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EXM-23

LCD Controller

Hardware Reference

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07-0168-03 April 1994

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October 1993

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1. Product Description

This manual contains the information required to install and use the EXM-23 LCD Controller expansion module.

The EXM-23 is a 16-bit universal VGA interface module for use with the EXM expansion interface. The module is fully compatible with the IBM VGA standard and provides support for monochrome, gray scale and color LCD displays. This includes all data and control signals as well as an adjustable -40V to +40V power supply, to facilitate LCD integration and backlight requirements.

The EXM-23 has maximum flexibility for LCD panel connection via a female shielded mini D-50 connector. Cables are not included, but the pin-out for the connector is described in Appendix A.

The EXM-23 is based on the Chips and Technologies 65535 controller chip, which integrates a high-performance VGA controller, industry-standard RAMDAC, monitor sense circuitry, and a clock synthesizer into one chip. The module supports a standard 512 Byte of video memory using one 256K x 16 fast page mode DRAM. A build-time option is to use 1 Megabyte of video memory using two fast page mode DRAMs.

The EXM-23 can support most flat panel technologies, including monochrome, passive color, active color and electroluminescent flat panels.

The video memory is mapped at addresses 0A0000h - 0BFFFFh in the EXM Interface memory address space.

The standard EXM-23 contains the VGA BIOS for monochrome, passive and active color, and electroluminescent displays in a 27C010 32-pin DIP EPROM. A build-time option is to use a 27C256 28-pin DIP EPROM, and to select one display.

The EXM-23 cannot be used with the EPC-2E or with the EPC-3 because the built-in VGA controllers on these products cannot be disabled. The EXM-23 cannot be used with the EPC-6 due to slot size limitations.

1 1

Specifications

Table 1 defines the environmental and electrical specifications of the EXM-23.

Characteristic		Value
Environmental		
Temperature	operating	0° to 60° C (* see below)
	storage	-40° to 85° C
Humidity	operating	5% - 95% (non-condensing)
	storage	5% - 95% (non-condensing)
Vibration	operating	.015" displacement with 2.5 g peak (max) acceleration over 5 to 2000 Hz
	storage	.030" displacement with 5 g peak (max) acceleration over 5 to 2000 Hz
Shock	operating	30g 11 msec duration, half-sine shock pulse
	storage	50g 11 msec duration, half-sine shock pulse
Electrical		
Current	maximum	5V @ 1.6A
	typical	5V @ 0.7A
Other		
Weight		3.5 oz. (105 g.)
Memory Address		0A0000h - 0BFFFFh
I/O Address		3B4h - 3DEh

Table 1. EXM-23 Environmental and Electrical Specifications.

* Upper temperature limit degrades 2° C per 1000 ft. elevation. Maximum elevation 10,000 ft.

2. Installation

Before installing the EXM-23, 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-23, 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.**

Before inserting the EXM-23, a four-pin header must be configured to select the BIOS support for your flat panel. Refer to the figure below.

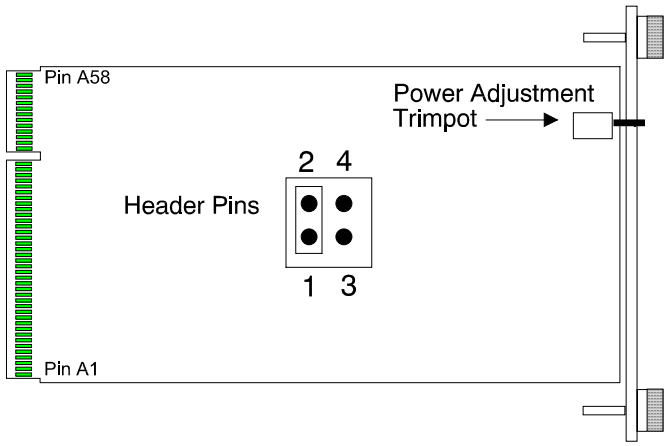


Figure 1. EXM-23 Header Pins Location.

