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Industrial PC/AT Computer System

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PAGE(S)	DESCRIPTION
ix	Added Table Listings
1-5	Added Note and updated Configuration Option
1-11	Removed incorrect reference in Fan and Filter paragraph
1-12	Added Warning
3-16	Added Table 3-3
3-25	Updated Line Voltage
3-26	Added Warning and removed reference in instruction number 1.
3-30	Renumbered Table 3-4
3-31	Renumbered Table 3-5
6-12	Deleted line: 030-03F VMEbus Interface Control and Status Reg. in Table 6-3
9-1	Corrected last sentence in the Third Bullet item

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1.2 PRODUCT OVERVIEW

The 8450 Industrial Computer System puts the power and versatility of an IBM PC/AT compatible computer in a package that makes sense for the factory floor and other harsh environments. The Xycom 8450 Industrial PC/AT Computer System features an open-ended design to meet a wide variety of applications where both a powerful PC and a durable industrial enclosure are required. The system integrates the operator interface, computer card cage, mass storage, and power supply in a truly industrial form factor.

The 8450 system includes a 5-slot passive AT backplane, a VGA monitor, hard and floppy disk drive facilities, and data entry and function keypads. The front panel is sealed to NEMA 4/NEMA 12 standards, and the CRT is protected by an impact-resistant Lexan shield. The open-architecture design accepts any IBM PC, XT, or AT compatible cards.

The system comes with an 80386SX, 80486SX, 80486DX or 80486DX2 computer installed (configuration determined upon order). The processor board combines all the functions of a complete IBM PC/AT compatible computer on a single, industrially-hardened circuit board. The system's "works in a drawer" design allows easy access to the boards, switches, power supply, and disk drives. The drawer is easily removed by detaching four screws.

Many software packages are compatible with the 8450. Some of these packages include:

- **SoftScreen PC/AT**
- AB 6200
- AIMAX-PLUS
- Cellworks
- DMACS
- Development Series
- Factory Link
- The FIX
- FloPro
- GENESIS
- Intouch
- Microtie
- MICRO-VIEW
- Modsoft
- MULTI-VIEW
- OI-2000
- ONSPEC
- Paragon 500
- PCIM
- PLANT-VIEW
- ScreenWare2
- Viewpoint

This software list is continually expanding. Consult Xycom for additional listings.

The 8450 offers the following standard features:

- 80X86 CPU
- Five-slot PC/AT Passive Backplane (5 AT Slots)
- 12" High-Resolution VGA Color Monitor
- VGA Video Controller Board
- 32 Data Entry and 20 Function Keys
- 120, and 240 Mbyte IDE hard drive
- 3.5" 1.44 Mbyte Floppy Drive
- MS-DOS
- Removable Equipment Drawer (Accesses Disk Facilities, Backplane, and Power Supply)
- 130-Watt Power Supply
- IBM PC/AT/XT Compatibility
- External floppy Disk Drive Port
- External Printer Port
- External COM1 and COM2 Ports
- Rugged Front Panel Sealed to meet both NEMA 4/NEMA 12 Specifications when Panel-Mounted, and EIA 19-inch Standard when Rack-Mounted
- Touch Screen; to order place a T following the product version number

Configurations:

IMPORTANT NOTICE
ALL REFERENCES TO THE 8450-5254 SERIES ALSO APPLY TO THE **8450-6254**.

- 8450-5252: 80386SX, 25MHz, 2 Mbytes, 120 Mbyte hard disk
- 8450-5254: 80386SX, 25MHz, 4 Mbytes, 120 Mbyte hard disk
- 8450-3204: 80486SX, 25MHz, 4 Mbytes, 120 Mbyte hard disk
- 8480-4254: 80486DX, 25MHz, 4 Mbytes, 120 Mbyte hard disk
- 8450-4508: 80486DX2, 50MHz, 8 Mbytes, 240 Mbyte hard disk
- 8450-6254: 80486SLC, 25MHz, 4 Mbytes, 120 Mbyte hard disk

Optional items are also available with the 8450:

- 4100-SSD Solid State Drive emulator
- 8000-KB3 Panel mount, QWERTY sealed-membrane keyboard
- 8000-KB4 Panel mount, numeric sealed-membrane keyboard
- 4100-MS1 3-button serial mouse
- 4100-CN1 Extender cable to allow unit to operate while drawer is removed
- 8000-RAD Radar card with isolated RS232/RS485 serial ports and runtime diagnostics

Two optional sealed keyboards are available: an external sealed membrane keyboard and an external full-stroke keyboard. Both keyboards have a standard typewriter layout which facilitates programming and supervisory access. The long-life keyswitches are designed to reduce your margin of error in data entry: you know when your keystrokes are properly entered by the resistant pressure and movement of the keyswitches. The sealed membrane keyboard can be rack- or panel-mounted, while the external keyboard plugs into the front panel.

1.3 UNPACKING THE SYSTEM

When you remove the 8450 from its box, verify that you have the parts listed below. It is a good idea to save the box and inner wrapping in case you need to re-ship the unit.

- 8450 unit
- Documentation kit, which includes:
  - Video cable
  - Power cable
  - PKIM utility diskette
  - Diagnostic software diskette
  - Two spare fuses
  - 16 nuts
  - 8450 user manual
  - Business reply card
  - Any options such as keyboards, utility programs, mouse, touch screen, etc.

1.4 SYSTEM COMPONENTS

1.4.1 Front Panel Components

The 8450 is equipped with a NEMA 4/NEMA 12 sealed front panel. The panel protects the system's interior when the system is properly panel-mounted. See Section 3.8 for rack- and panel-mounting instructions. Figure 1-1 illustrates the front panel features of the 8450-5252/4. (The 8450-320X, 8450-4XXX do not have status LEDs.)

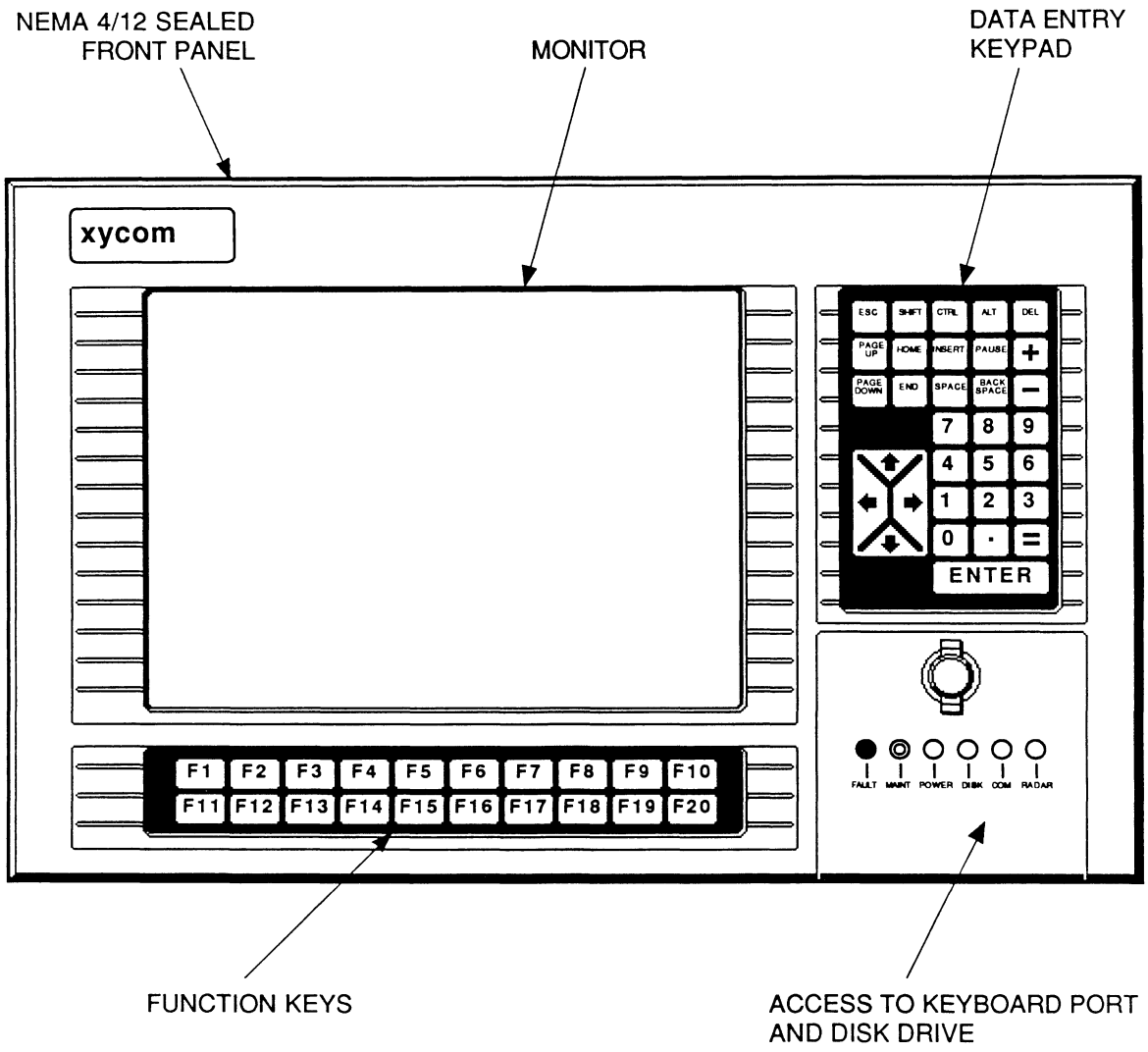


Figure 1-1. Front Panel

1.4.2 **Back Panel Components of the 8450-525X**

Figure 1-2 illustrates the features on the 8450 back panel.

> **NOTE**
> The proper "volt select" setting must be selected before supplying electrical current to the system. Otherwise, the unit could be damaged.

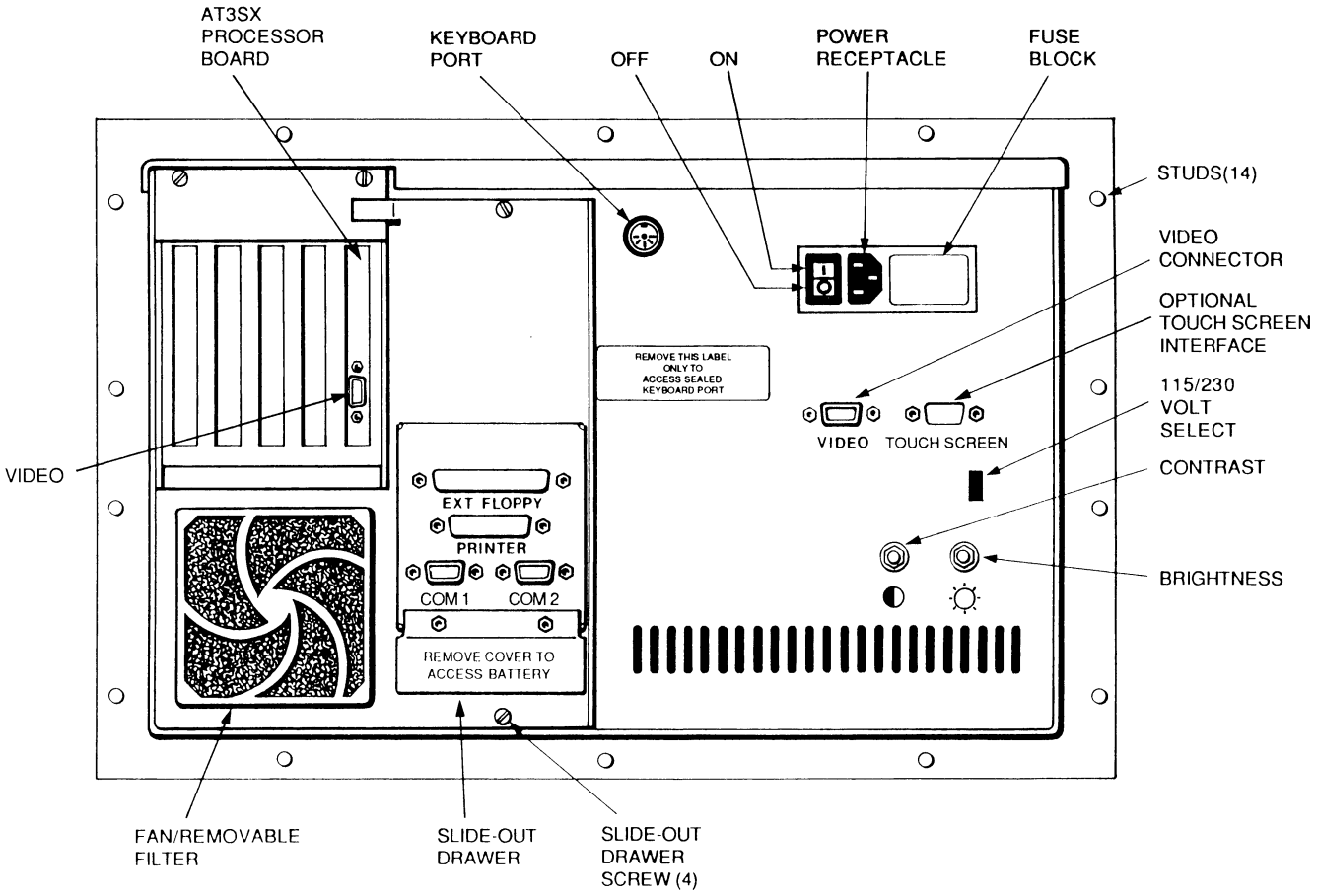


Figure 1-2. 8450-525X Back Panel

1.4.3 **Back Panel Components (8450-3204, 3208, 4254, 4508)**

Figure 1-3 illustrates the features on the 8450-3204/3208 and 8450-4254/4258

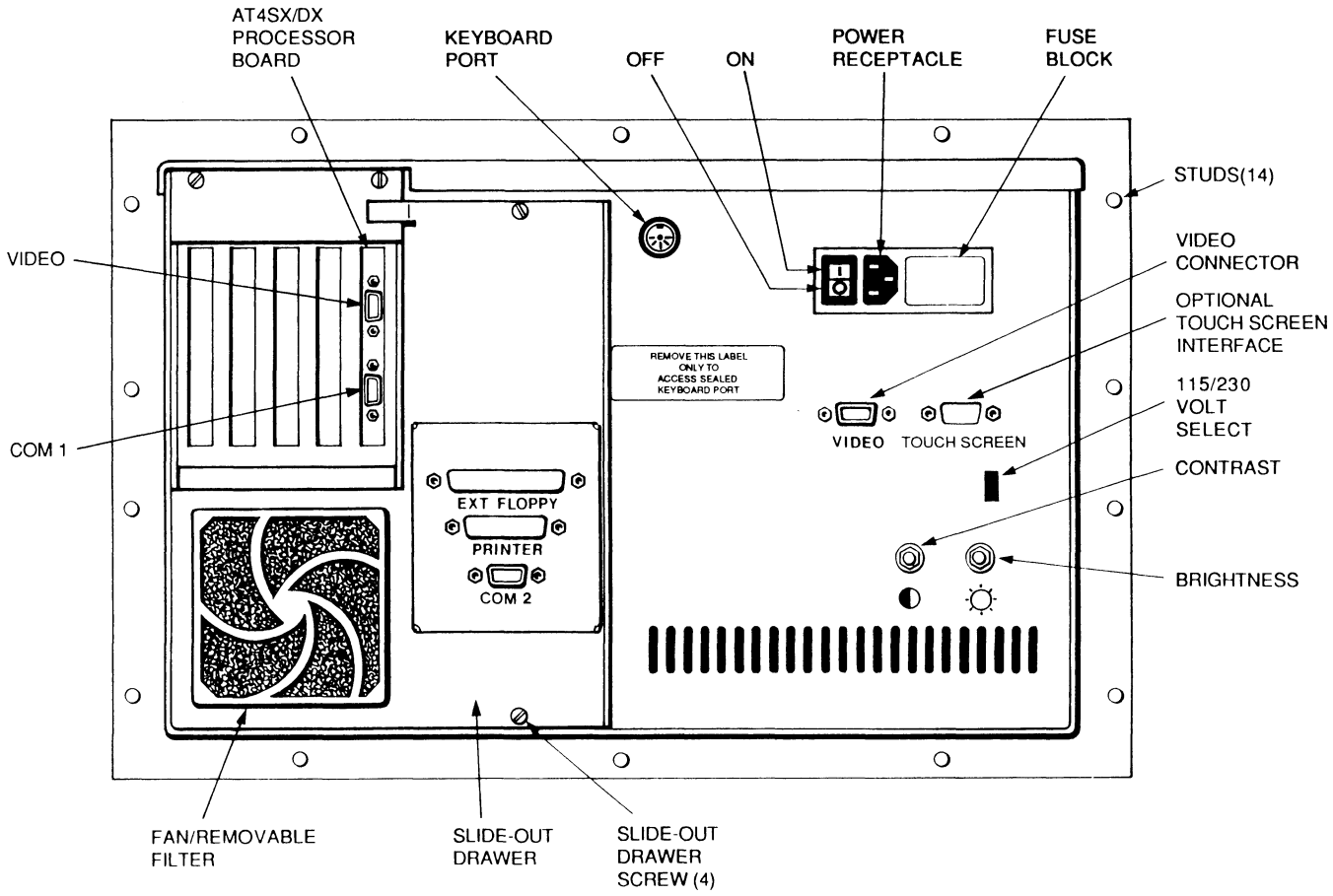


Figure 1-3. 8450-3204/3208 and 8450-4254/4258 Back Panel

Voltage Select The voltage selection switch for the 8450 is located above the brightness and contrast knobs (see Figure 1-2). To move the switch to either 115 VAC or 230 VAC, use a small blunt object such as a flathead screwdriver to move the switch up or down.

Monitor Protected from breakage by an impact resistant Lexan shield, the 12" monitor offers a high resolution VGA color. If the touch screen option is installed, the Lexan shield will be replaced by safety glass.

Function Keys These twenty fully operable sealed keys are located directly below the monitor. They provide the user with easy access to familiar PC routines. The function keys are programmable to enable you to customize your keypad keycodes.

Access to Disk Keyboard Port Located below the keypad, this door allows access to the floppy disk and the keyboard port. The keyboard port (located just above the disk access) allows a PC keyboard to be interfaced with the system.

Data Entry Pad This sealed 32-key numeric keypad includes the following keys for data entry: "Shift", "Control", "Alt", "Esc", "Backspace", "Space", "Numeric", "Cursors", ".", "+", "-", "Enter," and arrows.

ON/OFF Switch This switch should be positioned to OFF (O) until the system is properly configured and connected to a 115 VAC or 230 VAC power source.

Power Receptacle The power receptacle is located to the right of the ON/OFF switch. The plug and cord must be securely positioned before turning power ON.

Fuse Receptacle The 4A slo blo fuse is located to the right of the power receptacle. To access the fuse, insert a blunt object in the notch in the cover and pry the door open.

Sealed Keyboard Connector The optional sealed keyboard (8000-KB3 or 8000-KB4) interfaces with the system via this single-row, 26-pin connector, which is located near the center of the back panel. To access the connector, remove the adhesive cover.

Video Connector The 15-pin video connector is located beneath the ON/OFF switch.

Video Controls The contrast and brightness controls are located near the bottom of the back panel, below the ON/OFF switch. Turning the knobs left or right will adjust contrast (left knob) or brightness (right knob) on the monitor.

Com1 Port This serial port is a DB-9 connector, and is located on the (8450-3XXX, 4XXX

only CPU) card. COM1 is located on the I/O panel located on the bottom right of the drawer for the 8450-525X.

Com2 Port The serial port (COM2:) connector is a DB-9 male.

Printer Port The printer port (LPT1:) connector is a DB-25 female.

Floppy Disk Port The floppy disk (B:) port is a DB-37 connector.

Fan & Filter The fan is located at the bottom rear corner of the back panel (when fully assembled).

Video Port The video port is a 15-pin VGA connector and is located on the CPU board for all configurations.

> **NOTE**
> The pinouts for connectors and ports are shown in Appendix C.

External Battery The 8450-5252/4 has an external battery located below COM 1 and COM 2. To replace the battery, remove two screws and unplug the battery.

1.5 QUICK START-UP

> **NOTE**
> Xycom recommends you *at least* read this section and the appendices. This section gets your 8450 up and running without explaining the capabilities and options of the system. The appendices provide pinouts, error messages, setup information, specifications, etc.

To prepare the system for use, perform the steps listed below:

> **WARNING**
> Turn the power to the unit off and unplug the power cord while making any adjustments to the inside or outside of the terminal.

> **WARNING**
> If the battery is disabled in your system, please do the following: upon enabling, your system **must** be powered up for a minimum of 30 seconds. Failure to follow this procedure may result in premature battery failure.

1. **Set the voltage** by using a blunt object such as a screwdriver to move the voltage switch to 115 VAC or 230 VAC.

2. **Connect the video cable** from the 15 pin connector on the CPU board to the connector labeled "video" in the center of the 8450 back panel.

3. **Attach optional keyboards/mouse.**

   - Attach a sealed membrane keyboard to the sealed keyboard connector on the 8450 back panel. The sticker must first be removed from the connector to gain access.
   - Connect an external full-stroke keyboard to the keyboard connector behind the access door at the lower right of the 8450 front panel or to the connector on the back panel.
   - A serial mouse can be connected to either the serial port on the processor (P2) or the serial port at the lower left of the 8450 back panel (COM 2).

4. **Attach any other optional equipment** following the instructions in chapter 3.

> **NOTE**
> Enable onboard battery via either J2 in the "B" position or SW1 S1 turned on, for the AT3SX.

5. **Attach the power cord** from the power receptacle to a properly grounded 115 or 230 VAC outlet.

6. **Turn power to the unit ON**. The system will boot up at the C: prompt if DOS is installed on drive C:.

7. **Set the brightness and contrast controls** on the back panel to the desired levels.

8. **Install MS-DOS** onto the system if it is not already present. Follow the instructions in Section 3.6.1.

9. **Install application software** via the A: floppy disk drive located behind the access door on the front panel.

2.1 INTRODUCTION

> **NOTE**
> Unexpected failures may occur if Xycom diagnostics are run with device drivers or memory resident programs installed on the system.

Make sure the Setup Menu is configured properly (factory set configuration). To enter the Setup Menu, press <CTRL><ALT>S simultaneously anytime after the post RAM test has completed. Make any changes necessary by following directions on the CRT. Save and leave the Setup by pressing <F10>, then <F5>. Refer to Chapter 5 for more information on the Setup menus.

To test your 8450, you need the following equipment:

- System Test Disk - 3 1/2", DS/DD (720 Kbyte) Disk (bootable)
- IBM PC/AT compatible keyboard (Xycom P/N 91971-001 or equivalent)
- Centronics compatible printer cable
- Parallel printer (Centronics style interface)
- VGA video cable (Xycom P/N 94825-001)
- Two serial loopback test connectors (see Figure 2-2 for wiring)
- Scratch, formatted 3-1/2", DS/HD (1.44 Mbyte) disk(s)

2.2 PREPARING FOR THE TEST

Before starting the system test, perform the steps below:

1. Place the controller board jumpers and switches to the factory set positions. The numbers in parentheses are the pins onto which to install the jumper, (e.g. J1 (3-4) indicates the jumper is on pins 3 and 4 of J1). Refer to Chapters 6 and 7 to check jumper and switch settings.

2. Verify that the AC input select switch is set to the proper voltage for your application (115 or 230 VAC). Plug the female end of the AC power cable into rear of the unit, and the male end into a properly grounded outlet.

3. Connect the serial loop connector(s), printer cable, and video cables to appropriate connectors at the rear of the unit, and a PC/AT keyboard to the front of the unit.

2.3 RUNNING THE TESTS

The following paragraph explains how to run the test.

Insert the diagnostics diskette into Drive A:. Power up the computer (the diagnostics program will boot up). Figure 2-1 shows the main menu as it is displayed on the screen.

Diagnostic Tests Sequence/Selection Menu (Rel. 1.0)

0)	WILL pause on an error	4)	Auto-select tests
1)	SINGLE PASS test mode	5)	Deselect all tests
2)	Save setup to file	6)	Quit and exit to DOS
3)	Extract setup from a file	7)	Return to Previous screen
A)	RAM Test	K)	Video Interface Test
B)	Video RAM Test	L)	Speaker Port Test
C)	Extended RAM Test	M)	LPT1: Printer Port Test
D)	Real Time Clock Test	N)	LPT2: Printer Port Test
E)	COM1 Serial Port Test	O)	C: Hard Drive Interface Test
F)	COM2 Serial Port Test	P)	D: Hard Drive Interface Test
G)	COM3 Serial Port Test	Q)	A: Floppy Drive Interface Test
H)	COM4 Serial Port Test	R)	B: Floppy Drive Interface Test
I)	Math Coprocessor Test	≡ S)	Keyboard, Keypad Tests
J)	Video Adjustments Test	≡	= Test Selected

[ENTER] = START TESTING

Use the letters to move the cursor and select/deselect, or use the arrow keys to move, then use the [SPACE] key to select/deselect a test or function:

Figure 2-1. Main Menu

NOTE

Please read the DIAG.TXT and CMOS.TXT files on the diagnostics disk for detailed information.

3.1 INTRODUCTION

This chapter discusses how to install options into the 8450. The figures on the next three pages show the components on the front panel, back panel, and inside the unit to help you locate features relevant to installation. Figure 3-1 illustrates the front panel features of the 8450-5252/4. (The 8450-320X, 8450-4XXX do not have status LEDs.)

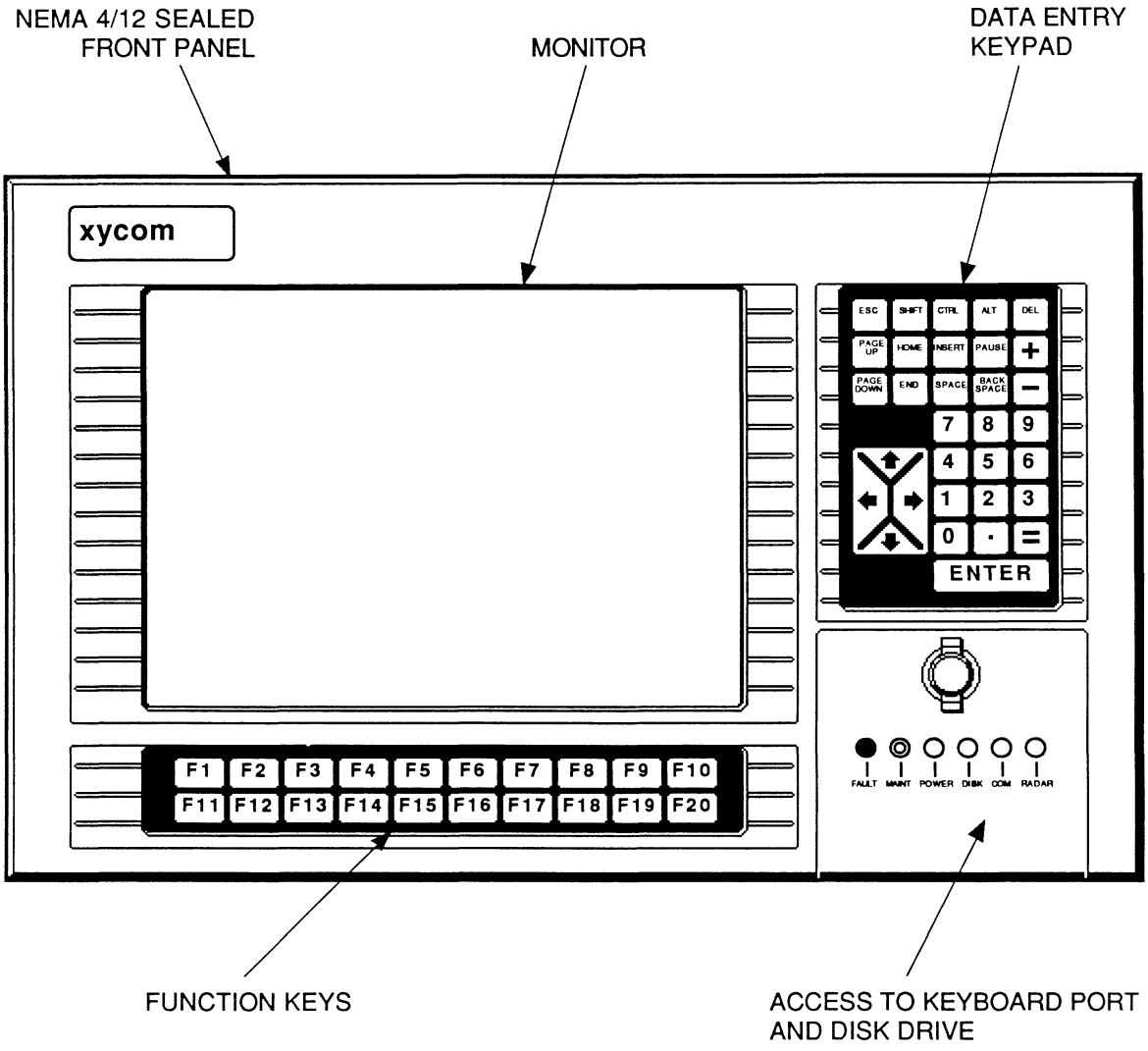


Figure 3-1. Front Panel

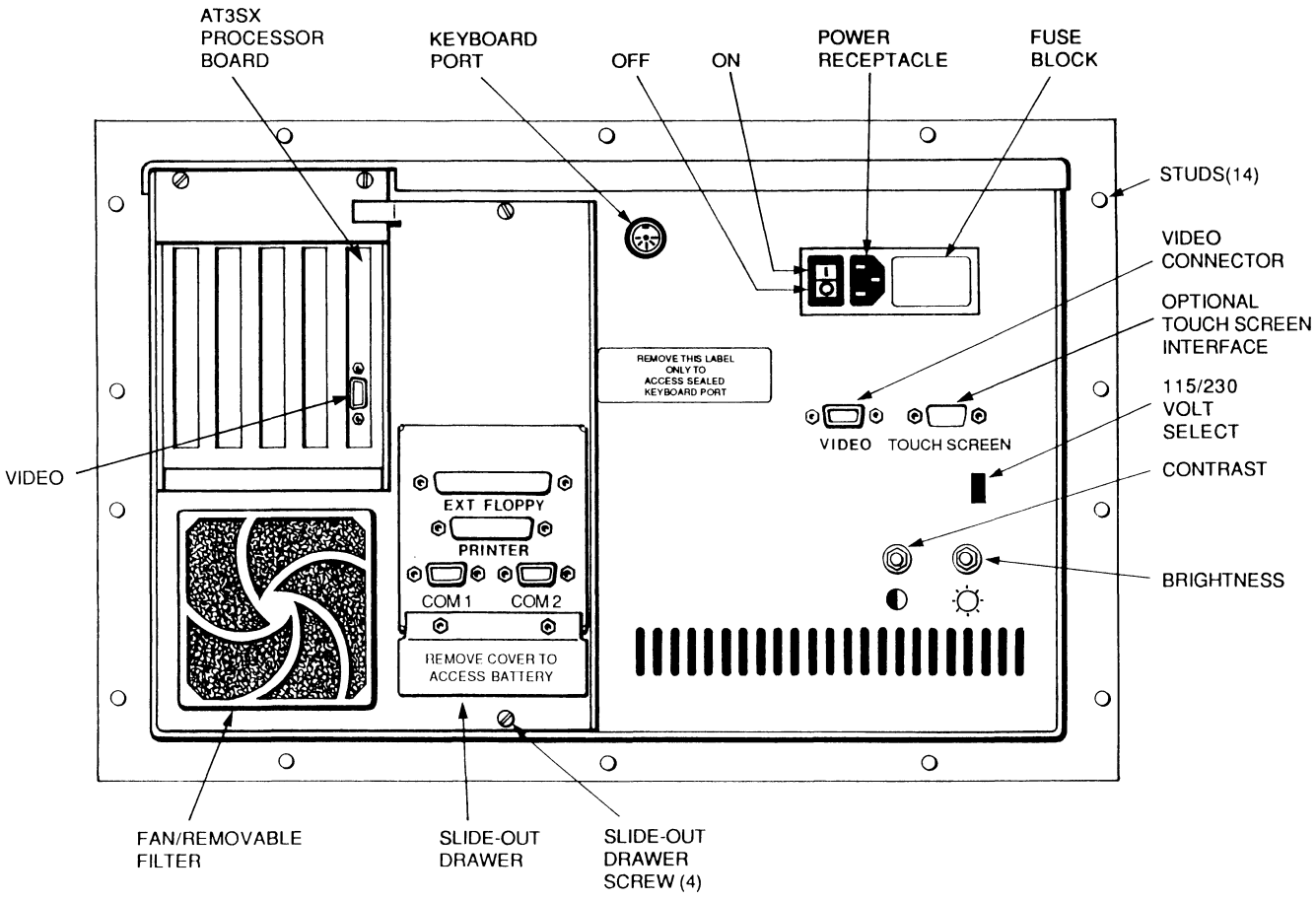


Figure 3-2. Back Panel for 8450-525X

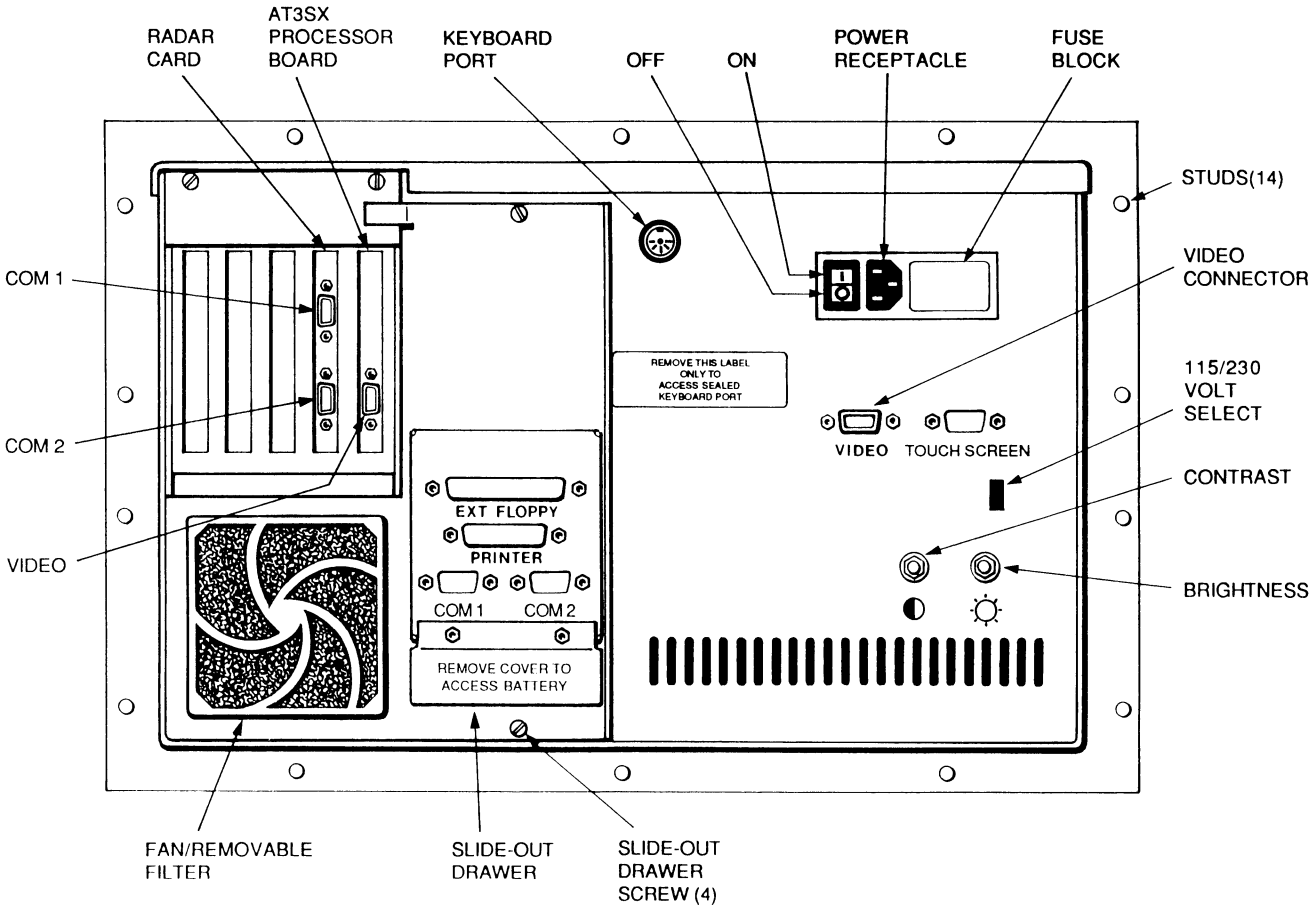


Figure 3-3. Back Panel for 8450-525X AT3SX with optional RADAR Card

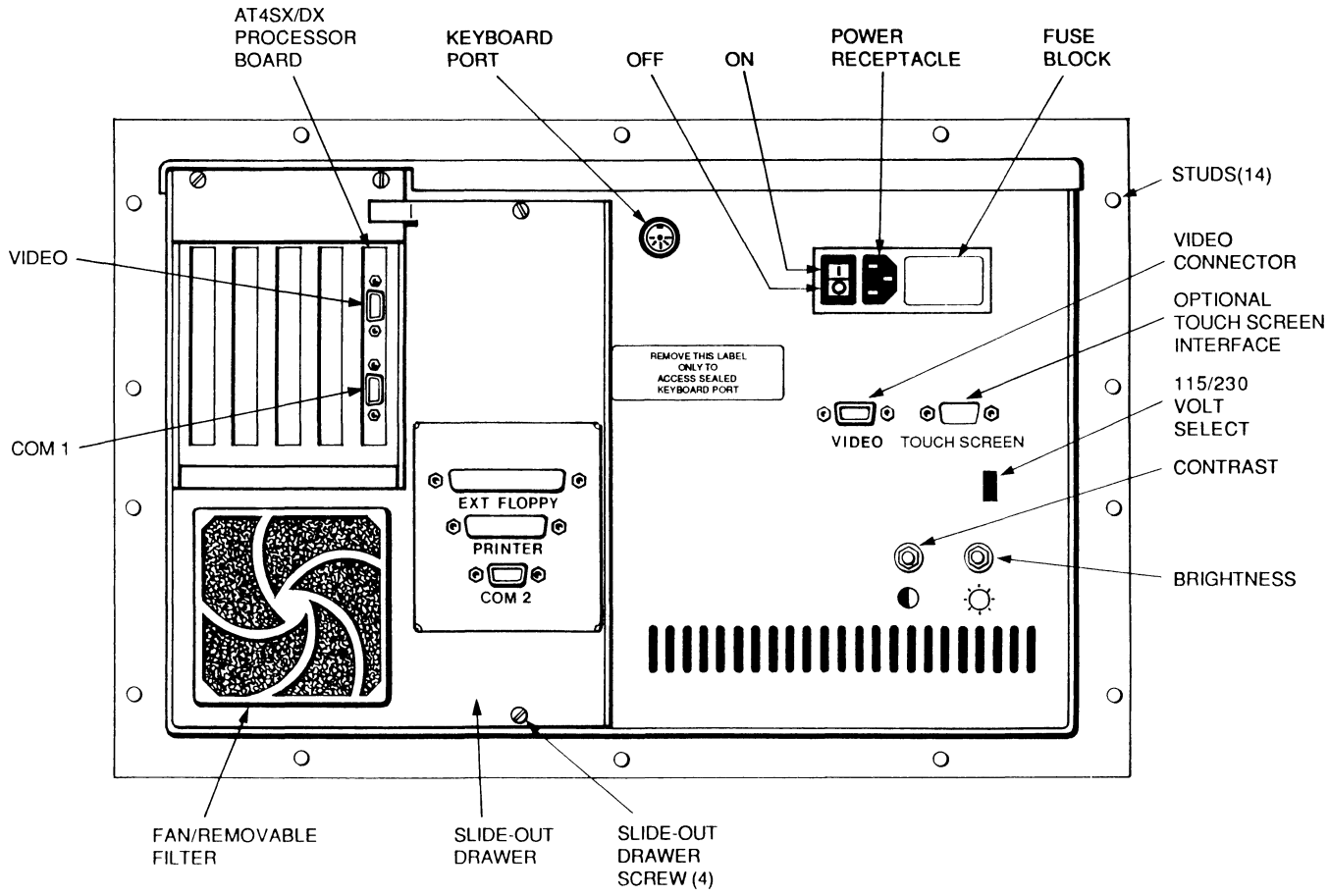


Figure 3-4. Back Panel for 8450-3204/4254/4508 AT4SX/DX/DX2

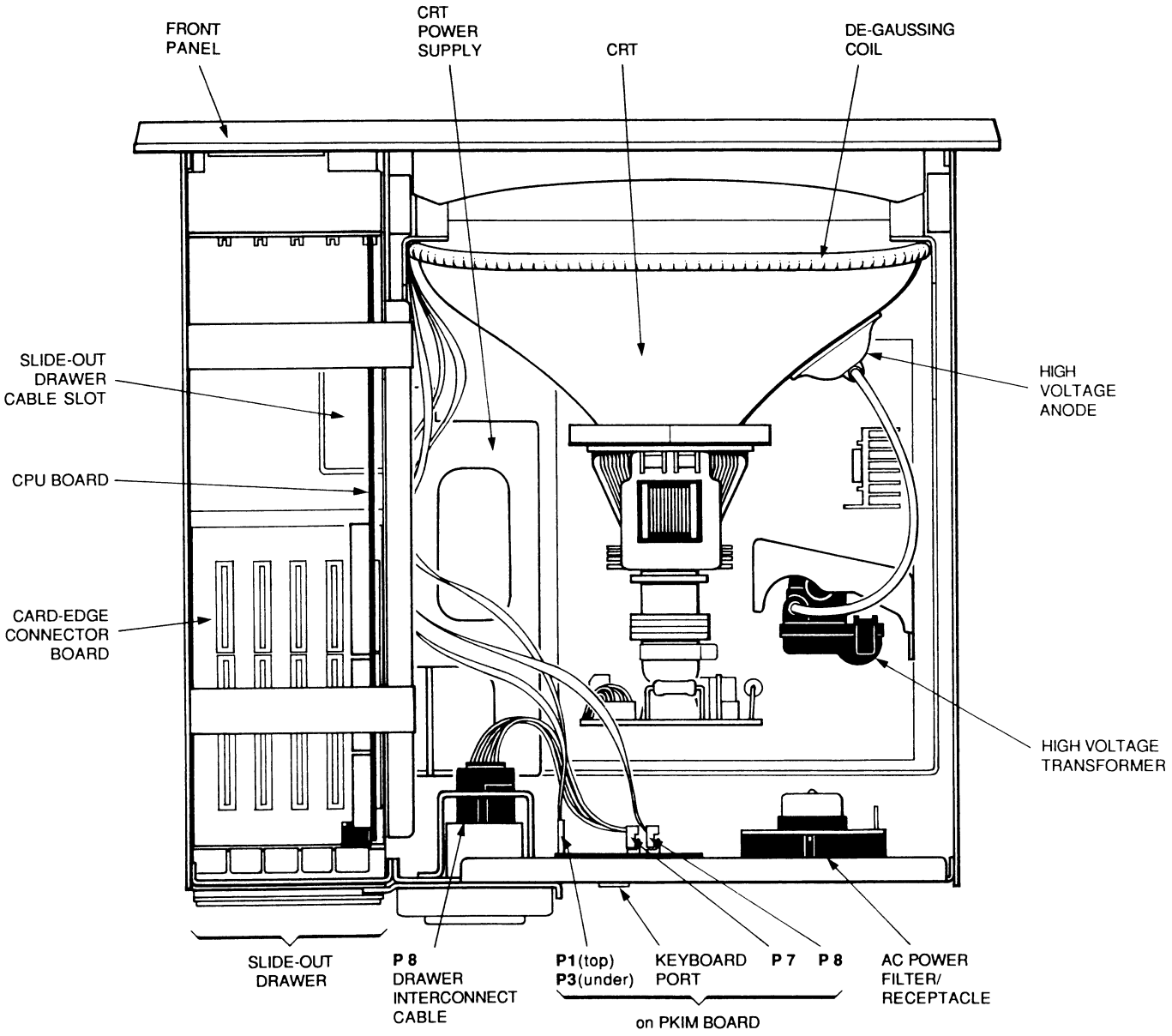


Figure 3-5. Internal System Components

3.2 PREPARING THE SYSTEM FOR USE

To prepare the system for use, perform the steps listed below. If you have purchased any options, install them according to the instructions in the next two sections.

