

# **RTE-IVB Drivers DVR32 and DVA32 Reference Manual**



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**HEWLETT-PACKARD COMPANY**  
Data Systems Division  
11000 Wolfe Road  
Cupertino, California 95014

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# Chapter 1

## General Information

This manual contains information and procedures needed to write FORTRAN or Assembly application programs that call RTE-IVB disc drivers DVR32 and DVA32.

This chapter lists the components of the driver and describes the operating environment required. Chapter 2 describes the drivers' calling sequences, error conditions, and device time-out processing. Chapter 3 contains information used when incorporating DVA32 or DVR32 (or both) into an RTE-IVB operating system.

Appendix A lists performance characteristics and recommended time-out values for disc drives serviced by DVA32 and DVR32.

### Components

DVA32 and DVR32 consist of the following components:

- a. This manual, part number 92068-90012.
- b. The binary relocatable file %DVA32, part number 92067-16553, or %DVR32, part number 92067-16330 (revision 2001 or later).

### Operating Environment

The operating environment must include:

- a. HP 1000M/E/F Series computer.
- b. RTE-IVB operating system.
- c. For DVA32: 12821A Integrated Controller Disc (ICD) card.  
For DVR32: 13175A/B Controller Interface Card and 13037B/C Multiple Access Controller.
- d. For DVA32: Any of the following disc drives connected to the 12821A interface. Up to two of any combination is allowable.  
9895      7906H      7920H      7925H  
For DVR32: Any of the following disc drives connected to the 13037B/C controller. Up to eight of any combination is allowable.

7905      7906      7920      7925



# Chapter 2

## Application Information

DVA32 provides the software interface between RTE-IVB user programs and Integrated Controller Disc (ICD) disc drives (listed in Chapter 1). DVR32 performs the same function for Multiple Access Controller (MAC) drives. DVA32 communicates with the disc via the 12821A ICD card. The card communicates with individual controllers contained in each 79xxH and 9895 disc drive.

The driver accesses a specific disc drive by means of an address number between 0 and 7 assigned to the drive during the initialization phase of generation, and set with a switch on the drive.

DVR32 communicates with the 79xx drives via the 13175A/B Controller Interface Card and the 13037B/C Multiple Access Controller. A specific drive is accessed by means of a unit number between 0 and 7 assigned during generation and set with a switch on the drive. MAC disc drives and DVR32 support multiple-CPU configurations. Information about this capability is included in Appendix B of the RTE-IVB System Managers Manual.

All disc drives accessed by DVR32 and DVA32 have 128-word physical sectors. Both drivers, however, operate using 64-word logical sectors. The specification of sector number in an RTE read or write operation refers to a logical 64-word sector, not a 128-word physical sector. For most efficient usage, all operations (particularly write operations) should start on an even numbered logical sector and end on an odd numbered logical sector.

DVA32 is compatible with DVR32 (programs that use DVR32 will run with DVA32) with the exception that ICD drives and DVA32 do not support the multiple-CPU capability. Also, ICD drives and DVA32 do not have error correction capability, although they do have complete error detection capability.

This section describes read, write, and status requests for both drivers. A control request (EXEC 3) may be used as a LOCK or UNLOCK function for DVR32 in a multiple-CPU environment. For information about this feature refer to RTE-IVB System Manager's Manual, Appendix B. The drivers will handle a control request from the system if the calling program is aborted during an I/O operation.

## Read and Write Requests

Table 2-1 shows the calling sequences used in FORTRAN and Assembler to read and write data.

Table 2-1. READ and WRITE Calling Sequences

ASSEMBLY	Where:
EXT EXEC	RTRN = Return address
.	ICODE = Request code: 1=read, 2=write
JSB EXEC	ICNWD = Control word:
DEF RTRN	Bits 0 through 5 = LU number of disc subchannel
DEF ICODE	Bit 10: 1 = Verify after write
DEF ICNWD	0 = Do not verify after write
DEF IBUFR	IBUFR = Starting address of buffer
DEF IBUFL	IBUFL = Length of buffer: positive indicates words, negative indicates characters
DEF ITRAK	ITRAK = Track number (decimal)
DEF ISECT	ISECT = Sector number (decimal)
FORTRAN	CALL EXEC(ICODE,ICNWD,IBUFR,IBUFL,ITRAK,ISECT)

If bit 10 in the control word (ICNWD) is set, the driver will perform a data verification routine after the write. If an error is detected, the driver will again attempt the write and verification. This process is repeated until successful data transfer is verified, or until ten write attempts have been made, at which point a track error is reported (refer to ERROR CONDITIONS later in this chapter).