When using the standard 27C010 EPROM, there are four possible settings configured by jumpering four header pins. By default, the EXM-23 is set as monochrome (00) at the factory. All four header pin settings are shown in Figure 2:



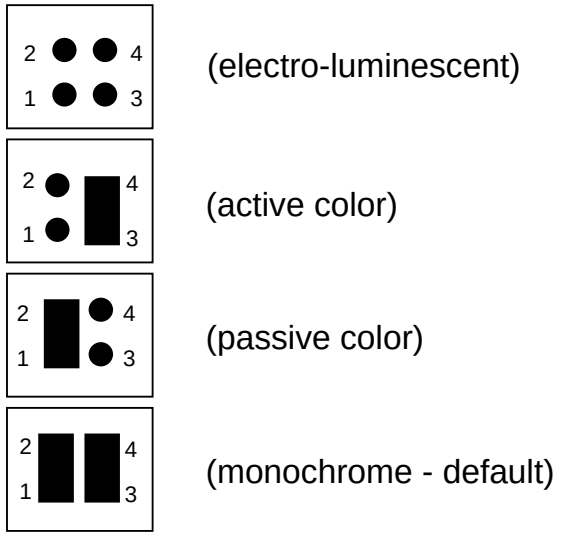


Figure 2. EXM-23 Header Pin Selection.

Insertion in an EXM Carrier

Once the header pins are set, insertion of the EXM-23 into an EXM carrier is straightforward. Remove a blank EXM panel from the carrier (by unscrewing the thumbscrews) and insert the EXM-23 into the card guides. Firmly press the EXM-23 front panel to ensure that the module is properly seated in the subplane and secure it with the thumbscrews. DO NOT OVERTIGHTEN.

- **MAKE SURE THAT POWER TO YOUR SYSTEM IS OFF. THIS 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.**

- **INSERT IT WITH ADEQUATE CONTINUOUS FORCE RATHER THAN TAPPING OR HAMMERING ON IT.**

Before Attaching the Flat Panel

CAUTION

You ***must*** adjust the voltage on the front panel trimpot BEFORE attaching the flat panel via a cable to the EXM-23. Failure to do so could result in electrical damage to the flat panel or the EXM-23. Refer to Figure 1 for the location of this trimpot. Refer to Chapter 4, *Connectors*, for a description of the cable.

To adjust the voltage of the EXM-23 to match the flat panel voltage, carefully attach a voltage meter to the 50-pin front panel connector, using either pin 3 if positive voltage is needed (+VADJ) or pin 4 (-VADJ) if negative voltage is needed, and also pin 9 (ground). Refer to Table 9 on page 15 for more information about the pin locations. Take care not to short out the connection, or you could blow the fuse.

Refer to the documentation accompanying the flat panel to determine the correct voltage setting for the EXM-23. With the voltage meter attached as described above, and the EXM-23 powered up but with no flat panel attached, turn the trimpot using a small slot-head screwdriver until the voltage reading matches the flat panel manufacturer's specifications.

Once the power is calibrated, power the unit down. Proceed with the configuration steps that follow. Note that after the panel is connected and draws down the power, slight additional trimpot adjustment may be necessary.

CAUTION

Do not insert or remove the connector to the front panel while the system is powered on. Serious damage to the flat panel could result.

2 2

Connecting the Panel

A panel is connected via the 50-pin connector on the EXM-23. Refer to Chapter 3, *Connectors*, for more information about the cable. The EXM-23, being a VGA graphics controller, produces analog color signals, meaning that old-style EGA, CGA, and monochrome monitors cannot be used. VGA panels may be color or gray scale; make the selection via headers as described earlier in this chapter.

To ensure a reliable connection, the panel's cable must be attached properly onto the EXM-23's connector. The cable connector is a clamp-type that must be pinched to open. To attach the cable to the EXM-23, pinch the cable connector, mate the cable to the EXM-23, and release the clamp. .

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.

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 an EXM CONFIGURATION ERROR message when the system is booted.

Configuring the BIOS Setup

Once the header pins are set, the EXM-23 is inserted into the carrier, and the panel is attached, turn the system on and boot it up. If no image displays, try slightly adjusting the trimpot. The EXM configuration data in the EPC to which the
EXM-23 is connected must now be modified to recognize and enable the card and select from the available options. Invoke the BIOS setup function from the command line by pressing the CTRL-ALT-ESC keys simultaneously.

