EXOR
VAX Disk Exerciser
User's Guide

PB9900-9056 REV A

SYSTEM INDUSTRIES

®

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REVISION RECORD

REVISION NUMBER	DATE	DESCRIPTION	EO NUMBER
A	02/22/88	Initial Release - Change transfer size	4925
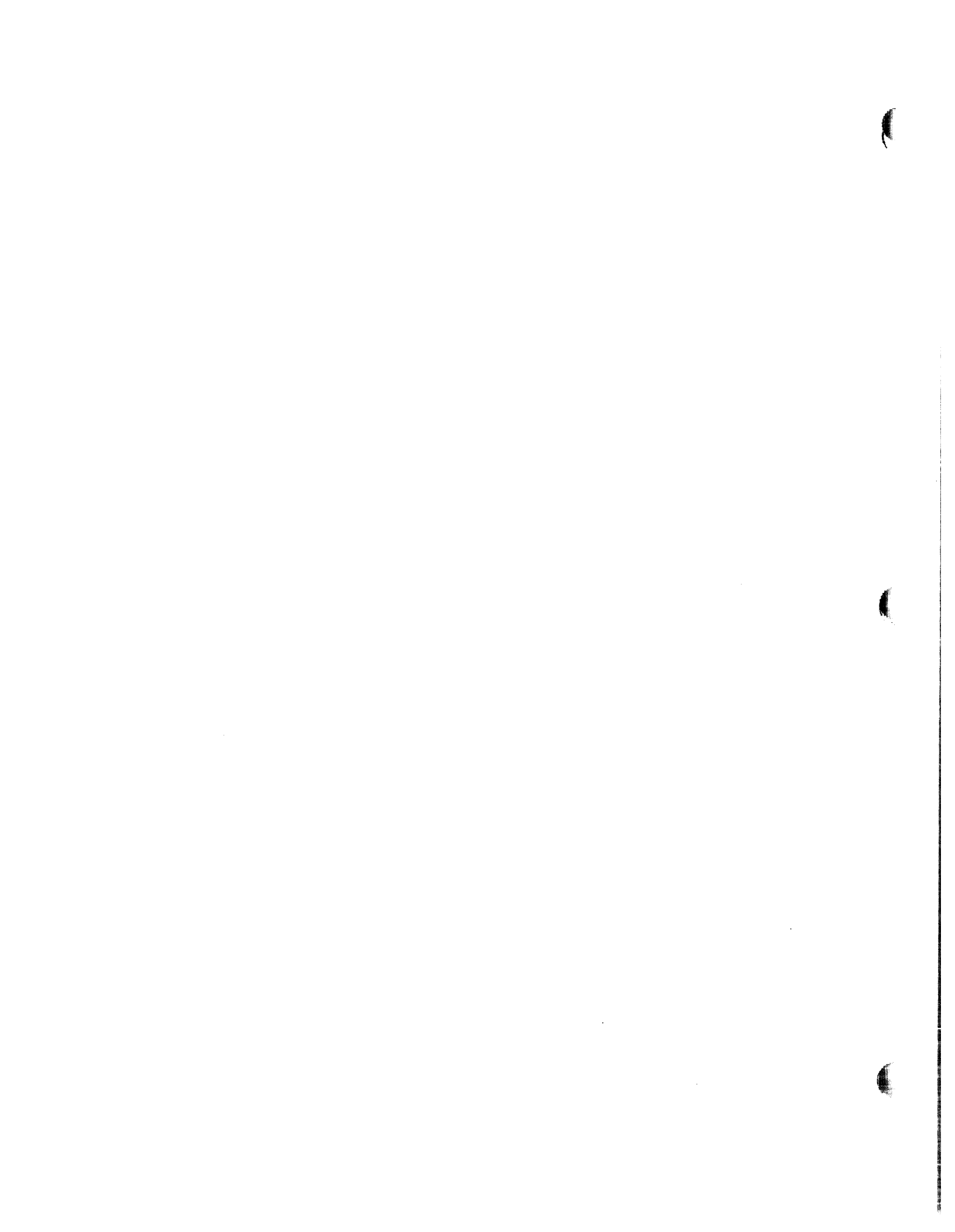
PREFACE

EXOR is a disk diagnostic program used to format, bad or test any System Industries disk connected to any VAX interface - SBI, CMI or UNIBUS.

The EXOR User's Guide is designed to be used in conjunction with System Industries VAX Software Modification User Guides. These publications are:

    o   VAX 11/780 11/750 S/W MODIFICATION USER'S GUIDE
          PB9900-9033

    o   VAX 11/780 11/750 11/730 S/W MODIFICATION USER'S GUIDE
          PB9900-9044

This manual is presented in three main sections:

Section One: Complete instructions for installing and running EXOR on your system are outlined.

Section Two: This section lists all of the EXOR commands, and gives an example of a sample EXOR session.

