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EXM-9

Disk Controller

Reference

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1. Getting Started

This manual contains the information you will need to install and use the EXM-9 disk controller.

The EXM-9 disk controller allows you to use external floppy disk and IDE (integrated device electronics) hard disk devices. It is designed to plug into any slot in an EXMbus carrier. The floppy and IDE interfaces in the EXM-9 are independent from each other and can be individually enabled or disabled.

Note that if your system is to contain both an IDE drive and a floppy diskette drive, both must be connected to the EXM-9; you cannot use a different controller for the floppy drive. Thus you cannot use an EXM-9 in a system containing an integrated EXP-MS/MX drive.

If you are using an external floppy drive that receives power form a power source that has its own on/off switch (separate from the processor), it is possible that data corruption can occur on a floppy diskette in the external floppy drive. When the system is powered off, the controller chip asserts the WRITE ENABLE bit.

Two possible ways to prevent this data corruption are:

1. Remove the floppy diskette from the external floppy drive before powering off the system.

2. Turn off the power to the floppy drive before powering off the system.

1 1

Specifications

The following table defines the power and environmental specifications of the EXM-9.

Characteristic		Value
Temperature	operating	0 to 60°C ambient
	storage	-40 to 125°C
Humidity	operating	0 to 90% non condensing
	storage	0 to 95% non condensing
Altitude	operating	10,000 ft (3000 m)
	storage	50,000 ft (15,000 m)
Vibration	operating	0.015 inch (0.38 mm) Peak to Peak displacement with 2.5 g peak (max) acceleration over 5 to 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

Table 1. EXM-9 Environmental and Electrical Specifications.

2. Installation

Before installing the EXM-9, 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-9, 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

Once the header pins are set, insertion of the EXM-9 into an EXM carrier is straightforward. Remove a blank EXM panel from the carrier (by unscrewing the thumbscrews) and insert the EXM-9 into the card guides. Firmly press the EXM-9 front panel to ensure that the module is properly seated in the subplane and secure it with the thumbscrews.