Enabling the EXM module

Once in the setup program, a menu displays specifying which function keys are available for further configuration. Press the F2 function key to invoke the EXM menu. The screen display resembles the figure below.

```
          ID OB1 OB2
Slot 0    FF  00  00
     1    DB  C1  00
     2    EE  01  00
     3    FA  25  00
     4    F5  05  00
     5    7D  05  00
```

Figure 3. EXM Setup Screen.

The EXM Setup Screen 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 configuration data for the EXM-23 is shown in bold in slot 2. 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 EXM slot the EXM-23 occupies. Note that dashed lines indicate EXM slots that may not be available on all systems.

EXM Slots

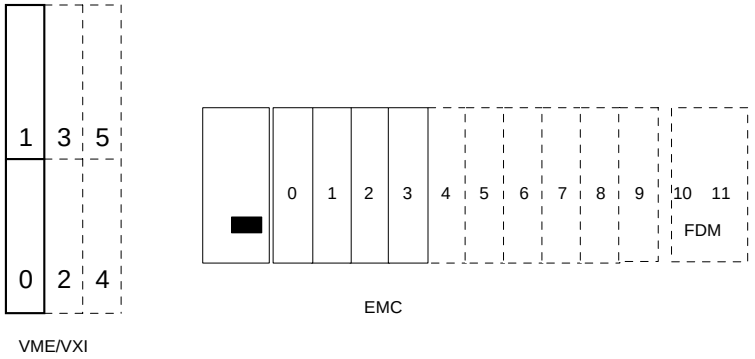


Figure 4. EXM Slot Numbering.

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

OB1/OB2 — are two bytes of option information.

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-23 should be set to **EE**h.

OB1 is a hexadecimal value derived by combining the following:

Reserved (bits 7 - 1)	Card enable (bit 0)
Set to 0.	0 - disabled 1 - enabled

Figure 5. OB1 Register.

For example, a typical OB1 value is **01**h (00000001) indicating the card is enabled.

OB2 is not accessible from the EXM setup screen and should be set to **00**. Refer to the *Standard EXM Registers* section of Chapter 3 for more information.

3. Programming Interface

This chapter contains information needed to write custom software drivers for the EXM-23. If using standard VGA drivers, skip this chapter.

3 3

The EXM-23 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 ROM

Table 2. Video Memory Mapping.

The EXM-23 defines the following registers in the I/O space:

Address	Read	Write
3B0	Reserved for MDA/Hercules	Reserved for MDA/Hercules
3B1	Reserved for MDA/Hercules	Reserved for MDA/Hercules
3B2	Reserved for MDA/Hercules	Reserved for MDA/Hercules
3B3	Reserved for MDA/Hercules	Reserved for MDA/Hercules
3B4	CRTC Index	CRTC Index
3B5	CRTC Data	CRTC Data
3B6	Reserved for MDA/Hercules	Reserved for MDA/Hercules
3B7	Reserved for MDA/Hercules	Reserved for MDA/Hercules
3B8	Hercules Mode Register (Mode)	Hercules Mode Register (Mode)
3B9	--	Set Light Pen FF (ignored)
3BA	Status Register (STAT)	Feature Control Register (FCR)
3BB	--	Clear Light Pen FF (ignored)
3BC	Reserved for system parallel port	
3BD	Reserved for system parallel port	
3BE	Reserved for system parallel port	
3BF	Hercules Configuration Register (HCFG)	Hercules Configuration Register (HCFG)

Table 3. Monochrome Mode I/O Map.

3 3

Address	Read	Write
3C0	Attribute controller index/data	Attribute controller index/data
3C1	Attribute controller index/data	Attribute controller index/data
3C2	Feature Read Register (FCR)	Miscellaneous Output Register
3C3	Video Subsystem Enable (VSE) (MC/PI/LB)	Video Subsystem Enable (VSE) MC/PI/LB)
3C4	Sequencer index	Sequencer index
3C5	Sequencer data	Sequencer data
3C6, 83C6	Color Palette Mask	Color Palette Mask
3C7, 83C7	Color Palette State	Color Palette Read Mode Index
3C8, 83C8	Color Palette Write Mode Index	Color Palette Write Mode Index
3C9, 83C9	Color Palette Data	Color Palette Data
3CA	Feature Read Register (FEAT)	--
3CB	--	
3CC	Miscellaneous Output Register	--
3CD	--	
3CE	Graphics Controller Index	Graphics Controller Index
3CF	Graphics Controller Data	Graphics Controller Data

Table 4. I/O Map Used By Both Monochrome and Color Modes.