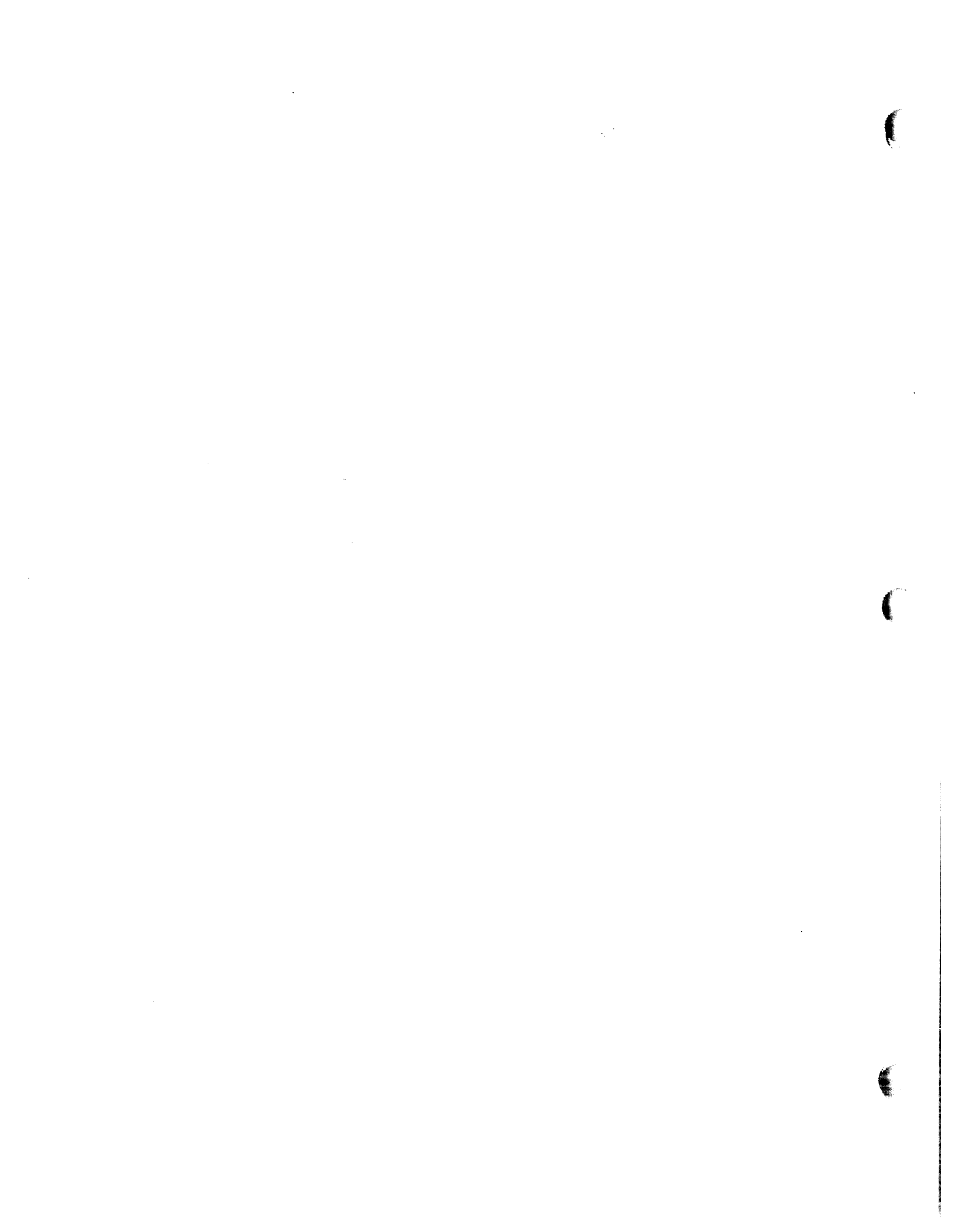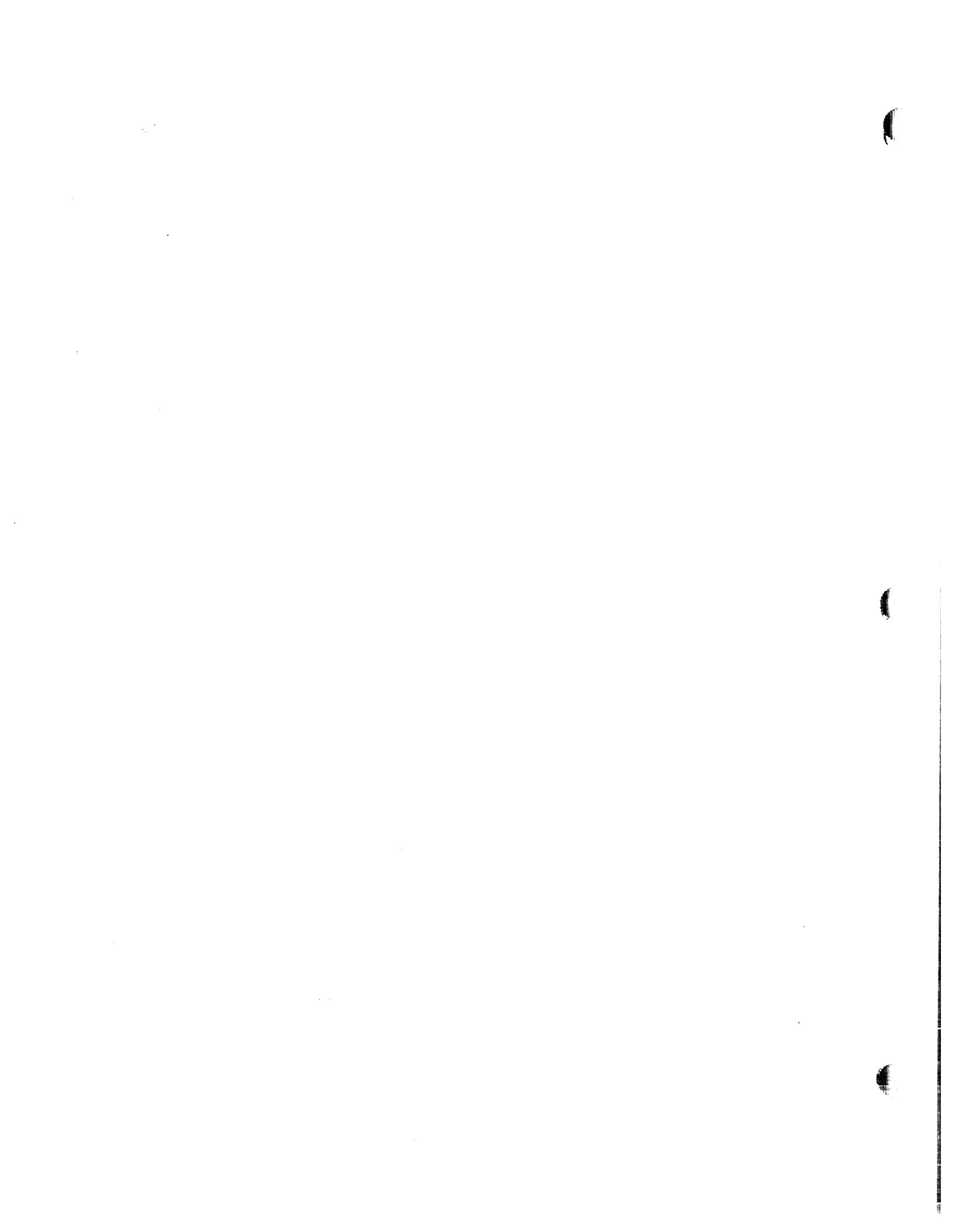Section Three: This section gives complete EXOR diagnostic information.

