

MADE IN THAILAND



FOUNTAIN

FTN-88 USER'S MANUAL



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FCC Interference Statement

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient the receiving antenna

Relocate the computer with respect to the receiver

Move the computer away from the receiver

Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

“How to Identify and Resolve Radio-TV Interference Problems”.

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004000003454.

Please note: Shielded cables are required in order to meet FCC emission limits.

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FCC Interference Statement

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Chapter 1

Introduction

1.1 Congratulations!

Congratulations on purchasing your Fountain PC/XT system! This book is designed both as an introductory user's guide and as a technical reference manual. It will be revised periodically to reflect improvements in the technology and the wishes of customers. Please send suggestions for making this book more helpful to Fountain Technologies.

1.2 Compatibility

The Fountain PC/XT computer system is very compatible with the personal computers made by IBM¹, both in terms of software and hardware.

1.2.1 Software Compatibility

This refers to a computer's ability to run programs written to run on the IBM PC. Several companies, including Fountain, have designed machines which have achieved software compatibility. Almost all software runs with no difficulty on the Fountain PC/XT; this includes such popular programs as Lotus 1-2-3, Sidekick, and Microsoft Flight Simulator. The only known exceptions are programs which make use of IBM's copyright ROM Basic. Such programs will usually run after the user loads a disk-based version of Basic, such as GW Basic.

1.2.2 Hardware Compatibility

This refers not only to a computer's ability to use expansion cards and peripherals designed for the IBM PC, but also to incorporate parts' replacements and upgrades. A question often asked by potential PC-compatible owners is, "Suppose I buy a machine from company X, can I be sure that they will be around in five years, so that I can get parts and service for the machine?" With a Fountain, you can be confident. Any

1. we will use the name IBM PC to refer both to the PC and PC/XT made by International Business Machines

service center with the parts and expertise to maintain an IBM PC can also maintain the Fountain PC/XT.

Some other machines claiming compatibility are deficient in this respect. For instance, the Leading Edge Model D has a case with different physical dimensions containing a motherboard which not only has different dimensions but also has a different expansion port layout. A person with this computer who wants to upgrade his computer to gain the power of an AT by replacing the motherboard (there are several such products now on the market) is just out of luck. The Tandy Model 1000 is a more extreme example of limited hardware compatibility; several full-size cards designed for the IBM PC will not fit in the Tandy machine.

1.3 Organization of this book

Chapter 2 introduces you to the basic components of your system and shows you how to connect these components together. If your system was delivered with all the cards installed, the two sections, **Connecting the Parts Together** and **Checking out the System**, are the only sections you need to get started. Chapters 3 through 8 go into more detail for each of the components.

MC 5401

Chapter 2

Overall System

The three components shown in the photograph below are the main system unit, the keyboard, and the monitor.

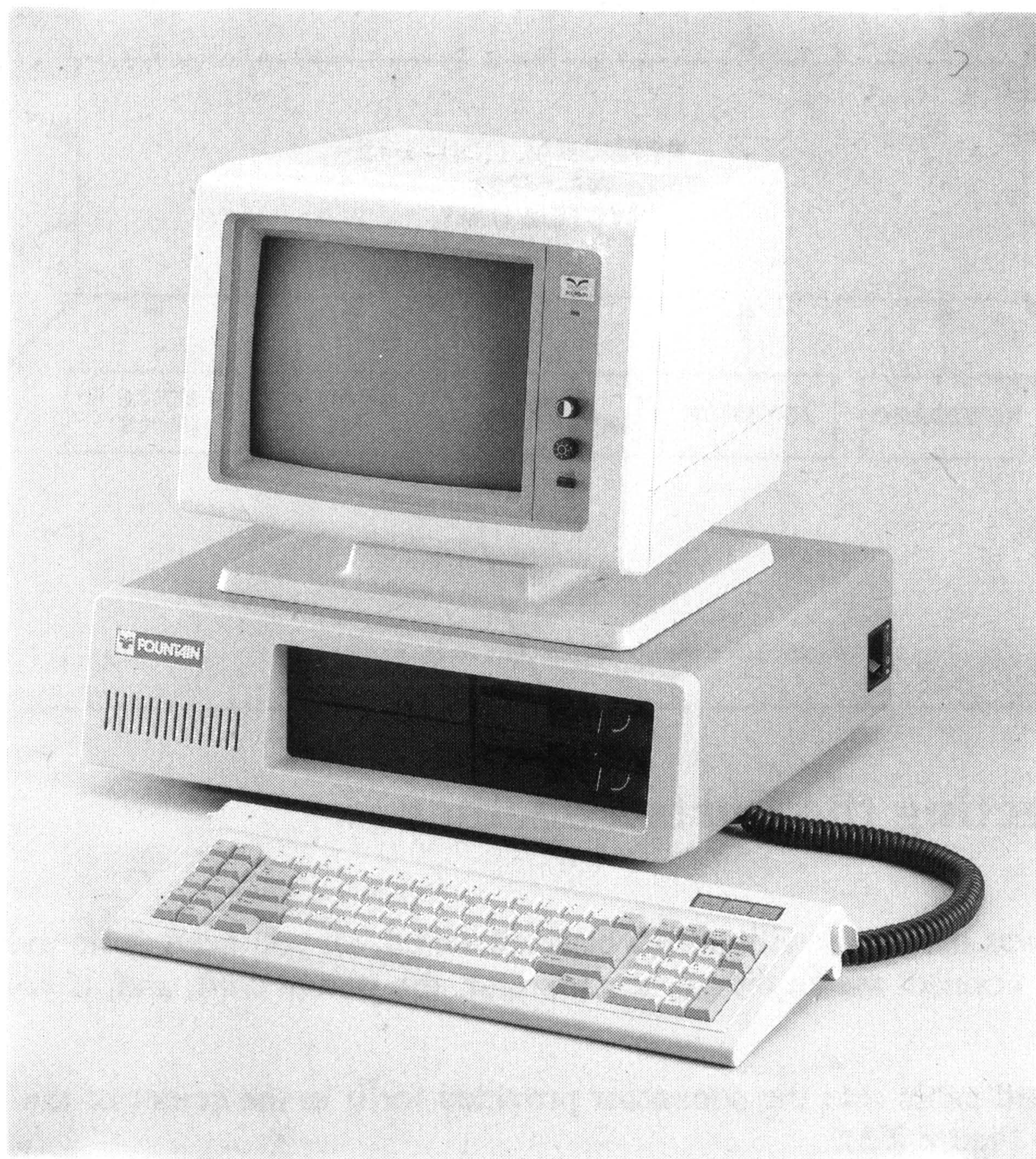


Figure 2.1: Fountain PC/XT Computer System

The block diagram below shows schematically the components of the system.

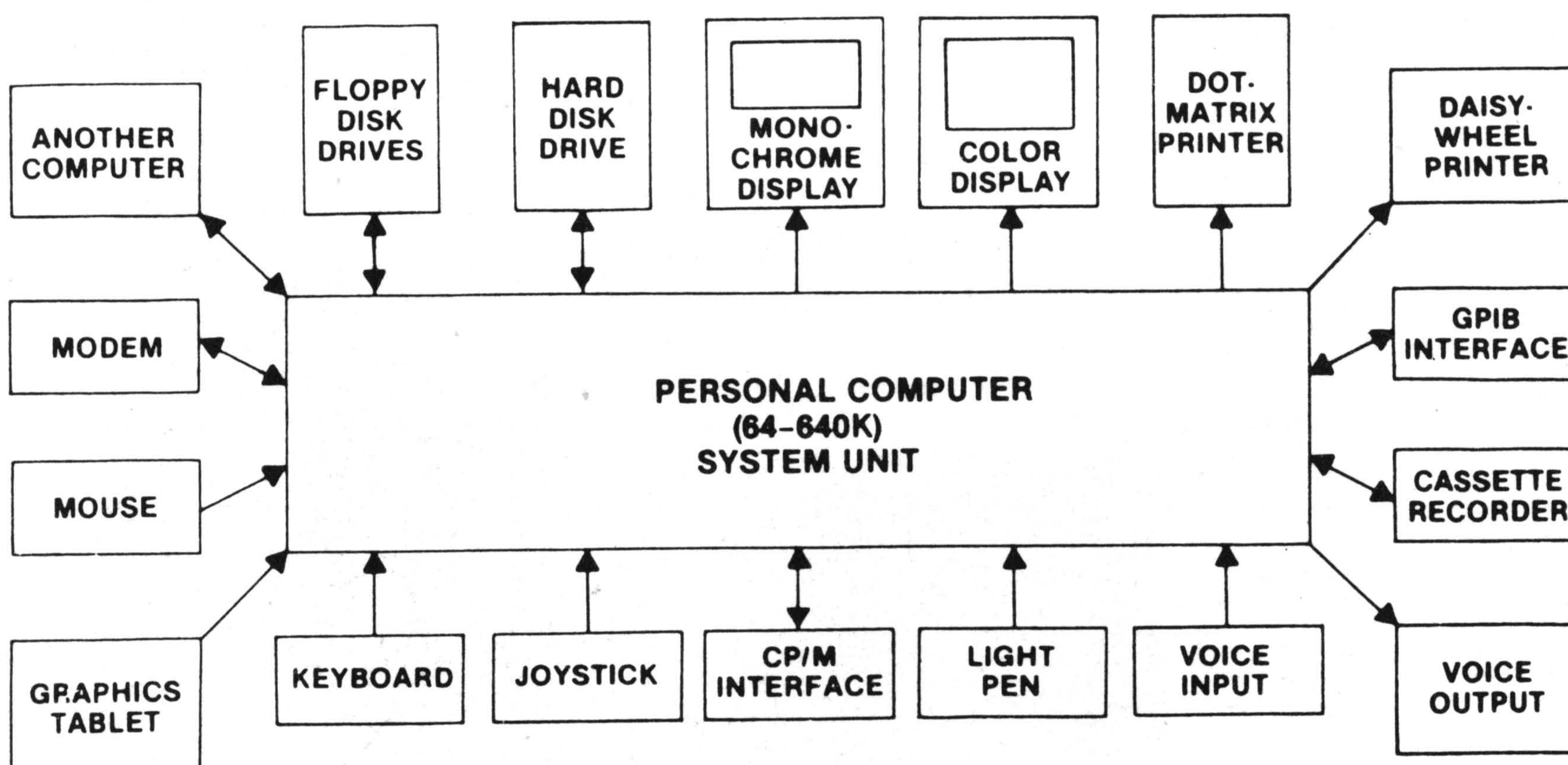


Figure 2.2: Computer System Shown Diagrammatically

2.1 Connecting the Parts Together

If your system was delivered with all the cards installed, all you need to do to begin using the system is to connect the keyboard, the monitor, the power cord, and, if you have one, the printer.

Plug the keyboard cable into the connector provided for it in the center of the back of the system unit (see Figure 2.3).

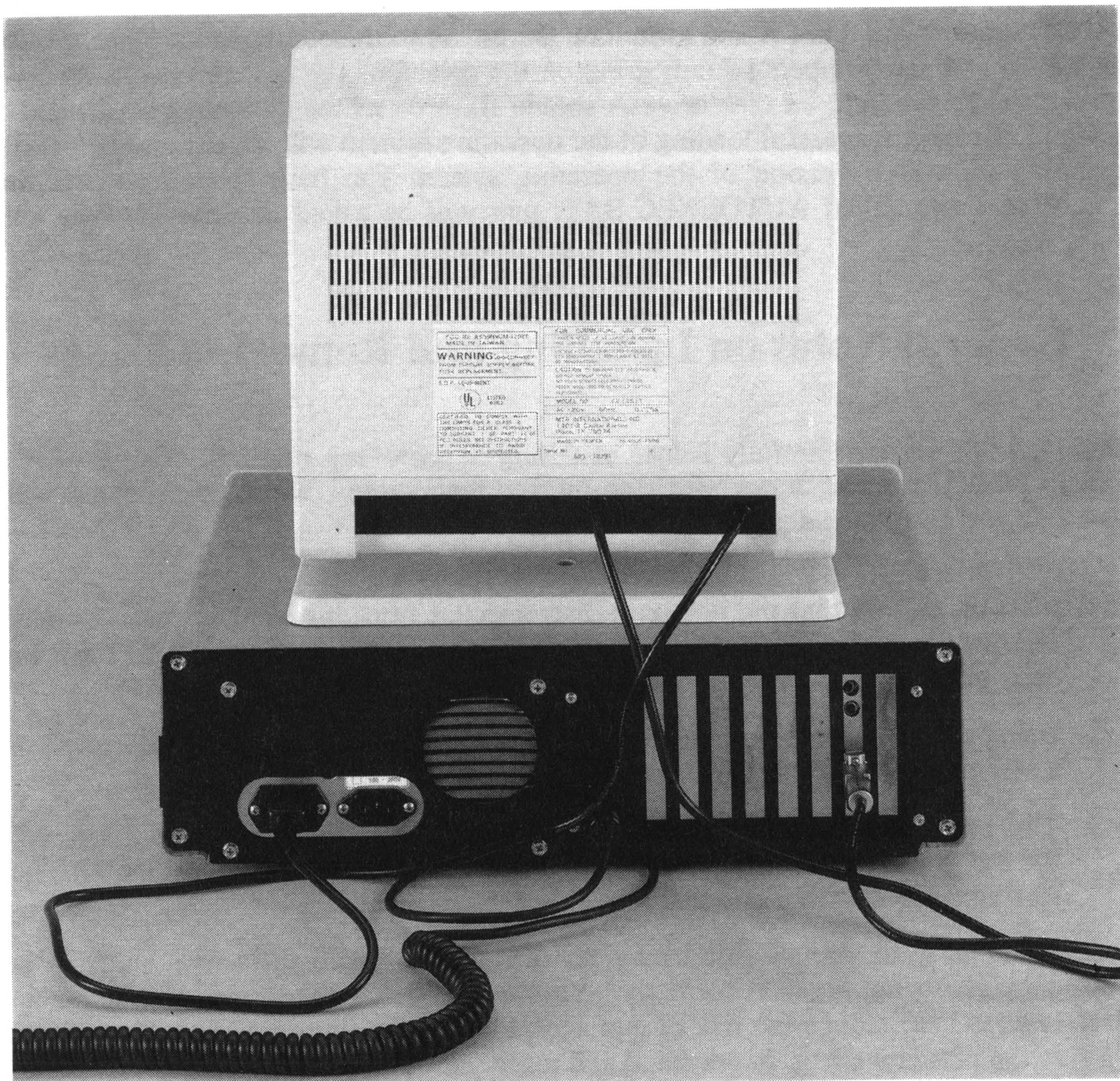


Figure 2.3: Rear View of Fountain System

Plug the video cable from your monitor into the matching 9-pin connector in the back of the system unit (located on the right in Figure 2.3). If you have a monochrome monitor, its power cord may be plugged into the power outlet on the opposite side of the system unit (on the left in Figure 2.3), but for a color monitor, you will need to connect its power cord directly to an outlet.

We recommend that you plug your computer components (system unit, printer, and color monitor) into the Fountain Surge Protector. This provides protection for your components, as well as the convenience of having a central switch to turn all the components on and off at the same time. After making sure the surge protector is turned off, plug it into an outlet and plug the components into it.

2.2 Checking out the System

Put a DOS diskette in drive A and switch on the power to the components. You should hear a beep and see numbers incrementing on the screen as the system checks its own memory. Then the light on disk drive A should flash on as the computer boots, and a message indicating successful loading of the operating system will appear on the screen. Depending on which version of the operating system you have loaded and on the presence of a file called AUTOEXEC.BAT, you will be asked to enter the date and time.

2.3 General Notes on Installing and Removing Cards

Please read this section carefully *before* installing or removing adapter cards from your Fountain PC/XT system. It contains step-by-step instructions, which, if followed, will insure safe and correct operation.

1. First make sure that the power is disconnected from the system; turn the main on/off switch to the off position and also disconnect the power cord from the back of the system unit (see Figure 2.3).
2. Using a Phillips screwdriver, remove the five retaining screws and store these in a safe place.
3. The expansion slot into which you will install your option card has a screw in the top bracket of the slot (see Figure 2.4). Remove this screw and the bracket, storing these also in a safe place.
4. Some of your option cards may be sensitive to static discharge and can be damaged if not handled correctly. Your option cards are wrapped in anti-static bags to help reduce the risk of damage. Pick up the option card, still contained in the protective bag, in one hand and place your other hand on any metal part of your Fountain system unit. This procedure will ground your option card and prevent any static damage to it.

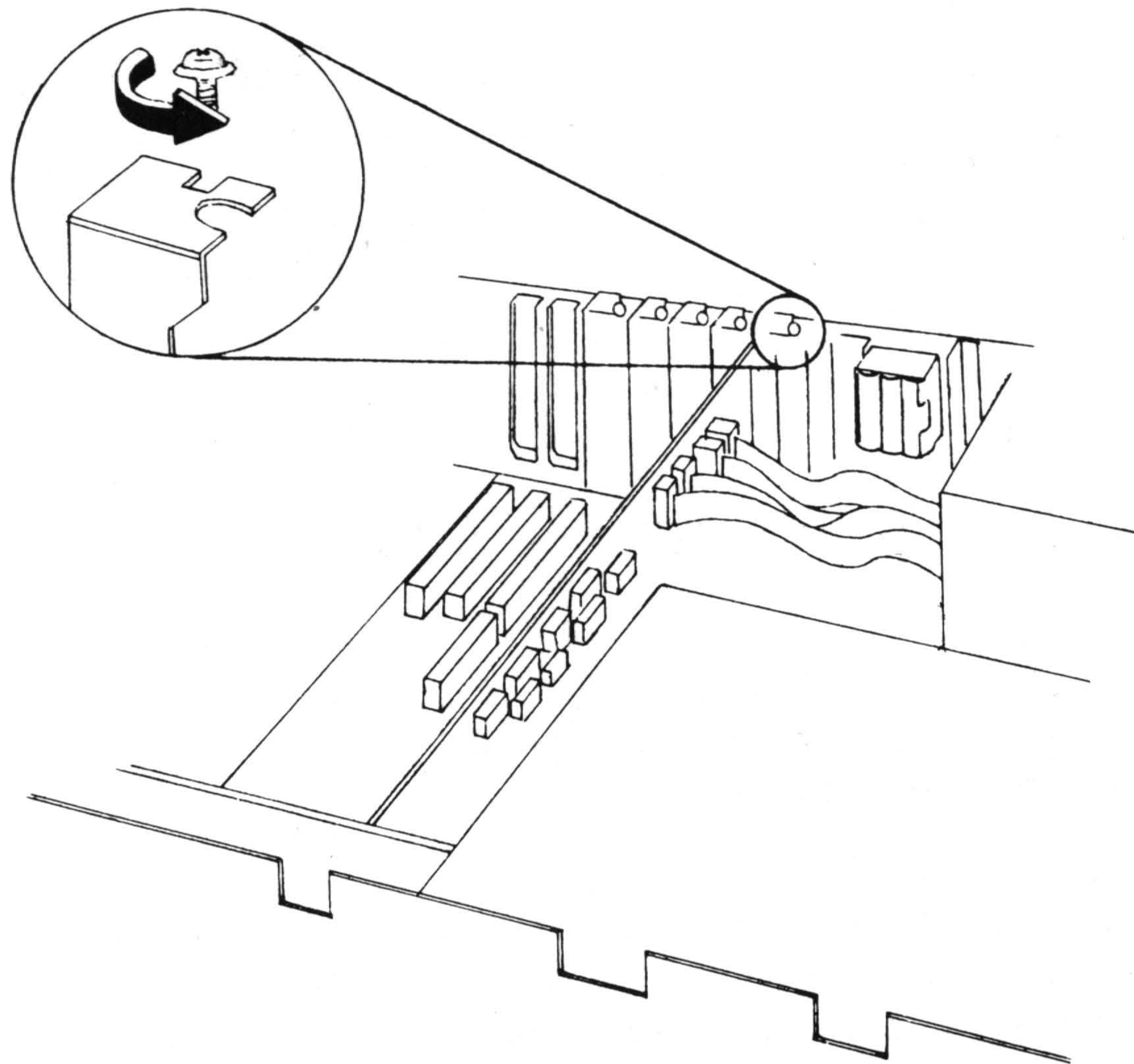


Figure 2.4: Removing Expansion Slot Screws

5. Now you can remove the option card from its protective bag. Hold your option card by the adapter brackets without touching any of the components or connections on the card. Always hold an option card by its top edge or upper corner when you are ready to insert it in an expansion slot.
6. Line up the edges of the memory card slide brackets with those in the expansion slots. Now gently push the card down into the expansion slots; Forcing the card into the slot may cause damage to the card. Your card should be level with the other installed cards in your system. Please re-install the card if it is not level with the other cards.
7. Now that you have installed your option card in the expansion slot you should replace the screw you previously removed from the top bracket of the expansion slot.