Port Address	Read	Write
3D0	--	--
3D1	--	--
3D2	--	--
3D3	--	--
3D4	CRTC Index	CRTC Index
3D5	CRTC Data	CRTC Data
3D6	CHIPS™ Extensions Index	CHIPS™ Extensions Index
3D7	CHIPS™ Extensions Data	CHIPS™ Extensions Data
3D8	CGA Mode Register (MODE)	CGA Mode Register (MODE)
3D9	CGA Color Register (COLOR)	CGA Color Register (COLOR)
3DA	Status Register (STAT)	Feature Control Register (FCR)
3DB	--	Clear Light Pen FF (ignored)
3DC	--	Set Light Pen FF (ignored)
46E8	--	Setup Control (ISA bus only)

Table 5. Color Mode Registers.

Hercules, CGA, MDA and EGA mode registers are included for completeness, but the Chips & Technologies specification sheet for the 65535 chip set will probably be required.

Register	Register Name	Bits	Access	I/O Port - MDA/Herc	I/O Port - CGA	Comment
ST00 (STAT)	Display Status	7	R	3BA	3DA	
CLPEN	Clear Light Pen Flip Flop	0	W (n/a)	3BB (ignored)	3DB (ignored)	ref only; no light pen
SLPEN	Set Light Pen Flip Flop	0	W (n/a)	3B9 (ignored)	3DC (ignored)	ref only; no light pen
MODE	CGA/ MDA/ Herc	7	RW	3B8	3D8	
COLOR	CGA Color Select	6	RW	n/a	3D9	
HCFG	Hercules Config	2	W R	3BF 3D6-3D7 index 14	n/a n/a	XR14
RX, R0-11	'6845' registers	0-8	RW	3B4-3B5	3D4-3D5	
XRX, XR0-7F	Extension Registers	0-8	RW	3D6-3D7	3D6-3D7	

Table 6. Register Summary - CGA, MDA, and Hercules Modes.



3 3

Register	Register Name	Bits	Access	I/O Port - Mono	I/O Port - Color	Comment
MSR	Misc Output	7	W	3C2	3C2	
FCR	Feature Control	3	W	3BA	3DA	
ST00 (FEAT)	Feature Read Input Stat 0	4	R	3C2	3C2	
ST01 (STAT)	Display Status Input Stat 1	7	R	3BA	3DA	
CLPEN	Clear Light Pen Flip Flop	0	W (n/a)	3BB (ignored)	3DB (ignored)	ref only; no light pen
SLPEN	Set Light Pen Flip Flop	0	W (n/a)	3B9 (ignored)	3DC (ignored)	ref only; no light pen
SRX, SR0-7	Sequencer	0-8	RW	3C4-3C5	3C4-3C5	
CRX, CR0-3F	CRT Controller	0-8	RW	3B4-3B5	3D4-3D5	
GRX, GR0-8	Graphics Controller	0-8	RW	3CE-3CF	3CE-3CF	
ARX, AR0-14	Attributes Controller	0-8	RW	3C0-3C1	3C0-3C1	
XRX, XR0-7F	Extension Registers	0-8	RW	3D6-3D7	3D6-3D7	

Table 7. Register Summary - EGA Mode.

