



# **RTE Driver DVR23 for HP 7970 Series Digital Magnetic Tape Units**

**Reference Manual**

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# General Information

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This manual contains information and procedures that allow you to write application programs using FORTRAN or Assembly language and RTE Driver DVR23. Chapter 3 provides information required when configuring DVR23 into a Real-Time Executive (RTE) Operating System.

The driver is entered through a FORTRAN or Assembly language call to control one to four HP 7970 Series 9-track Digital Magnetic Tape Units (via an HP 13181A or HP 13183A Magnetic Tape Unit Interface Kit) in an RTE environment. The interface provides all tape motion and data transfer control signals required for generating IBM-compatible nine-track formats. The multi-speed capability of the interface kit permits interfacing with tape units operating at 12.5, 37.5, or 45 inches per second with a packing density of 800 or 1600 characters per inch. (Commonly controlled paralleled tape units must be at the same tape speeds.)

The interface kit requires two computer I/O addresses: a command channel address and a data channel address. The data channel is assigned the higher priority I/O address. DMA is required for all tape speed configurations.

## Operating Environment

The operating environment for this software must be an HP 21xx Series Computer, an RTE Operating System, and interface kit hardware. Refer to one of the following manuals for interface kit hardware details:

- *HP 13181A Digital Magnetic Tape Unit Interface Kit Operating and Service Manual*, part number 13181-90901
- *HP 13183A Digital Magnetic Tape Unit Interface Kit Operating and Service Manual*, part number 13183-90000

# Application Information

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## General

This chapter details the calls to the driver. Before writing programs using the driver, it is recommended that you consult Chapter 3 of the interface kit operating and service manual. That chapter provides instructions on how to operate the tape unit, including a description of controller commands, status information, and typical Assembly language operating programs.

## Calling Sequences

The HP 7970 Series Magnetic Tape Unit is operated in the RTE System through FORTRAN/Assembly language programs calling DVR23. The driver will cause the magnetic tape unit to respond to Read, Write, Control and Status requests using the standard calls to EXEC. These calls are listed in Tables 2-1 through 2-3.

## Status Request

Information returned from a status request is detailed in Table 2-4. Note that:

1. A rewind, backspace record, or backspace file request will perform no action if the tape unit is at load point. The start-of-tape condition will be reflected both before and after the request in the status word.
2. Forwardspace file and backspace file commands cause the tape unit to go forward or backward until a file mark has been detected. Data is not transferred, but parity is checked. A parity error in any record of the file will set the parity error status bit. A backspace file will position the tape in front of a file mark or at load point whichever comes first.
3. If the end-of-tape mark is sensed during the execution of a forwardspace file function, the tape will stop at the end of the current record rather than after a file mark. The user must check for this condition with a status request.

**Table 2-1. HP 7970 Read/Write Calls (DVR23)**

<p><b>Assembly:</b></p> <pre> EXT EXEC . . JSB EXEC DEF *+5 DEF ICODE DEF ICNWD DEF IBUFR DEF IBUFL &lt;return point&gt; </pre>	<p>where:</p> <p>ICODE = Function code  1 = Read request  2 = Write request</p> <p>ICNWD = Control word  Bits 0–5 = LU number of tape unit  Bit 6 = Type of data; only used when a zero-length read occurs.  0 = ASCII read/write  1 = binary read/write  Bit 10 = Transparency bit  1 = transparent request  0 = non-transparent request</p> <p>When the transparent bit is not set, the tape LU will be placed down if more than two forward motion requests are attempted at or beyond the EOT marker. When the transparent bit is set, there are no restrictions on the number of forward motion requests processed at or beyond the EOT marker.</p> <p style="text-align: center;"><b>CAUTION</b></p> <p><i>When the transparent bit is set, it is the responsibility of the user program to check and handle the EOT condition. If the user program does not check for EOT, tape run-off can occur.</i></p> <p>All other bits are set to zero (0).</p> <p>IBUFR = Address of first word of input/output buffer</p> <p>IBUFL = Input/output buffer length in either characters or words. A negative value indicates ASCII characters (2 per word); a positive value indicates words. A length of 0 on output causes immediate completion of the request. On input, only as much data as will fit within specified buffer length is transmitted. A zero-length buffer size on Binary Read causes a forward skip of one record. A zero-length buffer size on ASCII read causes immediate completion of the request. The minimum length of a Read/Write operation for tape unit is one word or 2 characters. Because of hardware limitations, only even byte length records can be written.</p> <p>On Return: A = Status (see Table 2-4)  B = Transmission Log. The positive number of word or characters transmitted on all reads and unbuffered writes. Units will be words if IBUFL is positive and characters if IBUFL is negative.</p>
<p><b>FORTRAN:</b></p> <pre> CALL EXEC ( ICODE , ICNWD , IBUFR , IBUFL ) </pre>	

