WYSEpc Maintenance Manual

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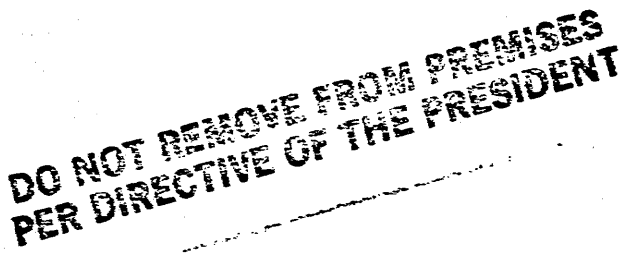
This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type-tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of the 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, try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer in relation to the receiver
- Plug the computer into a different outlet so that computer and receiver are on different branch circuits



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Preface

The WYSEpc is designed and manufactured by Wyse Technology. This manual provides a qualified technician with the information to service and maintain the computer.

How to Use This Manual

This manual is a single-volume reference guide with chapter divisions as follows:

- Chapter 1 provides general information about the computer, including a physical description, system configuration, features and options, installation instructions, and connection instructions.
- Chapter 2 provides removal and replacement instructions for the system modules.
- Chapter 3 provides a list of tools required for troubleshooting, a quick reference guide, and a troubleshooting flowchart.
- Chapter 4 provides a list of part numbers with illustrations of the computer assemblies.
- Chapter 5 contains a functional description and the theory of operation of the computer components.
- Chapter 6 contains schematic drawings for all the major assemblies of the computer.
- Appendix A provides system and MS-DOS error messages.
- Appendix B provides information and specifications about expansion items for the computer. The multifunction backplane and color graphics board are discussed.
- Appendix C provides specifications for the computer, the keyboard, power supply, standard backplane, diskette drive, hard disk drive, hard disk drive controller, parallel printer subsystem, asynchronous communication subsystem, monochrome monitor subsystem.
- Appendix D provides DIP switch setting information to reflect the addition of memory and installed options on the computer.
- Appendix E contains a jumper and connector summary.
- Appendix F contains the ASCII character codes.

Reference Manuals

The following publications provide detailed information on various computer components.

- WYSEpc User's Guide
- Intel Microsystem Components Handbook, Volumes 1 and 2
- Texas Instruments TTL Data Book
- Western Digital Communications Products Handbook
- NEC Microcomputer Products Data Book
- Synertek Data Book
- Standard Microsystems Data Catalog
- Seagate ST-212 Winchester Disk OEM Manual
- Adaptec ABC-2002 Winchester Hard Disk Controller OEM Manual
- Xebec 1210/A Winchester Hard Disk Controller OEM Manual
- Epson SD-521 Floppy Disk Specification
- National Semiconductor MOS Data Book

1 GENERAL INFORMATION

You'll learn how to set up your microcomputer for the first time in this chapter. The chapter lists the features and options of the system, then gives the power requirements and a description of the system configuration switch. The rest of the chapter is a step-by-step guide to getting started with the computer's disk operating system, MS-DOS.

Overview

The WYSEpc is a powerful 8088-based microcomputer, and is IBM PC-compatible. It's available with two 360K diskette drives, or a single 360K diskette drive and a 10M hard disk. Both configurations have 256K of built-in random-access memory (RAM), expandable to 512K with the addition of the optional multifunction backplane.

The display of the computer is either the WY-500 monochrome option or the WY-600 color graphics option which includes the WY-600 color monitor and a color graphics card, or any IBM-compatible monitor.

Two internal expansion slots provide space for optional printed circuit boards. Options may also be installed by attaching an external expansion chassis.

The computer is "plug-compatible" with the IBM PC. It supports a wide range of standard peripheral devices, including modems, printers, plotters, and auxiliary input devices such as a mouse or a light pen.

Software Compatibility

The computer runs under MS-DOS, a standard operating system for computers. With the WYSEpc, you gain access to the rapidly growing library of applications software written for MS-DOS and the IBM PC. This software includes popular spreadsheet, data base, and word processing packages, as well as applications for accounting, communications, graphics, and much more.

