number
	WD2	Status A
	WD3	Status B
	WD4	Controller Address Register
4	WD1	Error number
	WD2	Unit # deleted
	WD3	Status A
	WD4	Status B
	WD5	Controller Address Register



STATUS REGISTER A BIT ASSIGNMENT

RP15



STATUS REGISTER B BIT ASSIGNMENT

MAGTAP EXERCISER MODULE

GENERAL DESCRIPTION

The purpose of this test is to operate from 1 to 8 TU10, TU20, or TU30 tape transports selecting them randomly using random modes and data in such a way as to simulate system operation. This test is available in two versions that differ only in program buffer size (and of course record size). MAGTAP has a 4000 word buffer where MAGTPS has a 400 word buffer. Determination of the availability of specific transports is done by polling during initialization. Placing a particular transport in the ready state will cause its inclusion in the set to be tested. Any errors which occur during operation of the test are transmitted to the system monitor for display on the console TELEPRINTER in standard system format. The test terminates automatically after 2000 operations have been performed. As more transports are added, the amount of operations per unit will decrease. To increase the operation time per transport, set some number greater than 2000 and less than 377777 in UODSW+3 with Parameter Mode.

OPERATION

After polling for available transports, records of random data will be written. These records will vary in size between buffer size (4000 or 400) to one twentieth of buffer size. The first word in the record size. The last word will be the two's complement checksum of the record. When a record is read, the record number, record size and checksum are all checked. This in addition to hardware checks verify the data path from memory to tape and back to memory. In addition to data checksumming, each successful operation is checked for the correct Word Count and Current Address at the completion of the operation.

PARAMETER MODE OPERATIONS

WRITE EXERCISER TEST I

The purpose of this test is to provide a method of continuously writing records of equal length on a particular transport. The transport to be used is selected by polling. The first one found in the ready state being the one chosen for operation. Detected errors are displayed on the teleprinter. The write buffer is set to all ones and density and parity set to 800 BPI, ODD PARITY. 2000 uniform length records of the maximum buffer size are written ending with termination of the test, and rewinding of the transport.

WRITE-READ TEST 2

This test is an extension of test 1 in that 2000 uniform length records are written, the tape transport is rewound, and then the same records re-read. As with the previous test, the data used is all ones, odd parity and 800 BPI.

SIMULATED COPY TEST 3

The purpose of this test is to simulate a randomly variable length record copy operation. The data used is random, odd parity, 800 BPI. Operation of the test is as follows: The transports are polled as before with the first two found to be ready being the ones which are selected for use. The first transport is used a the source with approximately 2000 random length records being written on it. After the first transport is rewound, and with the second transport being used as the destination, the data previously written on the source tape is copied to the destination tape. Upon completion of this operation, both transports are rewound and test terminated.

PARAMETER MODE

MODE NO.	OPERATION
0	Random Exerciser
1	Write
2	Write Then Read
3	Copy

Bit 2 = 1 in UODSW Enables Modes 1-3.

PARAMETER MODE INPUT WORDS

UODSW + 1 = Data Pattern to use in Tests 1 and 2.

UODSW + 2 = Record Length to use in Tests 1 and 2.

UODSW + 3 = Bits Ø1-17 are the number of operations before done statement. As the number of transports increase, the operations per unit decrease. To increase the operations per unit, insert a number greater than 2000. The default case of Ø will give 2000 operations. Bit ØØ (if set) is used for the DATA LATE error. If the operator is aware that the DATA LATE is caused by excessive Data Channel operations from other devices, or desires to suppress this error, he can set bit ØØ in UODSW +3. The program will backspace and retry the operation that had a DATA LATE error with no error typeout.

** The third character in UODSW is the density for 7 track drives. The default is 800BPI. It can be made to run at 200 or 556 BPI with Parameter Mode.

MAGTAPE ERROR CODES

ER. NO	ERROR DESCRIPTION	ERROR FORMAT NO.
1	Controller not ready	0
2	Transport not ready	1
3	Illegal command return from controller	2
4	Error flag, no cause status bits	2
5	Nonsense status bits returned for this command	2
6	Bad tape detected	2
7	Parity error detected	2
10	Data request late detected	2
11	Inconsistent WC/CA after read	2
12	On read: Short REC.: WC≠0 or REC. LEN INCOR. BIT NOT SET. Full REC. : WC≠ or REC. LEN INCOR. BIT SET	
13	Inconsistent WC/CA after write	2
14	WC≠0 after write	2
15	Write end of file status bit not set after write EOF.	2
16	API error-API entry with no MAGTAPE flag	0
17	Calculated WC error on write part of copy	0
20	No transports available for test	0
21	REC. Length, written in REC., not equal Length of REC. READ.	3
22	Sum check error on READ.	3
23	Block no. incorrect in record.	3

ERROR FORMATS

ERROR FORMAT NO.	FORMAT DESCRIPTIONS
0	Error no. only. (abort operation)
1	WD 1 Error no. (Delete this Transport) WD 2 Command
2 *	WD 1 Error no. (continue operation) WD 2 Command WD 3 Status Reg. WD 4 Initial word count WD 5 Final word count WD 6 Initial current address WD 7 Final current address.
3	WD 1 Error no. (continue operations) WD 2 Command Register WD 3 Status Register WD 4 C (CNTR) ; calculated record number WD 5 C (BUF1); record number from tape WD 6 C (BUF1+1); record length from tape WD 7 Record length calculated from final W.C. WD 8 Sum check difference

* On parity errors, there will be 5 retrys. The amount of failing retrys will be present in the first digit of WD1

TC-59 COMMAND REGISTER CODES

BIT NO.	DESCRIPTION
0	Unit selection no. (0-7)
1	Unit selection no. (0-7)
2	
3	Parity: 0=even, 1=odd
4	Core Dump Mode
5	Write extended inter record gap
6	0 No-op 3 Read/compare 6 Space Forware
7	Command 1 rewind 4 Write 7 Space Backware
8	2 read 5 Write EOF
9	Interrupt enable flag: 0=disable, 1=enable.
10	Recording density ØØ = 200 BPI Ø1 = 556 BPI
11	1Ø = 800 BPI 11 = 800 BPI 9 channel

TC-59 STATUS REGISTER CODES

BIT NO.	DESCRIPTION (WHEN SET)
0	Error Flag (EF)
1	Tape Rewinding
2	Beginning of Tape (BOT)
3	Illegal Command or Transport Decelerating
4	Parity Error (Lateral or Longitudinal)
5	End of File (EOF)
6	End of Tape (EOT)
7	Read/Compare Error
8	Record Length Incorrect [WC=0 (long), WC≠0 (short)]
9	Data Request Late
10	Bad Tape
11	Magnetic Tape Flag (MTF) or Job Done.
12	Character counter bits.
13	
14	No. of Tracks, This Handler. 1=7 TRK., Ø=9 TRK.