**Table 2-2. HP 7970 Control Request Calls (DVR23)**

<p><b>Assembly:</b></p> <pre> EXT EXEC . . JSB EXEC DEF *+3 DEF ICODE DEF ICNWD &lt;return point&gt; </pre>	<p>where:</p> <p>ICODE = Function code; 3 = Control request</p> <p>ICNWD = Control word</p> <p>Bits 0–5 = LU number of tape unit</p> <p>Bits 6–9 = Function code:</p> <ul style="list-style-type: none"> <li>01 = Write End-of-File</li> <li>02 = Backspace 1 record</li> <li>03 = Forward 1 record</li> <li>04 = Rewind</li> <li>05 = Rewind/Standby</li> <li>06 = Dynamic Status</li> <li>12 = Erase 4 inches of tape</li> <li>13 = Forward file</li> <li>14 = Backspace file</li> </ul> <p>Motion requests (codes 02 thru 04 and 12 thru 14) set the transmission log to zero. When a rewind is requested, control is returned to the caller after a rewind is indicated (before rewind is completed).</p> <p>Dynamic Status request 06 is never buffered by the system. Therefore, the status returned by this call is always a post operation status.</p> <p>Bit 10 = Transparency bit</p> <ul style="list-style-type: none"> <li>1 = transparent request</li> <li>0 = non-transparent request</li> </ul> <p>When the transparent bit is not set, the tape LU will be placed down if more than two forward motion requests are attempted at or beyond the EOT marker. When the transparent bit is set, there are no restrictions on the number of forward motion requests processed at or beyond the EOT marker.</p> <p style="text-align: center;"><b>CAUTION</b></p> <p style="text-align: center;"><i>When the transparent bit is set, it is the responsibility of the user program to check and handle the EOT condition. If the user program does not check for EOT, tape run-off can occur.</i></p> <p>All other bits are set to zero (0).</p> <p>On Return: A = Status (see Table 2-4). For a buffered device, the status is not affected, but retains the same value as before the request was made.</p> <p>B = No meaning.</p>
<p><b>FORTRAN:</b></p> <pre> CALL EXEC (3, ICNWD) </pre>	



**Table 2-3. HP 7970 Status Request Call (DVR23)**

<p><b>Assembly:</b></p> <pre>EXT EXEC . . JSB EXEC DEF *+4 (or 5) DEF ICODE DEF ICNWD DEF ISTA1 DEF ISTA2 (optional) &lt;return point&gt;</pre>	<p>where:</p> <p>ICODE = Function code; 13 = Status request</p> <p>ICNWD = Control word Bits 0–5 = LU number of tape unit All Other Bits = not used</p> <p>ISTA1 = Word 5 of Equipment Table (EQT) Tape Unit Status flags. See Table 2-4 for format.</p> <p>ISTA2 = Word 4 of EQT. See Table 2-5 for format.</p>
<p><b>FORTTRAN:</b></p> <pre>CALL EXEC (13, ICNWD, ISTA1, ISTA2 [optional])</pre>	

**Table 2-4. Status Return Information (ISTA1)**

Bits	Function																		
14 and 15	Tape unit availability code: 0 = Unit available for use (not busy) 1 = Unit disabled 2 = Unit currently in operation (busy) 3 = Unit waiting for an available DMA channel																		
13 – 8	Equipment code Always = 23 octal																		
7 – 0	Status flags. Meaning when on (1 = on, 0 = off) <table border="0"> <thead> <tr> <th>Bit</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>7</td> <td>End-of-file record encountered when reading, forward spacing, or backward spacing.</td> </tr> <tr> <td>6</td> <td>Start-of-tape marker sensed.</td> </tr> <tr> <td>5</td> <td>End-of-tape marker sensed.</td> </tr> <tr> <td>4</td> <td>Timing error on last read/write operation.</td> </tr> <tr> <td>3</td> <td>I/O request rejected: a. Tape motion required, but tape is at load point. b. Backward tape motion required, but tape is at load point. c. Write Request was given, but reel does not have a Write enable ring.</td> </tr> <tr> <td>2</td> <td>Reel does not have a Write enable ring.</td> </tr> <tr> <td>1</td> <td>Parity and/or timing error.</td> </tr> <tr> <td>0</td> <td>Tape unit not online (this bit can be ignored by the user).</td> </tr> </tbody> </table>	Bit	Status	7	End-of-file record encountered when reading, forward spacing, or backward spacing.	6	Start-of-tape marker sensed.	5	End-of-tape marker sensed.	4	Timing error on last read/write operation.	3	I/O request rejected: a. Tape motion required, but tape is at load point. b. Backward tape motion required, but tape is at load point. c. Write Request was given, but reel does not have a Write enable ring.	2	Reel does not have a Write enable ring.	1	Parity and/or timing error.	0	Tape unit not online (this bit can be ignored by the user).
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2	Reel does not have a Write enable ring.																		
1	Parity and/or timing error.																		
0	Tape unit not online (this bit can be ignored by the user).																		

**Table 2-5. Status Return Information (ISTA2)**

Word	Contents																
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
EQT 4	D	B	P	S	T	Unit No.						Channel No.					
ISTA2	D = 1 if DMA is required. B = 1 if automatic output buffering is used. P = 1 if driver is to process powerfail. S = 1 if driver is to process timeout. T = 1 if device timed out (system sets to zero before each I/O request). Unit = Last subchannel addressed. Channel = I/O select code for device (lower number if a multi-board interface).																

