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EXM-13A

True Color SVGA Controller

Reference

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Appendix A: Supported Video Modes A1

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1. Product Description

The EXM-13A expansion module is a Super VGA video controller using the NCR 77C22E+ controller chip. Software diskettes with video drivers and utilities are included for resolutions beyond the standard 640 x 480 x 16 colors; up to 1280 x 1024 x 256 colors are supported. The EXM-13A is available in two memory sizes: 1 MByte, which supports resolutions up to 1024 x 768, and 2 MBytes, which supports resolutions up to 1280 x 1024.

The EXM-13A implements the full VGA video standard, as well as a number of "Super VGA" resolutions. It has a standard DB-15 VGA connector for attachment to an analog VGA or multiscan monitor. It also has an auxiliary video connector similar to the auxiliary video extension in the IBM PS/2 and the feature connector on many VGA cards; this contains auxiliary video signals that can be used for connection to other types of displays, such as certain flat-panel displays.

For current users of the EXM-13 video adapter using standard VGA mode (640 x 480 x 16), the EXM-13A is a "drop-in" replacement. No additional drivers are required for this mode. The user may notice a slight delay on power-up because the EXM-13A has both more memory to check and performs a more extensive test of that memory.

The EXM-13A uses standard video memory and I/O addresses and thus cannot be used in systems with other video controllers also using these addresses. Therefore the EXM-13A cannot be used in an EPC-2 or EPC-3 system, since these have integrated VGA controllers. Also, more than one video controller cannot be used in a single system unless the application software ensures that no more than one video controller is enabled at any point in time.

WARNING!

DO NOT PLUG IN ANY CABLE OR CONNECTOR INTO THE FRONT PANEL CONNECTORS WHILE THE SYSTEM IS POWERED UP. IN GENERAL, ELECTRONICS EQUIPMENT IS NOT DESIGNED TO WITHSTAND POTENTIAL DAMAGE THAT COULD ARISE FROM

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FLUCTUATIONS IN POWER. **NEVER** PLUG IN A SERIAL OR PARALLEL DEVICE, KEYBOARD, TRANSCEIVER, MONITOR OR OTHER COMPONENT WHILE THE SYSTEM IS ON.

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Specifications

The following table defines the power and environmental specifications of the EXM-13A.

Environmental		
Temperature	operating	0 to 60°C ambient
	storage	-40 to 85°C
Humidity	operating	5 - 90% noncondensing
	storage	5 - 95% noncondensing
Altitude	operating	10,000 ft (3000 m)
	storage	50,000 ft (15,000 m)
Vibration	operating	0.015 inch (0.38 mm) P-P displacement with 2.5 g peak (max) acceleration over 5-2000 Hz
	storage	0.030 inch (0.76 mm) P-P displacement with 5.0 g peak (max) acceleration over 5-2000 Hz
Shock	operating	30 g, 11 ms duration, half-sine shock pulse
	storage	50 g, 11 ms duration, half-sine shock pulse
Electrical		
Power	maximum	8 W
	typical	3.5 W
Current	maximum	5V @ 1.6A
	typical	5V @ 0.7A
Other		
Weight		3.5 oz (105 g)
Addresses		
Memory		A000h - C7FFh
I/O		3B4h - 3DEh

Table 1. EXM-13A Environmental and Electrical Specifications.

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2. Installation

Before installing the EXM-13A, unpack and inspect it for shipping damage.

✉ **DO NOT REMOVE THE MODULE FROM ITS ANTI-STATIC BAG UNLESS YOU ARE IN A STATIC-FREE ENVIRONMENT. THE EXM-13A, LIKE MOST OTHER ELECTRONIC DEVICES, IS SUSCEPTIBLE TO ESD DAMAGE. ESD DAMAGE IS NOT ALWAYS IMMEDIATELY OBVIOUS, IN THAT IT CAN CAUSE A PARTIAL BREAKDOWN IN SEMICONDUCTOR DEVICES THAT MIGHT NOT IMMEDIATELY RESULT IN A FAILURE.**