> **WARNING**
> Do not plug the unit in until the voltage switch is set to the correct position (115 VAC or 230 VAC, depending on your application).

> **WARNING**
> The FRAGILE Cathode Ray Tube (CRT) is exposed when the computer is opened. Wear safety glasses to protect your eyes in case of accidental breakage. Internal coating of CRT is extremely TOXIC. If exposed RINSE IMMEDIATELY and consult a physician.

1. **Set the Voltage** by using a blunt object such as a screwdriver to move the voltage switch to 115 VAC or 230 VAC.

2. **Attach the Power Cord** by attaching one end to the power receptacle and the other to a properly grounded 115 or 230 VAC outlet.

3. **Connect the Video Cable** from P10 on the video card to the video connector in the center of the 8450 back panel.

4. **Connect the Touch Screen Cable** from the touch screen card to the touch screen connector on the 8450 back panel *(this feature is optional)*.

3.3 REMOVING/INSTALLING THE SLIDE-OUT DRAWER

The slide-out drawer allows access to the PC boards and disk drives. To remove or replace the slide-out drawer, follow the instructions below. The slide-out drawer is shown in Figure 3-5 on the following page.

Removing the Slide-Out Drawer

1. Remove the four screws (shown in Figure 3-4) that attach the drawer to the 8450 back panel.

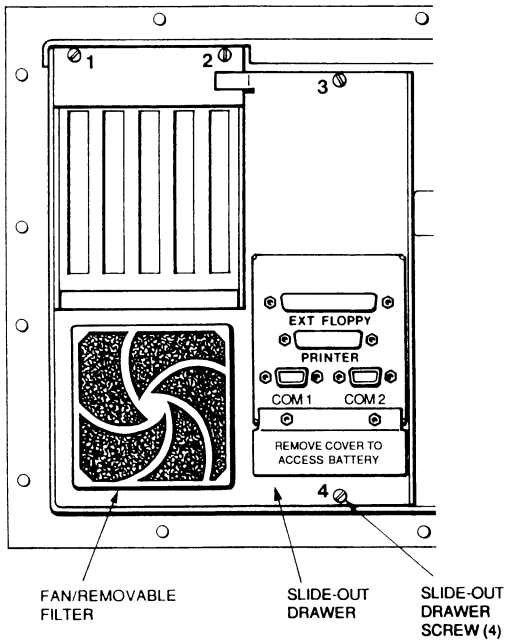


Figure 3-6. Drawer Side of the Back Panel

2. Hold the front panel with one hand (to stabilize the unit) and pull the utility drawer with the other, using the handle above the fan/filter.

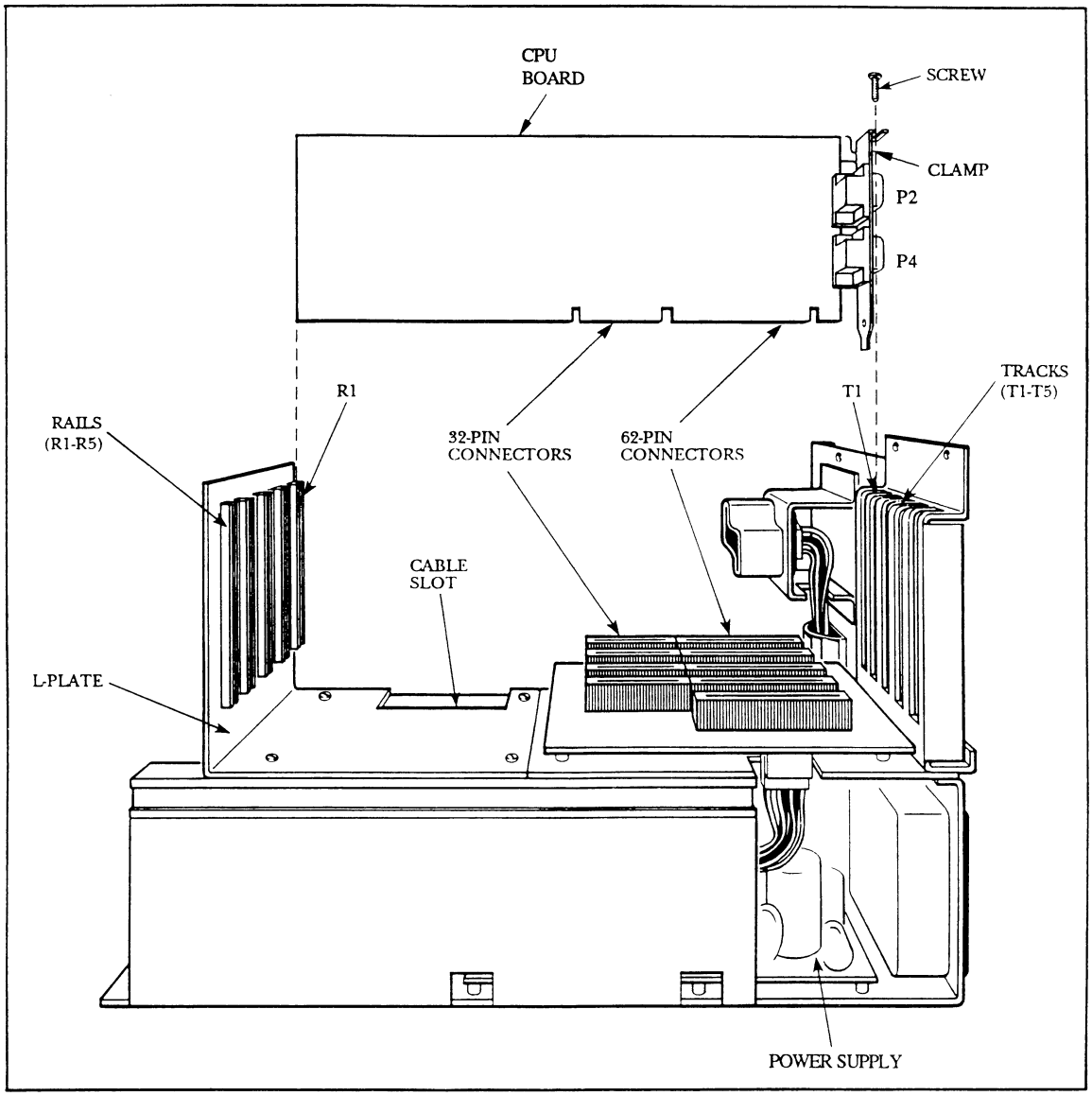


Figure 3-7. Equipment Drawer

Replacing the Slide-Out Drawer

After you have installed all options into your 8450 and are finished with the drawer, re-install it into the unit according to the instructions given below:

1. Match the guide rails on the drawer with those on the those on the inside of the system shell, as illustrated in Figure 3-8.

2. Push the drawer all the way into the shell. Secure the drawer with the four screws removed earlier (see Figure 3-6).

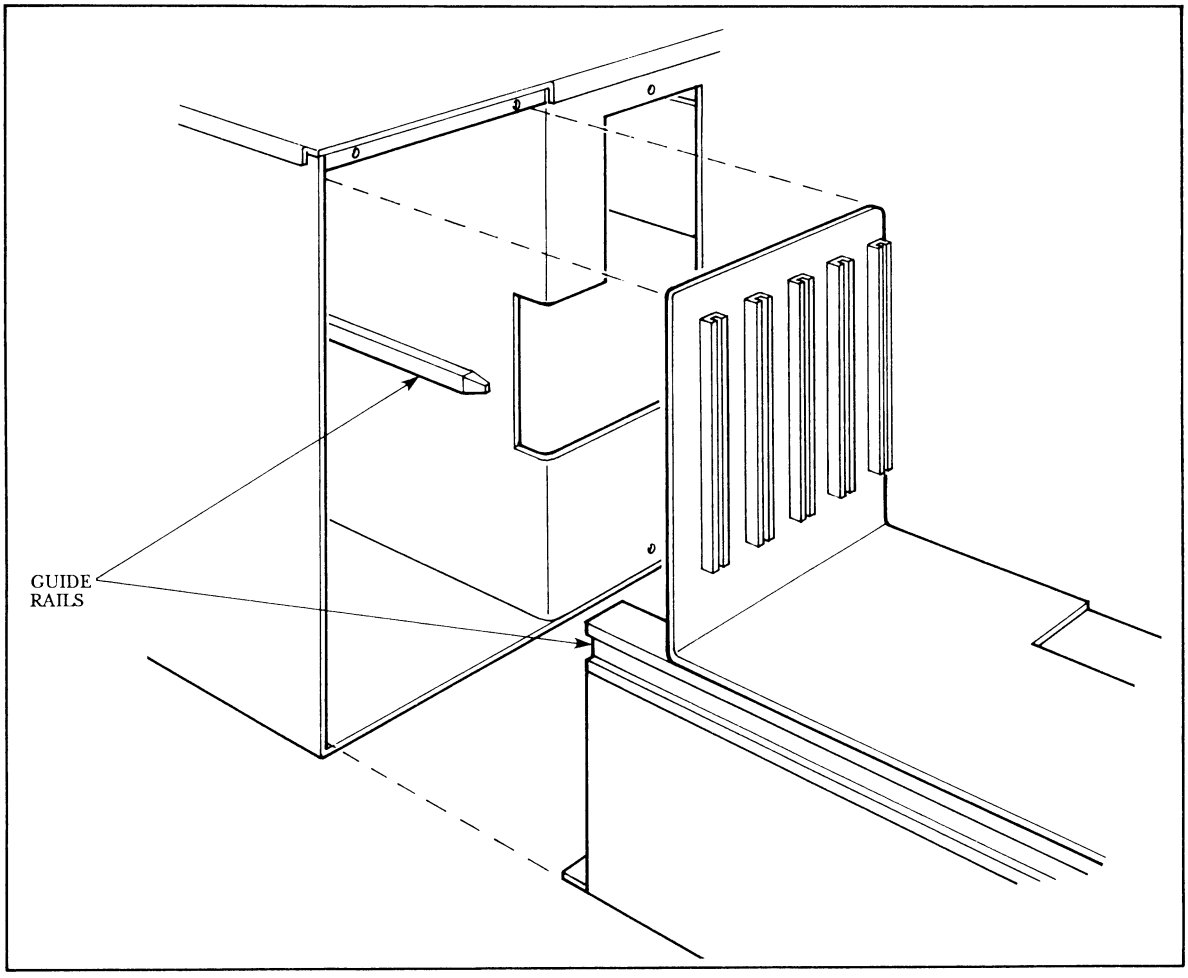


Figure 3-8. Installing the Equipment Drawer

3.4 INSTALLING INTERNAL HARDWARE OPTIONS

> **NOTE**
> Unit **must be turned off** before installing internal hardware.

To install any of the internal hardware options, first you need to remove the slide-out drawer as described in Section 3.3.

3.4.1 Installing a Math Co-processor

An optional math co-processor is available with the 8450 unit.

To install a 80387SX 25 MHz math co-processor, insert the chip into U30 of the 8450 AT3SX (386SX) processor board as shown in Figure 3-9.

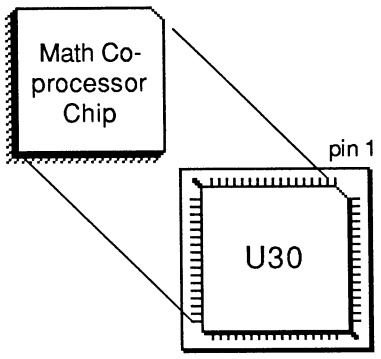


Figure 3-9. Math Co-processor Chip

3.4.1.2 Installing a Math Co-processor for the 8450-3204

To install a 80487SX 20 MHz math co-processor, remove the 80486SX CPU chip and install the 80487DX in its place. Install jumpers J12A, J13, and J14A.

3.4.2 **Installing the RADAR Card**

Before installing the 8000-RAD (RADAR Card) into the 8450, the jumpers and switches must be set appropriately for your particular configuration. See Chapter 8 for more information.

After the RADAR card is properly configured, it can be installed into the 8450 cardcage as follows:

1. Unplug the 8450 from the AC wall outlet.

2. Remove the 8450 slide-out equipment drawer. Set the screws aside for later use. (See Section 3.3 for details.)

3. Verify all jumper and switch settings. Refer to Sections 8.8 and 8.9 of the this manual for the correct settings.

4. Disconnect all cables from the AT3SX. Remove the AT3SX card from the first card slot by removing the screw that holds the AT3SX ORB to the host system.

5. Seat the RADAR card into slot one in the backplane. Push down on the card evenly until it firmly seats into the cardedge connectors.

6. Secure the RADAR ORB to the host system by replacing and tightening the screw that was removed in Step 4.

7. a. Connect cable connector P1 to P1 on the RADAR Card.
   b. Connect cable connector P3 to P6 on the RADAR Card.
   c. Connect cable connector P6 to P8 on the RADAR Card.
   d. Connect cable connector P8 to P9 on the RADAR Card.
   e. Connect cable connector P2 to P3 on the RADAR Card.

8. If present, remove the blank ORB from slot two that the AT3SX card will occupy. Save the screw.

9. Seat the AT3SX card into the slots in the back plane slot #2. Push down on the card evenly until it seats firmly into the cardedge connectors.

10. Connect cable connector P11 to P11 on the AT3SX.

11. Secure the AT3SX ORB to the host system by replacing and tightening the screw that was removed in Step 8.

12. Replace the equipment drawer into the 8450 and tighten the screws that were removed in Step 2. (See Section 3.3 for more information.)

3.4.3 **Installing the Solid State Disk Emulator Card**

Before installing the 4100-SSD (Solid State Disk) board into the 8450, the jumpers and switches must be set appropriately for your particular configuration. See your 4100-SSD manual for more information.

After the 4100-SSD is properly configured, it can be installed into the 8450 cardcage as follows:

1. Unplug the 8450 from the AC wall outlet.

2. Remove the 8450 slide-out equipment drawer. Set the screws aside for later use. (See Section 3.3 for details.)

3. Verify all jumper and switch settings. Refer to Sections 2.4 and 2.5 of the 4100-SSD manual for the correct settings.

4. If present, remove the blank ORB from the slot that the 4100-SSD card will occupy. Save the screw.

5. Seat the SSD card into the slots in the backplane. Push down on the card evenly, until it firmly seats into the cardedge connectors.

6. Secure the SSD ORB to the host system by replacing and tightening the screw that was removed in Step 4.

7. Replace the equipment drawer into the 8450 and tighten the screws that were removed in Step 2. (See Section 3.3 for more information.)

3.4.4 Installing PC Boards

1. Check that the memory and I/O configuration of the board you want to install does not conflict with the CPU and I/O memory maps in your CPU board manual.

2. Remove slide-out drawer as described in Section 3.3.

3. Remove the ORB screw in the desired track.

4. Slide the PC board into a corresponding rail (R1-R5) and track (T1-T5).

5. Push the board into the backplane connectors.

> **NOTE**
> **DO NOT** force the boards or apply uneven pressure.

6. Secure the board by installing the screw through hole in the board's metal ORB and into the top of the track.

7. Re-install the slide-out drawer as described in Section 3.3.

3.4.5 **Installing Additional DRAM (AT4) Single-Line Memory Modules (SIMMs)**

You can order your 8450 AT4 board factory-configured for either 4 or 8 Mbyte DRAM. You can reconfigure the DRAM capacity by changing the DRAM SIMMs on your board.

> NOTE
> If you reconfigure your board, you MUST use 60 ns access time SIMMs with gold contact tabs to ensure the proper connection.

Recommended DRAM manufacturers for AT4 with their respective part numbers are listed below:

Table 3-1. DRAM Manufacturers/Part Numbers

	1Mx9 SIMM (60NS)	256Kx9 SIMM (60NS)
PG DESIGN	PG10249GD-06	PG 2569G1-06
DOLPHIN/KEY	KEY10249LM-60	Key 256LM-60 Key 256LMM-60
SAMSUNG	KMM591000BG-6	
FUJITSU	MB85235A-60PSG	
XYCOM	96455-001	96454-001

To alter the DRAM capacity, simply remove the factory-installed SIMMs and replace with the SIMMs for the configuration you want:

1 MBYTE:	Four 256K9 SIMMs
2 MBYTE:	Eight 256K9 SIMMs
4 MBYTE:	Four 1M9 SIMMs
8 Mbyte:	Eight 1M9 SIMMs

For 1 or 4 Mbyte boards, the SIMMs MUST go in the four slots nearest the center of the board, as shown in Figure 3-10.

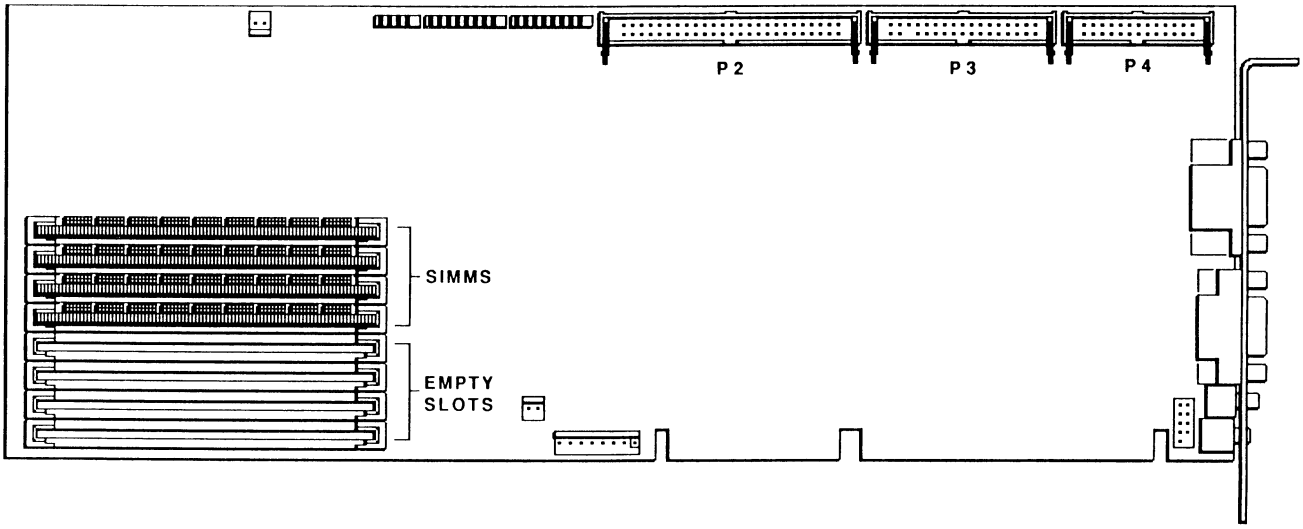


Figure 3-10. SIMM Placement

3.4.6 **Installing DRAM (AT3SX)**

The AT3SX has four SIMM sites in which to add memory. Due to the 25 MHz CPU speed, the access time of the DRAM interface is very important. To run at 0 wait states, the SIMMs must have the following access times:

- 60ns access time for nine chip DRAM SIMMs
  or
- 70ns access time for three chip DRAM SIMMs

If you opt for 80ns DRAMs, the 0 wait state option must be changed to 1 wait state in the Setup Menu.

The AT3SX can accommodate 1, 2, 4, 10 or 16 Mbytes of DRAM. SIMM supported 256Kx9, 1Mx9, or 4Mx9 DRAM may be used. Table 3-3 lists the combinations needed for the five memory configurations. (The bank location is silk screened on the back of the board.)

Recommended DRAM manufacturers for AT3SX with their respective part numbers are listed below:

Table 3-2. DRAM Manufacturers/Part Numbers (For AT3SX)

	1Mx9 SIMM (70NS)	256Kx9 SIMM (70NS)	4Mx9 SIMM (60NS)
MICRON	MT3D19M-7	MT3D2569MP-7	
SAMSUNG	KMM591000AN-7	KMM591000AN-7	
HITACHI	HB56619B-7A		HB56A49BR-6A
XYCOM	98012-001	98011-001	98749-001

Table 3-3. DRAM SIMM Module Combinations

Memory	**SIMM Site U1 (quantity)**	**SIMM Site U2 (quantity)**
1 Mbyte	256Kx9 (2)	256Kx9 (2)
2 Mbytes	1Mx9 (2)	empty
4 Mbytes	1Mx9 (2)	1Mx9 (2)
10 Mbytes	1Mx9 (2)	4Mx9 (2)
16 Mbytes	4Mx9 (2)	4Mx9 (2)

Figure 3-11, on the following page, shows DRAM installation.

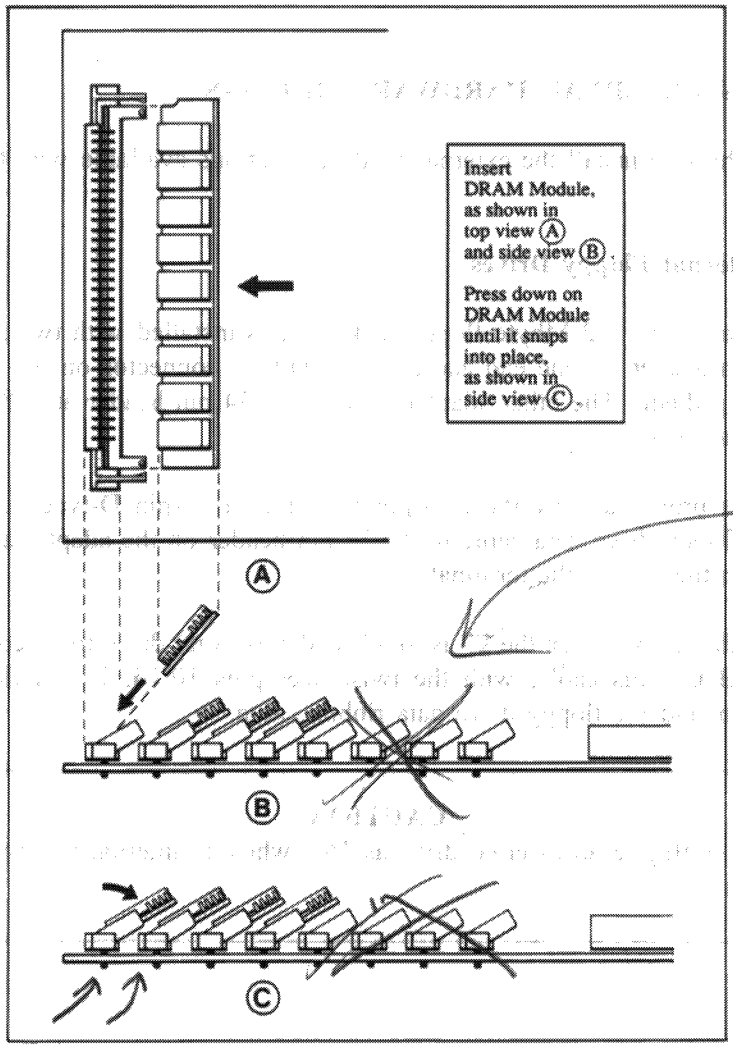


Figure 3-11. DRAM Installation

CAUTION
Do not pull too hard on the metal tabs or they could snap off the socket.

To remove a strip, pull outward on the two metal tabs on both ends of the socket. The strip should loosen in the socket and pop forward slightly for removal.

3.5 INSTALLING EXTERNAL HARDWARE OPTIONS

This section explains how to install the external hardware options available with the 8450.

3.5.1 Installing External Floppy Drives

The 4100-XD3 external 5.25", 1.2 Mbyte floppy disk drive is installed with two small adapter cables. One cable has a 34-pin header on one end and a 37-pin D-type connector on the other, with a straight ribbon cable connecting them. The other adapter cable has a 34-pin header at both ends, connected by a partially twisted ribbon cable.

The first adapter cable provided converts a 34-pin header to a 37-pin D-type connector. To install, attach the end of the floppy drive data cable to the 34-pin header on the adapter and the 37-pin end to the appropriate port on the rear of the terminal.

The second adapter cable provided in the kit is to allow the external drive to be configured as the "A:" drive (the default is B:). This cable, with the twist over pins 10-16, is installed between the first adapter's 34-pin header and the floppy drive data ribbon cable.

> **CAUTION**
> Do **not** configure an external drive as "A:" when an internal floppy drive is present.

3.5.2 **Installing the Extender Cable**

The 4100-CN1 extender cable allows the 8450 to operate when the slide-out drawer is pulled out from the system enclosure. This cable connects between the two P8 connectors located in the 8450 unit.

> **CAUTION**
> High voltages are present in the drawer when the extender cable is used.

1. Turn off power.
2. Remove the slide-out drawer as described in Section 3.3 and shown in Figure 3-4.
3. Connect the female end of the extender cable to the P8 connector in the slide-out drawer, located to the right of the PC card connectors.
4. Connect the male end of the extender cable to the P8 connector inside the 8450 unit, located to the right of the PKIM.
5. Turn power on.

The drawer cannot be re-installed into the computer system with the extender cable connected. Before re-installing the drawer, turn off power and remove the cable from connections made in steps 3 and 4.

3.5.3 **Installing Keyboards**

Two keyboard options are available for the 8450: the 8000-KB3 and the 8000-KB4.

The 8000-KB3 is panel-mount sealed QWERTY keyboard. It provides 20 function keys as well as the standard typewriter keys, numeric keys, arrows, PgUp, PgDn, etc.

The 8000-KB4 is panel-mount sealed membrane numeric keyboard. It provides 52 function keys as well as numeric keys, arrows, PgUp, PgDn, etc.

The keyboards are installed in the same manner. Mount them according to the cutout in Appendix C, Figure C-4. Once the keyboard is mounted, remove the sticker covering the sealed membrane connector on the 8450 back panel, and connect the keyboard cable to that connector.

The keyboards and dimensions are shown in Figures 3-12 and 3-13.

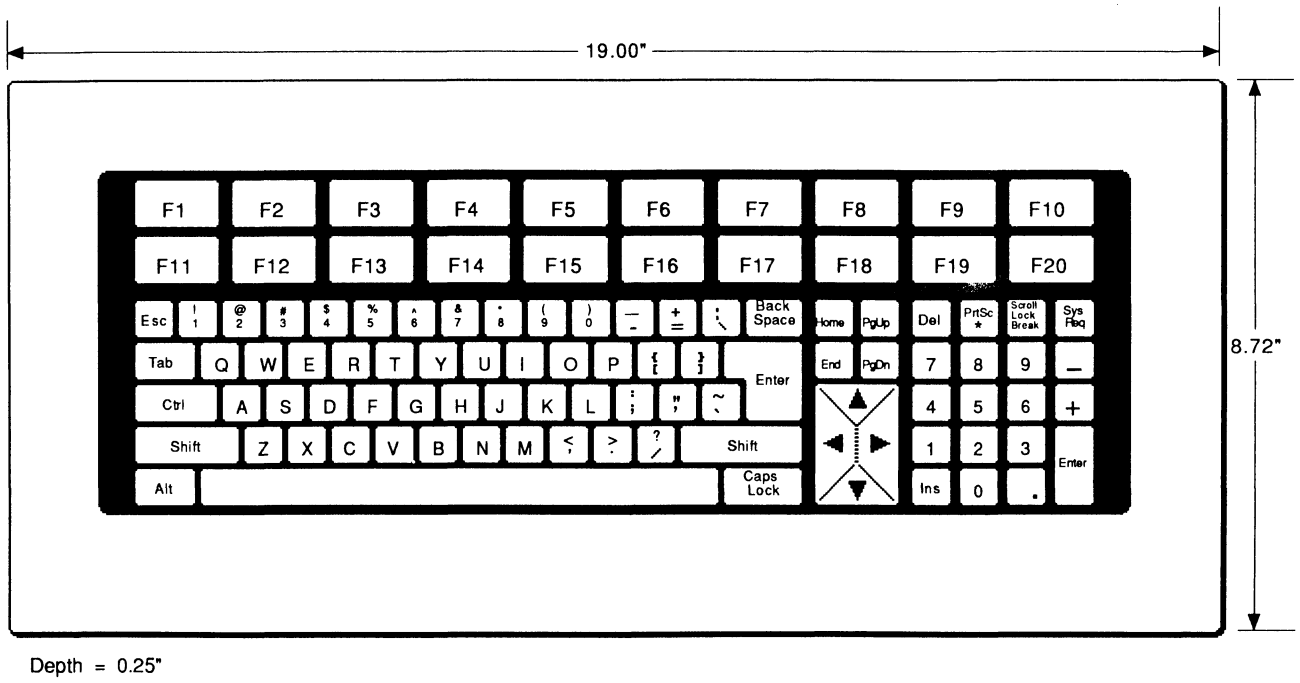


Figure 3-12. 8000-KB3 Keyboard with Dimensions

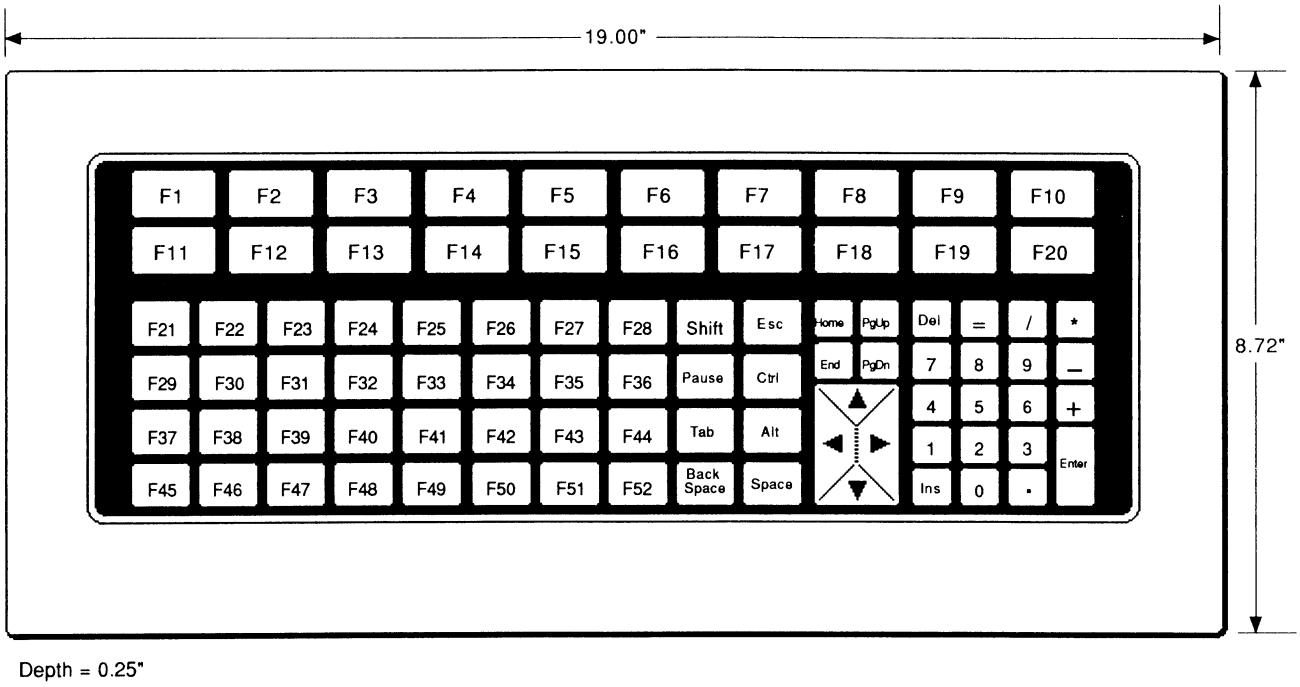


Figure 3-13. 8000-KB4 Keyboard with Dimensions

3.5.4 **Installing a Serial Mouse**

To install Xycom's 4100-MS1 three-button serial mouse, attach the connector on the mouse cable to either the serial connector (COM1) on the PC/AT processor board (P5), or to the serial port connector (COM2) on the back panel of the 8450 equipment drawer.

3.6 INSTALLING SOFTWARE OPTIONS

This section explains how to install the software options available with the 8450.

3.6.1 **Installing MS-DOS**

If your unit was not already shipped with DOS installed, install the latest version of MS-DOS on your 8450 by following the instructions below:

1. Turn power to the system off.
2. Insert the MS-DOS Install disk into drive A.
3. Turn the power on.
4. Wait for the DOS prompt to appear on the screen.
5. Type **A:install** (or just **install** at the A: prompt) and follow any instructions on the screen.

For more information, see your MS-DOS manuals.

3.7 INSTALLING THE SYSTEM INTO A RACK OR PANEL

The 8450's rugged design allows it to be installed in most industrial environments. The 8450 is generally placed in a NEMA 4/12 enclosure to protect against contaminants such as dust, moisture, etc. Metal enclosures also help minimize the effects of electromagnetic radiation that may be generated by nearby equipment. Follow these guidelines for installing your 8450:

- Place the unit so the slide-out drawer is easily accessible
- Account for the unit's depth as well as cabling when choosing the depth of the enclosure
- Select an enclosure that will allow access to the 8450 ports and slide-out drawer
- Consider locations of AC power outlets and lighting (interior lighting and windows)
- If condensation is expected, install a thermostat-controlled heater or air conditioner
- Do not select a location near equipment that generates excessive electromagnetic interference (EMI) or radio frequency interface (RFI) (equipment such as high power welding machines, induction heating equipment, and large motor starters).
- Make sure the location does not exceed the 8450's shock, vibration, and temperature specifications

3.7.1 Mounting Considerations

Once you have found a location for the 8450, install it in the enclosure according to the manufacturer's instructions. Consider the following points and precautions before placing the 8450 inside an enclosure:

- **Mount the 8450 in an upright position**
- **To allow for maximum cooling, avoid obstructing the air flow.**
- **Place the 8450 at a comfortable working level**.
- **Place incoming power lines (such as isolation or constant voltage transformers, local power disconnects, and surge suppressors) alongside the power supply and away from the 8450.** The proper location of incoming line devices keeps power wire runs as short as possible, and minimizes electrical noise transmitted to the 8450.
- **Place any fans or blowers close to the heat generating devices**. If using a fan, make sure that outside air is not brought inside the enclosure unless a fabric or other reliable filter is also used. This filtration prevents conductive particles or other harmful contaminants from entering the enclosure.

3.7.2 **Excessive Heat**

The 8450 is designed to withstand temperatures from 0° to 50° C and is cooled by convection, in which a vertical column of air is drawn in an upward direction over the surface of the components. To keep the temperature in the range, the cooling air at the base of the system must not exceed 50° C. Proper spacing must also be allocated between internal components installed in the enclosure.

When the air temperature is higher than 50° C in the enclosure, use a fan or air conditioner.

3.7.3 **System Power**

It is always a good idea to use a common AC source to the system power supply and the I/O devices. This practice minimizes line interference and prevents the possibility of reading faulty input signals if the AC source to the power supply and CPU is stable while the AC source to the I/O devices is unstable. By keeping both on the same power source, you take advantage of the power supply's own line monitoring feature.

Another good practice is to use isolation transformers on the incoming AC power line to the 8450. An isolation transformer is especially desirable in cases in which heavy equipment is likely to introduce noise onto the AC line. The isolation transformer can also serve as a step-down transformer to reduce the incoming line voltage to a desired level. The transformer should have a sufficient power rating (units of volt-amperes) to supply the load adequately.

Proper grounding is essential to all safe electrical installations. Refer to the National Electric Code (NEC), article 250, which provides data such as the size and types of conductors, color codes, and connections necessary for safe grounding of electrical components. The code specifies that a grounding path must be permanent (no solder), continuous, and able to safely conduct the ground-fault current in the system with minimal impedance. The following practices should be observed:

- **Separate ground wires from power wires at the point of entry to the enclosure.** To minimize the ground wire length within the enclosure, locate the ground reference point near the point of entry for the plant power supply.

- **All electrical racks or chassis and machine elements should be grounded to a central ground bus**, normally located in the magnetic area of the enclosure. Paint and other non-conductive materials should be scraped away from the area where a chassis makes contact with the enclosure. In addition to the ground connection made through the mounting bolt or stud, a one-inch metal braid or size #8 AWG wire can be used to connect between each chassis and the enclosure at the mounting bolt or stud.

- **The enclosure should be properly grounded to the ground bus.** Make sure a good electrical connection is made at the point of contact with the enclosure.

- **The machine ground should be connected to the enclosure and to earth ground.**

3.7.4 **Excessive Noise**

Electrical noise is seldom responsible for damaging components, unless extremely high energy or high voltage levels are present. However, noise can cause temporary malfunctions due to operating errors, which can result in hazardous machine operation in certain applications. Noise may be present only at certain times, may appear at widely-spread intervals, or in some cases may exist continuously.

Noise usually enters through input, output, and power supply lines and may be coupled into lines electrostatically through the capacitance between these lines and the noise signal carrier lines. This usually results from the presence of high voltage or long, closed-spaced conductors. When control lines are closely spaced with lines carrying large currents, the coupling of magnetic fields can also occur. Use shielded cables to help minimize noise. Potential noise generators include relays, solenoids, motors, and motor starters, especially when operated by hand contacts like push buttons or selector switches.

3.7.5 **Excessive Line Voltage**

The power supply section of the 8450 is built to sustain line fluctuations of 90 - 131 VAC or 189-262 VAC and still allow the system to function within its operating margin. As long as the incoming voltage is adequate, the power supply provides all the logic voltages necessary to support the processor, memory, and I/O.

In cases in which the installation is subject to "soft" AC lines and unusual line variations, a constant voltage transformer can be used to prevent the system from shutting down too often. However, a first step toward the solution of the line variations is to correct any possible feed problem in the distribution system. If this correction does not solve the problem, a constant voltage transformer must be used.

The constant voltage transformer stabilizes the input voltage to the power supply and input field devices by compensating for voltage changes at the primary in order to maintain a steady voltage at the secondary. When using a constant voltage transformer, check that the power rating is sufficient to supply the input devices and the power supply. The output devices are generally connected to the line in front of the constant voltage transformer, instead of providing power to the outputs from the transformer. This arrangement lessens the load supported by the transformer and allows a smaller rating.

3.7.6 **Mounting the 8450**

Once the conditions in the preceding sections have been met, mount the 8450 by following the instructions below.

1. Locate a position for your 8450 that meets the specifications listed in the previous sections.
2. Add the cutout (as shown in Appendix C Figure C-5) to the enclosure.
3. Make sure the area around the cutout is clean and free from metal burrs.
4. Make sure the 8450 enclosure is grounded to the enclosure.
5. Install the unit into the cutout.
6. Tighten the 14 #10 nuts to 27 inch pounds.

3.7.7 **Installing the CPU into a Chassis**

The following are the steps required to install the AT4 into a chassis.

WARNING
Never attempt to open or service any piece of equipment before disconnecting all external power supplies.

WARNING
If the battery is disabled in your system, please do the following: upon enabling, your system **must** be powered up for a minimum of 30 seconds. Failure to follow this procedure may result in premature battery failure.

CAUTION
Verify the positions of all jumpers and switches before installation. Check configurations with the lists and diagrams in this manual.

1. Disconnect all power supplies

2. Remove all screws that secure the cover to the cabinet

3. Verify all jumper settings

4. Place the 8450 CPU card into the slots in the passive backplane. Push down on the card evenly, until it firmly seats into the cardedge connectors.

5. Secure the ORB with one screw at the top.

NOTE

Not all of the connections described below will be in every application. The installation instructions are geared toward an application using all of the 8450 CPU capabilities. Ignore those that do not apply.

CAUTION

DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Bei falschem Umgang mit oder falschem Einbau einer Lithium-Batterie kann eine Explosion entstehen, bel der in der Nahe befindliche Personen schwere Verietzungen erieiden konnen. Versuchen Sie nicht, Lithium-Batterien wieder aufzuiaden, kurzzuschliessen oder zu ottnen, und werfen Sie sie nicht in den Mull oder in ein Feuer. Wechsein Sie sie nur gegen gensu den gleichen Typ aus. Zur Entsorgung mussan Sie Lithium-Batterien an ihren Handler zuruckgeben.

6. If an external battery is used connect the lead to P1.

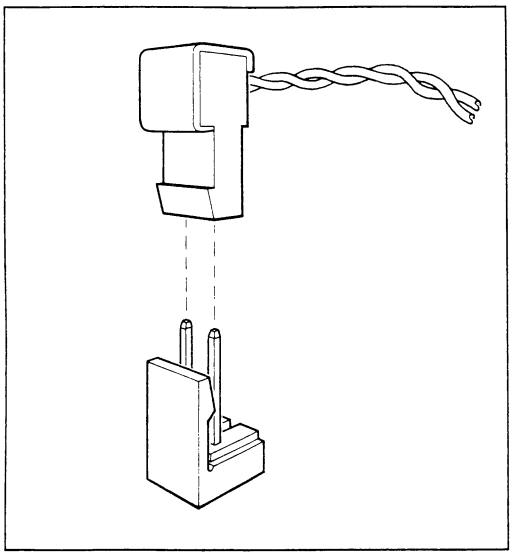


Figure 3-14. Battery

7. Attach the keyboard connector to P8.

> **CAUTION**
> Connectors P2-P4 and P9 can be connected backward if you do not use keyed connectors. Ensure that the markings on the ribbon wire mate to pin 1 on both the board and the other component.

> **NOTE**
> P2-P4 are latch connectors. Before connecting a ribbon cable to them, make sure the latches are pulled down near the surface of the board. When the cable connection is made, the latches snap up (see Figure 7-4). When removing a cable connector, move the latches down near the board. This nudges the connector up so you can remove it easily.

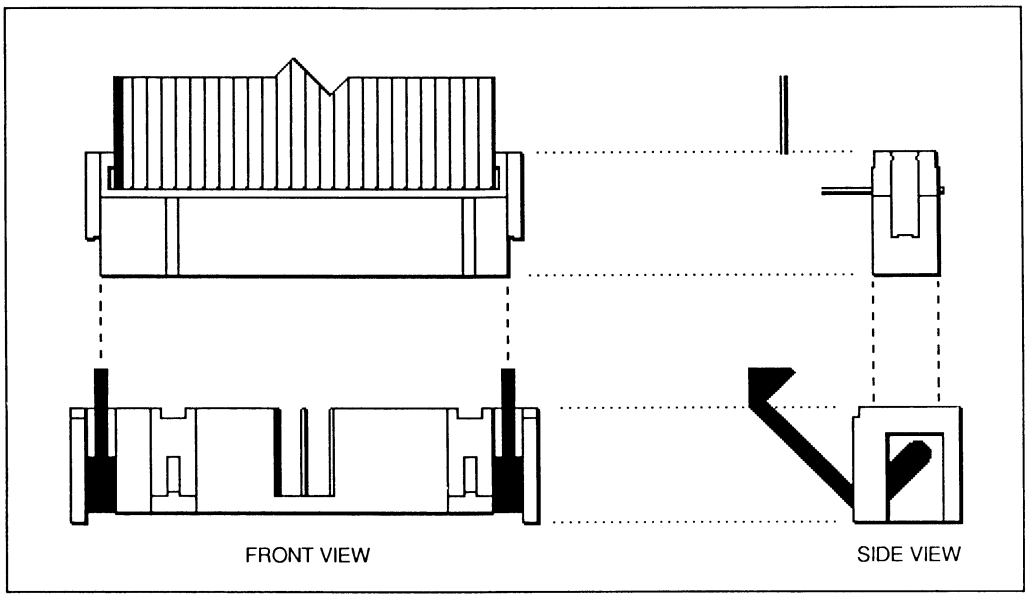


Figure 3-15. Sample Connector

8. Attach the IDE hard drive control connector to P2. If connecting to more than one hard drive, and additional connector must be placed on the cable.

9. Attach the floppy drive connector to P3.

10. If installed, attach ribbon wires from optional ORB to P4 and P9.

11. Attach the monitor to P5 on the ORB.

12. Attach any serial devices to P6, and optional ORB if installed.

13. Attach the printer to optional ORB if installed.

14. Plug in external speaker to P10.

15. Install cover on cabinet.

16. Connect power sources.

The 8450 AT4 is now ready for operation.