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SECTION   ONE

INTRODUCTION

EXOR   can   be   used   to format, bad or test disk packs of any
size   and   type supported by System Industries. Exor supports
all of the SI VAX interfaces - SBI, CMI, and UNIBUS.

EXOR   can   be run either standalone or on a timeshare system.
In STANDALONE mode you will be using SYSTEM_1 and SYSTEM_2
volume   set   of   the   standalone kit built with STABACKIT or
SIBACKIT   under   VMS 4.x. The third volume is the application
volume and can contain BACKUP or STAEXOR as selected during
the build phase of STANDALONEs.

To boot on a 11/780 or 11/730, mount the console boot media
and type:

    >>>B CS1

You   will   be   instructed   when to mount the first and second
STANDALONE   volumes.   After   the   third   volume   has finished
loading, EXOR will be running.

To   boot   on a 11/750, insert SYSTEM_1 STANDALONE volume, set
the   boot   switch   to the console device position (usually A)
and press RESET. You will be instructed when to mount each of
the other STANDALONE volumes.

In TIMESHARE mode, EXOR requires the following privileges:

    DIAG
    PHY_IO

EXOR   requires   exclusive   allocation of the disk under test.
Users may continue to use other drives on the controller with
no effects,   except that they may not access the drive under
test.

EXOR   can be used to format, bad, and test disk drives of any
size   and type supported by System Industries.   EXOR supports
all of the SI VAX interface types:

    UNIBUS
    SBI
    CMI

1.2 Running EXOR

To run the EXOR program, use the following procedure:

1. Remove the user disk pack and mount a scratch disk pack on
   the drive to be tested.

2. Start EXOR in one of the following ways:

   If EXOR is not on your system:

      Load the System Industries distribution kit. Build the
      EXOR.EXE file into SYS$SYSTEM by entering the
      following commands from a privileged account:

         $MCR SYSGEN
         CONNECT CONSOLE
         EXIT
         $MOU/OV=ID CS1:
         $LINK CS1:[SYSUPD]EXOR.OBJ/NOMAP/NOTRACE/
          EXECUTABLE SYS$SYSTEM
         $MCR EXOR

   If EXOR is now on your system (in SYS$SYSTEM), type:

      $MCR EXOR

3. When EXOR starts running, it will prompt you for the Drive
   to be tested:

      Drive:

   Enter the device name, which consists of drive mnemonic
   controller letter and a unit number. i.e. DRC0, SIA1, etc.

4. EXOR will return with the configuration specification for
   the drive at that nexus:

        DRA1 - RM05 with 823(D) cylinders, 19(D) tracks,
        32(D) sectors

        SBI INTERFACE
        NON-BBF UNIT

   EXOR determines the drive configuration from the disk I/O
   driver,   not   from   the   disk   itself.   Hence,   if   the
   configuration specification does not match that expected,
   stop here and try find out why. Possible reasons could
   include:

   o The drive is not physically connected to the controller

   o The internal switch settings within the controller are
     set incorrectly.

   o The system disk does not have a patched disk driver to
     support the SI device.

5. Type an EXOR command. By typing '?', testing parameters
   will be displayed. By typing 'H', all possible commands
   will be listed. These commands are listed and discussed in
   the next section.

SECTION TWO

EXOR COMMANDS

An   Set transfer size (n = 1 to 127 (sectors/track))

            The transfer size can be set from one sector (512
            bytes) up to 127 sectors. The default is one track.

B   List or Add bad blocks

            The Manufacture's Bad Block File can be listed
            and/or changed. The disk Serial Number can also be
            listed or changed.

Ci:j   Restrict cylinder range form i to j inclusive

            Restricts the cylinder range of the test to i
            through j. Otherwise, the entire disk is subject to
            test. If i is omitted, 0 is used as the lower limit.
            If j is omitted, the last cylinder on the disk is
            used as the limit. Limits remain in effect until
            altered by another C command. The restricted range
            option is applicable only to F, M, N, P, Q, R, S, U,
            and W commands.

D   Dump the registers

            Displays the interface and controller's registers.

ER0   Allow error retry within the driver
ER1   Do not allow error retry within the driver (DEFAULT)
EH0   Do not halt on error (DEFAULT)
EH1   Halt on error
EL0   Do not loop on error (DEFAULT)
EL1   Loop on error
ES0   Do not inhibit overlap seek within the driver
            (DEFAULT)
ES1   Inhibit overlap seek within the driver
EE0   Allow the driver to log errors
EE1   Do not allow the driver to log errors (DEFAULT)

All of the above flags toggle bits in the disk driver to
accomplish the stated condition.

F   Format the disk.

         Format the disk with the format applicable to the
         disk type, (RP or RM). The data area is initialized
         to all ones. You will be ask if you want to format
         the last track of RM drives or last sector of RP
         drives. Answer Y only if the bad block file does
         notneed to be preserved.