✉ **ENSURE THAT THE INSTALLATION PROCESS AS DESCRIBED HEREIN IS ALSO PERFORMED IN A STATIC-FREE ENVIRONMENT.**

Insertion in an EXM Carrier

Insertion of the EXM-13A into an EXM carrier, such as the EMC, EXP-MC or the integrated EXM carriers in the EPC-4 or EPC-5 is straightforward. Remove any blank EXM panel from the carrier (by unscrewing the thumb-screws) and insert the EXM-13A into the cardguides. Firmly press the EXM-13A front panel to ensure that it has mated with the rear connector, and secure it with the thumbscrews.

✉ **MAKE SURE THAT POWER TO YOUR SYSTEM IS OFF. THE EXM IS NOT DESIGNED TO BE INSERTED OR REMOVED FROM A LIVE SYSTEM.**

✉ **WHEN INSERTING THE EXM, AVOID TOUCHING THE CIRCUIT BOARD, AND MAKE SURE THE ENVIRONMENT IS STATIC-FREE.**

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Configuring the BIOS Setup

The EXM configuration data in the EPC to which the EXM-13A is connected needs to be modified to recognize and enable the card and select from the available options. Invoke the BIOS setup function. This is done by pressing the CTRL-ALT-ESC keys simultaneously.

Enabling the EXM module

Once in the setup program, a menu will be displayed specifying which function keys are available for further configuration. Press the F2 function key to invoke the EXM menu. The screen looks something like the following:

```
EXM Setup Screen

          ID  OB1 OB2
Slot  0   ED  01  00
      1   FF  00  00
      2   FF  00  00
      3   FF  00  00
      4   FF  00  00
      5   FF  00  00
```

This displays the EXM configuration data (in hexadecimal) stored in nonvolatile memory which the EPC uses at power-up to recognize and configure each installed EXM. The displayed data shows SLOT, ID, OB1 and OB2. These are defined as follows:

SLOT — indicates the slot in which the EXM is installed. See the diagram below to determine which slot the EXM occupies. Dotted lines indicate EXM slots that may not exist on all chassis.

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EXM Slots

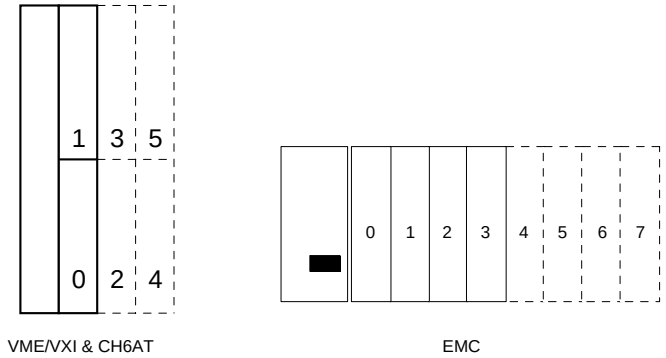


Figure 1. EXM Slot Numbering.

ID is a hard-wired ID value. Each EXM has a unique ID value.

OB1/OB2 are two bytes of option information.

Note that all slots are listed even if the system configuration does not have all the possible EXM slots. All slots **not** occupied by an EXM module should show an ID of FF and OB1/OB2 of 00 00 indicating that no EXM is present.

To add or change an EXM configuration, use the cursor keys (arrows) to move between the fields on the screen. Move the cursor to the appropriate slot entry and type in the correct value.

The **ID** for the EXM-13A should be set to **ED**. For upward compatibility, this is the same ID that is used on the EXM-13.

OB1 should be set to **01** to enable the card. OB1 of 00 disables the card.

OB2 is not used by the EXM-13A and should be set to **00**.

Default Initialization of Video EXMs

For a variety of reasons, the BIOS in EPCs automatically enables a video EXM if it finds that none are enabled. The primary reason is the chicken-and-egg problem of configuring the EXM the first time; one needs to be able to see the video output of the setup program in order to configure the video EXM.