3.8 DERATING THE POWER SUPPLY

On the average, the temperature within the 8450 is 7-10° higher than that outside the enclosure. When the ambient (exterior) temperature reaches 42° C, the system's power supply will begin to derate at a rate of 3.25 watts per increase of 1° C. The 8450 is rated to work at temperatures up to 50° C. At 50° C, the power supply should be derated to 104 W of total available power. Refer to Tables 3-4 and 3-5 for more information.

Table 3-4. 8450-525(x) Derating Example

	+5 VDC	+12 VDC	-12 VDC	-5 VDC
Total Current Available Before Derating (not to exceed 130 W)	20 A	5 A	1 A	1 A
Total Current Available After DeRating at 50°C ambient outside (not to exceed 104 W)	16 A	4 A	0.8 A	0.8 A
8450-525(x) Configured Current Required:				
80386SX	2.5 A	.05 A	.05 A	0
Hard disk (Quantum)	.32 A	1.1 A	0	0
Floppy disk (Sony)	1.0 A	0	0	0
PKIM	0.4 A	0	0	0
Touch Screen Controller	.275A	.029A	.029A	.275A
Fan	0	0.26 A	0	0
Total (max)	**4.495 A**	**1.439 A**	**.079 A**	**.275 A**
8450-525(x) Expansion Current Available	11.505 A	2.561 A	.721 A	.525 A

NOTE

It is acceptable to draw slightly more current than is specified for expansion current as long as the total wattage drawn does not exceed 104 watts at 50° C and you do not exceed the current available before derating.

Table 3-5. 8450 -320(x) -425(x) Derating Example

	+5 VDC	+12 VDC	-12 VDC	-5 VDC
Total Current Available Before Derating (not to exceed 175 W)	20 A	5 A	1 A	1 A
Total Current Available After Derating at 50°C ambient outside (not to exceed 140 W)	16 A	4 A	0.8 A	0.8 A
8450 -425(x) Expansion Current Available				
4100-AT4DX	5.16 A	0.3 A	0.003 A	0
Hard disk (Quantum)	0.65 A	1.6 A	0	0
Floppy disk (Sony)	1.0 A	0	0	0
PKIM	0.4 A	0	0	0
Fan	0	0.26 A	0	0
Total (max)	**7.21 A**	**2.16 A**	**0.003 A**	**0**
8450 -425(x) Expansion Current Available	8.79 A	1.84 A	0.797 A	0.8 A
8450 -320(x) Configured Current Required:				
4100-AT4	4.5 A	0.3 A	0.3 A	0
Hard disk (Quantum)	0.65 A	1.6 A	0	0
Floppy disk (Sony)	1.0 A	0	0	0
PKIM	0.4 A	0	0	0
Fan	0	0.26 A	0	0
Total (max)	**6.55 A**	**2.16 A**	**0.3 A**	**0**
8450 -320(x) Expansion Current Available	9.45 A	1.84 A	0.5 A	0.8 A

NOTE

It is acceptable to draw slightly more current than is specified for expansion current as long as the total wattage drawn does not exceed 104 watts at 50° C and you do not exceed the current available before derating.

CHAPTER 4 - PROGRAMMABLE KEYBOARD INTERFACE MODULE

4.1 INTRODUCTION

The Programmable Keyboard Interface Module (PKIM) consists of the actual PKIM circuit located on the interior back panel of the 8450, and a program utility disk. The PKIM utility allows re-defining all keys on the keypads without programming or looking up key codes. The PKIM utility features pull-down menus that allow redefining the keys through the use of macros. The data entry and function keypad keys can also be re-legended to reflect the specific requirements of your application.

An external full-stroke PC/XT or PC/AT keyboard is used to access the PKIM utility. (This keyboard is not re-definable.)

> **NOTE**
> While the PKIM utility is running, the keypad/keyboard switch arrays are disabled.

4.2 SWITCH CONFIGURATION ON THE PKIM MODULE

The PKIM contains one eight-position DIP switch, SW1. Each of the eight switch settings can be positioned to open (1) or closed (0) as labeled on the actual switch. Switches 4 through 8 are undefined and should not be altered from the factory-shipped positions. Switch 1 should always be positioned to open. The default settings are open for all switches. Table 4-1 below lists the settings.

Table 4-1. PKIM Switch Settings

Switch	OPEN (1)	CLOSED (0)
1	AT Host	Undefined
2	AT Keyboard	XT Keyboard
3	101 Key AT	84 Key AT
4 - 8	Undefined	Undefined

To change the switches, follow the instructions below:

1. Remove the front panel by removing the nine screws that secure it to the chassis. Locate the PKIM on the right hand interior side of the back panel (see Figure 4-1 below).

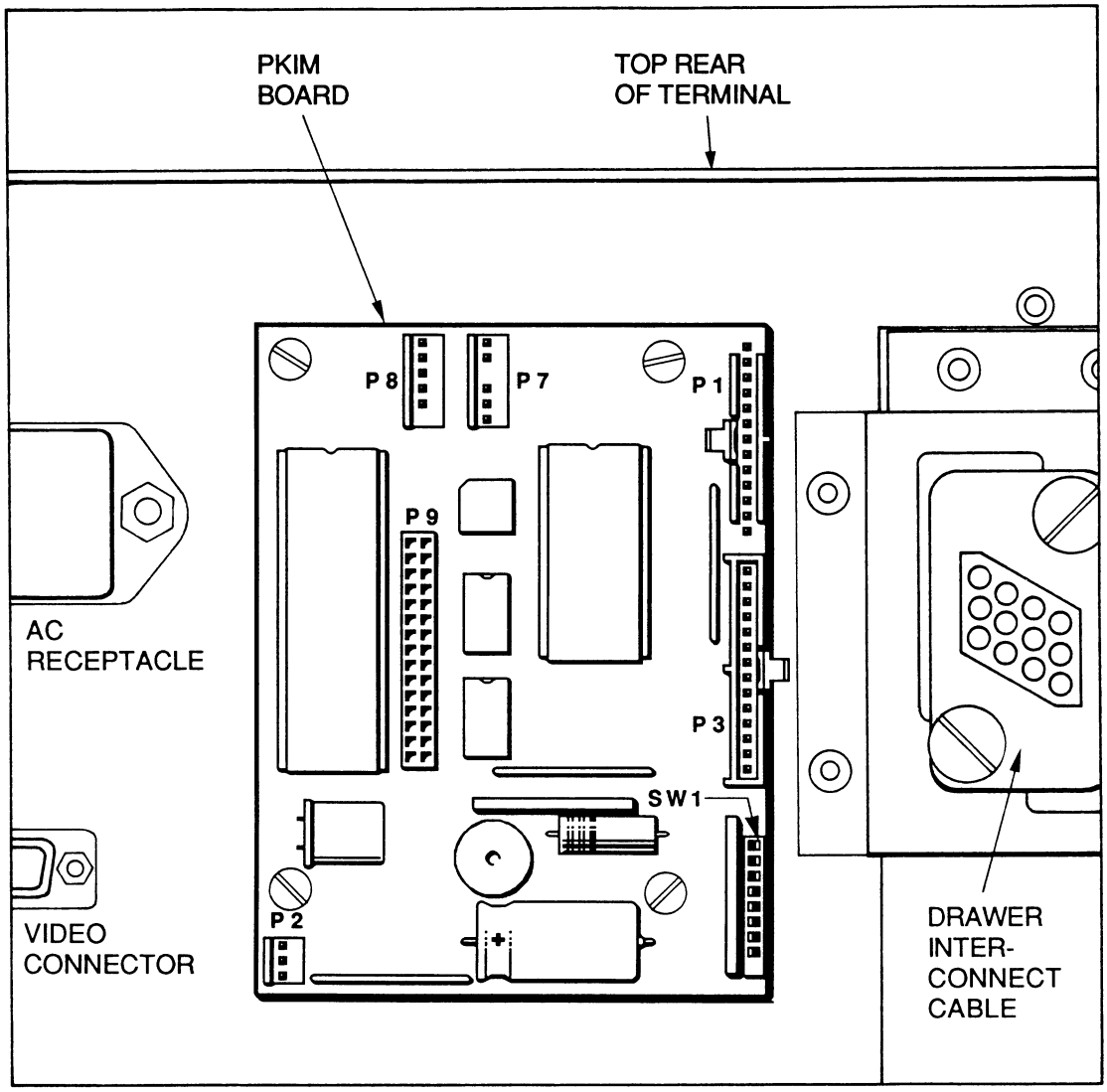


Figure 4-1. Location of Programmable Keyboard Interface Module

2. Set the appropriate switch(es) on the PKIM by using a long, narrow instrument such as a screwdriver.

4.3 JUMPER CONFIGURATION

The jumpers on the PKIM are not user-configurable and should remain in the factory-shipped configuration.

4.4 KEYPAD INFORMATION

All of the keys on the keypads perform exactly the same functions as the keys on an IBM keyboard. However, certain keys are duplicated. The following table shows how keys on the 8450 keypads correspond with the IBM keyboard.

Table 4-2. How Keypads Correspond to Keyboard

8450 Keypad	**IBM Keypad**
Cursors	Cursors, Numeric keypad
"+","-" (plus, minus)	Grey keys "+","-"
"." (period)	Regular keypad "."
Numbers	Regular keypad numbers
Shift	Left shift key

Table 4-3 on the following page shows the hexadecimal scan codes each key returns.

Table 4-3. Hex Scan Codes

Key	Code
A	1C
B	32
C	21
D	23
E	24
F	2B
G	34
H	33
I	43
J	3b
K	42
L	4B
M	3A
N	31
0	44
P	4D
Q	15
R	2D
S	1B
T	2C
U	3C
V	2A
W	1D
X	22
Y	35
Z	1A
0/)	45
1/!	16
2/@	1E
3/#	26
4/$	25
5/%	2E
6/^	36
7/&	ED
8/*	3E
9/(	46
+	79
Ins/0	70
Del/.	71
Scroll Lock	7E
*	7C
Alt r	E0 11
Ctrl r	E0 14
Ent k	E0 5A
Break	F0

Key	Code
[/{	54
]/}	5B
;/:	4C
'/"	52
,/<	41
./>	49
//?	4A
`/~	OE
-/_	4E
=/+	55
\/|	5D
F1	05
F2	06
F3	04
F4	0C
F5	03
F6	0B
F7	83
F8	0A
F9	01
F10	09
F11	78
F12	07
Back Space	66
Enter	5A
Shift Right	59
Shift Left	12
Caps Lock	58
Alt Left	11
Ctrl Left	14
Tab	0D
Space	29
ESC	76
Num Lock	77
Home/7	6C
Up Arrow/8	75
Page Up/9	7D
Left Arrow/4	6B
/5	73
Right Arrow/6	74
-	7B
End/1	69
Down Arrow/2	72
Page Down/3	7A

Table 4-3. Hex Scan Codes

Key	Code
A	1C
B	32
C	21
D	23
E	24
F	2B
G	34
H	33
I	43
J	3b
K	42
L	4B
M	3A
N	31
0	44
P	4D
Q	15
R	2D
S	1B
T	2C
U	3C
V	2A
W	1D
X	22
Y	35
Z	1A
0/)	45
1/!	16
2/@	1E
3/#	26
4/$	25
5/%	2E
6/^	36
7/&	ED
8/*	3E
9/(	46
+	79
Ins/0	70
Del/.	71
Scroll Lock	7E
*	7C
Alt r	E0 11
Ctrl r	E0 14
Ent k	E0 5A
Break	F0

Key	Cod
[/{	54
]/}	5B
;/:	4C
'/"	52
,/<	41
./>	49
//?	4A
`/~	OE
-/_	4E
=/+	55
\/|	5D
F1	05
F2	06
F3	04
F4	0C
F5	03
F6	0B
F7	83
F8	0A
F9	01
F10	09
F11	78
F12	07
Back Space	66
Enter	5A
Shift Right	59
Shift Left	12
Caps Lock	58
Alt Left	11
Ctrl Left	14
Tab	0D
Space	29
ESC	76
Num Lock	77
Home/7	6C
Up Arrow/8	75
Page Up/9	7D
Left Arrow/4	6B
/5	73
Right Arrow/6	74
-	7B
End/1	69
Down Arrow/2	72
Page Down/3	7A
Pause	EE

Ctrl Break .... 14 EE F0 14 Ø
ctl Pau bk Ctl EOM

Ctrl Alt DEL .... ctl Alt Del bk Del bk Alt bk Ctl EOM

4.5 LOADING THE PKIM UTILITY

The PKIM utility can be run from the diskette or copied unto your hard drive. To run the utility from the disk, change the directory to the appropriate drive and type PKIM. To load the PKIM utility onto your hard drive, create a subdirectory for the files, and copy all the files on the disk into that subdirectory. Enter the subdirectory and type PKIM.

4.6 USING THE PKIM UTILITY

The PKIM utility uses a menu bar and pull down menu system. All menu bars are displayed across the top of the screen. "Xycom PKIM Utility" and the current menu title are shown at the bottom of the screen (see Figure 4-2 on the following page).

A full stroke keyboard is needed to enter keystrokes while recording a new key macro, editing an existing macro, and entering utility commands. All keys on all of the keypads and switch array keyboard are redefinable. While the utility is running, the keypads and switch array keyboard, as well as the touch screen function (if applicable), will be disabled.

Dialogue boxes are used for user prompts and to display error and user advice messages.

Two keys can be used to exit from the menus:

- <ESC> moves to the previous menu, or out of the utility from the Main menu
- F1 returns to the current menu headings in some of the menus where Exit can be chosen to exit this menu

The keys specific to each menu are shown at the bottom of each screen.

4.6.1 PKIM Utility Batch Mode

Version 2.2 and up of the PKIM utility includes a mode for re-programming keypads from a batch file. This feature is useful if you wish to re-program many units with customized keypad macros without having to enter the full PKIM utility for each unit. Once the full utility has been used to create and save keypad macros, the files containing these macros can be included on a disk with the PKIM utility, and then used to re-program other units from a batch file.

PKIM will run the full PKIM utility

PKIM filename will run the PKIM utility batch mode where filename is the file containing the new keypad macros. The filename extension must be included.

Example:

PKIM kbdef104.pkm

in a batch file, this will re-program the sealed keyboard with the default macros for the 104 key QWERTY keypad.

4.7 MAIN MENU

The main menu provides five selections: Exit, Files, Macros, Upload, and Download. The Main Menu is shown in Figure 4-2 below.

Exit	Files	Macros	Upload	Download
Xycom PKIM Utility: MAIN L-Arrow, R-Arrow, Enter				

Figure 4-2. Main Menu

Each of the selections from the Main Menu is described in separate sections below. Choices from the menu are discussed in the order they appear on the screen.

4.8 EXIT MENU

Selecting Exit closes any open files and exits the utility. Escape can also be used for this purpose and for exiting the other menus.

4.9 FILES MENU

Files containing keypad/keyboard macro sets (a macro for each key) may be saved on disk and loaded into memory to be viewed, edited, or downloaded to the PKIM. Some of these files may be included in the utility package for use in reconfiguring the keypads for different software packages and as templates for defining completely new keypad/keyboard macro sets.

> **NOTE**
> It is recommended that you save the default keypad and keyboard configurations before programming any changes. To do so, select Save As from the Files menu and enter a file name.

When Files is chosen, a pull down menu is displayed which gives the following choices: Open, Close, Save, Save As, Delete, and Exit.

Open Opens a file that contains a macro set for one of the keypads, or the switch array keyboard, and loads the contents into memory. Any macro set previously in memory is overwritten. Once loaded, the macro set is available for editing, viewing, teaching, and/or downloading to the PKIM.

Close Clears the set of macros from memory and closes the file from which they came.

Save Copies the set of macros from memory back into their original file. The original file contents are overwritten.

Save As Creates a new file under the specified name and copies the set of macros from memory into it. For example, to define different sets of codes, save each set under a different name and download the one you wish to use.

Delete Deletes a file.

Exit Returns to Main Menu.

4.10 MACROS MENU

When Macros is selected, a menu bar displays these four choices: Exit, View, Teach, and Edit.

Exit Returns to the Main Menu.

View Allows viewing the macro for the selected key without having to worry about an accidental change to the macro. When View is chosen, Exit and the state of the key click are displayed on the menu bar and a graphic representation of the chosen keypad or keyboard is shown. Select Exit from the View Menu to return to the Macros Menu.

To select a key to view, use the arrow keys to position the cursor on the desired key and press <ENTER>.

The macro is displayed as two lines -- ASCII and code. The ASCII line displays each keycode as the keys it represents on the full stroke keyboard. Special labels are used for certain keys (e.g. Spc for space bar, UAr for up arrow, and bk for the break code prefix). The code line is displayed in either Hex or decimal, as explained below. There is a one to one correspondence between the ASCII and code lines to help you interpret the code line.

The menu bar displayed while viewing the macro offers two options: Exit and Hex/Decimal.

Exit Return to View menu

Hex/ Decimal Toggles between displaying the macro in hex or decimal format. When Hex is chosen, the keycodes are displayed as they are in memory -- hexadecimal value scan codes. When Decimal is chosen, the keycodes are displayed as the decimal equivalent of the hex codes.

For example, the macro, **abc**, would be displayed as: 1C F0 1C 32 F0 32 21 F0 210 in hex, and, 28 240 28 50 240 50 33 240 330 in decimal. The default is Hex.

Teach Allows you to record key strokes into a macro. When Teach is selected, a graphic representation of the keypad/keyboard currently in memory is displayed. The menu bar choices are Exit, ASCII/Hex/Decimal, and Key Click ON/OFF.

Exit	Returns to Macros menu.
ASCII/ Hex/Decimal	Chooses the format to display the keystrokes as they are entered. The default is ASCII.
Key Click ON/OFF	Toggles between ON and OFF. If ON is selected, the keypad or keyboard is programmed to emit an audible tone whenever a key is pressed. Key click encompasses the entire keypad or keyboard. If ON is selected, any key on that keypad or keyboard will emit a tone.

To select a key to define, use the arrow keys to position the cursor on the desired key, and press <ENTER>. After a key is selected, the utility records every key stroke on the external full stroke keyboard into a macro to be assigned to the chosen key. As the keys are entered they are displayed using the chosen format. The escape key is used to stop recording and return to the Teach Menu, and is therefore not a recordable key. However, escape can be included in a macro by using the editor.

> **NOTE**
> The changes made to the macros in the Teach Menu are not programmed until you select Download.

Edit Displays a graphic representation of the keypad/keyboard in memory and a menu bar displaying Exit and Key click ON/OFF.

Exit	Returns to the Macros Menu.
Key Click ON/OFF	toggle between ON and OFF. If ON is selected, the keypad or keyboard is programmed to emit an audible tone whenever a key is pressed.

To select a key to edit, use the arrow keys to position the cursor on the desired key, and press <ENTER>.

In edit mode, the macro is displayed as two lines. The top line (the edit line) displays the macro in either hex or decimal format and is the line in which the actual editing takes place. The

bottom line (the ASCII line) displays the macro in ASCII format and is not user-configurable. This line helps keep track of which part of the macro you are editing, and will be updated by the utility as editing takes place.

For example:

edit line ->	12	75	F0	75	F0	12	1C	F0	1C	12	22	F0	22	F0	12	0
ASCII line ->	sh	8	bk	8	bk	sh	a	bk	a	sh	X	bk	X	bk	sh	EOM

The insert, delete and cursor control keys are active for editing.

When a key is selected, the menu bar displays the following choices: Exit, Cut, Copy, Paste, Codes, and Hex/Decimal, and I/O. The macro for the chosen key is also displayed.

Exit Returns to the Edit Menu.

Cut Deletes a sequence of scan codes from the macro. To select a section to cut:

- Place the cursor on the first character to cut.
- Press F1 and select Cut.
- Press <ENTER>. Cut should still be highlighted, but the cursor will appear on the Edit line. Move the cursor on the last character to cut and press <ENTER>.

The last character of every macro is the end of the macro and cannot be deleted.

Copy Copies a sequence of scan codes from the macro into memory. To select the section to copy:

- Place the cursor on the first character to copy.
- Press F1 and select Copy.
- Press <ENTER>. Copy should still be highlighted, but the cursor will appear on the Edit line.
- Move the cursor on the last character to copy and press <ENTER>.

The copied item does not appear on the screen until you select Paste.

Paste Inserts a sequence of scan codes (which were saved in memory using Copy) into the macro. Cut sections can not be pasted unless they were copied before they were cut. To paste a sequence of scan codes that were previously copied, position the cursor where you want the text to appear and then press F1. Select Paste and then press <ENTER>.

Codes Displays a table of keys and their scan codes in Hex. See Appendix B for a complete code listing.

Hex/Decimal Toggles between displaying the scan codes in Hex and Decimal formats.

Insert The insert key toggles between insert and overtype mode.

4.11 UPLOAD MENU

The Upload Menu allows choosing which keypad or keyboard macro information to load. The choices in this menu are Function keypad, Numeric keypad, Keyboard, and Exit.

Function Keypad Commands the PKIM to send its entire macro set for the function key keypad.

Numeric Keypad Commands the PKIM to send its entire macro set for the numeric key keypad.

Keyboard Commands the PKIM to send its entire macro set for the switch array keyboard.

Exit Returns to the Main Menu.

> **NOTE**
> Only one macro set may reside in memory at a time.

A checksum will be calculated during transmission and an error message displayed should an error occur.

4.12 DOWNLOAD MENU

> **CAUTION**
> Any macro set previously programmed is overwritten when you select Download.

Download sends the set of keypad/keyboard macros to the PKIM. The macro set must reside in memory before it can be downloaded. A checksum is calculated during transmission and an error message is displayed if an error occurs.

As the macro is sent, PKIM programs its EEPROM with the new macros which become the new key definitions for the selected keypad/keyboard.

4.13 SPECIAL PKIM CODES

For the 101-key enhanced keyboard, special PKIM codes replace the standard IBM scan codes in the macros for these keys. The special scan codes are listed below:

Table 4-4. Special PKIM Scan Codes

Code	Meaning
E2	Insert
E3	Home
E4	Page Up
E5	Delete
E6	End
E7	Page Down
E8	Up Arrow
E9	Left Arrow
EA	Right Arrow
EB	Down Arrow
EC	Forward Slash
ED	Print Screen/Sys Rq
EE	Pause/Break

5.1 INTRODUCTION

This chapter contains information on running the BIOS Setup Program for all configurations using ATX CPU boards. All pertinent menu instructions are included.

Beyond the standard key codes translated by the BIOS, there are additional function keys available:

<CTRL><ALT>S	Starts SETUP program
<CTRL><ALT>L	Soft Key Lock

5.1.1 Soft Key Lock

Soft Key Lock is provided in conjunction with password security so that the system can be temporarily locked from access. This is useful if you want to leave your system on and unattended for a short period of time and do not want anyone else to be able to access your system.

To lock your system, press <Ctrl><Alt><L>. When this key sequence is pressed, the screen will blank and the system will beep once. While the system is locked, the LED lights on the keyboard will blink. This is to remind you that your system is on and locked when you return.

To unlock the system, press <Ctrl><Alt><L> again. At this time the system will beep twice, the screen will reappear and the system will be reactivated.

> **NOTE**
> If the SoftKey Lock function is used, some programs that rely on the timer tick may not operate properly.

5.2 SOFTWARE CONTROL AND INITIAL START-UP

The ATX CPU is equipped with the Quadtel AT Compatible BIOS System. This BIOS allows easy modification of certain characteristics of the system configuration. The parameters set during the BIOS SETUP program are stored in battery-backed CMOS RAM so that the information is retained during power down periods. Once the BIOS is set-up, it is ready to run most PC/AT software. (Consult the operating manual for specific applications and instructions.)

During power-up, the CPU board communicates with devices and checks its hardware configuration against the configuration information stored in the CMOS memory. The amber MAINT LED and the green POWER LED are on during the Power-On Self Test (POST). If the POST is successful, the MAINT LED will be turned off. If any of the RADAR features are enabled, the RADAR LED will

also be turned on at this time.

> **NOTE**
> You must have the RADAR card installed in order to have RADAR functions. Only the 8450-525X will have the diagnostic LED's.

Table 5-1 shows LED states when an AT3SX and RADAR is in the system and the RADAR Card is driving the LEDs.

Table 5-1. RADAR Card Drives the LEDs (AT3SX only)

Fault	Maint	Power	Radar	Condition
off	off	off	off	No power
off	off	on	off	System in reset prior to post
off	on	on	off	Running POST
on	off	on	off	Failed POST
off	off	on	off	Passed POST (RADAR off)
off	off	on	on	Passed POST (RADAR on)
off	on	on	on	RADAR Maintenance
on	off	on	on	RADAR Fault

> **NOTE**
> You **must** have the RADAR Card installed to have these functions.

The Quadtel BIOS performs the following tests and initialization at power-up:

Flag Test	Second Protected Mode Test
Register Test	- Verify LDT Instruction
System Hardware Initialization	- Verify TR Instruction
Initialize Chip Set Registers	- Verify LSL Instruction
BIOS ROM Checksum	- Verify LAR Instruction
DMA Page Register Test	- Verify VERR Instruction
8254 Timer Test	- Address Line 20 Test
8254 Timer Initialization	Keyboard Ready Test
8237 DMA Controller Test	Determine AT or XT Keyboard
8237 DMA Initialization	Third Protected Mode Test
8259 Initialization/Reset Coprocessor	- Base Memory Test
8259 Interrupt Controller Test	- Base Memory Address Test
Memory Refresh Test	- Shadow Memory Test
Base 64KB Memory Test	- Extended Memory Test
Base 64KB Test (Upper 16 Bits)	- Extended Address Test
8742 Keyboard Self Test	- Determine Memory Size
MCI46818 CMOS Test	Copy BIOS to Shadow RAM
First Protected Mode Test	8254 Clock Test
- Memory Sizing Test	MC146818 Real Time Clock Test
- Autosize Memory Chips	Keyboard Stuck Key Test
- Chip Interleave Enable	Initialize Hardware Interrupt Vectors
Determine System Board Memory Size	Math Coprocessor Test
Relocate Shadow RAM if Configured	Determine COM Ports Available
Initialize Wait States	Determine LPT Ports Available
Retest 64K Base RAM	Initialize BIOS Data Area
Determine CPU Speed	Determine Floppy/Fixed Controller
Initialize Interrupt Vectors	Floppy Disk Test
Verify Video Configuration	Fixed Disk Test
Initialize Video System	External ROM Scan
Test Unexpected Interrupts	System Key Lock Test
	Final System Initialization

5.3 MAIN MENU

To access the **Main Setup Menu**, press **<CTRL><ALT>S**. (The Main Setup Menu is also displayed if **F2** is pressed after a power-on self test error is displayed.) The **Main Setup Menu** offers the following choices:

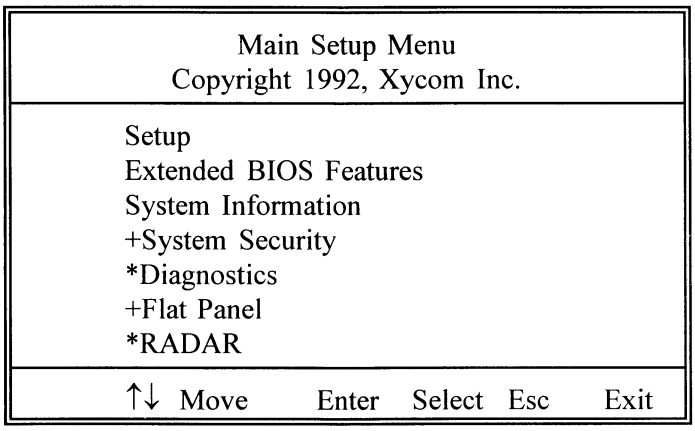


Figure 5-1. Main Menu

Items that appear in **bold** in the menus indicate fields that the user can change. Any default settings initially appear on the screen. The keys used in each of these menus are described below:

Use the arrow keys (↑↓) to move the cursor up, down, left, and right to select your choice. Press <ENTER> to validate the selection.

Press ESC to exit the menu. You are prompted to save any changes.

***NOTE**

The 8450 **must** have the 8000-RAD (RADAR Card) installed to support these features. The 8000-RAD Card only works with the AT3SX CPU board.

+NOTE

These features are not supported on the AT4 CPU board.

5.4 SETUP MENU

When SETUP is selected from the Main Menu, the Extended BIOS Setup menu appears on the screen. This menu is shown in Figure 5-2 below.

```
                    Setup Menu - Copyright 1992, Xycom Incorporated

Current Date:       [11/15/92]          Video System:       [EGA/VGA]
Current Time:       [15:52:19]          Power Up Speed:     [Fast]

[ 640K]             System Memory       Bios Shadow:        [System in RAM]
[ 3072K]            Extended Memory                         [Video in RAM]
  96K               Shadow Memory       Wait States:        [0, All Banks]
+[ 288K]            EMS Memory

Internal COM A:     [COM1, 3F8H]        Internal Floppy:    [Enabled]
Internal COM B:     [COM2, 2F8H]        Internal IDE:       [Enabled]
Internal LPT:       [LPT1, 378H]

Diskette Drive 0:   [1.44 MB, 3 1/2]    **System Memory Cache    [on]
Diskette Drive 1:   [Not Installed]     **Non-Cacheable Start    [0k]
                                        **Non-Cacheable Size     [0k]

*Fixed Disk 0:      Type:[User] CY:[ 755] HD:[ 16] ST:[17] LZ:[ 755] WP:[None]
*Fixed Disk 1:      Type:[None]

←↑↓→  MOVE          F5  Previous Value      F9  Automatic Configuration
F1    Help          F6  Next Value          F10 Save Configuration
Esc   Exit
```

*Read the DIAG.TXT on the diagnostic disk file for the latest hard disk setup information.
**This is supported on 80486 based systems only. +The 80486 does not support EMS memory.

Figure 5-2. SETUP Menu

Information in **bold** indicates user-configurable fields.

The menus are relatively self-explanatory. The default function settings will initially appear on the screen. Some of the function keys are described below:

<Esc> Exits without saving any changes

<F1> Displays help information for the selected item

<F5> Selects the previous or smaller value, or **<F6>** to select the next or higher value.

<F9> Automatically configures the system with the amount of memory and sets default values for system memory, extended memory, shadow memory, EMS memory, wait states, ROM/RAM BIOS control, and video type. Automatic configuration is useful when adding or subtracting memory. When doing so, you need only add memory to the system board and press **F9** to set the proper memory configuration. The default values used with automatic configuration are defined by your system configuration and by the values set in the Setup Menu.

The RAM on the CPU board can be partitioned or allocated between system memory, extended memory, and EMS memory. As you increase the amount of EMS memory, the amount of extended memory decreases and vice versa. If you feel you have selected an invalid memory combination, press **F9** to automatically resize memory and select default memory values.

<F10> Saves any changes

> **NOTE**
> The disk drives must be configured manually.

The Setup Menu allows you to change the time, date, and setup information contained in the clock CMOS RAM. This information is used by the System BIOS for system configuration.

The options are described in the following sections.

5.4.1 **Current Date**

The date entry sets the real time clock for month, day, and year.

5.4.2 **Current Time**

The time entry sets the real time clock for hours, minutes, and seconds. During the power up sequence, the time is read from the real time clock and saved in the BIOS system time. The time is calculated according to a 24-hour military clock, i.e., 00:00:00 through 23:59:59.

5.4.3 **System Memory**

This option sets the size of system memory to 256 Kbytes, 512 Kbytes, or 640 Kbytes.

5.4.4 **Extended Memory**

This option sets the size of extended memory in 64 Kbyte increments. The maximum amount of extended memory is 15 Mbytes (15296 Kbytes).

5.4.5 **Shadow Memory**

Shadow memory is used to copy the system and/or video BIOS into RAM to improve performance. The AT3SX has 96 Kbytes allocated for Shadow RAM, and this number will be displayed on the menu. The AT4 has 256 Kbytes allocated for shadow RAM. This value cannot be changed.

5.4.6 **EMS Memory**

This allows setting the amount of EMS memory on the system board. As you increase the amount of EMS memory, the amount of extended memory decreases and vice versa. This is only supported on the AT3SX CPU board.

5.4.7 **Internal Floppy and Internal IDE**

These selections enable or disable the internal floppy and internal IDE hard disk drive controllers.

5.4.8 **Diskette Drives 0 and 1**

These selections individually configure drives A: (drive = 0) and B: (drive = 1) to 360 Kbytes, 1.2 Mbytes, 720 Kbytes, 1.44 Mbytes, or Not Installed. The 360 Kbyte and 1.2 Mbyte drives are 5 1/4" drives, while the 720 Kbyte and 1.44 Mbyte selections are 3 1/2" drives.

5.4.9 **Fixed Disks 0 and 1**

These selections individually configure the disk drives as one of 45 predefined drive types, two user-defined types, or not installed. All 45 predefined drive types are displayed on the screen when you press F1 for help, and then press F2 to display the table. If you select User as the type, you must specify several fixed disk parameters: number of cylinders (CY), heads (HD), sectors per track (ST), landing zone cylinder (LZ), and write precompensation cylinder (WP). Consult the manual for your fixed drive for information on any of these parameters.

5.4.10 **Video System**

The four choices for video adapter are:

1. EGA/VGA (Enhanced Graphics Adapter, Video Graphics Array)
2. CGA 40 x 25 (Color Adapter, power up in 40 column mode)
3. CGA 80 x 25 (Color Adapter, power up in 80 column mode)
4. Monochrome

5.4.11 **Power Up Speed**

This option determines the CPU speed at boot time. Choices are Fast (25 MHz) and Normal (12.5 MHz).

5.4.12 **BIOS Shadow**

The BIOS can execute from the 8-bit ROM or from the shadow RAM. If shadow RAM is used, the BIOS will be copied into RAM and executed. This substantially increases BIOS execution speed. There are two selections: one for shadowing the system BIOS and one for shadowing the video BIOS

5.4.13 **Wait-States**

This option allows choosing 0 or 1 wait states for memory controlled by the chip set (default is 0).

5.4.14 **Internal COM A and COM B**

These selections individually set the address of each COM port. The options are COM1, 3F8H or Off for COM A and COM2, 2F8H or Off for COM B.

5.4.15 **Internal LPT**

This item selects the address of the internal LPT port. The options are LPT1, 378H, LPT1, 278H, LPT1, 3BCH, or Off

5.4.16 **System Memory Cache**

The default setting on your AT4 board assigns the total available memory as cacheable. You can define an upper limit on the cacheable memory space. Cacheable memory is always assigned starting from 0 H up to the user-defined limit. Within the cacheable memory area you can define two additional blocks of non-cacheable memory.

5.4.17 **Non-Cacheable Start**

The starting address for the non-cacheable block must have the same granularity as the block size. For example, if you select a 1 Mbyte non-cacheable block, its starting address is a multiple of 1 Mbyte (only address bits A20-A23 are significant, A16-A19 are don't care).

5.4.18 **Non-Cacheable Size**

You can designate one block of non-cacheable DRAM from 64 Kbyte up to 1 Mbyte in size. To set up the block, you must set the start and size registers that define the non-cacheable space.

5.4.19 **Fixed Disk Drive**

Table 5-2. Fixed Disk Drive Table

TYPE	CYLINDERS	HEADS	SECTORS	WRITE PRECOMP	LANDING ZONE
0	Reserved				
1	306	4	17	128	305
2	615	4	17	300	615
3	615	6	17	300	615
4	940	8	17	512	940
5	940	6	17	512	940
6	615	4	17	-1	615
7	462	8	17	256	511
8	733	5	17	-1	733
9	900	15	17	-1	901
10	820	3	17	-1	820
11	855	5	17	-1	855
12	855	7	17	-1	855
13	306	8	17	128	319
14	733	7	17	-1	733
15	Reserved				
16	612	4	17	0	633
17	977	5	17	300	977
18	977	7	17	-1	977
19	1024	7	17	512	1023
20	733	5	17	300	732
21	733	7	17	300	732
22	733	5	17	300	733
23	306	4	17	0	336
24	612	4	17	305	663
25	612	2	17	300	612
26	614	4	17	-1	614
27	820	6	17	-1	820
28	977	5	17	-1	977
29	1218	15	36	-1	1218
30	1224	15	17	-1	1224
31	823	10	17	512	823
32	809	6	17	128	809
33	830	7	17	-1	830
34	830	10	17	-1	830
35	1024	5	17	-1	1024
36	1024	8	17	-1	1024
37	920	5	17	0	920
38	920	10	17	0	920
39	862	16	17	0	862
40	991	10	17	-1	991
41	723	13	51	-1	723
42	751	8	17	-1	751
43	755	16	17	-1	755
44	762	8	39	-1	762
45	980	5	17	-1	980
User Configurable					
User Configurable					

5.5 EXTENDED BIOS FEATURES MENU

This menu allows performing functions to the BIOS which normally require separate utility programs. The extended BIOS Features Menu is shown below:

Extended BIOS Features, Copyright 1989-91, Quadtel Corp.			
Auto Park Disk:	**[No]**	Keyboard Click:	**[No]**
Quick Boot:	**[Yes]**	Keyboard Delay:	**[3/4 Sec]**
Screen Saver:	**[Disabled]**	Keyboard Rate:	**[22/Sec]**
		Numlock Boot State:	**[Off]**
←↑↓→Move	F5	Previous Value	F9 Auto Configuration
Esc Exit	F6	Next Value	F10 Save Configuration

Figure 5-3. Extended BIOS Features Menu

The menu choices are described on the following pages.

5.5.1 Auto Park Disk

This selection determines whether the system BIOS will automatically park the fixed disk drive. If the option is enables, the system BIOS parks the fixed disk drive(s) heads after several seconds of inactivity.

CAUTION

This feature can be incompatible with fixed disk drives that are not BIOS compatible and could cause problems with programs that do not utilize the BIOS for fixed disk I/O.

NOTE

Parking the heads causes some drives to spin down so that they do not respond to accesses quickly enough, and display the message:
"Not ready reading drive C. Abort, Retry, Fail?"

5.5.2 **Quick Boot**

When Quick Boot is selected, the system BIOS bypasses the floppy disk drive tests, memory tests, and floppy disk drive boot-on, power-up or soft reset. The system initializes and boots from the fixed disk in a few seconds.

CAUTION

During hard disk partitioning and formatting, the quick boot selection must be set to **No**. Otherwise, an operating system missing error is displayed, and the system does not boot.

NOTE

If this option is selected, memory is not tested and the floppy disk drive(s) defined in the Setup Menu must be correct. **Also, you cannot boot from drive A.**

5.5.3 **Screen Saver**

This option allows blanking the screen after a specified period of keyboard inactivity. This ensures that the data displayed will not permanently burn into the monitor. You can select blanking to occur after 10 minutes, 30 minutes, or 1 hour, or disable the option. Press any key for the screen to re-display.

CAUTION

Do not enable the screen saver when running programs that do not use the BIOS for keyboard handling, such as Microsoft Windows. If you enable screen saver with these programs, the screen will blank after the specified time regardless of activity, and can only be restored by exiting the program.

5.5.4 **Keyboard Click**

If enabled, this function provides audible key press feedback by causing the BIOS to click through the system speaker every time a key is pressed.

5.5.5 **Keyboard Delay**

This sets the amount of time to elapse after a key is pressed before the key starts to repeat. The smaller the time selected, the sooner the key starts to repeat. The choices are 1/4 second, 1/2 second, 3/4 second or 1 second.

5.5.6 **Keyboard Rate**

This option defines the rate at which the keyboard repeats while a key is depressed. The number of keys generated per second can be selected as 2, 6, 10, 13, 18, 22, 27, or 30.

5.5.7 **Numlock Boot State**

This option determines how the BIOS defines the numlock key at power-up of soft reset. Normally the BIOS sets the numlock (numeric keys selected) if it detects a 101 or 102 key keyboard at power-up. If an 84-key keyboard is detected, numlock is turned off (cursor keys selected). Select Auto to keep this state, On to select the numeric keys regardless of keyboard or Off to choose the cursor keys.

5.6 SYSTEM INFORMATION MENU

The System Information Menu displays data about your system configuration and is shown in Figure 5-4 below. This menu is not user-configurable.

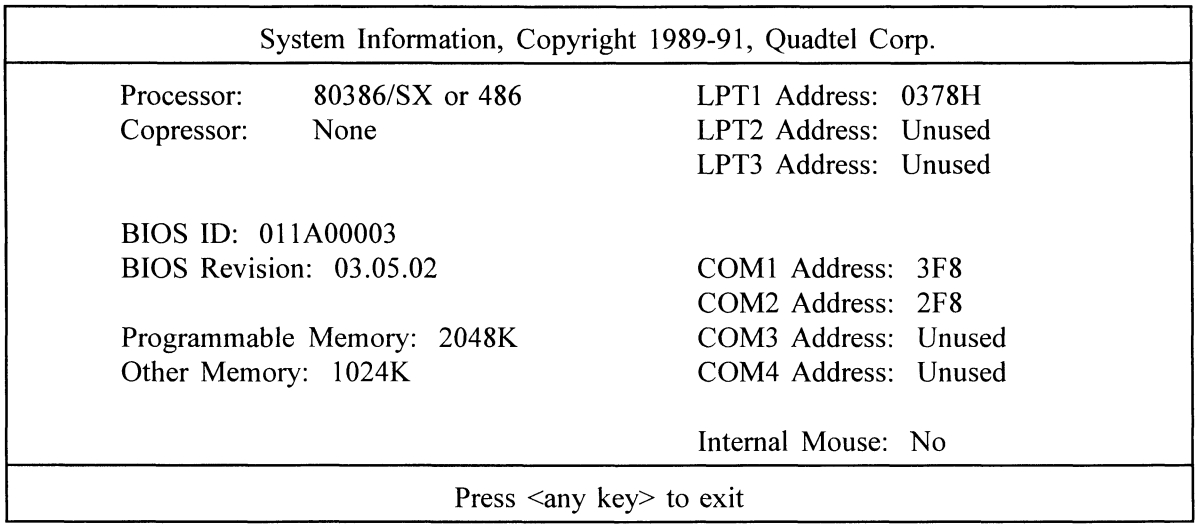


Figure 5-4. System Information Menu

The **System Information Menu** states the type of processor and math co-processor used, and the port addresses. The BIOS ID and revision are specific to your unit. Programmable memory is the memory controlled by the BIOS. Other memory includes ATbus memory that is annexed as DOS memory.

5.7 SYSTEM SECURITY

System security is provided to restrict access to your computer system. If you want to use system security, select this option and the following window will be displayed:

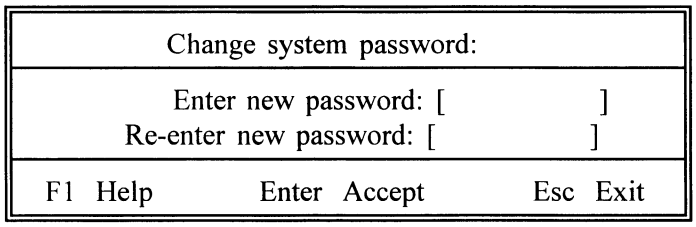


Figure 5-5. System Security Window

Use a password value which is easy for you to remember. You may designate up to eight characters for your password (the characters are not case sensitive.). To set the password enter the password twice. For information on what to do if you lose your password, consult the section on the next page. To remove your password, simply press **<Enter>** twice without entering any password characters.

Once a valid password has been entered the BIOS will request the password each time the system is powered on or soft reset:

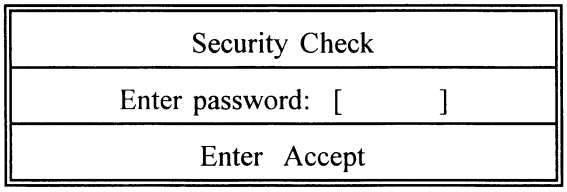


Figure 5-6. BIOS Password Window

You must enter the same sequence of digits you entered to set the password. The BIOS will also request the password before you can enter the **Main Setup Menu**. This prevents unauthorized access to the system security control.

