RTE Driver DVA13
(for HP 91200B)
Programming and Operating Manual

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PUBLICATION NOTICE

Text changes are supplied in the form of manual change notices or complete revisions to the manual. The publication history of any changes to this edition of the manual is given under "Publication History" below. The last change listed reflects the current software.

All changed pages are identified by a change number at the bottom of the page. Changed information is specifically identified by a vertical line (change bar) on the outer margin of the page.

PUBLICATION HISTORY

Second Edition .... November 1979

SAFETY CONSIDERATIONS

GENERAL - This product and relation documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOLS

⚠ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal (sometimes used in manual to indicate circuit common connected to grounded chassis).

WARNING **The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.**

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

CAUTION

STATIC SENSITIVE DEVICES

When any two materials make contact, their surfaces are crushed on the atomic level and electrons pass back and forth between the objects. On separation, one surface comes away with excess electrons (negatively charged) while the other is electron deficient (positively charged). The level of charge that is developed depends upon the type of material. Insulators can easily build up static charges in excess of 20,000 volts. A person working at a bench or walking across a floor can build up a charge of many thousands of volts. The amount of static voltage developed depends on the rate of generation of the charge and the capacitance of the body holding the charge. If the discharge happens to go through a semiconductor device and the transient current pulse is not effectively diverted by protection circuitry, the resulting current flow through the device can raise the temperature of internal junctions to their melting points. MOS structures are also susceptible to dielectric damage due to high fields. *The resulting damage can range from complete destruction to latent degradation.* Small geometry semiconductor devices are especially susceptible to damage by static discharge.

The basic concept of static protection for electronic components is the prevention of static build-up where possible and the quick removal of already existing charges. The means by which these charges are removed depend on whether the charged object is a conductor or an insulator. If the charged object is a conductor such as a metal tray or a person's body, grounding it will dissipate the charge. However, if the item to be discharged is an insulator such as a plastic box/tray or a person's clothing, ionized air must be used.

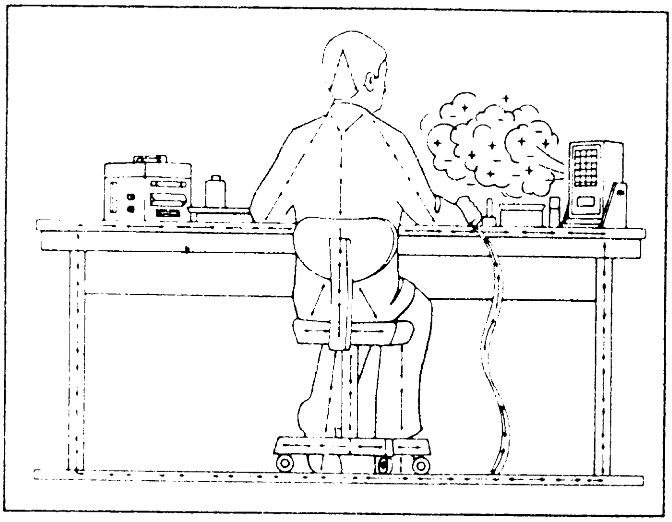
Effective anti-static systems must offer start-to-finish protection for the products that are intended to be protected. This means protection during initial production, in-plant transfer, packaging, shipment, unpacking and *ultimate use*. Methods and materials are in use today that provide this type of protection. The following procedures are recommended:

1. All semiconductor devices should be kept in "antistatic" plastic carriers. Made of transparent plastics coated with a special "antistatic" material which might wear off with excessive use, these inexpensive carriers are designed for short term service and should be discarded after a period of usage. *They should be checked periodically to see if they hold a static charge greater than 500 volts in which case they are rejected or recoated.* A 3M Model 703 static meter or equivalent can be used to measure static voltage, and if needed, carriers (and other non-conductive surfaces) can be recoated with "Staticide" (from Analytical Chemical Laboratory of Elk Grove Village, Ill.) to make them "antistatic."

2. Antistatic carriers holding finished devices are stored in transparent static shielding bags made by *3M Company*. Made of a special three-layer material (nickle/polyester/polyethylene) that is "antistatic" inside and highly conductive outside, they provide a Faraday cage-like shielding which protects devices inside. "Antistatic" carriers which contain semiconductor devices should be kept in these shielding bags during storage or in transit.

Individual devices should only be handled in a static safeguarded work station.

3. A typical static safeguarded work station is shown below including grounded conductive table top, wrist strap, and floor mat to discharge conductors as well as ionized air blowers to remove charge from nonconductors (clothes). Chairs should be metallic or made of conductive materials with a grounding strap or conductive rollers.



SAFETY EARTH GROUND - This is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

WARNING

EYE HAZARD

Eye protection must be worn when removing or inserting integrated circuits held in place with retaining clips.