EXTENDED ARITHMETIC ELEMENT OPTION PART I

The Purpose of this module is to exercise the EAE option if it is available on the system under test and also to provide a BACKGROUND task for the Central Processor unit during system operation. All modes are exercised with the exception of Multiply & Divide which are handled by EAE PART 2. The method used to prepare this exerciser was to adapt the original EAE PART 1 Diagnostic (Maindec-15-DØ9A-D (D)) for operation under the system exerciser monitor. Almost the entire test has been preserved and reference can be made to the original Diagnostic for details of operation. Error indicators were modified to conform to the error display procedures available in the monitor. This consisted of removing the Headers, etc. from the typeouts of the original, but still presenting the contents of the various error information cells in multiple lines if necessary. This first word represents the address at which the error was detected. Reference to the listing at the location and the original Diagnostic write-up (Maindec-15-DØ9A-D) will provide information relating to the cause of the error and the significance of the various error words displayed on the console typewriter.

Scope looping, suppression of error typeouts etc. have been eliminated. Switch 12 is used to cause the test to hold temporarily. There is no parameter mode option with this test.

EXTENDED ARITHMETIC ELEMENT OPTION - PART 2

The purpose of this exerciser module is to provide a test for the multiply and divide portions of the EAE Option, if it is available on the system under test. It also provides a BACKGROUND Task for the CPU during systems operation. The method used to prepare this exerciser consisted of extracting the basic Hardware Tests and Software Multiply and Divide simulators from the original EAE PART 2 Diagnostic Test and adapting them for use under the System Exerciser Monitor. In the Basic Test, Random numbers are selected for the Multiplier/Multiplicand for multiply or the Dividend/Divisor for divide and the corresponding operation performed by both the Hardware and the corresponding Software Simulator. The results are then compared and an error indicated if a discrepancy is found. In each case, 300,000 octal operations are performed.

Under Parameter Mode Operation, either Multiply, Divide or both can be selected. In each case, the starting values for Multiplier/Multiplicand or Dividend/Divisor are taken from UODSW's 1, 2, and 3 as follows:

```
UODSW1          /HIGH ORDER DIVIDEND
UODSW2          /MULTIPLICAND OR LOW ORDER DIVIDEND
UODSW3          /MULTIPLIER OR DIVISOR
```

After each operation is performed and checked, the multiplicand or the dividend is incremented by one and the next operation done. This continues 300,000 octal times. Test 1 performs multiplication only, Test 2 division only and Test 3 does both. As with EAEPT1, Switch 12 is used to cause temporary suspension of operation of the test.

ERROR CODES

ERROR CODE	DESCRIPTION
1	Bad Multiply-Software MPY ≠ Hardware MPY.
2	Bad Divide - Software DIV ≠ Hardware DIV.

ERROR FORMATS

ERROR 1 - MULTIPLY ERROR

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	Multiplier
WD3	Multiplicand
WD4	Hardware - Hi order Product
WD5	Hardware - Lo order Product
WD6	Software - Hi order Product
WD7	Software - Lo order Product

ERROR 2 - DIVIDE ERROR

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	Hi order Dividend
WD3	Lo order Dividend
WD4	Divisor
WD5	Hardware Quotient
WD6	Hardware Remainder
WD7	Software Quotient
WD8	Software Remainder

PARAMETER MODE OPERATION

MODE NO.	DESCRIPTION
0	Random numbers selected. Both multiply and divide.
1	Multiply only. Start parameters in UODSW 1, 2, & 3.
2	Divide only. Start parameters in UODSW 1, 2, & 3.
3	Multiply then divide. Start parameters in UODSW 1, 2, & 3.

UODSW WORD ENTRIES IN PARAMETER MODE

UODSW NO.	FOR MULTIPLY	FOR DIVIDE
1	N/A	Hi order dividend
2	Multiplicand	Lo order dividend
3	Multiplier	Divisor

DESCRIPTION

This program is designed to exercise the Index, Limit registers and all related control and transfer instructions of the PDP-15. Provision is made via means of PARAMETER mode to test indexed addressing of all additional memory above 32K up to and including 128K. Provision is also made via means of PARAMETER mode to loop on any specified test (1-12) of the XRLR test. The program starts by testing simple data transfer between the AC, XR, and LR and gradually builds in complexity testing such things as indirect index auto incremented addressing up thru 128K of memory if available. Console switch 6 halts the XRLR test.

PARAMETER MODE OPTIONS

A. Using Parameter mode to indicate the additional memory above 32K up to 128K.

   1. The locations of UODSW+1, +2, and +3 may be modified to represent the number of available fields in BLOCK 1, BLOCK 2 and BLOCK 3 of memory respectively.

      Example:

      To represent that memory fields Ø and 7 are available in BLOCK 1, UODSW+1 would be modified to contain 2Ø1, where field Ø is represented by bit 17 and field 7 is represented by bit 1Ø. If all 8 fields were available UODSW+1 would be modified to 377.

B. Using Parameter mode to indicate the desired test to be looped on (1-12).

   1. Provision is made for the operator to loop on any specified

test via modifying the UODSW location. Setting bit 2 of the UODSW word and placing the desired test number in bits 7 to 11 will cause the program to loop in the desired test when the test is run. The program will stay in this test until the program is either re-loaded or the location is again modified via the operator.

ERROR DESCRIPTION

Fourteen (14) possible errors may be detected by the XRLR test.

	ERROR CODES	DESCRIPTION
1)	ØØØØØ1	Processor won't enter Page mode.
2)	ØØØØØ2	Processor won't enter Bank mode.
3)	ØØØØØ3	Bad data transfer XR TO LR
4)	ØØØØØ4	Bad data transfer LR TO XR
5)	ØØØØØ5	Bad data transfer AC TO LR
6)	ØØØØØ6	Bad data transfer AC TO XR
7)	ØØØØØ7	Bad data transfer XR TO AC
1Ø)	ØØØØ1Ø	Bad data transfer LR TO AC
11)	ØØØØ11	AC failure
12)	ØØØØ12	XR failure
13)	ØØØØ13	LR failure
14)	ØØØØ14	Bad data transfer to LOC. Ø of extended field.
15)	ØØØØ15	Bad data transfer to LOC. 1 of extended field.
16)	ØØØØ16	Bad data transfer to LOC. 7777 of extended field.

