

RTE Driver DVA13 (for HP 91200B)

Programming and Operating Manual



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.

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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 configuring 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.

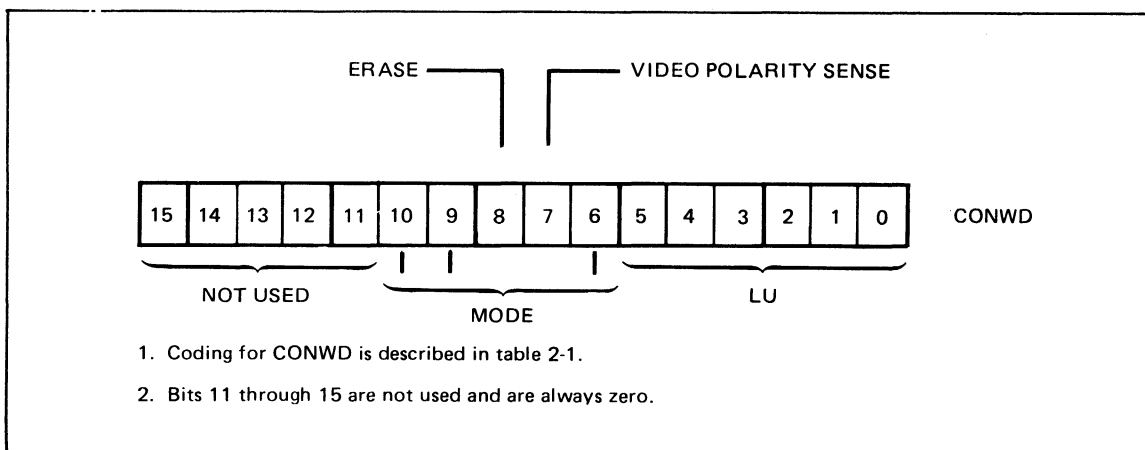


Figure 2-1. CONWD Format

Table 2-1. Driver DVA13 Control Request

ASSEMBLY LANGUAGE																																																																															
<pre> EXT EXEC . . JSB EXEC DEF *+3 DEF ICODE DEF ICNWD <return point> </pre>	<p>Where:</p> <p>ICODE = Function code. 3 = Control.</p> <p>ICNWD= Control word. See figure 2-1 for format.</p> <p>Bits 0 thru 5 } = Logical unit (LU) number of TV interface card.*</p> <p>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).</p> <p>Complementary pairs of colors are as follows:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">3-Card System</th> <th style="text-align: center;">2-Card System</th> <th style="text-align: center;">1-Card System</th> </tr> <tr> <th style="text-align: center;">Normal Inverse</th> <th style="text-align: center;">Normal Inverse</th> <th style="text-align: center;">Normal Inverse</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">White - Black</td> <td style="text-align: center;">Yellow - Black</td> <td style="text-align: center;">Black - White</td> </tr> <tr> <td style="text-align: center;">Red - Cyan</td> <td style="text-align: center;">Red - Green</td> <td></td> </tr> <tr> <td style="text-align: center;">Green - Magenta</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Blue - Yellow</td> <td></td> <td></td> </tr> </tbody> </table> <p>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.</p> <p>Bits 6, 9, 10 } = Mode (color).</p> <table style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="text-align: center;">Bits</th> <th style="text-align: center;">3-Card</th> <th style="text-align: center;">3-Card</th> <th style="text-align: center;">2-Card</th> <th style="text-align: center;">2-Card</th> <th style="text-align: center;">1-Card</th> </tr> <tr> <th style="text-align: center;">10 9 6</th> <th style="text-align: center;">Color</th> <th style="text-align: center;">BW</th> <th style="text-align: center;">Color</th> <th style="text-align: center;">BW</th> <th style="text-align: center;">BW</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0 0 0 (0)</td> <td style="text-align: center;">= White</td> <td style="text-align: center;">7/8 (White)</td> <td style="text-align: center;">Yellow</td> <td style="text-align: center;">3/4 (White)</td> <td style="text-align: center;">White</td> </tr> <tr> <td style="text-align: center;">0 0 1 (1)</td> <td style="text-align: center;">= Black</td> <td style="text-align: center;">Black</td> <td style="text-align: center;">Black</td> <td style="text-align: center;">Black</td> <td style="text-align: center;">Black</td> </tr> <tr> <td style="text-align: center;">0 1 0 (2)</td> <td style="text-align: center;">= Red</td> <td style="text-align: center;">1/2</td> <td style="text-align: center;">Red</td> <td style="text-align: center;">1/2</td> <td style="text-align: center;">White</td> </tr> <tr> <td style="text-align: center;">0 1 1 (3)</td> <td style="text-align: center;">= Green</td> <td style="text-align: center;">1/4</td> <td style="text-align: center;">Green</td> <td style="text-align: center;">1/4</td> <td style="text-align: center;">Black</td> </tr> <tr> <td style="text-align: center;">1 0 0 (4)</td> <td style="text-align: center;">= Blue</td> <td style="text-align: center;">1/8</td> <td style="text-align: center;">Black</td> <td style="text-align: center;">Black</td> <td style="text-align: center;">Black</td> </tr> <tr> <td style="text-align: center;">1 0 1 (5)</td> <td style="text-align: center;">= Yellow</td> <td style="text-align: center;">3/4</td> <td style="text-align: center;">Yellow</td> <td style="text-align: center;">3/4 (White)</td> <td style="text-align: center;">White</td> </tr> <tr> <td style="text-align: center;">1 1 0 (6)</td> <td style="text-align: center;">= Magenta</td> <td style="text-align: center;">5/8</td> <td style="text-align: center;">Red</td> <td style="text-align: center;">1/2</td> <td style="text-align: center;">White</td> </tr> <tr> <td style="text-align: center;">1 1 1 (7)</td> <td style="text-align: center;">= Cyan</td> <td style="text-align: center;">3/8</td> <td style="text-align: center;">Green</td> <td style="text-align: center;">1/4</td> <td style="text-align: center;">Black</td> </tr> </tbody> </table>	3-Card System	2-Card System	1-Card System	Normal Inverse	Normal Inverse	Normal Inverse	White - Black	Yellow - Black	Black - White	Red - Cyan	Red - Green		Green - Magenta			Blue - Yellow			Bits	3-Card	3-Card	2-Card	2-Card	1-Card	10 9 6	Color	BW	Color	BW	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
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1 0 0 (4)	= Blue	1/8	Black	Black	Black																																																																										
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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	
<pre> EXT EXEC . . JSB EXEC DEF *+5 DEF ICODE DEF LU DEF IBUFR DEF IBUFL <return point> </pre>	<p>Where:</p> <p>ICODE = Function code. 1 = Write</p> <p>LU = Control word Bits 0 thru 5 } = Logical unit (LU) number of TV interface card.</p> <p>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</p> <p>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.</p> <p>IBUFL = Length of array in words (points).</p>
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	
Black	1	0	0	1	1	1	
Red	2	0	1	0	0	1	
Green	3	0	1	1	1	1	
Blue	4	1	0	0	1	0	
Yellow	5	1	0	1	0	1	
Magenta	6	1	1	0	0	1	
Cyan	7	1	1	1	1	0	