CONTENTS

ILLUSTRATIONS

TABLES

GENERAL INFORMATION

SECTION I

1-1. GENERAL DESCRIPTION

1-2. This manual contains information and procedures that allow the user to write application programs using HP FORTRAN or HP Assembly language and Real-Time Executive (RTE) Driver DVA13. Section III provides information required when configurating DVA13 into a Real-Time Operating System.

1-3. Driver DVA13 and a library of graphic display subroutines supplied with the Real-Time Executive software (included in the HP 92062 RTE Driver Package) for the HP 91200B TV Interface Kit are used together to program display information on one or more black-and-white (BW) or color television (TV) monitors. The driver may also be called directly with HP FORTRAN or HP Assembly language calls to perform write and control requests. The Direct Memory Access (Dual Channel Port Controller for 21MX and HP 1000) function is required by the driver for write requests. Several TV monitors connected in parallel may be operated by the driver to display the same information on all monitors. Also, the driver is capable of operating one or more TV interface cards at the same time with each card supplying different information. If desired, two or three TV interface cards can be operated jointly to supply gray-scale video to a black-and-white monitor or color video to a color monitor.

1-4. Driver DVA13 can command the TV interface card(s) to perform the following functions:

a. Set mode (color) of display.

b. Set polarity of display.

c. Write any point(s) on a 256 x 256 display.

d. Erase any point(s) on a 256 x 256 display.

e. Erase entire display to selected polarity.

1-5. OPERATING ENVIRONMENT

1-6. The operating environment for this driver must be an HP 2100A/S, 21MX, or HP 1000 Computer, an RTE Operating System, and the HP 91200B TV Interface Kit. Refer to the *HP 91200B TV Interface Kit Installation and Service Manual,* part no. 91200-90001, for hardware details.

APPLICATION INFORMATION

SECTION II

2-1. GENERAL

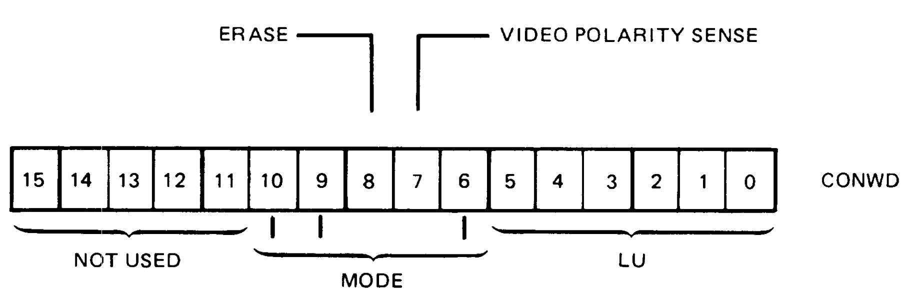
2-2. This section details the calls to the driver and describes any results of the hardware/software marriage where the hardware may influence software techniques.

2-3. CALLING SEQUENCE

2-4. The HP 91200B TV Interface Kit is operated in the RTE system through HP FORTRAN, HP BASIC, or HP Assembly language programs calling DVA13. The driver and the display subroutines are used together to allow the user to program display information for one or more TV monitors. The driver is not generally accessed directly by the calling program, rather calls are made to the library subroutines which format the proper calling sequences to the driver. These calls are described in Section III of the *HP 91200B TV Interface Kit Programming and Operating Manual,* part no. 91200-90006. Direct calls to the driver in HP FORTRAN or HP Assembly can also cause the TV interface card(s) to respond to control and write requests using the standard calls to EXEC. These calls are described in paragraphs 2-5 through 2-11.

2-5. CONTROL REQUESTS

2-6. Direct Memory Access (DMA) or Dual Channel Port Controller (DCPC) is not used for control functions and the DMA/DCPC channel is released. The control word format is illustrated in figure 2-1. Valid control functions recognized by the driver for control word bits 6 through 10 are fully detailed in table 2-1. Control requests with bit 8 set to 0 (mode and sense) are executed by storing the function code in a 2-bit mode control register on the TV interface card. This is achieved by issuing STF and CLC instructions followed by an OTA/B with bit 0 of the mode storage register programmed as shown in table 2-3. No interrupt is expected after these requests, and the driver does an immediate completion return.



1. Coding for CONWD is described in table 2-1.
2. Bits 11 through 15 are not used and are always zero.

Figure 2-1. CONWD Format

Table 2-1. Driver DVA13 Control Request

ASSEMBLY LANGUAGE

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

Where:

ICODE = Function code.
3 = Control.

ICNWD= Control word. See figure 2-1 for format.

Bits 0 thru 5 = Logical unit (LU) number of TV interface card.*

Bit 7 Video polarity sense.
0 = normal video polarity (color as specified by Mode bits 6,9,10).
1 = inverse video polarity (complement of color specified by Mode bits, 6,9,10).