- **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.**

2 2

Configuring the BIOS Setup

Once the EXM-9 is inserted into the carrier, turn the system on and boot it up. The EXM configuration data in the EPC to which the EXM-9 is connected now must 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    DC  00  00
     1    DB  C1  00
     2    F6  07  00
     3    DE  00  39
     4    F5  05  00
     5    DC  F5  00
```

Figure 1. 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. An example of configuration data for the EXM-9 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-9 occupies. Note that dashed lines indicate EXM slots that may not be available on all systems.

EXM Slots

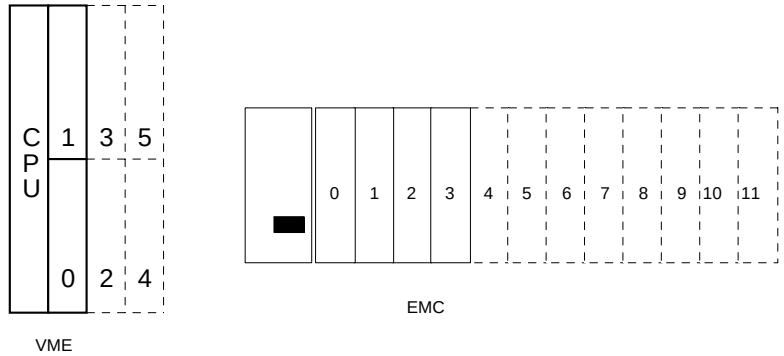


Figure 2. EXM Slot Numbering.

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 on the screen even if the actual 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-9 should be set to **F6**h.

OB1 should be set according to the following bit definitions:

00	EXM-9 disabled
03	IDE interface enabled, floppy controller disabled
05	Floppy enabled, IDE interface disabled
07	IDE and floppy interfaces enabled

Table 2. OB1 Configuration Bit.

For instance, a typical OB1 value is **07**h, representing IDE and floppy interfaces enabled.

OB2 is not used and should be set to **00.**

NOTES



3. Operation

This chapter discusses the main setup and connectors of the EXM-9.

In addition to configuring the EXM-9 using the EXM Setup Screen, you will also need to describe your connected disk configuration on the main setup screen. If you have a floppy drive connected and enabled, select the diskette drive A option that matches your floppy drive. If you have an IDE drive connected and enabled, enter the fixed-disk menu, select "AT" as the type for fixed disk C, and then select a numeric type that matches the characteristics of your drive.

Translating Sector Information

To select the correct IDE drive type number, you must first determine how your disk drive translates sector information. There are two common modes: fixed translation mode and universal translation mode.

Fixed Translation Mode

If your drive uses fixed translation mode, you must select a drive type with the exact number of sectors per track and heads per cylinder as specified by the drive's manufacturer. What doesn't need to be exact is the number of cylinders. Find an entry on the BIOS fixed-disk menu that matches the number of sectors per track and heads per cylinder and whose number of cylinders is less than or equal to your actual drive. Typically this will be in the range of AT drive types 1-23.

Universal Translation Mode

If your drive uses the universal translation mode, you do not have to use the exact physical parameters of the drive. Instead, you may follow this procedure:

1. Determine the total number of blocks (sectors) on your drive. Call this value B. If this is not specified directly by the manufacturer, it can be computed as the number of cylinders times the number of heads times the sectors per track.

2. For use by the translation mapping, select either 63 or 17 sectors per logical track. Call this value S. Use S of 63 for drives greater than 136 MB, and S of 17 for smaller drives.

3. Compute the minimum number of logical heads needed to cover the capacity of the drive. Call this value H. H is computed as

$$H = \frac{B}{1024 \times S}$$

Round H up to the next higher integer.

4. Find a drive type entry in the BIOS fixed-disk menu whose logical number of sectors per track (S) matches the number you've selected (17 or 63) and whose number of heads is the smallest number at least as large as H.

5. Some programs (e.g., FDISK in earlier versions of DOS) need to understand the number of cylinders. If you need this value, the number of logical cylinders on the drive is given by the integer no larger than

$$\frac{B}{H \times S}$$

Use this value for software that needs to understand the number of cylinders on the drive (e.g., the FDISK disk partitioning program).

As an example, consider the Conner Peripherals CP3204F 200 MB drive. The number of blocks on the drive is specified as 415,264. Because of the size of the drive we use 63 sectors per logical track (S). The number of logical heads is 415264/(1024×63), which rounds up to 7. Drive type 36 in the EPC BIOS's fixed-disk menu is the proper choice.

For two other commonly used IDE drives, the Conner Peripherals CP3044 and CP30104, the appropriate drive types are 24 and 33 respectively.

Disk Partitioning

If you have used the universal translation mode, you may have noticed that the number of logical cylinders, heads, and sectors per track of the drive type selected on the fixed-disk menu produces a product that exceeds the actual capacity of your drive. This can confuse disk-partitioning programs, which must understand the *actual* capacity of the drive. For the FDISK program in DOS version 4 and beyond and OS/2, use the actual capacity of the drive in MB. For the FDISK program in earlier versions of DOS, use the number of cylinders calculated in step 5 above. For Unix, use H times the value calculated in step 5 to describe the number of tracks available.

Troubleshooting

Mating a disk controller to a new set of cables and the wide variety of drives available can be an exasperating experience. If you have trouble, try the following before calling for assistance.

If you cannot boot from a floppy disk, the problem could be (1) the software configuration, (2) the drive configuration, (3) power to the drive, (4) the cable, (5) an improperly formatted diskette, or (6) the EXM-9. Invoke the BIOS setup program and ensure that the floppy drive specification matches that of your drive, that the EXM-9 is in the proper slot, and that the EXM-9 configuration data specifies that both the EXM-9 and floppy controller are enabled. Review the bullets at the end of the previous chapter to ensure that the drive is configured correctly. Ensure that you are supplying power to the drive. Check the cable connections and the cable itself. Ensure that you have a bootable diskette (e.g., try booting from it in another PC). Try the drive and cable in another PC.

