PROGRAMMING AND OPERATING MANUAL

REAL-TIME EXECUTIVE SYSTEM DRIVER DVR 24

FOR

HP 7970 SERIES DIGITAL MAGNETIC TAPE UNITS

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HEWLETT hp PACKARD

Automatic Measurement Division
974 East Arques Avenue
Sunnyvale, California 94086

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SECTION I
GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

1-2. This manual contains information and procedures that will allow the user to write application programs using FORTRAN or Assembly language and RTE Driver DVR24. Section III provides information required when configuring DVR24 into a Real-Time Executive Operating System.

1-3. The driver is entered through a FORTRAN or Assembly language call to control one to four HP 7970 Series 7-track Digital Magnetic Tape Units (via a HP 13182A Magnetic Tape Unit Interface Kit) in a Real-Time Executive Operating System environment. The interface provides all tape motion and data transfers control signals required for generating both IBM-compatible binary-coded-decimal (BCD), and HP binary 7-track formats. The multidensity/speed capability of the interface kit permits interfacing with tape units operating at 12.5, 25, 37.5, or 45 inches per second with packing densities of 200, 556, and 800 characters per inch. (Paralleled tape units may operate at different packing densities but must be at the same tape speeds.)

1-4. 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. Direct memory access (DMA) is required.

1-5. OPERATING ENVIRONMENT

1-6. The operating environment for this software must be a HP 2150 Series Computer, a RTE Operating System, and the interface kit hardware. Refer to the HP 13182A Digital Magnetic Tape Unit Interface Kit Operating and Service Manual (HP Part No. 13182-90005) for interface kit hardware details.

1-7. COMPONENTS

1-8. The following components are included with driver DVR24:

a. This manual.
b. Driver DVR24 binary tape, HP Part No. 25117-60499.

SECTION II
APPLICATION INFORMATION

2-1. GENERAL

2-2. This section details the calls to the driver and describes any requests of the hardware/software marriage where the hardware may influence software techniques.

2-3. Before writing programs using the driver, it is recommended that the user consult Section III of the HP 13182A Interface Kit Operating and Service manual. This provides instructions on how to operate the tape unit, including a description of controller commands, status information, and typical Assembly language operating programs.

2-4. CALLING SEQUENCES

2-5. The HP 7970 Series Magnetic Tape Unit(s) is operated in the Real-Time Executive System through FORTRAN/Assembly language programs calling DVR24. The driver will cause the magnetic tape unit to respond to Read, Write, and Control requests using the standard calls to EXEC. These calls are listed in Tables 2-1 through 2-3 and discussed in Paragraphs 2-6 through 2-20.

2-6. WRITE REQUEST

2-7. Writing on to magnetic tape may be performed in one of two modes: BCD or Binary. In the BCD mode, for the transmission of any given computer word, bits 13 through 8 are sent first and followed by bits 5 through Ø, resulting in two BCD characters being transmitted to the magnetic tape. See Figure 2-1.

2-8. When the special BCD mode feature is used, the integer CPU tape word should appear as shown in Figure 2-2. When this data word is transmitted, it is transferred in the order shown, high order and then low order. In the binary mode, for the transmission of any given computer word, bits 15 through 10 are sent first, followed by bits 10 through 5, and then bits 5 through 0. See Figure 2-3. This results in three magnetic tape characters per 16-bit word.

2-9. The minimum number of characters that can be written in either mode (BCD or binary) is three. The maximum record length that may be written in the BCD mode is 67 words (134 characters). The maximum record length that may be written in the binary mode is limited only by DMA capacity (16K) and the amount of time taken by DMA to make the transfer. These limits are hardware defined and software enforced.

2-10. If the driver checks after a record and finds that a parity or timing error occurred, the driver backspaces, gaps, and rewrites the record. If a parity or timing error occurs on the 3-inch gap, the Write request will be aborted.

2-11. READ REQUESTS

2-12. Data may be read from magnetic tape that was written in one of the formats described under Write requests.

2-13. The ultimate limit for reading data is 16K words for either the BCD or binary mode. However when reading long BCD records, the interrupt system is off while the driver is marking the BCD-to-ASCII conversions. Therefore, a reasonable limit (less than 500 characters) does exist which, if exceeded, will result in the loss of a tick of the time base generator. A read request for less than the physical length of the record will result in a timing error. Data actually read will, however, be correct and only the number of characters requested are transmitted.

2-14. A zero buffer length on a binary Read causes a forward skip of one record.

2-15. All ASCII characters that are written in BCD format onto the tape will be read from the tape as the same ASCII character except for the ampersand (&). The "&" is written as BCD 30 (octal 60). The BCD 30 is read as "+".

2-16. On a Read parity error, the driver rereads the records three times before setting the parity error status bit and returning to the calling program. The final read attempt is sent to the program buffer and the system will print:

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

The magnetic tape unit will be downed by the system. It is the responsibility of the operator to "up" the unit before continuing.

2-17. CONTROL REQUESTS

2-18. The control and positioning requests (using bits 9 through 6 of ICNWD) are described in Table 2-2.

2-19. STATUS REQUEST

2-20. The Status request call is shown in Table 2-3. The status bits of the magnetic tape unit are contained in Equipment Table word 5 and are as listed in Table 2-4.