Complementary pairs of colors are as follows:

3-Card System Normal Inverse	2-Card System Normal Inverse	1-Card System Normal Inverse
White - Black	Yellow - Black	Black - White
Red - Cyan	Red - Green	
Green - Magenta		
Blue - Yellow		

Bit 8 = Erase
1 = all other function bits ignored and screen cleared (bulk erase). Resulting screen is black if bit 7 = 0 in previous control request and white if bit 7 = 1.

Bits 6, 9, 10 = Mode (color).

Bits 10 9 6		3-Card Color	3-Card BW	2-Card Color	2-Card BW	1-Card BW
0 0 0 (0)	=	White	7/8 (White)	Yellow	3/4 (White)	White
0 0 1 (1)	=	Black	Black	Black	Black	Black
0 1 0 (2)	=	Red	1/2	Red	1/2	White
0 1 1 (3)	=	Green	1/4	Green	1/4	Black
1 0 0 (4)	=	Blue	1/8	Black	Black	Black
1 0 1 (5)	=	Yellow	3/4	Yellow	3/4 (White)	White
1 1 0 (6)	=	Magenta	5/8	Red	1/2	White
1 1 1 (7)	=	Cyan	3/8	Green	1/4	Black

*If the designated LU is for a non-zero subchannel, white is produced for all values of Mode except 001 (1) black.

FORTRAN

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

2-7. A control request with bit 8 set to 1 (erase) is executed by a MIA instruction. An interrupt is required and the driver does a normal interrupt return.

2-8. TIME OUT

2-9. The driver processes time-out interrupts so that a CLC instruction will not be sent to the TV interface card and the card will not be "downed". The driver does a normal completion upon time-out.

2-10. WRITE REQUESTS

2-11. A write request is a request for DMA/DCPC transfer of 16-bit XY coordinates to the TV interface card. The call is fully detailed in table 2-2. The driver initiates the DMA/DCPC transfer. An STC command follows each word transfer but no final CLC instruction is issued. The driver prevents a final DMA/DCPC interrupt, but responds to a device interrupt to determine completion of the transfer.

Table 2-2. Driver DVA13 Write Request

ASSEMBLY LANGUAGE	
EXT EXEC • • JSB EXEC DEF *+5 DEF ICODE DEF LU DEF IBUFR DEF IBUFL <return point>	Where: ICODE = Function code. 1 = Write LU = Control word Bits 0 thru 5 = Logical unit (LU) number of TV interface card. IBUFR = An array of point XY coordinates to be transferred to the TV interface card. Bits 0 thru 7 = X coordinate Bits 8 thru 15 = Y coordinate Note: The points in IBUFR are written or erased in BW or color depending upon the format of ICNWD in the previously issued control request, as described in table 2-1. IBUFL = Length of array in words (points).
FORTRAN	CALL EXEC (1, LU, IBUFR, IBUFL)

2-12. USER NOTES

2-13. The following information is provided to enable the user to make better use of the software supplied.

a. When the TV interface card is initialized (PRESET), it is ready to accept the first data word as a control word. A control request should therefore precede a series of write requests in order to prevent the possibility of storing the first XY coordinate address as a control word.

b. When processing a control request, the driver releases the DMA/DCPC channel that has been assigned and returns a zero transmission log.

c. The driver sets bit 12 of its EQT4 entry to indicate that it will process a time-out.

d. The driver processes a time-out interrupt by clearing bit 11 of its EQT and returns with (A) = 0.

e. The driver processes a spurious interrupt by clearing its EQT15 entry.

f. The driver initiates a DMA/DCPC transfer for a write request and completes the request by setting the request buffer length in the transmission log.

2-14. HARDWARE OPERATION

2-15. The TV interface card controls the sense of the displayed video by selecting the polarity of the raw video that it generates. For either sense, writing a point stores a logical 0 in a random access memory (RAM) location corresponding to the XY coordinates of the point. Conversely, erasing a point stores a logical 1 in the RAM address location. Whether a point is written or erased depends on the state of the mode storage register on the TV interface card. Bit 1 of this register controls the video polarity (0 = normal, 1 = inverse) and bit 0 controls the write/erase function (0 = write, 1 = erase). In a three card system, the state of bit 1 is stored in the mode register on all three cards and the state of bit 0 is determined by the color programmed, as shown in table 2-3.

