RTE Driver DVR33 For HP 12732A/HP 12733A Disc Drives

Programming Manual

(Includes DSKET Program Information)

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Library Index Number
12732.320.12732-90001

PART NO. 12732-90001

Printed in U.S.A. 10/79

PUBLICATION NOTICE

Changes in text to document software updates subsequent to the initial release are supplied in manual change notices and/or complete revisions to the manual. The history of any changes to this edition of the manual is given below under "Publication History." The last change itemized reflects the software currently documented in the manual.

Any changed pages supplied in an update package are identified by a change number adjacent to the page number. Changed information is specifically identified by a vertical line (change bar) on the outer margin of the page.

PUBLICATION HISTORY

Third Edition ..... Oct 79 (part no. 12732-16001, Software Rev. Code 1805)
(part no. 92067-16467, Software Rev. Code 1903)

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SECTION I

This manual contains information and procedures that allow you to write application programs using HP FORTRAN or HP Assembly Language to call RTE driver DVR33. This section introduces DVR33 components and the operating environment required. Section II describes the available program calling sequences for DVR33. Section III provides the information you need when incorporating DVR33 into an RTE operating system. Prior to using DVR33 with the flexible disc, the disc must be formatted with the program DSKET. Appendices A and B provide information on program DSKET and disc organization, respectively. Appendix C provides information on using DVR33 in RTE-II, RTE-III, RTE-IV, RTE-IVB, and RTE-M operating systems. DVR33 controls I/O data transfers to and from the HP 12732A/12733A Flexible Disc Subsystem which contains the HP 9885M/S Flexible Disc Drive.

1-1. COMPONENTS

DVR33 is a binary relocatable program having part no. 12732-16001 for RTE-II, RTE-III, RTE-IV, and RTE-M. For RTE-IVB the part number is 92067-16467. This manual, part no. 12732-90001, describes the driver and provides programming information.

1-2. OPERATING ENVIRONMENT

The operating environment for DVR33 must be the following:

a. HP 1000 computer.

b. One of the following software operating systems:
   RTE-II (product no. 92001B)
   RTE-III (product no. 92060B)
   RTE-IV (product no. 92067A)
   RTE-IVB (product no. 92068A)
   RTE-M (product no. 92064A)

c. HP 12732A Flexible Disc Subsystem (includes HP 9885M Disc Drive).

d. Optional HP 12733A Slave Flexible Disc Drive (includes HP 9885S Disc Drive).

The interface PCA's should have been installed according to the instructions in the *HP 12732A/12733A Flexible Disc Subsystem Operating and Service Manual,* part no. 12732-90005.

If difficulty is experienced with the disc drive, it may be checked with the "self test" which is started with a rear-panel switch. For service information, refer to the *HP 12732A/12733A Flexible Disc Subsystem Operating and Service Manual,* part no. 12732-90005.

APPLICATION INFORMATION

SECTION II

This section describes the driver calls and calling sequences for data read/write, status requests, and control requests. Complete information on disc format and organization is provided in Appendix B.

2-1. CALLING SEQUENCE

The following paragraphs describe the DVR33 calling sequences in both HP FORTRAN and HP Assembly Languages.

2-2. READ/WRITE DATA

Table 2-1 shows the calling sequence for the reading and writing of data. The control word (ICNWD) parameter specifies the logical unit (LU) of the disc drive in bits 0 thru 5. ICNWD bits 6 thru 10 is the function code.

Normal operation is when the function code equals 0. A function code of 30 (octal) is *read with "tight margin"* in which the disc controller's read electronics uses tighter timing restrictions in reading the data. If the data does not pass the tighter timing margin, then a *tight margin error* is returned by the system. However, the data is still correct if there is no Data Checkword Error.

The "tight margin" mode may be used when it is extremely important that the written data was recorded as accurately as possible. Reading the data in this mode is a check on how well the data was recorded and hence an indication of how well it may be read in the future.

After a successful data transfer, the A Register will contain a status code (see table 2-3). The B Register contains a transmission log for both successful and unsuccessful data transmission. The transmission log is a count of the words or characters transmitted (specified in the executive calling program by using (+) for words and (−) for characters).

For unsuccessful data transmissions the system will return the following error messages:

a. "IO07" for the reasons below:

   (1) Specified a negative track number.