Features and Options

Table 1-1 lists the basic system components. See Appendix C for specifications for each component.

Table 1-1 Basic System Components

Name	Description
Computer processor unit	256K RAM Two half-height diskette drives or a hard disk with a single diskette drive Two RS-232C serial communications ports One Centronics-compatible parallel port One speaker One monochrome display output One keyboard interface Standard backplane with two IBM-compatible I/O slots Socket for 8087 numeric coprocessor DIP switch for system configuration
Keyboard	Regular keyboard as well as Command, Function, and Cursor Control keys
Monitor	Monochrome option or color graphics option
Computer power cable	3-prong, grounded
Monitor power cable	3-prong, grounded
System diskette	Current version of MS-DOS operating system, GW-BASIC, and WYSEpc system enhancement utilities
WYSEpc User's Guide	User documentation including MS-DOS commands

The display output is compatible with either the WY-500 monochrome monitor, WY-600 color monitor, or any IBM PC-compatible monitor.

Table 1-2 lists the options available for the computer. Refer to Appendix B for option specifications.

Table 1-2 Options Available

Name	Description
Multifunction backplane	Two IBM PC-compatible expansion slots, 256K RAM, and battery operated real time clock
Hard disk	10M Winchester drive with a single 360K diskette drive and hard disk controller card
WY-500 monochrome option	IBM compatible 14-inch monochrome monitor with video signal cable and AC power cord
WY-600 color graphics option	RGB color 14-inch monitor (640 x 200 resolution) with video signal cable, AC power cord, and a color graphics adapter card (supports WY-600 or IBM color monitor operation in 40/80-column alphanumeric IBM compatible high-resolution monochrome graphics and color graphics modes); has connector pins for RF modulator and light pen, and a composite video output.
Pedestal	Add-on base for standalone WY-500 monochrome or WY-600 color monitor

Installation Overview

Power Requirements

The computer is designed to operate from either a 115 VAC/60 Hz or 230 VAC/50 Hz source, and requires about 150 watts. The correct input voltage is selected by changing the voltage select jumper on the power supply printed circuit board (see Figure 2-4).

Caution--You can damage the system if you operate it with the incorrect input line voltage.

The fuse installed at the factory is for 115/230-volt operation. The computer is equipped with a three-pronged power cable. The third prong grounds the system when the cable is plugged into an appropriate receptacle. The offset pin on the power cable three- prong connect is the ground connection. To preserve the protection feature when operating the computer from a two-contact outlet, use a three-prong to two-prong adapter and connect the green lead on the adapter to ground.

System Configuration

A ten-bit dual-inline package (DIP) switch, located on the CPU logic board, is set to reflect the addition of memory and other installed options in the computer. See Appendix D for DIP switch settings. You can easily set the DIP switch with a sharp pointed object, such as a paper clip, letter opener or screwdriver. Do not use a ballpoint pen or pencil because ink and lead can build up and damage the DIP switch. See Chapter 2 in this manual for instructions on opening the computer case.

Setting Up the Computer

You can easily set up your new computer in a few minutes and begin to use it immediately.

If you have a hard disk system, you will find a sheet entitled "Hard Disk Test Sheet" when you unpack the computer. Keep this sheet--you will need it when you initialize the hard disk.

Before You Start

Consider the following before you set up your computer:

Space--Decide where you want to set up your computer. The room should be clean, cool, and dry. You'll need a flat surface and at least three inches of clearance on all sides. This allows air circulation and room for cables. Don't set your computer up in direct sunlight. Make sure you have a secondary source of light, bright enough to read by, but not bright enough to create glare on the screen. If you plan to install peripheral devices such as a printer or expansion module, leave extra room to the left or right of the computer.

Power--The computer runs on 115 volts AC (standard household voltage). Make sure you have a grounded power outlet that can accommodate a three-pronged plug. If you don't have this type of outlet, use an adapter.

Supplies--Included with your computer is an MS-DOS system diskette containing the MS-DOS operating system and utility programs. You also need a supply of blank 5 1/4-inch double-sided, double-density diskettes.