During a read, DVR32 executes an error detection and correction routine. If an error is detected and can not be corrected by this routine, DVR32 attempts the read again. A track error is reported after ten read attempts. DVA32 follows the same procedure except that it does not perform error correction, but will retry the read up to 10 times before reporting a track error.

Upon return the B register contains the transmission log. This is the positive number of words or characters transferred, depending on which the user specified. The A register contains status information explained in the following section of this Chapter.



If a request is made in which the track number (ITRAK) is greater than the size of the subchannel, or if track number = -1, the driver returns after setting the B register to the number of tracks on the subchannel, and setting bit 5 in EQT word 5 to 1 (refer to RTE-IVB Programmer's Reference Manual, Chapter 2, I/O Status Word Format). If the request was a read, the driver also returns the number of 64-word sectors per track in IBUFR(1).

A read or write request will cause an IO07 error ("Driver has rejected call") and program abortion under the following conditions:

- a. The subchannel number corresponding to the LU number in ICNWD was larger than the number of subchannels defined in the initialization phase of generation.
- b. The sector number was larger than the number of sectors per track on the drive.
- c. The sector or track number was negative (except for track number = -1, explained above).
- d. The length of the requested transfer (IBUFL) was larger than the length of the track, or the operation would go beyond the end of the subchannel.

### Status Request

Table 2-2 shows FORTRAN and Assembly calling sequences for a status request.

Table 2-2. Status Request Calling Sequence

ASSEMBLY	
	Where:
JSB EXEC	
DEF RTRN	RTRN = Return address
DEF ICODE	ICODE = Request code: 13 decimal
DEF ICNWD	ICNWD = Logical unit number
DEF ISTA1	ISTA1 = Status word 1 (word 5 of EQT entry)
DEF ISTA2	ISTA2 = Status word 2 (optional - EQT word 4)
DEF ISTA3	ISTA3 = Status word 3 (optional - word 2 of DRT entry)
FORTRAN	CALL EXEC(ICODE,ICNWD,ISTA1[,ISTA2][,ISTA3])

Table 2-3 describes the information returned in ISTA1 from EQT word 5.

Application Information

Table 2-3. Status Word 1 (ISTAL) Information

BIT	MEANING
0	ANY ERROR. Set if any bit marked * is true.
1*	BUSY. Set if drive is busy (seek incomplete).
2*	NOT READY. Set if drive is not ready.
3*	SEEK CHECK. Set if a seek check condition (illegal track address, head malfunction, etc.) has occurred.
4	PROTECT. Set if the track is flagged as protected.
5*	FAULT. Set if any of a number of hardware failures has occurred. Refer to appropriate hardware manual.
6	FORMAT. Set if the Format switch of the drive is "on".
7	PROTECTED. Set if the "Protected" switch of the accessed disc is "on".

For more information about EQT words 4 and 5, and DRT word 2, refer to RTE-IVB Programmer's Reference Manual, Appendix C.

In addition to the EXEC 13 status request, another request is available that returns the two controller status words from the previous operation as well as the two current status words. Table 2-4 shows the calling sequence for this status request.

Table 2-4. Full Status Read Calling Sequence

ASSEMBLY	
	Where:
JSB EXEC	
DEF RTRN	RTRN = Return address
DEF ICODE	ICODE = 1 (READ)
DEF ICNWD	ICNWD = Bits 0 - 5 : logical unit number Bits 6 - 10: 23 octal (function code)
DEF IBUFR	IBUFR = Buffer address
DEF IBUFL	IBUFL = Length of buffer: 2 or 4 words
DEF ITRAK	ITRAK is not used
DEF ISECT	ISECT is not used
FORTTRAN	CALL EXEC (ICODE, ICNWD, IBUFR, IBUFL, ITRAK, ISECT)

If the buffer length is 2, only the current controller status words are returned in IBUFR(1) and IBUFR(2), respectively. If the buffer length is 4, the two status words of the previous operation are returned in IBUFR(3) and IBUFR(4), and the current status words are returned in IBUFR(1) and IBUFR(2).