   (2) Specified an odd or negative sector number.

   (3) Specified a sector number greater than 58.

   (4) Specified a non-existent track number between 0 and 66. This occurs when bad tracks reduce the number of available tracks. Determine number of tracks on disc by making

a read/write request to a track number greater than 66 which will return the number of available tracks in the B register. Thus, the maximum track number is (B Register contents less 1). In RTE-IVB, if the request is a read request, the number of logical sectors is also returned in the first word of the buffer (refer to IBUFR in table 2-1). There are 64 words per logical sector and 60 logical sectors per track.

(5) Write was to track 0, sector 0 which is reserved for use by DVR33. (Word 1 has the number of available tracks, 1-67, and word 2 has the number of disc revolutions to read one track).

(6) Attempted to write more sectors than are available on the disc; e.g., two sectors are left on the last track and the current request is to write 512 words which equals four sectors.

b. "I/O ERR NR EQT" message indicates an equipment malfunction or the equipment is not ready. Check the disc drive for:

(1) Power On.

(2) Door Open.

(3) No Disc.

c. "I/O ERR PE EQT" indicates that a transmission error is due to one of the following conditions:

(1) Record not found.

(2) Track not found.

(3) Data checkword error.

(4) Data overrun.

(5) Transfer incomplete

d. "I/O ERR TO EQT" indicates a time-out which occurs if an expected interrupt does not happen within five seconds of an I/O initiation. Prior to exit from the driver due to a timeout, DVR33 resets the drive (heads go to track 0).

For normal read operations, ten tries are made before transmission error exit is taken. For "Read with Tight Margin" (ICNWD = 30) then one read is made.

NOTE

There are 128 words per sector, each track has 30 sectors (numbered 0-58 using even numbers only), and 67 tracks maximum (0-66). The number of tracks will vary according to the number of bad tracks on the disc. The bad tracks are found during formatting and the number of good tracks is written in Word 1 of Track 0, Sector 0 and is returned in the B Register when a read/write request to a Track greater than 66 is made. In RTE-IVB after a read request, the number of logical sectors (60 logical sectors per track) is also returned in the first word of the buffer (refer to IBUFR in table 2-1). Refer to Appendix B on Disc Format and Organization for additional details.

Table 2-1. Read/Write Data Request Calling Sequence

ASSEMBLY LANGUAGE	Where:
EXT EXEC • • JSB EXEC DEF RTRN DEF ICODE DEF ICNWD DEF IBUFR DEF IBUFL DEF ITRAK DEF ISECT	RTRN = Return Point ICODE = DEC1 or DEC2 (Request Code 1 = Read, 2 = Write) ICNWD = Control Word in Octal Notation Bits 0 thru 5 = LU number of drive Bits 6 thru 10 = Function Code 0 = normal 30 = Read with "tight margin" IBUFR = Buffer Starting Address IBUFL = I/O Buffer Length = DEC n, pos. = 16-bit words, neg. = 8-bit characters = 0 gives immediate completion ITRAK = Decimal track number (DEC n) ISECT = Decimal sector number (DEC n). Even sectors only from 0 thru 58; i.e., 0-2-4...58.
FORTRAN	CALL EXEC(ICODE,ICNWD,IBUFR,IBUFL,ITRAK,ISECT)

2-3. STATUS REQUEST

Table 2-2 shows the calling sequence for the status request. The control word (ICNWD) specifies the logical unit (LU) of the disc drive and the status word location is called by IEQT5 and IEQT4 (optional). Status is stored in EQT word 5 and optionally in EQT word 4. Use of the optional word 4 of EQT is defined in the applicable RTE manual.

The status request calling sequence returns the status word of the last accessed drive. Of the 16 status bits, bits 0 thru 7 contain the hardware status and bits 8 thru 15 are described in the applicable RTE manual. The hardware status bits in EQT 5 are described in table 2-3. The conditions causing the status errors are as follows:

a. Status words 3, 5, and 7 (octal) for no drive power, door open, and no disc cause a "Not Ready" exit with a system error message: I/O ERR NR EQT.

b. Status words 13, 15, 17, 21, and 37 (octal) after 10 tries cause a transmission error with a system error message:

    I/O ERR PE EQT
    TR nnn EQT eqt
    U pp U

    where: nnn = track number, pp = drive number.