ERROR FORMAT

WD1 Test number

WD2 Error code

WD3 Unrelocated address of failure

WD4 Bank and field bits

WD5 AC

WD6 XR

WD7 LR

FP15 EXERCISER MODULE PART 1

DESCRIPTION

This module is designed as an instruction test exerciser for the FP15. The method used to prepare this exerciser was to adopt as closely as possible the original RPIT03 INSTRUCTION TEST PART 3, MAINDEC-15-D0VA. This module checks the instruction capability of the FPU using selected instructions and selected, known data. All tests are performed in user mode although the diagnostic mode is employed to dump out the 16 FPU registers for error reporting of errors 5-101.

OPERATION

The instructions covered by RP15T1 (in approximately the following order) are:

A. LOAD and STORE JEA.

B. BRANCHES (conditioned and unconditioned).

C. LOAD, SWAP and STORE.

D. FIX and FLOAT.

E. ADD, SUBTRACT AND REVERSE SUBTRACT.

F. MULTIPLY.

G. DIVIDE and REVERSE DIVIDE

H. JEA TRAPS

I. INDIRECT ADDRESSING

J. EXTENDED MEMORY ADDRESSING (if available)

PARAMETER MODE OPTIONS

Parameter mode can be used to indicate the amount of extended memory above 32K and also used to set up an error loop for errors 5 thru 101.

A. Using parameter mode to indicate the amount of extended memory above 32K up to 128K.

1. The locations of UODSW+1 and +2 can be modified to indicate the available fields in BLOCK 1, BLOCK 2, (UODSW+1) and BLOCK 3 (UODSW+2).

   where:

   Bits 0-7 of UODSW+1 = BLOCK 1, fields 0-7

   Bits 9-16 of UODSW+1 = BLOCK 2, fields 0-7

   Bits 0-7 of UODSW+2 = BLOCK 3, fields 0-7

B. Using parameter mode to set up an error loop for errors 5 thru 101.

1. Set the location of UODSW to 100000 (Bit 2 set to indicate error looping requested) and set UODSW+3 = to the *address of the failing test. The failing test will be looped eternally when the program is executed.

   *Refer to error format NØ.5 to determine the address of the failing test.

AC SWITCHES

AC SW10 (0) NORMAL FP15T1 OPERATION

AC SW10 (1) INHIBITS FP15T1 TEST

ERROR CODES

ERROR CODE	DESCRIPTION
1	FP15 Configuration not present
2	No BRANCH occurred with conditions set
3	A BRANCH was executed without conditions set
4	Unexpected JEA break occurred
5	LJE error
6	IST error
7	ELD error
10	UNFLD error
11	URFLX error
13	EAD error
14	UUDAD error
15	ESB error
16	UUDRS error
17	IMP error
20	UUDMP error
21	IDV error
22	IRD error
23	EDV error
24	ERD error
25	FAD error
26	URFAD error
27	UNFAD error

ERROR CODES (cont'd)

ERROR CODE	DESCRIPTION
36	UNDST error
37	URDMP error
40	UNDMP error
41	FDV error
42	URFDV error
43	FLD error
44	FRD error
45	URFRD error
46	DDV error
47	URDDV error
50	DLD error
51	DRD error
52	URDRD error
53	JEA DID NOT OCCUR
54	JEA STORED WRONG ADDRESS
60	Load error from Extended Memory
61	Load Indirect error from Extended Memory
62	Store Indirect error from Extended Memory
70	LJE Indirect error
71	SJE Indirect error
72	ILD Indirect error
73	IST Indirect error
74	ELD Indirect error
75	EST Indirect error

ERROR CODES (cont'd)

ERROR CODE	DESCRIPTION
76	UNDLD Indirect Error
77	UNDST Indirect Error
100	UUDAD Indirect Error
101	LOAD and STORE Indirect Error

ERROR FORMATS

ERROR 1 - FP15 Configuration no present.

WORD NO.	WORD DESCRIPTION
WD1	Error Code

ERROR 2 - No BRANCH with conditions set.

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	BRANCH "IOT"
WD3	(FMA)

Error 3 - BRANCH was executed without conditions set.

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	BRANCH "IOT"
WD3	(FMA)

ERROR 4 - Unexpected "JEA" BREAK

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	= 1 JEA "OVERFLOW" error
WD2	= 2 JEA "UNDERFLOW" error
WD2	= 3 JEA "DIVIDE" error
WD2	= 4 JEA "MEM. VIOL." error
	NOTE: This is followed by the 16 FPU registers. Refer to ERROR5 for full description.

ERROR FORMATS (cont'd)

ERROR 5 - All other data and instruction errors (5-101)

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	Bad Data
WD3	Expected Data
WD4	Address is listing where error occurred.
WD5	"LOOP" address (for parameter mode)
	Followed by the 16 FPU registers:
WD1	MBH
WD2	MBL
WD3	SIR
WD4	EPA
WD5	FAH
WD6	FAL
WD7	EPB
WD8	FBH

1-8

WORD NO.	WORD DESCRIPTION
WD1	FBL
WD2	MQH
WD3	MQL
WD4	ADH
WD5	ADL
WD6	JEA
WD7	STA
WD8	ADR

9-16

FP15 EXERCISER MODULE PART 2

DESCRIPTION

This module is designed to simulate system usage. A predetermined ratio of 256 hardware operations to 1 software calculation is employed to optimize this system effect. The method used to prepare this exerciser was to adapt as closely as possible the random test section of the original PDP-15 FLOATING POINT RANDOM EXERCISER MAINDEC-15-D0WA. All tests are performed in user mode although the diagnostic mode is employed to dump out the 16 FPU registers for reporting errors 2-7.

OPERATION

The instructions covered by FP15T2 are stored in a buffer which is scrambled every 1000 passes and reset to the listing every 2000 passes.

PARAMETER MODE

No user switches are available in the program.

AC SWITCHES

AC SW10 (1) Inhibits RP15T2 test

ERROR CODES

ERROR CODE	DESCRIPTION
1	FP15 configuration not present
2	FP15T2 Data error
3	Unexpected JEA break
4	Expected JEA break but none occurred
5	LOAD/STORE FAILURE
6	Unexpected BRANCH occurred
7	No BRANCH occurred when expected

NOTE:

Errors 2-7 are followed by a typeout of 17 diagnostic aid registers, refer to ERROR FORMAT error 1Ø.

ERROR FORMAT

Error 1 - FP15 configuration not present.