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If the BIOS finds no enabled video EXM, it searches for the first video EXM by slot and enables it. If this occurs, use the setup program to configure the EXM properly to avoid receiving an EXM CONFIGURATION ERROR message every time the system is booted.

Connecting a Monitor

A monitor is connected via the 15-pin D connector on the EXM-13A front panel. The EXM-13A, being a VGA graphics controller, produces analog color signals, meaning that old-style EGA, CGA, and monochrome monitors cannot be used. VGA monitors may be color or gray scale; the EXM-13A automatically senses the difference between the two. If using a multiscan monitor, make sure to set the monitor's switch to analog (not TTL).

The monitor type cannot be detected correctly if the monitor is disconnected or powered off when the EPC is powered on or reset. Typical symptoms are lack of color on a color monitor and an error message about lack of a suitable video adapter when invoking Windows. If a color monitor is not detected correctly under MS-DOS, the command

```
mode co80
```

can be used to switch the controller into color mode.

To ensure a reliable connection, the monitor's cable should be screwed into the EXM-13A's connector.

Connecting a monitor is not absolutely necessary; its presence or absence does not affect the operation of the system.

Installing Super VGA Drivers

The EXM-13A supports certain video modes beyond standard VGA mode (see Appendix A for a complete list of supported modes under Windows). Use of these modes requires a Super VGA or multiscan monitor, as well as special software drivers. Drivers are provided on accompanying diskettes for Microsoft Windows, OS/2, SCO Unix and several other software packages.

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Updated video drivers are available on the NCR Bulletin Board System (BBS) at (719) 596-1649.

Other operating systems may or may not have Super VGA driver support for the NCR 77C22E+ chip. When using an operating system other than DOS, OS/2, or SCO Unix consult the operating system manual for details on supported video modes and drivers.

Installing the Windows Drivers

The video drivers supplied on the accompanying diskettes are in compressed form. Insert Disk #1 into the floppy drive. Make that drive A: is the active drive. Then type `INSTALL`. This expands the files and copies them to the local hard disk. Follow the instructions on the screen carefully. When prompted, highlight both `SOFTMODE & UTILITIES` and the appropriate Windows version drivers. Softmode is a device driver that works with the Windows driver and is required for Windows to display high resolution graphics.

After running the `INSTALL` program, change to the sub-directory containing `SOFTMODE & UTILITIES` and invoke `SOFTSET`. This program tests the system and monitor for compatible video modes. Not all Super VGA monitors support all modes. `SOFTSET` then adds a line to the CONFIG.SYS file listing the supported modes; something similar to the following:

```
DEVICE=.....\SOFTMODE.SYS  /m:2,15,16,3,.....
```

Reboot the system so `SOFTMODE` is loaded.

To install the actual Windows driver, run the Windows setup program from the DOS prompt. Change to the Windows sub-directory and, at the DOS prompt, type `SETUP`. The executable will display a list of hardware recognized by Windows. Use the cursor arrows to highlight the video display line and press ENTER. This will display a list of supported video drivers. At the end of the list is an entry something like "`OTHER (requires hardware vendor diskette)`". The setup program will ask for a driver diskette. Enter the name of the drive and sub-directory where the Windows drivers were copied.

VSHIFT

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The VSHIFT program is used to center the screen when using the EXM-13A with the EXM-14. To install the VSHIFT software from the Miscellaneous disk, follow the instructions below.

1. Insert the EXM13A Miscellaneous disk into drive A:.
2. Install the VSHIFT files onto the hard drive by running VINST. Include the location where you want the files to be copied to. For example, to install VSHIFT in the C:\TEMP directory, type the following:

   A:\VINST C:\TEMP

To use VSHIFT, type VSHIFT from the command line. You must supply an instruction following the command: i.e., (U)p, (D)own, (R)ight, or (L)eft. For example, type VSHIFT 2L to shift the screen two vertical scan lines to the left. You can combine instructions, such as VSHIFT 2R 2D to shift the screen image two lines right and two lines down, or VSHIFT 2U 2R to shift the screen two lines up and two lines right. Whenever you enter a command, keep track of what you enter so that you will eventually discover what the best single starting instruction is.