If the specified buffer length is not 2 or 4, the program will abort with an IO07 error.

## Error Conditions

This section describes DVR32 and DVA32 error conditions.

**IO07 Error** - Driver rejects call, program aborted.

- a. DMA not assigned for the device . DMA can be assigned during system generation in RTE-IVB.
- b. Requested subchannel number is out of range. Check LU#.
- c. Requested length of transfer too large. Length + starting sector# \* 64 was larger than the track size (number of sectors/track \* 64).
- d. Requested negative track or sector number (except track = -1, described earlier in this section).

**Track Error** - parity error exit.

Format: TR nn EQT xx U yy S(or U)

where: "nn" = logical track number (track number relative to subchannel)

"xx" = EQT entry number

"yy" = subchannel number

"S(or U)" = the request was from System (or User).

This error occurs in the following situations:

- a. Verify after write or error detection after read indicates that an error occurred after ten attempts.
- b. "Seek check" error condition detected after six write attempts. Check if disc is formatted.
- c. Controller status indicates illegal access to spare track.
- d. Attempted to write on protected track with the format switch "off".
- e. Overrun exists after ten read attempts. Detected by disc controller whenever instantaneous data transfer rate of controller exceeds that of DMA.
- f. Attempted to write when the protect switch on drive is "on".

## Application Information

### IO Not Ready

Format: IONR Lnn Exx Syy zzz

where: "nn" = LU number

"xx" = EQT entry number

"yy" = Subchannel number

"zzz" = Status word, see Table 2.3

- a. Disc controller indicates drive not ready.
- b. Disc controller returns status indicating hardware malfunction exists.
- c. Drive is busy.
- d. DVA32 only. Drive timed-out because:
  1. Device address is invalid or non-existent.
  2. Power is down on the specified device.
  3. Disc did not respond within the time specified in EQT14, or within 2 seconds if the user has not specified the time-out length (refer to Device Time-Out Processing later in this Chapter).

### Immediate Completion

Driver executes a normal exit without doing any I/O to the disc controller. This occurs when the requested track number is -1 or is larger than the number of tracks on the subchannel. As previously explained, the B register is set to the number of tracks on the subchannel, bit 5 in EQT5 is set, and if the request was a read, the number of 64-word sectors per track is returned in IBUF(1).

## Return Codes

Below is an explanation of the information returned in the A and B registers upon return from the Initiation and Continuation/Completion sections of DVA32 and DVR32. For more information about standard driver structure and functions, see RTE Operating System Driver Writing Manual, part number 92200-93005.

### Initiation Section

Return codes from this section are as follows:

A = 0 Operation initiated

A = 1 Illegal write or read. Caused by:

1. Negative track number (except -1) was specified.
2. Requested length of transfer was too large.
3. Requested sector number larger than number of sectors per track on drive.

A = 3 Equipment malfunction exists or equipment is not ready.

A = 4 Indicates immediate completion has occurred. Caused by:

1. Requested track number was too large or = -1 .
2. Received control request with a non-zero subfunction code. (e.g. subfunction code of 22 for call from disc library routine, 23 for full status read.)

### Continuation/Completion Section

A = 0 Successful completion.

A = 1 Equipment malfunction, or drive not ready.

A = 3 One or the following data transmission errors:

1. Error detected during write verification.
2. Data overrun occurred during read.
3. Transfer incomplete.

B = Transmission log. This is the positive number of words or characters transmitted, depending on which the user requested. B = 0 for time-out during request from a disc library routine, refer to the following section.

## Device Time-Out Processing

It is strongly recommended that the user set the time-out value for DVA32 at generation time or by using the RTE "TO" command. If it is not set at generation time, or is set to "0" with the "TO" command, the default time-out value of two seconds is assumed by DVA32. Refer to Appendix A for recommended time-out values for specific disc drives.

DVR32 does not process its own time-outs (they are processed by the system). It is not necessary to set a time-out value since the driver has access to device status information as long as the 13037 controller is powered on and functional. If a time-out value is set for DVR32 the system processes it as follows:

When a time-out occurs the system issues a "IOTO" message and the LU of the I/O request is set down. The program that called the driver resumes and the value of the transmission log (from the B-register) returned to it is zero. Since DVR32 has access to device status information, it is able to detect if a drive is down. In this case the driver returns from the initiation section to RTE I/O control module (RTIOC) after setting the A register = 3. The system then issues an "IONR" message.