WORD NO.	WORD DESCRIPTION
WD1	Error Code

Error 2 - FP15T2 Data Error

WORD NO.	WORD DESCRIPTION
WD1	Error Code

Error 3 - Unexpected JEA break

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	Error Number (as follows)
	1=overflow from rounding
	2=exponent overflow
	3=underflow from normalization
	4=floating abnormal divide
	25=integer division by zero

Error 4 - Expected JEA break but none occurred.

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	Error Number (as follows)
	11=overflow from rounding
	12=exponent overflow
	13=underflow from normalization
	14=exponent underflow
	15=floating abnormal division
	30=integer overflow
	35=integer division by zero

Error 5 - Load/Store Failure

WORD NO.	WORD DESCRIPTION
WD1	Error Code

Error 6 - Unexpected BRANCH occurred

WORD NO.	WORD DESCRIPTION
WD1	Error Code
WD2	Failing BRANCH IOT

Error 7 - No BRANCH occurred when expected

ERROR NO.	WORD DESCRIPTION
WD1	Error Code
WD2	Failing BRANCH IOT

Error 10 - 17 Diagnostic aid registers

ERROR NO.	WORD DESCRIPTION
WD1	Ratio of operations
WD2	Function
WD3	FMB H ; before
WD4	FMB L ; before
WD5	EPA ; before
WD6	FMA H ; before
WD6	FMA L ; before
WD8	EPA ; before
WD1	FMA H ; (DRR)
WD2	FMA L ; (DRR)
WD3	EPA ; (DRR)
WD4	FMA H ; stored
WD5	FMA L ; stored
WD6	EPA ; stored
WD1	FMA H ; calculated
WD2	FMA L ; calculated
WD3	EPA ; calculated

LINE FREQUENCY CLOCK EXERCISER MODULE

GENERAL DESCRIPTION

This module uses the line frequency clock option to print the time every minute. It is available in a 6Ø and 5Ø cycle version (TIME & TIME5). The time is printed via the monitor error reporting function. Console switch 8 halts operation of the TIME & TIME5 module.

OPERATION

Location 7 is initialized to a number which will produce a clock flag every second. Every minute the monitor error reporter is signaled to print the time as six octal digits. The first two digits are for the hours (Ø-27) and the last two digits are for the minutes (Ø-73).

ERROR

The only error from the clock is an API entry with no clock flag. This will be indicated by a time of 777777.

HIGH SPEED READER EXERCISER MODULE

DESCRIPTION

The "Random Number Reader Test" is run using a Tape Punched via the "Random Number Punch Test". The Tape is read at both full speed and random stall intervals. Every other column is read using either the IOT RSA or RSB.

PROGRAM ACTION

The punched tape should be placed in the Reader and it must be ready to read when the "System Exerciser" is started. The tape is read first at full speed and then at random stall and full speed intervals. The stall can be eliminated by setting bit 17 of UODSW+1 with Parameter Mode. This will cuase the tape to be read as fast as possible. After completing the read test, the same tape or another tape can then be reloaded into the Reader to be verified. When the tape is reloaded the no tape flag is cleared and a delay is started. Approximately 10 seconds after the no tape flag was cleared, the Read Test will restart. This delay is present every time the tape is reloaded and is a stand alone figure.

When a read error is encountered, the error message is typed out and a stall is set up allowing the operator to remove the tape and examine it to verify as to whether the error was a Read or a Punch Error. He also has the option of ignoring the error and after a delay of approximately 2 minutes the test will resume verifying the tape. After an error typeout, AC SW13 may be set to a "1" causing an indefinite hold until either the tape is removed or the switch is reset to "0" allowing the test to resume. If the tape is removed from the Reader, the no tape flag is set and the error code for no tape is typed.

out. The tape must then be reloaded at the beginning of the tape and after a delay the test will restart automatically.

NO TAPE ERROR

Any time a no tape condition is encountered, an error code of ØØØØØ1 will be typed out. To recover from a no tape condition, the test tape must be reloaded and the test will restart automatically.

AC SWITCHES

AC SW13 (Ø) NORMAL READ OPERATION

AC SW13 (1) INHIBIT READER TEST

AC SW13 MAY BE SET TO INHIBIT THE READER AT ANY TIME DURING THE TEST.

ERRORS

Four (4) possible errors maybe detected by the Reader Test.

ERROR CODE		DESCRIPTION
1)	ØØØØØ1	No tape flag
2)	ØØØØØ2	RSF skipped with IORS reader Bit clear
3)	ØØØØØ3	Illegal API Interrupt. API interrupted with the Reader Flag clear.
4)	ØØØØØ4	Read Data Error.

Example:

TEST	ERROR CODE	COLUMNS READ	READ MODE	GOOD	BAD
RDRTST	ØØØØØ4	1ØØ21 (8)	7ØØ1Ø4	37Ø	371

COLUMNS READ will be equal to the number of columns read in octal.

READ MODE will be equal to either the IOT 7ØØ1Ø4 (RSA) or 7ØØ144 (RSB).

DESCRIPTION

The "Random Number Punch Test" will punch a tape which can be verified using the "Random Number Reader Test". The tape is punched at both full speed and random stall intervals. Every other column is punched using either the IOT PSA or PSB.

PROGRAM ACTION

The program starts off by punching blank leader and then at full speed and random stall intervals. The random stall intervals can be eliminated by setting bit 17 of UODSW+1 with Parameter mode. The punch test will punch random numbers complimenting the punch mode (PSA, PSB) for every other random number. After punching a specified number of columns, blank leader is punched and the test will start over. The punched tape may be torn off any place in the blank leader to be used as a test tape for the "Random Number Reader Test".

AC SWITCHES

AC SW14 (Ø) NORMAL PUNCH OPERATION

AC SW14 (1) INHIBIT PUNCH TEST

NOTE: AC SW14 MAY BE SET TO INHIBIT THE PUNCH TEST AT ANY TIME DURING THE TEST.

ERRORS

Two (2) possible errors may be detected by the Punch test.

ERROR CODE	DESCRIPTION
1) ØØØØØ1	No tape flag set.
2) ØØØØØ2	PSF skipped with IORS bit clear.

NO TAPE ERROR

Anytime a not tape condition is encountered, an error code of 'ØØØØØ1' will be typed out. To recover from a 'no tape' condition, the test must be restarted.

LP15 C&F LINE PRINTER SYSTEMS EXERCISER MODULE

The LP15 Exerciser Module drives the Printer Control Electronics and Line Printer within the Systems Exerciser environment using 5 different patterns. Print control errors are monitored and reported if they occur but, since no feedback is provided for detection of data transmission errors, these must be detected visually. The patterns printed have been choosen so that this may be easily done.