Register	Register Name	Bits	Access	I/O Port - Mono	I/O Port - Color	Comment
VSE	Video Subsystems Enable	1	RW	3C3 if MC/PI/LB	3C3 if MC/PI/LB	Disabled by XR70 bit-6
SETUP	Setup Control	2	W	46E8 if ISA	46E8 if ISA	Disabled by XR70 bit-7
ENABLE	Global Enable	1	RW	102 if ISA/MC	102 if ISA/MC	Setup Only
MSR	Misc output	7	W R	3C2 3CC	3C2 3CC	
FCR	Feature Control	3	W R	3BA 3CA	3DA 3CA	
ST00 (FEAT)	Feature Rd (status 0)	4	R	3C2	3C2	
ST01 (STAT)	Display stat (status 1)	6	R	3BA	3DA	
CLPEN	Clear Light Pen flip flop	0	W (n/a)	3BB (ignored)	3DB (ignored)	ref only; no pen
SLPEN	Set Light Pen flip flop	0	W (n/a)	3B9 (ignored)	3DC (ignored)	ref only; no pen
DAC MASK	Color palette pixel mask	8	RW	3C6, 83C6	3C6, 83C6	
DAC STATE	Color Palette State	2	R	3C7, 83C7	3C7, 83C7	
DACRX	Color palette read index	8	W	3C7, 83C7	3C7, 83C7	
DACWX	Color palette write index	8	RW	3C8, 83C8	3C8, 83C8	
DAC DATA	Color palette data 0-FF	3x6 3x8	RW	3C9, 83C9	3C9, 83C9	
SRX	Sequencer	0-8	RW	3C4-3C5	3C4-3C5	
CRX	CRT Ctrlr	0-8	RW	3B4-3B5	3D4-3D5	
GRX	Graph Ctrlr	0-8	RW	3CE-3CF	3CE-3CF	
ARX	Attrib Ctrlr	0-8	RW	3C0-3C1	3C0-3C1	
XRX	Exten Ctrlr	0-8	RW	3D6-3D7	3D6-3D7	

Table 8. Register Summary - VGA Mode.

3 3

Standard EXM Registers

The Devices ID and Configuration Option Byte 1 registers are described below:

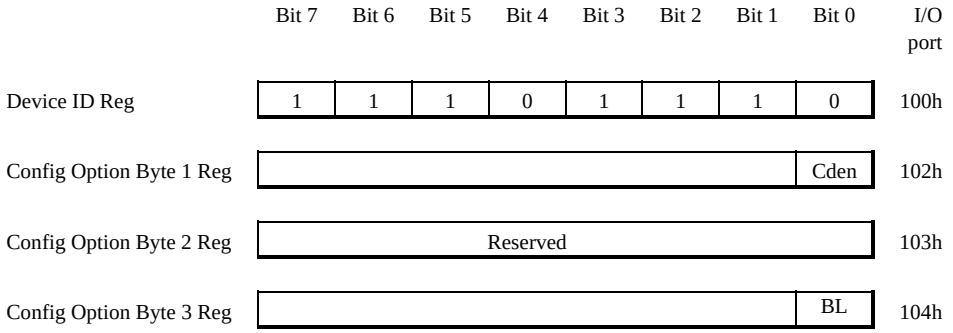


Figure 6. Additional I/O Registers.

Device ID and OB1 are standard EXM registers for device identification and configuration. The EXM-23 responds to accesses to these ports only if EXM expansion interface line -EXMID is asserted. An 8-bit read from I/O address 100h returns the device ID value **EE**. A read/write configuration register appears at I/O address 102h.

CDEN specifies whether the EXM is disabled or enabled. Writing a 0 to this bit clears the flat panel display.

BL (Backlight) at address 104h specifies whether the backlight is on or off. This register is not accessible from the EXM Setup Screen and is not saved in CMOS RAM. A debug example is provided below:

debug <return>
-o 96 *slot number* <return> (insert the number of the slot the card resides in)
-o 104 FF <return> (this turns the light off)
-o 104 FE<return> (this turns the light on)

The backlight defaults to "on" with a hardware reset.

4. Connectors

Because flat panels vary greatly from product to product, standard cables are not possible. Instead, the connector part numbers and pin-outs are included here.

Mini-D-50 Connector

The female mini D-50 connector (3M 10250-52B2VE or equivalent) mates with a male 3M 10150-6000EC or equivalent. The pin-out is below.

Pin	Signal	Pin	Signal
1	F+5V	26	GND
2	F+12V	27	PD8
3	+VADJ	28	PD9
4	-VADJ	29	GND
5	~LITEON	30	PD10
6	GND	31	PD11
7	M	32	GND
8	FLM	33	PD12
9	GND	34	PD13
10	LP	35	GND
11	~SCLK	36	PD14
12	GND	37	PD15
13	SCLK	38	GND
14	GND	39	PD16
15	PD0	40	PD17
16	PD1	41	GND
17	GND	42	RSVD(PD18)
18	PD2	43	RSVD(PD19)
19	PD3	44	GND
20	GND	45	RSVD(PD20)
21	PD4	46	RSVD(PD21)
22	PD5	47	GND
23	GND	48	RSVD(PD22)
24	PD6	49	RSVD(PD23)
25	PD7	50	GND

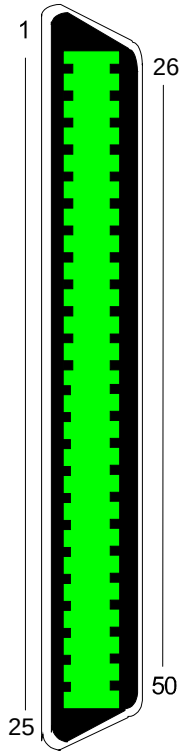


Table 9. EXM-23 Mini-D-50 Pin-out.