Once you have determined the optimum VSHIFT command, insert that single instruction into your STARTUP.COM statement. Every time the machine is turned off, the monitor defaults back to the original setting.

Installing the OS/2 Drivers

To install the OS/2 drivers, OS/2 must be loaded using the FAT file structure. This procedure does not work with the HPFS file structure.

The following procedures are for OS/2 up to version 1.3. Refer to the following section for instructions that pertain to OS/2 version 2.1.

OS/2 Version 1.3

First, the drivers must be installed to the hard disk under DOS, either using a DOS window or by booting from a DOS floppy disk. Run the `INSTALL` program on the software drivers diskette. When prompted, highlight the OS/2 drivers for installation. By default, the drivers are installed on the hard disk under the `PM` directory.

If OS/2 is running, perform a `SHUTDOWN`. OS/2 locks the video driver files when running, so the system must be rebooted under DOS. At the DOS

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prompt, copy all the .DLL files in the PM directory to the \OS2\DLL directory. Change directories to \OS2\DLL.

Rename DISPLAY.DLL to DISPLAY.OLD. Rename BVHVGA.DLL to BVHVGA.OLD.

Copy BVH77C22.DLL to BVHVGA.DLL.

NCR800.DLL is the 800 x 600 driver. NCR1024.DLL is the 1024 x 768 driver. Copy the appropriate driver to DISPLAY.DLL.

Reboot the system to OS/2.

OS/2 Version 2.1

The OS/2 video drivers provide for higher screen resolutions, such as 1024 x 768 x 256 colors. To install the OS/2 version 2.1 video drivers, follow the instructions below:

1. Insert the EXM13A Miscellaneous disk into drive A:
2. Run the install program on the disk. Don't forget to put the drive letter of your OS/2 installation. For example, if OS/2 was installed on drive D: the following command would be used:

   A:\INSTALL D

3. Click on "Primary Display", then click on "OK".
4. Select "NCR 77C22E+/77C32BLT SVGA Chipset." Press "OK".
5. Answer the prompt to indicate what type of monitor is attached.
6. Select the appropriate driver resolution from the list and press "OK".
7. The next panel allows you to change the source directory. Simply press "INSTALL..." and accept the default of "A:\".
8. Files will be copied to your hard drive. **CONFIG.SYS, OS2.INI**, and **SYSTEM.INI** will be modified to use the new SVGA drivers.
9. A message window will be displayed stating that the system must be shutdown and rebooted for the changes to take effect. Press "OK" to continue.

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If the standard VGA (640x480x16) drivers are installed after installing NCR high resolution drivers, an extra line may be left in **CONFIG.SYS** that will generate a warning message. This is the result of an attempt to load two virtual video drivers. Edit **CONFIG.SYS** and delete the extra line.

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Example: After installing NCR's SVGA drivers and reinstalling the standard VGA drivers, **CONFIG.SYS** may have these two lines:

```
DEVICE=C:\OS2\MDOS\VSVGANCR.SYS
DEVICE=C:\OS2\MDOS\VVGA.SYS
```

Delete (or remark) the NCR driver to use the standard VGA driver.

```
REM DEVICE=C:\OS2\MDOS\VSVGANCR.SYS
DEVICE=C:\OS2\MDOS\VVGA.SYS
```

Installing the SCO ODT Driver

To install the SCO Unix driver, run the `INSTALL` program on a DOS machine. When prompted, highlight the SCO Unix driver to be installed. After installation, copy the driver to a floppy disk.

Boot SCO ODT as normal. Open a shell window. Type the following commands:

```
cd /usr/lib/grafinfo
mkdir ncr
cd ncr
doscp /def/fd0:pc3433.xgi
mkdev graphics
```

Select `Update`. Select the NCR 3433 driver from the video card list. Select the desired resolution and then the type of monitor that is connected.

Quit and save the configuration.

