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EXM-10A

Ethernet

Hardware Reference

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1. Product Description

The EXM-10A is a "universal" Ethernet controller that works in standard 8-bit and faster 16-bit mode, and emulates both the Western Digital WD8003E and WD8013 controllers and the Novell NE2000 and NE2000+ controllers.

There are no jumpers on the EXM-10A. Selection of compatibility modes and parameters such as emulation mode, IRQ, and base address is made using the Autoset setup program, included on the EXM-10A distribution diskettes.

The two distribution diskettes provided with the EXM-10A also include drivers for IPX, ODI, NDIS and FTP's packet driver interface. Operating systems supported by these drivers are DOS, Windows and OS/2. Many other operating systems, such as LynxOS and SCO UNIX, support the EXM-10A via built-in drivers.

The EXM-10A is based on National Semiconductor's AT/LANTIC™ chip, a highly integrated Ethernet controller IC. The chip contains an AT-bus interface, the equivalent of the National Semiconductor chipset (DP8390 and DP8391) and an integrated 10-base-T transceiver. A 28-pin DIP socket is located on the EXM-10A for the optional installation of a boot ROM. Standard boot ROMs are available from Novell or other network vendors.

On the front panel of the EXM-10A there are transceivers for 10-base-T (twisted pair) and 10-base-2 (thin Ethernet) and an AUI connector for external transceivers to thick Ethernet or other media. A dual LED indicates when the EXM-10A is transmitting or receiving data.

Before configuring the EXM-10A, determine if the system requires 8-bit or 16-bit data width settings; if Western Digital or NE2000 emulation is preferred; and several other setup parameters. It is a good idea to read (or at least skim) this entire manual *before* starting. In addition, reference the installation manuals that accompany the operating system or higher-level networking software before proceeding.

Specifications

The following table defines the power and environmental specifications of the EXM-10A.

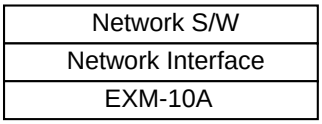
Characteristic		Value
Temperature	operating	0 to 60°C ambient
	storage	-40 to 85°C
Humidity	operating	5% to 95% non condensing
	storage	5% to 95% non condensing
Altitude	operating	10,000 ft (3000 m)
	storage	50,000 ft (15,000 m)
Vibration	operating	0.015 inch (0.38 mm) Peak to Peak displacement with 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
Power	maximum	2.5 W
	typical	1.8 W
Current	maximum	+5V @ 0.50A
	typical	+5V @ 0.36A
Weight		4.3 oz.

Table 1. EXM-10A Environmental and Electrical Specifications.

RadiSys EXM-7 RS-232 Interface Card2. Installation

Before You Begin

All network software requires a network interface (driver) as a connecting layer or link between the network software and the network hardware (EXM-10A).



Some operating systems provide both the network software and the network interface layers. Some operating systems do not provide any of the layers. Before installing the EXM-10A, determine how your particular operating system deals with networking; what is provided by the operating system and what you need to provide. The table below shows how several operating systems handle this issue.

Operating System	Network Software	Network Interface
UNIX, VENIX, QNX, LynxOS, etc.	TCP/IP - built into OS	Packet driver - Built into OS
OS/2	Lan Manager - built into OS	ODI - ships with Novell Netware
Windows NT	Built into OS	NDIS - built into OS
DOS - Windows for Workgroups	Built into OS	NDIS - built into OS
DOS	Novell Netware, Banyan Vines, 3Com LanMan, etc.	ODI - ships with EXM-10A IPX - ships with EXM-10A NDIS - ships with EXM-10A Packet - ships with EXM-10A

Table 2. Operating Systems and Interface Software.

The EXM-10A supports both shared memory and I/O port addressing. Shared memory mode is a concept whereby a section of memory is set aside in the DOS upper memory area (above 640K and below 1M) that is used as a bi-directional buffer for the network card. This allows greater throughput but can cause memory conflicts when not enough upper memory is available.

I/O port addressing uses 16 bytes in I/O space for transferring data and control. Although potential I/O port base addresses can still conflict, it is relatively simple to move base addresses to eliminate the conflict.

The EXM-10A can emulate either the Western Digital standard, which is based on shared memory, or it can emulate the Novell standard, which is I/O based. In most cases, both 8-bit operation and 16-bit operation are possible.

Each mode uses one IRQ line to interrupt the CPU. The IRQ line selection is part of the configuration process. The EXM-10A interrupt must not conflict with interrupt selections already setup in the system, such as COM1, COM2, LPT1, etc.

RadiSys provides network drivers for the following interfaces: ODI, IPX, NDIS and packet driver. For most DOS/Windows users, selecting 16-bit mode and using NE2000+ (I/O Port) architecture with an ODI network driver is recommended. Using 16-bit mode ensures faster data transfers and NE2000+ with ODI is compatible with popular Novell networks.

If NE2000+ ODI is not appropriate for your network implementation, select from the chart below. It includes suggested interrupt and memory address settings for the most common situations. Note that not all emulation modes are supported for all network interfaces.

Interface Driver	WD Mode		NE2000 Mode	
	WD8003	WD8013	NE2000	NE2000+
	8-bit Mode	16-bit Mode	8-bit Mode	16-bit Mode
ODI ATLANTIC	IRQ4 I/O 240 DC00	IRQ5 I/O 240 DC00	IRQ5 I/O 240	IRQ9 I/O 240
IPX NE2000			IRQ3 I/O 340	
IPX ATLANIC	IRQ3 I/O 280 D000	IRQ3 I/O 280 D000		
NDIS ETHAT	IRQ7 I/O 300 DC00	IRQ7 I/O 300 D000	IRQ7 I/O 300	IRQ7 I/O 300
PACKET WD8003E	IRQ11 I/O 340 DC00	IRQ12 I/O 340 DC00		
PACKET ATDRIVE				IRQ15 I/O 340

Table 3. Typical EXM-10A Settings.

The EXM-10A supports the following interrupts:

IRQ3, IRQ4, IRQ5, IRQ7, IRQ9(2), IRQ11, IRQ12, IRQ15

The EXM-10A supports the following I/O addresses:

200h, 220h, 240h, 260h, 280h, 300h, 320h, 340h, 360h

The EXM-10A supports the following memory addresses:

C800, CC00, D000, D400, D800, DC00

Table 4 lists the EXM-10A default settings as set at the factory.