G   Mark headers as per bad block list

         Based on the discriptor of blocks found in the
         Manufacturer's and User's Bad Block File, the
         appropriate bit will be marked in the header of each
         bad block. The headers may be unmarked by answering
         "N" to the 'Do you want the header MARKed?. (Not for
         BBF devices)

H   Display this text.

I   Drive clear and Recal

         This resets the registers associated with this drive
         and then recals the drive to cylinder zero.

L   Initialize bad block file to zero bad blocks

         Write a bad block descriptor track saying all blocks
         are good.

M   Random read of one sector

         A random cylinder, head, and sector within the
         useable range is used as a starting point for a one
         sector read.

N   Random read/write test

         A random cylinder, head, and sector within the
         useable range is used as a starting point for a
         random length transfer into a random byte starting
         address within the memory page used.

P   Write and writecheck (read) patterns

         Select one to sixteen patterns to write to the disk.
         The pattern is then read and compaired for errors.
         If the drive is a RM last track or RP last sector
         device, the error sector is recorded in the bad
         block file. If the drive is a BBF device, the sector
         is marked as a skip sector and the format is
         shuffled down to the end of the cylinder where a
         spare will be used.

Q   Read and check headers

           This tests for the correct format in all headers.
           Manufacturer's and User's marked bad headers are
           listed as well as other corruptions within the
           header. (Not for BBF devices)

R   Read the disk

           Read the disk. This can be done to a data disk with
           write protection for validation. The transfer size
           is set by "A" command.

S   Seek test

           Seek to cylinder 0 (or to i if set by C) then seek
           to the last cylinder on the disk (or to j if set).
           Then seek to cylinder 0 + 1 (or i + 1), then to the
           last cylinder -1 (or j - 1) until the entire range
           is covered.

Ti:j   Restrict track range from i to j inclusive

           Restricts the track range of the test to i through
           j.   Otherwise, all tracks are subject to test. If i
           is omitted, 0 is used as the lower limit. If j is
           omitted, the last track on the cylinder is used as
           the limit. Limits remain in effect until altered by
           another T command. The restricted range option is
           applicable only to F, M, N, Q, R, and W commands.

U   List "skip sectors" and remaining spares. (BBF only)

           This test reads all the headers of a BBF disk and
           reports the sectors marked bad (skip sectors). At
           the end of the list the total skip sectors and the
           number of the spare sectors that remain are shown.

V   Verify/Examine data on the disk.

           The test will ask for the starting sector. The
           starting cylinder and track must be set with
           "C" and "T" before the test is started.

W   Write, writecheck, read back and compare the data

           Write a pattern, writecheck it, then read it back,
           and software check it. If an error is detected, the
           data mismatch is printed at the operator's terminal.

X   Leave EXOR and return to command level

Z   Restart EXOR to select another drive.

?   Print the user defined options

            Prints all flags set by "E" command.

CTRL/C   Abandon current set of tests and ask for more
            Return to Tests: question.

CTRL/F   Print current cylinder, track and sector
            Check current address on disk to show progress.

2.1 Sample EXOR Interactive Session

VAX STANDALONE EXOR version 4.02

Drive: DRA1 (drive to be tested)
DRA1: - RM05 with 823(D) cylinders, 19(D) tracks, 32(D) sectors
SBI INTERFACE
NON-BBF UNIT

Tests: F   (Format the disk)
Tests: SC:1W   (Seek test, then write test and verify cylinders
                0-1 only)
Tests: CR   (Read the entire disk)
Tests: X   (Exit from EXOR)

When EXOR is performing either read or write functions, the
orange I/O light on the front of the SI controller should
either be on continuously or blinking intermittently. (If not a
6100 controller)

When working with mapped devices, EXOR treats each logical
drive as a separate device.

If there are any problems with any of these tests, contact your
System Industries service representative.

2.3 Problems Encountered During EXOR

Trouble -- No Such Device Available

VMS cannot find the disk on the end of the controller, or
it may not be able to find the controller. Make sure you
have entered the proper logical name as recognized by
VAX/VMS ($SHOW DEV dev:). It must be online. Remember that
UNIBUS configurations will not be configured using the
SYSGEN command AUTOCONFIGURE/ALL. You must connect this
device using the connect command in SYSGEN.

Unknown Device with 0 tracks, 0 cylinders, and 0 sectors

The device driver cannot recognize the device at the end
of the controller. Make sure that the firmware and
controller boards are configured correctly for the disk at
the end of the cable. Make sure that the drive is
acknowledging its link with the controller.