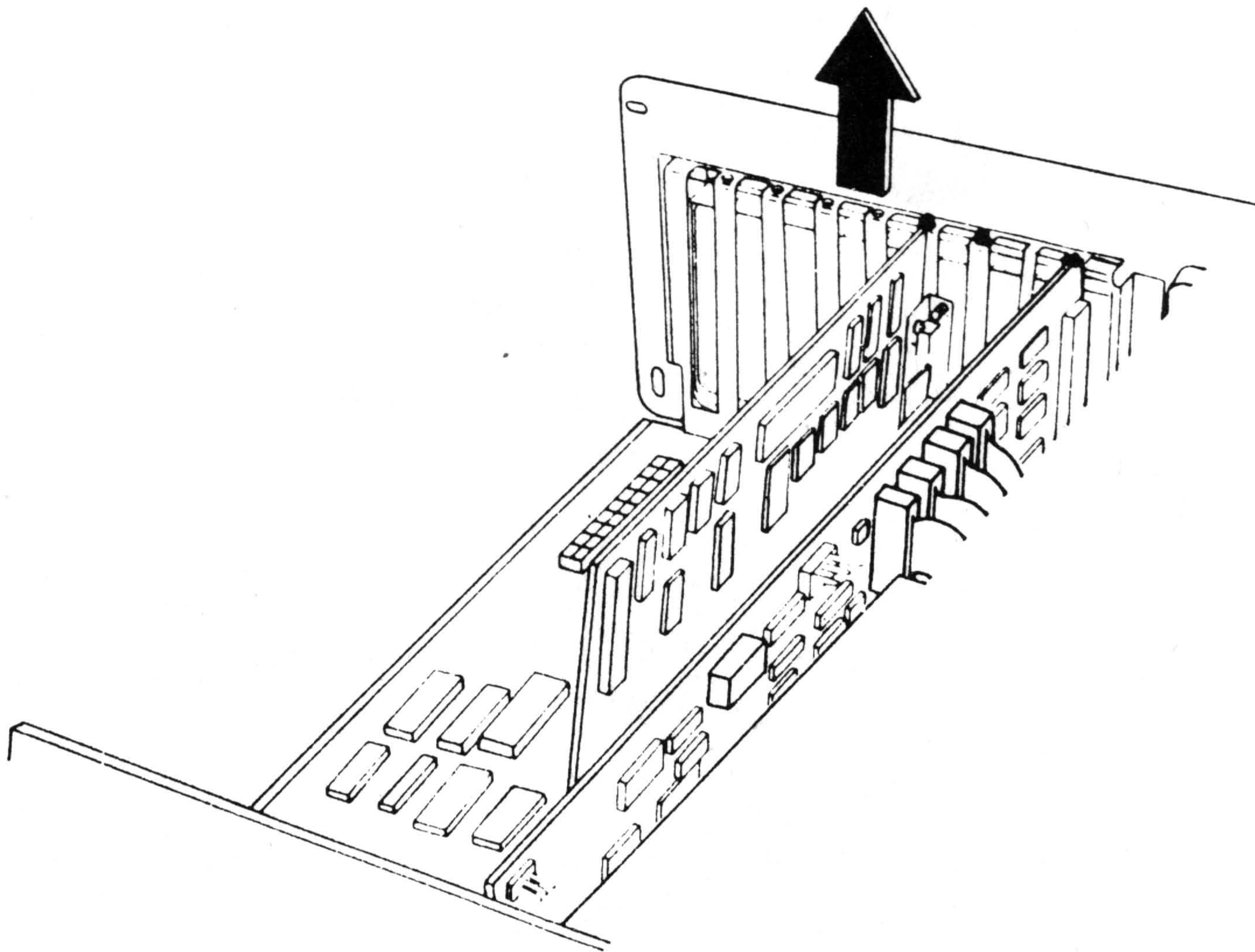


Figure 2.5: Inserting/Removing Card in Expansion Slot

Chapter 3

PC/XT System Board

3.1 System Board Description

The Fountain system board (see Figure 3.1) consists of three functional sub-units:

1. the processor sub-system and its support elements
2. the read/write (RAM) and read only (ROM) memory subsystems
3. the integrated I/O adapters

Each is described in this section.

3.1.1 The Processor Subsystem and Support Elements

The heart of the PC/XT system board is the Intel 8088 micro-processor. This processor is an 8-bit external bus (path over which information is transferred) version of Intel's 16-bit 8086 processor. The difference is the number of data lines used to transfer information to and from the processor unit (CPU). The 8088 processor is software-compatible with the 8086 and thus supports all 16-bit operations including multiplication and division. The processor is supported by a set of high-functional devices providing four DMA (Direct Memory Access) channels, each containing 20 separate pathways or address lines capable of accessing approximately one megabyte of storage locations, three 16-bit time-counters, and eight prioritized interrupt levels.

Three of the DMA channels are available on the I/O bus and support high speed data transfer between I/O devices and memory without processor intervention. The fourth channel is programmed to refresh the system dynamic memory (RAM). The three programmable time-counter channels are used by the system as follows. Channel 0 is used as a general purpose timer, providing a constant time-of-day clock. Channel 1 is used to time and request refresh cycles from the fourth DMA channel; this is done by programming channel 1 to request periodically a dummy DMA transfer that will in turn initiate a memory-read cycle which will refresh the dynamic storage on the system board and in the expansion system slots. Channel 2 is used to support tone generation for the audio speaker.

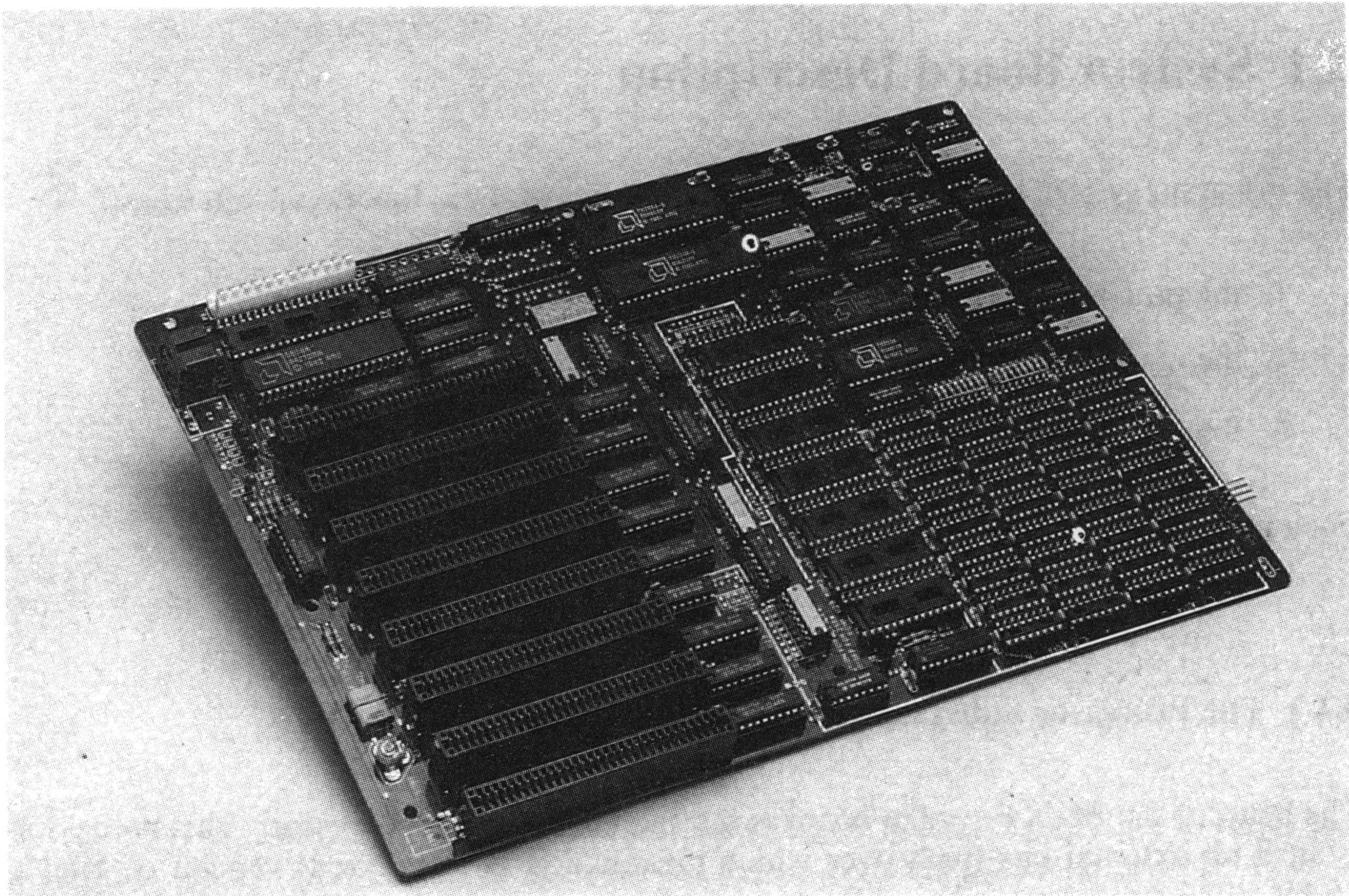


Figure 3.1: Fountain PC/XT System Board

The interrupt system has 8 prioritized levels. The first two levels are used on the system board itself. Level 0, the highest priority, is attached to channel 0 of the time-counter and provides a periodic interrupt for the time-of-day clock. Level 1 is attached to the keyboard adapter circuits and receives an interrupt for each scan code sent by the keyboard. The other six interrupts are bussed to the system expansion slots (I/O channels).

The processor operates at a 4.77 MHz. This frequency, which is derived from a 14.318 MHz crystal, is divided by 3 for the processor clock and by 4 to obtain the 3.58 MHz color burst signals for color television. At the 4.77 MHz rate, the 8088 bus cycles are four clocks of 210ns, or 840ns. All DMA data transfer (I/O) cycles take five 210ns

clocks, or 1.05ns if the processor ready line is not de-activated. Refresh DMA cycles take four clocks or 840ns. Each of the three time-count channels has a minimum timing resolution of 1.05ns, or five clocks. Refresh cycles occur once every 72 clocks (approximately 15ns) and require four clocks, or approximately 7% of the bandwidth.

The system board fits in the base of the system unit and is approximately 8 1/2 by 12 inches. It is a double sided printed circuit board. The DC power supply is attached to the board through two six-pin connectors. Other connectors on the board are for attaching the keyboard and speaker. Eight 62-pin card edge sockets are also mounted on the board. The I/O channel is bussed across these eight channels.

3.1.2 The Read/Write (RAM) and Read Only (ROM) Memory Subsystems

The system board also contains from 128K to 640K of r/w memory. A minimum system would have 128K of memory, or two rows of nine 64K RAM chips. The ninth chip in each row is used for parity checking; the non-maskable interrupt (NMI) of the 8088 is used to report memory parity errors. Two additional rows of module sockets for memory chips are included; the maximum system supported by DOS consists of two rows of 256K RAM chips and two rows of 64K RAM chips, for a system board maximum of 640K.

In addition, the system board has space for 128K x 8 of ROM or EPROM. This ROM contains the power-on self-test, Basic Input/Output Services (BIOS), diskette bootstrap loader, and dot patterns for 128 characters in graphics mode.

3.1.3 Integrated I/O Adapters and Channels

At the back of the system board and expansion board of the expansion chassis are several connectors that are soldered into place. These expansion slots are the extensions of the personnel computer bus and contain 62 connections which provide for use of a video monitor, a printer, a modem, additional memory, disk drives and other devices. The Fountain PC/XT system board contains 8 extension slots. Devices not part of the system board require use of an expansion slot and are called peripherals. The Fountain system board and its peripherals combine to form the hardware of the system.

The I/O channel is an extension of the 8088 microprocessor bus. It is, however, demultiplexed, repowered and enhanced by the addition of interrupts and direct memory access (DMA) functions.

The I/O channel contains an 8-bit bidirectional data bus, twenty address lines, six levels of interrupt, control lines for memory and I/O read/write, clock and timing lines, three channels of DMA control lines, channel check line, and power and grounds for the adapters. Four voltage levels are provided for I/O cards: +5 vdc, -5dc, +12 vdc, and -12dc. These functions are provided in a 62-pin connector with 100-mil tab spacing.

A ready line is available on the I/O channel to allow operation with slow I/O memory devices. If the channels ready line is not activated by an addressed device, all processor-generated memory read/write cycles take four 210ns clock or 840ns. I/O

devices are addressed using I/O mapped address spaces. The channel is designed so that 768 I/O device addresses are available to the I/O channels cards.

A channel line exists for reporting error conditions to the processor. Activating this line results in a non-maskable interrupt (NMI) to the 8088 processor. Memory expansion options use this line to report memory parity errors.

The I/O channel is repowered to provide sufficient drive to power all eight (J1-J8) expansion slots, assuming two low-power Schottky (LS) loads per slot. The I/O adapters typically use only one load.

3.2 I/O Channel Description

The following is a description of the Fountain PC/XT I/O Channel. All lines are TTL-compatible.

OSC O Oscillator High; speed clock with a 70-ns period (14.31818 MHz). It has a 50% duty cycle.

CLK O System Clock

It is a divide-by three of the oscillator and has a period of 210ns (4.77 MHz). The clock has a 33% duty cycle.

RESET DRV O This line is used to reset or initialize system logic upon power-up or during a low line voltage outage. This signal is synchronized to the falling edge of clock and is active high.

AO-A19 O Address Bits 0 to 19

These lines are used to address memory and I/O devices within the system. The 20 address lines allow access of up to 1 megabyte of memory. AO is the least significant bit (LSB) and A19 is the most significant bit (MSB). These lines are generated by either the processor or DMA controller. They are active high.

DO-D7 I/O Data Bits 0 to 7

These lines provide data bus bits 0 to 7 for the processor, memory, and I/O devices. DO is the least significant bit (LSB) and D7 is the most significant bit (MSB). These lines are active high.

ALE O ADDRESS Latch Enable

This line is provided by the 8288 Bus Controller and is used on the system board to latch valid addresses from the processor. It is available to the I/O channel as an indicator of a valid processor address (when used with AEN). Processor addresses are latched with the falling edge of ALE.

I/O CH CK-I I/O Channel Check

This line provides the processor with parity (error) information on memory or devices in the I/O channel. When this signal is active low, a parity error is indicated.

I/O CH RDY I I/O Channel Ready

This line, normally high (ready), is pulled low (not ready) by a memory or I/O device to lengthen I/O or memory cycles. It allows slower devices to attach to the I/O channel with a minimum of difficulty. Any slow device using this line should drive it low immediately upon detecting a valid address and a read or write command. This line should never be held low longer than 10 clock cycles. Machine cycles (I/O or memory) are extended by an integral number of CLK cycles (210ns).

IRQ2-IRQ7 I Interrupt Request 2 to 7

These lines are used to signal the processor that an I/O device requires attention. They are prioritized with IRQ2 as the highest priority and IRQ7 as the lowest. An interrupt Request is generated by raising an IRQ line (low to high) and holding it high until it is acknowledged by the processor (interrupt service routine).

IOR O I/O Read Command

This command line instructs an I/O device to drive its data onto the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

LOW O I/O Write command

This command line instructs an I/O device to read the data on the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

MEMR O Memory Read Command

This command line instructs the memory to drive its data onto the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

MEMW O Memory Write Command

This command line instructs the memory to store the data present on the data bus. It may be driven by processor or the DMA controller. This signal is active low.

DRQ-DRQ3 I DMA Request 1 to 3

These lines are asynchronous channel requests used by peripheral devices to gain DMA service. They are prioritized with DRQ3 being the lowest and DRQ1 being the highest. A request is generated by bringing a DRQ line to an active level (high). A DRQ line must be held high until the corresponding DACK line goes active.

DACKO-3 ODMA Acknowledge 0 to 3

DACK3 lines are used to acknowledge DMA requests (DRQ1-DRQ3) and to refresh system dynamic memory (DACKO). They are active low.

AEN O ADDRESS Enable

This line is used to de-gate the processor and other devices from the I/O channel to allow DMA transfers to take place. When this line is active (high), the DMA controller has control of the address bus, data bus, read command lines (memory and I/O), and the write command lines (memory and I/O).

T/C O Terminal Count

This line provides a pulse when the terminal count for any DMA channel is reached. This signal is active high.

CARD SLCTD I Card Selected

This line is activated by a card in expansion slot J8. It signals the system board that the card has been selected and that appropriate drivers on the system board should be directed to either read from, or write to expansion slot J8. Connectors J1 through J8 are tied together at this pin, but the system board should be driven by an open collector device.

The following voltages are available on the system-board I/O channel:

+5 Vdc +5%	located on 2 connector pins
-5 Vdc +10%	located on 1 connector pin
+12 Vdc +5%	located on 1 connector pin
-12 Vdc +10%	located on 1 connector pin
GND (Ground)	located on 3 connector pins

3.3 PC/XT System Board Switch Settings

A dual-in-line package (DIP) switch (one eightswitch pack) is mounted on the system board and can be read under program control (ROM). This dip switch is labeled SW1 and is located at position U20 (see Figure 3.1) . It provides the system software with information about the installed options, how much storage the system board has, what type of display adapter is installed, what type operation modes are desired when power is switched on (color or black-and-white, 80-character or 40-character lines) and the number of diskette drives attached.

The switch settings are as follows:

Position	Function
1	Normal operation off

2	Use for 8087 Coprocessor
3-4	Amount of memory on system board
5-6	Type of display adapter
7-8	Number of 5-1/4 inch drives

Switch (SW1):

1=OFF	(NORMAL OPERATION)
2=ON	W/O 8087 co-processor
2=OFF	W/ 8087 co-processor

Memory Switch Settings:

[256k type]

3=OFF 4=ON	128K MEMORY INSTALLED
3=ON 4=OFF	192K MEMORY INSTALLED
3=OFF 4=OFF	256K MEMORY INSTALLED

[640K Type]

3=OFF 4=ON	512K MEMORY INSTALLED
3=ON 4=OFF	576K MEMORY INSTALLED
3=OFF 4=OFF	640K MEMORY INSTALLED

Display Adapter Switch Settings:

5=ON 6=ON	No Display Adapter
5=OFF 6=ON	Color/Graphics (40x20 mode)
5=ON 6=OFF	Color/Graphics (80x25 mode)
5=OFF 6=OFF	Monochrome Display Adapter or both

Display Drive Switch Setting:

7=ON 8=ON	1 Drive Installed
7=OFF 8=ON	2 Drives Installed
7=ON 8=OFF	3 Drives Installed
7=OFF 8=OFF	4 Drives installed

3.4 Speaker Interface

The system unit has an 2 1/4 inch audio speaker. The speaker control circuit and driver are on the system board. The speaker connects through a 2-wire interface that attaches to a 3-pin connector on the system board.

The speaker drive circuit is capable of approximately 1/2 watt of power. The control circuits allow the speaker to be driven three different ways: 1) a direct program control register bit may be toggled to generate a pulse train; 2) the output from channel 2 of the time counter may be programmed to generate a waveform to the speaker; 3) the clock input to the timer counter can be modulated with a program controlled I/O register bit. All three methods may be performed simultaneously.

The sound system has a small, permanent-magnet, 2-1/4 inch speaker. The speaker can be driven from one or both of two sources:

- An 8255A-5 PPI output bit. The address and bit are bit defined in the "I/O Address Map".
- A timer clock channel, the output of which is programmable within the functions of the 8253-5 timer when using a 1.19-MHz clock input. The timer gate also is controlled by an 8255A-5 PPI output-port bit. Address and bit assignment are in the "I/O Address Map".

The speaker connection is a 4-pin Berg connector. See "System Board Component Diagram", earlier in this section, for speaker connector placement.

3.5 Technical Notes for Engineers

The Fountain XT system board will accept 4 different types of ROM/EPROM power supply pin 1. If using an IBM power supply, insert a jumper on JP1 from 1 to 2, otherwise connect JP1 from 2 to 3, which will provide a power reset circuit on board. The keyboard interface is a 5-pin DIN connector on the system board that extends through the rear panel of the system unit.

Trouble Shooting Points:

This section gives some hints to experienced engineers and technicians to test and bring up the XT system board.

System Clock 4.77 MHz at U1 (8284A) pins 8 and U3 (8088) pin 10, etc., With 33% duty cycle. If no system clock, check Y1(14.3118MHz) crystal, U1.

Power UP Reset When power is up U3 (8088) pin 21 should go HIGH then back to low again. If no power is up, please check jumper on JP1.

Memory Decoding Circuit

When power is up, the processor will start to execute the program through ROM 7 (BIOS & Self Test). The CS7 - line should see a train of low pulses to fetch instruction from the ROM 7. If no pulses on CS7 - on U23 (LS138 pin 7), check the memory decoding circuit and make sure the ROM/EPROM jumpers (W1-W12) are in the right position.

RAM Refresh The RAM is being refreshed using the timer chip U49 (8253-5 pin 13 OUT 1) to trigger the chip (8237A-5 DRQ, and the DMA chip will send out a dummy address to refresh the dynamic RAMs

(4164). If no periodic low pulses on RAM chip pin 4 (RAS-), check the TIME, DMA, and refreshing circuit.

R.T.C. Circuit

A square wave is generated through TIMER/COUNTER CHIP (8253-15U49) pin 10 (OUT 0), and then interrupts the processor through 8259A pin 17 (INT Signal) for the R.T.C. Timing.

Keyboard Circuit

The keyboard data input is through keyboard connector pin 2 and U22 (LS322) to convert the serial data to parallel and read by 8255A-5 (U37) port A. Interrupt 1 (ITQ 1) is used to inform the processor that a key has been pressed. If no keyboard response, check U52 (74LS74), U22 (LS322), and U37 (8255A-5).