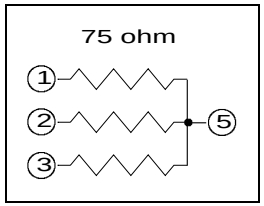
Reboot SCO ODT.

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Flat-Panel Displays

Flat-panel displays have a number of different conventions for interfacing to a VGA controller. Most require some of the signals on the auxiliary connector. Some connect to the analog color signals; others do not. Some "non-color" flat panels operate best with the video controller in gray-scale mode; others have their own color-to-gray-scale conversion logic and require color mode. The latter may require that the EXM be "tricked" into thinking that an analog color monitor is connected.

The EXM-13A detects the type of monitor in use at the time of system reset by sensing the three analog color signals on the DB-15 VGA connector. If it senses a 75 ohm load on all three color signals, it initializes to color mode. All other conditions initialize the controller to gray-scale mode.



When using a flat-panel display that requires color mode (e.g., it does its own conversion) and either doesn't connect to the analog signals or doesn't provide the 75-ohm load on the analog signals, it may be necessary to build a terminating connector that plugs into the DB-15 connector. The terminating connector contains three 75-ohm resistors. The resistors connect the red, green, and blue color signals (pins 1-3) to one of the ground pins (e.g., pin 5).

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NOTES

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3. Programming Interface

This chapter contains information needed to write custom software drivers for the EXM-13A. Anyone using the standard software drivers shipped with the EXM-13A can skip this chapter.

The EXM-13A is mapped into both the memory space and I/O space. In the memory space, the mapping is as follows:

Range		Content
000A0000	000BFFFF	Video RAM
000C0000	000C7FFF	Video BIOS Shadow

The EXM-13A defines the following registers in the I/O space.

Port	Functional group	Usage
100	EXM Configuration	Device ID
102		Option byte 1
3B4	Video controller	CRT index register (mono)
3B5		CRT ctlr data reg (mono)
		0 Horizontal total register
		1 Horiz display enable end
		2 Start horiz blanking
		3 End horizontal blanking
		4 Start horiz retrace pulse
		5 End horizontal retrace
		6 Vertical total register
		7 Overflow
		8 Preset row scan
		9 Max scan line/others
		A Cursor start
		B Cursor end
		C Start address high
		D Start address low

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		E Cursor location high F Cursor location low

Port	Functional group	Usage
		10 Vertical retrace start 11 Vertical retrace end 12 Vert display enable end 13 Offset 14 Underline location 15 Start vertical blank 16 End vertical blank 17 CRTC mode control 18 Line compare
3B8		Mode control reg (mono) (W)
3B9		Preset light pen (mono) (W)
3BA		Input status reg 0 (mono) (R) Feature control (mono) (W)
3BB		Clear light pen (mono) (W)
3BF		Hercules register
3C0		Attribute index register Attribute data register (W)
3C1		Attribute data register (R) 0X Palette registers 10 Attribute mode control 11 Overscan control 12 Color plane enable 13 Horizontal PEL panning 14 Color select
3C2		Misc output register (W) Input status register 0 (R)
3C3		Video subsystem enable reg
3C4		Sequencer index register
3C5		Sequencer data register 0 Reset register 1 Clocking mode register 2 Map mask register 3 Character map select reg 4 Memory mode register
3CA		Feature control register (R)
3CC		Misc output register (R)
3CE		Graphics controller index reg
3CF		Graphics data register 0 Set/reset 1 Enable set/reset 2 Color compare 3 Data rotate 4 Read map select 5 Graphics mode 6 Miscellaneous 7 Color don't care