# Error Recover Procedures

## Read Parity Error

The driver will re-read a given record up to ten times before declaring the parity error to be irrecoverable. After the tenth attempt, the last try will be transmitted to the user buffer and nominal return taken. The status will indicate the parity error; the user must check for this condition. The operating system prints:

```
I/O ERR PE EQT #n
```

where:

*n* is the Equipment Table (EQT) entry number.

## Write Parity Error

The driver will continue to retry writing a given record until one of three conditions is met:

- a. The record is successfully written.
- b. The end-of-tape (EOT) is encountered.
- c. 75 attempts have been made.

## Equipment Not Ready

The tape unit will stop if a write is made and no write ring is provided or if a tape motion request is made when the tape unit is offline. The operating system prints:

```
I/O ERR NR EQT #n
```

where:

*n* is the Equipment Table (EQT) entry number.

## Attempted Write at End-of-Tape (EOT)

The drive will allow one additional forward motion request made after an EOT condition is encountered.

There are only two “legal” forward motion requests after EOT:

- a. Write end-of-file (EOF) mark.
- b. Read record.

A second forward motion request after EOT is sensed, will put the magnetic tape unit down. This is to ensure that the user rewinds the magnetic tape, inserts a new reel, and ups the unit.

Backward motion requests (rewind and backspace record and backspace file) will reinstate the EOT situation to the way it was upon first encountering EOT.

## Limited Length Records

The minimum record length is one word. The maximum record length is dependent on DMA operation and available memory. Only the length specified in the request will actually be transmitted from or to the user buffer. Note that due to hardware limitations of the controller, DVR23 cannot write odd byte length records.

## Dynamic Status

The dynamic status request has been provided so that the actual status of the tape unit can be determined. Because this type of status request goes all the way to the driver for its operation, it may take slightly longer than the normal status request. The status word is returned in the A-Register to the user. This request will not be processed until the mag tape EQT entry is not busy. The EQT entry is updated by this request.



# Configuration Information

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This section provides configuration information for Driver DVR23 and is intended to augment the data provided in the RTE Software System programming and operating manuals.

Note that DVR23 drives either an 800 BPI or a 1600 BPI 9-track magnetic tape.

## Generation

The driver is loaded into the RTE system during system generation. At this time, the following items must be supplied by the operator to configure the tape unit into the RTE system being generated:

### Program Input Phase

Driver DVR23 must be relocated during this phase.

### Table Generation Phase

In this phase, the following three entries must be made:

- a. An Equipment Table entry for each HP 13181A or HP 13183A Interface card:

```
*  EQUIPMENT TABLE ENTRY
EQT m?
.
.
nn, DVR23, [B], T=700
.
.
```

where:

- m* is the EQT number of the tape.
- nn* is the lower-numbered select code of the HP 13181A or HP 13183A Interface card.
- B is output buffering enabled. This is not required but is usually set to increase the throughput for short records. It can, however, have the adverse effect of causing some utilities to suspend due to lack of System Available Memory (SAM). HP supplied utilities use the “unbuffered bit” in their EXEC calls for large record transfers to eliminate this condition.
- T is the timeout value in units of tens of milliseconds.

Note that the D bit is not required since DVR23 will allocate a DCPC channel automatically when needed.

- b. A Device Reference Table (DRT) entry for each HP 13181A or HP 13183A Interface card:

```
* DEVICE REFERENCE TABLE
.
.
n = EQT ?
m
.
.
```

where:

*n* is the logical unit number assigned to the tape drive.

Response *m* is the EQT number of the tape drive that corresponds to the *nn*, DVR23 position in the Equipment Table.

- c. An Interrupt Table entry for each HP-13181A or HP-13183A card:

```
* INTERRUPT TABLE
.
.
nn, EQT, m
nn+1, EQT, m
.
.
```

where:

*nn* is again the lower-numbered select code of the HP 13181A or HP 13183A Card.

*nn+1* is the higher-numbered select code of the card.

*m* is again the position of the tape drive in the Equipment Table.

Below is an example of the entries that could be made for the three tables discussed above. In this example, the magnetic tape interface cards are in select codes 13 and 14, the EQT number of the tape drive is 3, and the LU number is 4.

Equipment Table:           EQT 01?  
                                   12,DVR32,D  
                                   EQT 02?  
                                   11,DVR00,B  
                                   EQT 03?  
                                   13,DVR23,B,T=700

Device Reference Table:    1 = EQT ?  
                                   2  
                                   2 = EQT ?  
                                   1  
                                   3 = EQT ?  
                                   0  
                                   4 = EQT ?  
                                   3  
                                   .  
                                   .

Interrupt Table:           11,EQT,2  
                                   -  
                                   12,EQT,1  
                                   -  
                                   13,EQT,3  
                                   -  
                                   14,EQT,3  
                                   -  
                                   .  
                                   .





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