NOTE: The system board will run with the IBM XT ROM set (32Kx8), but will not run with the IBM PC ROM set (8Kx8).

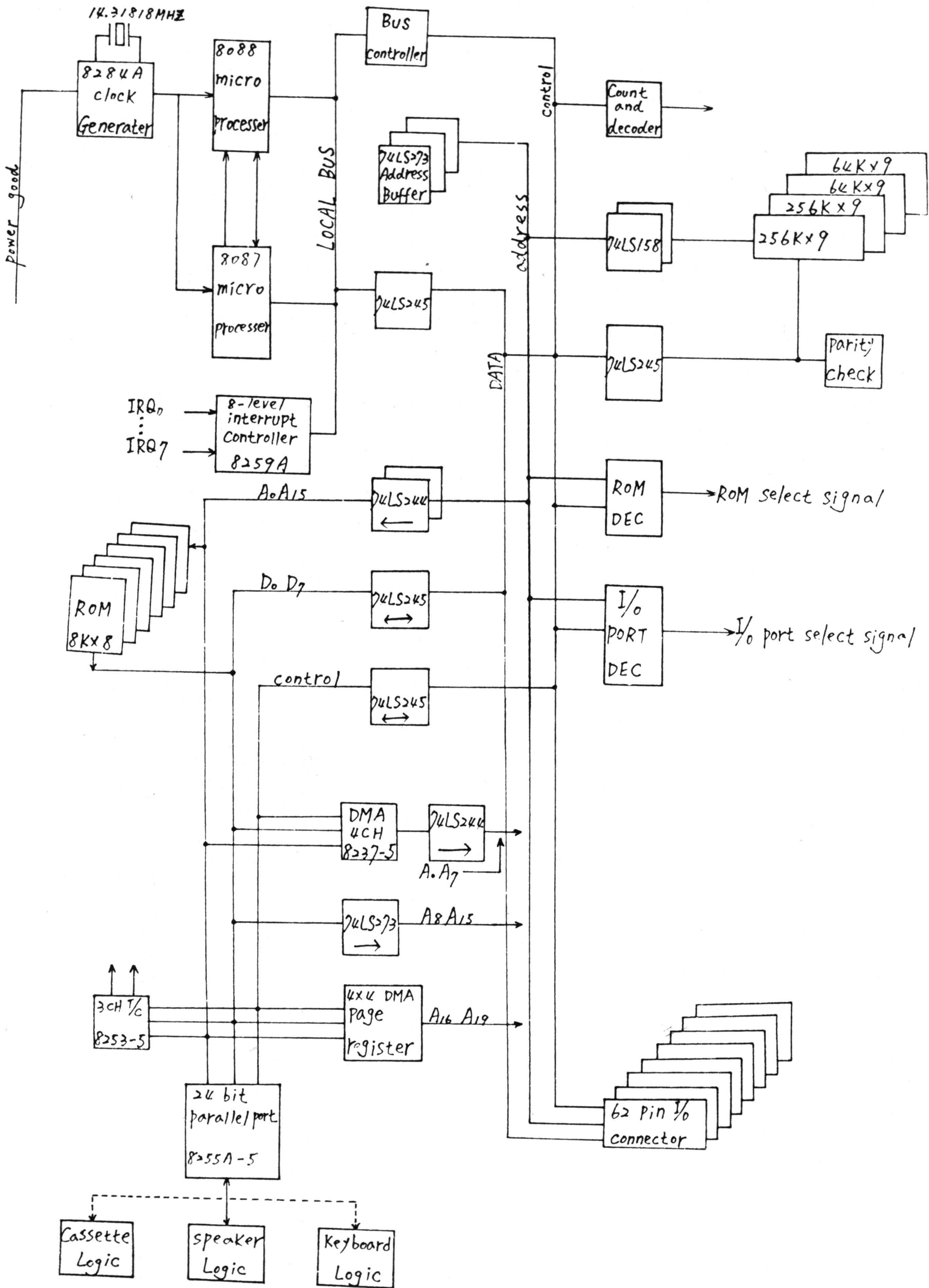


Figure 3.2: Block Diagram

Figure 3.3.1: System Board Circuit Diagram (1 of 6)

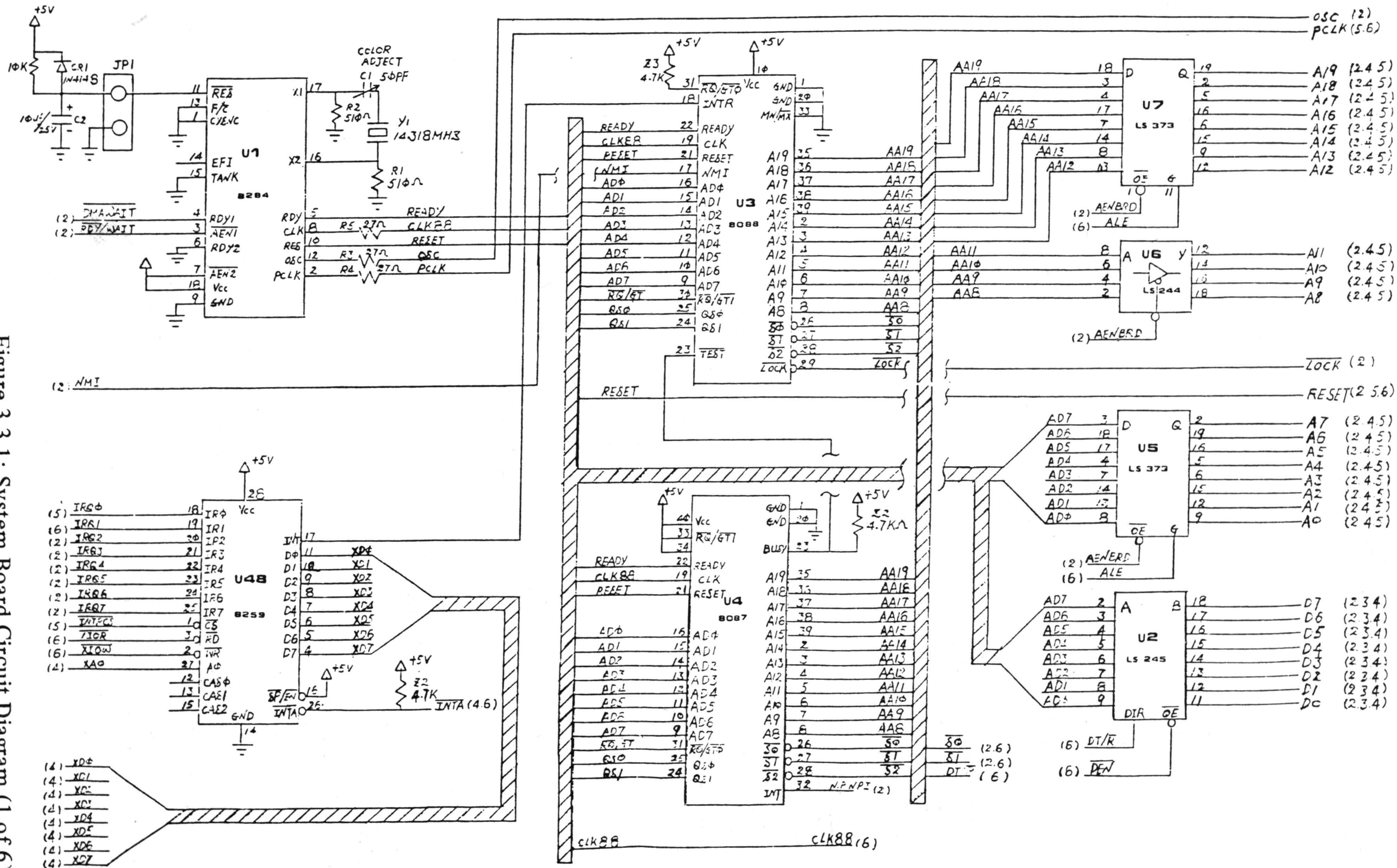


Figure 3.3.2: System Board Circuit Diagram (2 of 6)

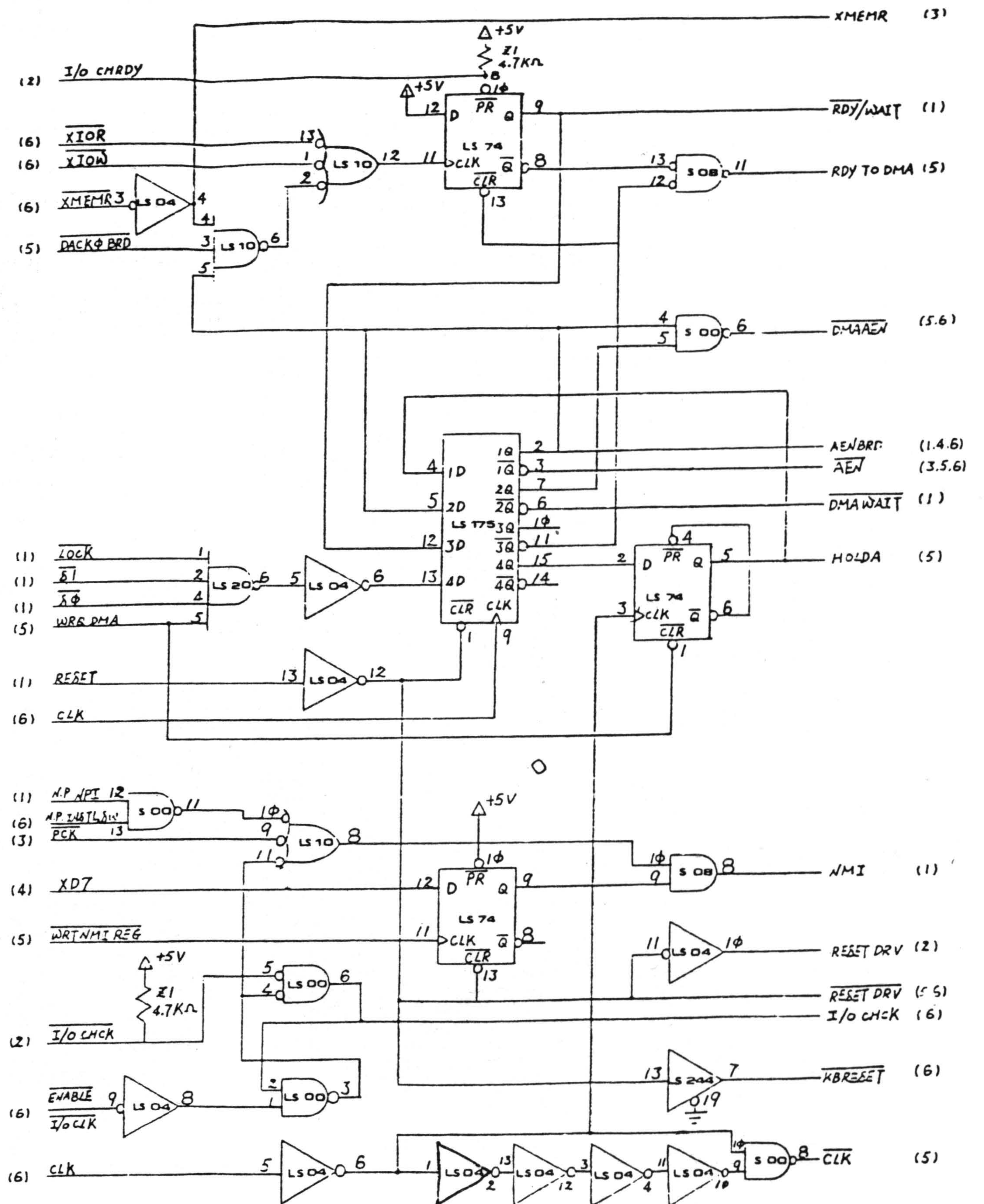
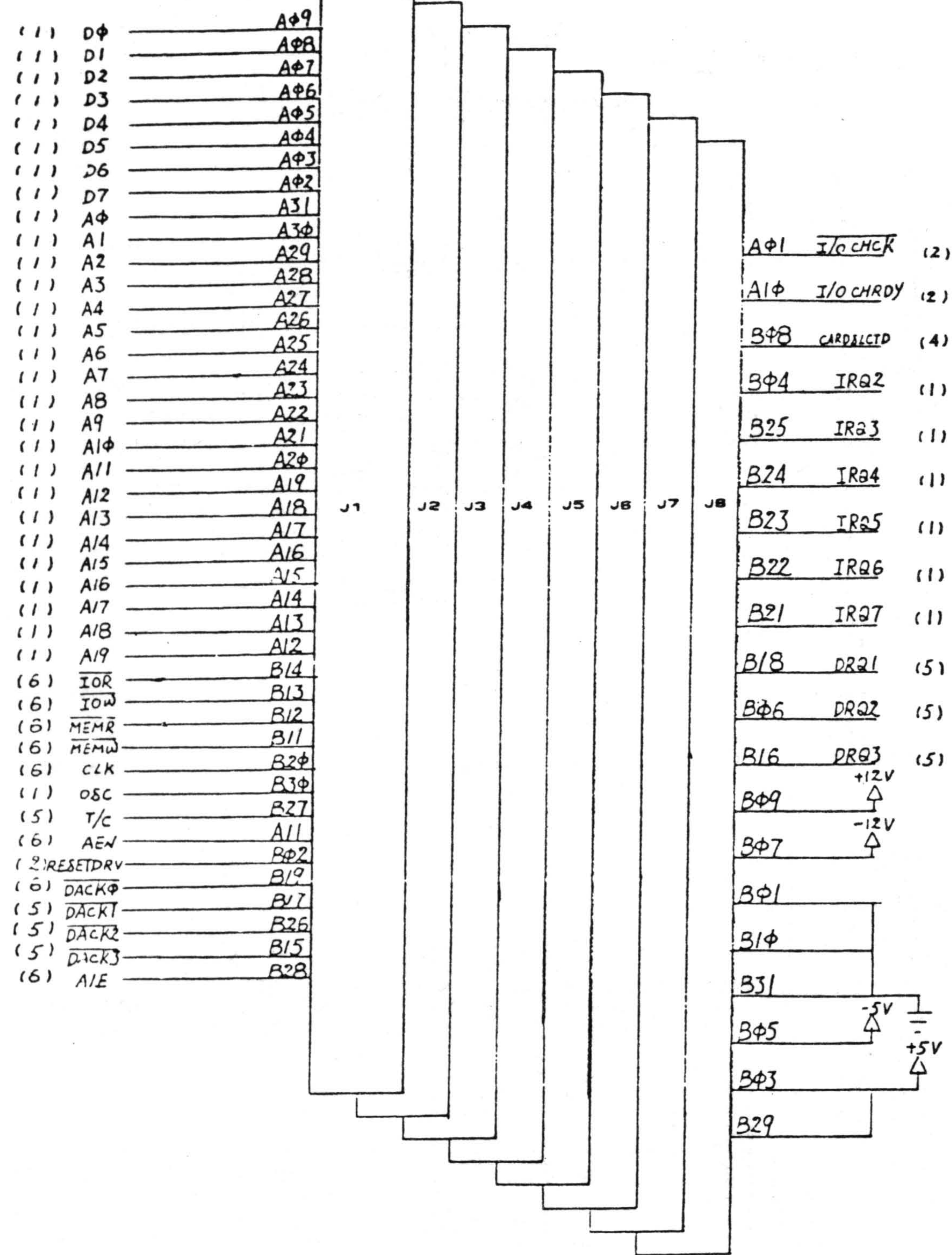


Figure 3.3.4: System Board Circuit Diagram (4 of 6)

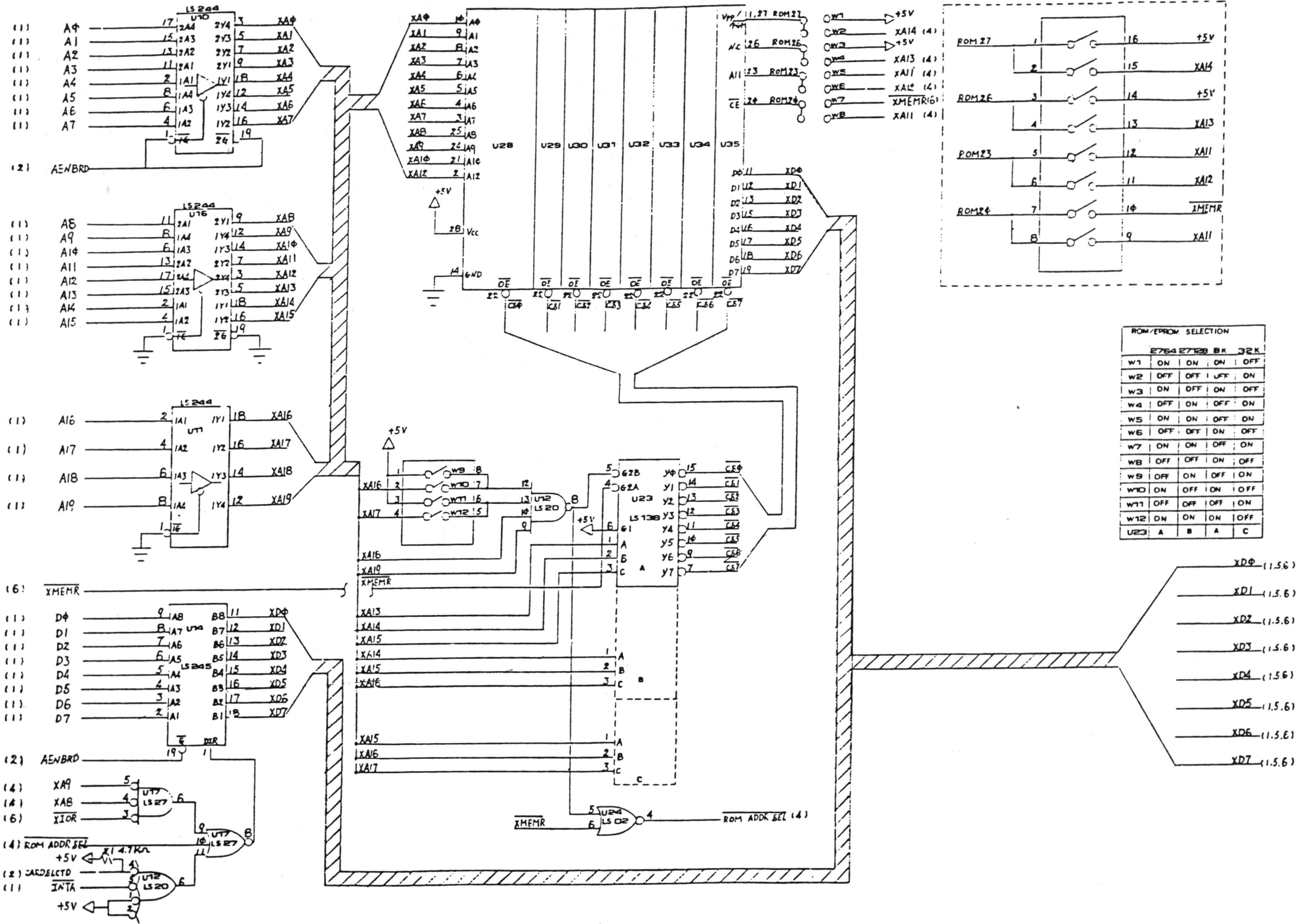
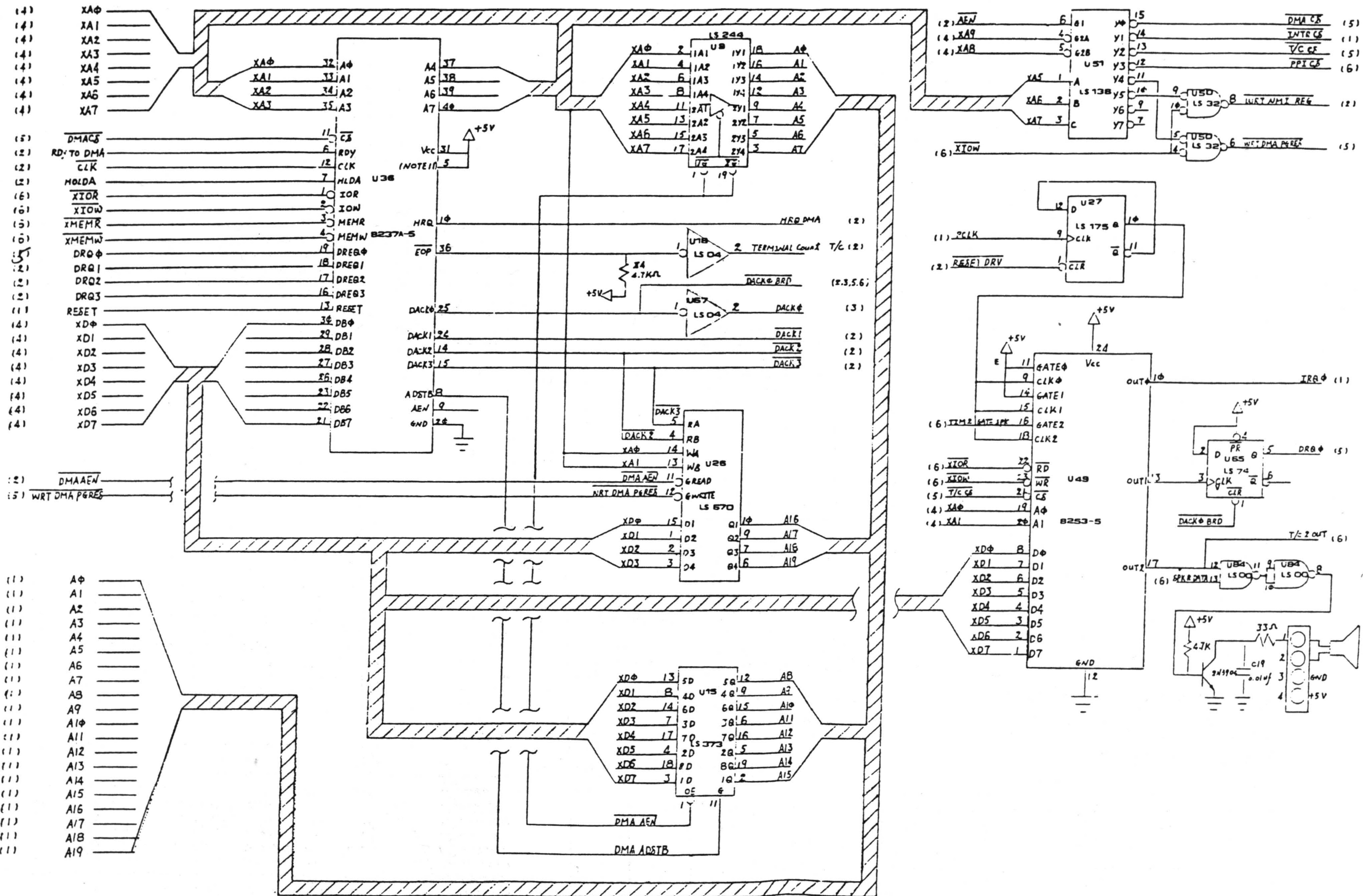