For a time-out during a call from a disc library routine, the action taken by DVR32 is the same as that taken by DVA32, explained below.

DVA32 processes time-outs in the following manner:

For a normal time-out (the call was not from a disc library routine) the driver clears the interface card and returns from the continuation section to RTIOC after setting the A register = 1, indicating "device malfunction". The system issues an "IONR" error. Since the interface card does not have access to device status information, the message issued upon time-out will always be "IONR", rather than "IOTO".

NOTE: Disc library routines are used by SWTCH, FORMT, and the disc backup utilities. They reside in the libraries:

\$DSCLB 92067-12002 ICD/MAC Disc Utilities Library

\$DKULB 92067-12003 ICD/MAC Disc Backup Library

For a time-out during a request from a disc library routine the driver returns from the continuation section to RTIOC after setting the A and B registers = 0, indicating "disc library time-out". No error message is issued by the system, and the time-out should be handled by the program which called the disc library routine.

# Chapter 3

## Configuration Information

This Chapter contains configuration information for DVA32 and DVR32.

For more information, refer to the following manuals:

- \* RTE-IVB On-Line Generator Reference Manual, part number 92068-90007
- \* RTE-IVB System Manager's Manual, part number 92068-90006
- \* RTE-IVB Programmer's Reference Manual, part number 92068-90004
- \* RTE-IVB Utility Programs Reference Manual, part number 92068-90010

Follow the procedures below to configure the appropriate driver into the RTE-IVB system at generation time.

The examples below use DVA32. The procedure is the same for both drivers, with the exception that the time-out value does not need to be set for DVR32.

### Program Input Phase

Load the driver along with the other I/O drivers by making the following entry:

```
PROG INPUT PHASE:  
.  
.  
.  
REL, &DVA32
```

### Table Generation Phase

During this phase make the following entries:

1. Equipment Table entry.

```
EQUIPMENT TABLE ENTRY  
.  
.  
.  
EQT n?  
sc, DVA32,D,T=x
```

where:

"n" is the EQT entry number.

"sc" is the octal select code of the ICD card

"D" indicates that DMA is required.

DVA32 only =

"x" is the desired time-out value expressed in tens of milliseconds. (Refer to Appendix A.)

2. A Device Reference Table (DRT) entry relating the desired LU number for each disc subchannel defined during the initialization phase of generation:

DEVICE REFERENCE TABLE

```
      .  
      .  
      .  
lu = EQT#?  
n,m
```

where:

"lu" is an LU number.

"n" is the EQT entry number associated with the LU number.

"m" is the subchannel number associated with the LU number.

Note: All disc LU's must be numbered less than 64.

3. An interrupt table entry for the ICD card (or MAC card for DVR32):

INTERRUPT TABLE:

```
      .  
      .  
      .  
sc,EQT,n
```

where:

"sc" is the octal select code of the ICD card (or MAC card for DVR32).

"n" is the EQT entry number from step "1" above.



## Multiple Disc Interfaces

This section explains procedures used when configuring additional disc interfaces into an RTE-IVB system.

### Different Interfaces

To configure both an ICD and a MAC interface into your RTE-IVB system, follow the procedure in the above section for both drivers. In addition, you must provide your own relocatable track map table module during the Program Input Phase to accompany the peripheral disc driver (that driver which does not support the system disc subchannel on LU 2). A track map table contains your disc subchannel definitions. The system disc track map table is defined interactively during the initialization phase of generation, and thus need not be supplied by the user.

The track map table used by DVR32 is \$TB32, and that used by DVA32 is \$TA32. Both track map tables must exist if both DVR32 and DVA32 are included in your system. If DVR32 supports the system disc (\$TB32 was constructed during generation) then the user must supply the track map table \$TA32 to be used by DVA32. If DVA32 supports the system disc, then \$TB32 must be supplied by the user. Directions for building and assembling a track map table module are included in Appendix B of the RTE-IVB System Manager's Manual. A sample source and relocatable file for each table is distributed with your RTE-IVB system in the following files:

&\$TB32/%\$TB32	relocatable part number	92067-16509
&\$TA32/%\$TA32	relocatable part number	92067-16507

### Identical Interfaces

To configure two interfaces of the same type into your system, follow the procedure in the above section. The standard driver DVR32 or DVA32 is used and the corresponding track map table is defined by the generator.