Mode	Interrupt	I/O Address	Memory Address
Western Digital	IRQ 7	I/O 240	DC00

Table 4. Default EXM-10A Settings.

Installation

Before installing the EXM-10A, 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-10A, 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-10A into an EXM carrier is straightforward. Remove a blank EXM panel from the carrier (by unscrewing the thumbscrews) and insert the EXM-10A into the card guides. Firmly press the EXM-10A 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.**

Configuring the BIOS Setup

The EXM configuration data in the EPC to which the EXM-10A is connected needs to be modified to recognize and enable the card and select from the available options. Invoke the BIOS setup function 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 display resembles Figure 1 below.

```
          ID OB1 OB2
Slot 0    FF  00  00
     1    7D  05  00
     2    F5  05  00
     3    DE  01  00
     4    ED  01  00
     5    DC  F5  91
```

Figure 1. EXM Setup Screen.

The 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 displayed data shows SLOT, ID, OB1 and OB2 for each installed EXM.

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. A typical value for the EXM-10A is shown in bold letters in slot 2.

Slot, OB1 and OB2 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-10A occupies. Note that dashed lines indicate EXM slots that may not be available on all systems.

EXM Slots

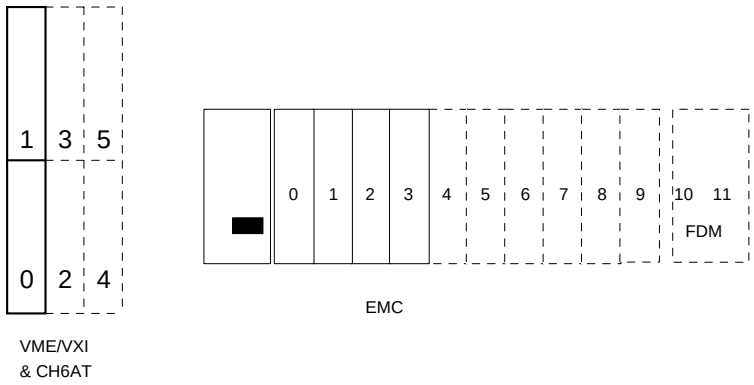


Figure 2. EXM Slot Numbering.

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

OB1/OB2 are two bytes of option information.

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-10A should be set to **F5**h.

OB1 is a hexadecimal value derived by combining the following:

Bits 7 through 3 are unused.
The data width is configured using bit 2.
The size of the boot ROM is configured using bit 1.
The card is enabled or disabled using bit 0.

Refer to Table 5.

Unused (bit 7 - 3)	DWID Data Width (bit 2)	ENA14 Enable A14 to ROM (bit 1)	CDEN Card Enable (bit 0)
Set to 0	0 - 8-bit mode 1 - 16-bit mode	0 - Boot ROM smaller than 32K 1 - 32K Boot ROM	0 - disabled 1 - enabled

Table 5. EXM-10A OB1 Field.

Bits 7 through 3 are **unused.** Set to 0.

DWID - Bit 2 determines whether the EXM-10A is forced into 8-bit mode (used for EPC2E and to run some WD8003 drivers). If set to 1, the EXM-10A is set for 16-bit operation.

ENA14 - Bit 1 is used to enable address line A14 to the boot ROM socket. When disabled, the address line going to the ROM is held at a high state. This allows operation of ROMs that are smaller than 32K, such as 2764 and 27128-type devices. If there is no boot ROM, the setting does not matter.

CDEN - Bit 0 enables or disables the EXM-10A.

For instance, a typical OB1 value is **05**h (00000101) representing 16-bit mode, small boot ROM, and EXM-10A enabled.

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

Installing the Software

With the EXM-10A installed and configured, the next step is to install the software supplied on the distribution diskettes enclosed with the EXM-10A. Follow the instructions below.

Under DOS 5.0 or higher, or in a DOS window, insert the EXM-10A distribution diskette marked DISK-1 in the floppy drive and switch the command line to that floppy drive.

The DOS install.bat file creates a subdirectory on the hard disk and copies the collection of software drivers and configuration files from the distribution disks to the hard disk. Type install and press Enter. Be prepared to insert DISK-2 when prompted. The programs **must** be installed on a hard disk.

These distribution diskettes contain the setup program Autoset, and a collection of drivers for various network interfaces and operating systems.

3. Connectors

Connecting to the Network

If using thick Ethernet, connect the transceiver cable to the DB-15 connector on the EXM-10A front panel.

If using thin Ethernet, connect the cable to the BNC connector on the front panel. This must be done with a "T" connector. If this EXM-10A is not the last station on the cable, the T connector should connect to two coaxial cables. If this EXM-10A is the last station, a terminator should be connected to one side of the "T" connector.

If using twisted-pair Ethernet (10-base-T), connect the cable to the RJ-45 connector.

Note that only *one* of these connections should be made to the EXM-10A at any one time.

DB-15 Connector

A 15-pin connector is provided on the front panel for connection to an external MAU for thick Ethernet. The connector is an AMP 745782-4 or equivalent socket and is defined in the following table:

Pin	Signal	Pin	Signal
1	GND	9	CD-
2	CD+	10	TX-
3	TX+	11	GND
4	GND	12	RX-
5	RX+	13	+12V Fused
6	GND	14	GND
7	No connect	15	No connect
8	GND		

Table 6. Thick Ethernet Connector Pin-out.

Notes:

1. The minus sign next to a signal indicates active low.
2. The plus sign next to a signal indicates active high.
3. +12V is fused at 2A.

BNC Connector

An industry-standard BNC connector is provided for thin Ethernet connection.

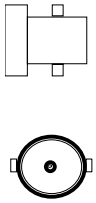


Figure 3. BNC Connector.

RJ-45 Connector

The DTE RJ-45 phone jack that supplies the 10-Base-T interface to the EXM-10A is defined in the following table:

RJ-45	Signal
1	No connect
2	No connect
3	Rx+
4	No connect
5	No connect
6	Rx-
7	Tx-
8	Tx+

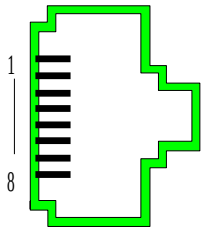


Table 7. RJ-45 Phone Jack Pin-out.