Figure 3.3.5: System Board Circuit Diagram (5 of 6)



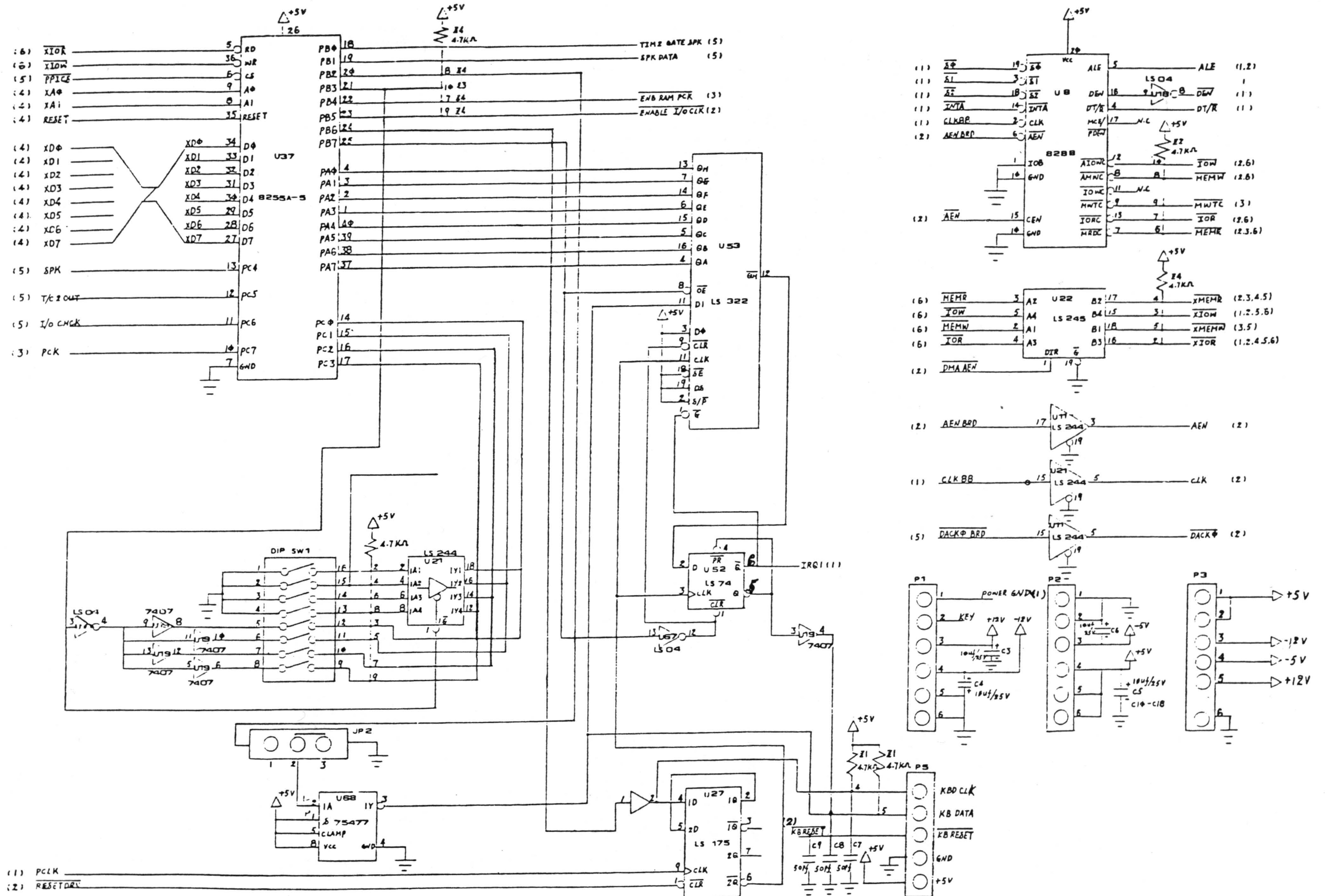


Figure 3.3.6: System Board Circuit Diagram (6 of 6)

Chapter 4

Keyboard

The Fountain PC/XT comes with an AT-style keyboard with such enhanced features as large, conveniently placed Enter, Shift, Control, and Tab keys, as well as indicator lights for Caps Lock, Num Lock, and Scroll Lock (see Figure 4.1 below). The keyboard contains a 8049 keyboard controller chip, which monitors the keys and reports to the ROM-BIOS whenever a key has been pressed or released. Every time a key is pressed or released, the keyboard circuits generate a scan code that uniquely identifies the keystroke. As we type, the keyboard doesn't know the meaning of the keystrokes; it merely reports the actions. It is the job of the ROM-BIOS keyboard routines to translate the key actions into information that programs can use. The keyboard communicates with the ROM-BIOS by way of ports and interrupts.



Figure 4.1: Fountain PC/XT Keyboard

4.1 The Main Keyboard

The main keyboard behaves much like a standard typewriter. All the letters are included, in the usual places; the numbers 0 through 9 are on the top row along with some special characters above them. The functions of the special keys are described below.

- ALT** This key is located to the left of the space bar on the bottom key row. Depending on the software, this key can be used in conjunction with other keys to enter particular keywords more quickly, instead of having to type in entire commands.
- SHIFT** Capital letters and the special characters shown above the numbers on the number keys are displayed by holding down either of the shift keys and pressing the desired key.
- CTRL** The Control key, like the Shift and Alt keys, does not generate a character itself, but rather, is always used with another key to perform a particular command or function. The system restart command is an example of a key function using both the Control and Alternate keys. If it is necessary to restart your computer system, it is faster to start the system warm instead of cold. A

cold start will use the system self-test when power is applied to the system unit, whereas with a warm start you are restarting the system without powering off. Simultaneously pressing the CTRL, ALT and DEL key will restart your system warm.

- ENTER** This key is similar to a carriage return. Each time pressed it moves the cursor to the start of a new line. The ENTER key is used mainly to instruct the computer to accept the instructions that have just been entered at the keyboard.
- BACKSPACE** This key can be used to erase mistakes by moving the cursor back one key position to the left. It deletes each time it is pressed.
- SPACEBAR** This key is used to move the cursor one position to the right. Each character that the cursor moves over is replaced by a blank space.
- CAPS LOCK** Once the CAPS LOCK is pressed a green light above the numeric keypad will indicate the CAPS LOCK mode has been activated. Pressing the key again returns the keyboard to its normal operating mode.

4.2 Cursor/Numeric Keypad

- NUM LOCK KEY** Pressing this key will alter the functions of the cursor control keys so they can be used as number keys. The keypad becomes similar to a small calculator; this can help save you time when inputting many numbers. Pressing NUM LOCK again returns the keypad to its normal cursor control mode. The NUM LOCK led indicator will light when the keyboard is in numeric keypad state.
- CURSOR-UP** Moves the cursor up one line.
- CURSOR-DOWN** Moves the cursor down one line.
- CURSOR-LEFT** Moves the cursor one position left. If the cursor advances beyond the left edge of the screen, it will move to the right side of the screen on the proceeding line.
- CURSOR-RIGHT** Moves the cursor one position right. If the cursor advances beyond the right edge of the screen, it will move to the left side of the proceeding line.
- HOME** Moves the cursor to the top of the logical screen. When you press both CTRL and HOME keys, the screen is cleared and the cursor is positioned in the upper left hand of the screen.
- END** Moves the key to the end of the logical line. When you press both the CTRL and END keys, the logical line is erased starting from the current cursor position.

ESC KEY	This key is used to cancel or escape from a command or function that you do not wish to use. Its functions are defined in your operating system or applications program manual.
INS	Toggles between insert and overwrite modes. When insert mode is on, characters at and following the cursor position are pushed over as characters are typed.
DEL	Deletes the character at the current position. All characters to the right of the deleted characters are moved one position to the left to fill in the deleted previous space.
PG UP	The PG UP key will change the current work page to the previous page each time it is pressed.
PG DN	The PG DN key will change the current work page to the next page each time it is pressed.
SCROLL LOCK	This key allows scrolling up or down of text on the screen. When you press this key, the SCROLL LOCK led light will be lit. Pressing again releases from SCROLL LOCK mode.
PRT SC *	Pressing this key and SHIFT will cause anything that is currently displayed on your screen to be printed. Pressing this key alone will cause an asterisk (*) to be displayed on the screen.

4.3 Function Keypad

The function keypad, located on the left side of the keyboard, is designed to relieve you of repetitive entry of typed commands and control functions; depending on the software, a single key entry can replace many keystrokes. For example, DOS responds to the F3 key by repeating the last command; many programs treat F10 as a request-for-help key.

Chapter 5

Diskette Drive Adapter

5.1 Introduction

The Fountain 5 1/4 inch diskette drive adapter fits into one of the expansion slots in the system unit of IBM PC, XT or any PC compatible. It is fully compatible with IBM 5 1/4 inch diskette drive adapter and attaches to one or two diskette drives through a daisy-chained flat cable that connects to one end of the drive adapter. The adapter has a connector at the other end for external diskette drives; thus it can attach four 5 1/4 inch drives -- two internal and two external.

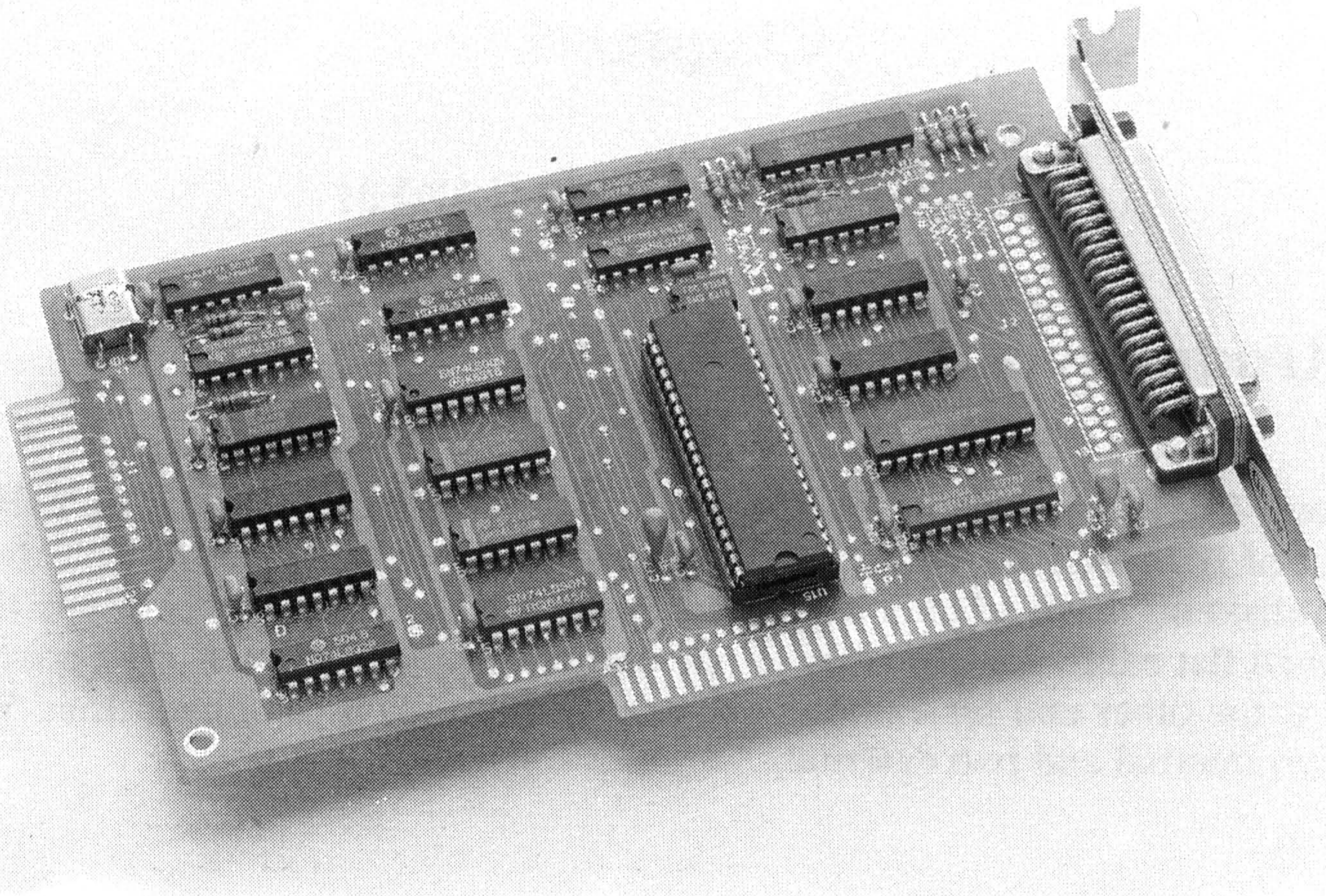


Figure 5.1: Fountain Diskette Drive Adapter

The Fountain diskette drive adapter is designed for double-density, MFM-Coded diskette drives, using a NEC uPD765-compatible controller and WD9216 data separator for clock and data recovery. In addition, the adapter supports write compensation and write protect features. It is buffered on the I/O bus and uses the system board's direct memory access (DMA) for record data transfer. An interrupt level is also used to indicate when an operation is complete and a status condition requires processor attention.

In general, the 5 1/4 inch diskette drive adapter presents a high-level command interface to software I/O drivers. A functional block diagram is on Figure 5.1.

5.2 Functional Description

From a programming point of view, this attachment consists of an 8-bit digital-output register in parallel with an NEC uPD765 or equivalent floppy disk controller (FDC).

In the following description, drive numbers 0, 1, 2, and 3 are equivalent to drives A, B, C, and D.

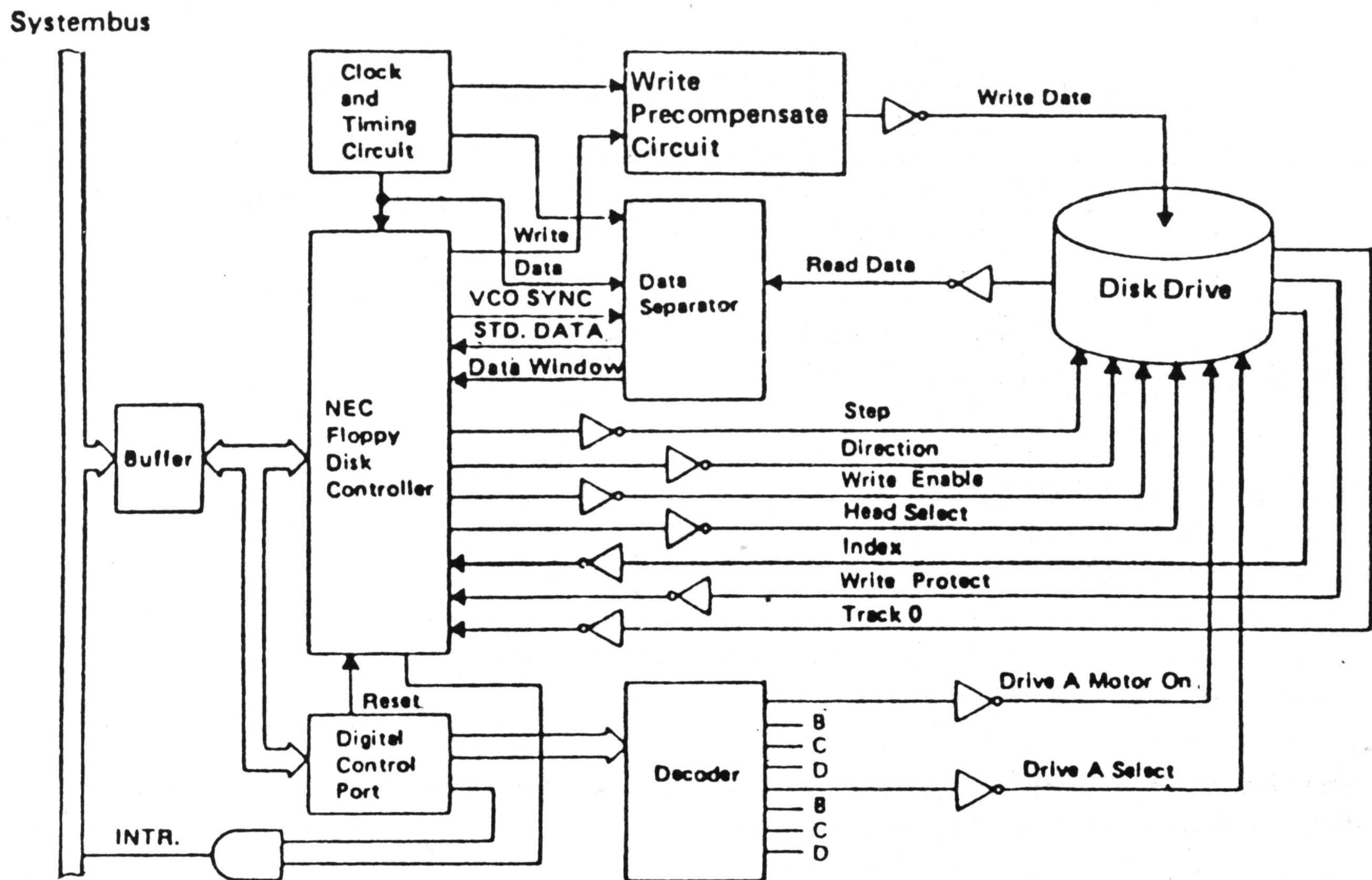


Figure 5.2: 5 1/4 Inch Diskette Drive Adapter Block Diagram

5.2.1 Digital-Output Register

The digital-output register (DOR) I/O Address Hex 3F2, is an output-only register used to control drive motors, drive selection, and feature enable. All bits are cleared by the I/O interface reset-line. The bits have the following functions:

Bits 0 and 1 These bits are decoded by the hardware to select one drive if its motor is on:

Bit	1 0	Drive
-----	-----	-------

0 0	0 (A)
0 1	1 (B)
1 0	2 (C)
1 1	3 (D)

- Bit 2** The FDC is held reset when this bit is clear. It must be set by the program to enable the FDC.
- Bit 3** This bit allows the FDC interrupt and DMA requests to be gated onto the I/O interface. If this bit is cleared, the interrupt and DMA request I/O interface drivers are disabled.
- Bits 4, 5, 6, and 7** These bits control respectively the motors of drives 0, 1, 2, and 3 (A, B, C, D). If a bit is clear, the associated motor is off, and the drive cannot be selected.

5.2.2 Floppy Disk Controller

The floppy disk controller (FDC) contains two registers that may be accessed by the main system processor: a status register and a data register. The 8-bit main status register contains the status information of the FDC and may be accessed at any time. The 8-bit data register (actually consisting of several registers in a stack with only one register presented to the data bus at a time) stores data, commands, and parameters, and provides floppy disk drive (FDD) status information. Data bytes are read from or written to the data register in order to program or obtain results after a particular command. The main status register may only be read and is used to facilitate the transfer of data between the processor and FDC.

The FDC is capable of performing 15 different commands. Each command is initiated by a multi-byte transfer from the processor, and the result after execution of the command may also be a multi-byte transfer back to the processor. Because of this multi-byte interchange of information between the FDC and the processor, it is convenient to consider each command as consisting of three phases:

- Command Phase** The FDC receives all information required to perform a particular operation from the processor.
- Execution Phase** The FDC performs the operation it was instructed to do.
- Result Phase** After completion of the operation, status and other housekeeping information is made available to the processor. For detailed information, refer to manufacturer-supplied data sheet.