    The track number will be stored in the B Register. Status errors 13, 15, and 17 (octal) indicate a media problem (e.g., a scratched surface) or possibly a drive malfunction. Errors of status 21 and 37 (octal) result from a drive malfunction.

Table 2-2. Status Request Calling Sequence

ASSEMBLY LANGUAGE	Where:
EXT EXEC • • JSB EXEC DEF RTRN DEF ICODE DEF ICNWD DEF IEQT5 DEF IEQT4	RTRN = Return Point ICODE = Request Code for Status = DEC 13 ICNWD = Control Word in Octal Notation Bits 0 thru 5 = LU number of drive IEQT5 = Equipment Table Word 5, BSS 1=storage word IEQT4 = Equipment Table Word 4, BSS 1=storage word
FORTRAN	CALL EXEC (ICODE,ICNWD,IEQT5,IEQT4)

Table 2-3. I/O Status Word Bits

Status in EQT5 is returned as per below:		
Bits 0-7	Meaning	Octal Value
00000000	No Error	0
00000011	No Drive Power	3
00000101	Door Open	5
00000111	No Disc	7
00001011	Record Not Found	13
00001101	Track Not Found	15
00001111	Data Checkword Error	17
00010001	Data Overrun	21
00010011	Read "Tight Margin" Error	23
00011111	Transfer Incomplete	37
00100001	Data Block too long	41
00100000*	End of Track (Access track > 66)	40
01000000*	Disc Change	100
10000000*	Disc Write Protected	200

*These errors may occur simultaneously.

c. Status word 23 (octal) for a problem in reading with "tight margin" causes a successful exit after one try with no error message. The track number is stored in the B Register. Therefore, when using a "tight margin" Read, it is important to check EQT5 for error 23 (octal) after each Read. If this is the only error, the data is still good (no data checkword error).

d. Status word 40 (octal) occurs when an attempt is made to Read or Write on a track numbered greater than 66. The number of available tracks is returned in the B Register with A Register contents of 0.

e. Status word 41 (octal) is caused if the Read/Write request data block is larger than the available disc space; e.g., an attempt to write 10 sectors and only nine are left.

f. Status word 100 (octal) occurs when a new disc has been installed, the power turned on since the last request, or reset has just been carried out.

g. Status word 200 (octal) occurs whenever the "write protect" hole on the flexible disc is not covered (write protected disc).

2-4. CONTROL REQUEST

As contrasted to the status request ICODE=13, this request with ICODE=3 actually interogates the disc drive for current status if ICNWD Function = 6. Under normal operation it should not be necessary to reset the controller (ICNWD Function = 0). The control request calling sequence is described in table 2-4.

Table 2-4. Control Request Calling Sequence

ASSEMBLY LANGUAGE	Where:
EXT EXEC • • • JSB EXEC DEF RTRN DEF ICODE DEF ICNWD •	RTRN = Return ICODE = Request Code for Control = 3 ICNWD = Control Word in Octal Notation Bits 0-5 = Logical Unit No. of drive Bits 6-10 = Function 0 = Reset Controller. All drives are Reset with heads moving to track 0. Reset also occurs at Power On. 6 = Dynamic Status. Current status of selected LU returned in EQT5 and the A Register.
FORTRAN	CALL EXEC (ICODE,ICNWD)

CONFIGURATION INFORMATION

SECTION III

This section provides configuration information for Driver DVR33. It is intended to augment the data provided in the following manuals:

a. *RTE-M Programmer's Reference Manual,* part number 92064-90002.

b. *RTE-II Programming and Operating Manual,* part number 92001-93001.

c. *RTE-III Programming and Operating Manual,* part number 92060-90004.

d. *RTE-IV Programmer's Reference Manual,* part number 92067-90001.

e. *RTE-IVB Programmer's Reference Manual,* part number 92068-90004.

3-1. GENERATION PROCEDURE

Load the driver into the RTE System during generation as described in the appropriate RTE manual. During system generation, take the following steps to configure the driver into the RTE system being generated.