4. Network Interface Configuration

This chapter explains how to configure the EXM-10A for several different networking environments and software interfaces using the Autoset program.

The Autoset program contains diagnostics and an interactive interface for configuring the options of the EXM-10A. After you specify the appropriate options, Autoset saves the configuration in the EXM-10A's nonvolatile memory. The EXM-10A remains configured even when the computer is powered off. The configuration chosen using the Autoset program must not cause a conflict with other boards installed in the system.

If external registration of the Ethernet node address information is required by your operating system, turn the system off and remove the EXM-10A to locate the sticker on the printed circuit board, behind the front panel. The node address is a 12-digit hexadecimal number (e.g., 000050ABCDEF). It is a good idea to record this number somewhere on a **Notes** page in this manual.

It is recommended that you read this entire chapter, and Chapter 5, before proceeding with the configuration.

Autoset Program

The Autoset program is contained in the two-disk software package that accompanies the EXM-10A. Installation instructions are in Chapter 2, *Installation,* and should have already been completed.

If configuring multiple EXM-10A cards in a single system, refer to the next section, "Configuring Additional EXM-10As."

The Autoset program must be run from DOS or a DOS shell and enables the following actions:

- Select one adapter to be configured, from up to four adapters that may be installed.
- Manually select configuration options (such as I/O base address and IRQ) for a specific installation.

Using the Autoset Program

Make sure that network software is not currently running on the computer system. If network software is running, reboot or unload the network software.

To start the program, move to the EXM-10A subdirectory and type Autoset, then press Enter. The menu depicted in the figure below displays.

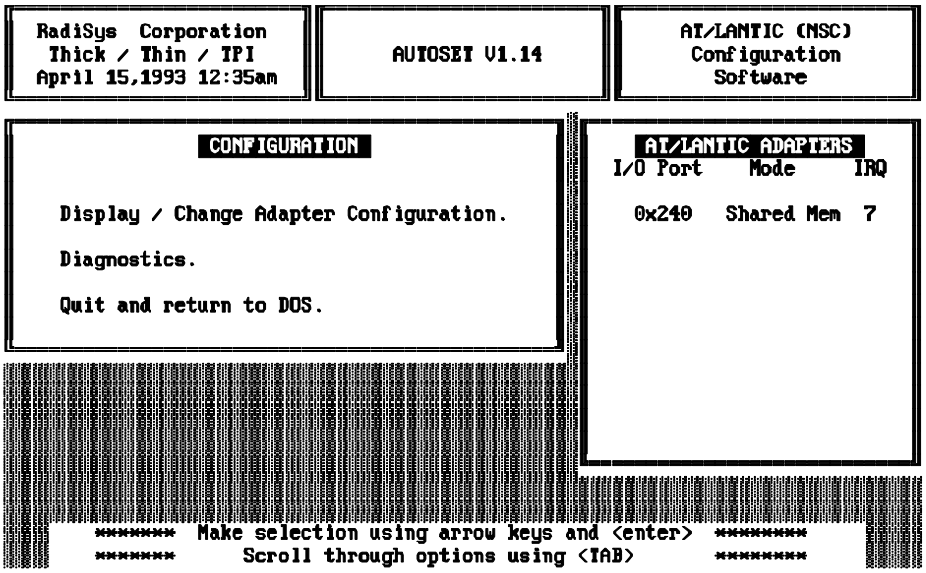


Figure 4. Autoset Program Main Menu.

The following options are in the main menu: Display/Change Adapter Configuration, Diagnostics, and Quit.

To initialize an EXM-10A for the first time, to change the configuration, or to configure multiple EXM-10As, select "Display/Change Adapter Configuration" in the main menu.

To diagnose problems or verify the configuration, select "Diagnostics."

Note: If more than one EXM-10A requires configuration for the first time, see the section *Configuring Additional EXM-10As*.

Configuring an EXM-10A with Autoset

Quick Start

The brief descriptions below of the settings depicted in Figure 5 are intended for experienced users. For more detailed explanations of each setting in Autoset, refer to the descriptions for that entry later in this chapter.

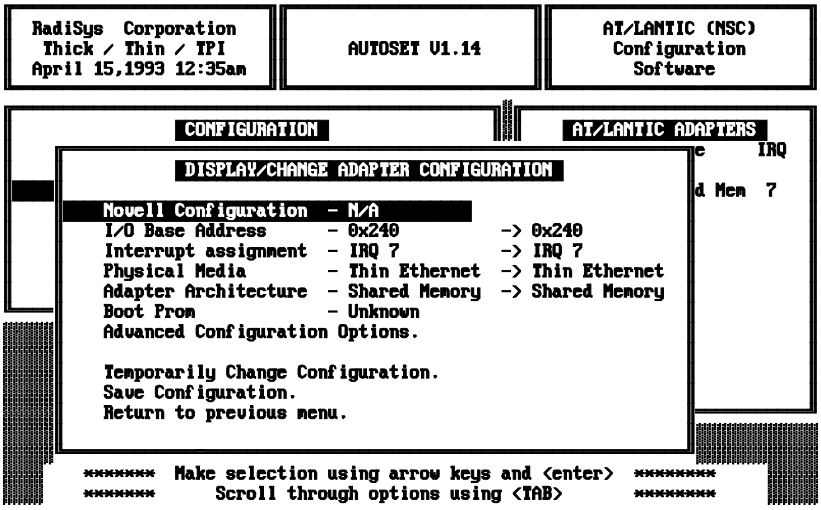


Figure 5. Manual Configuration Menu.