5.2.3 Programming Summary

FDC Data Register	I/O Address Hex 3F5
FDC Main Status Register	I/O Address Hex 3F4
Digital Output Register	I/O Address Hex 3F2

Bit 0 Drive	00: Dr#A	10: DR#C
1 Select	01: DR3B	11: DR#D
2 Not FDC Reset		
3 Enable INT & DMA Requests		
4 Drive A Motor Enable		
5 Drive B Motor Enable		
6 Drive C Motor Enable		
7 Drive D Motor Enable		

All bits cleared with channel reset.

Chapter 6

Monochrome Video System

6.1 Introduction

The Fountain Monochrome display and parallel printer interface (see Figure 6.1 below) is designed for IBM PC, PC/XT, or IBM-compatible PC, to provide monochrome display and parallel printer function. Its features are listed below:

Monochrome display interface:

- Using MC6845 CRT Controller.
- 80x25 display.
- 9x14 character shell.
- 7x9 character.
- Attributes supported: Normal, Reverse, Blinking, Intensify, Underline.
- Direct drive output.
- 18.432 KHz monitor.
- 350x720 lines of resolution.

Parallel printer interface:

- Standard parallel interface.
- Maximum 1,000 cps data transfer rate.

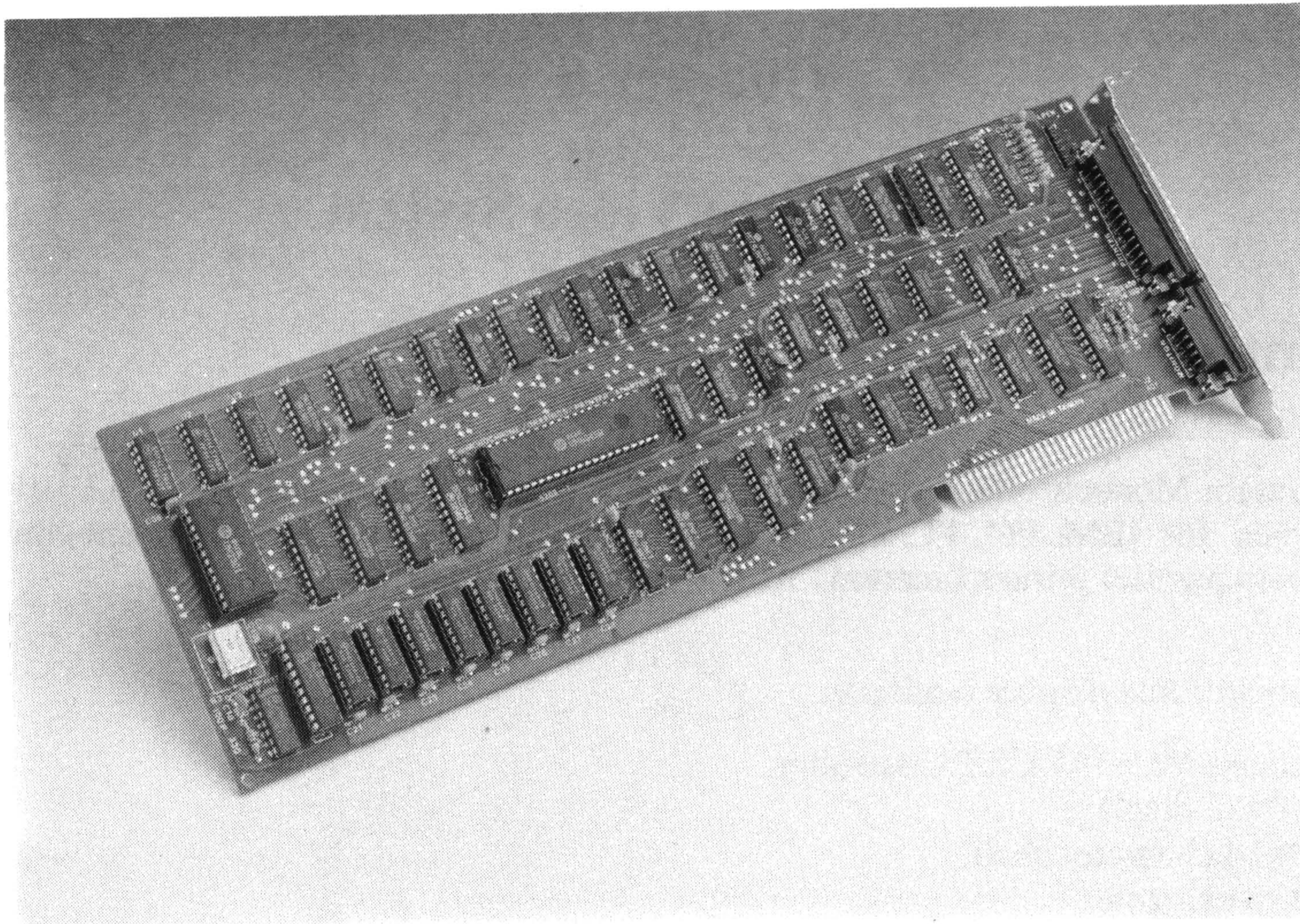


Figure 6.1: Fountain Monochrome Display/Parallel Printer Adapter

6.2 Installing the Monochrome Display Adapter

Refer to the Section 2.3, General Notes on Installing and Removing Cards, before performing the steps below.

This option card should be installed in expansion slot number one (1). If this expansion slot is being used, then the card can be installed in any available expansion slot. Please note that expansion slot number one usually does not have an expansion slot cover.

Set the switches on the system board. **WARNING:** Before you change any switch settings, record how the switchers are presently set.

- a. There are two switch blocks on the system board, marked SW1 and SW2. There are eight positions, marked 1, 2, 3, 4, 5, 6, 7, 8, on each switch block. In addition, there is an on/off indicator on the side. If you press a switch position down to "off" side, the status of that switch position is "off". On the other hand, if you press a switch position down to "on" side, the status of that switch position is "on".

- b. Find the switch block 1 (SW1), and look at switch positions 5 and 6 (we are interested on those two positions only).
- c. Set the switches to their proper position according the following table.

SWITCH BLOCK 1		
	Position 5	Position 6
Monochrome Display	OFF	OFF

Close the system unit:

- a. Put the top cover of the system unit back on its tracks.
- b. Slide the cover toward the rear of the unit until it is back in place. Take care that it does not catch on the ribbon cable.
- c. Refasten the cover screws which you removed.

Interface to the external devices:

- a. Plug the monochrome monitor to the D-Shell 9 pin connector.
- b. Plug the parallel printer to the D-Shell 25 pin connector.

Power up the system:

- a. Place a copy of your normal PC-DOS system diskette in drive A.
- b. Power up the system in the normal sequence.
- c. Does the system come up in the normal manner with system prompt?

YES: YOU SUCCEEDED.

NO : CHECK:-

- Appropriate switches (power, CRT) on.
- Recabling of system correct (display, power).
- Appropriate diskette installed in diskette drive.

If this step cannot be successfully completed, do not continue!

- d. If further troubleshooting is required, remove power from the system board. If the system still does not operate, remove the interface card and see if the system is back to normal. This will isolate the problem to the adapter or other peripherals.
- e. Press Ctrl-P then type DOS command Dir <return> and see if the printer will print all the data as the screen display. If not, check the printer power or cable connection, or go to step d.

WARNING:

Always remove power from any piece of equipment in your computer system before modifying it.

6.2.1 I/O Register Definition

4.1 MC6845 Index Register
I/O port address: 3B4H

4.2 MC6845 Data Register
I/O port address: 3B5H

4.3 CRT control port
I/O port address: 3B8H
Bit 0: High resolution mode
Bit 1: Not used
Bit 2: Not used
Bit 3: Video enable
Bit 4: Not used
Bit 5: Blink enable
Bit 6: Not used
Bit 7: Not used

NOTE:

The first command issued to this interface card must be to output a 01 (HEX) to this port; otherwise, this card will not function properly.

4.4 CRT Status port
I/O Port address; 3BAH
Bit 0: Horizontal drive
Bit 1: Not used
Bit 2: Not used
Bit 3: B/W video

4.5 Parallel data port
I/O port address 3BCH

4.6 Printer status port
I/O port address: 3BDH
Bit 0: Not used
Bit 1: Not used
Bit 2: Not used

- Bit 3: Error (pin 15)
- Bit 4: Select (pin 15)
- Bit 5: Paper End (pin 12) 13
- Bit 6: Acknowledge (pin 10)
- Bit 7: Busy (pin 11)

4.7 Printer control port

- I/O port address 3BEH
- Bit 0: Strobe (pin 1)
- Bit 1: Autofeed (pin 14)
- Bit 2: Initialize (pin 16)

6.3 Monochrome Monitor

Designed for use with the advanced IBM personal computer system, this high performance data display monitor (see Figure 6.2 below) features an anti-reflective viewing screen, computer matched styling, and high resolution data display. With 5 x 7 dot characters as the input, monitor resolution and computer compatible scanning provide a display capability of up to 24 lines of characters with 80 characters per line. Data displayed on Model EV-1251T is crisp green or amber on black. For maximum long-term viewing comfort, Model EV-125T features crisp green or amber on black data display. Convenient up-front controls permit easy adjustment of display brightness and contrast. TTL signal input is 4.0 volt p-p video, intensity, Horizontal, Vertical (from IBM PC)



Figure 6.2: Fountain Monochrome Monitor

FEATURES

- * Anti-reflective, 75 square inch viewing screen
- * High resolution data display
- * Computer compatible 80 character x 24 line display format
- * Attractive, IBM personal computer matched styling
- * Convenient, up-front display brightness control
- * Easy care plastic cabinet with swivel and tilt base.

* LED power indicator

CAUTION

(1) Do not install this monitor in an excessively hot location, or in any way obstruct the ventilation holes located on the bottom and rear of the cabinet. Premature component failure or damage to the cabinet may result.

(2) When this monitor is not to be used for several days, it is advisable to disconnect the AC power cord from the utility outlet.

(3) Some common household aerosol sprays, cleaning agents, solvents or polishes may cause damage to the cabinet finish. Best results for cleaning are obtained with mild soap and water, and a soft cloth for drying. Do not expose this monitor to moisture.

IDENTIFICATION AND OPERATION OF CONTROLS

- | | |
|------------------------|--------------------------|
| 1. Power On-Off Switch | 4. Led Power Indicator |
| 2. Brightness Control | 5. Video Input Connector |
| 3. Contrast Control | 6. AC Power Cord |

AC POWER CORD

Connect POWER CORD to utility outlet supply power with 120 VAC, 60Hz.

POWER ON-OFF SWITCH

This push switch provides power on-off control. Push side for power "ON", opposite side for power "OFF".

LED POWER INDICATOR

Illuminates to indicate that power is "ON".

BRIGHTNESS CONTROL

This control permits adjustment of overall picture brightness and is used to compensate for differences in room lighting.

CONTRAST CONTROL

This control permits adjustment of the contrast between the white/green and black portions of the data display.

VIDEO INPUT CONNECTORS

9-pin "D" shell connectors

Pin assignment:

- | | |
|--------------|---------------|
| 1. Shield | 7. Video |
| 2. Ground | 8. Horizontal |
| 3. 4.5. NC | 9. Vertical |
| 6. Intensity | |

INSTALLATION

- (1) Pick a convenient location for your new data display monitor but take care to observe the important information in the section titled "CAUTION", above.
- (2) The power cord should be connected to a utility outlet supplying 120VAC, 60Hz.
- (3) Use a 9 pin "D" shell connector (including cable) with a male connector at one end and the IBM personal computer matching a female connector at the other.

OPERATION

1. Install the EV-1251T as outlined in the section titled "INSTALLATION". Be sure that a TTL signal 4.0 volt p-p (IBM PC) is applied to the monitor's VIDEO INPUT.
2. To turn the monitor on, press the ON-OFF SWITCH. The LED power indicator should light up.
3. After approximately 30 seconds, a display will appear on the monitor screen.
4. Adjust the brightness and contrast controls to obtain optimum display quality.
5. The monitor should now be displaying bright, clear data. This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna - Relocate the computer with respect to the receiver - Move the computer away from the receiver - Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio/TV Interference Problems"

This booklet is available from the U.S. government Printing Office Washington, D.C. 20402 Stock NO. 004-000-00345-4

Chapter 7

Color Video System

7.1 Introduction:

The Fountain Color Graphics/Printer Adapter is designed to attach to the IBM Color Display, or any other IBM compatible personal computer. The adapter is capable of operating in black and white, or in color. It also includes one printer port and thereby eliminates the need for a separate printer adapter. The adapter provides three interfaces: an RGB port, a printer port, and a light-pen interface.

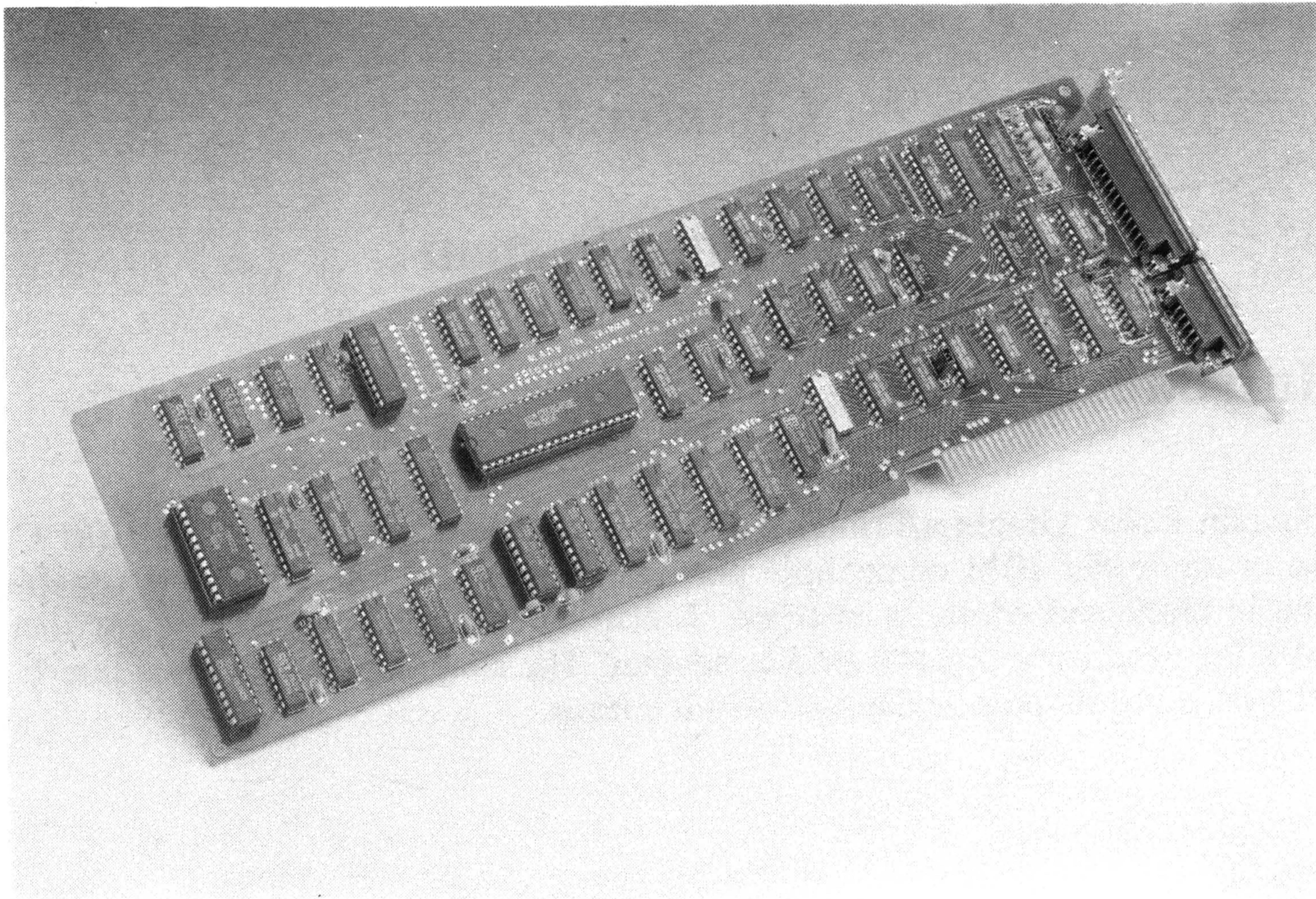


Figure 7.1: Fountain Color Graphics/Printer Adapter

When in color operation, two basic modes of operation are supported: Alphanumeric (A/N) and all-points-addressable graphics (APA). They can be configured as follows:

- 40 x 25 Alphanumeric Black-and-White.
- 40 x 25 Alphanumeric Color.
- 80 x 25 Alphanumeric Black-and-White.
- 80 x 25 Alphanumeric Color.
- 320 x 200 Black-and-White Graphics.
- 320 x 200 Color Graphics.
- 640 x 200 Black- and -White Graphics.

The printer interface is a standard parallel interface, with maximum transfer rate of 1,000 cps.

Users will find that this adapter is much the same as the IBM Color/Graphics Adapter, except that an additional printer port is provided to replace the composite video port which was originally supported by IBM and other compatible Color/Graphics Adapters.

The adapter printer port is pre-set at the factory to hex addresses 378-37F. If required this can be changed to 278-27F by means of jumper J1.

If you already have one printer port in your system, it is important that the second printer port has a different address, otherwise they will not work normally.

The priority of the printer port will be 3BX, then 37X, and then 27X, which are controlled by the BIOS in the software design. The FT-100 Color/Graphics Adapter has both RGB and printer interface.

7.2 Installing the Color Graphics Adapter

Refer to the Section 2.3, General Notes on Installing and Removing Cards, before performing the steps below.

This option card should be installed in expansion slot number one (1). If this expansion slot is being used, then the card can be installed in any available expansion slot. Please note that expansion slot number one usually does not have an expansion slot cover.

Set the switches on the system board. **WARNING:** Before you change any switch settings, record how the switchers are presently set.

- a. There are two switch blocks on the system board, marked SWL and SW2, each with 8 positions marked 1, 2, 3, 4, 5, 6, 7, 8 and an on/off indicator on the side.
- b. Locate the switch block 1 (SW1), and look at switch positions 5, 6 (we are interested on those two positions only).
- c. Set the switches to their proper position according the following table:

SWITCH BLOCK 1

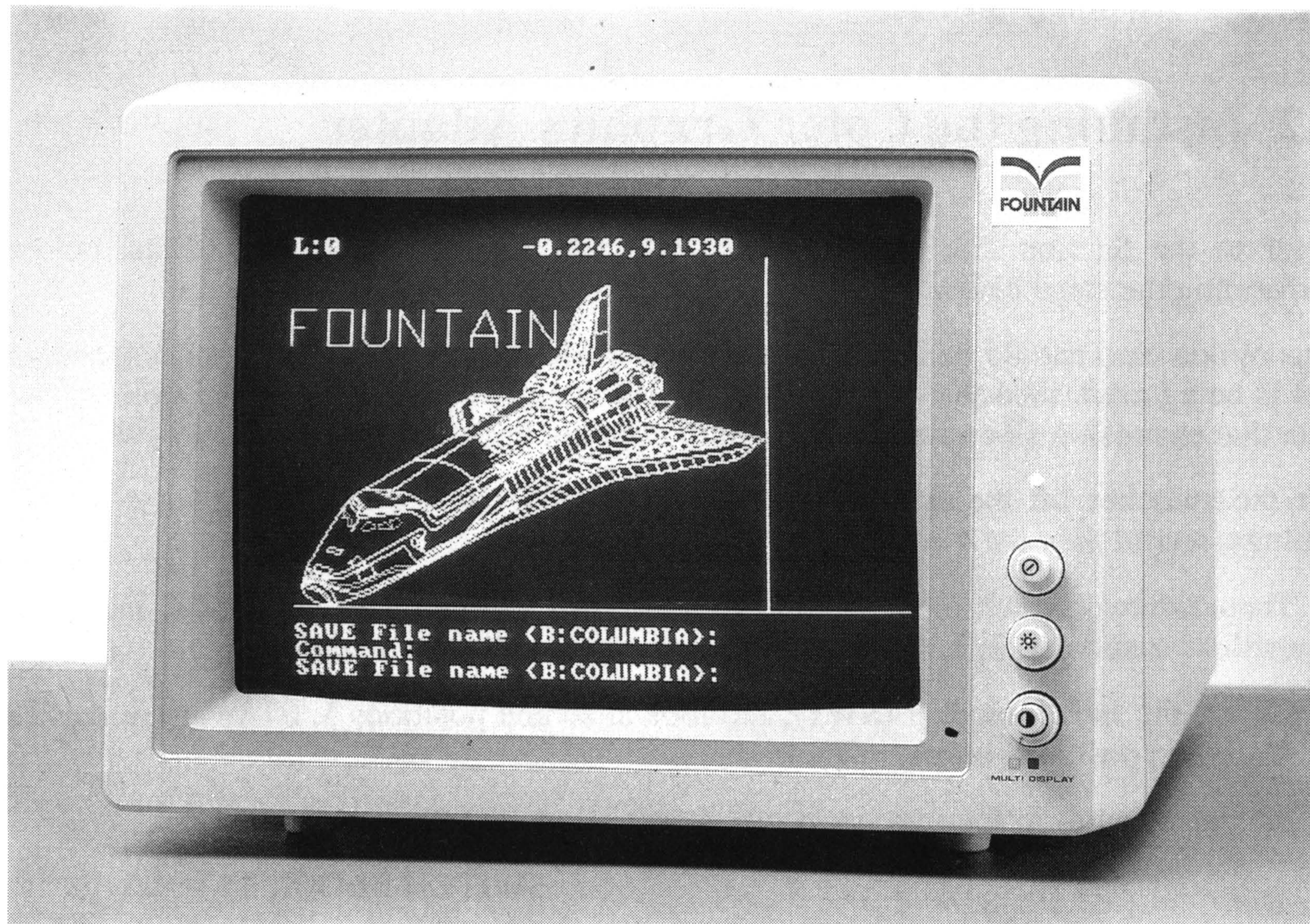
Color Display	Position 5	Position 6
40 x 25 mode	off	on
80 x 25 mode	on	off

Close the system unit:

- a. Put the top cover of the system unit back on its tracks.
- b. Slide the cover toward the rear of the unit until it is back in place. Take care that it does not catch on the ribbon cable.
- c. Refasten the cover screws which you removed.