3-2. PROGRAM INPUT PHASE

During the Program Input Phase, load Driver DVR33 along with the other I/O drivers being loaded by making the following entry:

```
PROGRAM INPUT PHASE (message in RTE-M only)
•
•
REL, %DVR33
```

3-3. TABLE GENERATION PHASE

In the Table Generation Phase, make the following entries:

a. An Equipment Table Entry.

```
*EQUIPMENT TABLE ENTRY
•
•
EQT n?
scl, DVR33, D
```

where: "n" is the EQT entry number, "scl" is the select code of the higher priority I/O card, "D" is tor DCPC (or DMA) to provide direct memory transfer.

Notes: (1) DO NOT BUFFER EQT. (2) Do not set timeout (it is set by the driver to 5 seconds).

b. A Device Reference Table (DRT) entry relating the desired logical unit number (LU) for each disc drive device (e.g., master and slave disc drives) to the EQT entry.

```
*DEVICE REFERENCE TABLE
•
•
lu = EQT #?
n, m
•
•
```

where: "lu" is the LU number assigned to the disc drive, "n" is the EQT entry number of the master drive, and "m" is a subchannel number of the master drive and slave drives according to the drive number set on the rear of the device. Each drive is set to a different number from 0-3.

c. An Interrupt Table entry for each of the two I/O cards.

```
*INTERRUPT TABLE
•
•
scl, EQT, m
sc2, EQT, m
```

where: "scl" is the octal select code for the control, higher priority I/O card, and "sc2" is the octal select code for the data, lower priority I/O card; and m is the EQT table entry number of the disc drive subsystem.

FORMAT PROGRAM "DSKET"

APPENDIX A

A-1. INTRODUCTION

All new discs must be formatted by writing track and sector addresses on them. A relocatable utility program named "DSKET", part no. 12732-16002 is provided with the HP 12732A Flexible Disc Subsystem for this purpose. DSKET is normally supplied on a flexible disc, part no. 12732-13401.

Another function of DSKET is to identify bad tracks on the disc and "mark" them as such. The number of usable tracks equals the maximum of 67 tracks less the number of bad tracks. The system returns the number of usable tracks to the B-Register when a read or write request is made to a track number greater than 66 (see paragraph 2-2). After the disc has been formatted, it is initialized for the RTE File Manager.

A-2. RUNNING PROGRAM DSKET

The procedure for running format utility program DSKET follows:

(1) Follow instructions in the applicable RTE manual to activate the RTE operating system.

(2) Insert the flexible disc, part no. 12732-13401, on which DSKET resides in the file %DSKET (relocatable format) into the HP 9885M Flexible Disc Drive.

(3) Load DSKET from the file %DSKET using the RTE loader following the procedure given in the applicable RTE manual.

(4) Remove the flexible disc with the DSKET program and install a blank flexible disc to be formatted.

(5) Type on the system console:

RU, DSKET, LU

where LU is the logical unit number assigned to the terminal being used for control. Default is LU 1.

(6) DSKET responds:

ENTER DRIVE LU?

Type in the LU number of the drive containing the blank disc.

(7) DSKET responds:

DO YOU REALLY WANT TO FORMAT THIS DISC?

Important Note: This question is asked to prevent accidental erasure of valuable information that may be on the disc.

FORMATTING A DISC ERASES ALL DATA ON IT.

Type YES if you want to continue formatting. Any other response terminates DSKET with message: DSKET ENDS.

(8) DSKET responds:

STANDARD FORMAT?

Respond by typing YES for optimum File Manager operation and type NO for the fast format. Refer to Appendix B for an explanation of these choices.

(9) If anything except YES or NO is entered to the "Standard Format" question, DSKET ends. Completion of formatting is indicated by the message:

THE NUMBER OF GOOD TRACKS IS N

where N equals the number of good tracks from 0 thru 66.

10) When a bad track is found the message TRACK "N" IS DEFECTIVE is displayed where "N" is the current physical track number. Also the system may issue an I/O transmission error message (see paragraph 2-3,b). These error messages are for information only; i.e., no action is required.

Upon completion of formatting, the number of good tracks is written into track 0, sector 0, word 1. A *five* for standard format or *one* for fast format is written into track 0, sector 0, word 2. The information in word 1 is needed to tell the File Manager the last track number. The information in word 2 can be used to determine the format type. All tracks are numbered serially starting at 0; therefore, the user need not concern himself with the number of bad tracks other than knowing this limitation on the storage capacity of the disc [storage capacity = (number of good tracks) × (3840 words)].