For a single EXM-10A installation, follow these steps:

1. From the Autoset program, select "Display/Change Adapter Settings" to set up the EXM-10A just installed.
2. Skip the Novell options prompt if you are not using the I/O Port/NE2000 mode, or if you want to set up the I/O Base Address and/or IRQ yourself. Use the tab key to change the settings, if necessary.
3. Select the I/O base address. Use the tab key to change the EXM-10A's I/O base address to any available location. **Note: 240**h is recommended because it allows the use of most software drivers without modification.
4. Select the Interrupt. Be sure to avoid any interrupts used by other interfaces in the system. For example, if using an EPC3, EPC4 or EPC5 with an EXP-MS/MX, avoid IRQ12. In addition, do not use IRQ12 with an EPC2, and do not use IRQ11 with an EPC7.
5. Select the physical media cabled up in Chapter 3: thin Ethernet (default), thick Ethernet, or 10-Base-T.
6. Select the Adapter architecture. Use "I/O Port" for NE2000 mode, or use "Shared Memory" for Western Digital mode. Note that the available shared memory addresses are: C800, CC00, D000, D400, D800, and DC00.
7. Select the Boot PROM, if necessary. If a boot PROM is present, select the size here. Use 8/16K for small boot PROMs, or use 32K. Make sure that this selection matches the entry for bit 1 in the OB1 configuration register.
8. Save the configuration to the on-board memory. If you are experiencing difficulties, save as *temporary* changes to determine if they work correctly, then run Autoset again and save the changes as *permanent*.
9. Run Diagnostics to verify the setup. If using Western Digital mode, specify a shared memory base address to be used during diagnostics. Also, to guard against conflicts, exit Diagnostics and check that any EMM386 entries in the config.sys file and system.ini file (if using Windows) both exclude the memory assignment to the EXM-10A. If the system does not pass the Diagnostics, try again, changing the indicated parameters.
10. Press ESC to return to the previous menu.

If only one EXM-10A is to be installed, the configuration procedure is complete. Exit the Autoset program and turn to Chapter 5, *Configuring the Software Driver*.

The responses entered from the Autoset configuration menu depicted in Figure 5 are discussed in detail below.

Novell Configuration

There are several pre-set Novell Configuration options programmed into the Autoset program that are not applicable to the EXM-10A. The Novell Configuration option must be set to N/A.

I/O Base Address

The EXM-10A uses 16 bytes in I/O space. The I/O Base Address **must** be selected using the Autoset program. The Autoset program can only access the EXM-10A when the I/O space occupied by the EXM-10A does not conflict with I/O space previously assigned. In addition, the network interface drivers used with the EXM-10A (set up in Chapter 5) must use the same I/O base address parameter as the EXM-10A.

The EXM-10A is programmed at the factory with a default I/O base address of **240**h. If necessary, use the tab key to choose an optional address according to the guidelines set out in the following sections. Autoset allows selection of the following I/O base addresses: 200h and 360h are 240h, 280h, 2C0h, 300h, 320h, 340h, and 360h.

> **Warning:** If the EXM-10A is mistakenly programmed to use an I/O address that conflicts with another I/O device, the Autoset program will not pass the diagnostics test. In this case, disable the other device or select a different I/O address for the EXM-10A. For example, an EXM-10A installed in an EPC system that also contains an EXM-16 SCSI controller must not be set to I/O base address **340**h.

Shared Memory

The EXM-10A has up to 16K bytes of shared memory buffer. The default shared memory base on the EXM-10A is DC00h.

If using the DOS expanded memory manager or Microsoft Windows, be sure to exclude the area of memory reserved for the EXM-10A base memory.

For instance, if the EXM-10A shared memory selected is 16K bytes and is located at DC00h, when you finish using Autoset, include the following statement in the config.sys file:

device=c:\dos\emm386.exe x=dc00-dfff ... *other parameters* ...

For Microsoft Windows, include the following statement in the [386Enh] section of the system.ini file:

EMMExclude=dc00-dfff

Note that the area excluded may be greater than that required by the EXM-10A due to other system requirements. For example, VME and VXI EPCs also require excluding the E page (E000 to EFFF).

If you are unsure how to make these changes, refer to the *Microsoft DOS User's Guide and Reference* and *Microsoft Windows Operating System* manuals.

Interrupts

The EXM-10A hardware supports the following interrupts: IRQ3, IRQ4, IRQ5, IRQ7, IRQ9(2), IRQ11, IRQ12, or IRQ15. The default setting is IRQ7.

The following limitations need to be observed when assigning interrupts:

- If using an EPC-2e do not change the interrupt assignment. This was set up correctly at the factory. The factory default is the only setting supported by the EXM-10A.

- IRQ4, IRQ3 and IRQ7 are also used for COM1, COM2 and LPT1 respectively. If running software that uses one of these ports, do not use IRQ4, IRQ3, or IRQ7 unless the corresponding port has been disabled via the BIOS Setup Screen.

Use the tab key to scroll through the displayed options and select one of the listed interrupts. Note that Autoset lists all interrupts, not simply those that are available.

Physical Media

There are three physical media (or *Cabling*) options. Use the tab key to scroll through the displayed options and choose either thick Ethernet, thin Ethernet, or 10-Base-T media. This selection must match the operation performed in completing Chapter 3.

Adapter Architecture

There are two options for the method of data exchange between the CPU and the EXM-10A. Use the tab key to toggle the displayed option and choose the I/O Port or Shared Memory for data exchange.

NE2000 and NE2000+ users should select the I/O Port mode.
WD8003 and WD8013 users should select the Shared Memory mode.

Systems with limited amounts of memory should select I/O Port mode to avoid conflicts with other memory-mapped devices.

Systems with ample memory, where increased performance is important, should select Shared Memory mode.

Boot PROM

There are four options to select when using a boot PROM. For users who have not inserted their own boot PROM on the EXM-10A, choose **none**. Otherwise select either the 8/16K option or the 32K option, depending on the size of the boot PROM used.

If using the NE2000 boot PROM, refer to the *Novell Ethernet Installation Supplement* for correct configuration options. Note that the boot PROM size (if used) must also be configured in OB1. See Chapter 2, *Installation*, for more details.

Configuring Additional EXM-10As

To configure multiple EXM-10As for use in a single EPC, each EXM-10A must be inserted in the computer and configured, **one at a time**, *before* inserting the next EXM-10A. EXM-10As are shipped with the default I/O base address of 240h. A conflict occurs if more than one unmodified EXM-10A is installed at a time. If I/O base address 240h is not available, disable the conflicting EXM and configure the EXM-10A. To install more than one EXM-10A, follow these steps:

1. Turn the EPC off, install one EXM-10A, and turn the EPC on.
2. Modify the EXM configuration data using the BIOS setup screen.
3. Invoke the Autoset program and select "Display/Change Configuration."
4. Manually select an available I/O base address.
5. Specify the other configuration options for this EXM-10A.