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),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),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.

READER COMMENT SHEET

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

91200-90005

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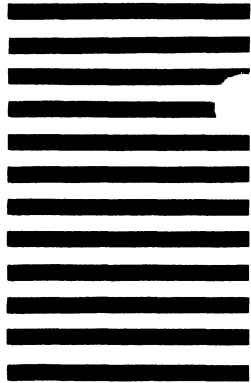


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Tel: 3041-82, 3068-38
Telex: 23051, 22822
E
Gerep
2 rue d'Agadir
Boite Postale 156
CASABLANCA
Tel: 272093, 272095
Telex: 23 739
P

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Van Heuven Goedhartlaan 121
NL 1181KK AMSTELVEEN
P.O. Box 667
NL 1180 AR AMSTELVEEN
Tel: (020) 47-20-21
Telex: 13 216 HEPAC NL
A,CH,CM,CS,E,MP,P

Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2906VK CAPELLE, A/D IJSSEL
P.O. Box 41
NL 2900AA CAPELLE, A/D IJSSEL
Tel: (10) 51-64-44
Telex: 21261 HEPAC NL
A,CH,CS,E

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Hewlett-Packard (N.Z.) Ltd.
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Kilbirnie, WELLINGTON 3
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Cable: HEWPACK Wellington
CH,CM,E,P

Northrop Instruments & Systems
Ltd.
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Telex: 60605
A,M

Northrop Instruments & Systems
Ltd.
110 Mandeville St.
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CHRISTCHURCH
Tel: 486-928
Telex: 4203
A,M

Northrop Instruments & Systems
Ltd.
Sturdee House
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N-5033 FYLLINGSDALEN (Bergen)
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OMAN

Khimjil Ramdas
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MUSCAT
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Telex: 3289 BROKER MB MUSCAT
P
Suhail & Saud Bahwan
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MUSCAT
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Mushko & Company Ltd.
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ISLAMABAD
Tel: 26875
Cable: FEMUS Rawalpindi
A,E,M
Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
KARACHI 0302
Tel: 524 131, 524 132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi
A,E,M,P*

PANAMA

Electrónico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 64-2700
Telex: 3483 ELECTRON PG
A,CM,E,M,P



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Arranged alphabetically by country

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LIMA 1
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Telex: Pub. Booth 25306
CM,E,M,P

PHILIPPINES

The Online Advanced Systems Corporation
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P.O. Box 1510
Metro MAMLA
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Telex: 3274 ONLINE
A,CH,CS,E,M
Electronic Specialists and Proponents Inc.
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Cubao, QUEZON CITY
P.O. Box 2649 Manila
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Telex: 40018, 42000 ITT GLOBE
MACKAY BOOTH
P

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Intercambio Mundial de Comércio S.A.R.L.
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P-LISBOA
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Telex: 16691 munter p
M
Soquímica
Av. da Liberdade, 220-2
1298 LISBOA Codex
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Telex: 13316 SABASA
P
Telectra-Empresa Técnica de Equipamentos Eléctricos S.A.R.L.
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QATAR

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Telex: 4806 CHPARB
P
Eastern Technical Services
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DOHA
Tel: 329 993
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Nasser Trading & Contracting
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DOHA
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Telex: 4439 NASSER DH
M

SAUDI ARABIA

Modern Electronic Establishment
Hewlett-Packard Division
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Thuobah
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CH,CS,E,M,P

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A

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A,CH,CS,E,M
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