Data Mismatch

EXOR types out the data that it read followed by the data
it had expected to read.
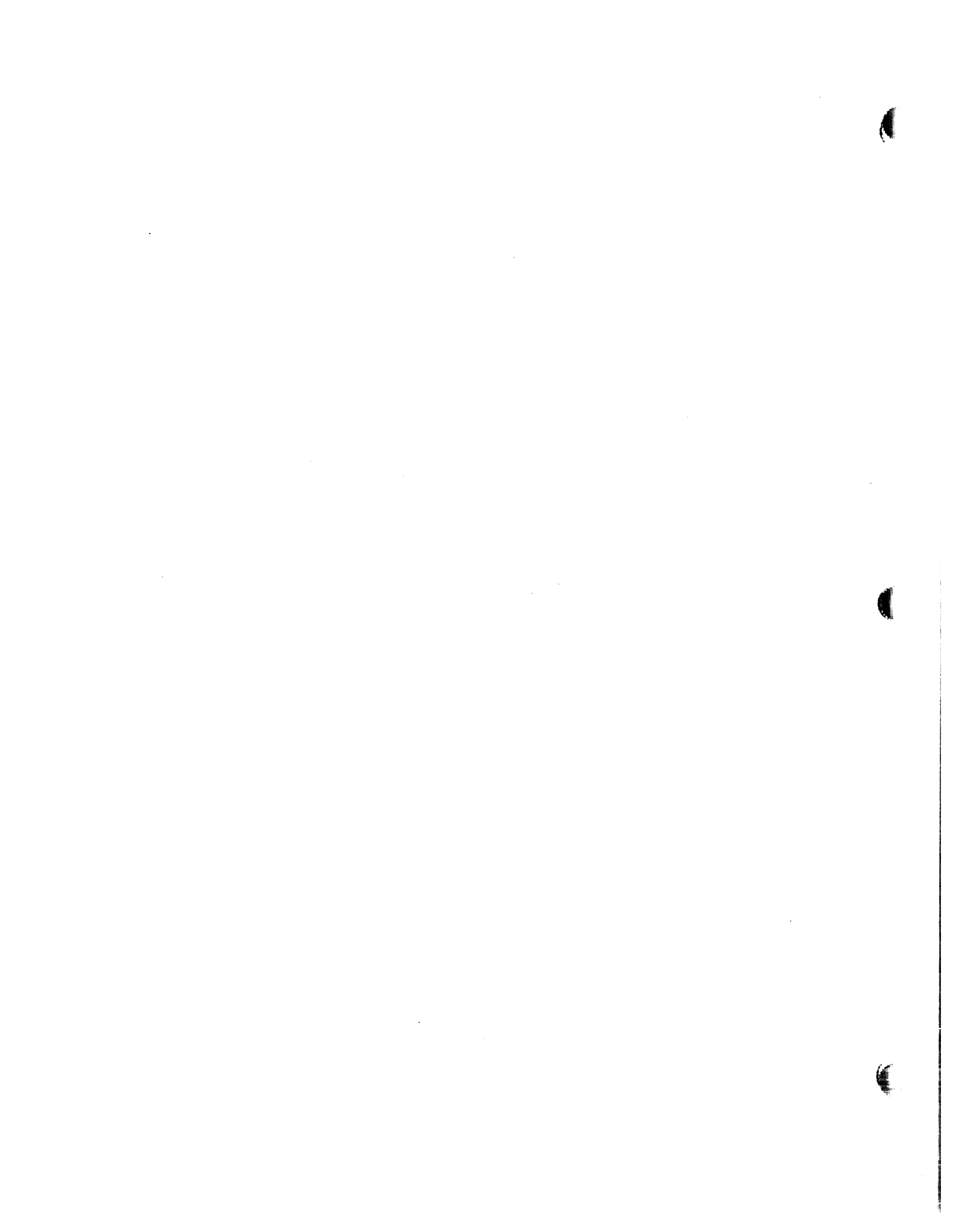
SECTION THREE

EXOR DIAGNOSTIC INFORMATION

EXOR returns a large number of registers to indicate such
things as where bad sectors of the disk are or other states
that triggered an error condition. the following
abbreviations are used to indicate parameters at the time of
the error:

SBI/CMI Interfaces:

CSR	MBA Configuration Register
CR	MBA Control Register
SR	MBA Status Register
VAR	Virtual Address Register
BCR	Bite Count Register
FMAP	Final Map Register
PMAP	Previous Map Register
CS1	Control and Status 1
DS	Drive Status
AS	Attention Summary
OF	Offset
ER1	Error Register 1
ER2	Error Register 2
DT	Drive Type i.e. RM03, etc.
SN	Serial Number (of drive)
DC	Desired cylinder
DA	Head Sector Address
ECC1	ECC Register 1
ECC2	ECC Register 2

UNIBUS Interfaces:

DPN	Data Path Number
DPR	Data Path Register
FMAP	Final Map Register
PMAP	Previous Map Register
CS1	Control Status Register 1
CS2	Control Status Register 2
DS	Drive Status
AS	Attention Summary
OF	Offset
WC	Word Count
BA	Buffer Address
ER1	Error Register 1
ER2	Error Register 2
DT	Drive Type i.e. RM03, etc.
SN	Serial Number
DC	Desired cylinder
DA	Head Sector Address
VER	Version Number of SIDRIVER

CMI/SBI INTERNAL REGISTERS

    BASE ADDRESSES

SBI			CMI	
CPA TRIP LEVEL	MBACSR		DEVICE #	MBACSR
8	20010000		0	F28000
9	20012000		1	F2A000
10	20014000		2	F2C000
11	20016000			

ABBREVIATIONS USED:

E/M	EXTENDED MODE
F/H	FIXED HEAD.
F/P	FIXED PLATTER.
I.C.	INIT CLEARS.
I.S.C.	INIT OR SETTING THE BIT CLEARS.
I.S.C.C.	INIT, SETTING THE BIT OR ISSUING A VALID COMMAND CLEARS.
M/H	MOVABLE HEADS.
N/U	NOT USED.
N/U 0	NOT USED ALWAYS READS 0.
N/U 1	NOT USED ALWAYS READS 1.
R/P	REMOVABLE PLATTER.

CMI/SBI INTERNAL REGISTERS

BA 00   MBACSR CONFIGURATION/STATUS (N/U WITH CMI ALL BITS 0).

31	80000000	SBI PARITY ERROR.
30	40000000	WRITE DATA SEQUENCE.
29	20000000	UNEXPECTED READ DATA.
28	10000000	N/U 0.
27	08000000	MULTIPLE TRANSMITTER FAULT.
26	04000000	TRANSMITTER DURING FAULT.
24-25	03000000	N/U 0.
23	00800000	ADAPTER POWER DOWN.
22	00400000	ADAPTER POWER UP.
21	00200000	OVER TEMPERATURE (N/U 0).
08-20	001FFF00	N/U 0.
00-07	000000FF	ADAPTER CODE (00100000).