Notes to Table 9:

1. F+5V is a fused version of +5V from the backplane.
2. F+12V is a fused version of +12V from the backplane.
3. +VADJ and -VADJ contrast adjustment accessed at the panel trim pot.
4. ~LITEON is used to turn the backlight off via register 104h (0 on, 1 off).
5. FLM is the flat panel equivalent of VSYNC.
6. SCLK (Shift Clk) is the pixel clock for flat panel data.
7. ~SCLK (Inverted Shift Clk) is the pixel clock normally for EL panels.
8. PD0 - PD17 are the eighteen bits of flat panel data output.
9. RSVD (PD18 - PD23) are reserved pins for future expansion.



For more information, refer to Appendix A.

Trimpot

Since adjusting the power serves to adjust the contrast on the flat panel, contrast adjustment is provided with a nominal 50K ohm 20-turn trimpot which adjusts the +VADJ and -VADJ in parallel; for example, when the +VADJ is at +15V, the -VADJ terminal is at -15V. The trimpot is depicted in Figure 1 on page 3.

Fuse

All power from the backplane to the front panel is fused with a socketed 2A Schurter SMD fuse (part number 3402.0012.2).

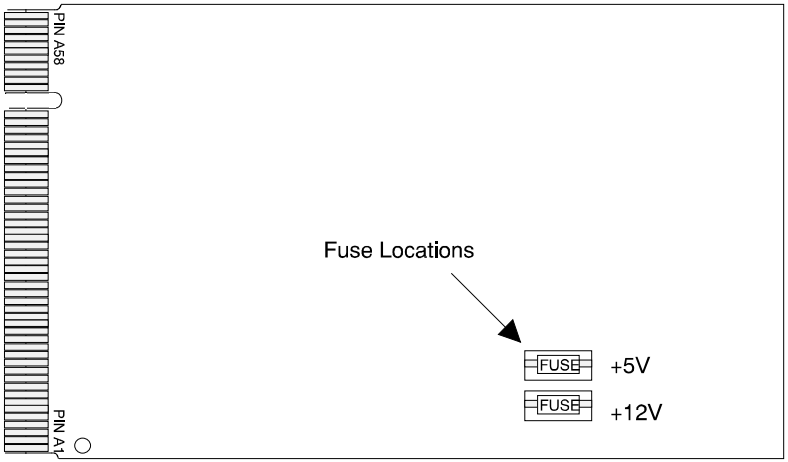


Figure 7. EXM-23 Fuse Location.

NOTES



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 the 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.

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.

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

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.

Appendix A: Video Modes and Supported Panels

The EXM-23 will support color 640 x 400 and color 640 x 480 panels from: Epson (LCD), Fujitsu (plasma), Hitachi (LCD, Color LCD*), Kyocera (LCD*), Optrex (LCD), Panasonic (Plasma), Planar (EL), Sanyo (LCD), Sharp (LCD, Color TFT, EL* some), Toshiba (LCD).

The EXM-23 will support monochrome panels from: Epson (LCD), Fujitsu (plasma), Hitachi (LCD), Kyocera (LCD*), Optrex (LCD), Panasonic (Plasma), Planar (EL), Sanyo (LCD), Sharp (LCD, EL*some), Toshiba (LCD).