For the second interface and driver, however, special provisions must be made. Because a driver can not service more than one interface, a separate driver and track map table must be included for the second interface. To avoid duplicate module and entry point names at generation time, the names of the driver, its entry points, and its track map table must be unique. For this reason, the following drivers are distributed with your RTE-IVB system:

filename:	part number:	driver name:	track map table used:	interface type:
%DVC32	92067-16506	DVC32	\$TC32	ICD (12821A)
%DVP32	92067-16508	DVP32	\$TP32	MAC (13175A/B)

The track map tables \$TC32 and \$TP32 can be built by modifying the source files &\$TA32 and &\$TB32, respectively, and assembling the new source file. The resulting relocatable module must be included along with the driver during the Program Input Phase of generation. The track map table subchannel definition format is shown in Appendix B of this manual. For more information about creating a track map table, refer to Appendix B of RTE-IVB System Manager's Manual.

# Appendix A

## Recommended Disc Time-Out Values

Table A-1. Disc Performance Characteristics  
and Recommended Time-Out Values

	9895	7905	7906(H)	7920(H)	7925(H)
# Tracks/Cylinder	2	3	4	5	9
# Cylinders	77	411	411	823	823
# Sectors/Track (64 word sectors)	60	48	48	48	64
Track to Track Seek Time	3ms/track +15ms track settling	5ms	5ms	5ms	5.4ms
Max Seek Time	231ms	45ms	45ms	45ms	48.5ms
Average Latency	83.3ms	8.33ms	8.33ms	8.33ms	11.11ms
Capacity Per drive (M-bytes)	1	15	20	50	121.4
Recommended time- out value (seconds)	see below	2	2	2	2

For the 79xxd drives, the default time-out value of 2 seconds will be sufficient in most cases. This value can be decreased, however, if the user's application requires faster detection of time-out conditions.

The time-out value for DVA32 should be set to the largest recommended time-out value among all devices serviced by the driver in your configuration.

In the case of the 9895 flexible disc (DVA32 only), the appropriate time-out value will vary according to how the sectors have been organized by the disc utility program FORMT. This program "interleaves" sectors on the 9895 according to the number of "fill" sectors specified by the user. For detailed information see the Utility Programs Reference Manual, part number 92068-90010. A good rule for determining the time-out value for the 9895 is:

$$\text{Time-out value (in seconds)} = (\text{fill\#} + 2) * 0.2$$

The formula is valid for fill values between 1 and 28. A fill value of 1 is the smallest recommended value, and will result in the fastest transfer rate. A fill value of 0 is not recommended.

# Appendix B

## TRACK MAP TABLE ENTRY FORMAT

Disc subchannel definitions in track map tables defined by the user follow the formats shown below.

Table B-1. \$TB32 Entry Format (DVR32)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
word 0	+-----+ #64-word sectors/track -----+															
1	+-----+ first cylinder # -----+															
2	+-----+ #surfaces   starting head #   unit # -----+															
3	+-----+ # tracks -----+															
4	+-----+   # spares -----+															

Table B-2. \$TA32 Entry Format (DVA32)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
word 0	+-----+ #64-word sectors/track -----+															
1	+-----+ first cylinder # -----+															
2	+-----+ # surfaces   starting head #   addr # -----+															
3	+-----+ # tracks -----+															
4	+-----+ 1 0 0   unit #   # spares -----+															



# Appendix C

## SUMMARY OF DVR32 AND DVA32 FEATURES

Table C-1. DVR32 and DVA32 Features

	DVR32:	DVA32:
Supported Discs	7905 7906 7920 7925	9895 7906H 7920H 7925H
Interface	13175A/B	12821A
Multiple CPU Access	YES	NO
Error Detection	YES	YES
Error Correction	YES	NO
Device Time-out Detection	NO	YES
On-Line Sparring and Initialization	YES	YES





**READER COMMENT SHEET**  
**RTE-IVB DRIVERS**  
**DVR32 and DVA32**  
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92068-90012

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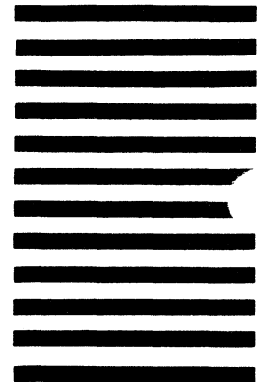


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