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Port	Functional group	Usage
		8 Bit mask
		9 Address offset A (PR0A)
		A Address offset B (PR0B)
		B Memory size (PR1)
		C Video select (PR2)
		D CRT control (PR3)
		E Video control (PR4)
		F Lock/status (PR5)
3D4		CRT index register (color)
3D5		CRT controller data (color)
		0 Horizontal total
		1 Horiz display enable end
		2 Start horizontal blanking
		3 End horizontal blanking
		4 Start horiz retrace pulse
		5 End horizontal retrace
		6 Vertical total register
		7 Overflow
		8 Preset row scan
		9 Max scan line/others
		A Cursor start
		B Cursor end
		C Start address high
		D Start address low
		E Cursor location high
		F Cursor location low
		10 Vertical retrace start
		11 Vertical retrace end
		12 Vert display enable end
		13 Offset
		14 Underline location
		15 Start vertical blank
		16 End vertical blank
		17 CRTC mode control
		18 Line compare
3D8		Mode control reg (color) (W)
3D9		Color select register (W)
3DA		Input status reg 0 (color) (R)
		Feature control (color) (W)
3DB		Clear light pen (color) (W)
3DC		Preset light pen (color) (W)
3DE		AT&T / M24 (W)

Table 2. EXM-13A Registers.

All but the first two registers are standard VGA registers. For further explanation consult the manual of the NCR 77C22E+ video controller chip, the text *EGA/VGA A Programmer's Reference Guide* by B. D. Kliewer

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(McGraw-Hill), or the text *Programmer's Guide to PC and PS/2 Video Systems* by R. Wilton (Microsoft Press).

The other two registers are as follows:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	I/O port
Device ID Reg	1	1	1	0	1	1	0	1	100
Config Option Byte 1 Reg								Cden	102

These are standard EXM registers for device identification and configuration. The EXM-13A responds to accesses to these ports only if EXMbus line -EXMID is asserted. An 8-bit read from I/O address 100h returns the device ID value ED. A read/write configuration register appears at I/O address 102h.

CDEN specifies whether the EXM is disabled or enabled. If disabled, the EXM does not respond to any I/O or memory addresses and does not assert an interrupt output; it only responds to reads from I/O port 100h and reads from and writes to I/O port 102h, and then only if EXMbus line -EXMID is asserted.

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4. Connectors

The DB-15 monitor connector is defined below:

Pin	Signal	Pin	Signal
1	Red	9	(key)
2	Green	10	Ground
3	Blue	11	(not used)
4	(not used)	12	(not used)
5	Ground	13	Horizontal sync
6	Ground	14	Vertical sync
7	Ground	15	(not used)
8	Ground		

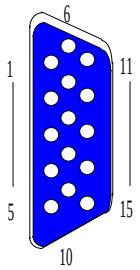


Table 3. DB-15 Pin-out.

The EXM-13A contains an auxiliary connector. Its 36-pin connector is a shielded female 3M 10236-5212VE (or equivalent). The mating connector is a 3M 10136-6000EE male connector (or equivalent).

The pins on the auxiliary video connector on the EXM-13A are defined below.

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Pin	Signal	Pin	Signal
1	EVIDEO	19	Ground
2	P7	20	P0
3	Ground	21	P1
4	DCLK	22	P2
5	EDCLK	23	Ground
6	P6	24	P3
7	Ground	25	P4
8	-BLANK	26	P5
9	HSYNC	27	Ground
10	VSYNC	28	ESYNC
11	Ground	29	Ground
12	reserved	30	Ground
13	reserved	31	Ground
14	reserved	32	Ground
15	Ground	33	Ground
16	RED	34	Ground
17	GREEN	35	Ground
18	BLUE	36	Ground

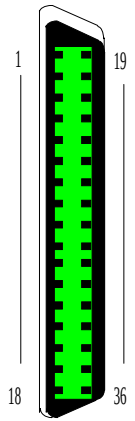


Table 4. Auxiliary Connector Pin-out.

The signals on the auxiliary connector are described below.

-BLANK — This input/output signal is an alternate blanking signal to the digital-to-analog converter (DAC) in the EXM-13A. When enabled (see ESYNC), a low input causes the DAC to drive its analog color outputs to 0V. When disabled, this pin outputs the internal blanking signal.

BLUE — This analog output is the same as the blue output on the DB-15 connector.

DCLK — This input/output signal is the dot clock to the DAC. When enabled (see EDCLK), it is an input whose rising edge causes the DAC to latch the digital video signals. When disabled, it outputs the internal dot clock.