If you fail to enter the correct password the following window will be displayed:

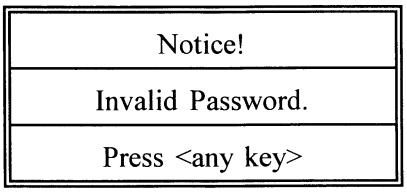


Figure 5-7. Incorrect Password Window

After three tries if you have not successfully entered the password, this window will be displayed:

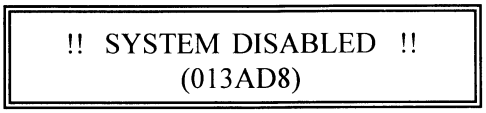


Figure 5-8. System Disabled Window

If this window appears, the system has been halted. Reset the system and enter the correct password.

If you have lost your password, write down the number in parentheses on the System Disabled Window and contact Xycom. Using this number, we can generate an alternate password that will allow you to gain access to your system.

5.8 DIAGNOSTICS

The Advanced Diagnostics Software System is a collection of utility programs that provide advanced tests for PC/AT compatible systems. This section contains information on using the Advanced Diagnostics Software System on the AT3SX. All pertinent menu instructions are included. The Diagnostics Menu offers the following choices:

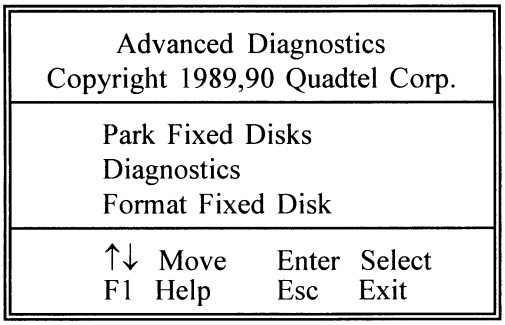


Figure 5-9. Main "Diagnostics" Menu

Each of the choices from the Main Menu is explained in the sections below. **<Esc>** exits the diagnostics and reboots the system.

5.8.1 **Park Fixed Disks**

This menu selection parks the fixed disk drive(s) by placing the fixed heads over the diagnostic cylinder so that vibration will not damage the usable media.

5.8.2 **Diagnostics Menu**

When Diagnostics is selected from the Main Menu, the following warning message is displayed:

Warning!
You have selected the Diagnostics. The diagnostics should be run on a system with no device drivers or TSRs loaded. Many of the diagnostic functions directly operate on the system hardware and memory. This can cause problems with installed software such as hard disk caches or RAM drives. The system should be rebooted after the diagnostics have been run. Floppy disks must be formatted by DOS after exiting the diagnostics to be usable. Insert scratch diskettes in all drives.
Continue Y/[N]

Figure 5-10. Diagnostics "Warning" Message

After reading the warning and inserting the disks, press <**N**> to abort the operation or Y to continue.

Select <**Y**> and the Advanced Diagnostics Menu appears (shown in Figure 4-19 on the following page).

CAUTION
The diagnostics should be run on a system with no device drivers or TSRs loaded.

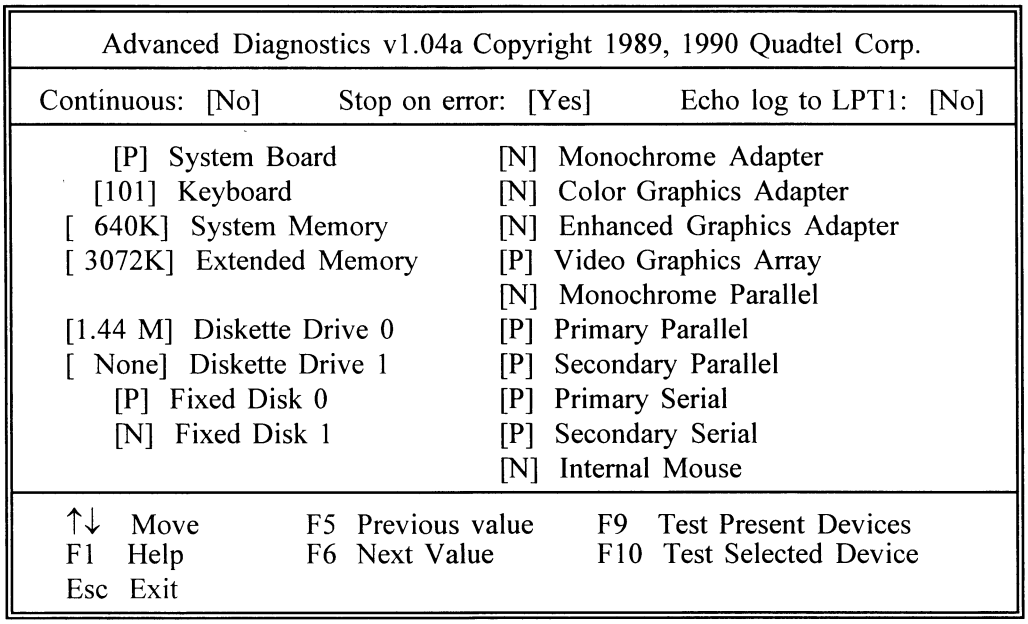


Figure 5-11. Advanced Diagnostics Menu

Items that appear in brackets indicate fields that the user can change. Any default settings initially appear on the screen.

Each of the selections on the menu indicate the hardware item to test and the configuration of that item. Some items are present (P) or not present (N), while others specify a hardware type. For example, Keyboard can be an 84 key keyboard, a 101 key keyboard, or not present.

The initial hardware selections shown in the menu is determined by the current system configuration that is detected by the diagnostics software. To override the initial selections or exclude certain test from being performed, use the arrow keys **(←↑↓→)**, **<Tab>**, or **<Enter>** to move the cursor to the item(s), and use **<F5>** or **<F6>** to change the selection.

Press **<Esc>** to exit the menu.

Press **<F5>** to select the previous or smaller value, or **<F6>** to select the next or higher value.

Press **<F9>** to test all currently available items. If there are specific tests that you do not want performed, set these selections to not present **(N, None, or 0)**.

To test a single item, move the cursor to the specified test and press **<F10>**. The selection to test cannot be set to (N, None, or 0).

The fields at the top of the screen are options that control how the tests are performed. These options must be set before a test or tests are initiated.

Continuous can be set to Yes or No. When set to Yes, the test performs continuously until you specifically stop it by pressing **<Esc>**. After pressing **<Esc>** you can continue again by pressing the space bar or abort the test(s) by again pressing **<Esc>**. Continuous test works with either a single test (selected by **<F10>**) or several tests (selected by **<F9>**).

Stop on Error can be set to Yes or No. When set to Yes, the diagnostic system stops after detecting an error. After the system reports the error, press the space bar to continue or **<Esc>** to end testing.

Echo to LPT1 can be set to Yes or No. If set to Yes, the test result data will be written to a printer attached to LPT1. This feature is useful if you set Continuous Test to Yes, Stop Error to No, and are running the test(s) unattended.

> **NOTE**
> Some of the submenu tests require you to respond to prompts. These are identified as interactive. If you are performing continuous unattended tests, do not select any interactive tests.

Each of the tests selected from the Diagnostics Menu is described below.

When a test is initiated, a window like that shown in Figure 4-12 on the next page is displayed. The actual information shown depends on the type of test selected.

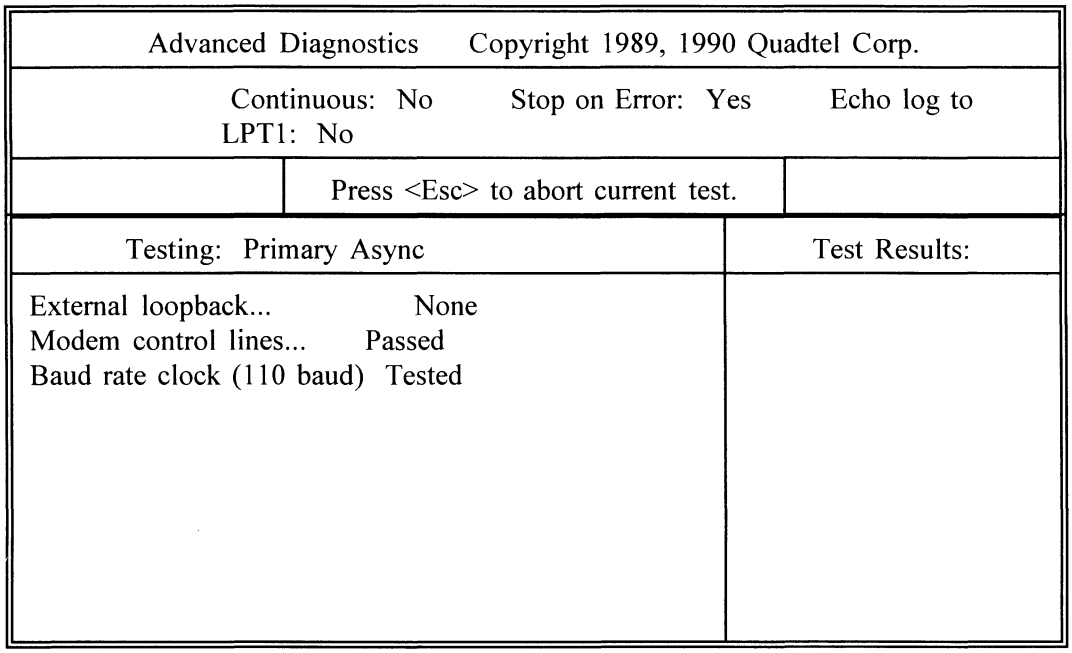


Figure 5-12. Sample Advanced Diagnostics Test Menu

The left side of the screen shows information relating to the test(s) being performed, while the right side of the screen shows results of completed tests.

CAUTION
Tests that are labeled destructive could destroy information.

5.8.3 **Test Control Option Menu**

Many of the hardware items shown in the Advanced Diagnostics menu have an associated test control option menu. One or more of these menus will appear depending on how many tests have been started. Each of these menus allow you to enable or disable parts of each test. A description of the keys used in these menus can be found below.

<↑ ↓>	Moves the cursor to another option.
<Tab>	Moves the cursor to another option.
<Enter>	Moves the cursor to another option.
<Esc>	Returns to the Diagnostics menu.
<F5>	Enables the selected test option if it is currently disabled or disables the selected test option if it is currently enabled.
<F7>	Enables all test options.
<F8>	Disables all test options.
<F10>	Either goes to the next test option menu if there are any that must be examined and set, or starts the test(s).

5.8.4 **System Board**

This selection tests the processor, DMA registers, CMOS RAM, real time clock, timers, and interrupt controller. After the test is completed, press **<Esc>** to return to the Main Diagnostics Menu or the space bar to run the test again.

5.8.5 **Keyboard**

If selected, this menu will appear before the Keyboard test is executed.

Select tests for Keyboard:		
Keyboard test (interactive)	[No]	
Controller test (non-interactive)	[Yes]	
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure 5-13. Keyboard Test Menu

If the interactive Keyboard test is executed, a picture of the keyboard defined in the Main Diagnostics Menu (84 or 101 key) is displayed. The first time you press and release a key, the equivalent key on the screen should highlight. Subsequent press/release cycles should cause the highlight on that key to blink. Pressing and holding a key should cause the equivalent key on the screen to blink, and the key on the screen should be highlighted when the key is released.

The Caps Lock, Num Lock, and Scroll Lock LEDs will match those on the screen unless you press and hold one of these keys long enough to make them blink on the screen.

After testing all of the keys, press **<Ctrl> <Y>** if the keyboard is functioning correctly, otherwise press **<Ctrl> <N>**.

5.8.6 **System Memory**

This diagnostic tests the system memory.

5.8.7 **Extended Memory**

This diagnostic tests the extended memory. Separate read/write and address line tests are performed.

5.8.8 **Diskette Drives 0 and 1**

Before the Diskette Drive 0 or Diskette Drive 1 test is executed, a test control option menu like the following will be displayed. **<F7>** Selects all tests. **<F8>** Sets all tests to No.

```
┌──────────────────────────────────────────────┐
│        Select tests for diskette drive A:    │
├──────────────────────────────────────────────┤
│  Seek tracks                      [Yes]      │
│  Verify tracks                    [Yes]      │
│  Disk change (interactive)        [Yes]      │
│                                              │
│  Read/Write  (destructive)        [No ]      │
│  Format      (destructive)        [No ]      │
├──────────────────────────────────────────────┤
│  ↑↓ Move   F5 Toggle   F7 All                │
│  Esc Abort F8 None     F10 Accept            │
└──────────────────────────────────────────────┘
```

Figure 5-14. Diskette Drive 0 Menu

The Disk change, Read/Write, and Format tests require a diskette of the proper type. The Read/Write and Format tests will destroy any data on the diskette.

5.8.9 **Fixed Disk 0 and 1**

The Fixed Disk 0 or Fixed Disk 1 test control option menu will be displayed before either test is executed.

```
┌──────────────────────────────────────────────┐
│        Select tests for fixed disk: 0        │
├──────────────────────────────────────────────┤
│  Controller test                  [Yes]      │
│  Head select test                 [Yes]      │
│  Seek test                        [Yes]      │
├──────────────────────────────────────────────┤
│  ↑↓ Move   F5 Toggle   F7 All                │
│  Esc Abort F8 None     F10 Accept            │
└──────────────────────────────────────────────┘
```

Figure 5-15. Fixed Disk 0 Menu

The Controller, Head Select, and Seek tests are non-destructive.

5.8.10 **Monitor Type**

Set your monitor type to **[P]** and the other monitor types to **[N]**. All of the monitor tests are interactive except the Memory test. The monitor selections and their test control option menus are:

- Monochrome Adapter

Select tests for Monochrome adaptor:	
Attribute test	[No]
Character test	[No]
Text test	[No]
Memory test	[Yes]
↑↓ Move F5 Toggle F7 All Esc Abort F8 None F10 Accept	

Figure 5-16. Monochrome Adapter Menu

- Color Graphics Adapter (CGA)

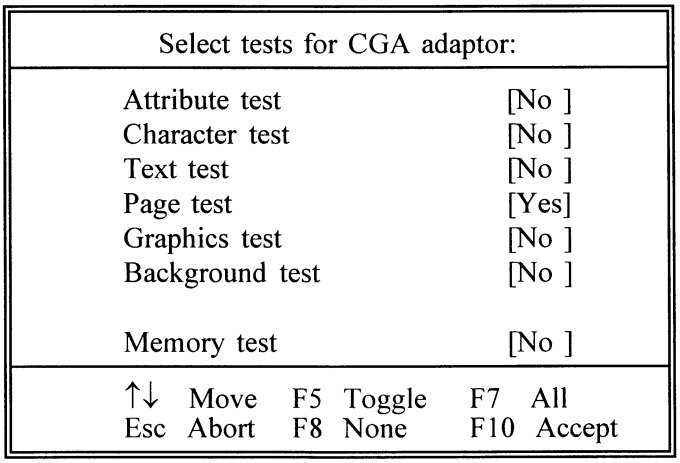


Figure 5-17. Color Graphics Adapter Menu

- Enhanced Graphics Adapter (EGA)

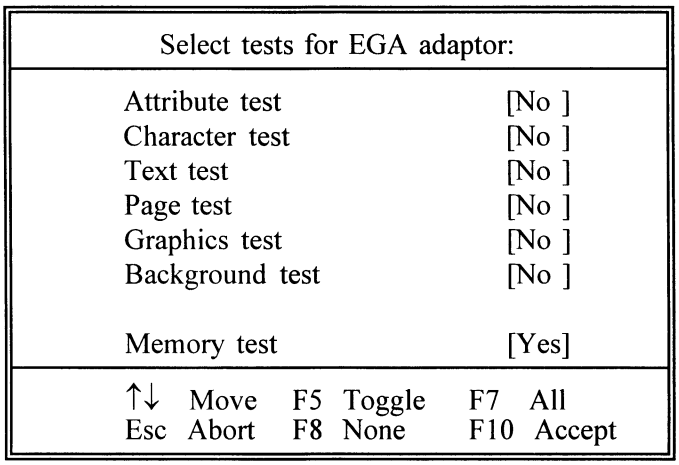


Figure 5-18. Enhanced Graphics Adapter Menu

- Video Graphics Array (VGA)

Select tests for VGA adaptor:	
Attribute test	[No]
Character test	[No]
Text test	[No]
Page test	[No]
Graphics test	[No]
Background test	[No]
Memory test	[No]
↑↓ Move F5 Toggle F7 All	
Esc Abort F8 None F10 Accept	

Figure 5-19. Video Graphics Array Menu

5.8.11 **Parallel Port Tests**

Set the primary, secondary, and monochrome parallel ports to **[P]** if present in your system or **[N]** if not present. When a parallel port test is selected, a menu similar to the one below appears:

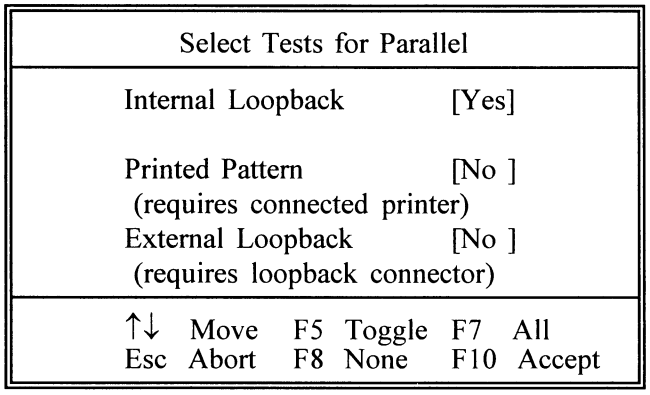


Figure 5-20. Parallel Port Test Menu

The port(s) selected can be tested for external loopback, internal loopback, and printer pattern.

If performing an external loopback test, there must be a loopback connector on the selected output ports. The pinouts for this connector are shown in Figure 5-21 below:

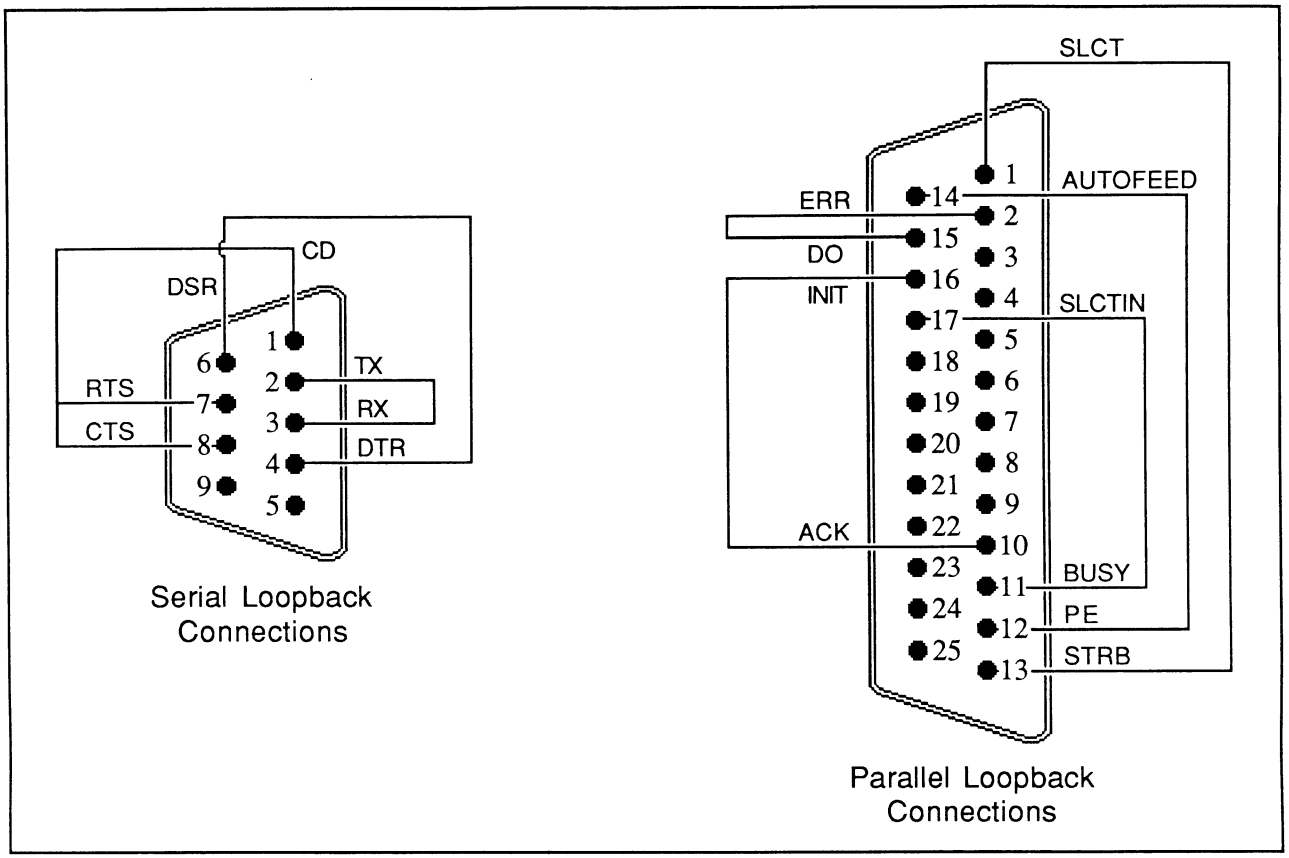


Figure 5-21. Serial and Parallel Loopback Connections

5.8.12 **Serial Port Tests**

Set the primary and secondary serial ports to **[P]** if present or **[N]** if not present in your system. A menu appears when you select the port(s) to test. The features that can be tested are baud rate clock, internal transmit and receive data lines, and modem control data lines. The external loopback test requires a loopback connector to be present.

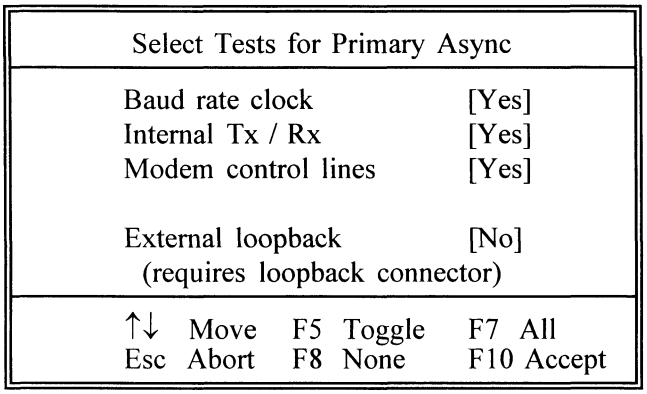


Figure 5-22. Select Tests for Primary Async Window

5.8.13 **Internal Mouse Test**

The test control option menu appears as shown below:

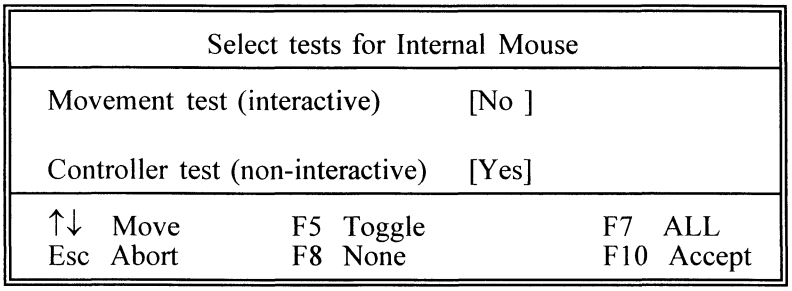


Figure 5-23. Internal Mouse Test Menu

5.8.14 **Format Fixed Disk**

> **CAUTION**
> Your unit has an IDE drive and should not be low-level formatted.

Select Format Fixed Disk from the Main Menu to format your fixed disk drive(s). A menu will prompt you for which fixed disk (0 or 1) you wish to format. Use the arrow keys to select the disk and press **<Enter>**. A warning will be displayed informing you that this operation will destroy all data on the selected hard drive. You are prompted to continue. If you select **<Y>**, the **Format Fixed Disk Menu** appears below:

Format Fixed Disk V1.06 Copyright 1989,90 Quadtel Corporation.					
Drive: 0 Heads: 8 Cylinders: 1024					
Cyl Hd	Cyl Hd	Cyl Hd	Cyl Hd	Cyl Hd	Cyl Hd
Interleave: **[3]**		Insert: Cyl **[0]** Hd **[0]**		Total bad tracks: 0	
↑↓ Move PgDn/PgUp Esc Exit		Ins/Del Bad Track F2 Clear Table F3 Print Table F4 Set Interleave		F5 Scan Bad Tracks F6 Analyze Surface F7 Format Unformatted Drive F8 Format Preformatted Drive	

Figure 5-24. Format Fixed Disk Menu

5.8.15 Using the Bad Track Table

Bad tracks are areas of the fixed disk that cannot properly store data. The bad tracks are displayed in the center of the menu. This list is automatically updated when the **<F5>**, **<F6>**, or **<F8>** commands are used.

To add a bad track manually, press **<Ins>** and use the arrow keys or **<Enter>** to select the cylinder and head fields. Enter the appropriate information, and press **<F10>** or **<ENTER>**. You are prompted if you enter an invalid head or cylinder. Use the arrow keys to position the cursor, press **<Del>**, and then enter the new information.

To clear the entire bad track table, press **<F2>**. To print the table press **<F3>**.

If the drive has already been formatted, you can search for existing bad tracks by pressing **<F5>**.

5.8.16 Setting the Interleave

The interleave is the value used by the format operation to interleave the fixed disk tracks. Press **<F4>** to set the interleave. Consult your disk drive manual for the proper interleave value.

> **NOTE**
> The interleave set is the value that will be used to format, which is not necessarily the current value for your fixed disk.

If you do not set the interleave, a default of three is used.

5.8.17 **Analyzing the Fixed Disk Surface**

If you do not need to reformat the entire fixed disk, but want to perform a thorough media test to detect any bad or marginal areas, select **<F6>** to analyze the surface.

> **CAUTION**
> Analyzing the surface causes all data on the disk to be lost.

Any bad tracks found in the analysis are automatically added to the bad track table. As they are located, the bad tracks are reformatted as bad to prevent these areas from being used subsequently.

5.8.18 **Formatting a New Fixed Disk Drive**

Formatting the disk will format the bad tracks with a special attribute so that other programs (like DOS FORMAT) will not attempt to use these areas on the disk.

After installing a new fixed disk drive, enter the bad track information provided by the manufacturer into the bad track table. Next, press **<F7>** to begin formatting. This operation will perform two functions:

- format each track of the fixed disk using the current interleave, and
- reformat each bad track as bad so that it cannot be used.

5.8.19 **Formatting an Already Formatted Disk**

If your fixed disk was previously formatted, select **<F8>** to begin formatting. The following operations will be performed:

- the drive is scanned for bad tracks, which are added to the bad track table
- each track is reformatted using the current interleave
- each bad track is reformatted as bad so it cannot be used
- a surface analysis is performed on the media and any additional bad tracks found are reformatted as bad and added to the bad track table

5.8.20 **Finishing the Formatting**

The Fixed Disk Format commands perform low level format operations on the fixed disk drive(s). After the format is complete, run the DOS FDISK command followed by DOS FORMAT to prepare the media for use under DOS (or the corresponding utilities for another operating system). Refer to your DOS manual for more information.

5.8.21 **Error Codes**

When the diagnostics system detects an error, a two-byte hexadecimal code is displayed. The first byte of this code is the class of error and the second byte is the sub-class. The error code class generally corresponds to a specific hardware system or group of systems. For example, the first class (01) is used for the system planar board. For example, error 0108 indicates a system board error regarding the 8253 counters.

Table 5-3. Error Codes

Code	Class	Failure Type
0101	System board	DMA registers
0102		DMA memory move
0103		Interrupt mask
0104		Hot interrupt line
0105		Struck NMI
0106		Process registers
0107		System timer
0108		8253 counters
0109		System timer interrupts (1)
010A		System timer interrupts (2)
010B		Processor flags
0110		CMOS memory
0111		Real time clock
0120		BIOS checksum
0701	Keyboard	Controller
0702		Keyboard map
1001	Co-processor	Registers
1002		Calculations
1701	Video	Text attributes
1702		Background colors
1703		Character set
1704		Text page registration
1705		Text pages
1706		Graphics display
1707		EGA/VGA palette
1708		Memory
1709		VGA sequencer
170A		VGA controller registers
170B		VGA attribute controller
170C		VGA DAC
1730		Cannot initialize video
2001	Serial	Baud rate clock
2002		Internal loopback data
2003		Internal loopback control
2004		External loopback data

Table continued on the following page

Table 5-3. Error Codes (Continued)

Code	Class	Failure Type
2701	LPT	Registers read/write
2702		Control loopback
2703		Printed pattern
2704		Printer not ready
2705		Unknown error
2706		No paper/paper jam
2707		Printer timeout
2708		Printer busy
3001	Memory	Address lines
3002		Data patterns
3003		Walking bits
3701	Disk	Invalid parameter
3702		Address mark not found
3703		Write protect error
3704		Sector not found
3705		Reset failed
3706		Change line active
3707		Drive parameter error
3708		DMA overrun
3709		Attempt to DMA across 64 K
370A		Bad sector flag found
370B		Bad cylinder detected
370C		Media type not found
370D		Invalid format sectors count
370E		Control data mark detected
3710		CRC or ECC error detected
3711		ECC corrected error
3720		General controller failure
3740		Seek operation
3750		Change line test
3780		Drive not ready
37BB		Undefined error occurred
37CC		Write fault on selected drive
37EO		Status error
37FF		Sense operation failed

5.9 FLAT PANEL MENU

> **NOTE**
> Only works when AT3SX is installed into the 8470.

By selecting the Flat Panel entry in the Main Setup Menu, a menu will appear only if a flat panel display is connected. If the flat panel does not support backlight blanking, "Not Available" will be in the timeout field. If backlight blanking is supported by the flat panel, but the blanking timeout has been set with the switches on the flat panel, "Not Configurable" will be in the timeout field. In a system that has a flat panel that allows backlight blanking, and the backlight timeout has not been defined in the switches on the flat panel, the menu shown below will allow you to disable backlight blanking, or set the backlight timeout.

Flat Panel Menu, Copyright 1992, Xycom Inc.		
Backlight Blanking Timeout: [Enabled / 10 minutes]		
↑↓ Move	F5 Previous Value	F10 Save Configuration
Esc Exit	F6 Next Value	

Figure 5-25. Flat Panel Menu

When blanking is enabled, the flat panel backlight will be turned off if no keys are pressed within the specified time. The blanking timeout can be set to any multiple of 5 minutes up to a maximum of 60 minutes. After the backlight has been turned off, pressing any keyboard or keypad key will turn the backlight back on. (The keycode of the key that was pressed to turn on the backlight will not be passed on to the software currently running on the system.)

5.10 RADAR SETUP MENU

RADAR stands for Runtime Alarm Detection And Recording. The RADAR BIOS consists of enhancements to Xycom's Industrial BIOS for PC/AT products. The enhancements for the 8470/80 increases the "uptime" of Xycom PC/AT systems. Some of the functions of RADAR include:

- Hard disk life meter
- Fan filter reminder
- Battery life meter
- Support for status LEDs at power-up
- Continuous Checksum Tests
- Temperature monitor

5.10.1 Hardware Configurations

RADAR BIOS requires that Xycom's AT3SX and RADAR Cards be installed. RADAR uses the Extended BIOS EPROM on the RADAR Card.

The SRAM and EPROM on the RADAR Card must be accessible over the PC/AT bus. The RADAR allows the SRAM/EPROM to be mapped at C8000H-CFFFFH, D0000H-D7FFFH, or D8000H-DFFFFH. RADAR automatically configures itself to any of these mappings. The memory and I/O addresses of any other cards installed in the same system must not conflict with those of the AT3SX and RADAR.

5.10.2 RADAR Menus

The RADAR features are accessed by selecting "RADAR" from the **Main Menu** of the Quadtel System BIOS, this will bring up the **RADAR Menu**.

RADAR Setup Menu - Copyright 1992, Xycom Inc.
Hard Disk Life Meter Fan Filter Reminder Battery Life Meter Continuous Checksum Tests Temperature Monitor
↑↓ Move Enter Select Esc Exit

Figure 5-26. RADAR Setup Menu

The **RADAR Menu** follows the conventions of the **Quadtel System BIOS Main Menu**.

(↑ ↓) moves the cursor to an item to select.

<Enter> selects the item

<Esc> exits the menu. Pressing **<Esc>** in the **RADAR Menu** exits the **RADAR Menu** and brings up the **Main Menu**. Pressing **<Esc>** in the **Main Menu** reboots the system.

The RADAR Menus are used to enable/disable/configure RADAR features and to view the statistics measured by those features.

If any of the RADAR features are causing the Fault or Maintenance LEDs to be on, the RADAR feature(s) responsible will have a flashing message to their right indicating either "Fault Occurred" or "Maintenance Required". For example, if the "Filter Cleaning Interval" (See "Fan Filter Reminder" menu) had elapsed since the last cleaning, the flashing "Maintenance Required" message would be to the right of the "Fan Filter Reminder" entry as shown below.

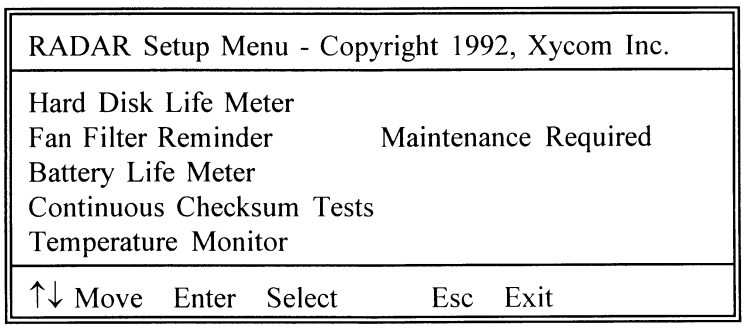


Figure 5-27. RADAR Setup Menu (Maintenance Required)

The individual menus selected from the **RADAR Menu** follow the conventions of the Quadtel SETUP menus. The arrow keys and **<Enter>** are used to move the cursor to the item to modify. Some fields can be modified by typing in a new value. White space is used in the menus to separate the items the user can change from those that are used to report the collected statistics.

<F5> selects the previous or smaller value
<F6> selects the next or higher value
<F2>, **<F3>** are used in some menus to reset values
<F10> saves the new configuration
<Esc> exits the menu The user will be given a chance to save changes if **<Esc>** is pressed before **<F10>** is pressed.

5.10.3 **Hard Disk Life Meter**

The RADAR hard disk life meter keeps track of the total number of hours of hard disk usage.

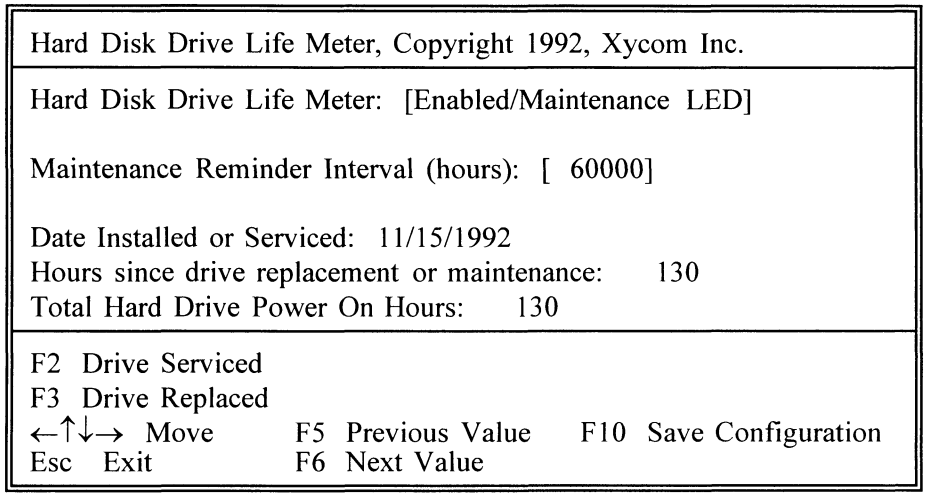


Figure 5-28. Hard Disk Drive Life Meter Menu

Hard Disk Drive Life Meter
This selection allows the user to enable ("Enabled/Maintenance LED") or disable ("Disabled") this feature. When enabled, the Maintenance LED is used to indicate when maintenance is required.

Maintenance Reminder Interval
When the "Hours since drive replacement or maintenance" is equal to or greater than the value in this field, the Maintenance LED will be turned on if this feature (Hard Disk Drive Life Meter) is "Enabled". The maximum value of this item is 999,999 hours. The manufacturer's reliability specifications for the mean time between failures (MTBF) for the ProDrive ELS and the LPS is 250,000 hours.

> **NOTE**
> If you do not know what to set the "Maintenance Reminder Interval" to, start with the MTBF of the hard drive that is in your system. As you gain experience with the reliability of hard drives in your specific application, modify this value appropriately.

Date Installed or Serviced
This field shows the last date at which the drive was serviced or replaced. Pressing **<F2>** or **<F3>** sets this field to the current date. The format of the date field is: month/day/year.

Hours since drive replacement or maintenance
This item shows the number of hours since the drive was last replaced or maintained. The RADAR BIOS maintains this number when the Hard Disk Drive Life Meter is enabled. It is set to zero when the user presses **<F2>** or **<F3>**.

Total Hard Drive Power On Hours
This item shows the total number of hours a drive has been powered on. This item is set to zero when the user presses **<F3>**. The RADAR BIOS maintains this number when the Hard Disk Drive Life Meter is enabled.

5.10.4 Fan Filter Cleaning Reminder

The fan filter cleaning reminder keeps track of how long the system has run since the last cleaning of the fan filter.

```
Fan Filter Cleaning Reminder, Copyright 1992, Xycom Inc.

Fan Filter Cleaning Reminder: [Enabled/Maintenance LED]

Filter Cleaning Interval (hours): [  720]

Date Serviced: 11/15/1992
Hours since cleaning:  130

F2  Fan Filter Cleaned
←↑↓→ Move      F5  Previous Value      F10  Save Configuration
Esc  Exit      F6  Next Value
```

Figure 5-29. Fan Filter Cleaning Reminder Menu

Fan Filter Cleaning Reminder
This item is used to enable ("Enabled/Maintenance LED") or disable ("Disabled") this feature. When enabled, the Maintenance LED is used to indicate when it is time to clean the fan filter.

Filter Cleaning Interval
When the "Hours since cleaning" is equal to or greater than the value in this field, the Maintenance LED will be turned on if this feature (Fan Filter Cleaning Reminder) is "Enabled". The maximum value of this item is 17,532 hours (2 years).

Date Serviced
This item shows the last date that the fan filter was serviced. Pressing **<F2>** sets this item to the current date. The format of the date field is: month/day/year.

Hours Since Cleaning
This field shows the number of hours the system has been powered on since the last time the filter was serviced. The RADAR BIOS updates this value when the Fan Filter Cleaning Reminder is enabled. The user clears this value by pressing **<F2>**.

5.10.5 Battery Life Meter

The battery life meter keeps track of the total number of hours the external battery has been used to preserve the contents of the SRAM on the RADAR. This battery can be changed without opening the box.

```
   Battery Life Meter, Copyright 1992, Xycom Inc.

Battery Life Meter: [Enabled/Maintenance LED]

Battery Life (hours): [41463]
Battery Replacement Interval (% ; hours): [ 90] ; 37316

Date New Battery Installed: 11/15/1992
Hours battery in use: 125
Remaining Battery Life: 41338

F2  Battery Replaced
←↑↓→ Move      F5  Previous Value     F10  Save Configuration
Esc  Exit      F6  Next value
```

Figure 5-30. Battery Life Meter

Battery Life Meter
This option is used to enable ("Enabled/Maintenance LED") or disable ("Disabled") this feature. When enabled, the Maintenance LED is used to indicate when it is time to change the battery.

Battery Life
This option is used to specify the life of the battery in hours. The maximum value of this item is 87,672 hours (10 years).

Battery Replacement Interval
This is a percentage of the "Battery Life". The user must specify at what percentage of battery life that the battery should be replaced. After the percentage is set, the number of hours that the percentage represents will be updated on the screen when the highlight bar is moved to another item in the menu. When the "Hours battery in use" is equal to or greater than the number of hours specified in this item, the Maintenance LED will be turned on if this feature (Battery Life Meter) is "Enabled". The minimum value of this item is 50 percent and the maximum value is 100 percent.

Date New Battery Installed
This option shows the date the battery was replaced. Pressing **<F2>** sets this item to the current date. The format of the date field is: month/day/year.

Hours Battery In Use
This option shows how long the current battery has been in use. The RADAR BIOS maintains this number when the Battery Life Meter is enabled. When the user presses **<F2>**, this option is set to zero.

Remaining Battery Life
This option shows the remaining life of the battery. This value is set to the same value as "Battery Life" when the user presses **<F2>**. RADAR BIOS maintains this number when the Battery Life Meter feature is enabled.

5.10.6 **Continuous Checksum Tests**

This test constantly performs a checksum test on the BIOS.

Continuous Checksum Test, Copyright 1992, Xycom Inc.
BIOS Continuous Checksum Test: [Enabled/Fault LED] BIOS Continuous Checksum Test Fault: No
F2 Reset BIOS Continuous Checksum Test Fault ↑↓ Move F5 Previous Value F10 Save Configuration Esc Exit F6 Next Value

Figure 5-31. Continuous Checksum Test Menu

BIOS Continuous Checksum Test
This option is used to enable ("Enabled/Fault LED") or disable ("Disabled") this feature. When enabled, this feature continuously checksums the system BIOS. If the checksum is not valid the Fault LED will be turned on. A complete checksum is performed once every few hours.

BIOS Continuous Checksum Test Fault [Yes] or [No]
If the checksum test detected a fault, this field will show **Yes**. This field is cleared to **No** by pressing **<F2>**.

5.10.7 **Temperature Monitor**

This feature monitors the temperature of the system. All temperatures are in degrees Celsius.

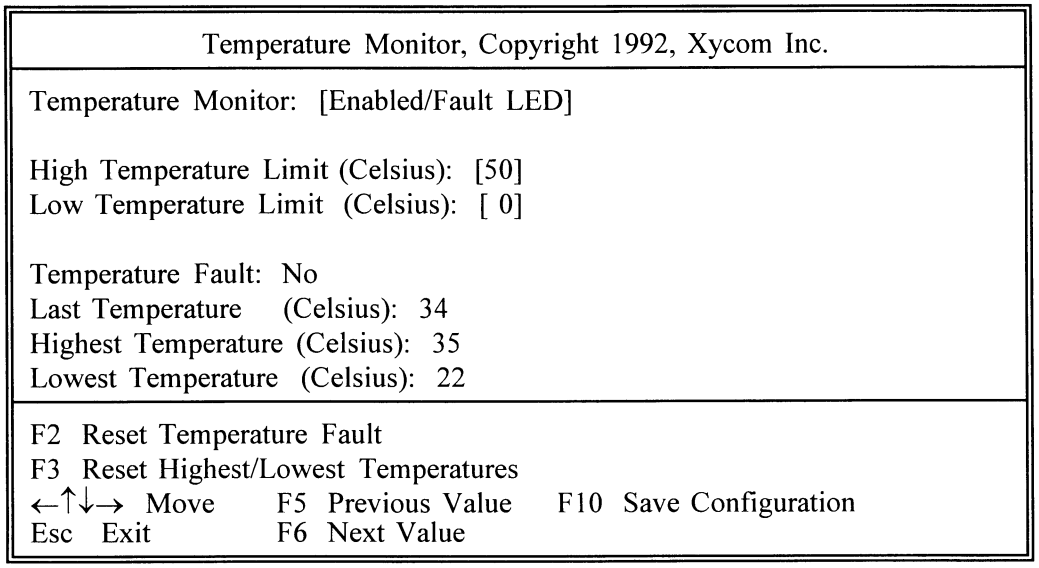


Figure 5-32. Temperature Monitor Menu

Temperature Monitor
This option is used to enable ("Enabled/Fault LED") or disable ("Disabled") this feature. When enabled, the Fault LED is used to indicate that the temperature has gone above or below the specified limits.

High/Low Temperature Limit
These fields are used to specify the allowable temperature range. If the temperatures goes out of the range specified, the Fault LED is turned on. The temperature limits can be set as low as 0°C and as high as 50°C.

Temperature Fault
If a temperature fault occurred, this field will be **<Yes>**. This field is reset to **<No>** by pressing **<F2>**.