The five patterns which are printed are:

1. Double wedge pattern consisting of a set of alternating left and right hand wedges.
2. Standard rotating pattern using all characters.
3. Alternating E's and space characters printed in the IOPS ASCII Mode.
4. And a high-speed printer test using characters spaced "4ms" apart on the print character drum.

The sequence of patterns is repeated 8 times at which point a LP15 done statement is issued.

In the event of detection of a controller error, an error 2 is indicated together with the contents of the printer status register. An Error 1 indication is produced if an API entry error is detected and the test is terminated. Parameter mode operation is not available in operation with this module. Console SW11 is used to temporarily stop printer operation. If the printer runs out of paper, an Error 1 will be printed. Automatic restart will take place approximately one minute after reloading the paper if no other tests are running. The time will increase as the amount of other tests increase.

ERROR CODES

ERROR NO.	DESCRIPTION
1	API Error - API entry with no line printer flag.
2	Printer Error

WD1 Error Code

WD2 Error Status Word from Printer

BIT NO.	DESCRIPTION
0	Error flag
1	Line Printer Alarm
2	Line Overflow Error
3	Illegal Horizontal Tab.
4	Busy
5	Job Done Flag.

LT15/LT19 EXERCISER MODULE

DESCRIPTION

The LT15/19 test is designed to exercise the transmitter, receiver and teleprinter for the LT15 and the LT19 . The program will exercise both the LT15 and the LT19 simultaneously in configurations of 1 to 16 teletypes.

PROGRAM ACTION

The test starts off by initializing all available teletypes with a carriage return-line feed and then types out a repeating pattern of characters simultaneously on all teletypes. After typing a pre-determined number of lines a "floating teletype" test is then run. In this test one (1) teletype is left silent while all remaining teletypes continue typing out the character set. After completing approximately ten (1Ø) lines of character sets, the silent teletype is re-started, continuing on from the last character typed, and another teletype is left silent . Any character may be typed in on the silent teletype and it will respond via echoing back the typed character thus testing the receiver section of that teletype.

HOLD MODE

A provision is also made to hold any selected teletype in an 'Echo' mode. This is done via typing a 'Cntr A', on any 'silent' teletype. This will enable the hold mode. The number of the selected teletype (1-16) should then be typed followed by a carriage return. The selected teletype will then go into an 'Echo' mode. Typing a second 'CNTR A' will release the selected teletype and the program will resume normal operation. In the 'Hold' mode, all illegal characters are echoed back as '?' and ignored. Typing 'Rubout' will enable any preceeding number to be deleted. If a number of non-existant teletype is typed, the program will automatically shift back to normal operation.

USER SWITCHES

The number in UODSW+3 determines the number of operations done before a done statement. This is set for 12 minutes with two teletypes and will vary inversely with the number of teletypes.

DATA SWITCHES

DATA SW4 (1) Inhibits the LT15/19 test.

ERRORS

Only (1) possible error is detected by the LT15/19 test.

ERROR CODE

1) ØØØØØ1 ILLEGAL API INTERRUPT. API interrupted with no LT15/19 flags set.

DESCRIPTION

The DCØ1-LB test is designed to exercise the transmitter and receiver for the DCØ1-EB teletype scanner. The program will exercise from 1 to 4 DCØ1-EB's simultaneously in configurations of 1 to 32 teletypes.

PROGRAM ACTION

The test starts off by initializing all available teletypes with a carriage return-line feed and then types out a repeating pattern of characters simultaneously on all teletypes. All transmitted characters are checked for validity before the next character is transmitted. After typing a pre-determined number of lines a "floating teletype" test is then run. In this test one (1) teletype on each DCØ1-EB unit is left silent while all remaining teletypes continue typing out the character set. After completing approximately ten (1Ø) lines of character sets, the silent teletype is re-started continuing on from the last character typed, and another teletype is left silent. Any character may be typed in on the silent teletype and it will respond via echoing back the typed character thus testing the receiver section of that teletype.

HOLD MODE

A provision is also made to hold any selected teletype in an "Echo" mode indefinitely. This is done via typing a 'CNTR A' on any 'silent' teletype. This will enable the hold mode. The number of the desired teletype (Ø-7) to be selected should then be typed in followed by a carriage return. The selected teletype will then go into an echo hold mode. Another teletype may be selected by this same procedure or the echo mode may be released by typing a second 'CNTR A' followed by a

carriage return and the program will resume normal operation. In the echo hold mode, all illegal characters are echoed back as '?' and ignored. Typing 'Rubout' will enable any preceeding number to be deleted.

PARAMETER MODE

The scanner API trap addresses may be changed with Parameter mode.

DATA SWITCHES

Data SW4 (1) holds the DCØ1-EB test.

ERRORS

Two (2) possible errors may be detected by the DCØ1-EB Test.

ERROR CODE	DESCRIPTION
1) ØØØØØ1	Data transfer error
2) ØØØØØ2	Illegal API interrupt. API interrupt with all DCØ1-EB flags cleared.

EXAMPLE (ERROR 1):

TEST	ERROR CODE	UNIT & TTY	TRAN'S DATA	REC'D DATA
DCØ1EB	ØØØØØ1	1Ø7ØØØ	ØØØ3Ø1	ØØØ2Ø1

WHERE:

UNIT will be equal to scanner units '1-4'.

TTY will be equal to teletypes 'Ø-7'.

I. GENERAL DESCRIPTION

This module tests for proper operation of the X and Y coordinate registers, in the VT15, by plotting all combinations of character input, basic vector, short vector, point and graph plot modes.

II. OPERATION

A. POINT PLOT MODE

With the Y coordinate register cleared, all combinations of X points from Ø to 1777 are plotted and the results checked. The test is then repeated with the X coordinate register cleared and all Y points plotted.

B. SHORT VECTOR MODE

All combinations of length and direction are plotted, originating from the center of the display area, and the results checked.

C. GRAPH PLOT MODE

The X and Y registers are set to 1 and then 1776 graph plot X direction points are plotted. The same is then repeated with graph plot in the Y direction. A check is made to insure that with one coordinate input the other coordinate will count automatically.

D. BASIC VECTOR MODE

Each of the eight directions are plotted with all values of vector length from Ø to 1777.