6. Run Diagnostics to validate the configuration options.
7. Save the configuration, then exit the Autoset program.

Repeat this procedure until all EXM-10As are installed and configured. Make sure that no parameter conflicts occur among the EXM-10As. With the exception of the last EXM-10A configured, each card must be set to an I/O address other than 240h. That way, as each succeeding EXM-10A is installed with its factory default of 240h, no conflict occurs with preceding EXM-10As. The software driver for each EXM-10A must be configured to match that EXM-10A's actual IRQ and I/O base address.

Diagnostics

Once the LAN adapter is installed and cabled, use the Autoset diagnostic program to check the adapter installation.

Note that the Autoset diagnostic program test requires that the adapter be attached to a properly-terminated network or to a BNC "T" connector that has two terminators connected. Once the cable is installed, use the Autoset diagnostic program to check the network interconnection.

Select the Diagnostics option in the Autoset menu. The Initialization and Diagnostics menu displays. The configuration options currently chosen are listed in parentheses. The following displays while several options are checked:

Network Interface Controller (12-byte node address).....OK
Buffer Memory Check .....OK
Check Cable Connection (Cable Connected).....OK
Interrupt Assignment (4).....OK
Boot PROM Check (No Boot PROM).....OK

Press ESC to return to the previous menu. If Diagnostics reveals an error, return to the Display/Change configuration menu and make the necessary changes. Run Diagnostics again.

Error Messages

The Autoset software has several associated error messages that may display during operation. These error messages are explained below.

Out of memory error

This message displays only during development and should never display during normal operation. If this message displays, contact RadiSys Technical Support.

No adapter at this address

This message displays when the address selected does not have an EXM-10A network adapter card attached. Check the hardware to make sure the EXM-10A is properly seated and functioning. If the message continues to display, select another address such as 300h, 280h, etc. If an address change does not fix the problem, the EXM-10A should be replaced.

Error - multiple boot ROM's detected
This error has been automatically corrected
Please re-power the PC to enable the corrections

This message displays when more than one installed EXM-10A adapter has enabled a boot ROM. Only one network boot ROM should ever be installed in a PC.

To correct this, the adapter at the lowest address should remain enabled, and all other adapters should be set for no boot ROM. After saving the changes in the software, invoke a hardware reset - either push the reset button, or turn the system off, wait ten seconds, then turn it back on.

Boot PROM changes occur only after cold boot of PC

This message displays following a saved change to the boot ROM configuration. Boot ROM changes are not in effect until a hardware reset is initiated - either push the reset button, or turn the system off, wait ten seconds, then turn it back on.

Error - no new adapter

This message displays when the user has attempted to enable a disabled EXM-10A, but the software never found the disabled adapter. Either the address is wrong or the adapter card is faulty.

No interrupt available for configuration

This message displays when there is no free interrupt to assign to the EXM-10A. The only solution is to determine where all the interrupts are configured, and to free an interrupt that is redundant or unnecessary.

Cannot initiate an adapter with a disabled interrupt

This message displays when a disabled interrupt has been selected. Retry with a valid interrupt selection.

No NIC. DMA Failure

These messages display when a fault is detected in the AT/LANTIC ™ chip on the EXM-10A. This is a fatal hardware error. Contact RadiSys Technical Support.

Incorrect PROM ID Byte

This message displays when there is a hardware problem in the EEPROM. I/O mode is thus disabled. Contact RadiSys Technical Support.

(xfer to memory)
(xfer from memory
Failed after X bytes with X

These messages display if there is a problem during the Buffer Memory test. The first two messages highlight errors in the transferal of data. The third message identifies where the data transfer error occurred. This is a fatal hardware error. Contact RadiSys Technical Support.

Cable Disconnected
Cable Unterminated

These messages indicate faults in the cabling or connection. Check to see if the network cable is in proper working order, properly connected and terminated. If the connections are proper and the termination is acceptable, the cables are faulty. If the cable tests good in another system, the connection is faulty.

No Interrupt

This message displays during the Interrupt Assignment test if the interrupt selected is not active. Return to the setup function and select another interrupt listed as available.

Boot ROM Failed

This message displays during the Boot ROM Check if the boot ROM does not pass the checksum test. The user must replace the boot ROM.

5. Configuring the Software Drivers

After the EXM-10A is installed, cabled and configured, follow the instructions in this chapter to configure the network interface drivers. The distribution diskettes supplied with the EXM-10A contain drivers for IPX, ODI, NDIS and a packet driver under DOS/Windows and OS/2.

The majority of users running DOS/Windows select the ODI driver in 16-bit mode, if supported by their network software.

Most OS/2 users select the ODI driver.

EXM-10A support under other operating systems, such as SCO UNIX, LynxOS, VentureCom VENIX, QNX, etc., is built into the operating system itself and does not require additional drivers. Use the instructions provided with the network software package.

The I/O base address, shared memory base address, and IRQ channel used by each LAN adapter must agree with the values for those parameters that are used by the adapter's network interface driver. The method used to change the driver parameters depends on the network operating system software in use.

NetWare IPX Driver for DOS Installation

The Internet Packet Exchange (IPX) drivers provided with the EXM-10A distribution diskettes are ne2000.com and atlanic.com. The ne2000.com driver is used in 8-bit, NE2000 mode with the IPX interface. Once the EXM-10A is configured using Autoset, and the distribution diskettes are loaded onto the system, use a text editor to modify the autoexec.bat file, entering these commands at the end of the file:

ne2000 /o0	(run ne2000 /d to display available options)
netx.com	(provided by network software or operating system distribution diskettes)

The ne2000.com driver supplied on the EXM-10A distribution diskettes is preconfigured for use with the Ethernet 802.3 interface. If your network requires operating **multiple** protocols on top of a single card, use the econfig program provided by Novell to change the ne2000.com interface setting to Ethernet II.