If you cannot boot from or access an IDE drive, the problems listed above apply. Invoke the BIOS setup program and ensure that you have the fixed disk specified as AT. Ensure that the EXM-9 is in the proper slot (consistent with the EXM configuration information) and that the configuration data specifies that both the EXM-9 and IDE interface are enabled. Ensure the fixed disk numeric type is consistent with your drive. Check power to the drive. Check the cable connections and the cable itself. If the trouble is booting, ensure that the device has been formatted as a system disk (which will require connecting and booting from a floppy to do so).

Some error messages that might appear and their interpretations are

Disk boot failure. No boot disk could be found by the BIOS.

Diskette drives or types mismatch error. The BIOS setup information is inconsistent with the drives detected (or absent).

Error initializing hard disk controller. The BIOS could not find the EXM-9 (e.g., missing or disabled).

Floppy disk cntrlr error. The BIOS could not find the EXM-9 (e.g., missing or disabled).

General failure... Usually indicates an unformatted disk or diskette.

Non-system disk. Trying to boot from a disk or diskette that is not formatted as a bootable system disk.

Connectors

The EXM-9 has two connectors on its front panel: a 40-pin IDE connector and a 34-pin floppy disk drive connector.

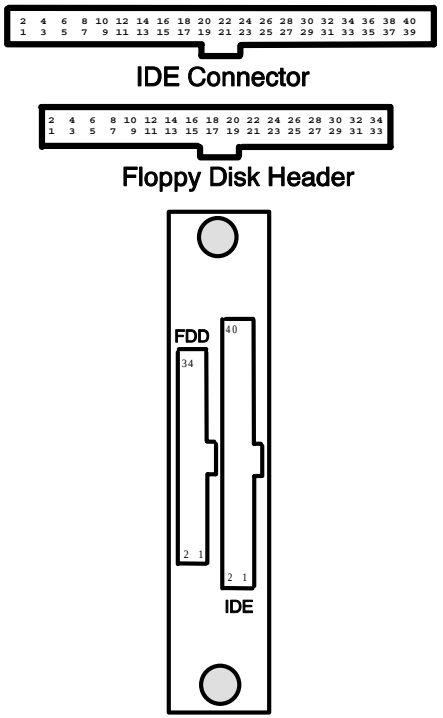


Figure 3. Front Panel Connectors.

The 40-pin IDE connector on the front panel of the EXM-9 mates with a ribbon cable to an IDE drive. The pins are defined below.

Pin	Signal	Pin	Signal
1	-RST	21	not used
2	Ground	22	Ground
3	DD7	23	-DIOW
4	DD8	24	Ground
5	DD6	25	-DIOR
6	DD9	26	Ground
7	DD5	27	not used
8	DD10	28	DALE
9	DD4	29	not used
10	DD11	30	Ground
11	DD3	31	IRQ14
12	DD12	32	-IOCS16
13	DD2	33	DA1
14	DD13	34	DIAG
15	DD1	35	DA0
16	DD14	36	DA2
17	DD0	37	-HCS0
18	DD15	38	-HCS1
19	Ground	39	HACT
20	KEY	40	Ground

Table 3. EXM-9 40-pin IDE Connector Pin-Out.

This product is designed to provide connectivity for external floppy drives and/or hard disks via ribbon cables from the front panel connectors. You should be aware that, as with all electrical cables, these ribbon cables can cause severe system problems if they short to the chassis.

This condition can occur if the ribbon cable extends beyond the edge of the connector, as shown below:

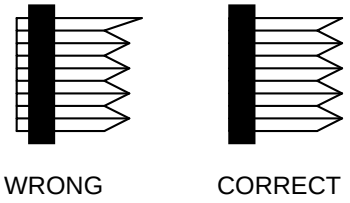


Figure 4. Cable Connection Instructions.

To help alleviate problems, the following cables are recommended:

Manufacturer	Floppy Connector (34 pin)	IDE Connector
3M	3414-7000	3417-7000
Ansley	609-3430CE	609-4030Ce

Table 4. Cable Recommendations.

4. Programming Interface

This chapter contains information needed to write custom software drivers for the EXM-9. Anyone just using the EXM-9 as a BIOS-controlled interface to external disks can skip reading this chapter.

The EXM-9 defines the following registers in the I/O space.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	I/O Port
1	1	1	1	0	1	1	0	100
Device ID Register								
					FLEN	IDEN	CDEN	102
Configuration Option Byte 1 Register								
								1F0
Data Register (16 bits)								
								1F1
Error/Write Precompensation Register								
								1F2
Sector Count Register								
								1F3
Sector Number Register								
								1F4
Cylinder Low Register								
								1F5

4 4

Cyliner High Register	1F6
SDH Register	1F7
Status / Command Register	3F2
Floppy Operations Register	3F4
Floppy Command Register	3F5
Floppy Data Register	3F6
Alt. Status/Digital Output Register	3F7
Drive Address (IDE)/Floppy Control	

The first two are standard EXM registers for device identification and configuration. The EXM-9 responds to accesses to these ports only if EXMbus line -EXMID is asserted. An 8-bit read from I/O address 100h returns the value F6, the device ID of the EXM-9. A read/write configuration register appears at I/O address 102h. The defined bits are as follows:

FLEN specifies whether the floppy diskette controller is enabled (1) or disabled (0). If FLEN and CDEN are set, the I/O addresses 3F0-3F7 and the floppy diskette controller are active.

IDEN specifies whether the IDE Interface is enabled (1) or disabled (0). If IDEN and CDEN are set, the I/O addresses 1F0-1F7 and 3F6-3F7 are active.

CDEN specifies whether the EXM-9 is enabled (1) or disabled (0). If disabled, the EXM-9 will not respond to the 1F0-1F7 and 3F0-3F7 I/O addresses; it will only

respond to reads from I/O port 100h and reads and writes from I/O port 102h, and then only if EXMbus line -EXMID is asserted.

The addresses 1F0-1F7 and 3F6-3F7 are interpreted by the integrated controller in the external IDE drive. Note that both the IDE interface and the floppy controller use address 3F7. Because of this, you cannot build a system containing an EXM-9 where the floppy controller function is being handled by some other device (e.g., another EXM-9, an EXM-3, an EXP-MS/MX); if you are using an EXM-9 and a floppy diskette drive, the floppy drive must be controlled by the EXM-9.

For an explanation of the IDE registers, refer to documentation on any standard PC/AT fixed-disk interface. For an explanation of the floppy diskette controller registers, refer to documentation on the WD37C65 controller chip.

The floppy diskette controller in the EXM-9 uses interrupt IRQ6 and DMA channel 2. The IDE interface uses interrupt IRQ14.



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 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.

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