Directions Ø and 1 begin at X=Ø, Y=Ø

Directions 2 and 3 begin at X=1777, Y=Ø

Directions 4 and 5 begin at X=1777, Y=1777

Directions 6 and 7 begin at X=Ø, Y=1777

E. CHARACTER INPUT MODE

Each of the characters available from the character generator are drawn from an originating point of X and Y equal to 1ØØØ. The results of the X and Y coordinate registers after each character is executed should be as follows:

CHARACTER	X	Y
All displayable characters	1Ø52	1ØØØ
Carriage return	Ø	1ØØØ
Line Feed	1ØØØ	712
Tab	12ØØ	1ØØØ

ERROR NO.	ERROR DESCRIPTION	ERROR FORMAT NO.
1	Display flag interrupt no caused by STOP FLAG	1
2	Point plot error	2
3	Short vector error	3
4	Graph plot error	2
5	Basic vector error	3
6	Character input error	2
7	API entry but no display flag	1

ERROR FORMATS

ERROR FORMAT NO.	FORMAT DESCRIPTION	
1	WD1	Error number
	WD2	Status 1
	WD3	Status 2
	WD4	Status 3
	WD5	Display PC
	WD6	X Position
	WD7	Y Position
2	WD1	Error number
	WD2	Good X
	WD3	Good Y
	WD4	Actual X
	WD5	Actual Y
3	WD1	Error number
	WD2	Good X
	WD3	Good Y
	WD4	Actual X
	WD5	Actual Y
	WD6	Vector Direction

VP15A EXERCISER MODULE

DESCRIPTION

This program is designed to exercise the 'VP15A' storage tube display system. The program consists of seven (7) separate display patterns all of which utilize only the 'Store Mode' of the VP15A .

PROGRAM ACTION

Upon completion of all seven (7) patterns the statement "VP15A DONE" is typed and the pattern sequence is repeated. The pattern sequence is as follows:

1) Displays a 'Box' with 'Bisectors' and 'Diagonals'.

   a. The pattern is retraced 2Ø (decimal) times and then storage tube is erased upon completion.

2) Displays a 3" circle in the center of the screen.

   a. This pattern is retraced 64 times and then continues.

3) Displays a 3" quadrant 'Complimented' circle inside the original 3" circle.

   a. This pattern is retraced 64 times and the storage tube is erased upon completion.

4) Displays a 6" circle in the center of the screen.

   a. This pattern is retraced 64 times and then continues.

5) Displays a 6" quadrant 'Complimented' circle inside the original 6" circle.

   a. This pattern is retraced 64 times and the storage tube is erased upon completion.

6) Displays a full screen 'Diamond' with 'Bisectors'.

   a. This pattern is displayed 40 times and the storage tube is erased upon completion.

7) Display random numbers. Either 262,144 or the number in UODSW+1.

   a. The screen should be almost entirely intensified on completion of this exercise.

   b. The storage tube is erased after ploting all points and then the patterns are repeated.

DATA SWITCHES

DATA SW1Ø (Ø) Normal VP15A operation
DATA SW1Ø (1) Inhibits the VP15A test.

ERRORS

Only (1) possible error is detected by the VP15A test.

ERROR CODES

1) ØØØØØ1 Illegal API interrupt. API interrupted with no VP15A flags set.

AD15 EXERCISER MODULE

DESCRIPTION

The AD15 test is designed to exercise the logic of the AD15 analog to digital converter. All three modes of the converter are exercised via taking conversions under program, sequential and random operation.

Program Action

The test is started by taking a conversion under program control. A check is then made for the correct channel address in the AD15 status buffer and that no illegal word count or memory overflow flags exist. A series of 127 conversions are then taken via sequential operation. The data buffer is examined to confirm that a data transfer actually took place and that only the selected storage area was modified. Random mode is then exercised by taking a series of 81 conversions on 9 selected channels*. The 'add to memory' mode and 'memory overflow' flags are then tested via taking another series of 5 conversions under random mode. A noise test is then run where a series of 1ØØ conversions are taken on channel 1 and the results are stored in a data buffer. Each value is then compared to be within + or - 5 counts of each other. Refer to 'Restrictions' before running the test.

*NOTE: A minimum configuration for 4 channels is all that is needed to run the AD15 System Exerciser.

RESTRICTIONS

A prerequisite for running the noise test is that a fixed voltage not to exceed + or - 1Ø volts must be jumpered to input of channel 1 (pin E14-C1). This can easily be done via placing a jumper from the AD15 +5 volt supply (pin A11-A2) to the input (pin E14-C1) of channel 1.

USER SWITCHES

No parameter mode operation is available for the AD15 test.

DATA SWITCHES

DATA SW5 (Ø) Normal AD15 operation.
DATA SW5 (1) Inhibits the AD15 test.

ERRORS

Nine (9) possible errors may be detected by the AD15 System Exerciser test.

ERROR CODES

1) ØØØØØ1 Illegal 'Word Count' flag occurred.
2) ØØØØØ2 Illegal 'Memory overflow' flag occurred.
3) ØØØØØ3 Wrong channel address in 'AD15' status register.
4) ØØØØØ4 Contents of W.C. 26 not equal to Ø after W.C. flag.
5) ØØØØØ5 Contents of data buffer unchanged after sequential conversion
6) ØØØØØ6 Illegal data transfer to data buffer.
7) ØØØØØ7 Data error, conversion values out of spec in 'Noise' test.
1Ø) ØØØØ1Ø Illegal API error. API interrupted with no AD15 flags set.
11) ØØØØ11 'Add to Memory' failed.

A. EXAMPLE PRINTOUT for ERRORS #1-6 and error #11 where:

TEST	ERROR CODE	AC	AD15 STATUS	CHANNEL	W.C.#24	W.C. #26
AD15	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

B. EXAMPLE PRINTOUT for ERROR #7 where:

TEST	ERROR CODE	1st CONVERSION VALUE	2nd CONVERSION VALUE
AD15	ØØØØØ7	XXXXXX	XXXXXX

EXAMPLE PRINTOUT of ERROR # 1Ø where:

TEST	ERROR CODE	AD15 STATUS REGISTER
AD15	ØØØØ1Ø	XXXXXX

CRØ3B EXERCISER MODULE

GENERAL DESCRIPTION

The purpose of this module is to run the card reader using multiples of card decks (MAINDEC-89-D2A2-C) as the input. Data checking is done and errors are reported via the monitor. The program also checks that the HOPPER EMPTY function occurs at the correct card count. Console switch 8 issued to halt card reader operation.

OPERATION

Load multiples of card decks into the feed hopper, press motor start and read start buttons on the card reader. All red lights should be out. Then using parameter mode insert the multiples of 80 cards in UODSW+2. Zero equals one card deck. If a missed data condition is expected because of system loading, and data checking is unimportant, set bit 17 of UODSW+1. Then start the operating system. When all the cards have read hopper empty will be checked and a done statement printed. Reload the cards into the feed hopper and press motor start. When read start is pressed, the cards will start feeding through the reader.