Table 2-1. HP 7970 Read/Write Calls (DVR24)

Assembly Language	Where:
EXT EXEC . . JSB EXEC DEF *+5 DEF ICODE DEF ICNWD DEF IBUFR DEF IBUFL <return point>	ICODE = Function code 1 = Read 2 = Write ICNWD = Control Word Bits 0 thru 5 = Logical unit number of tape unit Bit 6 = Data transfer mode 0 = ASCII 1 = Binary All unused bits. = Set to zero. IBUFR = Address of first word of input/output buffer IBUFL = Input/Output buffer length in either characters or words. a. A negative value indicates ASCII characters (two per word); a positive value indicates words. b. A length of zero causes immediate completion of request. c. On input, only as much data as will fit within specified buffer length is transmitted. d. A zero length buffer size on binary Read causes a forward skip of one record e. A zero length buffer size on ASCII Read causes immediate completion of request. f. Minimum length of a Read/write operation for tape unit is one word (two characters). g. Tape unit does not write an odd number of characters; driver will "pad" input buffer if an odd number of characters is read.
FORTRAN	CALL EXEC(ICODE,ICNWD,IBUFR,IBUFL)

Table 2-2. Request Control Call (DVR24)

Assembly Language

```
EXT  EXEC
 .
 .
JSB  EXEC
DEF  *+3
DEF  ICODE
DEF  ICNWD
<return point>
 .
 .
```

Where:

ICODE = Function Code
3 = Control request

ICNWD = Control word.
Bits 0 thru 5 = Logical unit number of tape unit
Bits 6 thru 13 = Function code:
01 = Write End-of-File
02 = Backspace 1 record
03 = Forward space 1 record
04 = Rewind
05 = Rewind/standby
06 = Dynamic status
12 = Erase 4 inches of tape
13 = Forward space file
14 = Backspace file

All unused bits = Set to 0.

NOTE

Motion request (codes 02 through 05 and 12 through 14) set transmission log to zero.

When a rewind is requested, control is returned to called after a rewind is initiated (before rewind is completed).

FORTRAN

```
CALL EXEC(3,ICNWD)
```

Table 2-3. HP 7970 Status Request Call (DVR24)

Assembly Language	Where:
EXT EXEC . . JSB EXEC DEF *+4(or 5) DEF ICODE DEF ICNWD DEF ISTA1 DEF ISTA2(optional) <return point>	ICODE = Function Code 13 = Status Request FCNWD = Control word Bits 0 thru 5 = Logical unit number of tape unit All other bits = Not used. ISTA1 = Word 5 of Equipment Table (EQT). Tape Unit Status flags. See Table 2-4 for format. ISTA2 = Most recent transmission count. May be omitted from calling sequence.
FORTRAN	CALL EXEC(13,ICODE,ICNWD,ISTA1,ISTA2 [optional])

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): Bit — Status 7 — End-of-file record encountered while 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 controller busy. 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 on line. NOTE Bit 3 can be ignored by the user.

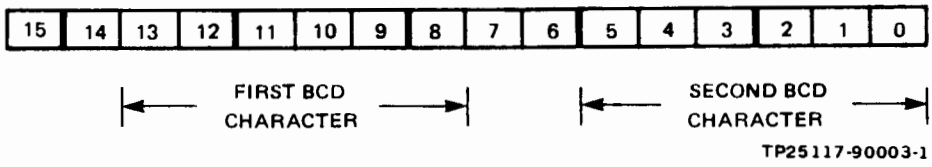

Figure 2-1. BCD Mode

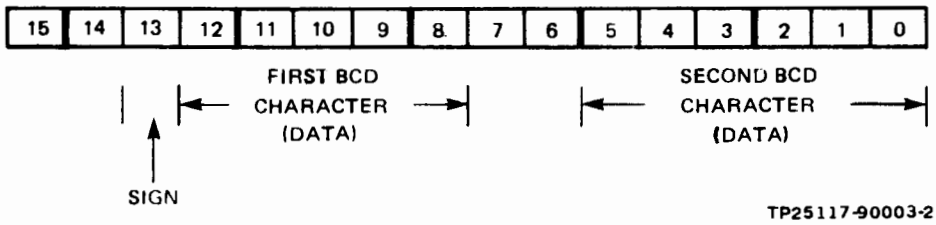

Figure 2-2. BCD Special Mode

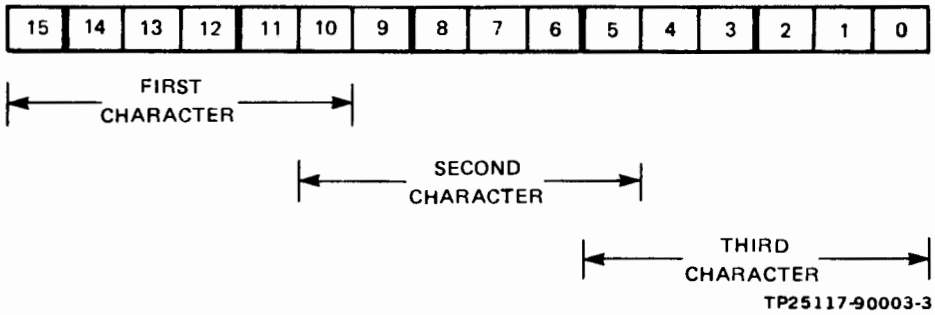

Figure 2-3. Binary Mode

c. An Interrupt Table entry for each HP 7970 Magnetic Tape Unit.

```
*INTERRUPT TABLE
  .
  .
xx,EQT,yy
  .
  .
```

Where "xx" is again the select code and "yy" is the EQT number of the magnetic tape unit.