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EDCLK — This input signal controls the source of the dot clock. When high (or unconnected), the clock is internal. When low, the DCLK input is enabled. Also, when EDCLK is low, the internal dot clock is disconnected and DCLK used in its place. While EDCLK is high or unconnected, the VGA miscellaneous output register must be configured so that it is not selected clock source 2.

EVIDEO — This input signal controls the source of the digital video information to the DAC. When high (or unconnected), the digital signals are obtained internally. When low, the digital signals are sourced from P0-P7 on the connector.

ESYNC — This input signal controls the source of the blanking and synchronization signals. When high (or unconnected), they are obtained internally. When low, the inputs -BLANK, HSYNC, and VSYNC are enabled as the source.

GREEN — This analog output is the same as the green output on the DB-15 connector.

HSYNC — This input/output signal is the horizontal sync signal on the VGA monitor connector. When enabled (see ESYNC), it is an input and drives the horizontal sync signal on the VGA monitor connector. When disabled, it outputs the horizontal sync signal.

P0-P7 — These input/output signals are the digital video inputs to the EXM-13A's DAC. When enabled (see EVIDEO), they are inputs that drive the DAC. When disabled, they output the internal digital video signals. P0-P5 represent, respectively, blue, green, red, secondary blue, secondary green, and secondary red.

RED — This analog output is the same as the red output on the DB-15
connector.

VSYNC — This input/output signal is the vertical sync signal on the VGA monitor connector. When enabled (see ESYNC), it is an input and drives the vertical sync signal on the VGA monitor connector. When disabled, it outputs the vertical sync signal.

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NOTES

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5. Support and Service

In North America

Technical Support

RadiSys maintains a technical support phone line at (503) 646-1800 that is staffed weekdays (except holidays) between 8 AM and 5 PM Pacific time. If you have a problem outside these hours, you can leave a message on voice-mail using the same phone number. You can also request help via electronic mail or by FAX addressed to RadiSys Technical Support. The RadiSys FAX number is (503) 646-1850. The RadiSys E-mail address on Internet is support@radisys.com. If you are sending E-mail or a FAX, please include information on both the hardware and software being used and a detailed description of the problem, specifically how the problem can be reproduced. We will respond by E-mail, phone or FAX by the next business day.

Technical Support Services are designed for customers who have purchased their products from RadiSys or a sales representative. If your RadiSys product is part of a piece of OEM equipment, or was integrated by someone else as part of a system, support will be better provided by the OEM or system vendor that did the integration and understands the final product and environment.

Bulletin Board

RadiSys operates an electronic bulletin board (BBS) 24 hours per day to provide access to the latest drivers, software updates and other information. The bulletin board is not monitored regularly, so if you need a fast response please use the telephone or FAX numbers listed above.

The BBS operates at up to 14400 baud. Connect using standard settings of eight data bits, no parity, and one stop bit (8, N, 1). The telephone number is (503) 646-8290.

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Repair Services

Factory Repair Service is provided for all RadiSys products. Standard service for all RadiSys products covers factory repair with customers paying shipping to the factory and RadiSys paying for return shipment. Overnight return shipment is available at customer expense. Normal turn-around time for repair and re-certification is five working days.

Quick Exchange services (immediate shipment of a loaner unit while the failed product is being repaired) or other extra-cost services can be arranged, but need to be negotiated in advance to allow RadiSys to pool the correct product configurations. RadiSys does not maintain a general "loaner" pool: units are available only for customers that have negotiated this service in advance.

RadiSys does not provide a fixed-price "swap-out" repair service, as customers have indicated that issues of serial number tracking and version control make it more convenient to receive their original products back after repair.

5 5

Warranty Repairs

Products under warranty (see warranty information in the front of this manual) will have manufacturing defects repaired at no charge. Products sent in for warranty repair that have no faults will be subject to a recertification charge. Extended Warranties are available and can be purchased at a standard price for any product still under warranty. RadiSys will gladly quote prices for Extended Warranties on products whose warranties have lapsed; contact the factory if this applies.