****

THE CRØ3 REQUIRES A HIGH RATE OF INTERRUPT SERVICE. BECAUSE OF SYSTEM LOADING, THE CRØ3 WILL MISS DATA.

****

ERRORS

ERROR NO.	ERROR DESCRIPTION	ERROR FORMAT NO.
1	API entry with no CRØ3B flag	1
2	Card Reader not reader on initialization	1
3	No column ready on CRØ3B flag and no error flag	1
4	Error flag but no cause	1
5	Incorrect data	2
6	Hopper empty too early	1
7	No pass	1
10	No hopper empty after a multiple of 80 cards	1
11	Bad data flag from CRØ3B	2

ERROR FORMAT DE$CRIPTIONS

ERROR FORMAT NUMER		FORMAT DESCRIPTION
1	WD1	Error number
	WD2	CRØ3B Status Register
2	WD1	Error number
	WD2	Status Register
	WD3	Good data
	WD4	Bad data

XY15 EXERCISER MODULE

GENERAL DESCRIPTION

The XY15 module can be used to plot on the 12" or 31" plotters with either 10 mil or 5 mil increments. The default assumption is the 12", 10 mil plotter. This can be changed with Parameter mode. Two figures are plotted. The first is concentric squares with bisectors and the second is concentric 8 sided polygons with bisectors joining directly opposite angles. These figures can be overlayed and repeated 10 (decimal) times for repeatability tests and extended runs with minimum paper usage. Repeatability is not guarenteed. Switch 17 halts operation of XY15 test.

OPERATION

Turn the plotter on, turn the chart drive on and start the System Exerciser. The plotter will run into the stops and will remember where it is from then on.

ERRORS

There is only one error checked and that is the Plotter flag did not clear after a clear flag command.

PARAMETER MODE OPTIONS

UODSW+1	Bit 17=1 for 5 mil plotter Bit 16=1 for 31" plotter
UODSW+2	Bit 17=1 for overlay patterns

BD15 EXERCISER MODULE

GENERAL DESCRIPTION

The BD15 module was changed from the original BD15 control test (MAINDEC-15-D8FA) to run under the System Exerciser format. The majority of the tests were kept or modified only by the elimination of timing loops, scope loops, and CAF's. Switch 14 is used to halt operation of the BD15 control test.

OPERATION

Remove the UDC and AFC cables from the BD15 controller. Load the BD15 program. If the AFC is not present, use Parameter mode to indicate the absence of the A/D to the program. Each subtest is repeated 20 (octal) times with the entire test cycled through 140 (octal) times before a done statement. If there is no A/D then each subtest is repeated 400 (octal) times.

PARAMETER MODE

UODSW+1 is used to indicate the absence of the A/D. If bit Ø=1, then UDC only is present. The default assumption is that both UDC and AFC are present.

ERROR FORMATS

Error typeouts (except for error Ø) will follow this format for a BD15 with both UDC and AFC,

WD1	Error Number
WD2	Status Register
WD3	Auto-Scan Address Register
WD4	COS gates
WD5	UDC Output Register
WD6	UDC Data Register
WD7	FC Address Register
WD8	FC Data Register

If only the UDC is present, the error typeouts will be only words one to six.

Error Ø is for an API entry with no BD15 flag present. WD1 will be Ø, WD2 will be the API status register.

ERROR NO.	ERROR DESCRIPTION
1	USNB failed after MCM
2	USI skipped after MCM
3	USD skipped after MCM
4	MCM not setting UDC mode
5	IMM flag set in status register after MCM
6	DEF flag set in status register after MCM
7	Busy flag set in status register after MCM
10	Deferred address fault set after MCM
11	Immediate address fault set after MCM
12	A-D done set in status register after MCM
13	P-flop set after MCM
14	Sample flop set after MCM
15	FCMOD did not set bit Ø of status register
16	MCM did not clear mode flop.
17	UMOD not clearing mode flop.
20	MCM did not clear mode flop
21	MLS did not set mode flop
22	MLS did not clear mode flop
23	IMM did not set with MLS
24	USI did not skip on IMM flag
25	USD skipped and should not have
26	IMM status bit not cleared by MCM
27	USI skipped and IMM flag clear
30	USD skipped and should not have
31	DEF flag did not set with MRS
32	USD did not skip
33	USI skipped and should not have
34	DEF flag did not clear with MCM

ERROR NO.	ERROR DESCRIPTION
35	USD skipped on cleared flag
36	USI skipped on cleared flag
37	MAINT flop not clear after MCM
40	MAINT flop not set with MSM
41	MAINT flop not clearing with MCM
42	MAINT flop not clearing with MCM
43	USI skipped with I mult disabled
44	USD skipped with D mult disabled
45	URA did not clear IMM and DEF flags
46	URAA did not clear IMM and DEF flags
47	RIF generated with MAINT equal to 1
50	IMM and/or DEF set with maint equal to a 1
51	IMM and/or DEF set with DEF EN set
52	DEF flag did not set or IMM set.
53	DEF flag did not clear
54	RIF did not clear DEF
55	IMM or DEF set with maint on a 1
56	IMM or DEF flag set with IMM EN set
57	IMM flag did not set or DEF flag set
60	RIF did not clear IMM flag
61	RIF did not clear IMM flag
62	DEF enable or IMM enable not cleared by MCM
63	IMM or DEF flag did not set
64	RIF did not clear DEF or IMM flag
65	A-D done did not set
66	FCSD failed
67	A-D done did not clear with FCRB

ERROR NO.	ERROR DESCRIPTION
70	MCM did not clear A-D done
71	A-D done or FCSD failed
72	MCM fail to clear A-D done
73	FCEI failed
74	FCDI failed
75	FCEN failed to set
76	FCEN failed to clear
77	MCM did not clear P flop
100	P flop did not set with status
101	MCM did not clear P flop
102	FCMOD cleared P flop
103	No A-D done in 100 microseconds
104	A-D done did not clear P flop
105	MCM did not clear sample flop
106	Sample flop won't set
107	MCM did not clear sample flop
110	FCSD failed after API or PI break
111	FCSD failed after FCCV
112	Cannot **clear FC address bits**
113	Cannot set all FC address bits
114	Cannot clear FC address bits
115	FC address did not load correctly
116	UDC load address generates FC load address
117	MCM did not clear busy