** External circuitry required*

Interface tables for the EXM-23 and the following panels are included here:

Sharp Monochrome LCD (BIOS setting for Monochrome - default)
640 x 480 LM64P80

Sharp Passive Color LCD (BIOS setting for Passive Color)
640 x 480 LM64C08P

Sharp 512 Color TFT (BIOS setting for Active Color)
640 x 480 LQ10DH11

Optrex Monochrome LCD (BIOS setting for Electroluminescence)
640 x 200 DMF651AN

Optrex Monochrome LCD (Contact RadiSys for more information about this panel)
640 x 200 DMF651AN

Seiko Monochrome LCD (Contact RadiSys for more information about this panel)
320 x 240 G321EX5R000

Sharp Monochrome LCD (Monochrome BIOS - default)
640 x 480 LM64P80

LM64P80	Signal Name	EXM23	Signal Name
1	S	8	FLM
2	CP1	10	LP
3	CP2	13	SCLK
4	DISP	6	GND
5	VDD	1	F+5V
6	VSS	9	GND
7	VEE	4	-VADJ
8	DU0	19	PD3
9	DU1	18	PD2
10	DU2	16	PD1
11	DU3	15	PD0
12	DL0	25	PD7
13	DL1	24	PD6
14	DL2	22	PD5
15	DL3	21	PD4

Sharp Passive Color LCD (Use Passive Color BIOS)
640 x 480 LM64C08P

LM64C08P	Signal Name	EXM23	Signal Name
CN1			
1	YD	8	FLM
2	LP	10	LP
3	XCK	13	SCLK
4	DISP	1	F+5V
5	VDD	1	F+5V
6	VSS	6	GND
7	VEE	3	+VADJ
8	DU0	31	PD11
9	DU1	30	PD10
10	DU2	28	PD9
11	DU3	27	PD8
12	DU4	19	PD3
13	DU5	18	PD2
14	DU6	16	PD1
15	DU7	15	PD0
CN2			
16	VSS	9	GND
17	DL0	37	PD15
18	DL1	36	PD14
19	DL2	34	PD13
20	DL3	33	PD12
21	DL4	25	PD7
22	DL5	24	PD6
23	DL6	22	PD5
24	DL7	21	PD4
25	VSS	12	GND

Sharp 512 Color TFT (Use Active Color BIOS)
640 x 480 LQ10DH11

LQ10DH11	Signal Name	EXM23	Signal Name
1	GND	6	GND
2	CK	13	SCLK
3	R1	34	PD13
4	R0	33	PD12
5	GND	6	GND
6	R2	36	PD14
7	G1	27	PD8
8	G0	25	PD7
9	GND	9	GND
10	G2	28	PD9
11	B1	19	PD3
12	B0	18	PD2
13	GND	12	GND
14	B2	21	PD4
15	GND	14	GND
16	HSYNC	10	LP
17	VCC	1	F+5V
18	VSYNC	8	FLM
19	VDD	2	F+12V
20	GND	17	GND
21	NC		
22	NC		

Sharp Grey Scale EL (Use Electroluminescence BIOS)
640 x 400 LJ640U34

LJ640U34	Signal Name	EXM23	Signal Name
A1	D0	15	PD0
B2	D1	16	PD1
A2	CKD	11	~SCLK
B2	GND	6	GND
A3	HORIZ. SYNC	10	LP
B3	GND	9	GND
A4	VERT SYNC	8	FLM
B4	NC		
A5	GND	12	GND
B5	GND	14	GND
A6	NC		
A6	NC		
A7	VL (+5V)	1	F+5V
B7	VL (+5V)	1	F+5V
A8	VD (+12V)	2	F+12V
B8	VD (+12V)	2	F+12V

Optrex Monochrome LCD (Contact RadiSys for more information)
640 x 200 DMF651AN

DMF651AN	Signal Name	EXM23	Signal Name
1	FLM	8	FLM
2	LP	10	LP
3	CP	13	SCLK
4	M	7	M
5	VADJ	4	-VADJ
6	VCC	1	F+5V
7	VSS	6	VSS
8	VEE	4	-VADJ
9	D0	15	PD0
10	D1	16	PD1
11	D2	18	PD2
12	D3	19	PD3

Seiko Monochrome LCD (Contact RadiSys for more information)
320 x 240 G321EX5R000

G321EX5R000	Signal Name	EXM23	Signal Name
1	FLM	8	FLM
2	M	7	M
3	CL1	10	LP
4	CL2	13	SCLK
5	D OFF	6	GND
6	D0	15	PD0
7	D1	16	PD1
8	D2	18	PD2
9	D3	19	PD3
10	VDD	1	F+5V
11	VSS	9	GND
12	VLC	4	-VADJ
13	VO	*	
14	FG	12	GND

* -VADJ------/\/\/\------GND
VO

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