Last/Highest/Lowest Temperature
These fields show the last, highest, and lowest temperatures measured when the temperature monitor was enabled. The Highest and Lowest Temperature fields are reset when **<F3>** is pressed. The temperature is measured once a minute. These values will not be updated while the menu for this feature is displayed.

5.10.8 **RADAR Runtime Functions**

The following descriptions assume that the feature being discussed is enabled. If a feature is not enabled, no fields in that menu will be updated and the feature will not affect the state of the Maintenance or Fault LEDs.

5.10.9 **Hard Disk Life Meter**

The hard disk life meter is implemented with two counters. The counter values are displayed as number of hours, but internally the values are stored as minutes. The counters are incremented every minute that the system is powered up. One of the counters counts the total time the hard disk has been in use, the other counts the time since the last service was done on the drive. When the "Hours since drive replacement or maintenance is equal to or greater than the "Maintenance Reminder Interval", the Maintenance LED is turned on.

5.10.10 **Fan Filter Cleaning Reminder**

The fan filter cleaning reminder is implemented with a counter. The counter value is displayed as a number of hours, but internally the value is stored as a number of minutes. This counter is incremented every minute that the system is powered up. When the "Hours since cleaning" is equal to or greater than the "Fan Filter Cleaning Interval", the Maintenance LED is turned on.

5.10.11 **Battery Life Meter**

This meter monitors the life of the external battery located on the unit. The battery can be changed without opening up the box and it can be done with power on. This battery is connected only to the RADAR Card. The RADAR Card also has its own battery.

The battery life meter keeps track of the number of hours the system has been turned off (since that is the only time the battery is being used). If the Maintenance LED is going to be turned on because of the battery life meter, it will be turned on as soon as the RADAR code begins running at power-up.

5.10.12 **Continuous Checksum Tests**

This test checksums the BIOS at the rate of one byte a minute. A checksum of the entire BIOS takes a few hours. This is the same checksum done at power-up.

5.10.13 **Temperature Monitor**

This test monitors the internal temperature inside the relocatable node box. The temperature is checked once a minute.

5.10.14 **Performance**

The workload is distributed so that very little CPU cycle time is taken from the application running.

5.10.15 **Software Compatibility**

RADAR BIOS requires a periodic interrupt. It gets this by attaching itself to the INT 1CH interrupt. The BIOS code handling the timer-tick interrupt (INT 8) does an INT 1CH for every tick.

Some software takes over INT 8. If the software does not pass control back to the BIOS, it is the responsibility of that software to do the INT 1CH. RADAR BIOS expects the INT 1CH to occur every 55ms. Software that reprograms the rate of the timer-tick must make sure that the average time between INT 1CH to occur every 55ms. Software that reprograms the rate of the timer-tick must make sure that the average time between INT 1CH interrupts is 55ms.

WARNING

Various SETUP menus may not work properly with all TSRs and drivers. It is recommended that no TSRs or drivers are loaded when going into the menus.

6.1 INTRODUCTION

The 8450 processor is a highly integrated, eight-layer 80386SX board. The board supports up to 16 Mbytes of fast page mode interleave DRAM, and provides an integrated floppy disk drive controller that supports up to two floppy disk drives. It also offers a high-performance, cost-effective integrated drive electronics (IDE) hard disk interface, two serial ports, and one parallel port.

6.2 FEATURES OF THE AT3SX CPU BOARD

- 80386SX @ 25 MHz
  - -Four SIMM sites supports up to 16 Mbytes and parity checked DRAM
  - -Flat panel driver circuitry
  - -Socket for optional 80387SX math co-processor
  - -Two RS232C serial ports
  - -One Centronics compatible parallel port
  - -Real time clock with on-board battery backup
  - -Keyboard/speaker/reset port on board
  - -VGA analog output
  - -One SA450 floppy disk interface (supports two drives)
  - -One IDE hard disk interface (supports two drives)
  - -8.33 MHz ATbus speed supported

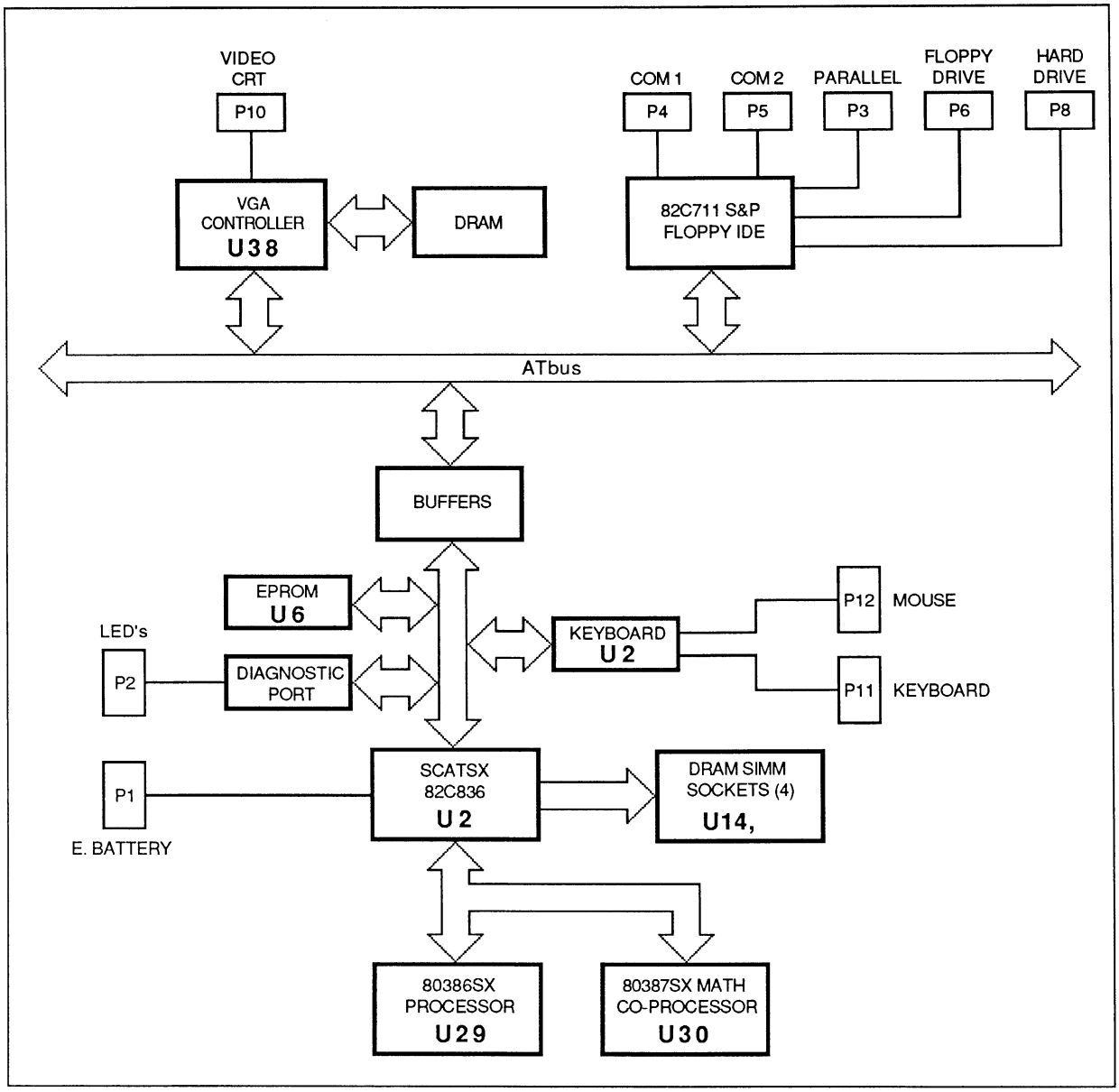


Figure 6-1. AT3SX Board Block Diagram

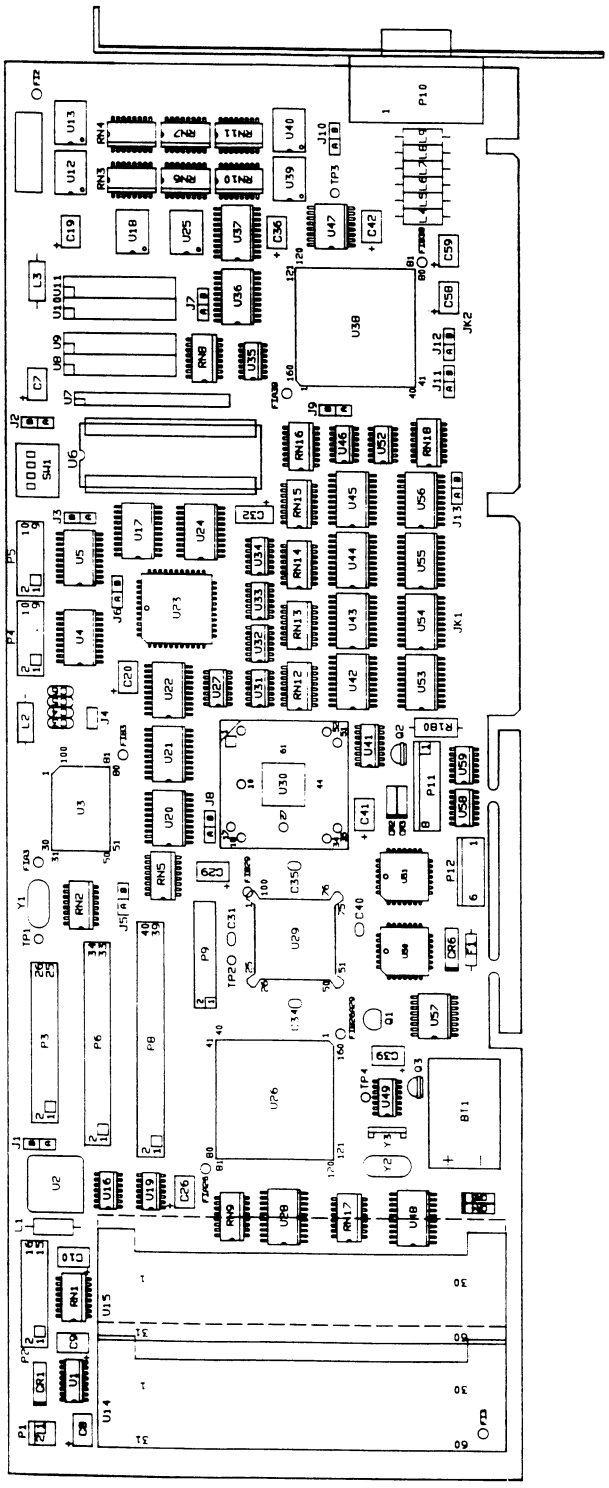


Figure 6-2. AT3SX Board Layout

6.3 JUMPERS

Table 6-1. Jumpers/Positions/Functions

Jumper	Position	Function
J1	A✓ B	Test jumper that supplies Vcc to OSC Test jumper that disconnects Vcc from OSC
J2	A✓ B	Disables battery Enables battery
J3	A✓ B	Sets EPROM or Flash RAM to non-writable +5V Sets Flash RAM to +12V
J4	A B	
J5	A✓ B	Enables 82C711 (Serial, parallel, and floppy hard disk) Disables 82C711 (Serial, parallel, and floppy hard disk)
J6	A✓ B	Mouse port connected to IRQ12 Mouse port disconnected to IRQ12
J7	A✓ B	Color and mono flat panels EL flat panels
J8	A✓ B	Secondary COM port set for IRQ3 (COM2:) Secondary COM port set for IRQ11 (COM4:)
J9	A✓ B	VGA enabled VGA disabled
J10	A✓ B	Orb not connected to logic GND Orb connected to logic GND
J11	A✓ B	Parallel port set for IRQ7 (LPT1:) Parallel port set for IRQ5 (LPT2:)
J12	A✓ B	One wait state Two wait states
J13	A✓ B	Primary COM port set for IRQ4 (COM1:) Primary COM port set for IRQ10 (COM3:)

✓indicates the default settings

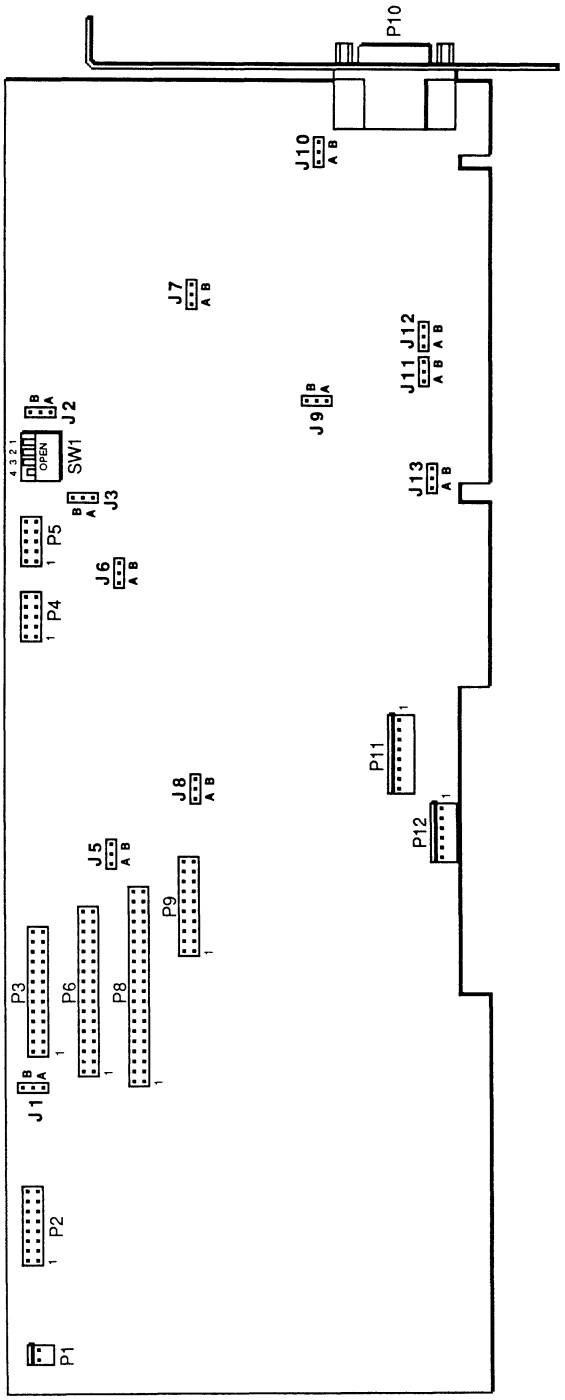


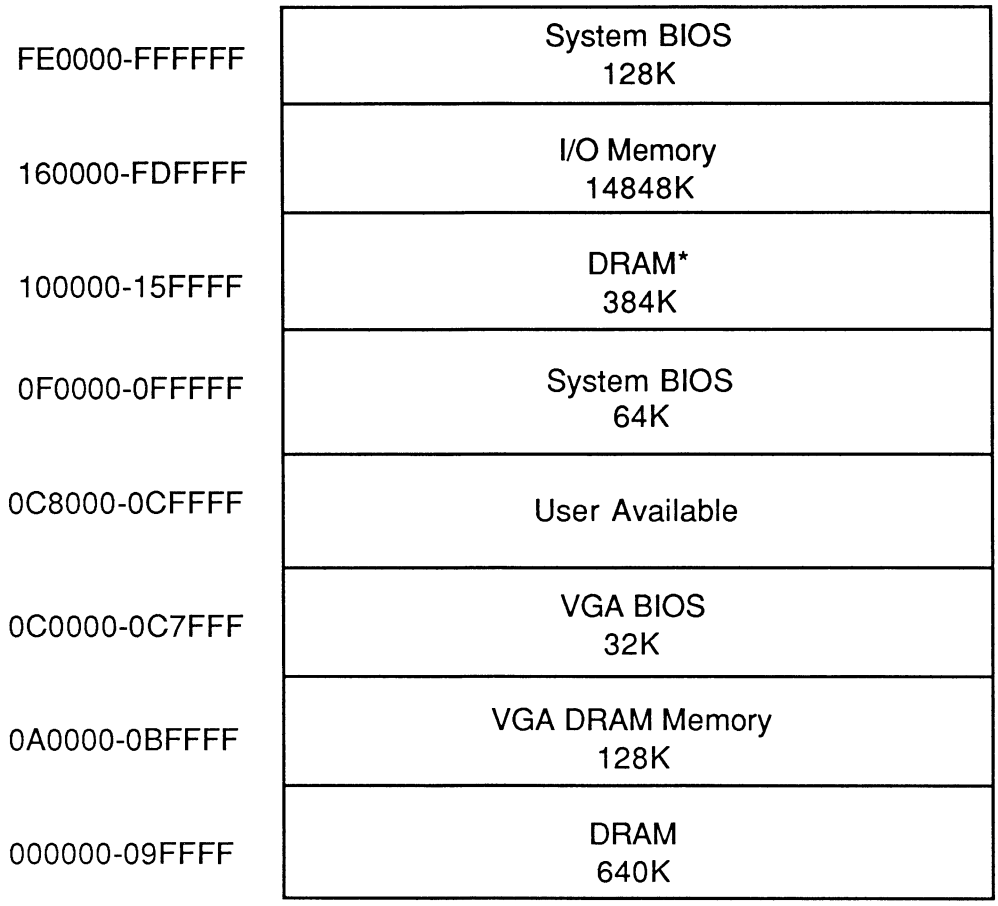
Figure 6-3. AT3SX - Jumpers, Connectors, and Switches

6.4 SWITCH OPTIONS

Table 6-2. Switch Options

SW1-1	Open Closed✓	When J2 is A, then battery is disconnected.
SW1-2	Open Closed✓	Unused Unused
SW1-3	Open Closed✓	Monochrome display Color display
SW1-4	Open✓ Closed	Keyboard unlocked Keyboard locked

✓indicates the default settings



* The 384K of Extended DRAM is only available when no BIOS is shadowed.

Figure 6-4. 1 Mbyte Memory Map (as seen by the 80386SX CPU)

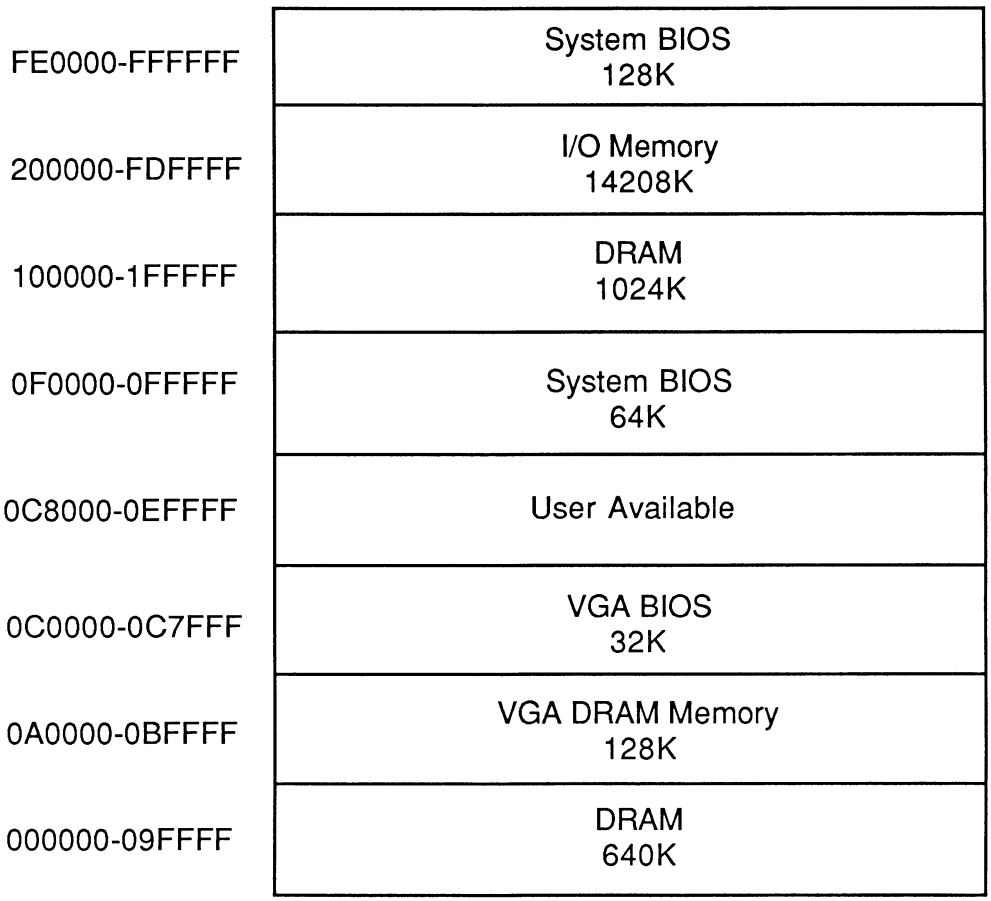


Figure 6-5. 2 Mbyte Memory Map (as seen by the 80386SX CPU)

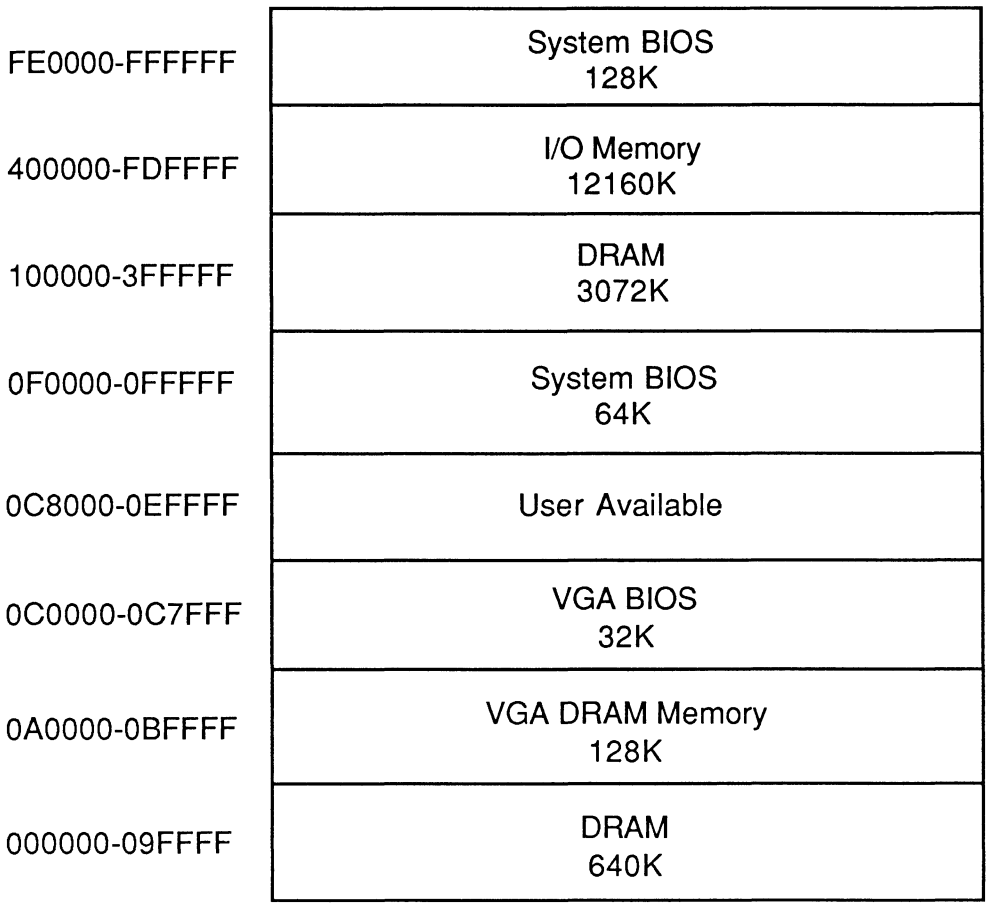


Figure 6-6. 4 Mbyte Memory Map (as seen by the 80386SX CPU)

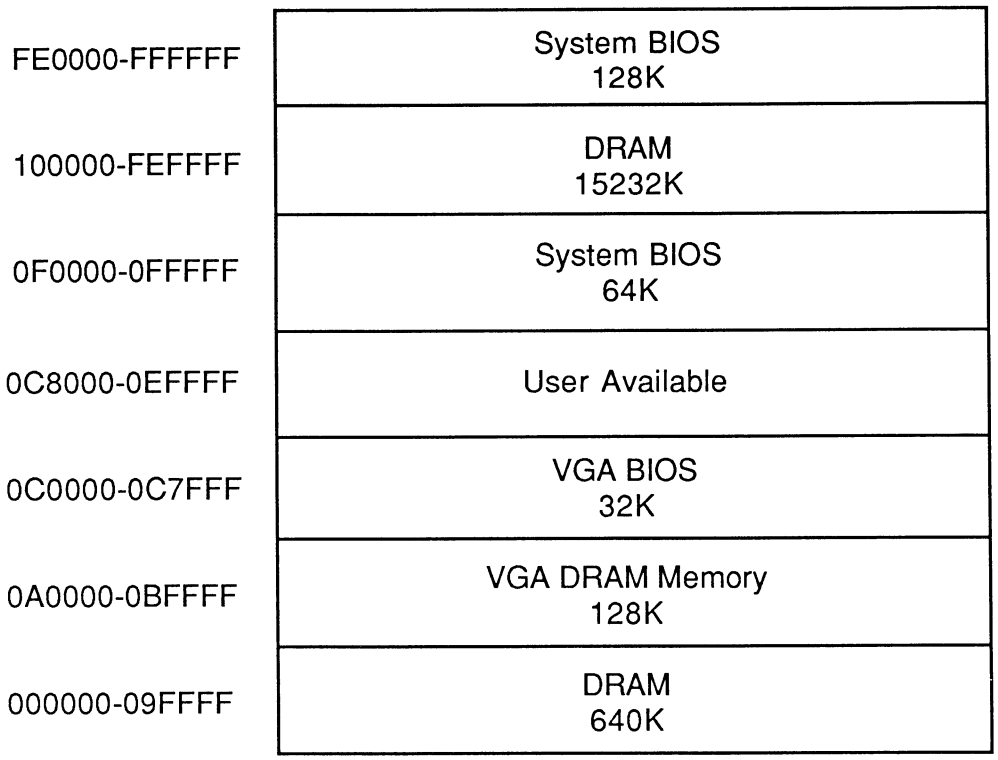


Figure 6-7. 16 Mbyte Memory Map (as seen by the 80386SX CPU)

6.5 EPROM

The AT3SX has one 256Kx8 EPROM. This EPROM can represent the entire IBM BIOS range. The EPROM memory map is shown in Figure 6-8 below:

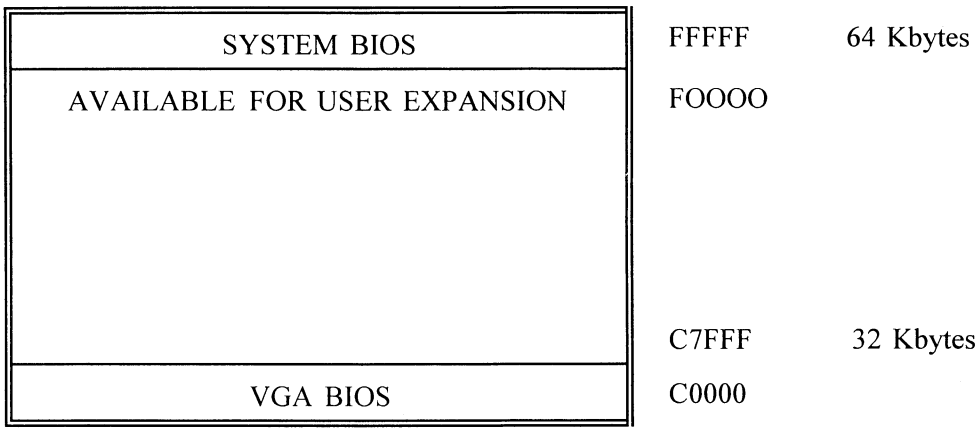


Figure 6-8. EPROM Memory Map

6.6 SHADOW RAM OPTION

Shadowing is the process of loading the BIOS from EPROM into DRAM after power-up. Both the System and VGA BIOS can be shadowed into DRAM to increase system performance.

On the 1 Mbyte version of the AT3SX, the 384 Kbytes of DRAM can be used to shadow the BIOS or can be relocated to the address above the EPROMs as DRAM.

The 2, 4, and 16 Mbyte versions of the AT3SX always allocate 384 Kbytes of DRAM for shadowing the BIOS.

Because shadowing the BIOS increases system performance, the AT3SX is factory-shipped with the System BIOS and the Video BIOS shadowed.

6.7 I/O PORT ADDRESSES

The AT3SX I/O map contains all IBM PC/AT architecture I/O ports, plus ten I/O ports at I/O address spaces 30H-34H, 36H, and 3CH-3FH. The AT3SX is shipped with serial ports 1 and 2 and parallel port 1 enabled at the address specified. Standard PC/AT I/O addresses are shown in Table 6-3 below. The additional 8-bit I/O ports are listed in Table 6-4 on the next page.

Table 6-3. I/O Address Map

Hex Range	Port
000-01F	DMA Controller 1, 8237A-5 Equivalent
020-021	Interrupt Controller 1, 8259 Equivalent
022-023	Chips & Technology Register Set-up
024-02F	Interrupt Controller 1, 8259 Equivalent
040-05F	Timer, 8254-2 Equivalent
060-06F	8742 Equivalent (Keyboard)
070-07F	Real Time Clock bit 7 NMI Mask
080-09F	DMA Page Resistor
0A0-0BF	Interrupt Controller 2, 8259 Equivalent
0C0-0DF	DMA Controller 2, 8237A-5 Equivalent
0E0-0EF	Available
0F0	Clear Math Co-processor Interrupt 13
0F1	N/A
0F2-0FF	Math Co-processor
100-1EF	Available
1F0-1F7	IDE Controller (AT drive)
1F8-277	Available
278-27F	Parallel Port 2 (see note)
280-2F7	Available
2F8-2FF	Serial Port 2 (see note)
300-36F	Available
370-377	Alternate Floppy Disk Controller (see note)
378-37F	Parallel Port 1 (see note)
380-3BF	Available
3C0-3CF	VGA/EGA
3D0-3EF	Available
3F0-3F7	Primary Floppy Disk Controller
3F8-3FF	Serial Port 1 (see note)

NOTE

Because the serial and parallel port addresses can be changed and disabled, these addresses may not be used for all applications.

NOTE
Because the serial and parallel port addresses can be changed and disabled, these addresses may not be used for all applications.

Table 6-4. CMOS RAM Address Map

Address	Description
00-0D	Real time clock information
0E	Diagnostic status byte
0F	Shutdown status byte
10	Diskette drive type byte - drives A and B
11	Reserved
12	Fixed disk type byte
13	Reserved
14	Equipment byte
15	Low base memory byte
16	High base memory byte
17	Low expansion memory byte
18	High expansion memory byte
19	Disk C extended byte
1A	Disk D extended byte
1B-2D	Reserved
2E-2F	2-byte CMOS checksum
30	Low expansion memory byte
31	High expansion memory byte
32	Date century byte
33	Information flags (set during power on)
34	Reserved
35-3F	Reserved
40-53	Extended CMOS
54	Reserved
55-77	Reserved
78-7D	Reserved
7E-7F	Extended CMOS checksum

6.8 FLOPPY DRIVE CONNECTOR (P6)

The floppy drive connector is a 34-pin header located on the board near P8, the COM2 serial port connector. It is the interface and control connection for up to two floppy drives.

Table 6-5. Floppy Drive Connector

PIN	SIGNAL	PIN	SIGNAL
1	GND	18	FDIRC*
2	FRWC*	19	GND
3	GND	20	FSTEP*
4	N/C	21	GND
5	KEY	22	FWD*
6	N/C	23	GND
7	GND	24	FWE*
8	IDX*	25	GND
9	GND	26	FTK0*
10	MO1*	27	GND
11	GND	28	FWP*
12	FDS2*	29	GND
13	GND	30	FRDD*
14	FDS1*	31	GND
15	GND	32	FHS*
16	MO2*	33	GND
17	GND	34	DCHG*

6.9 IDE HARD DRIVE CONNECTOR (P8)

The IDE hard drive connector is a 40-pin header. It is the control connector for any hard drive(s) interfaced with the AT3SX. The AT3SX can control up to two hard drives from this connector.

Table 6-6. IDE Hard Drive Connector

PIN	SIGNAL	PIN	SIGNAL
1	RESET*	21	N/C
2	GND	22	GND
3	IDED7	23	IOW*
4	SD8	24	GND
5	SD6	25	IOR*
6	SD9	26	GND
7	SD5	27	N/C
8	SD10	28	ALE
9	SD4	29	N/C
10	SD11	30	GND
11	SD3	31	IRQ14
12	SD12	32	IOCS16*
13	SD2	33	SA1
14	SD13	34	N/C
15	SD1	35	SA0
16	SD14	36	SA2
17	SD0	37	HCS0*
18	SD15	38	HCS1*
19	GND	39	HDACTIVE*
20	N/C	40	GND

6.10 KEYBOARD CONNECTOR (P11)

P6 is an 8-pin connector and the interface point for a keyboard, speaker, and reset push button.

Table 6-7. Keyboard Connector

PIN	SIGNAL
1	SPEAKER
2	NC
3	GND
4	KEYBOARD INHIBIT
5	DATA
6	CLK
7	N/C
8	GND
	PUSH BUTTON RESET

6.11 AUXILIARY CONNECTOR (P12)

P12 is a PS/2, 6-pin connector. This port will accept a PS/2 mouse, track ball, etc., with an adapter cable connector.

Table 6-8. Auxiliary Connector

PIN	SIGNAL
1	DATA
2	NC
3	GND
4	+5V
5	CLK
6	N/C

6.12 COM1 SERIAL PORT CONNECTOR (P4)

COM1 is a 10-pin dual row header. A 10-pin ribbon socket to 9-pin IDC style adapter is required.

Table 6-9. COM1 Serial Port Connector

PIN	SIGNAL	PIN	SIGNAL
1	DCD1	6	CTS1
2	DSR1	7	DTR1
3	RXD1	8	RI1
4	RTS1	9	GND
5	TXD1		

6.13 COM2 SERIAL PORT CONNECTOR (P5)

COM2 is a 10-pin dual row header. A 10-pin ribbon socket to 9-pin IDC style adapter is required.

Table 6-10. COM2 Serial Port Connector

PIN	SIGNAL	PIN	SIGNAL
1	DCD2	6	CTS2
2	DSR2	7	DTR2
3	RXD2	8	RI2
4	RTS2	9	GND
5	TXD2		

6.14 VGA CONNECTOR (P10)

The VGA connector, P10, is a 15-pin subminiature located at the bottom of the module's front panel.

Table 6-11. VGA Connector

PIN	SIGNAL	PIN	SIGNAL
1	RED	9	KEY
2	GREEN	10	GND
3	BLUE	11	N/C
4	N/C	12	N/C
5	GND	13	HSYNC
6	GND	14	VSYNC
7	GND	15	N/C
8	GND		

6.15 PARALLEL PORT CONNECTOR (P3)

JK1 is a 26-pin ribbon header. A 26-pin ribbon to 25-pin IDC D-style adapter is required.

Table 6-12. Parallel Port Connector

PIN	SIGNAL	PIN	SIGNAL
1	STROBE	14	GND
2	AUTOFEED	15	PDOUT6
3	PDOUT0	16	GND
4	PERROR	17	PDOUT7
5	PDOUT1	18	GND
6	INIT	19	PACK
7	PDOUT2	20	GND
8	SELIN	21	PBUSY
9	PDOUT3	22	GND
10	GND	23	PE
11	PDOUT4	24	GND
12	GND	25	SELECT
13	PDOUT5	26	NC

6.16 80386SX MICROPROCESSOR

The 80386SX Microprocessor is object code compatible with the 80386, 80286, and 8086 microprocessors and can run most software, including the growing 32-bit software base. The Intel 386 architecture can run UNIX, OS/2, and MS-DOS.

Instruction pipelining, high bus bandwidth, and a very high performance ALU ensure short average instruction execution times and high system throughput. The 80386SX processor is capable of execution at sustained rates of 2.5 to 3.0 million instructions per second.

The integrated memory management unit (MMU) includes an address translation cache, advanced multi-tasking hardware, and a four-level hardware-enforced protection mechanism to support operating systems. The virtual machine capability of the CPU allows simultaneous execution of applications from multiple operating systems such as MS-DOS and UNIX.

The 80386SX CPU offers on-chip testing and debugging features. Four break-point registers allow conditional or unconditional breakpoint traps on code execution or data accesses for powerful debugging of even ROM-based systems. Other test features include self-test, tri-state of output buffers, and direct access to the page translation cache.

Some of the 80386SX CPU features are highlighted below:

- Full 32-bit internal architecture
  - 8-, 16-, 32-bit data types
  - 8 general purpose 32-bit registers
- Runs Intel 386 software in a cost effective 16-bit hardware environment
  - Object code compatible with 8086, 80186, 80286, and 80386 processors
  - Runs MS-DOS, OS/2, and UNIX
- High performance 16-bit data bus
  - 16 MHz clock
  - Two-clock bus cycles
  - Address pipelining allows use of slower/cheaper memories
- Integrated Memory Management Unit (MMU)
  - Virtual memory support
  - Optional on-chip paging
  - 4 levels of hardware-enforced protection
- Virtual 8086 mode allows executing 8086 Software in a protected and paged system
  - Large uniform address space
  - 16 Mbyte physical
  - 64 Terabyte virtual
  - 4 Gigabyte maximum segment size
- High speed numerics support with the 80387SX Co-processor
- On-Chip debugging support including breakpoint registers
- High speed CHMOS III technology

6.17 BASE ARCHITECTURE

The 80386SX Microprocessor consists of a central processing unit (CPU), a memory management unit, and a bus interface.

The CPU consists of the execution unit and the instruction unit. The execution unit contains the eight 32-bit general purpose registers used for address calculation and data operations and a 64-bit barrel shifter used to speed shift, rotate, multiply, and divide operations. The instruction unit decodes the instruction opcodes and stores them in the decoded instruction queue for immediate use by the execution unit.

The memory management unit (MMU) consists of a segmentation unit and a paging unit. Segmentation allows managing the logical address space by providing an extra addressing component which allows easy code and data relocation, and efficient sharing. The paging mechanism operates beneath and is transparent to the segmentation process, to allow management of the physical address space.

The segmentation unit provides four levels of protection for isolating and protecting applications and the operating system from each other. The hardware enforced protection allows the design of systems with a high degree of integrity.

The 80386SX Microprocessor has two modes of operation: Real Address Mode (Real Mode), and Protected Virtual Address Mode (Protected Mode). In Real Mode the 80386SX Microprocessor operates as a very fast 8086, but with 32-bit extensions if desired. Real Mode is required primarily to set up the processor for Protected Mode operation.

Within Protected Mode, software can perform a task switch to enter into tasks designated as Virtual 8086 Mode tasks. Each task behaves with 8086 semantics, thus allowing 8086 software (an application program or an entire operating system) to execute. The Virtual 8086 tasks can be isolated and protected from one another and from the host 80386SX Microprocessor operating system by use of paging.

Finally, to facilitate high performance system hardware designs, the 80386SX Microprocessor bus interface offers address pipelining and direct Byte Enable signals for each byte of the data bus.

6.18 REGISTER SET

The 80386SX Microprocessor has thirty-four registers, which are divided into seven types:

General Purpose Registers: The eight 32-bit general purpose registers are used to contain arithmetic and logical operands. Four of these (EAX, EBX, ECX, and EDX) can be used either in their entirety as 32-bit registers, as 16-bit registers, or split into pairs of separate 8-bit registers.

Segment Registers: Six 16-bit special purpose registers select, at any given time, the segments of memory that are immediately addressable for code, stack, and data.

Flags and Instruction Pointer Registers: The two 32-bit special purpose registers record or control certain aspects of the 80386SX Microprocessor state. The EFLAGS register includes status and control bits that are used to reflect the outcome of many instructions and modify the semantics of some instructions. The Instruction Pointer (EIP) is 32 bits wide and controls instruction fetching. The processor automatically increments it after executing an instruction.

Control Registers: The four 32-bit control registers are used to control the global nature of the 80386SX Microprocessor. The CR0 register contains bits that set the different processor modes (Protected, Real, Paging and Coprocessor Emulation). CR2 and CR3 registers are used in the paging operation.

System Address Registers: These four special registers reference the tables or segments supported by the CPU's protection model. These tables or segments are:

GDTR	(Global Descriptor Table Register)
IDTR	(Interrupt Descriptor Table Register)
LDTR	(Local Descriptor Table Register)
TR	(Task State Segment Register)

Debug Register: The six programmer-accessible debug registers provide on-chip support for debugging.

Test Registers: Two registers are used to control the testing of the RAM/CAM (Content Addressable Memories) in the Translation Lookaside Buffer portion of the 80386SX Microprocessor.

6.19 INSTRUCTION SET

The instruction set is divided into the following categories of operations:

Data Transfer
Arithmetic
Shift/Rotate
String Manipulation
Bit Manipulation
Control Transfer
High Level Language Support
Operating System Support Processor Control

All 80386SX Microprocessor instructions operate on either 0, 1, 2 or 3 operands. The operand can reside in a register, in the instruction itself, or in memory. Most zero operand instructions (e.g. CLI, STI) take only 1 byte. One-operand instructions are generally two bytes long. The average instruction is 3.2 bytes long. Since the 80386SX Microprocessor has a 16 byte prefetch instruction queue, an average of five instructions will be prefetched. Using two operands permits the following types of common instructions:

Register to Register
Memory to Register
Immediate to Register
Memory to Memory
Register to Memory
Immediate to Memory

The operands can be 8, 16, or 32 bits long. As a general rule, when executing code written for the 80386SX Microprocessor (32-bit code), operands are 8 or 32 bits; when executing existing 8086 or 80286 code (16-bit code), operands are 8 or 16 bits. Prefixes can be added to all instructions to override the default operand length (i.e. use 32-bit operands for 16-bit code, or 16-bit operands for 32-bit code).

In addition to these basic data types, the 80386SX Microprocessor supports two larger units of memory: pages and segments. Memory can be divided into one or more variable length segments, which can be swapped to disk or shared between programs. Memory can also be organized into one or more 4 Kbyte pages. Both segmentation and paging can be combined to gain the advantages of both systems.

Segmentation and paging are complementary. Segmentation is useful for organizing memory in logical modules, and is a tool for the application programmer. Pages are useful to the system programmer for managing the physical memory of a system.

6.20 ADDRESSING MODES

The 80386SX Microprocessor provides eight addressing modes for instructions to specify operands. The addressing modes are optimized to allow the efficient execution of high level languages such as C and FORTRAN, and they cover the vast majority of data references needed by high-level languages.

6.21 DATA TYPES

The 80386SX Microprocessor supports all data types commonly used in high level languages as shown in the table below:

Table 6-13. Data Types

Data Type	Definition
Bit	A single bit quantity
Bit field	A group of up to 32 contiguous bits, which spans a maximum of four bytes
Bit string	A set of contiguous bits; bit strings can be up to 4 gigabits long
Byte	A signed 8-bit quantity
Unsigned byte	An unsigned 8-bit quantity
Integer (word)	A signed 16-bit quantity
Long integer (double word)	A signed 32-bit quantity; all operations assume a 2's complement representation
Unsigned integer (word)	An unsigned 16-bit quantity
Signed quad word	A signed 64-bit quantity
Unsigned quad word	An unsigned 64-bit quantity
Pointer	A 16- or 32-bit offset-only quantity which indirectly references another memory location
Long pointer	A full pointer which consists of a 16-bit segment selector and either a 16- or 32-bit offset
Char	A byte representation of an ASCII alphanumeric or control character
String	A contiguous sequence of bytes, words or dwords; strings may contain between 1 byte and 4 gigabytes
BCD	A byte (unpacked) representation of decimal digits 0-9
Packed BCD	A byte (packed) representation of two decimal digits 0-9 storing one digit in each nibble
Floating point*	A signed 32-, 64-, or 80-bit real number representation Floating point numbers are supported by the 80387SX numerics co-processor

* When the 80386SX Microprocessor is coupled with its numerics co-processor, the 80387SX, then the following common floating point types are supported.