BA 04   MBACSR   CONTROL REGISTER

```
    05-31 FFFFFFE0 N/U 0.
       04 00000010 IGNORE BYTE COUNT (N/U 0).
       03 00000008 MAINTENANCE MODE.
       02 00000004 INTERRUPT ENABLE.
       01 00000002 ABORT DATA TRANSFER.
       00 00000001 INITIALIZATION (WRITE ONLY READS AS 0).
```

BA 08   MBASR   STATUS REGISTER

```
       31 80000000 DATA TRANSFER BUSY.
       30 40000000 NO RESPONSE CONFIRMATION - CAUSES RETRY OF
                   COMMAND (I.S.C.) (CMI N/U 0).
       29 20000000 CORRECTED DATA READ (I.S.C.).
    24-28 1F000000 N/U 0.
       23 00800000 CONTROL BUS HUNG (CMI ONLY) (N/U 0).
    20-22 00700000 N/U 0.
       19 00080000 PROGRAM ERROR (I.S.C.).
       18 00040000 NONEXISTANT DRIVE (I.S.C.).
       17 00020000 N/U 0.
       16 00010000 ATTENTION (FROM ANY DRIVE).
       15 00008000 N/U 0.
       14 00004000 SILO PARITY ERROR (CMI ONLY) (N/U 0).
       13 00002000 DATA TRANSFER COMPLETED (I.S.C.C.).
       12 00001000 DATA TRANSFER ABORTED (I.S.C.C.).
       11 00000800 DATA LATE (I.S.C.C.). (CMI N/U 0).
       10 00000400 WRITE CHECK UPPER ERROR (I.S.C.C.).
       09 00000200  "" LOWER " (I.S.C.C.).
       08 00000100 MISSED TRANSFER ERROR (I.S.C.C.).
       07 00000080 EXCEPTION (I.S.C.C.).
       06 00000040 DATA PARITY ERROR (I.S.C.C.) (CMI N/U 0).
       05 00000020 PAGE FRAME MAP PARITY ERROR (I.S.C.C.).
       04 00000010 INVALID MAP (I.S.C.C.).
       03 00000008 SBI ERROR CONFIRMATION (I.S.C.C.).
                   CMI ERROR STATUS (I.S.C.C.).
       02 00000004 READ DATA SUBSTITUTE (I.S.C.C.) (CMI N/U 0).
       01 00000002 SBI INTERFACE SEQUENCE TIMEOUT (I.S.C.C.).
                   CMI NO RESPONSE STATUS (I.S.C.C.).
       00 00000001 READ DATA TIMEOUT (I.S.C.C.). (CMI N/U 0).
```

BA 0C   MBAVAR   VIRTUAL ADDRESS REGISTER

```
    17-31 FFFE0000 N/U 0.
    09-16 0001FE00 MAP POINTER.
    00-08 000001FF BYTE ADDRESS IN PAGE.
```

BA 10   MBABCR   BYTE COUNT

```
    16-31 FFFF0000 DISK BYTE COUNTER (READ ONLY).
    00-15 0000FFFF CMI OR SBI BYTE COUNTER (READ/WRITE).
                   ON WRITE A DUPLICATE APPEARS IN 16-31.
```

BA 14   MBADR   DIAGNOSTIC

         31 80000000 READ/WRITE (I.C.) (CMI N/U 0).
         30 40000000 SIMULATE LOADING FAR (I.C.) (CMI N/U 0).
         29 20000000 INVERT MAP PARITY CHECKING (I.C.).
         28 10000000 BLOCK SENDING COMMAND (I.C.).
         27 08000000 TEST DATA REQUEST (I.C.) (CMI N/U 0).
         26 04000000 TEST DOUT (I.C.) (CMI N/U 0).
         25 02000000 READ/WRITE (I.C.) (CMI N/U 0).
         24 01000000 SIMULATE ATTENTION (I.C.).
         23 00800000 TEST OB CLOCK (I.C.) (CMI N/U 0).
      21-22 00600000 READ/WRITE (I.C.) (CMI N/U 0).
         20 00100000 N/U 0.
         19 00080000 DATA STROBE READ ONLY (CMI N/U 0).
         18 00040000 DATA VALID READ ONLY (CMI N/U 0).
         17 00020000 ACCEPT INPUT READ ONLY (CMI N/U 0).
         16 00010000 D12 FULL READ ONLY (CMI N/U 0).
      08-15 0000FF00 MICROPROCESSOR DATA BUS READ ONLY (CMI N/U 0).
      00-07 000000FF RECEIVER BUS READ ONLY (CMI N/U 0).

BA 18   MBASMR   SELECTED MAP (CMI N/U APPEARS AS INVALID ADDRESS).

         31 80000000 VALID (VALID PAGE FRAME # PRESENT).
      21-30 7FE00000 N/U 0.
      00-20 001FFFFF PAGE FRAME #.

BA 1C   MBACAR   COMMAND ADDRESS.

               SBI   CMI

      28-31 F0000000 COMMAND   25-31 FE000000 COMMAND
                                      24 01000000 N/U 0
      00-27 0FFFFFFF ADDRESS   00-23 00FFFFFF ADDRESS

UNIBUS/EXTERNAL REGISTERS

WHERE BITS HAVE SPECIAL SIGNIFICANCE THE NUMERIC VALUE
COLUMNS ARE 1ST THE DECIMAL BIT # 00-15, THEN THE HEXADECIMAL
BIT VALUE(S) FOR CMI/SBI (IF NO VALUE IS SHOWN THE BITS ARE
NOT USED WITH EITHER CMI OR SBI AND WILL READ AS ZEROES., AND
LASTLY THE OCTAL VALUES FOR UNIBUS.