Customer induced damage (resulting from misuse, abuse, or exceeding the product specifications) is not covered by the standard product warranty.

Non-Warranty Services

There are several classes of non-warranty service. These include repair of customer induced problems, repairs of failures for products outside the warranty period, recertification (functional testing) of a product either in or out of warranty, and procurement of spare parts.

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All non-warranty repairs are subject to service charges. RadiSys has determined that pricing repairs based on time and materials is more cost-effective for the customer than a flat-rate repair charge. When product is received, it will be analyzed and, if appropriate, a cost estimate will be communicated to the customer for authorization. After the customer authorizes the repair and billing arrangements have been made, the product will be repaired and returned to the customer.

A recertification service is provided for products either in or out of warranty. This service will verify correct operation of a product by inspection and testing of the product with standard manufacturing tests. There is a product-dependent charge for recertification.

There are only a few components that are generally considered field-repairable, but, because RadiSys understands that some customers want or need the option of repairing their own equipment, all components are available in a spares program. There is a minimum billing charge associated with this program.

Arranging Service

To schedule service for a product, please call RadiSys Technical Support directly at (503) 646-1800. Have the product model and serial numbers available, along with a description of the problem. A Technical Support representative will issue a Returned Materials Authorization (RMA) number, a code number by which we track the product while it is being processed. Once you have received the RMA number, follow the instructions of the Technical Support representative and return the product to us, freight prepaid, with the RMA number clearly marked on the exterior of the package. If possible re-use the original shipping containers and packaging. In any case, be sure you follow good ESD-control practices when handling the product, and ensure that anti-static bags and packing materials with adequate padding and shock-absorbing properties are used.

Ship the product, freight prepaid, to the following address:

Product Service Center
RadiSys Corporation
15025 SW Koll Parkway
Beaverton, Oregon 97006-6902

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When shipping the product, include the following information: return address, contact names and phone numbers in purchasing and engineering, and a description of the suspected problem. Any ancillary information that might be helpful with the debugging process will be appreciated.

Other Countries

Contact the sales organization from which you purchased your RadiSys product for service and support.

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Microsoft Windows 3.x Video Modes Supported by Softmode.Sys

Format	Colors	Mode	Vert. Refresh Rate (Hz)	Horz. Refresh Rate (KHz)	Dot Clock (Mhz)	Remarks
640 x 400	256	5Eh	60.055	31.469	28.322	non-interlaced
640 x 480	16	12h	72.874	37.967	32.500	non-interlaced
			60.004	35.403	28.322	non-interlaced
640 x 480	256	5Fh	72.814	37.791	32.500	non-interlaced
			59.940	31.469	25.175	non-interlaced
800 x 600	16	58h	71.971	48.077	50.000	non-interlaced
			60.317	37.879	40.000	non-interlaced
			56.021	35.461	40.000	non-interlaced
800 x 600	256	5Ch	71.971	48.077	50.000	non-interlaced
			60.317	37.879	40.000	non-interlaced
			56.021	35.461	40.000	non-interlaced
1024 x 768	2	5Ah	87.064	35.522	44.900	interlaced

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Format	Colors	Mode	Vert. Refresh Rate (Hz)	Horz. Refresh Rate (KHz)	Dot Clock (Mhz)	Remarks
1024 x 768	16	5Dh	70.069	56.476	75.000	non-interlaced
			70.059	56.818	75.000	non-interlaced
			60.530	48.363	65.000	non-interlaced
			87.064	35.522	44.900	interfaced
1024 x 768	256	62h	70.099	56.991	75.000	non-interlaced
			60.004	48.363	65.000	non-interlaced
			87.064	35.522	44.900	interlaced
1280 x 1024 *	16	6Ch	86.938	48.077	75.000	interlaced
1280 x 1024 *	256	6Ah	86.938	48.077	75.000	interlaced

* 1280 x 1024 resolutions require 2 MBytes of VRAM

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