6.22 I/O SPACE

The 80386SX microprocessor has two distinct physical address spaces: physical memory and I/O. Generally, peripherals are placed in I/O space although the 80386SX Microprocessor also supports memory-mapped peripherals. The I/O space consists of 64 Kbytes which can be divided into 64 Kbyte 8-bit ports or 32 Kbyte 16-bit ports, or any combination of ports which do not exceed 64 Kbytes. The 64 Kbyte I/O address space refers to physical addresses rather than linear addresses since I/O instructions do not go through the segmentation or paging hardware. The M/IO# pin acts as an additional address line, allowing the system designer to easily determine which address space the processor is accessing.

The I/O ports are accessed by the IN and OUT instructions, with the port address supplied as an immediate 8-bit constant in the instruction or in the DX register. All 8-bit and 16-bit port addresses are zero extended on the upper address lines. The I/O instructions cause the M/IO# pin to be driven LOW. I/O port addresses 00F8H through 00FFH are reserved for use by Intel.

6.23 INTERRUPTS AND EXCEPTIONS

Interrupts and exceptions may occur after the normal program flow in order to handle external events or to report errors or exceptional conditions. Interrupts are used to handle a synchronous external events, while exceptions handle instruction faults. Although a program can generate a software interrupt via an INT N instruction, the processor treats software interrupts as exceptions.

Hardware interrupts occur as the result of an external event and are classified into two types: maskable or non-maskable. Interrupts are serviced after the execution of the current instruction. After the interrupt handler is finished servicing the interrupt, execution proceeds with the instruction immediately following the interrupted instruction.

Exceptions are classified as faults, traps, or aborts, depending on the way they're reported and whether or not restart of the instruction causing the exception is supported. Faults are exceptions that are detected and serviced before the execution of the faulting instruction. Traps are exceptions that are reported immediately after the execution of the instruction which caused the problem. Aborts are exceptions which do not permit the precise location of the instruction casing the exception to be determined.

When an interrupt service routine has been completed, execution proceeds from the instruction immediately following the interrupted instruction. On the other hand, the return address from an exception fault routine will always point to the instruction causing the exception and will include any leading instruction prefixes.

The 80386SX Microprocessor has the ability to handle up to 256 different interrupts and exceptions. In order to service the interrupts, a table with up to 256 interrupt vectors must be defined. The interrupt vectors are simply pointers to the appropriate interrupt service routine. In Real Mode, the vectors are 4 byte quantities, a Code Segment plus a 16-bit offset: In Protected Mode, the interrupt vectors are 8 byte quantities, which are put in an Interrupt Descriptor Table. Of the 256 possible interrupts, 32 are reserved and the remaining 224 are free to be used.

6.24 RESET AND INITIALIZATION

After the processor is initialized or reset, it will start executing instructions near the top of physical memory, at location 0FFFFF0H. When the first inter-segment Jump or Call is executed, address lines A20 - A23 drop LOW for DS-relative memory cycles, and the 80386SX Microprocessor only executes instructions in the lower 1 Mbyte of physical memory. This allows using a shadow ROM at the top of physical memory to initialize the system and take care of Resets.

RESET forces the 80386SX Microprocessor to terminate all execution and local bus activity. No instruction execution or bus activity occurs while Reset is active. Between 350 and 450 CLK2 periods after Reset becomes inactive, the 80386SX Microprocessor will start executing instructions at the top of physical memory.

6.25 TESTING

The 80386SX Microprocessor offers test features such as self-test and direct access to the page translation cache.

The self-test checks the function of all of the Control ROM and most of the non-random logic of the part. Approximately one-half of the 80386SX Microprocessor can be tested during self-test.

Self-test is initiated on the 80386SX Microprocessor when the RESET pin transitions from HIGH to LOW and the Busy# pin is LOW. The self-test takes about 2-20 clocks, or approximately 33 milliseconds. At the completion of self-test, the processor performs reset and begins normal operation. The self-test is successful if the contents of the EAX are zero. If the results of the EAX are not zero, the self-test has detected a flaw in the part.

6.26 DEBUGGING SUPPORT

The 80386SX Microprocessor provides several features which simplify the debugging process:

- The code execution breakpoint opcode (0CCH).
- The single-step capability provided by the TF bit in the flag register.
- The code and data breakpoint capability provided by the Debug Registers DR0-3, DR6, and DR7.

6.27 82C836 (U26)

The 82C836 provides the following features:

- 80386sx control logic and clocks to support CPU speeds of up to 25 MHz with zero (or one) wait states.
- A 146818-compatible real time clock with 114 bytes of CMOS RAM
- Two 8237-compatible DMA controllers
- Two 8259-compatible interrupt controllers
- An 8254-compatible programmable interval timer
- An 82284-compatible clock generation and READY interface
- An 82288-compatible bus controller
- A DRAM controller that supports up to 16 MB of DRAM
- A memory controller that provides shadow RAM and support for either 8-bit or 16-bit BIOS ROM
- A DRAM refresh controller
- Four EMS page register (LIM EMS 4.0 and 3.2 compatible)
- Interface logic for an 80387sx numeric coprocessor
- Interface logic for an 8042 keyboard controller
- Fast Gate A20 and Fast CPU Reset logic
- Compact packaging in a single 160-pin plastic flat pack (160PQFP)

6.28 **65520 (U8)**

The 65520 C & T display interface is designed to support a wide variety of flat panel and CRT displays. The 65520 will simultaneously drive both a flat panel and CRT.

Features:

- Flat panel and CRT support
- 1024x768x16
- 800x600x256
- 640x480x256
- Vertical and horizontal compensation
- Smart Map - maps color to gray levels
- Text Enhancement
- Inverse video

6.29 **82C7211 (U3)**

The 82C711 Universal Peripheral controller II is a single chip controller offering a complete I/O solution for PC-XT and PC-AT environments.

Features:

- 2 16450U Compatible carts
- 1 Enhanced parallel (Printer/Bi-directional) port
- 1 IDE interface
- 1 drive controller

7.1 INTRODUCTION

The AT4 is a single-board computer, completely IBM PC/AT compatible. It combines core logic (with internal math coprocessor and cache controller), graphics adapter, floppy drive control, hard drive control, serial and parallel ports on one board. The 8450 AT4 is designed to fit into a passive backplane system.

The AT4 supports 80486SX, 80486DX and 80486DX2 CPUs. Both the 80486DX and 80486DX2 have internal math co-processors on board. The 80486DX25 and 80486SX run at 20MHz while the 80486DX2 runs at 50MHz. All have 8K of internal high speed CACHE RAM.

You can order the 8450 with 4 or 8 Mbytes of 1-wait-state DRAM, supporting video and System BIOS Shadow RAM. The AT4 board supports up to two IDE hard disk drives at up to a 1.5 Mbyte/second sustained data rate. It will also support two IBM SA-450 floppy disk drives with 360 Kbytes, 720 Kbytes, 1.2 Mbytes, or 1.44 Mbytes capacity.

7.2 FEATURES OF THE AT4 CPU BOARD

The AT4 also features:

- Industrially hardened PC/AT design
- Synchronous 8.33 MHz ATbus
- 2 RS-232C Serial ports with ESD protection
- Centronics parallel port
- Real time clock
- AC power-fail detection
- Watchdog timer
- VGA controller
- 128 Bytes battery-backed CMOS RAM
- 8 SIMM sockets for 1, 2, 4, 8, 16 or 32 Mbytes of DRAM

7.3 AT4 OPERATIONAL DESCRIPTION

Figure 7-1 shows an operational block diagram of the AT4 Single Board Computer, and Figure 7-2 shows the AT4 board layout.

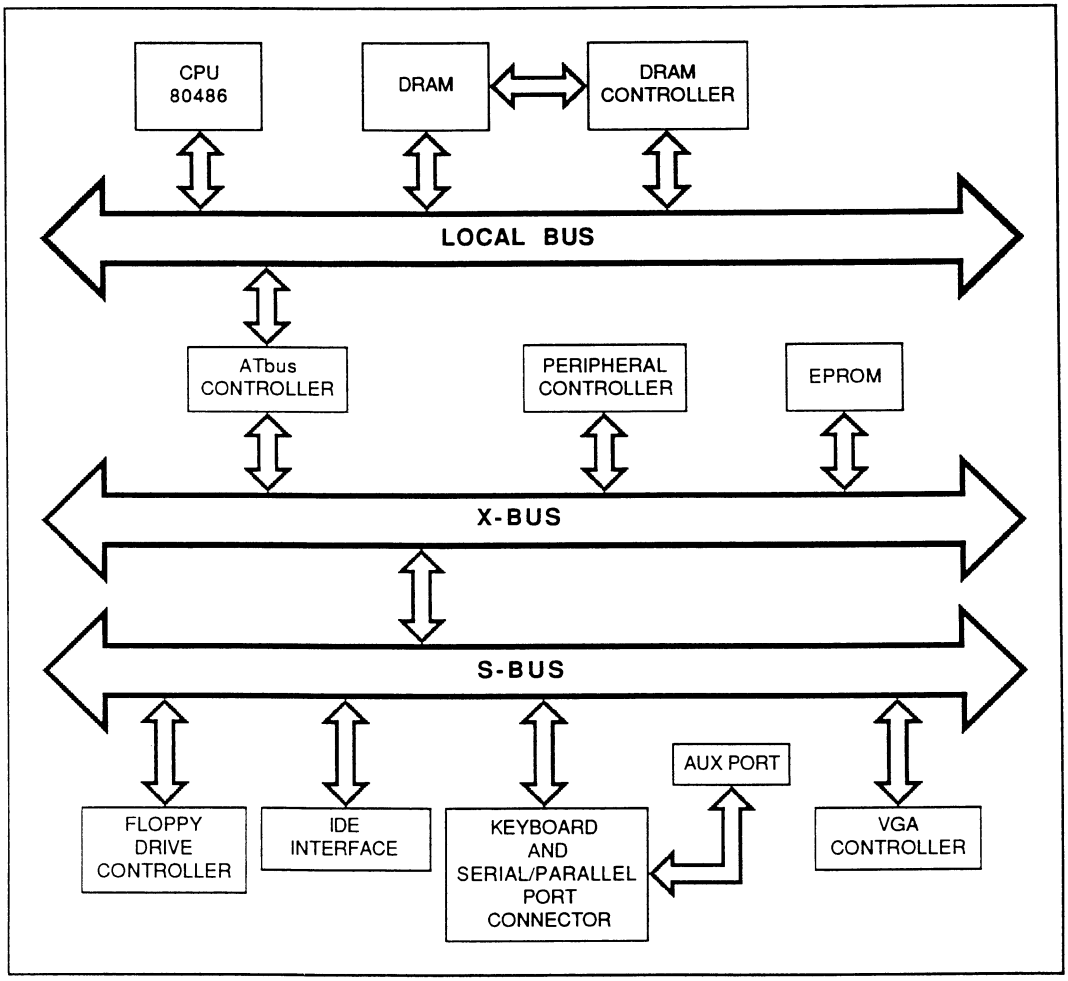


Figure 7-1. AT4 Operational Block Diagram

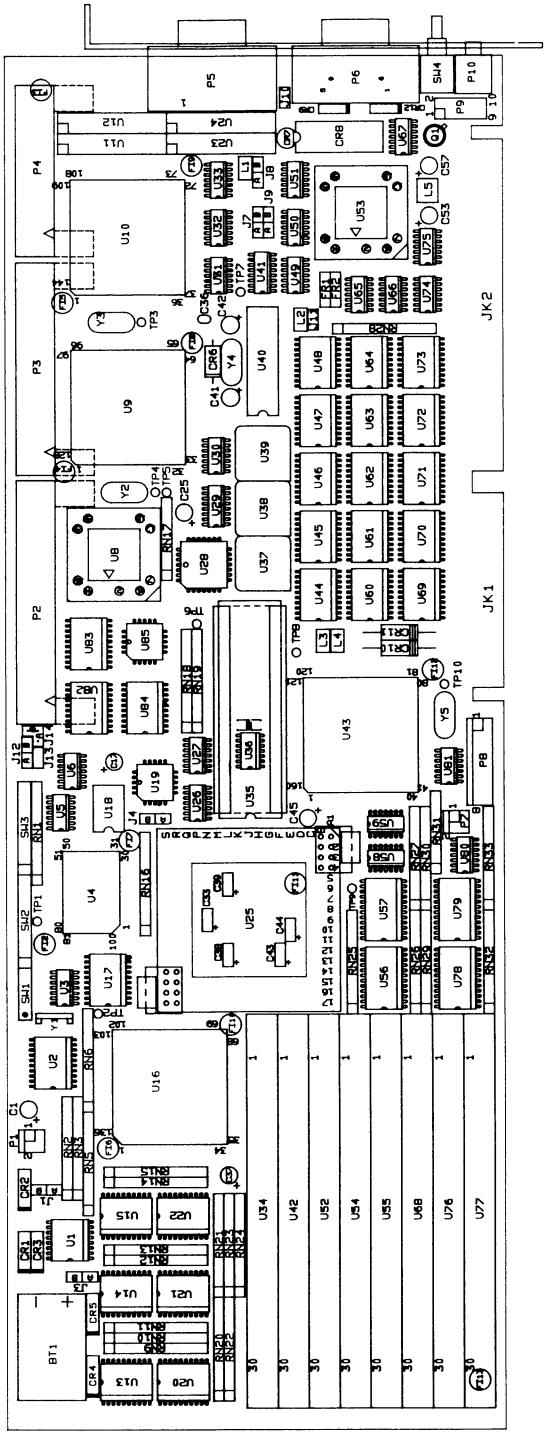


Figure 7-2. AT4 Board Layout

7.4 JUMPERS

Table 7-1. Jumper Settings

Jumper	Position	Function
J1	A✓	LPT1; parallel interrupt to IRQ7
	B	LPT2; parallel interrupt to IRQ5
J3	A	Disables on-board battery for storage
	B✓	Enables on-board battery
J4	OUT	Sets watchdog timer interval at 0.25 seconds
	A✓	Sets watchdog timer interval at 0.5 seconds
	B	Sets watchdog timer interval at 65 mseconds
J7	A✓	Enables video
	B	Disables video
J8	A✓	Enables ground to connector
	B	Enables dot clock to connector
J9	A	Enables IRQ9
	B✓	Disables IRQ9
J10	IN✓	Connects digital ground to ORB
	OUT	Connects logic ground to chassis
J11	IN✓	For future use - NOT USER CONFIGURABLE
J12*	A	Enables DX processor
	B	Enables SX processor
J13*	IN	Enables DX processor
	OUT	Enables SX processor
J14*	A	Enables DX processor
	OUT	Enables SX processor

✓Factory shipped configuration
*J12 through J14 are factory set to SX or DX to match the processor type

Figure 7-3, on the following page, shows the AT4 jumper locations.

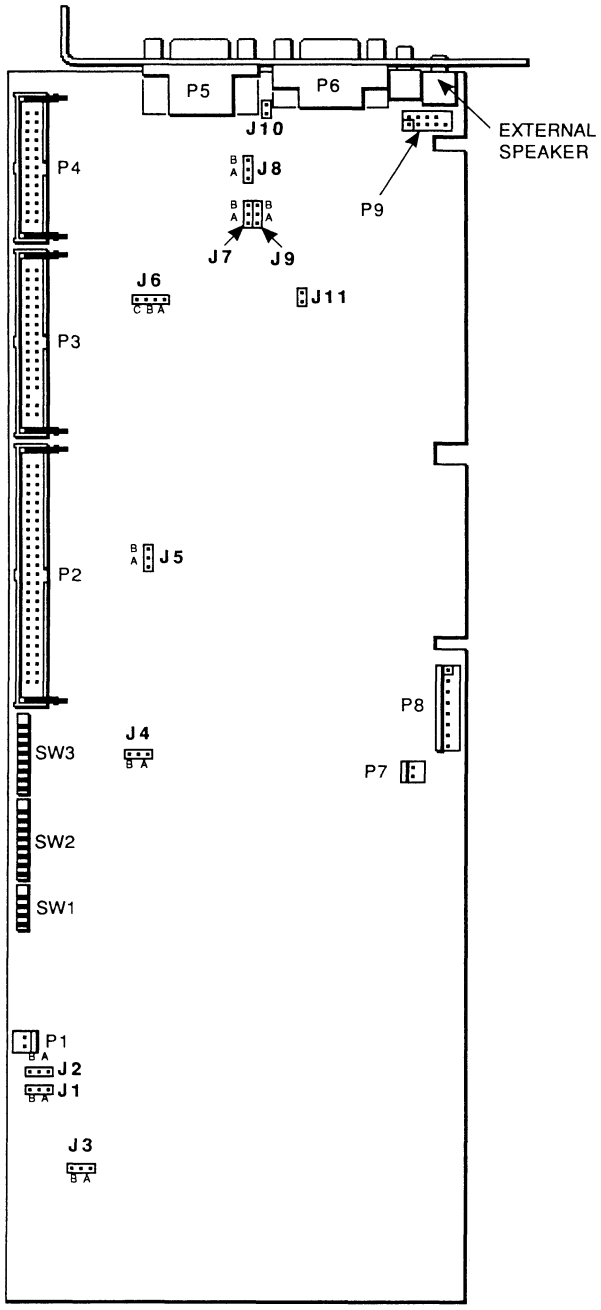


Figure 7-3. AT4 Jumper Locations

7.4.1 Battery Backed RAM and Real Time Clock

Jumper J3 determines whether the on-board battery is connected to the CMOS RAM and real-time clock. Position B connects the battery, and position A disconnects it. The default setting is B.

7.4.2 Video Configuration (J7, J8, J9)

Jumper J8 either puts the ground to the VGA connector for a VGA display (position A) or, for future flat-panel support, connects the video dot clock (position B). The default is A, VGA.

Jumper J7 enables the TVGA 8900 controller from the ATbus if set to A and disables the VGA controller if set to B. It was placed on the board to allow the 4100-AT4 video controller to be disabled. The default setting is B, VGA controller enabled.

7.4.3 Processor Configuration (J12, J14)

Setting jumper J2 to A allows IRQ3 interrupts to be connected to the SCSI drive. The B setting enables IRQ5 interrupts to be connected to the SCSI drive, and taking the jumper OUT allows no interrupts to be connected. The DOS environment does not require interrupts and the jumper is not installed when shipped for use in a DOS system.

7.4.4 Watchdog Timer Interval (J4)

This jumper sets the WDT timeout interval. There are three settings available: A provides a 0.5 second timeout, B provides a 65 msec timeout, and OFF gives a 0.25 second timeout. The default setting is A, 0.5 seconds.

7.4.5 Parallel Port (J1)

Jumper 1 lets you connect a parallel interrupt line. If your printer port is LPT1, set jumper J1 to A to connect the interrupt to IRQ7; if printer port is LPT2, set J1 to B to connect the interrupt to IRQ5.

7.4.6 Ground Connection (J10)

In the default position (IN), J10 connects the digital ground to chassis ground to let the Tranzorb pack shunt ESD current to the chassis ground. When J10 is OUT, it shunts ESD to the digital ground.

7.5 CONNECTORS

The AT4 has a total of 13 connectors, which include:

- auxiliary battery connector
- hard drive connector
- floppy drive connector
- parallel port connector
- VGA connector
- serial ports COM1 and COM2 connectors
- ACFAIL connector
- keyboard connector
- external speaker jack
- SCSI drive light connector
- two cardedge connectors

The connectors must be clean, dry, and undamaged at time of installation. Figure 7-4 on the following page shows the location of the connectors on the board and calls out pin one of each connector. Ensure that the markings on the ribbon wire mate to pin one on both the board and the other component. Appendix A details the switch settings; Appendix B lists all connector pinouts and the mating connector part numbers for several connectors.

> **NOTE**
> All connector locations are labelled on the circuit card.

P1 The auxiliary battery connector is a two-pin friction header that allows attaching an external battery to the 4100-AT4. The battery powers the real time clock and the CMOS RAM. When using an auxiliary battery, the on-board battery may be disconnected from the circuit by placing jumper J3 in position A.

Table 7-2. Floppy Drive Connector

Pin #	Signal	Pin #	Signal
1	GND	2	3 V Battery

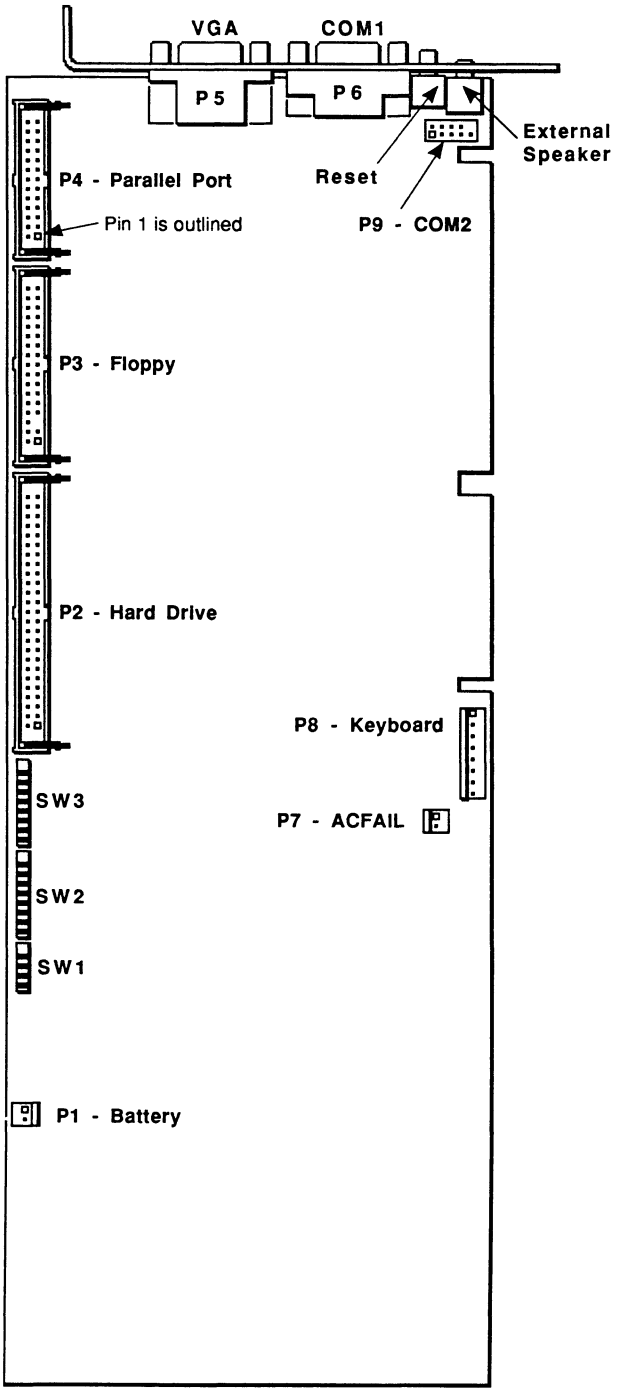


Figure 7-4. Connector Locations

P2 The IDE drive connector is the 40-pin header located between SW3 and P3. It is the control connector for any hard drive(s) interfaced with the 4100-AT4. The 4100-AT4 can control up to two hard drives from this connector.

Table 7-3. Hard Drive Control Connector

Pin#	Signal	Pin#	Signal
1	RESETDRV*	2	GND
3	DB7	4	DB8
5	DB6	6	DB9
7	DB5	8	DB10
9	DB4	10	DB11
11	DB3	12	DB12
13	DB2	14	DB13
15	DB1	16	DB14
17	DB0	18	DB15
19	GND	20	N/C
21	N/C	22	GND
23	IOW*	24	GND
25	IOR*	26	GND
27	N/C	28	ALE
29	N/C	30	GND
31	IDINT	32	N/C
33	SA(1)	34	N/C
35	SA(O)	36	SA(2)
37	HCS0*	38	HCS1*
39	N/C	40	GND

*Signal is active low

P3 The floppy drive connector is a 34-pin header located next to P2. It is the interface and control connection for up to two floppy drives.

Table 7-4. Floppy Drive Connector

Pin #	**Signal**	**Pin #**	**Signal**
1	GND	2	FRWC*
3	GND	4	N/C
5	KEY	6	N/C
7	GND	8	IDX*
9	GND	10	MO1*
11	GND	12	FDS2*
13	GND	14	FDS1*
15	GND	16	MO2*
17	GND	18	FDIRC*
19	GND	20	FSTEP*
21	GND	22	FWD*
23	GND	24	FWE*
25	GND	26	FTK0*
27	GND	28	FWP*
29	GND	30	FRDD*
31	GND	32	FHS*
33	GND	34	DCHG*

* Signal is active low

P4 The parallel port connector is a 26-pin header at the top right of the board. A 26-pin ribbon socket with standard ribbon cable and a 25-pin subminiature provide the standard parallel port. It is the interface point between the 4100-AT4 and a printer, and can be accessed internally or through an additional ORB.

Table 7-5. Parallel Port Connector

Pin #	Signal	Pin #	Signal
1	STROBE	2	AUTOFEED
3	PDOUT 0	4	PERROR
5	PDOUT 1	6	INIT
7	PDOUT 2	8	SELIN
9	PDOUT 3	10	GND
11	PDOUT 4	12	GND
13	PDOUT 5	14	GND
15	PDOUT 6	16	GND
17	PDOUT 7	18	GND
19	PACK	20	GND
21	PBUSY	22	GND
23	PE	24	GND
25	SELECT	26	KEY

P5 The VGA connector is a 15-pin D subminiature used to interface to the monitor. The pinouts are shown below.

Table 7-6. VGA Connector

Pin #	Signal	Pin #	Signal
1	RED	2	GREEN
3	BLUE	4	ID2
5	GND	6	GND
7	GND	8	GND
9	KEY	10	GND
11	ID0	12	ID1
13	HSYNC	14	VSYNC
15	RSVD		

P6 The serial port COM1 connector is a nine-pin D subminiature, located on the ORB under P5. It provides access for a peripheral device.

Table 7-7. Serial Port COM1 Connector

Pin #	Signal	Pin #	Signal
1	DCD1	2	RXD1
3	TXD1	4	DTR1
5	GND	6	DSR1
7	RTS1	8	CTS1
9	RI1		

P7 The ACFAIL connector is a two-pin header located near the bottom center of the board. It connects a low asserting ACFAIL* signal to the 8450 AT4. When asserted, this signal will generate a non-maskable interrupt (NMI) if the AUX_PORT ACFAIL* circuit is enabled.

> **CAUTION**
> To use this option, you must write an NMI interrupt handler; otherwise, the BIOS will assume the NMI is a IO-channel check error.

Table 7-8. ACFAIL Connector

Pin #	Signal	Pin #	Signal
1	GND	2	ACFAIL*

P8 The keyboard connector is an eight-pin friction header located on the bottom center of the board. It provides an interface point for a keyboard.

Table 7-9. Keyboard Connector

Pin #	Signal	Pin #	Signal
1	SPEAKER	2	+5V
3	KB_INHIBIT	4	DATA
5	CLOCK	6	N/C
7	GND	8	RESET1*

P9 The serial port COM2 connector is a 10-pin header that is designed to be used with a nine-pin ribbon D subminiature. It is located at the bottom right of the board. A special slot in the ORB allows the ribbon cable to be accessed from the rear panel.

Table 7-10. Serial Port COM2 Connector

Pin #	Signal	Pin #	Signal
1	DCD2	2	DSR2
3	RXD2	4	RTS2
5	TXD2	6	CTS2
7	DTR2	8	RI2
9	GND	10	KEY

P10 The external speaker jack is a micro-miniature phone jack located on the ORB. It provides an external speaker connection for the 4100-AT4.

Table 7-11. External Speaker Jack

Pos #	Signal
Center	POS (SPEAKER)
Outside	GND

CARDEDGE CONNECTORS

There is one 36- and one 62-pin cardedge connector on the 4100-AT4 card. The A and B sides comprise the 62-pin connector and the C and D sides the 36-pin connector. A and C are on the component side of the board; B and D are on the solder side.

A SIDE

Table 7-12. 62-Pin Cardedge Connector

Pin #	Signal	Pin #	Signal
1	IOCHCK*	2	SD7
3	SD6	4	SD5
5	SD4	6	SD3
7	SD2	8	SD1
9	SD0	10	IOCHRDY
11	AEN	12	SA19
13	SA18	14	SA17
15	SA16	16	SA15
17	SA14	18	SA13
19	SA12	20	SA11
21	SA10	22	SA9
23	SA8	24	SA7
25	SA6	26	SA5
27	SA4	28	SA3
29	SA2	30	SA1
31	SA0		

* Signal is active low

Table continued on next page

Table 7-12. 62-Pin Cardedge Connector (continued)

B SIDE

Pin #	Signal	Pin #	Signal
1	GND	2	RESETDRV
3	+5 VDC	4	IRQ9
5	N/C	6	DRQ2
7	-12 VDC	8	OWS
9	+12 VDC	10	GND
11	SMEMW*	12	SMEMR
13	IOW*	14	IOR*
15	DACK3*	16	DRQ3
17	DACK1*	18	DRQ1
19	REF*	20	SYSCL
21	IRQ7	22	IRQ6
23	IRQ5	24	IRQ4
25	IRQ3	26	DACK2
27	T/C	28	BALE
29	+5VDC	30	OSC
31	GND		

Table 7-13. 36-Pin Cardedge Connector

C SIDE

Pin #	Signal	Pin #	Signal
1	SBHE*	2	SA23
3	SA22	4	SA21
5	SA20	6	SA19
7	SA18	8	SA17
9	MEMR*	10	MEMW*
11	SD08	12	SD09
13	SD10	14	SD11
15	SD12	16	SD13
17	SD14	18	SD15

D SIDE

Pin #	Signal	Pin #	Signal
1	MEMCS16*	2	IOCS16*
3	IRQ10	4	IRQ11
5	IRQ12	6	IRQ15
7	IRQ14	8	DACK0*
9	DRQ0	10	DACK5*
11	DRQ5	12	DACK6*
13	DRQ6	14	DACK7*
15	DRQ7	16	+5 VDC
17	MASTER*	18	GND

7.6 SWITCHES

The AT4 board has three banks of switches, one bank with 4 positions and two banks with 8 positions. These SIP switches are mounted on the top of the board for easy access. When the tip of the switch is pushed in the direction of the board, the switch is closed. If the tip of the switch is pushed toward the upper edge of the board, the switch is open. Each of the tables throughout this section lists the switches and their functions. Figure 7-5 shows the switch locations.

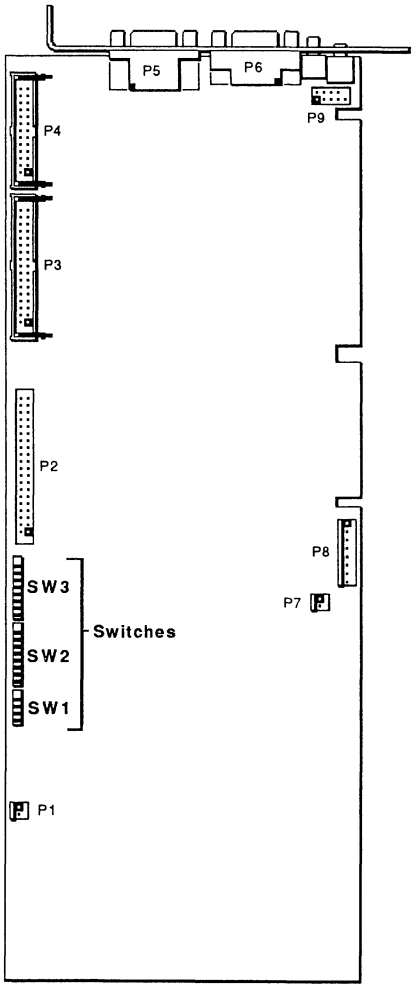


Figure 7-5. Switch Locations

Table 7-14. Switch Bank 1

SWITCH BANK 1 (SW1)			
Category	**Position**	**Description**	**Function**
AUXPORT	#1 #2	AUXPORT Address	These two switches define the AUXPORT address as follows:
	✓O O		331H
	C O		207H
	O C		201H
	C C		Disabled
NOT USED	#3	Not Used	✓Open: Closed:
VGA	#4	VGA Enable	✓Open: Enable VGA BIOS (default) Closed: Disable VGA BIOS

✓Factory shipped configuration

Table 7-15. Switch Bank 2

SWITCH BANK 2 (SW2)			
Category	**Position**	**Description**	**Function**
FLOPPY	#1	TYPE	✓Open: Standard 360K, 720K, 1.2M, 1.44M drive (default) Closed: Two-speed drive
FLOPPY	#2	PRECOMP	✓Open: 125 ns precompensation Closed: 187 ns precompensation
FUTURE	#3		This switch is reserved for future use.
FUTURE	#4		This switch is reserved for future use.
FUTURE	#5		This switch is reserved for future use.
MONITOR	#6	COLOR	✓Open: Color monitor Closed: Monochrome monitor
KEYBOARD	#7	INHIBIT	✓Open: Enable keyboard Closed: Disable keyboard
FUTURE	#8		This switch is reserved for future use.

✓Factory shipped configuration

Table 7-16. Switch Bank 3

SWITCH BANK 3 (SW3)				
Category	**Position**	**Description**	**Function**	
VIDEO	#1		✓Closed:	**NOT RECONFIGURABLE**
VIDEO	#2		✓Closed:	**NOT RECONFIGURABLE**
VIDEO	#3		✓Open:	**NOT RECONFIGURABLE**
VIDEO	#4		✓Open:	**NOT RECONFIGURABLE**
NOT USED	#5			
SYNC	#6	SYNC ON	Open: ✓Closed:	Sync signals tristated Enables HSYNC and VSYNC
VIDEO	#7	DISABLE	✓Open: Closed:	Enables video capabilities Disables video capabilities
NOT USED	#8		✓Open	**NOT RECONFIGURABLE**

✓Factory shipped configuration

7.7 MEMORY MAPS

The system memory map has a maximum of 640 Kbytes of user RAM for the 1 Mbyte version of the 8450 AT4. Additional 256 Kbytes are available to shadow BIOS's in the C000-FFFFF range. Any memory space above 1 Mbyte (in the larger memory versions of the 8450 AT3/AT4 board) cannot be accessed in the real mode of operation; it is reserved for the protected mode.

The portion of the memory reserved for video provides 256K DRAM, but only occupies the space of 128K. This is accomplished through bank switching.

Table 7-17. Memory Map

Address	
000000 - 09FFFF	640K System Memory
0A0000 - 0BFFFF	128K Video Memory
0C0000 - 0C7FFF	Video BIOS (Shadowed)
0C8000 - 0DFFFF	ROM BIOS Expansion (not on system board)
0E0000 - 0EFFFF	Reserved System Board, duplicated at FE0000
0F0000 - 0FFFFF	System BIOS (Shadowed)
100000 - 13FFFF	**1** Mbyte Board: **256K** Extended Memory (BIOS not shadowed)
100000 - 23FFFF	**2** Mbyte Board: **1M** Extended Memory (BIOS not shadowed)
100000 - 43FFFF	**4** Mbyte Board: **3M** Extended Memory (BIOS not shadowed)
100000 - 83FFFF	**8** Mbyte Board: **7M** Extended Memory (BIOS not shadowed)

7.7.1 **Cacheable and Non-Cacheable Memory**

You can prioritize the programs you run on the AT4 by designating each program to use cacheable or non-cacheable memory. Normally, any local DRAM cycles are cached, but you can define blocks of DRAM that are not cached, leaving the cache space available for your highest priority applications.

You can designate up to two such blocks of non-cacheable DRAM in sizes from 64 Kbyte up to 1 Mbyte. To set up the blocks, you must set boundary and size registers that define the non-cacheable space.

There are thirteen configuration registers which are accessed through IO ports 22H and 24H. Location 22H is the "Index Address". This address corresponds to the specific register which points to the required data value accessed through port 24H. So reading or writing to a specific register is a two step operation:

1. write to I/O port 22H with the register index.

2. write or read the data to or from I/O port 24H.

Every access to port 24H must be preceded by a write of the index value to port 22H even if the same data register is being accessed. After power up, the configuration registers assume default values.

The default setting on your AT4 board will assign the total available memory as cacheable. You can define an upper limit on the cacheable memory space; remaining memory is automatically designated as non-cacheable. Cacheable memory space is always assigned starting from 0 H up to the user-defined limit. Within the cacheable memory area you can define two additional blocks of non-cacheable memory.

The 8450 AT4 treats the total available memory as a collection of 1 Mbyte chunks, so on a 1 Mbyte board, all the memory will be defined as cacheable--it cannot be assigned in smaller chunks than 1 M.

Figure 7-5 shows sample arrangements of cacheable and non-cacheable memory. On the 2 Mbyte board, the cacheable memory area is defined as the first Mbyte only, so the second Mbyte is automatically designated as non-cacheable.

On an 8 Mbyte board, there are more configurations possible, but this example shows the flexibility of the memory structure. The first through sixth Mbytes are defined as the cacheable memory area, leaving Mbytes seven and eight as non-cacheable. Within the cacheable area are defined two blocks of non-cacheable memory: the second and third Mbytes, and the fifth Mbyte.

CACHEABLE MEMORY BLOCK

The cacheable memory area is defined in register 1C H. Bits 0-2 of this register is reserved and should NOT be reconfigured from the default setting of 0,0,0.

Bit 3 designates the 256 Kbyte remapped area as cacheable when set to 1, non-cacheable when set to 0. The default setting is 1, cacheable.

Bits 4-7 define the cacheable chunk of the memory, according to the address ranges shown in Table 7-18.

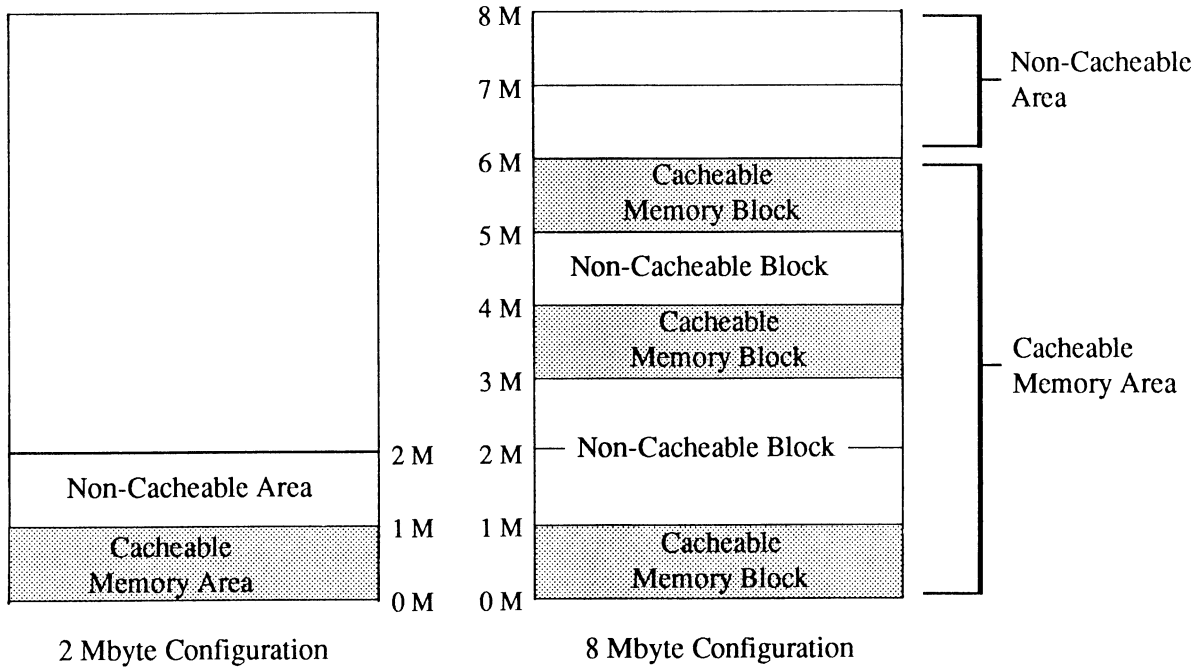


Figure 7-6. Cacheable Memory Configurations

Table 7-18. Cacheable Memory Address Range for Local Memory

INDEX = 1C H

Bit # 7 6 5 4	Address Range
0 0 0 1	1 Mbyte
0 0 1 0	2 Mbyte
0 0 1 1	3 Mbyte
0 1 0 0	4 Mbyte
0 1 0 1	5 Mbyte
0 1 1 0	6 Mbyte
0 1 1 1	7 Mbyte
1 0 0 0	8 Mbyte

NON-CACHEABLE MEMORY BLOCKS

The first block of non-cacheable memory is defined in register 18 H; the second block of non-cacheable memory is defined in register 1A H. Bits 0-4 of these registers are reserved and should NOT be reconfigured from the default setting of 0,0,0,0. Bits 5-7 define the size of the non-cacheable block (Table 7-19). The default setting (1,1,1) disables the non-cacheable memory facility.

Table 7-19. Non-Cacheable Block Size Register

INDEX

Block #1 - 18 H
Block #2 - 1A H

Bit # 7 6 5	Block Size
0 0 0	64 Kbyte
0 0 1	128 Kbyte
0 1 0	256 Kbyte
0 1 1	512 Kbyte
1 0 0	1 Mbyte
1 0 1	Reserved
1 1 0	Reserved
1 1 1	Disable

The starting address for the non-cacheable block must have the same granularity as the block size. For example, if you select a 1 Mbyte non-cacheable block, its starting address is a multiple of 1 Mbyte;

consequently, only address bits A20-A23 are significant, A16-A19 are don't care. Table 7-20 specifies the valid address bits to define the boundaries of the blocks.

Table 7-20. Valid Starting Address Bits

Block Size	Starting Address Bits							
	A23	**A22**	**A21**	**A20**	**A19**	**A18**	**A17**	**A16**
64 Kbyte	V	V	V	V	V	V	V	V
128 Kbyte	V	V	V	V	V	V	V	X
256 Kbyte	V	V	V	V	V	V	X	X
512 Kbyte	V	V	V	V	V	X	X	X
1 Mbyte	V	V	V	V	X	X	X	X
4 Mbyte	V	V	X	X	X	X	X	X
8 Mbyte	V	X	X	X	X	X	X	X

V = Valid Bit X = Don't Care

INDEX

Block #1 - 18 H
Block #2 - 1A H

7.8 I/O MAP

This I/O map shows the I/O addresses used on the AT4 card, not the I/O address reserved for IBM option Cards. Consult the IBM AT technical reference for those I/O addresses.

Table 7-21. I/O Address Map

Hex Range	Device
000 - 00F	DMA Controller #1
020 - 021	Interrupt Controller #1
022	82C206 Index Register (configuration) ** Also, 82C481/482 index register (configuration)
023	82C206 Data Register
024	82C481/482 Data Port
040 - 043	Counter Timer
060	Keyboard
061	IBM defined Port B
064	Keyboard
070	Index Register for RTC and SRAM
071	Data Port for RTC and SRAM
080 - 08F	DMA Page Registers
0A0 - 0A1	Interrupt Controller #2
0C0 - 0DF	DMA Controller #2
170	2nd RTC and Battery-Backed CMOS Index located in the 82C106
171	2nd RTC and Battery-Backed CMOS Data located in the 82C106
201	Auxiliary Port, Secondary Location
2F8 - 2FF	Serial Port, COM2
331	Auxiliary Port, Primary Location
378 - 37F	Parallel Port, LPT1
3C0 - 3CF	VGA
3F2	Floppy Drive LDOR
3F4 - 3F5	Floppy Drive FDCS
3F7	Floppy Drive LDCR
3F8 - 3FF	Serial Port, COM1

7.9 SYSTEM INTERRUPTS

This interrupt table shows the interrupts used on the 8450 AT4 single board computer.