176700   EDRA 400   RPCS1 & RMCS1 (CONTROL AND STATUS 1 REGISTER)

15		100000	SPECIAL CONDITION
14		40000	TRANSFER ERROR
13		20000	BUS PARITY ERROR (N/U 0).
12		10000	N/U ALWAYS SET TO 0.
11	0800	4000	DRIVE AVAILABLE (N/U 1).
10		2000	PORT SELECTION (N/U FOR RP'S).
9		1000	UNIBUS ADDRESS EXTENSION BIT A17.
8		400	" " " " A16.
7		200	READY.
6		100	INTERRUPT ENABLE.
00-05			FUNCTIONS
		75	READ MICRO-CONTROL (9xxx E/M).
	3B	73	READ HEADER AND DATA.
	39	71	READ DATA.
		67	AUTO-FORMAT (9xxx RM03 E/M).
		65	WRITE MICRO-CONTROL (9xxx E/M).
	33	63	WRITE HEADER AND DATA.
	31	61	WRITE DATA.
		55	CALL MICRO-CONTROL (9xxx E/M).
	2B	53	WRITE CHECK HEADER AND DATA.
	29	51	WRITE CHECK DATA.
	19	31	SEARCH COMMAND.
		27	SYSTEM RELEASE (9xxx E/M).
		25	" RESERVE (" / " ").
	13	23	PACK ACKNOWLEDGE.
	11	21	READ IN PRESET.
	0F	17	RETURN TO CENTERLINE.
	0D	15	OFFSET COMMAND.
	0B	13	RELEASE (DUAL PORT OPERATION).
	09	11	DRIVE CLEAR.
	07	7	RECALIBRATE.
	05	5	SEEK.
	03	3	UNLOAD (STANDBY RP'S ONLY).
	01	1	NO OPERATION.

176702   EDRA   N/U RPWC & RMWC (WORD COUNT REGISTER 2'S COMPLEMENT)

176704   EDRA   N/U RPBA & RMBA (UNIBUS ADDRESS REGISTER)

176706   EDRA   414 RPDA & RMDA (DESIRED SECTOR/TRACK ADDRESS REGISTER)

        08-15 FF00   177400   HEAD #.
        00-07 00FF   000377   SECTOR #.
        THE # OF BITS IN USE IS DRIVE/FIRMWARE DEPENDANT.

176710   EDRA   N/U RPCS2 & RMCS2 (CONTROL AND STATUS 2 REGISTER).

        15 8000 100000   DATA LATE (N/U 0).
        14 4000 40000   WRITE CHECK ERROR.
        13 2000 20000   UNIBUS PARITY ERROR.
        12 1000 10000   NON-EXISTENT DRIVE.
        11 0800 4000   NON-EXISTENT MEMORY.
        10 0400 2000   PROGRAM ERROR.
         9 0200 1000   MISSED TRANSFER.
         8 0100 400   MASS DATA BUS PARITY ERROR (N/U 0).
         7 0080 200   OUTPUT READY.
         6 0040 100   INPUT READY (N/U 1).
         5 0020 40   CONTROLLER CLEAR.
         4 0010 20   PARITY TEST (N/U 0).
         3 0008 10   INHIBIT UNIBUS INCREMENT.
    00-02 0007 7   SELECT DRIVE #.

176712   EDRA   404 RPDS & RMDS (DRIVE STATUS REGISTER)

        15 8000 100000   ATTENTION ACTIVE.
        14 4000 40000   ERROR IN RPER1/2/3 (RMER1/2).
        13 2000 20000   POSITIONING IN PROGRESS (9xxx N/U 0)
        12 1000 10000   MEDIUM ON LINE.
        11 0800 4000   WRITE LOCK.
        10 0400 2000   LAST SECTOR TRANSFERRED.
         9 0200 1000   PROGRAMMABLE (N/U 0).
         8 0100 400   DRIVE PRESENT (SET IF DRIVE POWERED UP).
         7 0080 200   DRIVE READY.
         6 0040 100   VOLUME VALID.
    01-05 003E 76   N/U 0.
         0 0001 1   RM03 = OFFSET MODE. RP04 = N/U.

176714 EDRA 408 RPER1 & RMER1 (ERROR REGISTER 1)

```
        15 8000 100000        DATA CHECK, ECC ERROR.
        14 4000 40000         UNSAFE.
        13 2000 20000         OPERATION INCOMPLETE (9xxx N/U 0).
        12 1000 10000         DRIVE TIMING ERROR.
        11 0800 4000          WRITE LOCK ERROR.
        10 0400 2000          INVALID ADDRESS ERROR.
         9 0200 1000          ADDRESS OVERFLOW ERROR.
         8 0100 400           HEADER CRC ERROR.
         7 0080 200           HEADER COMPARE ERROR.
         6 0040 100           ECC HARD ERROR.
         5 0020 40            WRITE CLOCK FAIL (N/U 0).
         4 0010 20            FORMAT ERROR.
         3 0008 10            PARITY ERROR (6100 N/U 0).
         2 0004 4             REGISTER MOD REFUSED (9xxx N/U 0).
         1 0002 2             ILLEGAL REGISTER (N/U 0).
         0 0001 1             ILLEGAL FUNCTION.
```

176716 EDRA 410 RPAS & RMAS (ATTENTION SUMMARY REGISTER)

```
     08-15 FF00 177400        N/U 0.
         7 0080 200           DRIVE ATTENTION UNIT 7
         6 0040 100           DRIVE ATTENTION UNIT 6
         5 0020 40            DRIVE ATTENTION UNIT 5
         4 0010 20            DRIVE ATTENTION UNIT 4
         3 0008 10            DRIVE ATTENTION UNIT 3
         2 0004 4             DRIVE ATTENTION UNIT 2
         1 0002 2             DRIVE ATTENTION UNIT 1
         0 0001 1             DRIVE ATTENTION UNIT 0
```

176720 EDRA 41C RPLA & RMLA (LOOK AHEAD REGISTER)

```
     06-10                    CURRENT SECTOR COUNT (9xxx N/U).
```