The atlanic.com driver is used in both 8-bit and 16-bit Western Digital mode with the IPX interface. Once the EXM-10A is configured using Autoset, and the distribution diskettes are loaded onto the system, modify the autoexec.bat file by entering these commands at the end of the file:

atlanic /o0	(run atlanic /d to display available options)
netx.com	(provided by network software or operating system distribution diskettes)

ODI Driver for DOS Installation

The Open Data-Link Interface (ODI) adds functionality to NetWare and network computing environments by supporting multiple protocols and multiple LAN adapters in a single workstation. Refer to the Novell *NetWare ODI Shell for DOS* manual for additional installation instructions.

Once the EXM-10A is configured using Autoset, and the distribution diskettes are loaded onto the system, use a text editor to modify the net.cfg file to match the Autoset parameters. The interrupt, I/O address, mode, and interface type must all match.

Then add the following programs into the autoexec.bat file:

lsl.com	Link support layer
atlantic.com	Multiple Link Interface Driver
ipxodi.com	IPX/SPX Protocol
netx.com	(provided by operating system or workstation distribution diskettes)

While editing the autoexec.bat file, make sure that the path= statement includes the directory containing the net.cfg file.

The atlantic.com driver is used for the ODI interface in 8-bit and 16-bit Western Digital mode and 8-bit and 16-bit NE2000 mode. If using the NE2000 Boot PROM, refer to Novell's *NetWare Installation Supplement* manual for the configuration option number that matches your network environment.

The ODI interface does not support IRQ7, IRQ11, IRQ12, and IRQ15.

ODI Driver for OS/2 Installation

The steps below outline a typical procedure for using the EXM-10A to access the Novell NetWare Requester using the ODI interface running under OS/2:

1. Open a DOS window.
2. Run Autoset. Set the IRQ=3, I/O port address=300, and select the adapter architecture.
3. Save and exit Autoset.
4. Shutdown OS/2.
5. From the command line, enter CTRL-ALT-ESC to enter the EXM Setup Screen.
6. Set the OB1 option byte on the EXM-10A so that bit 2, Data Width, is a 1, indicating 16-bit.
7. Hard Reset the computer so the change in OB1 takes effect. Save and reboot.
8. Install the OS/2 Workstation Service Requester (1 disk) and the OS/2 Utilities (2 disks) supplied with the Novell Network software.
9. Run INSTALL from C:\NETWARE to select and load NE2000.SYS. After the installation config.sys should contain the following section:

```
device=c:\netware\lsl.sys
run c:\netware\ddaemon.exe
device=c:\netware\ne2000.sys
device=c:\netware\ipx.sys
device=c:\netware\spx.sys
run c:\netware\spdaemon.exe
device=c:\netware\nwreq.sys
ifs=c:\netware\nwifs.ifs
run=c:\netware\nwdaemon.exe
```

10. Modify/create net.cfg according to the environment. For example:

```
Link Driver NE2000
        Frame Ethernet_802.3
        Protocol IPX
        Port 300 f
```

11. Reboot the system.

NDIS Driver for DOS Installation

The NDIS ethat2 driver is used for both 8-bit and 16-bit Western Digital mode and 8-bit and 16-bit NE2000 mode for the NDIS interface. It is used by various protocol stacks and applications, such as Windows for Workgroups (WFW). NDIS 3.0 protected mode support is already included in WFW. The steps below would be part of a typical setup for NDIS 2.0 real mode.

1. Set up protocol.ini according to the environment. To set up ethat2 for NE2000 using IRQ3 and I/O base address 300, refer to the example below.

```
[EXM10A]
DriverName=ETHAT20$
IOBASE=0x300
INTERRUPT=3

[MS$NETBEUI]
DriverName=netbeui$
SESSIONS=10
NCBS=32
LANABASE=1
```

```
BINDINGS=EXM10A
[NETBEUI]
LANABASE=1
BINDINGS=EXM10A
```

2. At the command line, enter NET START WORKSTATION.

3. At the command line, enter NET VIEW to verify access to other computers.

Packet Driver Installation

The diskettes distributed with the EXM-10A contain two packet drivers named atdrive.com (for 16-bit NE2000 mode) and WD8003E.com (for 8-bit and 16-bit Western Digital mode). RadiSys also supplies files named Telbin (a Telnet terminal emulation) and FTPBin (an FTP or File Transfer Program) that work with TCP/IP.

In order to install the packet drivers, first run Autoset to initialize the adapter (IRQ, I/O port, shared memory base, etc.)

Once Autoset has been run, install the packet driver. Add the following lines to the end of the autoexec.bat file:

For WD8003:

```
REM WD8003 <s/w interrupt> <IRQ> <IO_Base> <shared memory base>
wd8003e 0x60 7 0x240 0xDC000
ipxpkt.com          (supplied with EXM-10A distribution diskettes)
netx.com            (supplied with network software or operating system)
```

For NE2000:

```
REM ATDrive -i <software interrupt> -b <I/O Base> -q <IRQ> -n
ATDrive -i 60 -b 240 -q 7 -n
ipxpkt.com          (supplied with EXM-10A distribution diskettes)
netx.com            (supplied with network software or operating system)
```

Windows NT Driver Installation

This section explains how to use the NE2000 driver provided with Windows NT to access the network using the EXM-10A. Be sure to use a 16-bit data width, and run Autoset first (in DOS) to set up the hardware parameters in I/O Port mode.

Log on to Windows NT.

1. Select the Network icon in the Control Panel.
2. Select the Adapters button and install the NE2000 adapter.
3. Select and install the NE2000.SYS driver. When completed, restart the system in order for the changes to take effect.
4. Select the File Manager icon.
5. Select "Network Connection" under the Disk Menu.

Additional drives that are now available display in the list, verifying the installation.

SCO UNIX Installation

This section describes instructions for properly installing the TCP/IP drivers of SCO Open Desktop version 1.1 and 2.0 and the equivalent SCO UNIX/386 version.

First, configure the EXM-10A using the methods described in the previous sections. Do this under DOS. The Autoset program is a DOS program only.

After installation of the SCO UNIX/386 or SCO Open Desktop environment, proceed with the installation of the WD8013E and TCP/IP drivers as detailed in SCO's documentation. Use the values defined in the Autoset program for I/O base address, IRQ number, memory address and size. Note that SCO UNIX has built-in support for Western Digital cards. All other aspects of installing TCP/IP or other protocol stacks and communicating with remote workstations are identical to that outlined in the SCO documentation.