Table 7-22. Hardware Interrupt Listing

Level		Function
CTRL 1	**CTRL 2**	
IRQ0		Counter/timer, channel #0
IRQ1		Keyboard controller
IRQ2		Used to cascade CTRL 2
	IRQ8	Real time clock
	IRQ9	Video
	IRQ10	Available
	IRQ11	Available
	IRQ12	Available
	IRQ13	Math coprocessor
	IRQ14	Available for hard disk controller
	IRQ15	Available
IRQ3		Serial port, COM2
IRQ4		Serial port, COM1
IRQ5		Parallel port, LPT2 (jumper selectable)
IRQ6		Floppy drive
IRQ7		Parallel port, LPT1 (jumper selectable)

7.10 AUX PORT

AUX PORT consists of two auxiliary, non-maskable interrupts and a low battery detect. The AUX PORT signals are defined as follows:

Table 7-23 AUX PORT Signals

Name	Bit	Function	Description
ACFAIL*	0	R	Reading ACFAIL* "0" indicates ACFAIL* is still asserted.
LACFAIL*	1	R	Reading latched LACFAIL* "0" indicates an ACFAIL caused the NMI.
ENACFAIL	2	R/W	1 = enable ACFAIL. 0 = disable ACFAIL at power-up (default).
LWDT*	3	R	Reading watchdog timer as a "0" indicates a watchdog time-out condition caused the NMI.
EN/CLR WDT	4	R/W	1 = enable watchdog timer. 0 = disable watchdog timer at power-up (default).
WDST	5	R/W	Watchdog timer strobe; writing a "0" and a consecutive "1" strobes the watchdog timer.
FUTURE1	6	R/W	Undefined read and write bit.
LOWBAT	7	R	Reading this bit as "1" indicates a low battery condition.

The two auxiliary non-maskable interrupts (ANMI) are used for the watchdog timer and ACFAIL detection. Both of these ANMIs are disabled when the system is powered up.

Because the address for the AUX PORT is defaulted at power up to 331H only, an application designed to use this address will enable the ANMIs. As these two ANMIs are hardwired into the IO-channel check error bit of port 61H, three conditions may cause the error bit 7 of port 61H to be set and create an NMI. These are: if LACFAIL* is low; if LWDT* is low; or if another card asserts an IO-channel check. For this reason, when enabling and using the ANMIs, the interrupt handler must check both port 61H and AUX PORT to determine what caused the NMI.

If reading only port 61H, you might mistake a watchdog timeout or an ACFAIL error as an IO-channel check error. The following table defines the register states and the condition they relate to.

Table 7-24. AUX PORT Register States

ERROR	AUX PORT		PORT 61H
	LWDT* - bit 3	LACFAIL* - bit 1	I0CHCK - bit 6
Watchdog Timeout	0	1	1
Parity	1	1	1
ACFAIL	1	0	1

CAUTION

Always read the contents of the AUX PORT before writing to it, and then change only the read/write bit you are interested in. By following this procedure, the systems ANMI status will remain.

7.10.1 **Watchdog Timer (WDT)**

The WDT is enabled by writing a "1" to bit 4 of the AUX PORT. The WDT should be toggled prior to enabling to ensure the first cycle is of adequate length. (Cycle time is set by Jumper J4. Refer to Chapter 2 or Appendix A for options.)

CAUTION

Change only bit 5 when strobing the WDT. Altering any others may change the configuration of the ANMIs, such as enabling the ACFAIL NMI.

The WDT must be strobed after it is enabled to avoid causing a NMI condition. This is accomplished by writing a "0" to bit 5 of the AUX PORT followed by a consecutive "1".

If the WDT does time-out, it is cleared by writing a "0" to bit 4 of the AUX PORT.

7.10.2 **ACFAIL**

The ACFAIL is enabled by writing a "1" to bit 2 of the AUX PORT. If an NMI is generated by ACFAIL*, the LACFAIL* (bit 1) is latched low "0". Bit 0 was included to indicate if the ACFAIL condition remains. If the ACFAIL condition caused an NMI, writing a "0" to bit 2 of the AUX PORT will reset the ACFAIL if the ACFAIL* signal is high.

7.10.3 **Low Battery**

The LOWBAT signal is set every time the power is applied to the board by placing a load on the battery for the reset duration. This signal should only be monitored on power-up.

7.11 **DISABLING FUNCTIONAL BLOCKS OF THE 4100-AT4**

The AT4 was designed to let you disable certain functional blocks. This provides the flexibility to upgrade using the 80486 CPU section with different adapters. The following sections explain how to disable the VGA controller, the hard drive controller, and the floppy drive controller.

With power to the AT4 OFF, place jumper J7 in the B position and put switch number 4 of switch bank 1 in the CLOSED position. You can now plug your own video controller into the passive backplane.

Table 7-25. Disable On-Board VGA Controller

Switch Bank	Jumper or Switch #	Position
N/A	J7	B
SW1 SW3	4 7	Closed Closed

7.12 CONNECTOR PINOUTS

Table 7-26. Auxiliary Battery Connector

Pin #	Signal
1	GND
2	3V Battery

Table 7-27. Hard Drive Control Connector

Pin #	Signal	Pin #	Signal
1	GND	2	DBO
3	GND	4	DB1
5	GND	6	DB2
7	GND	8	DB3
9	GND	10	DB4
11	GND	12	DB5
13	GND	14	DB6
15	GND	16	DB7
17	GND	18	DBP*
19	GND	20	GND
21	GND	22	GND
23	GND	24	GND
25	N/C	26	N/C
27	GND	28	GND
29	GND	30	GND
31	GND	32	ATN*
33	GND	34	GND
35	GND	36	BSY*
37	GND	38	ACK*
39	GND	40	RST*
41	GND	42	MSG*
43	GND	44	SEL*
45	GND	46	C/D*
47	GND	48	REQ*
49	GND	50	I/O*

*Signal is active low

Table 7-28. Floppy Drive Connector

Pin #	**Signal**	**Pin #**	**Signal**
1	GND	2	FRWC*
3	GND	4	N/C
5	KEY	6	N/C
7	GND	8	IDX*
9	GND	10	MO1*
11	GND	12	FDS2*
13	GND	14	FDS1*
15	GND	16	MO2*
17	GND	18	FDIRC*
19	GND	20	FSTEP*
21	GND	22	FWD*
23	GND	24	FWE*
25	GND	26	FTK0*
27	GND	28	FWP*
29	GND	30	FRDD*
31	GND	32	FHS*
33	GND	34	DCHG*

Table 7-29. Parallel Port Connector

Pin #	**Signal**	**Pin #**	**Signal**
1	STROBE	2	AUTOFEED
3	PDOUT 0	4	PERROR
5	PDOUT 1	6	INIT
7	PDOUT 2	8	SELIN
9	PDOUT 3	10	GND
11	PDOUT 4	12	GND
13	PDOUT 5	14	GND
15	PDOUT 6	16	GND
17	PDOUT 7	18	GND
19	PACK	20	GND
21	PBUSY	22	GND
23	PE	24	GND
25	SELECT	26	KEY

Table 7-30. VGA Connector

Pin #	Signal	Pin #	Signal
1	RED	2	GREEN
3	BLUE	4	ID2
5	GND	6	GND
7	GND	8	GND
9	KEY	10	GND
11	ID0	12	ID1
13	HSYNC	14	VSYNC
15	RSVD		

Table 7-31. Serial Port COM1 Connector

Pin #	Signal	Pin #	Signal
1	DCD1	2	RXD1
3	TXD1	4	DTR1
5	GND	6	DSR1
7	RTS1	8	CTS1
9	RI1		

Table 7-32. ACFAIL Connector

Pin #	Signal	Pin #	Signal
1	GND	2	ACFAIL*

Table 7-33. Keyboard Connector

Pin #	Signal	Pin #	Signal
1	SPEAKER	2	+5V
3	KB_INHIBIT	4	DATA
5	CLOCK	6	N/C
7	GND	8	RESET1*

Table 7-34. Serial Port COM2 Connector

Pin #	Signal	Pin #	Signal
1	DCD2	2	DSR2
3	RXD2	4	RTS2
5	TXD2	6	CTS2
7	DTR2	8	RI2
9	GND	10	KEY

Table 7-35. External Speaker Jack

Pos #	Signal
Center	POS (SPEAKER)
Outside	GND

Table 7-36. SCSI Drive Light Connector

Pin #	Signal
1	Pull up
2	BUSY*
3	BUSY*
4	Pull up

Table 7-37. 62-Pin Cardedge Connector

A SIDE

Pin #	Signal	Pin #	Signal
1	IOCHCK*	2	SD7
3	SD6	4	SD5
5	SD4	6	SD3
7	SD2	8	SD1
9	SD0	10	IOCHRDY
11	AEN	12	SA19
13	SA18	14	SA17
15	SA16	16	SA15
17	SA14	18	SA13
19	SA12	20	SA11
21	SA10	22	SA9
23	SA8	24	SA7
25	SA6	26	SA5
27	SA4	28	SA3
29	SA2	30	SA1
31	SA0		

B SIDE

Pin #	Signal	Pin #	Signal
1	GND	2	RESETDRV
2	+5 VDC	4	IRQ9
5	N/C	6	DRQ2
7	-12 VDC	8	OWS
9	+12 VDC	10	GND
11	SMEMW*	12	SMEMR
13	IOW*	14	IOR*
15	DACK3*	16	DRQ3
17	DACK1*	18	DRQ1
19	REF*	20	SYSCL
21	IRQ7	22	IRQ6
23	IRQ5	24	IRQ4
25	IRQ3	26	DACK2
27	T/C	28	BALE
29	+5VDC	30	OSC
31	GND		

Table 7-38. 36-Pin Cardedge Connector

C SIDE

Pin #	Signal	Pin #	Signal
1	SBHE*	2	SA23
3	SA22	4	SA21
5	SA20	6	SA19
7	SA18	8	SA17
9	MEMR*	10	MEMW*
11	SD08	12	SD09
13	SD10	14	SD11
15	SD12	16	SD13
17	SD14	18	SD15

D SIDE

Pin #	Signal	Pin #	Signal
1	MEMCS16*	2	IOCS16*
3	IRQ10	4	IRQ11
5	IRQ12	6	IRQ15
7	IRQ14	8	DACK0*
9	DRQ0	10	DACK5*
11	DRQ5	12	DACK6*
13	DRQ6	14	DACK7*
15	DRQ7	16	+5 VDC
17	MASTER*	18	GND

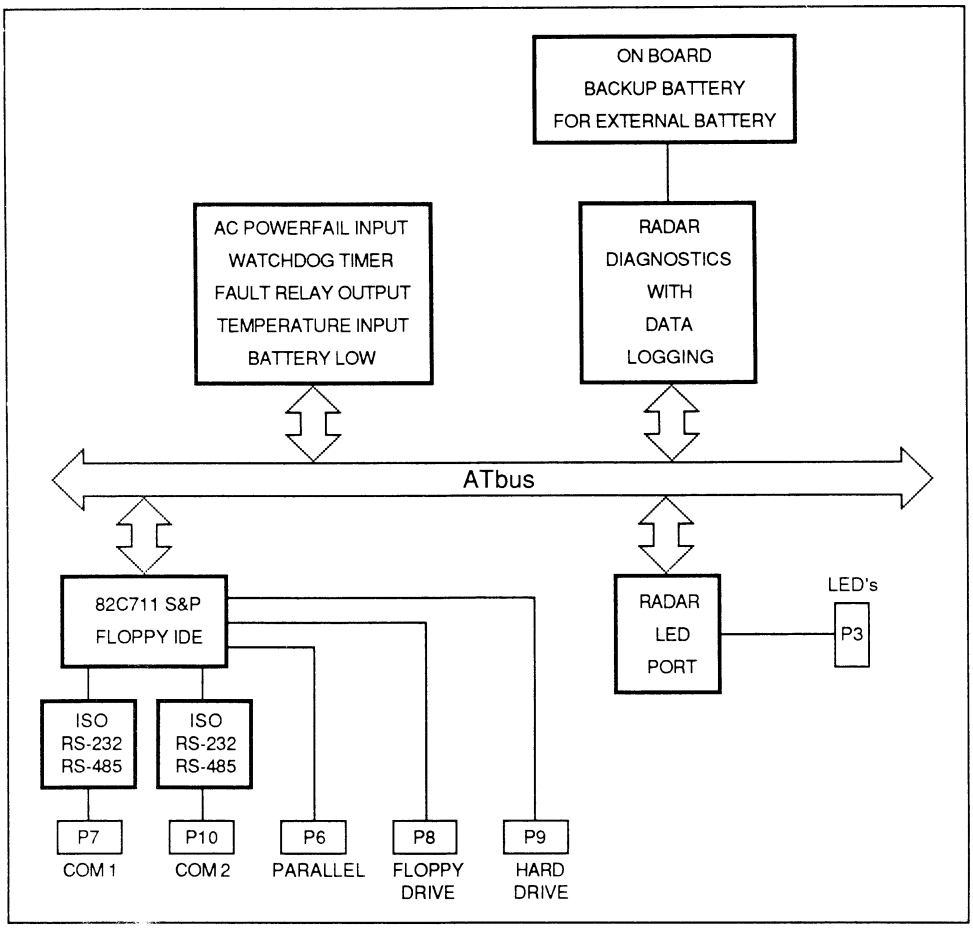
Table 7-39. Mating Connectors for AT4

XYCOM CONNECTOR	MATING CONNECTOR	
	MANUFACTURER	PART NUMBER
P1 Aux Battery (2-pin)	JST	02ER-E2R
P2 SCSI drive (50-pin)	T & B 3M	609-5000 M 3425-6000
P3 Floppy drive (34-pin)	T & B 3M	609-3400 M 3414-6000
P4 Parallel port (26-pin)	T & B	609-260 M
P7 ACFAIL (2-pin)	JST	02ER-E2R
P8 Keyboard (8-pin)	Molex	22-01-2087
P9 Serial COM2 (10-pin)	3M	3473-6000

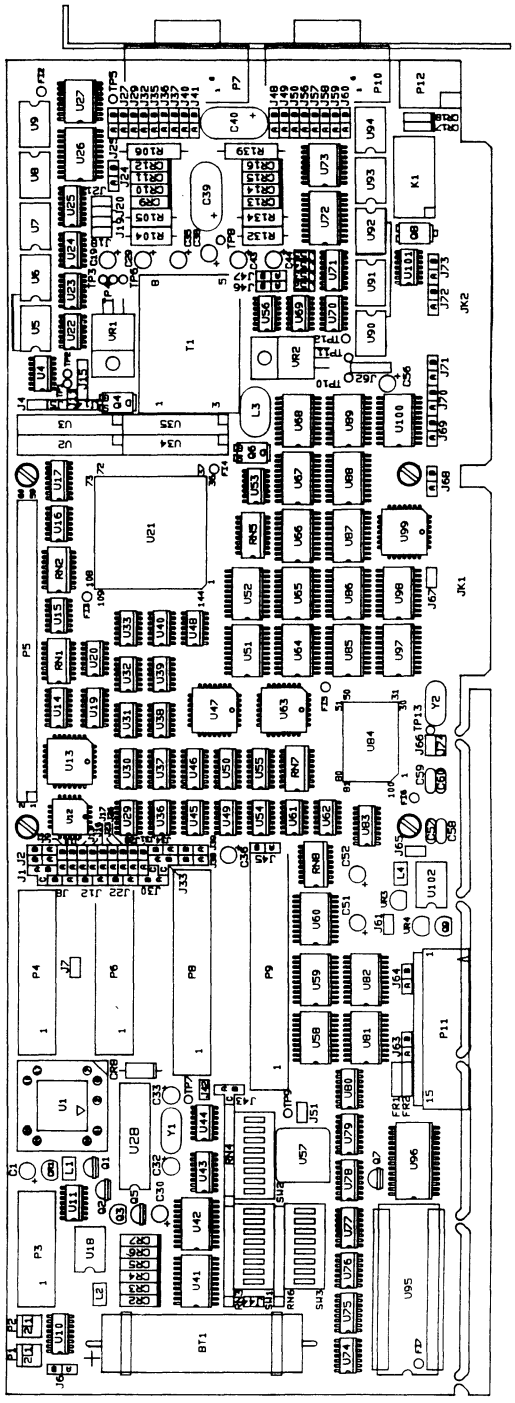
8.1 INTRODUCTION

Xycom's industrial computers can be configured with the optional Run-time Alarm Detection And Recording (RADAR) Card, providing additional preventive measures for extra protection. During run-time, RADAR monitors internal temperature, hard disk life, battery life, and BIOS memory. It can even notify operators of scheduled maintenance or imminent failures. All RADAR functions are user-selectable during installation.

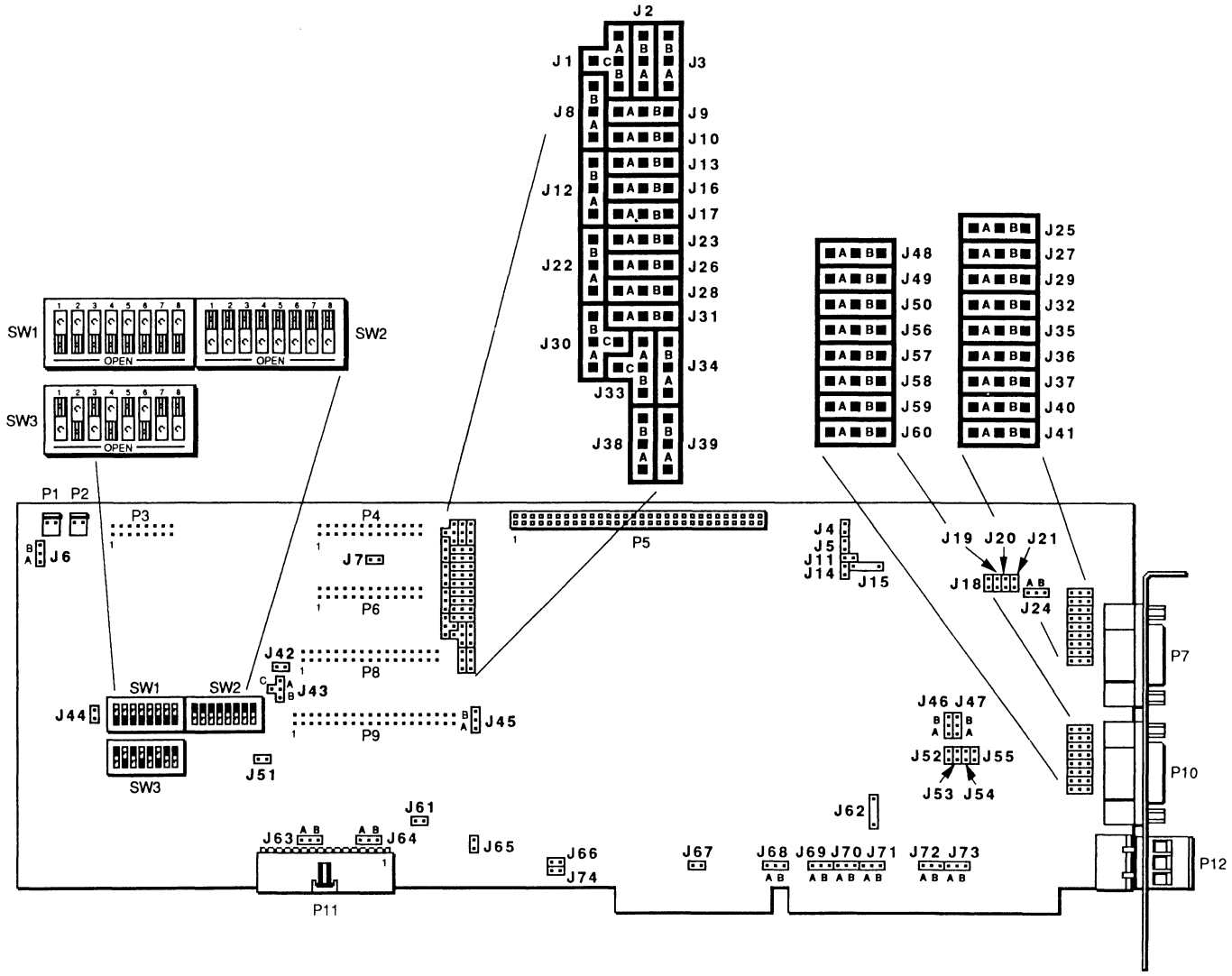
Additional features found on the RADAR card are: two optically isolated serial ports (each port can be configured as RS-232C or RS-485), status LED output port, fault relay output, off-line diagnostics, and set-up password protection.



8-1. RADAR Card Block Diagram



8-2. RADAR Board Layout



8-3. RADAR Jumpers, Connectors, and Switches

8.2 MEMORY MAP

With the RADAR Card, when its expansion sites are configured for memory, you can locate memory anywhere in the AT memory map using 128 Kbyte boundaries.

8.2.1 Extended BIOS/Data SRAM

A 512 Kbyte EPROM is provided to store all extended BIOS codes. The VGA BIOS is located at 0C0000h-0C7FFFh, and can be disabled by removing jumper J42. The rest of the EPROM (480K) is broken up into fifteen 32 Kbyte blocks. Each block can be mapped into the memory space by writing the block number into I/O register 232. The location of the extended BIOS is switch selectable and the positions are listed in the table below.

Table 8-1. Extended BIOS Switch Positions

SW2-7	SW2-6	LOCATION
closed	closed	0C8000h-0CFFFFh
closed	open	0D0000h-0D7FFFh
open	closed	0D8000h-0DFFFFh
open	open	Disabled

8.3 INPUT/OUTPUT MAP

230	SSD status/control
232	RADAR control status register 1
2F8-2FF	COM2 serial port (relocatable)
378-37F	Parallel port LPT1(relocatable)
3F0,3F1	Address/data port for C&T '711
3F2-3F7	Floppy
3F8-3FF	COM1 serial port (relocatable)
630	SSD dip switch/board select
632	RADAR control register 2
A30	SSD address select
E30	SSD data port

8.4 FLOPPY DRIVE CONTROL

The floppy disk controller is contained in the 82C7X1. The controller will support 360 and 720 Kbyte, 1.2 and 1.44 Mbyte drives.

8.4.1 **Floppy Drive Connector - P8**

Table 8-2. Floppy Drive Connector - P8

PIN	SIGNAL
2	FRWC*
4	NO CONNECT
5	KEY--NO PAD
6	NO CONNECT
8	IDX*
10	MO1*
12	FDS2*
14	FDS1*
16	MO2**
18	FDIRC*
20	FSTEP*
22	FWD*
24	FWE*
26	FTKO*
28	FWP*
30	FRDD*
32	FHS*
34	DCHG*

*All other pins are grounded.

8.5 SERIAL AND PARALLEL PORTS

There are two serial ports software, configurable as COM 1, 2, or disabled. The interrupt levels are IRQ4 for COM 1 or 3, IRQ3 for COM 2 or 4 and can be disabled by removing jumper J. Each port has the capability of being RS-232 or RS-485 independently. RS-485 will use DTR to tristate the transmit data lines.

8.5.1 Serial Isolation

Both serial ports will be individually isolated at 300V. The isolation is maintained by means of a standard DC-DC converter.

8.5.2 Parallel Port

One parallel port is provided, software configurable as LPT1. The port is bi-directional and is Centronics compatible. The interrupt level is jumper selectable for IRQ7 and IRQ5. The parallel port can be disabled by software.

8.5.3 **Serial Port Connectors**

Table 8-3. Serial Port Connectors 1 - P4

PIN	RS-232	RS-485
1	DCD	TXD-
2	RXD	TXD+
3	TXD	RTS-
4	DTR	RTS+
5	GND	GND
6	DSR	RXD-
7	RTS	RXD+
8	CTS	CTS+
9	RI	CTS-

Table 8-4. Serial Port Connectors 2 - P5

PIN	RS-232	RS-485
1	DCD	TXD-
2	RXD	TXD+
3	TXD	RTS-
4	DTR	RTS+
5	GND	GND
6	DSR	RXD-
7	RTS	RXD+
8	CTS	CTS+
9	RI	CTS-

8.6 HARD DRIVE SUPPORT

The RADAR Card will support up to two IDE (integrated drive electronics) drives. Cabling to the drive must be kept to less than 18 inches. The hard drive circuitry can be disabled through software.

Table 8-5. Hard Drive Connector - P9

PIN	SIGNAL	PIN	SIGNAL
1	RESETDRV	2	GND
3	D(7)	4	D(8)
5	D(6)	6	D(9)
7	D(5)	8	D(10)
9	D(4)	10	D(11)
11	D(3)	12	D(12)
13	D(2)	14	D(13)
15	D(1)	16	D(14)
17	D(0)	18	D(15)
19	GND	20	NC
21	NC	22	GND
23	IOW*	24	GND
25	IOR*	26	GND
27	NC	28	BALE
29	NC	30	GND
31	IRQ14	32	IOCS16*
33	SA(1)	34	NC
35	SA(0)	36	SA(2)
37	HCSO*	38	HCS1*
39	HDACTIVE*	40	GND

*All other pins are grounded.

8.7 STATUS LED SUPPORT

A connector will be provided to allow Xycom to cable to the status LEDs. These status LEDs will indicate the following conditions: Drive access (IDE or SSD), Serial activity (Receive data only for HMIO com. ports), Fault detection (WDT, ACF, Temp alarm), Maintenance, Relay status, User 1, and User 2.

Table 8-6. LED Output Connector - P3

PIN	SIGNAL
1	+5V
2	MAINTENANCE
3	+5V
4	RELAY
5	+5V
6	FAULT
7	+5V
8	SERIAL
9	+5V
10	DRIVE
11	+5V
12	USER 1
13	+5V
14	USER 2
15	GND
16	+5V

8.8 JUMPERS

The following sections describe the jumpers pertaining to the RADAR Card.

8.8.1 System Oscillator Power Jumper

J51 *IN: VCC supplied to 40 MHZ oscillator
OUT: Test mode only

8.8.2 Floppy Disk Drive Interface

J66 *IN: normal precompensation values
OUT: alternate precompensation values

J74 IN: dual speed spindle motor driver
*OUT: single speed spindle motor driver

J65 analog to digital ground connection point (permanently shorted on PCB)

8.8.3 IDE Hard Disk Drive Interface

J67 IN: AT bus IRQ14 driven by IDE hard disk drive
OUT: AT bus IRQ14 not driven by IDE hard disk drive

J68 A: allow IDE drive to assert IOCS16*
B: IDE drive can not drive IOCS16* (SW3-8 must be OPEN)

8.8.4 Serial

J15 IN: serial port one - connect Isolated GND to Digital GND
J62 *OUT: isolates Isolated GND and Digital GND

J24, 25, 27, 29, 35-37, 40, 41
A: serial port one = RS-485
*B: serial port one = RS-232C

J46-50, 56-60
A: enable RS-485
*B: enable RS-232C

J18-21 (Serial port one RS485 termination)
IN: terminated
*OUT: no termination

J52-55 (Serial port two RS485 termination)
IN: terminated
*OUT: no termination

J70 *A: Serial port two drives IRQ3
B: Not allowed
OUT: Serial port one cannot drive IRQ4
Wire-wrap post "A" to post "C": serial port two drives IRQ11

8.8.5 **Parallel Port**

J71 A: Printer port drives IRQ5 (LPT2)
*B: Printer port drives IRQ7 (LPT1)

8.8.6 **Memory**

J6 A: onboard battery disconnected
*B: onboard battery connected

8.8.7 **Relay**

J45 A: WDT time-out will relax relay
*B: relay dependant only on register bit

8.8.8 **LEDs**

J61 IN: SSD LED bit controls drive LED
*OUT: drive LED controlled by IDE drive only

8.9 SWITCHES

8.9.1 SW2

1 Open: bank 0 is in the AT memory map
*Closed: bank 0 is not in the AT memory map
2 Open: bank 1 is in the AT memory map
*Closed: bank 1 is not in the AT memory map
3 Open: bank 0 has 512 Kbyte c 8 devices
*Closed: bank 0 has 128 Kbyte x 8 devices
4 Open: bank 1 has 512 Kbyte x 8 devices
*Closed: bank 1 has 128 Kbyte x 8 devices
5 Open: memory starts in AT conventional memory (below 640 Kbyte)
*Closed: memory starts in at extended memory (above 1 Mbyte)
6-7 Extended BIOS location

Table 8-7. Extended BIOS Location

SW2-7	SW2-6	Extended BIOS Location
*closed	closed	0C8000h-0CFFFFh
closed	open	0D0000h-0D7FFFh
open	closed	0D8000h-0DFFFFh
open	open	Disabled

8 Open: S/W readable switch read as "1"
*Closed: S/W readable switch read as "0"

8.9.2 SW1

1-8 SSD chip type register
Software readable
*Open (all)

9.1 PREVENTIVE MAINTENANCE

The 8450 was designed to withstand the harsh environment of the factory floor. Routine maintenance can help keep your 8450 in good operating condition. Preventive maintenance consists of several basic procedures and checks that will greatly reduce the chances of system malfunction. Preventive maintenance should be scheduled along with the regular equipment maintenance to minimize 8450 down time.

Some preventive measures are listed below.

- **Clean or change the fan filter periodically** to ensure that the air circulating in the unit is clean. The procedure is described in section 8.2.2. Filter maintenance should not be put off until the scheduled maintenance, but should be performed periodically, depending on the amount of dust in the area.

- **Remove dust and dirt from PC components**. If dust builds up on heat sinks and circuitry, an obstruction of heat dissipation could cause the unit to malfunction. If dust reaches the electronic boards, a short circuit could occur.

- **Check the connections to I/O modules**, especially in environments where shock could loosen the connections. Check to see that all plugs, sockets, terminal strips, and module connections are solid.

- **Remove unnecessary articles, like drawings or manuals, from the unit**. They could obstruct air flow which creates hot spots, which cause the system to malfunction.

- **Do not move noise generating equipment too near the 8450**.

- **Stock spare parts** to minimize down time resulting from part failure. The spare parts stocked should be 10 percent of the number of each unit used. The main CPU card should have one spare each, regardless of the number of CPUs used. Each power supply should have a back-up. In certain applications where immediate operation of a failed system is required, an entire spare drawer may need to be stocked. See the spare parts list in Section 9.2.3.

- **When replacing a module, make sure it is the correct type.** If the new module solves the problem, but the failure reoccurs after a while, check for inductive loads that may be generating voltage and current spikes and may require external suppression.

9.2 MAINTENANCE

9.2.1 Replacing the Fuse

The 8450 uses a standard 4A slo blo fuse. The fuse holder/access door is located under the power receptacle and should be carefully pried open.

WARNING
Turn off the power to the terminal before removing the fuse.

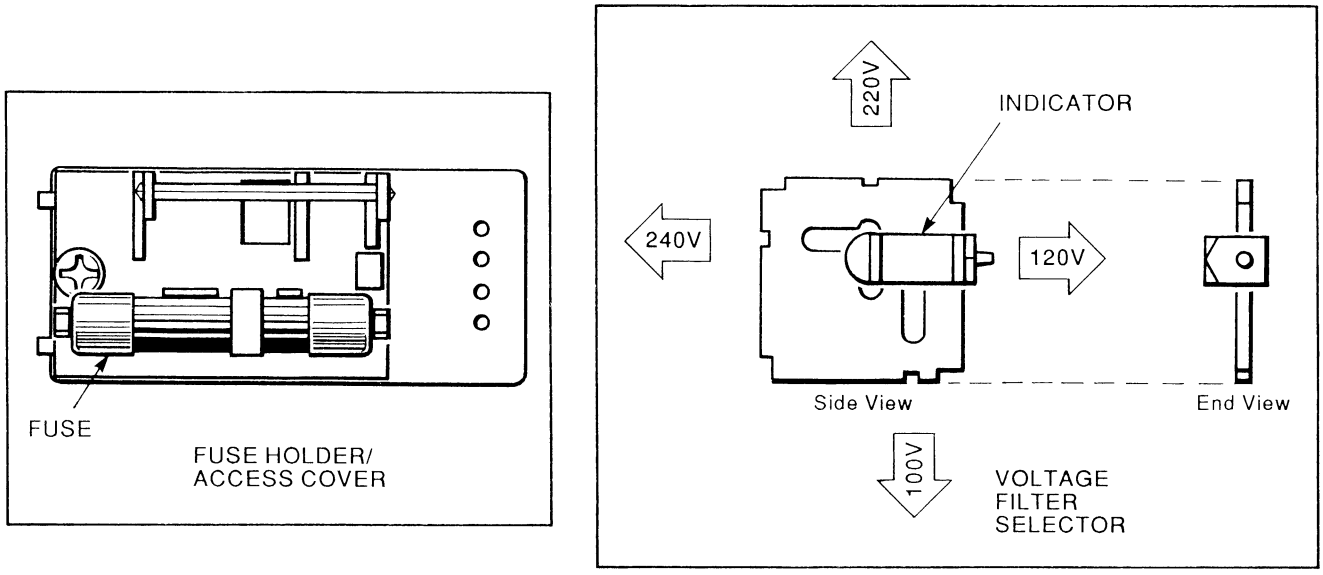


Figure 9-1. Fuse Holder/Access Door

9.2.1.2 Replacing Drawers

The entire end cover bracked assembly must be removed when a drawer with LEDs is inserted into an older unit without the compression plate access.

9.2.2 **Changing the Fan Filter**

To change the fan filter, remove the grill and filter as illustrated in Figure 9-2. Clean the filter and snap the grill back into position.

> **CAUTION**
> Do not operate the 8450 without a fan filter. Dust build-up could cause the unit to malfunction.

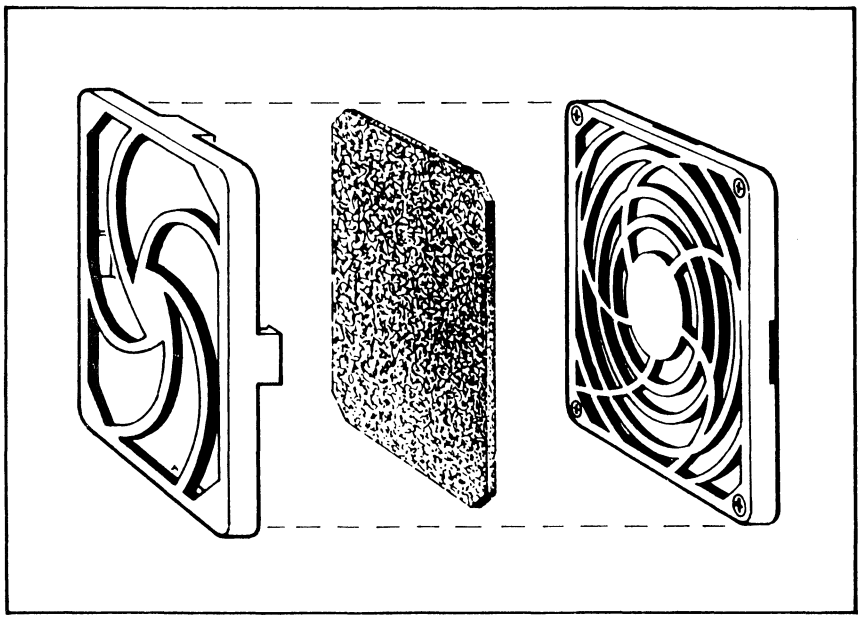


Figure 9-2. Changing the Fan Filter

9.2.3 **Spare Parts List**

In case you need to re-order parts to your 8450 unit, ust the part number specified below:

Table 9-1. Spare Parts List

DESCRIPTION	PART NUMBER
CPU 80386SX, 25 MHz, 2 Mbytes	98406-226
CPU 80386SX, 25 MHz, 4 Mbytes	98406-426
CPU 80486SX, 25 MHz, 4 Mbytes	97918-425
CPU 80486DX, 25 MHz, 4 Mbytes	97603-425
CPU 80486DX, 50 MHz, 8 Mbytes	97603-850
4100-SSD	94669-005
1.44 Mbyte Floppy Disk Kit	97019-001
105 Mbyte IDE Hard Disk Drive Kit	98137-001
240 Mbyte IDE Hard Disk Drive Kit	98509-001
Touch Screen Controller	98551-002
8000-RADAR Card	97612-001
Drawer Assembly (Empty)	95775-001
Assembly Enclosure (No Drawer)	96545-001
PKIM Module	95213-002
130 Watt Power Supply	91735-001
12" Lexan Screen	90597-002
12" Touch Screen	98638-002
4A Slo Blo Fuse	80377-001
#10-32 Nuts	80580-002
Power Cord	88760-001
Touch Screen Cable External	98987-001
VGA Video Cable	96246-001

9.3 PRODUCT REPAIR PROGRAM/RETURNING A UNIT TO XYCOM

Xycom's Product Repair Service performs services to restore equipment to normal operating condition and to implement engineering changes which enhance operating specifications. Products returned to Xycom will be tested with standard Xycom test diagnostics. Contact the RMA department for information on your particular turnaround time.

9.3.1 Preparing the Unit for Shipment

1. Obtain an RMA number for your unit by calling your local Product Repair Department or Xycom Repair Center. Have the following information ready:

   - Company name and shipping and billing address
   - Type of service desired - product repair or product exchange
   - Product model number, part number, quantity, serial number(s), and warranty status
   - Failure mode and failure systems
   - Purchase order number or repair order number

   You will then receive your RMA number. **This number must appear on the outside of the shipping container and on the purchase order.**

2. To prepare the 8450 for shipment, make sure the front panel assembly is properly attached to the unit, and that the slide-out drawer is secured by all four screws.

3. To speed processing, attach any failure information to the unit.

4. Place the unit securely in a heavy-duty box.

5. Mark the RMA number on the outside of the box as well as on your purchase order.

6. Send the unit to your local Xycom repair center.

A.1 SPECIFICATIONS

The specifications for the 8450 are listed in the tables below:

Table A-1. 8450 Mechanical Specifications

CHARACTERISTIC	SPECIFICATION
Dimensions	
Height	12.2" (310 mm)
Width	19" (483 mm)
Depth	16.25" (412.75 mm)
Weight	50 lbs (23 kg)
Mounting	Standard EIA 19" rack
Backplane	Five-slot AT passive backplane (5 AT slots) 130 watts avail. to backplane/drives +5 V @ 20 A / -5 V @ 1.0 A +12 V @ 5 A / -12 V @ 1.0 A -12V and -5V total 1.5 A
Monitor	
Compatibility	VGA
CRT size	12"
Resolution	640 h x 480 v
Dot trio pitch	0.28 mm

Table A-2. 8450 Electrical Specifications

CHARACTERISTIC	SPECIFICATION
Power Requirements	115/230 VAC, 14 to 21% 50/60 Hz, 290 Watts
Power Supply	130 Watts
Fuse	4 Amp, Slo blo

Table A-3. 8450 Environmental Specifications

CHARACTERISTIC	SPECIFICATION
Temperature	
Operating	32° to 122°F (0° to 50°C)
Non-operating	-40° to 140°F (-40° to 60°C)
Humidity	
Operating	10 to 80% RH, non-condensing
Shock	
Operating	15 g peak acceleration 11 msec duration
Non-operating	30 g peak acceleration 11 msec duration
Vibration	5 to 2000 Hz
Operating	.006 in. peak to peak 1.0 g max
Non-operating	.015 in. peak to peak 2.5 g max
Altitude	
Operating	Sea level to 10,000 ft (3048 m)
Non-operating	Sea level to 50,000 ft (15240 m)

B.1 CONNECTOR PINOUTS

Table B-1. Sealed Keyboard Connector

PIN	SIGNAL	PIN	SIGNAL
1	N/C	14	Row 7
2	Num Lock	15	Row 8
3	Num Limit	16	Column 10
4	Cap Limit	17	Column 9
5	Cap Lock	18	Column 8
6	Column 11	19	Column 7
7	Column 12	20	Column 6
8	Row 1	21	Column 5
9	Row 2	22	Column 4
10	Row 3	23	Column 0
11	Row 4	24	Column 3
12	Row 5	25	Column 2
13	Row 6	26	Column 1

Table B-2. Serial Port COM1 and COM2 Connector on back of drawer

Pin #	Signal	Pin #	Signal
1	DCD1	2	RXD1
3	TXD1	4	DTR1
5	GND	6	DSR1
7	RTS1	8	CTS1
9	RI1		

Table B-3. Printer Port Connector

PIN	SIGNAL	PIN	SIGNAL
1	STROBE	14	AUTOFEED
2	PDOUT 0	15	PERROR
3	PDOUT 1	16	INIT
4	PDOUT 2	17	SELIN
5	PDOUT 3	18	GND
6	PDOUT 4	19	GND
7	PDOUT 5	20	GND
8	PDOUT 6	21	GND
9	PDOUT 7	22	GND
10	PACK	23	GND
11	PBUSY	24	GND
12	PE	25	GND
13	SELECT		

Table B-4. External Floppy Disk Connector

PIN	SIGNAL	PIN	SIGNAL
1	GND	20	FRWC*
2	GND	21	N/C
3	KEY	22	N/C
4	GND	23	IDX*
5	GND	24	MO1*
6	GND	25	FDS2*
7	GND	26	FDS1*
8	GND	27	MO2*
9	GND	28	FDIRC*
10	GND	29	FSTEP*
11	GND	30	FWD*
12	GND	31	FWE*
13	GND	32	FTK0*
14	GND	33	FWP*
15	GND	34	FRDD*
16	GND	35	FHS*
17	GND	36	DCHG*
18	N/C	37	N/C
19	N/C		

Table B-5. VGA Video Connector (Video Card)

PIN	SIGNAL	PIN	SIGNAL
1	RED	9	KEY
2	GREEN	10	GND
3	BLUE	11	ID0
4	ID2	12	ID1
5	GND	13	HSYNC
6	GND	14	VSYNC
7	GND	15	RSVD
8	GND		

B.2 CONNECTING TO PLCs

The 8450 can also connect to a number of popular PLCs via RS-232C. The pin connections for some of the supported PLCs are shown in the Figures on the next few pages. (The PLCs are listed alphabetically under manufacturer's name.)