Table 2-3. Mode Storage Register Bit 0 Coding

COLOR	CONWD MODE CODE	CONWD BITS			MODE STORAGE REGISTER BIT 0		
		10	9	6	CARD A (RED)	CARD B (GREEN)	CARD C (BLUE)
White	0	0	0	0	0	0	0
Black	1	0	0	1	1	1	1
Red	2	0	1	0	0	1	1
Green	3	0	1	1	1	0	1
Blue	4	1	0	0	1	1	0
Yellow	5	1	0	1	0	0	1
Magenta	6	1	1	0	0	1	0
Cyan	7	1	1	1	1	0	0

RTE GENERATION

SECTION III

3-1. INTRODUCTION

3-2. This section provides supplementary information to the system generation instructions contained in the following RTE software manuals:

a. *HP Real-Time Executive-II Software System Programming and Operating Manual,* part no. 92001-93001.

b. *HP Real-Time Executive Core-Based Software System Programming and Operating Manual,* part no. 29101-93001.

c. *RTE-IV On-Line Generator Reference Manual,* part no. 92067-90002

d. *RTE-M System Generation Reference Manual,* part no. 92064-90003.

e. *RTE-IVB On-Line Generator Reference Manual,* part no. 92068-90007.

3-3. RTE GENERATION

3-4. The TV interface kit driver and library modules are loaded into the RTE system during RTGEN execution as described in the RTE system manuals. The items described in the following paragraphs must be supplied by the operator to configure the TV interface kit into the RTE system being generated.

3-5. PROGRAM INPUT PHASE

3-6. During the Program Input Phase, load the TV interface kit driver and library along with other I/O drivers and library programs being loaded. If a modified [TABL module is to be used (as discussed in Appendix A of the HP 91200B TV Interface Kit Programming and Operating Manual), load it *after* the TV interface kit library; this causes the modified [TABL to replace the library [TABL.

3-7. TABLE GENERATION PHASE

NOTE

In the following steps, "TV interface card" refers to the single card of a BW system or the master card (card A, red) of a multi-card system.

In the Table Generation Phase, make the following three entries:

a. An Equipment Table entry for the TV interface card:

```
*EQUIPMENT TABLE ENTRY
•
•
nn,DVA13,D,T=4
•
•
```

where "eqt" is the EQT entry number, "nn" is the select code or the TV interface card, "D" specifies the use of a DMA/DCPC channel, and "T" is the time-out value for the card. Set "T" to 4 (40 milliseconds). European systems may require a setting of 5 (50 milliseconds). Do not specify the buffering (B) option because buffering will slow down operation of the TV interface kit.

NOTE

The time-out values given assume POINT/PNTS programming with a buffer not exceeding 5K words. If a larger buffer is used, it may be necessary to increase the time-out setting.

b. A Device Reference Table entry relating the logical unit number chosen for the TV interface card to the Equipment Table entry.

```
*DEVICE REFERENCE TABLE
•
•
m = EQT #?
eqt
•
•
```

where "m" is the logical unit number to be assigned to the TV interface card and "eqt" is the EQT entry number for the card. Suppose the EQT entry was the sixth in the EQT table and the selected logical unit is 7; during entry of the DRT, the number 6,0 would be the correct response to 7 = EQT #?

A designated logical unit number with a non-zero subchannel will cause white to be produced for all values of MODE programming, with the exception of 001 (black). Designation of this *additional* logical unit number, in addition to the zero subchannel described above, provides the user with a convenient method of checking the black-and-white appearance of the color program.

c. An Interrupt Table entry for the TV interface card:

```
•
•
nn,EQT,eqt
•
•
```

where "nn" is the select code and "eqt" is the EQT entry number of the TV interface card.

3-8. RTE BASIC GENERATION

3-9. When generating an RTE BASIC system, add the TV interface library subroutines to the Branch and Mnemonic Tables as follows:

3-10. RTE-B

3-11. At the portion of the generation procedure where subroutines are added to the Branch and Mnemonic Tables, enter the following:

```
*ADD SUBROUTINES*
VIDLU(I,I),SUB=VIDLU
ERASE,SUB=ERASE
VECTR(I,I,I,I,I,I,I),SUB=VECTR
VAREA(I,I,I,I,I,I),SUB=VAREA
VEND(V,V),SUB=VEND
CHARS(I,I,R,I,I,I,I,),SUB=CHARS
PNTS(R,I,I),SUB=PNTS
/E
```

3-12. MULTI-USER REAL-TIME BASIC

3-13. Enter the following RTETG commands at Subroutine Table Generation:

```
VIDLU(I,I),OV=N,ENT=VIDLU,FIL=name
ERASE,OV=N,ENT=ERASE,FIL=name
VECTR(I,I,I,I,I,I,I),OV=N,ENT=VECTR,FIL=name
VAREA(I,I,I,I,I,I),OV=N,ENT=VAREA,FIL=name
VEND(IV,IV),OV=N,ENT=VEND,FIL=name
CHARS(I,I,RA,I,I,I,I),OV=N,ENT=CHARS,FIL=name
PNTS(RA,I,I),OV=N,ENT=PNTS,FIL=name
```

where:

"N" is the overlay number to be used for these routines.

"name" is the name of the file containing the TV interface library. If the TV interface library was configured into the RTE system at RTEGN time the ,FIL=name should be omitted.

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