176722 EDRA N/U RPDB & RMDB (DATA BUFFER REGISTER)

176724 EDRA 40C RPMR (MAINTENANCE REGISTER) NOT EMULATED

        RMMR1 (MAINTENANCE REGISTER 1) NOT EMULATED

176726   EDRA   418 RPDT & RMDT (DRIVE TYPE REGISTER)

```
   14-15 6000 140000          N/U 0.
      13 2000  20000          MOVING HEAD DISC TYPE (ALWAYS 1).
      12 1000  10000          N/U 0.
      11 0800  4000           DRIVE REQUEST REQUIRED (N/U 0).
   09-10 0600  3000           N/U 0.
   00-08                      DRIVE TYPE
            17    27            RM05
            14    24            RM03
            12    22            RP06
            11    21            RP05
            10    20            RP04
```

176730   EDRA   420 RPSN & RMSN (SERIAL NUMBER REGISTER)

```
      15 8000 100000          0/1 = RM05/RM03,RP04,05,06 EMULATION.
      14 4000  40000          0/1 = SKEW/NOSKEW (RM). MAPPED/DIR EMUL (RP)
                              MASKED BY RM FIRMWARE
      13 2000  20000          0/1 = DO/DO NOT OFFSET DRIVE (6100 = 0).
      12 1000  10000          0/1 = OFF/ON - BAD BLOCK FORWARDING
   08-11                      DRIVE TYPE DEFINED AS:
         0100  400            DIRECT 9762
         0200  1000           NOT USED
         0300  1400           DIRECT 9766/9733
         0400  2000           NOT USED
         0500  2400           NOT USED
         0600  3000           NOT USED.
         0700  3400           DIRECT 9775
         0800  4000           DIRECT 9712
         0900  4400           DIRECT 9798
         0A00  5000           DIRECT 9761
         0B00  5400           DIRECT 9784/9722
         0C00  6000           DIRECT 9751 BBF
         0D00  6400           MAPPED 9784/9722
         0E00  7000           MAPPED 9775/9798/9761
         0F00  7400           DIRECT 9751 NON BBF
      07 0080   200           0 = R/P CMD DRIVES (6100 = 0).
                              1 = F/P CMD DRIVES.
      06 0040   100           0 = M/H MMD & FMD DRIVES (6100 = 0).
                              1 = F/H MMD & FMD DRIVES.
      05 0020    40           0 = SEEK MOVES DRIVE ARM (6100 = 0).
                              1 = SEEK DOES NOT.
      04 0010    20           0/1 = REMOVABLE/NON-REMOVABLE DISK UNIT
      03 0008    10           0/1 STANDARD/COMPACT DRIVE
   00-02 0007     7           LOGICAL UNIT NUMBER.
```

176732   EDRA   424 RPOF & RMOF (OFFSET REGISTER)

```
         15 8000 100000        SIGN CHANGE (N/U 0).
      13-14 6000 60000         N/U 0.
         12 1000 10000         FORMAT BIT (FORCED TO A 1 FOR 9xxx).
         11 0800 4000          ERROR CORRECTION CODE INHIBIT.
         10 0400 2000          HEADER COMPARE INHIBIT.
      08-09 0300 1400          N/U 0.
          7 0080  200          OFFSET 1 = TO SPINDLE : 0 = AWAY (RM03).
      02-06 007C  174          N/U 0.
      00-01         3          TARGET COMPUTER INTERFACE PORT (RM03).
```

176734   EDRA   428 RPDC & RMDC (DESIRED CYLINDER REGISTER)

```
      10-15 FC00 176000        N/U 0.
      00-09 03FF   1777        DESIRED CYLINDER ADDRESS.
```

176736   EDRA   42C RPCC (CURRENT CYLINDER REGISTER)

```
      10-15 FC00 176000        N/U 0.
      00-09 03FF   1777        CURRENT CYLINDER ADDRESS (RP'S ONLY).
```

        RMHR (HOLDING REGISTER) NOT USED FOR 9xxx

176740   EDRA   430 RPER2 (ERROR REGISTER 2) N/U BY RM03

```
         15 8000 100000        AC UNSAFE.
         14 4000 40000         N/U 0.
         13 2000 20000         DRIVE FAULT.
         12 1000 10000         30 VOLTS UNSAFE.
      00-11 0FFF 7777          N/U 0.
```

        RMMR2 (MAINTENANCE REGISTER 2) N/U (6100 READS 11777)

176742   EDRA   434 RPER3 (ERROR REGISTER 3)

```
        15 8000 100000        OFF CYLINDER (N/U 0).
        14 4000 40000         SEEK INCOMPLETE.
     07-13 3FC0 37600         N/U 0.
         6 0040 100           AC LOW.
         5 0020 40            DC LOW.
         4 0010 20            DISABLE ERROR (N/U 0).
         3 0008 10            ANY UNSAFE (POWER LOW).
         2 0004 4             N/U 0.
         1 0002 2             VELOCITY UNSAFE (N/U 0).
         0 0001 1             PACK SPEED UNSAFE (N/U 0).
```

            RMER2 (ERROR REGISTER 2)

```
        15 8000 100000        BAD SECTOR ERROR.
        14 4000 40000         SEEK INCOMPLETE.
        13 2000 20000         OPE OPERATOR PLUG ERROR (9xxx N/U 0).
        12 1000 10000         IVC INVALID COMMAND.
        11 0800 4000          LSC LOSS OF SYSTEM CLOCK (N/U 0).
        10 0400 2000          LBC LOSS OF BIT CLOCK (6100 ONLY).
     08-09 0300 1400          N/U 0.
         7 0080 200           DVC DEVICE CHECK.
     04-06 0070 160           N/U 0.
         3 0008 10            DATA PARITY ERROR (N/U 0).
     00-02 0007 7             N/U 0.
```

176744   EDRA   438 RPEC1 & RMEC1 (ECC POSITION REGISTER)

```
     13-15  160000           N/U 0.
     00-12  17777            POS ERROR POSITION (9400/9800 N/U 0).
```

176746   EDRA   43C RPEC2 & RMEC2 (ECC PATTERN REGISTER)

```
     11-15  174000           N/U 0.
     00-10  3777             PAT ERROR PATTERN BITS (9400/9800 N/U 0).
```