Now you are read to plug the color monitor to the D-Type 9-pin connector and power up the system.

7.3 Color Monitor



Connector information is as follow:

9-Pin Color Display Signal Cable

Pin No.	Description
1	Ground
2	Ground
3	Red
4	Green
5	Blue
6	Intensity
7	Not connected
8	Horizontal sync.
9	Vertical sync.

Turn On Display

Apply power to the display by turning the power switch clockwise to the "on" position, allowing about thirty seconds for the tube to warm up. (To turn power off, turn the knob counter-clockwise).

The "Power -On" indicator will light up when display is on.

Select Display Mode

Set the desired display mode by rotating the MD control to the appropriate position.

- M 16-Color Display
- G Green Display
- A Amber Display

Adjust Brightness/Contrast

With the proper signal fed to the display, a pattern or data should appear. Brightness and contrast can now be adjusted.

The brightness control increases the brightness of the entire screen when turned clockwise, and decreases the brightness when turned counter-clockwise.

Color contrast can be increased by turning the contrast control clockwise, and decreased when turned counter-clockwise.

Adjust Vertical Hold

Vertical control can be adjusted to "lock-in" the display circuit with the signal source so that top-to-bottom or bottom-to-top rolling can be eliminated.

To adjust, first turn the Vertical Hold control clockwise as far as it will go, and then turn counter-clockwise until the screen stops rolling.

MD-3 Color Display servicing

If your MD-3 monitor requires service, first verify that all control adjustments have been properly set according to this manual.

If your display still functions incorrectly, it must be returned with the power cord for servicing.

Federal Communications Commission Radio Frequency Interference Warning:

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and TV reception.

Instructions To User

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the operating instructions, reference manuals,

and the service manual, may cause interference to radio or television reception. It has been tested and found to comply with the limits for a Class B computing device pursuant to Subpart J or Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a residential installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- . Reorient the receiving antenna.
- . Relocate the equipment with respect to the receiver.
- . Move the equipment away from the receiver.
- . Plug the equipment into a different outlet so that equipment and receiver are on different branch circuits.
- . Ensure that card mounting screws, attachment connector screws, and ground wires are tightly secured.
- . Ensure that card slot covers are in place when no card is installed.

If necessary, consult your dealer service representative for additional suggestions.

The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. It is the responsibility of the user to correct such interference.

Power Plug

The MD-3 Color Display monitor is equipped with a 3 wire grounding type of power plug. The third pin provides a safety ground for the display frame and will fit only into a grounding type of power outlet. If you are unable to insert the plug into your outlet, contact your electrician to replace the obsolete outlet. **DO NOT CIRCUMVENT THE SAFETY PURPOSE OF THE GROUNDING PLUG.**

Power Input

This display should be operated only from the type of power source indicated on the label. If there is any question about the type of power supplied to the outlet, consult your technician or dealer.

Ventilation

Openings in the cabinet back and bottom are provided for ventilation. To insure reliable operation and to protect the display from overheating, make sure these openings are not blocked or covered. Do not place the display near or over a radiator or heating vent. If this unit is installed within another enclosure be sure that adequate ventilation is still provided.

Never push objects of any kind through the cabinet openings. They may touch dangerous voltage points or cause short circuits that could result in fire or electrical shock.

Attachments

Signal sources must be of approved types and properly grounded if safety standards are to be maintained. Ask the service technician to perform routine safety tests to determine that all the equipment is in safe operation condition.

Overloaded or poorly grounded AC power systems can cause severe differences in ground potential between the display and the signal sources, particularly on long video lines where the display and the sources, particularly on long video lines where the display and the source are plugged into different AC power circuits. Besides causing signal instability, ground potential may be great enough to present a shock hazard. Ground potential tests should be a part of the routine safety check made by the service technician.

Installation

Do not place the display on an unstable cart, stand, or shelf where it may fall and cause personal injury or damage to the equipment.

Route the power cord and all cables so they can not be walked upon or tripped over. Do not allow anything to rest on the power cord.

Do not install this display in wet areas, or where it may be exposed to rain or water. Do not spill liquid of any kind on the unit.

Cleaning

Unplug the power cord from the outlet before cleaning the display. Use only a damp cloth and mild detergent. Never use strong liquid cleaners or aerosol sprays. Do not attempt to clean the interior of the unit-this action is performed by the service technician as required during normal maintenance.

Servicing

Removal of the back by unauthorized persons may expose the user to dangerous voltages or other hazards. Refer all servicing only to qualified service personnel.

Unplug the display from the power outlet immediately and notify the service technician if:

- A) Liquid has been spilled into the display.
- B) The display has been exposed to rain or water.
- C) The unit has been dropped or the cabinet damaged.
- D) Fuses continue to blow.
- E) The power cord is damaged or frayed.
- F) A distinct change from normal operation is apparent.

When replacement parts are required, be sure the service technician has used components specified by the manufacturer with the same characteristics as the original part. Unauthorized substitutions may result in fire, electrical shock, or other hazards.

Upon completion of any service or repairs, ask the technician to perform safety checks to determine that the equipment is in safe operating condition.

Warning

Serious shock hazards exist within the covers of the MD-3 Color Display. Do not open these covers under any circumstances. There are no user or field serviceable component inside.

APPLICATIONS	Typical data display, graphic display device for personal computer applications	
DISPLAY TUBE	14",90 , 29.1 neck, 0.39mm dot pitch dot in-line, dark tint; Type No. 370RKB22-TC14/E8019B22-TC25DT	
VIDEO SIGNALS	Red, Green, Blue, and intensity video signals; all are positive TTL	
SYNC. SIGNALS	Horizontal: 15750+30 Hz. positive TTL; Vertical: 50/60 Hz. positive TTL	
SIGNAL CONNECTOR	9-pin D-shell connector	
MULTI-DISPLAY COLOR	Amber-Green-16 Colors Selected by MD Ring	
DISPLAY AREA	Horizontal: 248mm. Vertical: 170mm	
DISPLAY TIME	Horizontal: 44.5l	Vertical: 12.5 ms
BAND WIDTH	14MHz	
RESOLUTION	Horizontal: 640 dots; Vertical: 489 scan lines (interlaced); 240 scan lines (non-interlaced)	
MISCONVERGENCY	Center 0.3 mm max. Corner: 0.7mm max.	
DISPLAY	2000 characters (80 Ch. x 25 Rows on 8x8 dot matrix)	
USER CONTROLS	Power on-off; Brightness, Contrast, Multi-Display, Vertical Hold, Vertical Size.	
SERVICE	H-Hold, H-Width, H-Phase, V-Center, Focus	
CONTROLS	Screen, G-Drive, B-Drive, R-BKG,G-BKG, B-BKG,B=115V Adjustable	
POWER SUPPLY	AC 90V to 270V, 50/60 Hz. power input; a six feet 3-wire grounded line cord is furnished	
POWER CONSUMPTION	70 watts max.	
ENVIRONMENTAL	Operation: 5 C to 35 C ambient; Storage : -40 C to 65 C; Humidity : 10% to 80% (non-condensing); Altitude : to 7000 feet above sea level	

DIMENSIONS 400(D)x395(W)x291(H) mm

WEIGHT 12.5 kgs (net)

7.4 Initial Power-Up

- a. Place a copy of your normal IBM PC DOS system diskette in drive A.
- b. Power up the system in the normal sequence.
- c. Does the system come up in the normal manner with system promptly?

YES: YOU SUCCEEDED

NO: CHECK:-

- Appropriate switches.(power, CRT) on.
- Recabling of system correct (display, power).
- Appropriate diskette installed in diskette drive.

If this step cannot be successfully completed, do not continue!

d. If further troubleshooting is required, remove power from the system, open the cabinet, check cable orientation, check system board. If this does not allow the system to operate, remove the interface card and see if the system is back to normal. This will help you to isolate the problem.

e. Press Ctrl-P then type DOS command Dir <return> and see if the printer will print all the data as the screen displays it. If not, check, the printer power or cable connection, or go to step d.

WARNING:

Always remove power from any piece of equipment in your computer system before modifying it.

7.5 I/O Register Definition

Hex Address	Function of Register
3D8	Mode Select Register
3D9	Color Select Register
3DA	Status Register
3DB	Clear Light Pen Latch
3DC	Present Light Pen Latch
3D4	6845 Index Register
3D5	6845 Data Register

3D0	6845 Register
3D1	6845 Register

7.5.1 Mode-select Register: (3D8)

- Bit 0: 1-selects 80 by 25 alphanumeric mode.
0-selects 40 by 25 alphanumeric mode.
- Bit 1: 1-selects 320 by 200 graphics mode.
0-selects alphanumeric mode.
- Bit 2: 1-selects black-and-white mode.
0-selects color mode.
- Bit 3: enable video signal.
- Bit 4: high resolution (640 x 200) black/white mode.
- Bit 5: Change background intensity to blink bit.
- Bit 6: not used
- Bit 7: not used

7.5.2 Color-Select Register: (3D9)

- Bit 0, 1, 2, 3: These bits select the screen's border color in the 40 by 25 alphanumeric mode; they select the screen's background color in the medium-resolution color-graphics mode.
- Bit 4 : Select alternate, intensified set of colors in graphics mode.
Select background color in alphanumeric mode.
- Bit 5 : Select active color set in 320 x 200 graphics mode.
- Bit 6,7 : not used.

7.5.3 Status Register: (3DA)

- Bit 0 : display enable.
- Bit 1 : light-pen trigger set.
- Bit 2 : light-pen switch.
- Bit 3 : vertical sync.
- Bit 4,5,6,7 : not used.

7.5.4 Printer Data Port: (378 or 278)**7.5.5 Printer Status Port: (379 or 279)**

Bit 0,1,2	: Not used.
Bit 3	: error (pin 15).
Bit 4	: select (pin 13).
Bit 5	: paper end (pin 12).
Bit 6	: acknowledge (pin 10).
Bit 7	: busy (pin 11).

7.5.6 Printer Control Port: (37A or 27A)

Bit 0:	Strobe (pin 1).
Bit 1:	auto feed (pin 14).
Bit 2:	initialize (pin 16).
Bit 3:	select in (pin 17).
Bit 4:	interrupt enable (IRQ7).

Chapter 8

Multi-Function Card

8.1 Introduction

The Fountain Multi-Function card is a flexible and powerful enhancement product for the IBM PC, PC/XT and compatibles. It provides memory expansion upgradeable to the maximum addressable user memory in the PC systems. It is also a powerful data I/O accessory; standard features include a real-time clock-calendar with rechargeable battery backup, one RS-232 asynchronous serial communication port, and a parallel printer port. A game adapter port is also provided.

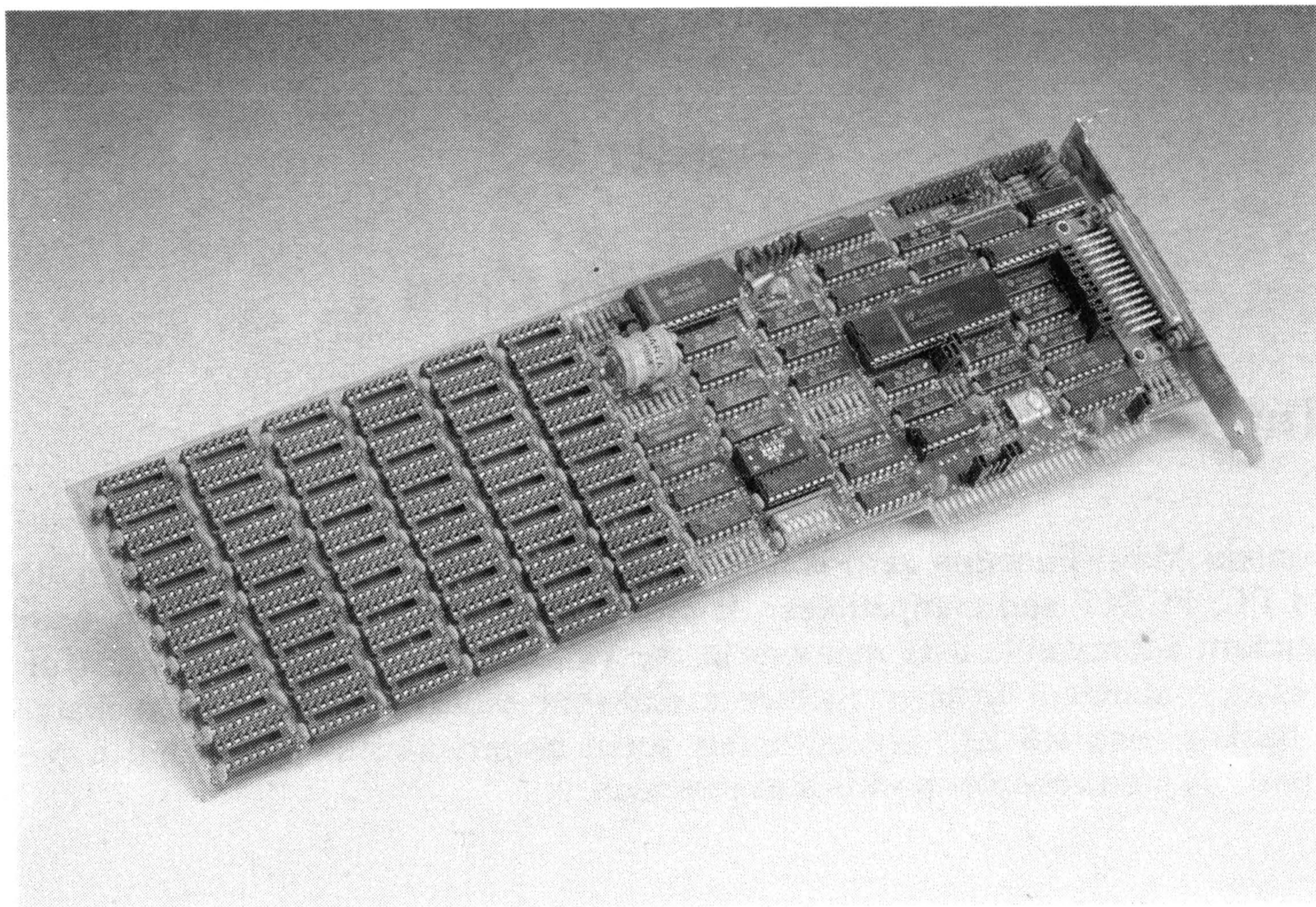


Figure 8.1: Fountain Multi-Function Card

8.1.1 Standard Features

1. Up to 384K of user installable memory.
2. An RS-232C serial interface to be used with a modem, serial printer, remote display terminal, or other serial device, or as asynchronous communications to another computer or peripheral operating under separate asynchronous communications software control.
3. A parallel printer port.
4. A real-time clock-calendar with rechargeable battery backup eliminating the need to reenter the time and date every time the system is started. The battery power is only used when the system is turned off.
5. The MFPLUS utility diskette containing clock software that supports the clock-calendar. RAMDISK and PSPOOL Software -- this software is described in the SOFTWARE SECTION.

8.1.2 Options

Memory expansion is available in 64K increments up to 384K. The 384K on the MultiFunction Card, added to 256K on the PC-XT system board, provides 640K, the maximum addressable user memory for these systems.

8.2 Memory Configuration

Before using the memory on your MultiFunction Card, you must properly configure both the MultiFunction Card and the PC system board. For the system board configuration, please refer to Chapter 3 on the PC/XT System Board.

8.2.1 MultiFunction Card Memory Switch Settings

Switch S1 and Jumper JP3 controls three different functions related to the memory on the card. The three functions which must be configured are:

1. The starting address of MultiFunction Card
2. The amount of memory installed on the MultiFunction Card
3. Parity checking (enabled or disabled)

Set the starting memory address according to the following table:

Starting Address	S1	S2	S3	MAXIMUM RAM on MultiFunction Card
0K (:00000)	OFF	OFF	OFF	384K
64k (:10000)	OFF	OFF	ON	384K
128K (:20000)	OFF	ON	OFF	384K
192K (:30000)	OFF	ON	ON	384K
256K (:40000)	ON	OFF	OFF	384K
320K (:50000)	ON	OFF	ON	320K
384K (:60000)	ON	ON	OFF	256K
448K (:70000)	ON	ON	ON	192K

Set the amount of memory installed according to the following table:

Bank Installed	S4	S5	S6	Total MultiFunction Card RAM
NONE	OFF	OFF	OFF	OK
1	OFF	OFF	ON	64K
2 (1-2)	OFF	ON	OFF	128K
3 (1-3)	OFF	ON	ON	192K
4 (1-4)	ON	OFF	OFF	256K

5 (1-5)	ON	OFF	ON	320K
6 (1-6)	ON	ON	OFF	384K

2.1-3 Parity Check Enable

Jumper block JP3 is used to enable/disable the memory parity check. When JP3 is jumpered with a shorting plug, the parity check is enabled. Without a shorting plug on JP3, the MultiFunction Card memory parity check is disabled.

8.2.2 Installing Additional Memory

A MultiFunction Card configured with less than its 384K maximum memory can be upgraded at any time by installing additional 64K RAM sets. The correct type of chip to be used is 64k dynamic memory, 200 nanosecond access time, pin 1 not used, +5 Volt only. The following memory chips are compatible with the MultiFunction Card or the PC and PC-XT system board:

Fujitsu MB826-20	Hitachi H:M4864P-3
Micron Technology	NEC UPD4164-15/20
MT4264-3 or MT4264-20	Toshiba TMM4264-15/20
Mitsubishi M5K4164NS-20	T.I. Tms4164-20NLJ

8.3 The Clock-Calendar

The Clock Calendar has following features:

1. 24-hour clock, maintained in a microprocessor real time clock chip (MM58167A) on the MultiFunction Card board.
2. four-year calendar (no leap year).
3. battery backup power supply, which recharges automatically when the computer is turned on.
4. full PC-DOS compatibility.

The clock utility programs GETCLOCK.COM and SETCLOCK.COM are supplied on your MFPLUS diskette. Using GETCLOCK can answer the TIME and DATE prompts which the DOS operating system issues each time you boot the system. SETCLOCK is used to update the real-time clock.

8.3.1 Configuration of the MultiFunction Card Clock-Calendar

Clock-Calendar I/O port address is defined as follows:

Port Configuration	I/O Ports
--------------------	-----------

CLOCK 1	340-35F HEX
CLOCK 2	2C0-2DF HEX (default) or 240-25F HEX

Set the jumper, as Figure 8.1, to select clock 1 or clock 2, but only one can be selected at the same time. In cases of conflict between the ports used by the clock and other devices installed in your PC, disconnect both jumpers to disable the clock.

8.3.2 The GETCLOCK Utility

GETCLOCK is a utility program which reads and displays the current time and date from the MultiFunction Card at each power-up or reboot of the system. GETCLOCK eliminates the need for manually entering the correct time and date through the keyboard whenever the PC is turned on or rebooted.

8.3.3 The SETCLOCK Utility

You need to execute the SETCLOCK Utility whenever you want to correct the time or date of the MultiFunction Card board's internal microprocessor clock. The DOS TIME and DATE commands only update the system's time and date parameters; they will not update the time and date values stored in the MultiFunction Card clock chip until you execute the procedure below.

- STEP 1 Boot the system with a diskette that leaves the screen at the A>prompt.
- STEP 2 From the DOS prompt A>, enter the following instruction:
SETCLOCK <enter>
- A message of current date and time will be displayed. If your clock calendar has not been used before, then the current date and time will be the system's time and date, and these data will be recorded into your clock calendar. Otherwise the date and time will be the clock calendar that you just loaded into the system by the SETCLOCK command. From now on, you can do step 3 and step 4 to update the date or time of clock calendar without any extra command executed.
- STEP 3 Enter the DOS command DATE. The current date will be printed on the screen, and you will be given a chance to enter a new date. Press <enter> if no change is necessary or type a new date in the form mm/dd/yy <enter> or mm-dd-yy<enter>. DOS will figure out the day of the week from the information that you enter.
- STEP 4 Enter the DOS command TIME. The current date will be printed on the screen, and you will be given a chance to enter a new time. Press <enter> if no change is necessary or type a new time in the

form hh:mm:ss <enter>. For maximum accuracy, type in a time that is 10 to 15 seconds ahead of the actual time, but do not press the <enter> key; observe a digital clock or watch, and press <enter> when the seconds reading on the clock catches up to the value that you typed in.

STEP 5 Re boot the system (Control-Alt-Del) to install the new TIME and DATE values.