ERROR NO.	ERROR DESCRIPTION
120	Cannot set busy flop
121	MCM did not clear busy
122	USNB failed
123	USNB failed
124	X fault not cleared with MCM
125	X fault not set
126	USNB failed
127	MCM did not clear X fault
130	Busy won't set
131	MCM did not clear X fault
132	Cannot set X fault
133	D fault did not generate reset busy
134	MCM did not clear X fault
135	UDC address register not clear
136	UDC address register will not set to all ones
137	UDC address register will not clear
140	52 pattern will not load
141	25 pattern will not load
142	ULA not disabled in FCMOD
143	UDC address register not clear
144	D fault did not set generic code bit 3
145	UDC address register not clear
146	A fault did not set generic code bit 3
147	UDC address register did not load correctly

ERROR NO.	ERROR DESCRIPTION
150	DEF X not counting correctly
151	X did not go to 0 or gen fault not generated
152	D fault not generated
153	UDC def address did not count (Y)
154	WD bits of def address did not count
155	IMM did not clear DEF address
156	Start scan did not set busy
157	IMM address did not clear
160	IMM address did not clock
161	IMM address did not jam into DEF address
162	IMM X not counting correctly
163	IMM did not transfer to DEF correctly
164	IMM flag did not inhibit start scan
165	IMM flag did not inhibit start scan
166	Start scan did not clear IMM add
167	Fault set IMM address = 7
170	A fault did not set
171	IMM flag did not inhibit USCAN
172	Start scan did not clear fault
173	IMM Y not counting correctly
174	IMM did not jam to DEFF correctly
175	IMM WD not counting correctly
176	IMM did not jam to DEFF correctly
177	GEN code for fault not GEN

ERROR NO.	ERROR DESCRIPTION
200	DEF adr fault did not set
201	GEN code for fault not GEN
202	GEN code incorrect
203	Scan started and USNB failed
204	DEF adr fault did not set
205	Scan started and timed out
206	IMM adr fault did not set
207	Data in picking up bits
210	Data in picking up bits
211	COS gates not disabled by open bus
212	COS gates not disabled by open bus
213	Bits Ø & 8 not selected by FC ADR decode
214	Bits 1 & 9 not selected by FC ADR decode
215	Bits 2 & 1Ø not selected by FC ADR decode
216	Bits 3 & 11 not selected by FC ADR decode
217	Bits 4 & 12 not selected by FC ADR decode
220	Bits 5 & 13 not selected by FC ADR decode
221	Bits 6 & 14 not selected by FC ADR decode
222	Bits 7 & 15 not selected by FC ADR decode
223	Maint not disabling FC ADR

ERROR NO.	ERROR DESCRIPTION	
224	Bits Ø & 8	
232	Bits 1 & 9	
240	Bits 2 & 10	
246	Bits 3 & 11	
254	Bits 4 & 12	DB error or COS gate error
262	Bits 5 & 13	
270	Bits 6 & 14	
276	Bits 7 & 15	
225	0 & 8	
233	1 & 9	
241	2 & 10	
247	3 & 11	DB error or POP = Ø allowed COS
255	4 & 12	
263	5 & 13	
271	6 & 14	
277	7 & 15	
226	0 & 8	
234	1 & 9	
242	2 & 10	
250	3 & 11	P close = Ø did not disable COS gates
256	4 & 12	
264	5 & 13	
272	6 & 16	
300	7 & 15	

ERROR NO.	ERROR DESCRIPTION	
227	Ø & 8	
235	1 & 9	
243	2 & 10	
251	3 & 11	P open = 0 did not disable COS gate
257	4 & 12	
265	5 & 13	
273	6 & 14	
301	7 & 15	
230	0 & 8	
236	1 & 9	
244	2 & 10	
252	3 & 11	DB error or COS gate error
260	4 & 12	
266	5 & 13	
274	6 & 14	
302	7 & 15	
231	0 & 8	
237	1 & 9	
245	2 & 10	
253	3 & 11	DB error or COS gate error
261	4 & 12	
267	5 & 13	
275	6 & 14	
303	7 & 15	

TITLE:	RBØ9
AUTHOR:	Stanley M. Rose
COMPANY:	Laboratory of Computer Science Massachusetts General Hospital Boston, Massachusetts
DATE:	June 27, 1971

DESCRIPTION

The RBØ9 test is designed to run as part of the PDP-9/15 system diagnostic. The program will completely test either the operational sectors of the disk at 64, 128, 256, and 512.length write/reads, or will test the maintenance sectors of the disk. The test uses the EAE, but saves and restores the MQ and STEP COUNTER so as not to interfere with EAEPT1 or EAEPT2.

PROGRAM ACTION

The test starts by writing every seventh block (64 word length) until the complete disk is written. Every seventh block is then read and verified until the complete disk is read.

Next, every sixth block is written using 128 length writes and then every sixth block is read and verified.

This is repeated using 12 block increments and 256 word transfer length, and 24 block increments and 512 word lengths. This comprises one pass.

MAINTENANCE MODE

If bit 2 of the UODSW is set, then the maintenance sectors (sector 80) are the only sectors used. The word length is fixed at 64 in this case.

PARAMETER MODE

The following parameters of the diagnostic can be changed.

A) UODSW

1) Bit 2 set indicates use maintenance section.
2) Bit 3 set fixes the word length at 64 word transfers, and causes 6 write/read passes over the disk to constitute a complete pass.
3) Bits 12-17 are the API channel (assumed to be Ø7, address 47).

B) UODSW+1

This is the maximum number of retries on hardware errors, assumed to be 2. After retrying the specified number of times, a new block is chosen. If the error occurs during writing, this will cause read/compare errors.

C) UODSW+2

The maximum number of compare errors per block (assumed 5) before the block is reread and reverified.

D) UODSW+3

The maximum number of times a block is reread and reverified when compare errors are found.

DATA SWITCH

Switch 15 causes the test to hold.

ERRORS

1) Hardware error. Legitimate BCD address.

   Status Register
   Disk Side (Ø or 1)
   Track Address (in octal)
   Sector Address (in octal)

2) Hardware error. Illegal BCD address.

   Status register
   Address loaded

3) More type 1 or 2 errors than specified by [USERSW+1]

   Will not re-try this block.

4) Compare error

   Disk side
   Track address (octal)
   Sector address (octal)
   Core address
   Offset
   Expected
   Received

5) More errors/block than specified by [USERSW+2]

Will re-read and try again.

6) Retried as many times as specified by [USERSW+3]

Will go on to next block.

7) Illegal API entry. No flag set.

Status register
IORS

8) After errors 7, 1Ø or 11 the program should reinitialize and restart.

However, it reentered illegally.

Status register
IORS

9) Interrupt entry after clearing status register and starting no new IO

operation.

Status register
IORS