The disc is Initialized by DSKET for the File Manager so that it can be mounted directly using the File Manager MC command. Also a "dummy" type 1 file "FLOPLK" is created to prevent the File Manager from attempting to write on track 0, sector 0.

DISC FORMAT AND ORGANIZATION

APPENDIX B

B-1. INTRODUCTION

The flexible disc has a diameter of 20 cm (7-7/8 inch). It is made with a mylar base which is coated with ferro-magnetic iron oxide to provide a characteristic quite similar to that of magnetic tape. Information is stored on the disc in the form of binary digits represented by magnetized points on the disc. The information is stored and retrieved by a read/write head that comes in contact with the surface of the disc. Data can be recorded on one side only.

B-2. DISC FORMAT

The disc format is shown in figure B-1. Data is stored in concentric tracks on the disc. Each disc has a maximum of 67 tracks numbered sequentially, starting at the outside track, from 0 through 66. The number of available tracks is reduced by the number of bad tracks on the disc. For example, if there were two defective tracks, the available tracks would be numberd from 0 thru 64.

The disc tracks are divided into 30 sections called sectors which are logically numbered in even integers from 0 through 58 and numbered physically from 0 through 29. Each sector can contain 256 bytes (or 128 words) of data. The disc sectors can be numbered in one of two ways according to the formatting choice. The "standard" format places four fill sectors between contiguously numbered sectors (i.e., *0*,6,12,18,24,*1*,7,13,19,25, *2*, etc.).

The "standard" format optimizes single sector throughput by allowing 22 ms to elapse between reading or writing on one sector and reading or writing on the next. As each sector is scanned in 5.5 ms, including the scanned sector and four "fill" sectors, a read or write operation takes 28 ms per sector. The addition of the "fill" sectors provides the RTE software operating system enough time to process the 128 words of the sector and be ready for the next 128 words.

If the data processing has not completed before entering the next sector to be read from or written to, the disc must rotate a complete revolution of 167.7 ms, picking up the sector on the next pass. If no sector in the sequence is missed on the first pass, then one complete track can be read in five disc revolutions taking about 1 second.

The "fast format" disc has the 30 sectors sequentially numbered with no "fill" sectors. Thus, there is no RTE processing time allowed between sectors and each sector is read from or written to in 5.5 ms. To take advantage of this increase in throughput rate requires the use of a buffer of substantial size to store the data until it can be processed. The recommended buffer size is 1000 words or greater. Refer to figure B-2 for a transfer time comparison of standard and fast formats vs buffer size.

Sectors on adjacent tracks are offset by four "fill" sectors positioned opposite to the direction of rotation in order to prevent missed sectors when seeking sequentially across track boundaries (e.g., from track 1, sector 29 to track 2, sector 0). This offset is used for both the standard and fast formats (see figure B-1).

B-3. DISC ORGANIZATION

Each disc has a maximum of 67 tracks, 30 sectors per track, and 128 words per sector. Sectors are addressed through the RTE driver DVR33 as even sectors only, numbered 0 thru 58. The first word on track 0, sector 0 contains the number of good tracks on that particular disc. The second word contains either a (5) for the standard format, of a (1) for the "fast" format. The format number equals the number of disc revolutions required to read every sector in a track.

When using the flexible disc subsystem with the RTE File Manager, the File Manager Directory will be recorded on the last available track (track 66 less the number of bad tracks). If more than one directory track was specified, then additional tracks are used in descending numerical order (e.g., 65, 64, etc.). The directory track format will be found in the appropriate file manager documentation for the system.