8.3.4 Clock-Calendar Interrupt Generation

The Clock-Calendar feature does not normally need or support interrupts. By writing your own software, however, it is possible to generate timed interrupts on any of the IRQ2, IRQ4,IRQ5,IRQ7 interrupt lines. To implement this feature, you will need to do the following:

1. Enable clock interrupts by installing a shorting plug on the appropriate position of the interrupt select jumper block JP1 shown in figure 3:
2. Obtain data sheets for the National Semiconductor MM58167AN clock chip from your local National Semiconductor distributor.
3. Write your own software to handle the interrupts, based upon the information contained in the clock chip data sheets and in the IBM Technical Reference Manual.

8.3.5 Setting the Software for Clock Functions

After installing your MultiFunction Card, you should prepare your working DOS diskette to automatically initialize the time and date each time you boot the system. This subsection lists the process used to invoke your Clock-calendar.

STEP 1 Copy the two clock programs, GETCLOCK.COM and SETCLOCK.COM to your working DOS diskette. These programs are on the Mfplus diskette.

STEP 2 If your working DOS diskette already has an AUTOEXEC.BAT file, then you need to alter this file to include the GETCLOCK command. To see the current contents of your AUTOEXEC file, insert the working DOS diskette in drive A: and from the A>prompt, type the following command line:

```
TYPE AUTOEXE.BAT<enter>
```

The contents of your AUTOEXEC file will be listed on your CRT screen. you now need to create a new AUTOEXEC file in which the command GETCLOCK precedes these other command(s). The following sequence will do this for you:

```
COPY CON: AUTOEXEC.BAT <enter>
```

```

GETCLOCK <enter>
.
.
.
Function Key F6 <enter>

```

If your working DOS diskette has no AUTOEXEC file, then you should use the above sequence to create one. The only command in the file will be GETCLOCK.

STEP 3 If necessary, use the SETCLOCK Utility to give the TIME and DATE variables their initial values.

8.3.6 Technical Information

I/O Address	Function
2C0	counter-1/10000 of seconds
2C1	counter-1/100 and 1/10 seconds
2C2	counter-seconds
2C3	counter-minutes
2C4	counter-hours
2C5	counter-day of the week
2C6	counter-day of the month
2C7	counter-month
2C8	RAM-upper nibble only
2C9	RAM-last month storage
2CA	RAM-year storage
2CB	RAM-reserved
2CC	RAM-not used
2CD	RAM-not used
2CE	RAM-not used
2CF	RAM-not used
2D0	interrupt status register
2D1	interrupt control register
2D2	counter reset
2D3	RAM reset
2D4	status bit
2D5	GO command
2D6	standby interrupt
2DF	test mode

Counter and RAM reset format

Data	Function
01	1/10000 of second
02	1/100 and 1/10 of second
04	seconds

08	minutes
10	hours
20	day of the week
40	day of the month
80	month

8.4 Parallel Printer Port

the MultiFunction Card has a standard feature for interfacing the PC to any Centronics compatible parallel printer such as the IBM/Epson MX-80. This port is completely compatible with the IBM PC and uses the same female DB25 connector.

8.4.1 Configuration of the MultiFunction Card Parallel Port

The IBM PC allows installation in the computer of up to three parallel ports, called LPT1, LPT3, and LPT3. The parallel port on the MultiFunction Card has been configured at the factory to respond as LPT1. It can be configured to be LPT2 by moving the jumper to select LPT2.

8.4.2 Parallel Port I/O Port Assignment and Pinouts

The parallel port on the MultiFunction Card uses the following system I/O ports:

Port Configuration	I/O Ports
LPT1	378-37A HEX
LPT2	278-27A HEX

Parallel Port Signal Line Configuration:

Line Name	J2Pin	DB25S	Printer
-STROBE	1	1	1
D0	2	2	2
D1	3	3	3
D2	4	4	4
D3	5	5	5
D4	6	6	6
D5	7	7	7
D6	8	8	8
D7	9	9	9
-ACK	10	10	10
BUSY	11	11	11
PE	12	12	12
SLCT	13	13	13
-AUTOFD	14	14	14

-ERROR	15	15	15
-INIT	16	16	16
-SLCT IN	17	17	17
CROUND	(18-25)	(18-25)	(16,19-30,33)

8.4.3 Installing the Parallel Interface Cable

The MultiFunction Card is supplied with a ribbon cable for the parallel port to bring the parallel interface out the rear of the PC. This cable is approximately 30 cm long and has a rectangular connector at one end and a female DB25S connector at the other end. A bracket is supplied to mount the DB25S connector. The rectangular connector on the 30 cm cable plugs into J2 on the MultiFunction Card, while the cable from the printer plugs into the DB25S connector at the opposite end. Note that one edge of the 30 cm flat ribbon cable has a red or blue line on it; this line indicated which end of the rectangular connector is to be installed to pin 1 of J2. The rectangular connector plugs into J2 with the red or blue line at the left side of J2 (toward the front of PC), with the cable exiting toward the back of the MultiFunction Card.

8.5 Serial Port

The MultiFunction Card has as a standard feature one serial port for asynchronous communications. This port can be used to connect your PC to a serial printer, modem, or other device which uses an RS-232C interface. The MultiFunction Card interface is a HOST/DTE type (Data Terminal Equipment) with a male DB25 connector. Note that the MultiFunction Card use a *female* DB25S connector)

8.5.1 Configuration of the Serial Port

The IBM PC allows installation in the computer of up to two serial ports called COM1 AND COM2. This can be selected on JP2 Jumper Block. The interrupt request line IRQ4 and IRQ3 can also be selected as the COM1,COM2 interrupt by setting the jumper on JP1.

5.2 Configuring the RS-232C Interface Line

MultiFunction Card has adhered to RS-232C engineering standards, all inputs to the serial port with the exception of Ring Indicator, Pin 22, must be connected to a signal, even if the device the port is connected to is not using one or more of the interface lines at connector J1. The serial part interface configuration block JP4 are provided to make some signal lines input such as CTS, DSR,DCD to be "forced true" state. JP5 are provided to make this port to be HOST or Data Terminal Configuration. These configuration jumpers are shown are shown as follows:

DTE Mode (Normal)

The JP5 configuration block has some jumper such as CTS, RTS, DTR, DSR ,DCD RI, that will be useful if you will use the serial port for two or more different serial devices at different times.

8.5.2 Serial I/O Port Assignments and Pinouts

The serial port on the MultiFunction Card uses the following system I/O ports and IRQ interrupt request lines:

Port Configuration	I/O Ports	IRQ Line
COM1	3F8-3FF HEX	IRQ4
COM2	2F8-2FF HEX	IRQ3

The pinouts for the serial port connector J1 on the MultiFunction Card are as follows:

RS-232C Name	J1 Pin#	Signal Name	Direction
AA	1	Chassis Ground	-
BA	2	TX (TRANSMIT DATA)	OUTPUT
BB	3	RX (RECEIVE DATA)	INPUT
CA	4	RTS (REQ. TO SEND)	OUTPUT
CB	5	CTS (CLEAR TO SEND)	INPUT
CC	6	DSR (DATASET READY)	INPUT
AB	7	SG (SIGNAL GROUND)	-
DF	8	DCD (CARRIER DETECT)	INPUT
CD	20	DTR (DATA TERM RDY)	OUTPUT
CE	22	RI (RING INDICATOR)	INPUT

8.6 Game Adapter Port

Game Adapter Port is furnished with one game adapter cable; any IBM-compatible joy stick may be used.

8.6.1 Game Port Pinout:

Line Name	J3 Pin	Cable Output DB-15 S
+5VDC	1	1
Button 4	2	2
Position 0	3	3
Ground	4	3
Position 1	5	5
Button 5	7	7
+5VDC	8	8
+5VDC	9	9
Button 6	10	10
Position 2	11	11
Ground	12	12
Position 3	13	13
Button 7	14	14
+5VDC	15	15

8.6.2 Installing the Game Port Cable

The game port cable is used to bring the game port interface out the rear of the PC. This cable is approximately 30 cm long and has a rectangular connector at one end and a female DB 15S connector at the other end. DB15S connector can mount on the additional bracket supplied with MultiFunction Card, and mount the bracket on the rear panel. The rectangular connector plugs into J3 with red or blue color side of ribbon cable as Pin 1. The IBM-compatible joy-stick DB15P male connector connect to the DB15 connector. Then the user can enjoy games by executing game software with the joystick.

8.7 RAM Disk and Spooler Software

This section describes the use and operation of the MFPLUS Utility programs. These programs. These programs will work satisfactorily on most expansion cards that are available for IBM PC and compatible Personal Computers and should be executed under current releases of MS DOS.

The MFPLUS Utility diskette includes the following six utility programs:

RAMDISK.COM - A program which emulates a floppy disk drive using your PC system RAM. It allows you to access data or execute programs much faster than with the floppy disk.

RAMHELP.COM - This utility lists the RAMDISK operation commands, giving you a brief listing of all options, types, and their meanings. When you are not sure how to enter a command, execute this utility to get help.

DISKCONF.COM - A program which displays the message of current RAMDISK status.

PSPOOL.COM - A program which enables printing a list of data files on the printer while you are doing other tasks on the PC system. Your print output data is queued in a predefined area of memory and will be printed using the PC system interrupt.

PSPLHELP.COM - This utility lists the PSPOOL operation menu, giving you a brief listing of all options, types and their meanings. When you are not sure how to enter a command, execute this utility to get help

PSPLCONF.COM - A program which displays the current PSPOOL status.

The MFPLUS Utility diskette is a single-side, 8-sector nonsystem diskette, which can be used with all PC-DOS and MS-DOS versions. You should back up your MFPLUS utility diskette before using it. The following steps tell you how to back up the MFPLUS utility programs.

Step 1: Write-Protect your original MFPLUS Utility diskette.

Step 2: Boot PC system.

Step 3: Copy the utility program to your system diskette.

(i) If you have only one floppy drive, type

```
COPY B:*. * A:<enter>
```

The system will prompt you to change source and destination diskette for coping programs.

(ii) If you have two or more floppy drives, place the MFPLUS diskette in drive B: and type

```
COPY B:*. * A:<enter>
```

The system will copy all the program in B: into A:

NOTE: The MFPLUS Utility diskette should be kept in a safe place and should not be used during system operation.

8.7.1 RAMDISK

The RAMDISK Utility programs allow you assign RAM space for use as up to four RAMDISKS that will enhance the processing speed of the computer. The RAMDISK could be thought as a disk drive. You can run any DOS command on it and save data into it. However, because RAMDISK is a program that must be loaded by EXEC loader, so it must be loaded each time you turn on the PC.

The RAMDISK provides many features:

1. Emulation of up to four disk drives.
2. The ability to define user's memory space and RAMDISK size.
3. Support of single and double side drives with eight or nine sectors per track.
4. Maximum RAMDISK of 360K.

Before you install the RAMDISK on your Personal Computer, set the PC for RAMDISK operation. Normally, you will do this only once. After you have set the PC as described below, you don't need any hardware preparation.

- (A) Set PC system Board DIP switch 1 to specify drives option. The switch 1 setting tells the computer how many floppy diskette drives are present.
NOTE: This drive number must include the RAMDISKS.

Refer to Figure 3.1; this figure shows the way of setting dip switch 1 on the main board. You may set the dip switch for more disk drives than are actually installed. It's perfectly acceptable for you to leave the switches set for a total of three or four drives, so that you can assign any of four drive name (A,B,C, and D) to your RAMDISK at any time.

- (B) Memory Setting

Refer to chapter three for memory settings, and set the switches to maximum memory size of the system. This allows you to fully use your memory space.

Getting Started

To start the RAMDISK, you must be sure copied these three utility programs onto your DOS diskette, as explained in Chap.7.

RAMDISK.COM
RAMHELP.COM
DISKCONF.COM

RAMDISK Help Command is one of the RAMDISK Utility programs. It provides an operation menu. After you type the command: RAMHELP, the screen will display.

RAMDISK HELP INFORMATION

RAMDISK X:[/1] [/2][/M=xxx] [/U=xxx][/8][/9]

/1 - Side specification. Creates a single side

RAMDISK. /2 - Side specification.

Creates a double side

RAMDISK. /M=xxx - RAMDISK size specification. /U=xxx - Reserves memory space size for user application program. /8 - Creates 8 sectors per track formatted RAMDISK. /9 - Creates 9 sectors per track formatted RAMDISK. X: - Drive specification. [] - Indicates an optional term. The [] is not part of the input.

Because RAMDISK is a program, just like a DOS command, it must be initialized each time you turn on your PC. This section describes in detail the various commands and options you can use, and the format in which they must be entered.

To install the RAMDISK, type the command using the following format:

```
RAMDISK X: [/M=xxx] [/U=xxx] [/1][/2][/8] [/9]
```

The work RAMDISK invokes the RAMDISK program's command handler routines. The remainder of the command syntax specifies the various options. They are described below:

- X:** It creates a RAMDISK in memory. X may be A,B,C, and D.
- /1 or /2** Side specification, creates a single-side drive with /1 option , the default drive size is 160K for DOS 1.1, 180K for DOS 2.0. Creates a double-side drive with /2 option, the default drive size is 320K for DOS 1.1,360K for DOS 2.0 or newer. Default side specification is /2.
- /8 or /9** Specifies eight sectors per track or nine sectors per track, under DOS 2.0 or newer.
- /M=xxx** This option reserves xxxK bytes of memory for RAMDISK use. If this option is omitted, as much memory as possible will be allocated to RAMDISK depend on /1 or /2 option.
- /U=xxx** This option reserves a minimum of xxxK bytes of memory for the user application programs, and its work space. If this option is omitted, the RAMDISK will reserve a minimum default program space of 64K memory space.

The following examples are provided to help clarify the use of the RAMDISK command.

```
RAMDISK B: <enter>
```

Will allocate a minimum 64K bytes of application memory space. And create a double-density, double-sided drive as B:

```
RAMDISK C: /2/U=128/M=128 <enter>
```

Will allocate a minimum 128K bytes of application memory space, and create a double side drive with memory space of 128K.

Now, we will take you step by step through the process of creating and using the RAMDISK.

Step 1: Create the RAMDISK by entering a command such as following:

```
RAMDISK D: <enter>
```

The screen will display the message.

```
RAMDISK Version 2.00  
RAMDISK D:total space xxxxxx bytes
```

```
A>
```

Step 2: Copy all of the files from drive A: to drive D:

Type:
COPY A:*. * D:<enter>

Step 3: Set drive to D:

Type:
D: <enter>

Step 4: Execute the program at drive D:

Program - Name <enter>

DISKCONF Command is one of the RAMDISK Utility programs. It allows you to check the current RAMDISK configuration. After you type in the command "DISKCONF", the screen will display the configuration of current RAMDISKS.

DISKCONF <enter>

RAMDISK CONFIGURATION INFORMATION

RAMDISK X: 1 side 8 sectors, total xxxxxx bytes.

RAMDISK X: 2 sides 9 sectors, total xxxxxx bytes.

. .
. .
. .

RAMDISK Error Messages

RAMDISK may give you an error message under certain conditions. These message are described below:

- A. INVALID RAMDISK SPECIFIED! - This indicates that either the system board switches have not been set for the correct number of drives or you have used an invalid drive letter in your RAMDISK command.
- B. NO AVAILABLE MEMORY SPACE! - This indicates that there is no available memory space to allocate a RAMDISK.
- C. xxxxxx BYTES SHORT! - This is a message indicating the amount of insufficient memory space that you specified for memory allocation.
- D. RAMDISK CAN NOT BE REPLACED! - Indicates an attempt to specify an installed RAMDISK name.
- E. INVALID PARAMETERS SPECIFIED! - Indicates an invalid parameter specified.

8.7.2 PSPOOL

The PSPOOL Utility program is a print spooler which provides buffered print-out data to a parallel or serial printer during concurrent processing of other programs. Files to be printed will be output to the PSPOOL buffer the PSPOOL program will handle output to the printer at printer speed.

PSPOOL has the following features:

- Provides buffered output of printer data to either a parallel or serial printer.
- Allows you to define the size of the spooler buffer.
- Allows stop/restart, and line-per-page controls.

Refer to Chapter 3 for setting the system board switches to maximum memory size. This allows you to use your memory space fully. Prior to entering the PSPOOL command, you must enter the DOS MODE command to disable the redirection of printer LPT#: This can be done by typeing in:

MODE LPT1: <enter>

If you assign the print data to a serial printer, you must do the following:

1. Refer to the DOS MODE command. Initialize the Asynchronous Communications Adapter by using option 3.
2. Use the PSPOOL command to redirect LPT1: to the serial printer.

To start the PSPOOL be sure you have copied these utility program onto your DOS diskette as explained in Chap 7.

PSPOOL.COM
PSPHELP.COM
PSPLCONF.COM

PSPOOL HELP Command is one of the PSPOOL Utility program. It provides you an operation menu. After you type the command:

PSPLHELP<enter>

The screen will display:

PSPOOL HELP INFORMATION

Command Format:

PSPOOL LPTn: [=COMn][U=xxx][M=xxx][L=xx]
[S][C][R][I][ON=][OFF=]

- | | |
|--------|--|
| LPTn: | - Selects parallel printer. |
| =COMn: | - Redirects parallel printer output to a serial port. |
| /U=xxx | - Reserves memory space size for user application programs. |
| /M=xxx | - PSPOOL queue size specification. |
| /L=xx | - Sets the number of lines per page. |
| /S | - Stops output of print data. |
| /C | - Continues output of print data. |
| /R | - Continues output of print data at the beginning of the current page. |

- /I - Initializes the PSPOOL queue, all print data will be purged.
- /ON= - Turns on serial printer port handshake line protocol options.
- /OFF= - Turns off serial printer port handshake line protocol options.
- [] - Indicates an optional term. The [] is not part of the input.

Because PSPOOL is a program just like a DOS command, it must be initialized each time you turn on your PC. This section describes in detail the various commands and options you can use, and the format which they must be entered in. The PC normally sends all printer output to LPT1 unless the user takes steps to redirect the output to a different port. When either a serial or parallel port is assigned for printer output with PSPOOL, the port can not be used by any other program for any purpose until the port is redirected by PSPOOL command again.

To install the PSPOOL, type the command using the following format.

```
PSPOOL LPTn: [=COMn:][U=xxx][M=xxx][L][S]
              [C][R][I][ON=OPTION]
              [OFF=OPTION]
```

The word PSPOOL invokes the PSPOOL program's command handler routines. The remainder of the command syntax specifies the various options. They are described below:

- LPTn: Selects one of the three possible parallel ports.
- =COMn: Redirects parallel printer output to a serial port. LPTn now responds as LPTn+1. NOTE: You must initialize the Asynchronous Communication Adapter by using DOS command MODE before you select this option.
- /U=xxx This option reserves a minimum of xxxK bytes of memory for the user application programs, and its work space. If this option is omitted, the PSPOOL will reserve a minimum default program space of 64K memory space.
- /M=xxx This option reserves a minimum of xxxK bytes of memory of PSPOOL buffer. If the option is omitted. The default buffer size is 64K. If =xxx is omitted, as much memory as possible will be allocated to PSPOOL buffer.
- /L Set the number of lines per page; default is 66.
- /S Stop output of printer data. No data will be lost, and data output can be restarted by using the /C option.
- /C Continues output of printer data.
- /R Continues output of printer data at the beginning of the current page.

- /I Immediately purges all data from PSPOOL queue, the queue is empty.
- /ON= Turns on the serial printer port's handshake line protocol options.
- /OFF= Turns off the serial printer port's handshake line protocol options.

The handshake line protocol options are XON,DCD,DSR,CTS, default ON=CTS, DSR, OFF=XON, DCD.

The following examples are provided to help clarify the use of PSPOOL command.
PSPOOL LPT1:<enter>

spooler printer output to LPT1.

PSPOOL LPT1:/U=192/M <enter>

spools printer output to LPT1, reserves a minimum of 192K for the application program. Uses as much memory space as possible for spooler buffer.

PSPOOL LPT1:=COM1:/ON=CTS <enter>

Redirects to the serial printer 1, with CTS handshake line protocol control.

Now, we will take you step by step through the process of creating and using a PSPOOL.

STEP 1: Prepare the DOS for PSPOOL by using the MODE command.

A>MODE LPT1: <enter>

STEP 2: Create the PSPOOL by entering a command such as following.

A>PSPOOL LPT1: <enter>

PSPOOL Version 2.00

PSPOOL total queue space xxxxxx bytes A>

STEP 3: To test the spooler, give a print ou file to LPT1:, and at this point, you can proceed with running whatever program you want and let PSPOOL to print out data.

Once PSPOOL has been activated, status can be checked at any time by enter PSPLCONF command. The current printer configuration and spooler buffer will be displayed. The PSPOOL directed printer port configuration can only be changed when the spool buffer empty.

b[PSPOOL Error Messages]

PSPOOL may give you an error message under certain conditions. The messages are described below:

A: PRINTER NOT AVAILABLE - No such printer port in the system or the printer

is not on line.

- B: INVALID PARAMETER SPECIFIED - Indicates an invalid parameter specified.
- C: CAN NOT BE REDIRECTED - The printer port cannot be redirected as requested.
- D: NO AVAILABLE MEMORY SPACE - This indicate that there is no available space for printer buffer.