Configuring an EXM-10A

To configure an EXM-10A, execute the Autoset program. This program configures the EXM-10A's interrupt vector, I/O base address, and RAM buffer addresses. Executing this program requires that the EPC be booted in DOS (not SCO UNIX), either from a DOS floppy or a DOS partition on the hard disk.

When installed in an EPC-2e, an EXM-10A must use IRQ3 as its interrupt vector. Since IRQ3 is used by the COM2 serial port driver, the COM2 serial port driver must be disabled (see "Disabling the COM2 Serial Port Driver", below). The EXM-10A may use 0x240, 0x280, 0x320 or 0x340 as its I/O base address. Use 8K bytes of memory for its RAM buffers.

When installed in an EPC other than the EPC-2e, an EXM-10A may use IRQ2, IRQ3, or IRQ7 as its interrupt vector (IRQ2 is recommended). It may use 0x240, 0x280, or 0x320 as its I/O base address. Use 8K bytes of memory for its RAM buffers.

If IRQ3 is chosen as the EXM-10A interrupt vector, the COM2 serial port driver must be disabled (see "Disabling the COM2 Serial Port Driver", below). If IRQ7 is chosen as the EXM-10A interrupt vector, the parallel port driver must be disabled (see "Disabling the Parallel Port Driver", below).

Disabling the COM2 Serial Port Driver.

The SCO UNIX COM2 serial port driver can be disabled in version 2.0 by running makdev serial and uninstalling the IBM-COM2 "board." COM2 can also be disabled manually by editing two kernel configuration files and rebuilding the kernel:

1. Edit the file /etc/conf/sdevice.d/sio. The file contains two lines:

   ```
   sio   Y   1   7   1   4   3F8   3FF   0   0
   sio   Y   1   7   1   3   2F8   2FF   0   0
   ```

   The line with a "3" in the sixth column specifies a serial I/O device driver on IRQ3. Change the "Y" in the second column of the line to "N" to remove the device driver from future kernel builds:

   ```
   sio   Y   1   7   1   4   3F8   3FF   0   0
   sio   N   1   7   1   3   2F8   2FF   0   0
   ```

2. Edit the file /etc/conf/pack.d/sio/space.c. In the section of this file defining non-microchannel devices is the line:

   ```
   {1,IBM_BOARD,1,3,1,sd(0x2f8),0,0,MCRBIT3}, /* ibm COM2 */
   ```

   This line defines the COM2 port in the serial I/O driver device table. Using "C" comment symbols, remove the line from the file:

/*{1,IBM_BOARD,1,3,1,sd(0x2f8),0,0,MCRBIT3},*//* ibm COM2 */

3. The final step in disabling the COM2 serial port driver is to rebuild the kernel:
   a. Log in as root and execute **sysadmsh**, or simply log in as **sysadmsh**.
   b. Select the "System" option.
   c. Select the "Configure" option.
   d. Select the "Kernel" option.
   e. Select the "Rebuild" option to build a kernel. When prompted, specify that the new kernel should boot by default, and that a new kernel environment should be built.
   f. Exit **sysadmsh**.

g. Reboot the system ("**shutdown -g0**" or "**init 6**").

Disabling the Parallel Port Driver

The SCO UNIX parallel port driver can be disabled in version 2.0 by entering makdev parallel and uninstalling the parallel port. Or you can disable the port manually by editing two kernel configuration files and rebuilding the kernel:

1. Edit the file /etc/conf/sdevice.d/pa. The file contains a single line:

   pa Y 1 3 1 7 378 37F 0 0

   The "7" in the sixth column specifies that the device driver will use IRQ7. Change the "Y" in the second column of the line to "N" to denote that the device driver should not be built into the kernel:

   pa N 1 3 1 7 378 37F 0 0

2. Edit the file /etc/conf/cf.d/mdevice. Included in the file is the line:

   pa ocIiw ictoHr pa 0 6 1 3 -1

   The "r" in the string in the third column specifies that the device driver is required in all kernel builds. Delete the "r" from the string in the third column:

   pa ocIiw ictoH pa 0 6 1 3 -1

3. The final step in disabling the parallel port driver is to rebuild the kernel:
   a. Log in as root and execute **sysadmsh**, or simply log in as **sysadmsh**.
   b. Select the "System" option.
   c. Select the "Configure" option.
   d. Select the "Kernel" option.
   e. Select the "Rebuild" option to build a kernel. When prompted, specify that the new kernel should boot by default, and that a new kernel environment should be built.
   f. Exit **sysadmsh**.

g. Reboot the system ("**shutdown -g0**" or "**init 6**").

VenturCom VENIX Installation

Installing an EXM-10A Ethernet controller requires that the EXM-10A be configured to execute effectively with the other devices in the system. VenturCom VENIX may also require re-configuration, depending on the EXM-10A's configuration parameters.

Configuring an EXM-10A

To configure an EXM-10A, execute the Autoset program. This program configures the EXM-10A's interrupt vector, I/O base address, and RAM buffer addresses. Executing Autoset requires that the EPC be booted to DOS (not VENIX), either from a DOS floppy or a DOS partition on the hard disk.

When installed in an EPC-2E, an EXM-10A must use IRQ3 as its interrupt vector. Since IRQ3 is used by the COM2 serial port driver, the COM2 serial port driver must be disabled (see "Disabling the COM2 Serial Port Driver", below). It may use 0x240, 0x280, 0x320, or 0x340 as its I/O base address. It may use 16K bytes or 32K bytes of memory for its RAM buffers (initially, 16K bytes is recommended).

When installed in an EPC other than the EPC-2e, an EXM-10A may use IRQ2, IRQ3, or IRQ7 as its interrupt vector (IRQ2 is recommended). It may use 0x240, 0x280, 0x320, or 0x340 as its I/O base address. It may use 16K bytes or 32K bytes of memory for its RAM buffers (initially, 16K bytes is recommended).

If IRQ3 is chosen as the EXM-10A interrupt vector, the COM2 serial port driver must be disabled (see "Disabling the COM2 Serial Port Driver", below). If IRQ7 is chosen as the EXM-10A interrupt vector, the line printer driver must be disabled (see "Disabling the Line Printer Driver", below).