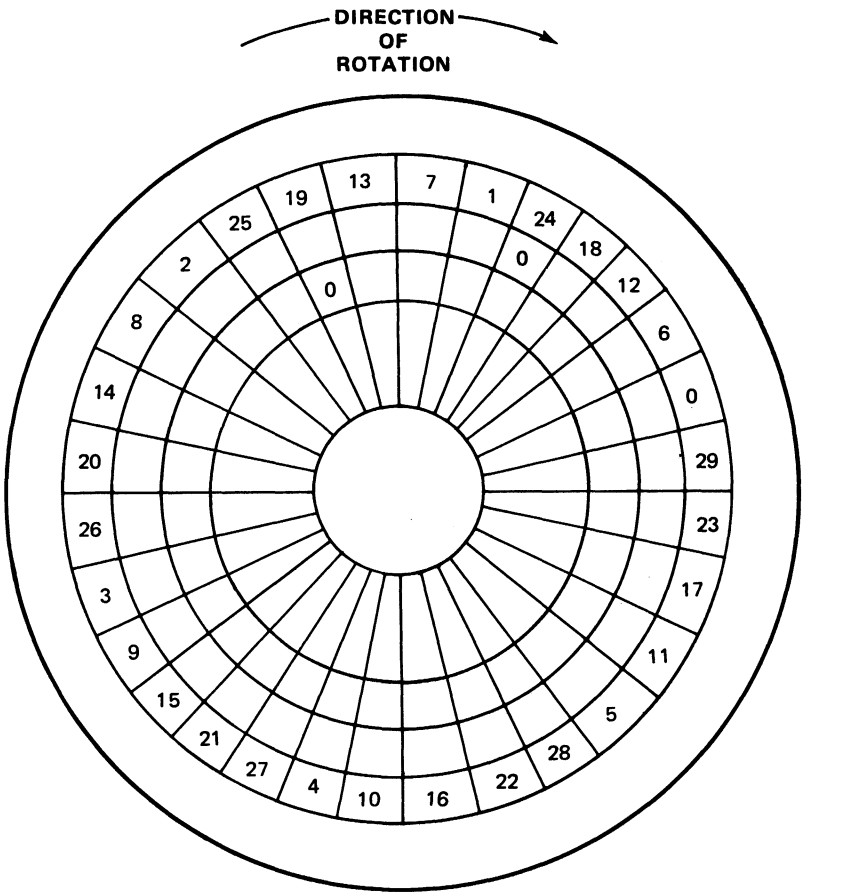
B-4. BACKUP DISCS

Flexible discs may deteriorate with age. This condition is indicated when there are persistent data recovery problems. The system reports a data recovery problem with the following "Equipment Error Message":

```
TR nnn EQT eqt
Upp U
```

where: nnn = Track Number
eqt = EQT Number
pp = Unit or Subchannel Number

If this error repeatedly occurs on a particular disc, the user should make a copy on a new flexible disc.



NOTES:

1. SHADED SECTORS SHOW SECTORS READ FROM 0 IN TRACK 0 FOR ONE REVOLUTION OF DISC. SECTOR 0 OF TRACKS 1 AND 2 ARE SHOWN TO ILLUSTRATE TRACK - TO - TRACK SECTOR OFFSET.
2. NOT TO SCALE.