Chapter 9

Hard Disk Installation

9.1 INSTALLATION

9.1.1 Preliminary Setup

First, remove diskettes from all drives and turn off the system unit. Remove the cables from all other components attached to your computer (keyboard, monitor, printer, and all others). Unplug all the power cords from their electrical outlets. This precaution will help prevent you from getting a shock or possibly damaging your equipment. Now move the system unit (main box of PC) to a convenient bench or table, with room to work.

9.1.2 Remove System Unit Cover

Remove the two screws at the bottom right and bottom left of the rear of the system unit and the three (3) screws along the top rear edge of the unit. Keep them in a safe place. You will use them to secure the cover when you replace it. Slide the cover forward completely. When it will go no further, lift up the front and remove it.

9.1.3 Discharge Static Buildup

HOLD A COIN IN YOUR HAND AND TOUCH THE TOP OF THE POWER SUPPLY BOX TO DISCHARGE ANY STATIC ELECTRICITY FROM YOUR BODY. THIS WILL HELP PREVENT DAMAGE TO THE INTEGRATED CIRCUITS. DO THIS OFTEN, ESPECIALLY IF STATIC IS LIKELY DUE TO DRY AIR, CARPETED ROOM, ETC.

9.1.4 Remove Floppy Disk or Cover Plate

This section provides instructions for preparing the system unit drive slot. If you have two floppy disk drives, follow the instructions for removing one of the disk drives. Otherwise, follow the instructions to remove the face plate covering the second drive slot.

Removal of Disk Drive

Locate the two screws on the right hand side of the disk drive, and remove them. Keep them in a safe place for possible future use. Pull the disk drive forward about 2 inches to access the cables attached to the rear of the drive. Carefully unplug the large ribbon cable connector and power supply connector from the drive. Tuck the excess ribbon cable behind the left disk drive making sure that it is not contacting the switches on the motherboard below. The power cable will be used to supply power to your hard disk when it is installed. Keep this power cable out of the way while installing the hard disk. Slide the drive the rest of the way out and set it aside at this time.

Next, the switches on the system board must be changed to reflect only one floppy drive in the system. Note that the number of hard disks is not included when setting the system board switches. Refer to your "Guide to Operations" for the proper switch settings.

Removal of Face Plate

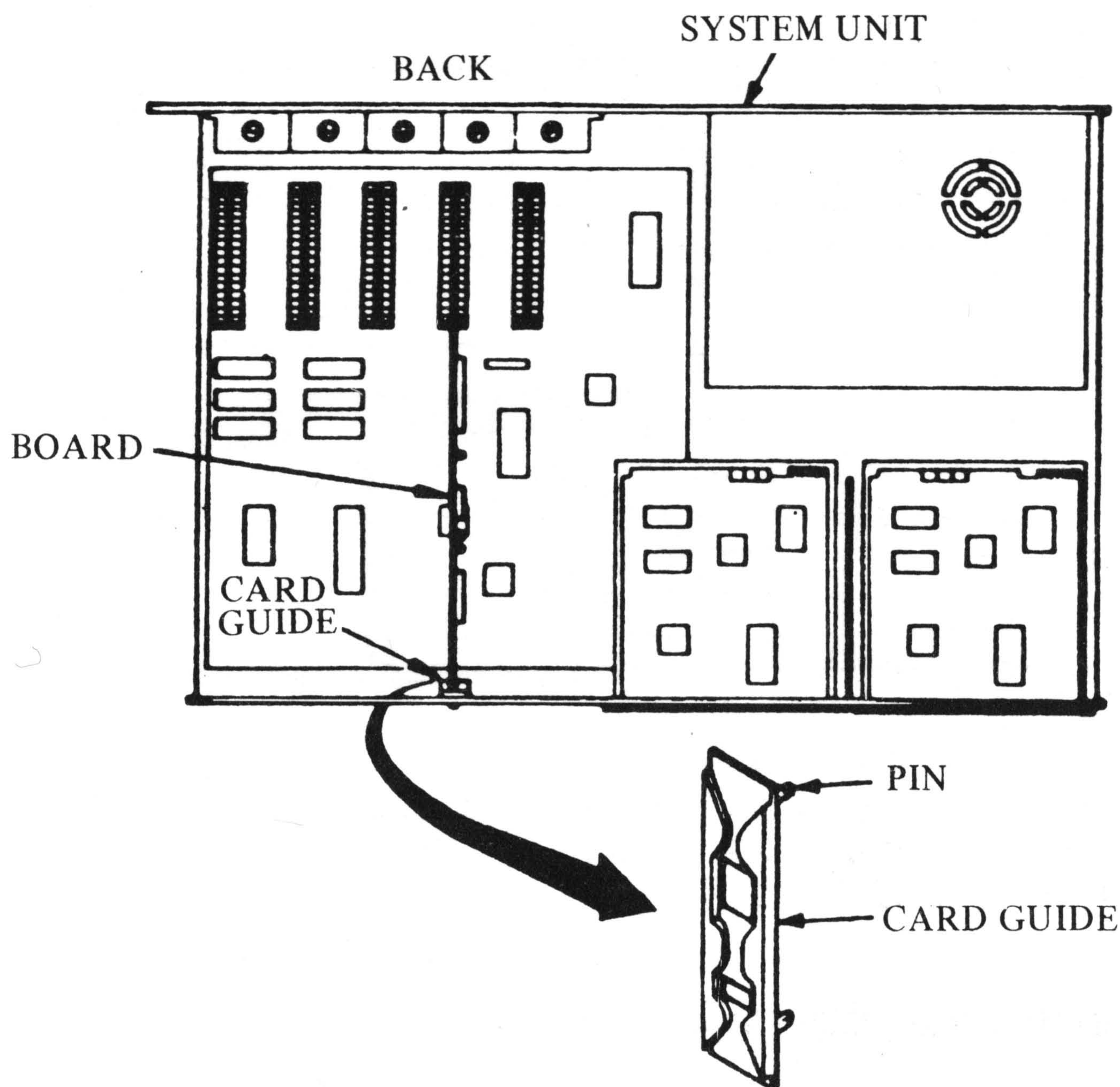
Remove the blank face plate covering the opening for the second disk drive by turning the two rectangular fasteners a half turn (either direction). Remove the clips to disassemble the face plate cover.

9.1.5 Install Controller In System Unit

Select an unused expansion slot in the large circuit board in your PC (this is called the "motherboard"). Select an empty slot farthest to the right when looking at the PC motherboard from the front. Any available slot may be used, but the cabling is easier if you use slot 4. (See Figure 2.5). Remove the small screw which holds the blank bracket at the rear of the slot and remove the blank bracket. Keep it in a safe place for possible changes in the future.

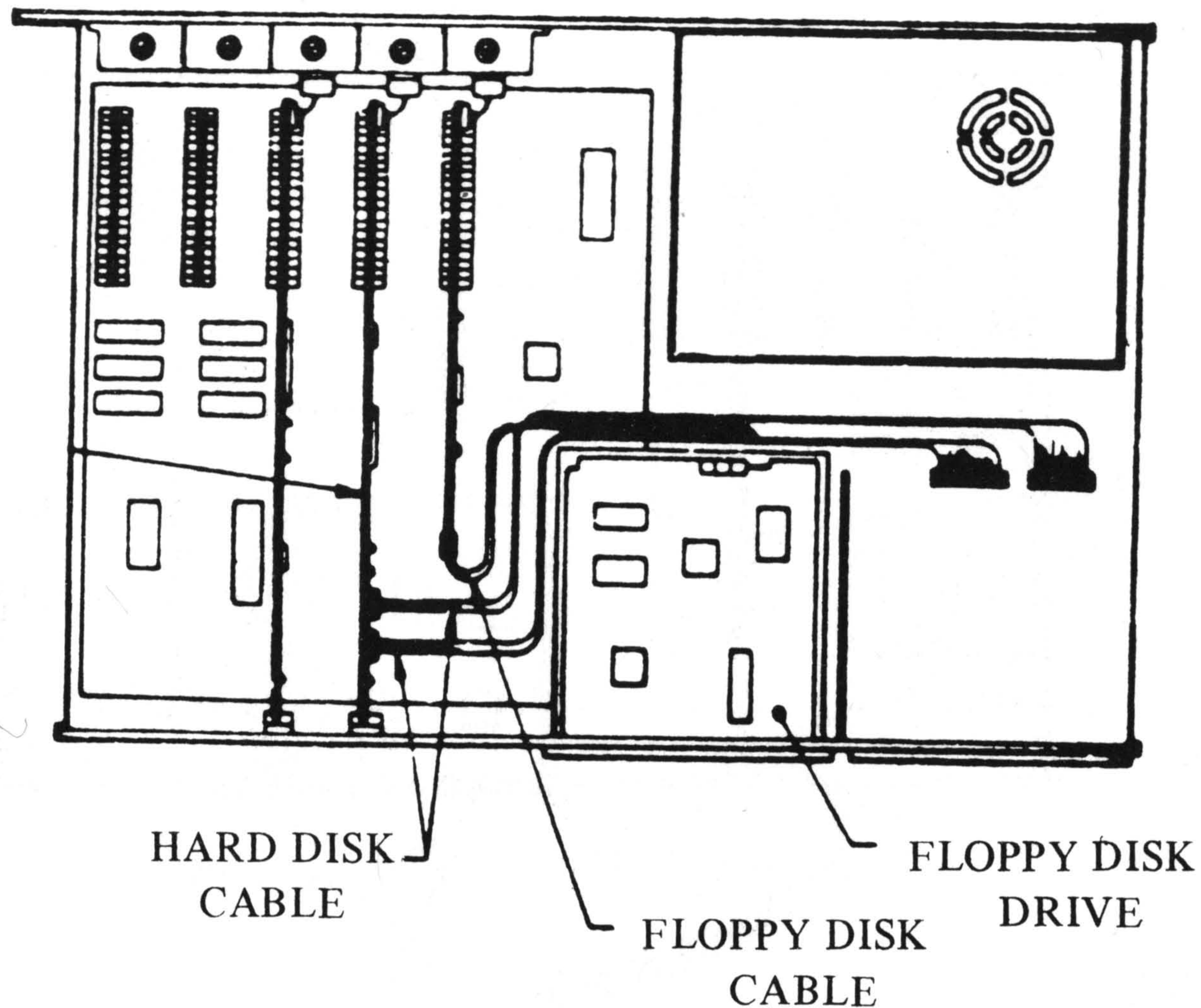
Install the Plastic card guide in the front of the system unit, aligned with the expansion slot you will use for the controller card. The guide pushes into place when located on the two holes in the front wall of the unit. (See Figure 2).

Figure 9.1



Check to be sure that the cables are properly connected to the controller card. The cables should be connected with the RED stripes toward the bottom of the controller board. Slide the controller card carefully through the open front drive slot. Pull the board through with the cables and drive following. Slide the drive in, leaving about 1 inch of space between the front wall of the PC and the drive front panel. Guide the ribbon cables between the disk controller in slot 5 and drive A: and then around the back of drive A: (See Figure 3). By holding the board by the rear bracket and the front corner, **CAREFULLY** press the board down so that the bottom connector goes into the expansion slot, taking care that the board slides into the plastic card guide. Press the board firmly until it is well seated in the slot. Using the screw removed from the blank bracket, secure the controller card in place.

Figure 9.2



9.1.6 Install Hard Disk Unit

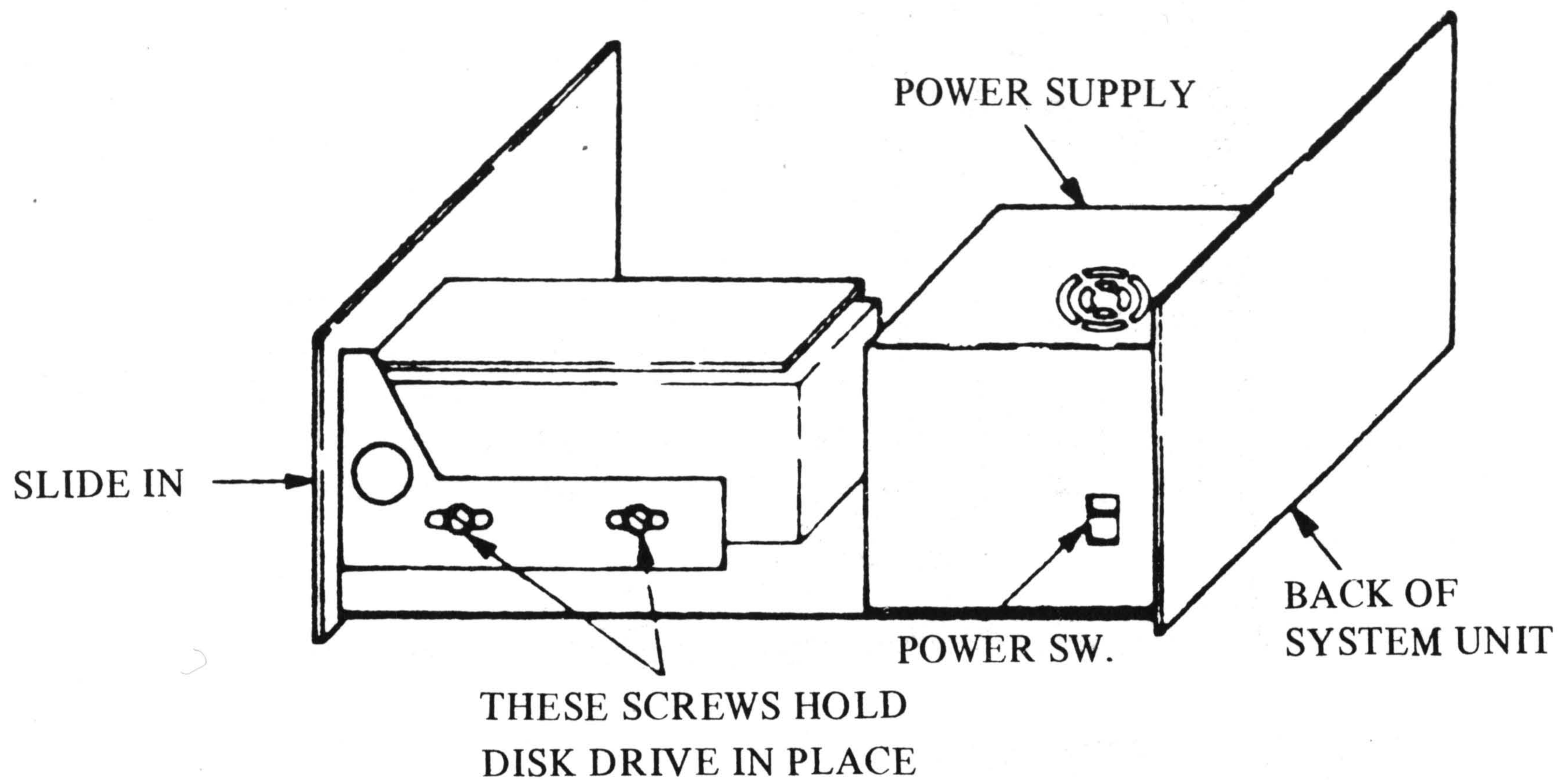
Check the cable connections to the hard disk. It is important to get the cables attached the correct way. Each cable has a red stripe, and each connector on the hard disk drive has a notch cut in it at one end.

Next, locate the power supply cable which was removed from the second floppy disk drive earlier. If no second floppy drive was installed the power supply cable will be near the power supply behind the first floppy drive. Attach the power supply cable to the nylon socket at the back of the hard disk drive. The power cable plug is keyed so it will only fit one way. Be sure to locate it correctly and push firmly into the socket.

Push the drive back in place and secure it to the system unit using the two screws provided. (See Figure 4).

USE THE SHORT SCREW IN THE HOLE CLOSEST TO THE FRONT TO PREVENT DAMAGE TO HARD DISK DRIVE.

Figure 9.3



9.1.7 Replace System Unit Cover

Slide the cover on the system unit from the front and secure with the screws removed earlier. Be sure not to bend any of the cables inside the system unit when the cover is replaced.

9.1.8 Reconnect System Unit Cables

Replace all connections from the monitor, printer, and keyboard to the PC, and plug in the power cord. Turn on the power to the system unit and all other external devices. The operating system should boot up from the hard disk and prompt you for the date and time.

9.2 FORMATING HARD DISK

Your HARD DISK drive comes from your dealer, fully prepared for use. When you turn on the system unit, after a few seconds the red light on the hard disk drive will light up indicating that the drive has power. The operating system will automatically boot and prompt you for the date and time. If the system does not boot up, create a DOS partition and then run Format as follows:

Perform the following steps:

- 1) Run FDISK
- 2) Run FORMAT

For each of the commands, type the command next to the DOS prompt, then hit [ENTER]. Each command is described below stating the operator entries and the screen responses.

For a further explanation of these commands, refer to your DOS manual.

9.2.1 Create DOS Partition

Place your DOS diskette in the disk drive and boot up your system. At the DOS prompt, type the following command:

```
A > FDISK (PRESS ENTER)
```

This runs the DOS program FDISK and displays a list of menu choices. Select option 1, Create DOS Partition, and answer the questions that follow appropriately. After partition creation is complete, reboot your system and go to the next step.

The following screen will appear:

```
*****
*
*      IBM Personal Computer      *
*      Fixed Disk Setup Program Version 2.xx *
*      (C) Copyright IBM Corp. 1983 *
*
*      FDISK Options              *
*
*      Current Fixed Disk Drive: 1 *
*
*      Choose one of the following: *
*
*      1. Create DOS Partition     *
*      2. Change Active Partition  *
*      3. Delete DOS Partition     *
*      4. Display Partition Data   *
*
*      Enter choice: [1]          *
*
*****
```

Figure 9.4

To select default option, press [ENTER]. Choice 1, "Create DOS Partition," will be the default value used. Then the question "Do you wish to use the entire fixed disk for DOS (Y/N)?" is displayed. Type "Y" and press [ENTER], as shown in Figure 9.5.

```

*****
*
*      IBM Personal Computer
*      Fixed Disk Setup Program Version x.xx
*      (C) Copyright IBM Corp. 1983
*
*      Create DOS Partition
*
*      Current Fixed Disk Drive: 1
*
*      Do you wish to use the entire fixed disk for DOS
*      [ Y/N ] .....? [ Y ]
*
*      Insert DOS diskette in drive A:
*      Press any key when ready ...
*
*
*****

```

Figure 9.5

The Message "Insert DOS diskette in drive A: Press any key when ready" will be displayed. Make sure your DOS diskette is in drive A: and press [ENTER]. DOS will reboot and prompt you for the date and time.

9.2.2 DOS FORMAT

To initialize your hard disk, run the following command at the DOS prompt:

```
A > FORMAT d: /S    d: may be C: or D:
```

This tells DOS to prepare the hard disk, allowing it to be used by your programs and transferring a copy of DOS to it. The message "Press any key to begin formatting in drive C:" will be displayed. Press any key to begin formatting.

The red light on the hard disk will illuminate, indicating that the formatting has begun. This procedure will take about 2 minutes for every 10 megabytes. When completed, DOS tells you that the system has been transferred, and the following message appears:

Volume label (11 characters, ENTER for none)?

You may enter any volume name up to 11 characters here. This is only a des-

criptive name and is not essential to the operation of your hard disk drive. If you have more than one hard disk drive, it is a good idea to use volume names to distinguish between them.

TO AVOID ERASURE, PLEASE PLACE A WRITE PROTECT TAB ON YOUR DOS SYSTEM DISKETTE. IF THE WRONG FORMAT COMMAND IS ENTERED INCORRECTLY, IT COULD ERASE THE CONTENTS OF THE DISK.

When complete, the status display appears on the screen. This shows:

```

xxxxx   Number of bytes total disk space
xxxxx   Number of bytes used by the system
xxxxx   Number of bytes in bad sectors
xxxxx   Number of bytes available on the disk
  
```

Check the number of bytes available on the disk. This should be equal to or greater than the advertised capacity of your hard disk. A discrepancy is very rare, but can happen during shipping and storage or if the hard disk has been mishandled. If there is still a problem, contact your dealer for assistance.

Figure 9.6 shows what the FORMAT dialog looks like on the display screen.

```

*****
*
*           A > FORMAT C: /S/V
*           Press any key to begin formatting drive
*           Formatting . . . Format complete
*           System transferred
*           Volume label (11 chars., ENTER none)?
*           xxxxx   bytes total disk space
*           xxxxx   bytes used by system
*           xxxxx   bytes in bad sectors
*           xxxxx   bytes available on disk
*
*           A >
*
*****
  
```

Figure 9.6

9.3 Troubleshooting

This section includes procedures to follow if your HARD DISK DRIVE is not operating properly. Power-On Self Test errors are described in Section 4.1 and other drive errors are described in Section 4.2.

9.3.1 POST Errors

POST Error Number	Corrective Procedure
1701 Error	<ol style="list-style-type: none">1) Check drive power connections for a loose cable.2) Make sure that the proper signal cable is connected to the drive installed.

9.3.2 Disk Operating System Errors

Error Message	Corrective Procedure
Invalid Drive Specification	<ol style="list-style-type: none">1) Run FDISK command on hard disk to prepare DOS partition.
Disk Won't Boot or Non-System Disk	<ol style="list-style-type: none">1) Check to be sure that the operating system has been properly installed.2) Format the disk using the DOS FORMAT command with the /S option.3) Make sure that jumper 2 on the controller board has been installed.

If you are unable to locate or correct the problem, please contact your dealer.

Fountain Technologies Inc.

12K, WORLDS FAIR DRIVE

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