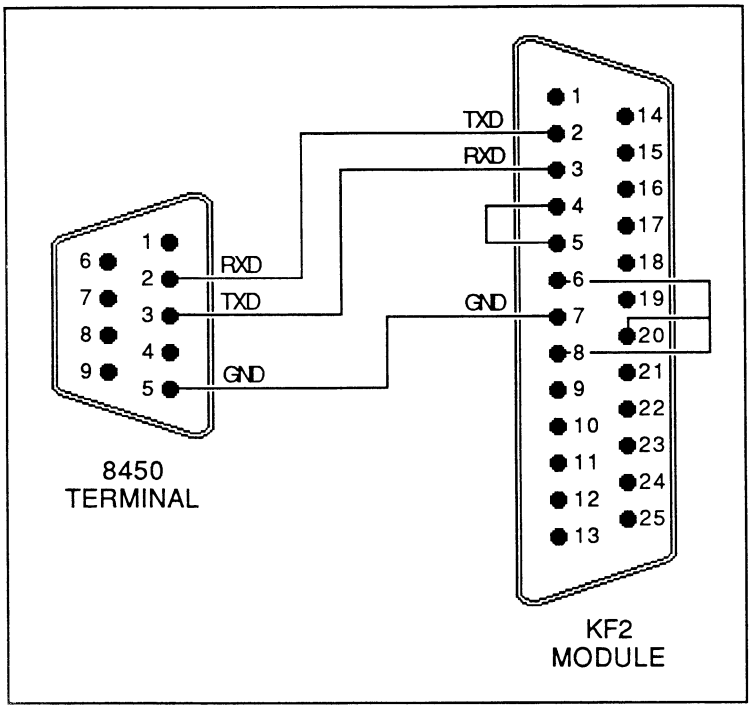


Figure B-1. Allen Bradley KF2 Module

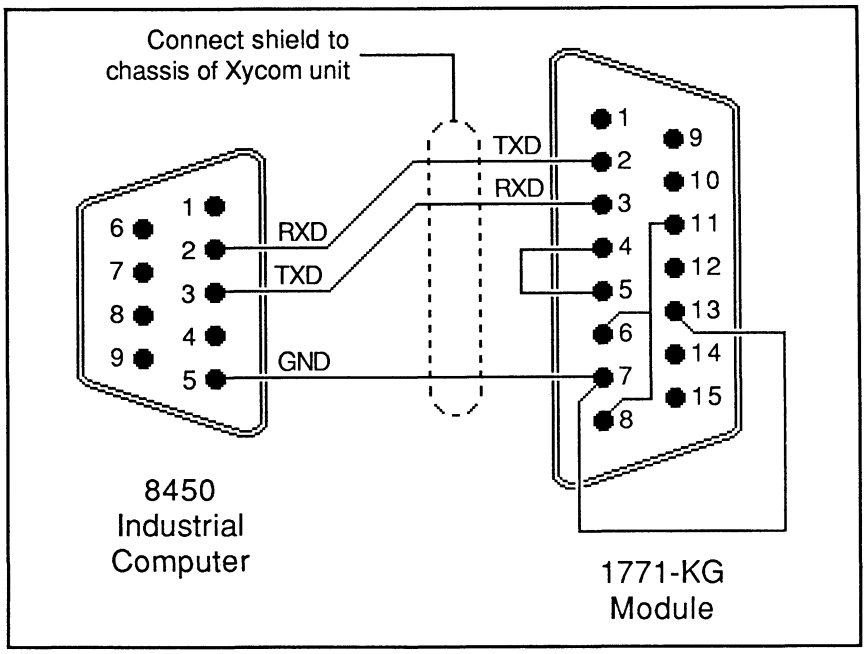


Figure B-2. Allen Bradley 1771-KG Module

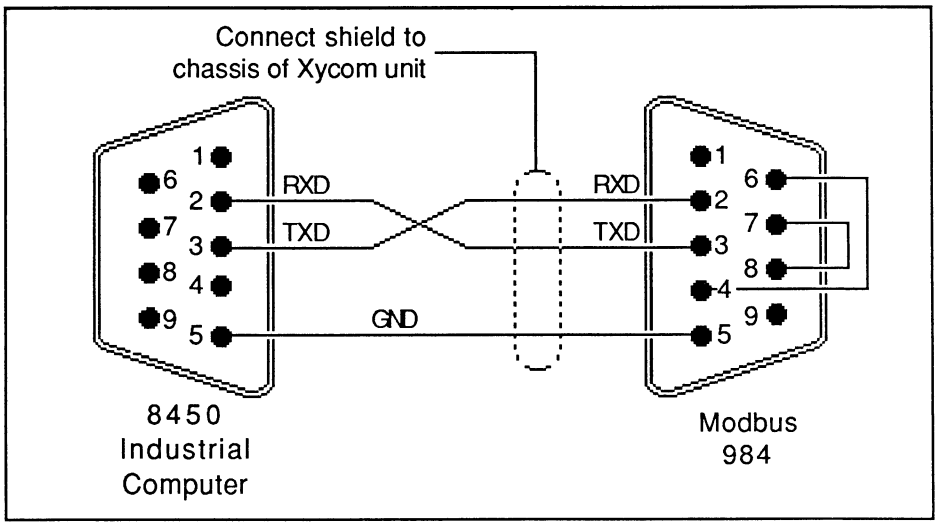


Figure B-3. MODBUS 984 PLC, 9-pin

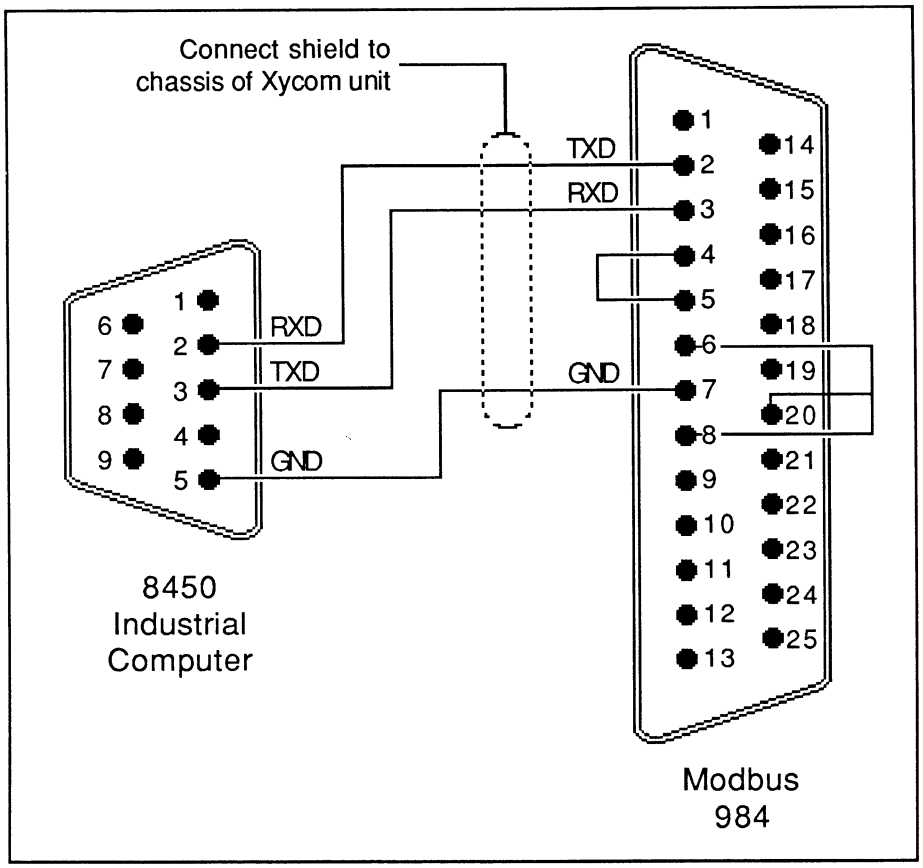


Figure B-4. MODBUS 984 PLC, 25-pin

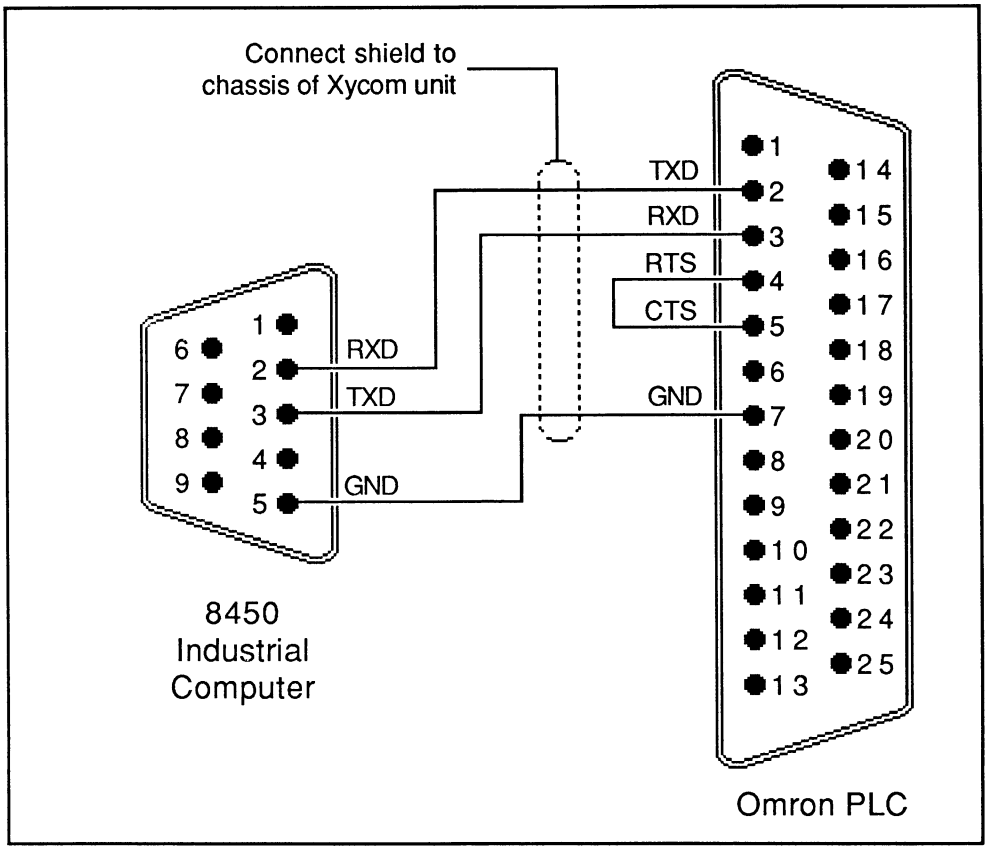


Figure B-5. OMRON PLC

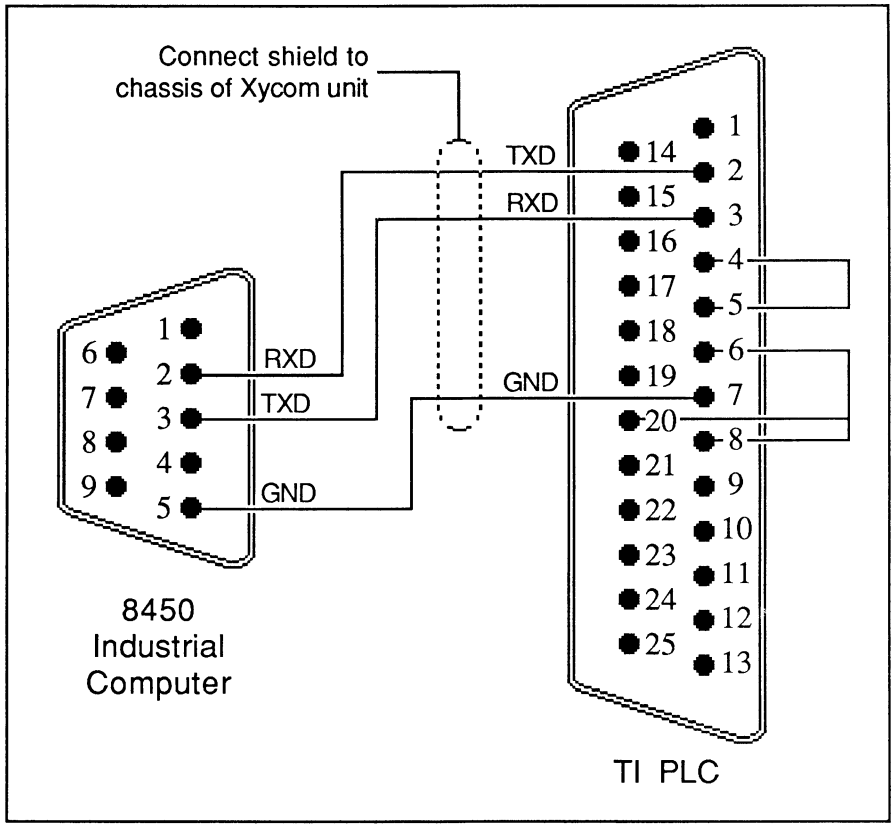


Figure B-6. Texas Instruments Series 500 PLC

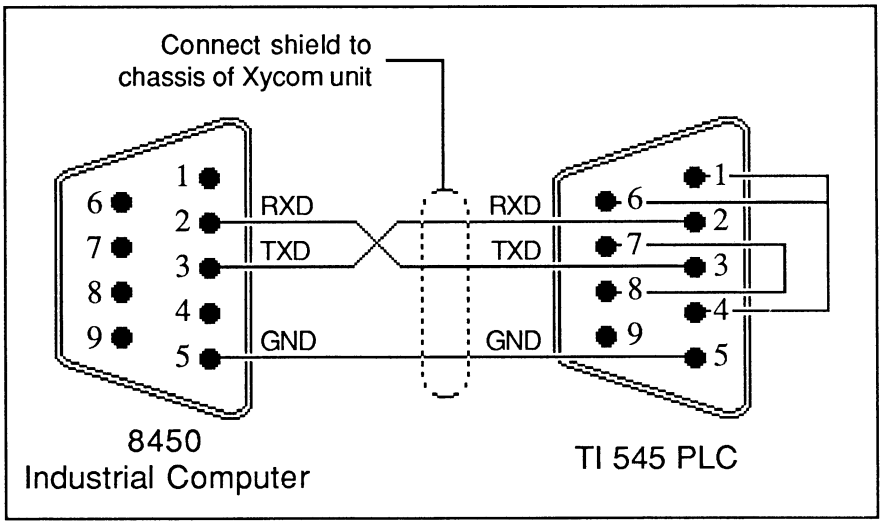


Figure B-7. Texas Instruments 545 PLC

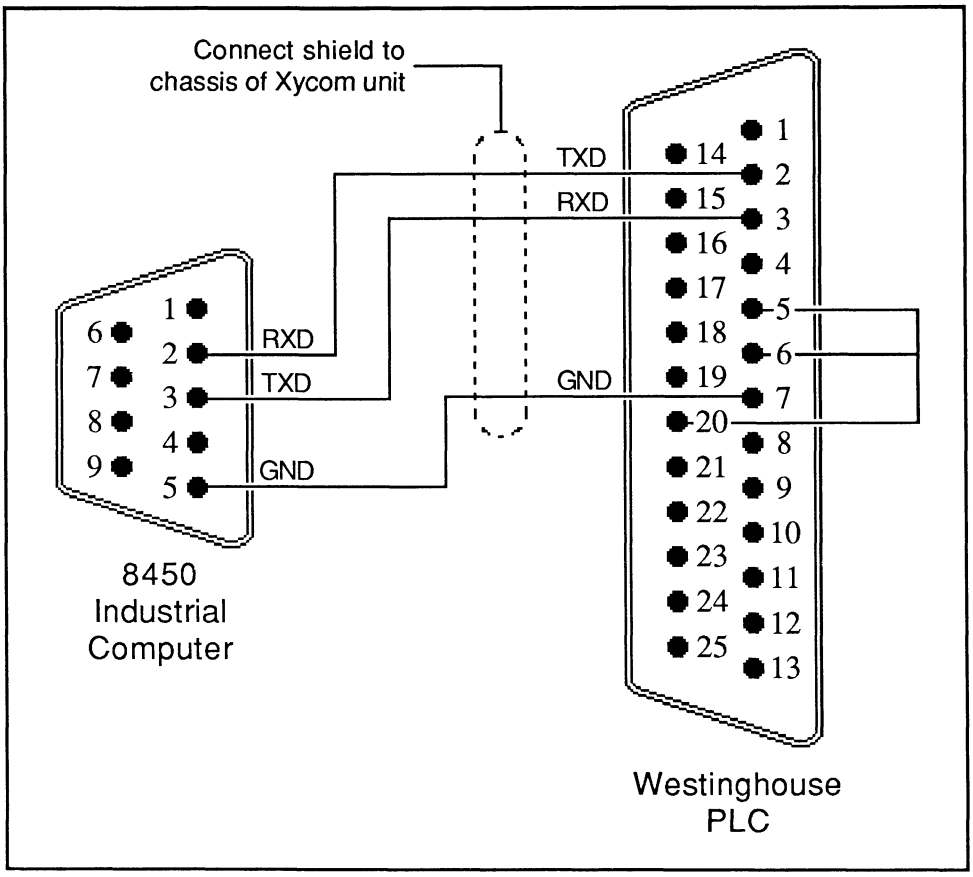


Figure B-8. Westinghouse PLC

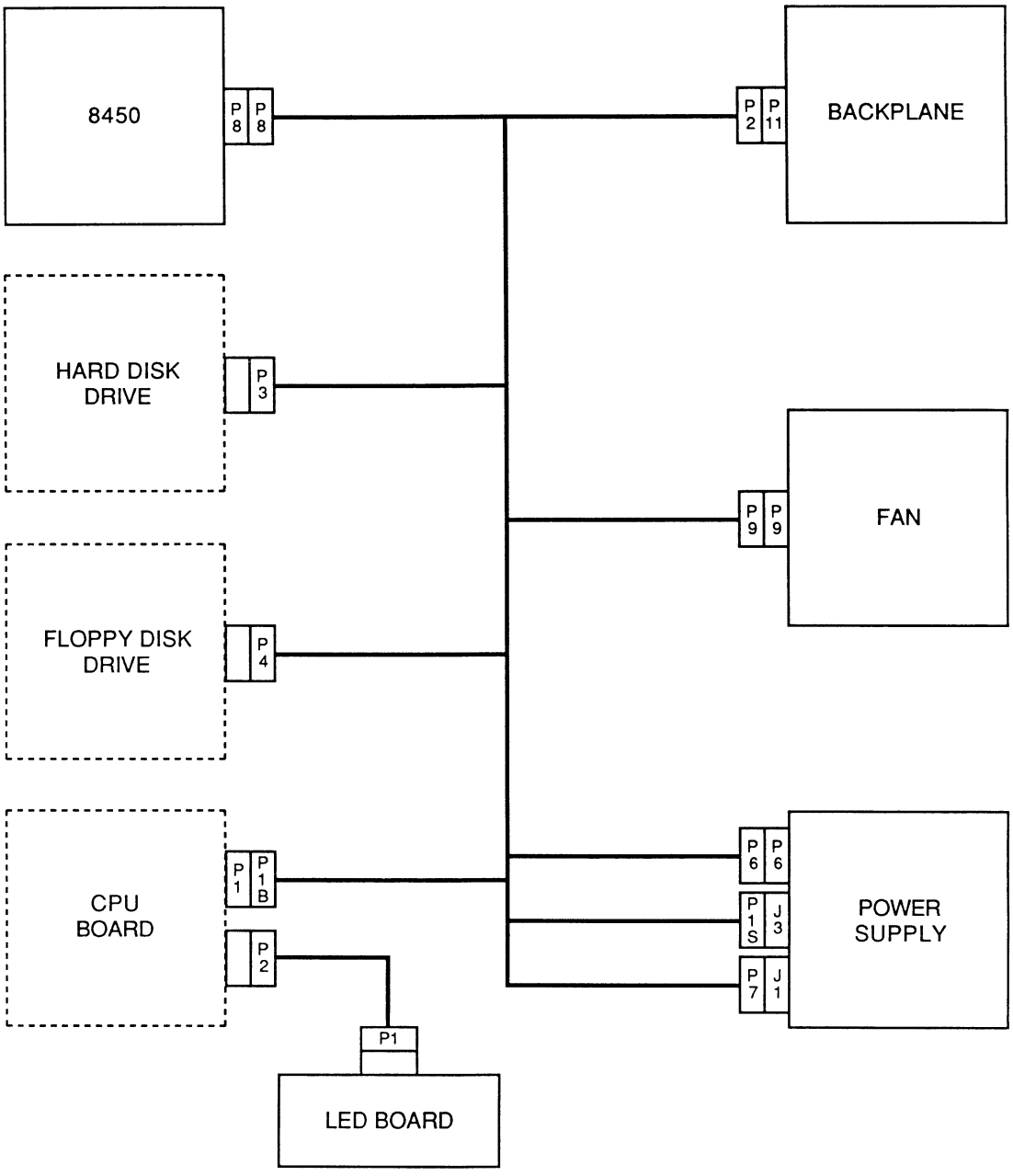


Figure C-1. Works in a Drawer 80386SX Block Diagram

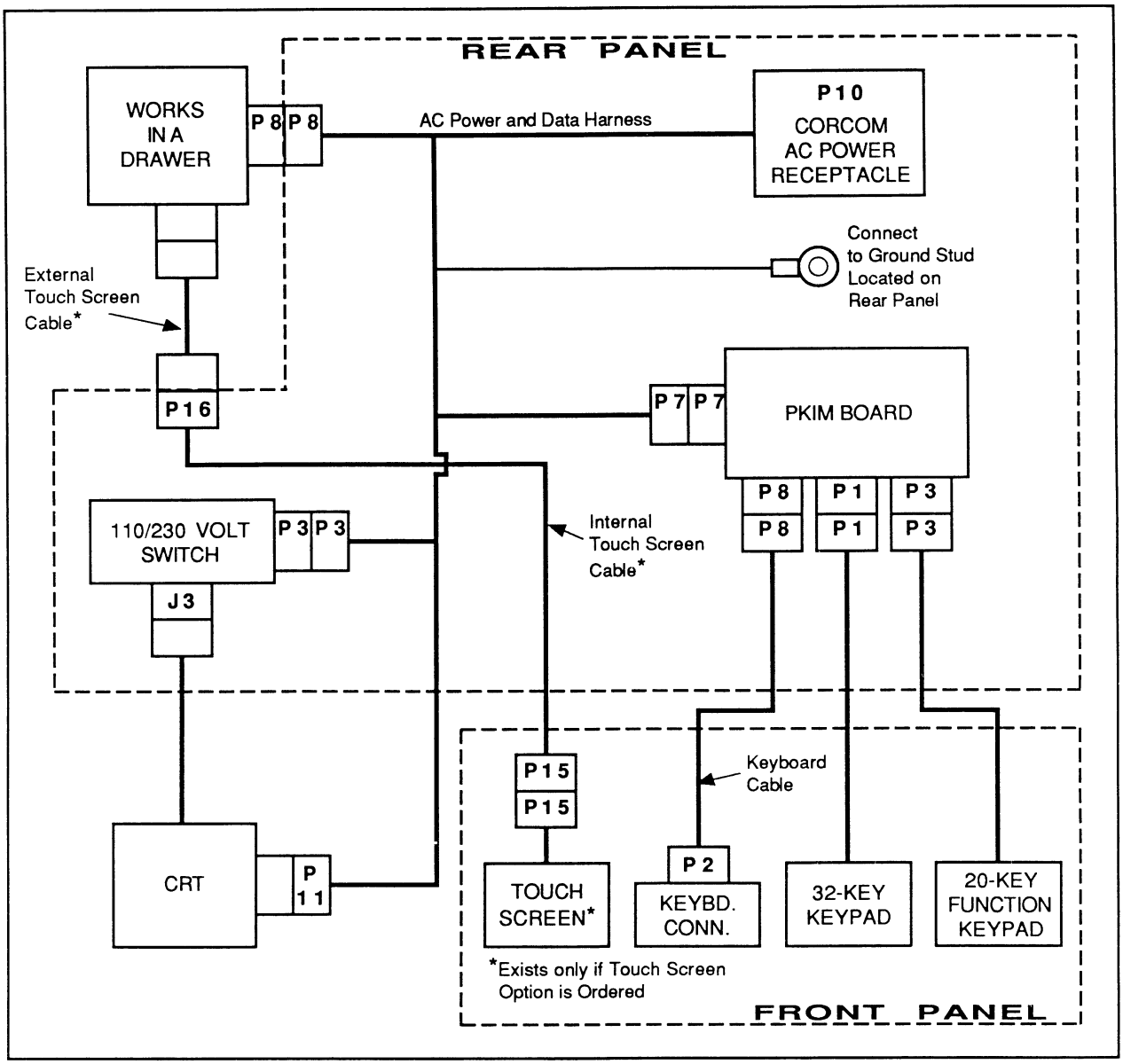


Figure C-2. System Block Diagram

NOTE

Material: .010 thk. Aluminum with .090 thk. domes Epoxy resin on the front side and 3M #468 adhesive on the back side.

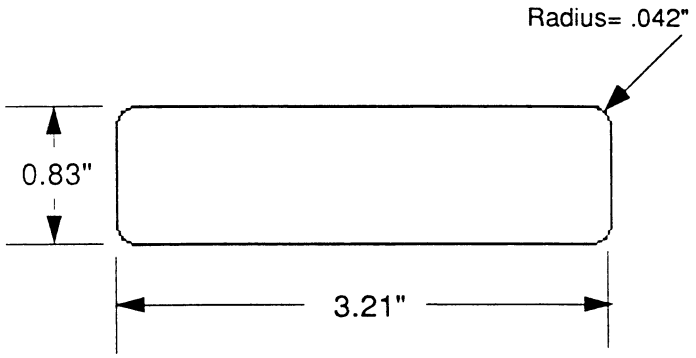


Figure C-3. 8450 Logo Dimensions

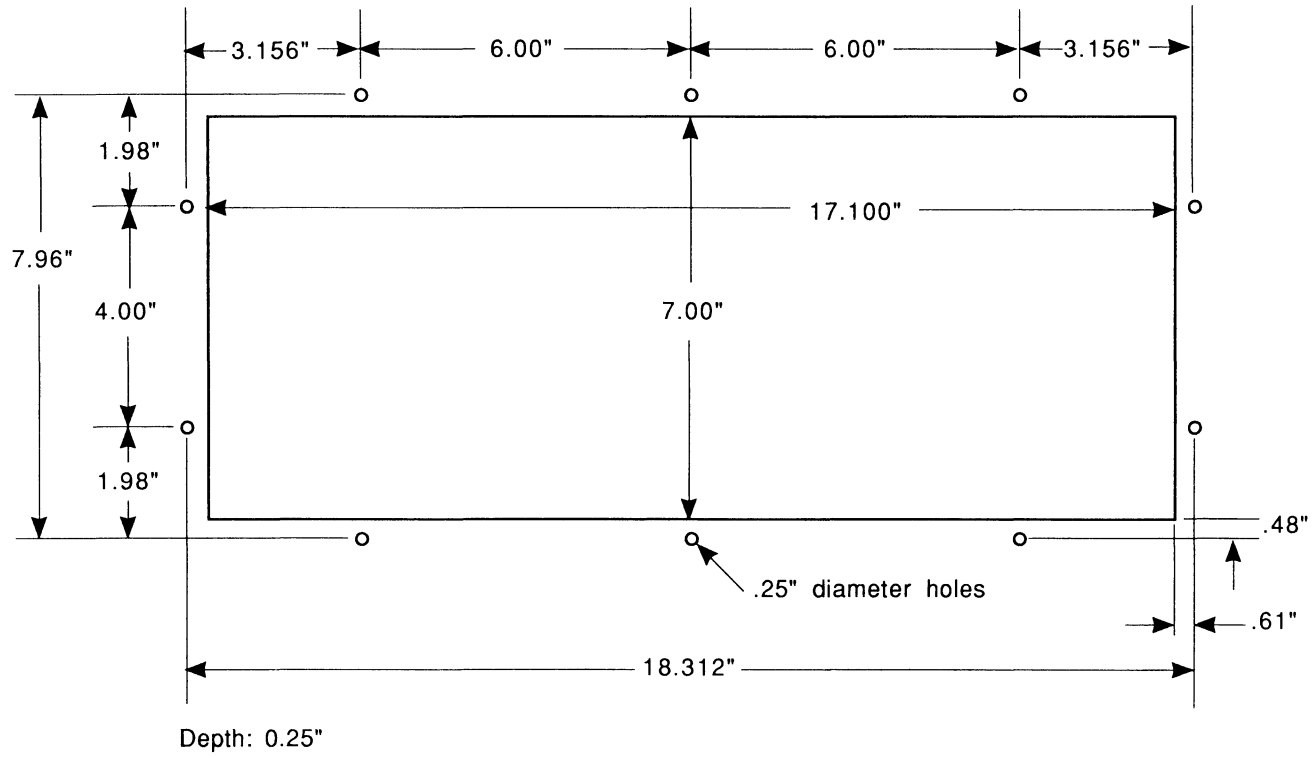


Figure C-4. 8000-KB3 and 8000-KB4 Keyboard Cutout Dimensions

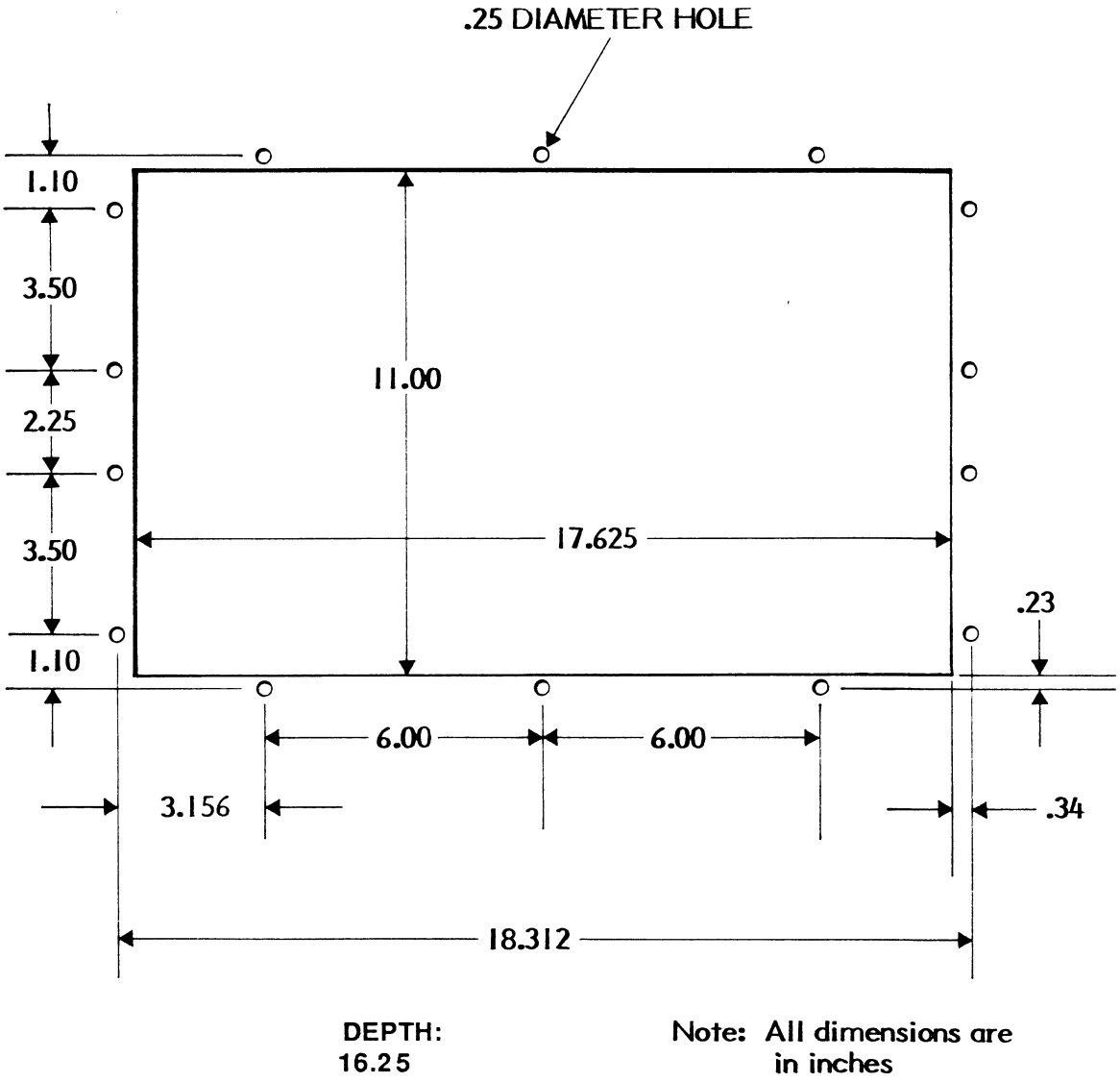


Figure C-5. 8450 System Cutout Dimensions

D.1 TOUCH SCREEN

The Xycom touch screen is based on resistive membrane technology and consists of two thin sheets of polycarbonate with transparent, conductive coatings on the facing sides. Finger or stylus pressure causes the outer sheet to make electrical contact with the inner sheet. Xycom's touch screen complies with the complete environmental specifications and remains operational even after two million touches.

The touch screen interface module circuit impresses a voltage across the conductive coatings and when pressed, converts from analog to x and y digital coordinate positions and passes the x and y codes to the Elographics driver installed in the system. The touch screen data is made to emulate a Microsoft mouse.

> **NOTE**
> Refer to the Elographics manuals for complete installation details. Use E271-2201, Interrupt 5, AccuTouch/DuraTouch when installing default Touch Screen driver.

D.2 MOUSE DRIVER

A standard mouse driver has two modes of operation, **absolute mode**, and **relative** or **mickey mode**. In absolute mode, the mouse driver returns values of actual pixel positions. In relative mode, the values returned represent the difference from the last position to the current position.

D.2.1 **Relative Mode**

If a mouse and a touch screen are connected at the same time and the mouse is moved, the monitor mouse driver will not be aware of the movement because it can only send information to the mouse driver and **not** receive information from the driver. You may correct this by disconnecting the mouse. Elographics provides a program called **'patchmse'**, which patches the mouse driver to operate without a mouse connected.

If you do not have the option of disconnecting your mouse, the following steps will get the touch screen and the mouse cursor back into synchronization:

1. Touch the touch screen in the center, and **while still pressing**, slide your finger all the way to the **right side center**, then to the **top center**, then to the **left center**, and finally to the **bottom center**.

2. The cursor should be directly under your finger. If not, try the steps again, moving more slowly across the screen or recalibrate the touch screen by using **'elocalib'**.

> **NOTE**
> This problem occurs with some software packages that use **relative mode**, when using both the mouse and the touch screen.

D.2.1.1 **Cursor Movement**

Some software packages may cause cursor movement to become erratic if a location greater than 128 pixels away from the current cursor location is touched. This may occur if the variable that is relied on to hold the delta X value is only 8 bits. This enables movements of only +/- 128 pixels max from the previous position. Please contact your software manufacturer if the cursor moves erratically during touch screen use.

D.3 **PINOUTS**

The connector pinouts are shown below.

Table D-1. Touch Screen Connector (Drawer) on Elographics AT Card and (Chassis) P16

PIN	SIGNAL
1	not used
2	not used
3	not used
4	not used
5	not used
6	X+
7	X-
8	Y-
9	Y+

D.4 BACK PANEL

Figures D-1 through D-3 show the 8450 components back panel with Touch Screen.

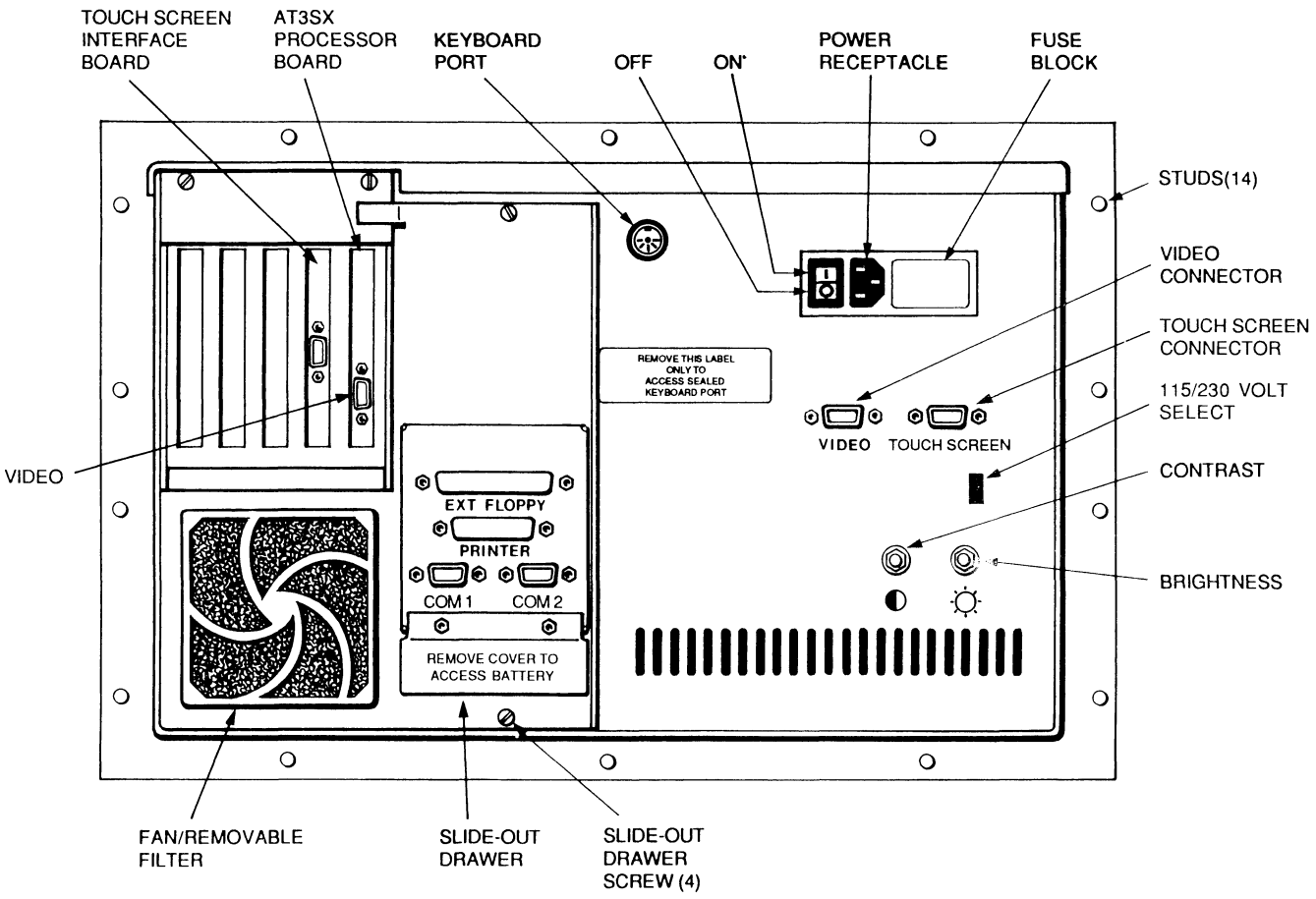


Figure D-1. Back Panel for 8450-525X AT3SX with Touch Screen

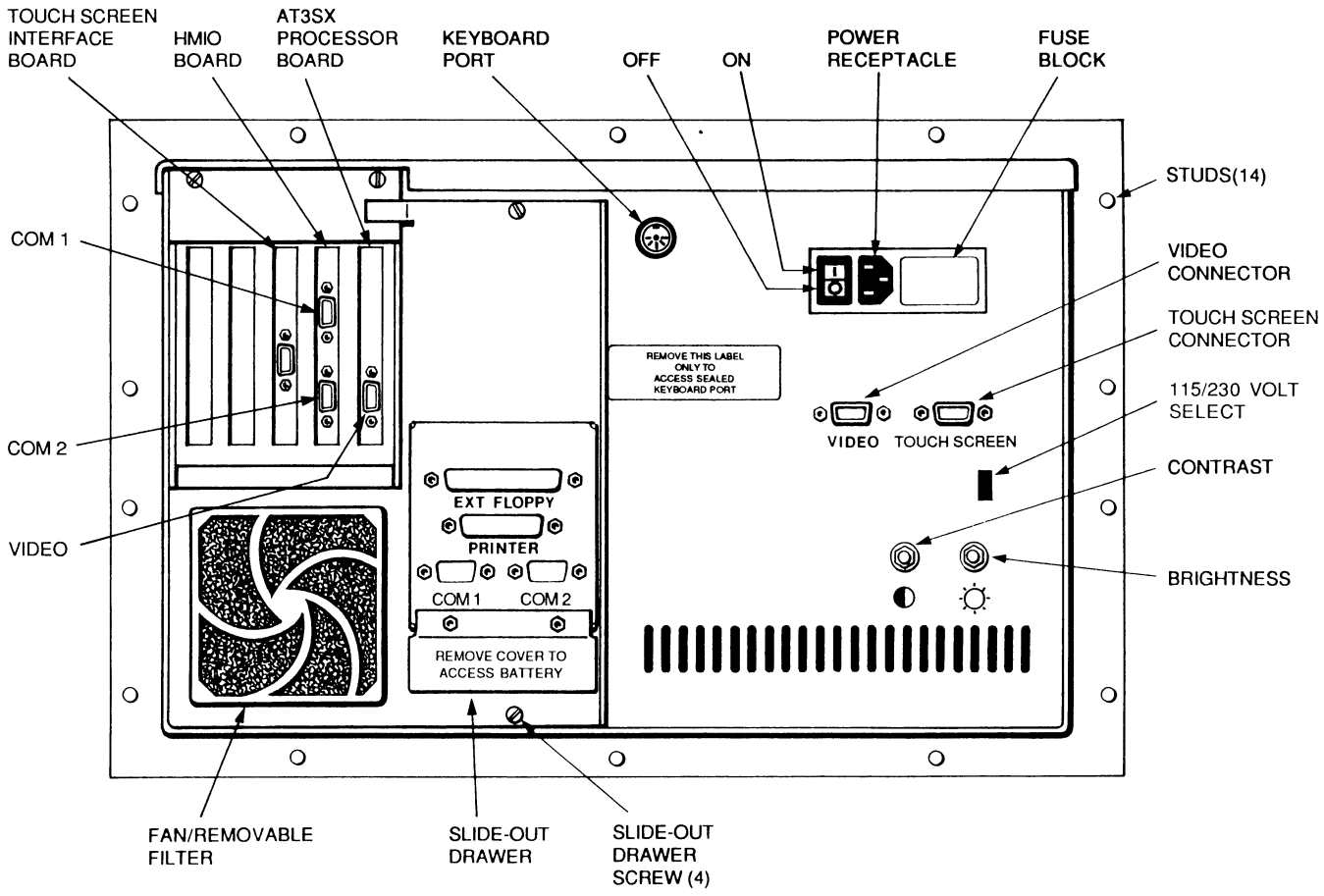


Figure D-2. Back Panel for 8450-525X AT3SX with optional RADAR and Touch Screen

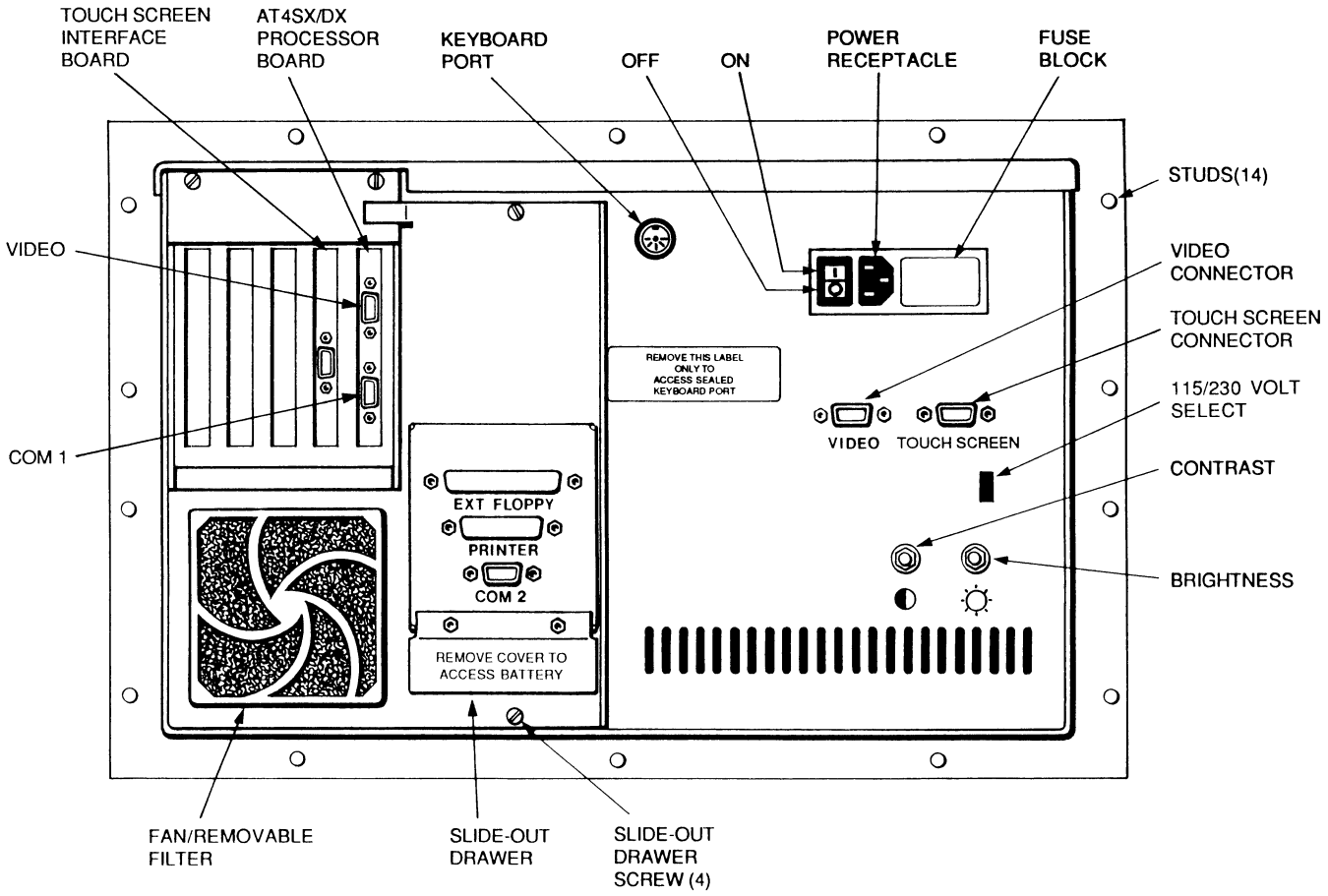


Figure D-3. Back Panel for 8450-3204/4254/4508 AT4SX/DX/DX2 with Touch Screen

Numeric

A

B

C

D

E

E (Continued)

F

G

H

I

I (Continued)

J

K

L

M

N

P

Q

R

S

T

U

V

W