Figure B-1. Flexible Disc Formats

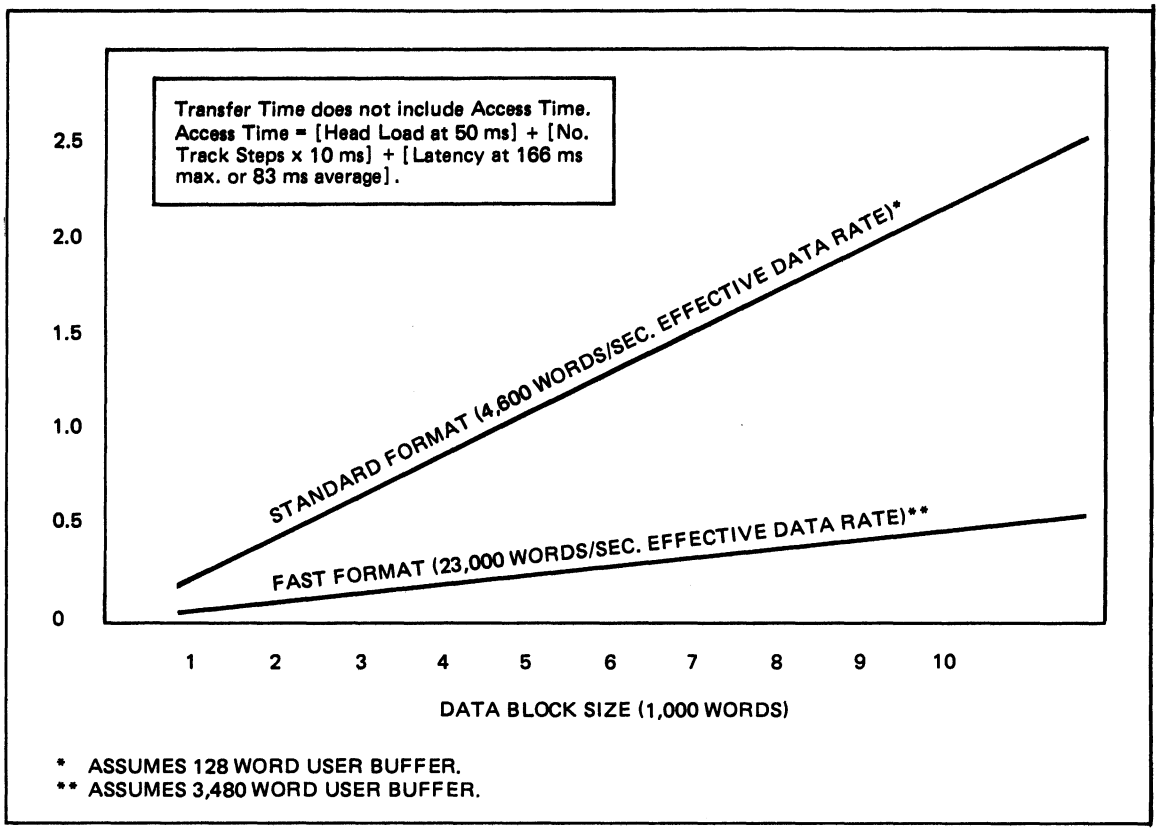


Figure B-2. Transfer Time vs Data Block Size for Standard and Fast Formats

USING THE HP 12732A IN RTE OPERATING SYSTEMS

APPENDIX C

This appendix describes the differences in using DVR33 and the HP 9885M/S in Hewlett-Packard RTE Operating Systems.

The flexible disc in the HP 9885M/S cannot be used as a system disc (LU2) in RTE operating systems. (RTE-M operating systems do not employ a system disc.) Also, the Track Map Table for RTE-II, RTE-III, RTE-IV, and RTE-IVB system disc tracks does not exist for the HP 9885M/S.

The flexible disc can be used with any of the RTE operating systems as an FMP (File Manager Package) disc or as a peripheral disc. When used as an FMP disc, there will be a logical area for file storage and a directory of files stored which are both managed by the FMGR (File Manager). When used as a peripheral disc, it is available to the user for read and write operations which are not managed by the FMGR. The flexible disc cannot be used for spooling with DVR33.

If the FMGR is to be used with the flexible disc, a formatted disc must be mounted and initialized. Mount the disc by entering the Mount Cartridge command of the FMGR:

MC, lu

where: "lu" is the logical unit number of the disc drive (omit the last track number parameter). Not specifying the last track causes the FMGR to request DVR33 to return the last track number which it reads from word 1 of track 0, sector 0.

The disc is Initialized by DSKET. The Initialization parameters may be changed by entering the Initialized Cartridge command of the FMGR:

IN, [master security code], cartridge, label, id [,1st trk [,#dir trks [,60 (#sec/trk) [,bad tracks]]]]

where: the #sectors/trk= 60 for the disc's 30, 128-word sectors (RTE recognizes only 64 word sectors for cartridge discs). See the appropriate RTE manual for the other listed parameters.

For additional information on the use of the MC and IN commands, refer to the file manager manual for your operating system as follows: for RTE-II, RTE-III, and RTE-IV use the *Batch Spool Monitor Reference Manual,* part no. 92060-90013, for RTE-IVB use the *RTE-IVB Terminal User's Reference Manual,* part no. 92068-90002, and for RTE-M use the *RTE-M Programmer's Reference Manual,* part no. 92064-90002.

If the user attempts to write in track 0, sector 0 for both FMP or peripheral discs, the request will be rejected by DVR33 with a system IO07 error message. When using the FMGR for the flexible disc, therefore, protect the track 0, sector 0 information by creating a dummy type 1 file, 1 block long immediately after initialization. Set up the dummy file with the Create File Command.

CR, namr

where: "namr" is the file name and parameters. DSKET creates a "dummy" file "FLOPLK".

PART NO. 12732-90001
PRINTED: OCT 1979
Printed in U.S.A.
REV. CODE 1903

HEWLETT hp PACKARD

Sales and service from 172 offices in 65 countries.
11000 Wolfe Road, Cupertino, California 95014