Disabling the COM2 Serial Port Driver.

The VenturCom VENIX COM2 serial port driver can be disabled manually by editing a kernel configuration file and rebuilding the kernel:

1. Edit the file /etc/conf/sdevice.d/asy. The file contains two lines:

   ```
   asy   Y   1   7   1   4   3F8   3FF   0   0
   asy   Y   1   7   1   3   2F8   2FF   0   0
   ```

   The line with a "3" in the sixth column specifies a serial I/O device driver on IRQ3. Change the "Y" in the second column of the line to "N" to remove the device driver from future kernel builds:

   ```
   asy   Y   1   7   1   4   3F8   3FF   0   0
   asy   N   1   7   1   3   2F8   2FF   0   0
   ```

2. To remove the COM2 serial port driver from the kernel, a new kernel must be built and rebooted:

   a. Log in as root and execute **kconfig**.

   b. Select the "BUILD A KERNEL" option.

c. When prompted, specify that the new kernel should be installed, specify the shutdown warning time, and confirm that a shutdown should occur.

Disabling the Line Printer Driver

The VenturCom VENIX line printer driver can be disabled using **kconfig**:

1. Log in as root and execute **kconfig**.
2. Select the "CONFIGURE KERNEL" option.
3. Select the "REMOVE DRIVER" option.
4. Select the "Line Printer Driver" option, if it is present, and confirm that the line printer driver should be removed. Otherwise, skip to the next step.
5. Return to the **kconfig** top-level menu (by specifying "m" as the selection to both the driver removal and configuration menus).
6. If earlier selections removed the line printer driver, a prompt will occur. Confirm that the modified system files should be saved.
7. Select the "BUILD A KERNEL" option.
8. When prompted, specify that the new kernel should be installed, specify the shutdown warning time, and confirm that a shutdown should occur.

LynxOS Installation

The EXM-10A must be set to 16-bit mode (bit 2 in OB1 - refer to Chapter 2) and configured by the Autoset program in Shared Memory (WD8013-compatible) mode.

For more information on driver data structure editing and building the kernel to operate correctly, reference the *LynxOS TCP/IP Installation and Configuration Manual*.

There are three basic steps to the installation of LynxOS TCP/IP:

1. Retrieve TCP/IP from the floppies or tape.
2. Configure the EXM-10A in Western Digital mode.
3. Install TCP/IP into the kernel.

Retrieve TCP/IP

Install the appropriate LynxOS floppy or tape onto the drive. Make sure you are in the root directory by typing cd / . Retrieve the data with the following command:

```
tar xvf /dev/r<Device_Name>
```

For example, if the system is an EPC system with a 3.5" disk, use the following command:

```
tar xvf /dev/rfd1440.0
```

Configure the EXM-10A Parameters

Follow these steps to set up the configurable parameters for the EXM-10A card to work under LynxOS.

1. Place the card in the expansion slot and boot up DOS.

2. Run the Autoset program and set the I/O base address and the IRQ. Set the shared memory base to a 16K byte boundary such as 0xCC00.

If you have purchased your EPC with LynxOS installed, the shared memory base address specified in the kernel matches that of the supplied EXM-10A. If you change the EXM-10A's shared memory base address, the drive

information must be modified. Edit the /sys/devices/if_wd3einfo.c file to reflect the new value and remake the kernel.

Install TCP/IP into the Kernel

Before starting the install script, decide on a host name and check with the Network Administrator to guarantee that the selected host name is unique.

The script Install.tcpip adds TCP/IP to the driver library and device library and then rebuilds the kernel. It will also prompt for the system's host name. To install TCP/IP into the kernel, type the following:

```
/usr/bin/Install.tcpip
```

For more information about this installation, refer to the *LynxOS TCP/IP for 386/AT & PS/2 Systems Installation and Configuration Manual.*

6. Support and Service

In North America

Technical Support

RadiSys maintains a technical support phone line at (503) 615-1100 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) 615-1121. 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.

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.

Warranty Repairs

Products under warranty 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
5445 NW Dawson Creek Drive
Hillsboro, OR, 97124

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: Replaceable Fuse and Boot ROM

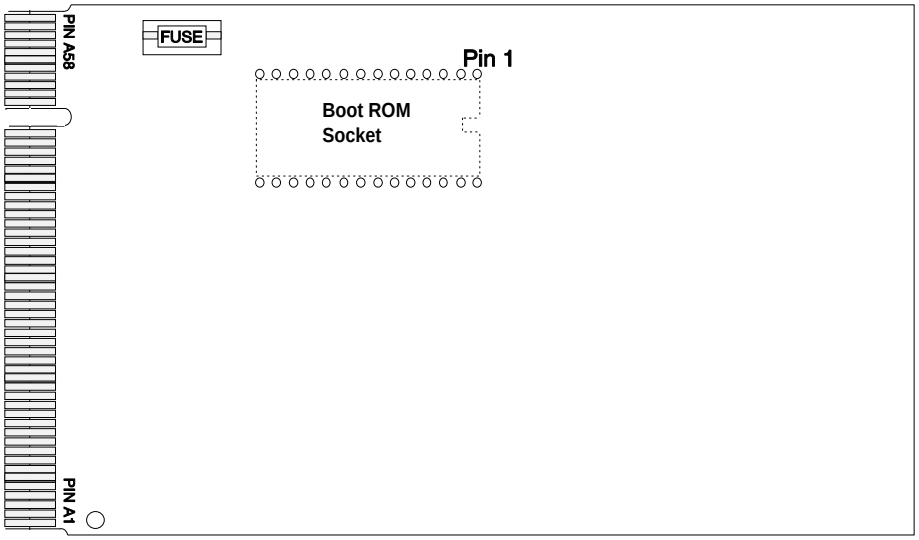


Figure 6. Fuse and Boot ROM Locations.

The EXM-10A fuse slides easily out of the fuse receptacle. Refer to the figure above. The part number is 3402.0012.2.

Boot ROM

The boot ROM socket, shown in the same figure, is designed to accommodate 8K x 8, 16K x 8, 32K x 8 and 64K x 8 ROM chips. To use a boot ROM, you not only have to enable Bit 1 in OB1, (described in Chapter 2, *Installation*) you have to configure the ROM size correctly using the Autoset program.

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