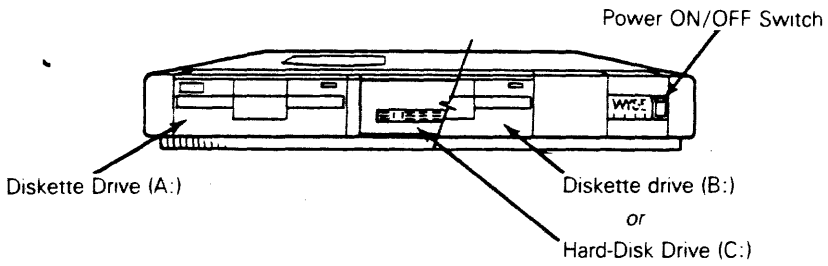
Tools--You'll need a small flat-blade screwdriver to install the video signal cable.

Warning--Before connecting the electrical power:

- Make sure the computer is set up for the voltage in your location. Refer to the label on the rear of the computer for the correct voltage.

- Make sure that all extension and power cords you connect with your computer are grounded (they should have three prongs including the ground pin). Also, make sure that the power outlet is grounded. Grounding is essential for preventing electrical shock. Other units hooked up to the system should also be grounded.

Figure 1-1 The Front of the Computer



Take a few moments to become familiar with the parts of the system before you start to connect them.

Look at the front of the computer first. Figure 1-1 shows the power switch and disk drives. The left-hand diskette drive is referred to as drive A. (Note that you must always include a colon whenever you specify a disk drive; however, in the text, we won't include it.) The right-hand disk drive is either a second diskette drive (drive B) or a 10-megabyte hard disk (drive C), depending on the system you purchased.

The rear panel of the computer has several connectors and a fan. Before you set up your new system, refer to Table 1-3 and look at the cable connections shown in Figure 1-2.

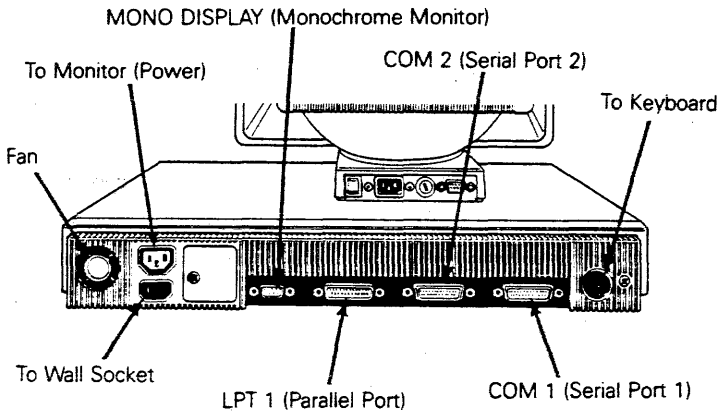
Table 1-3 Computer Connections

Connector	Purpose
Switched AC Output	Accepts the monitor power plug.
AC Power Input	Accepts the computer AC power cord.
MONO DISPLAY	Accepts the monochrome monitor 9-pin, D-shell female connector on the video signal cable.
LPT1 (Parallel Port)	This parallel port is designed for printers with a Centronics interface, but may be used for any device that matches its I/O capabilities. The 25-pin D-shell female connector provides the I/O signals.
COM2 (Serial Port 2)	This is one of two EIA RS-232C asychronous communications subsystem adapters built into the computer. Peripheral devices, such as an external modem, may be attached via a 25-pin D-shell male connector.
COM1 (Serial Port 1)	This is the second EIA RS-232C asynchronous communications subsystem adapter built into the computer. See Chapter 2 for instructions to disable this COM1 connector when adding an option board with an internal modem.

Table 1-3 Computer Connections (Continued)

Connector	Purpose
Keyboard Socket	Accepts a 10-pin DIN keyboard connector.
I/O Access Door	The computer has two expansion slots available at this location for installing optional printed circuit boards. Any IBM PC/XT compatible option board can be installed in these slots if it has the narrow XT-type metal connector brackets. If you add the color graphics option board, it provides additional connectors for the WY-600 color graphics monitor. If your computer contains the 10M hard disk drive, a hard disk drive controller board has already been installed in one of these two expansion slots.

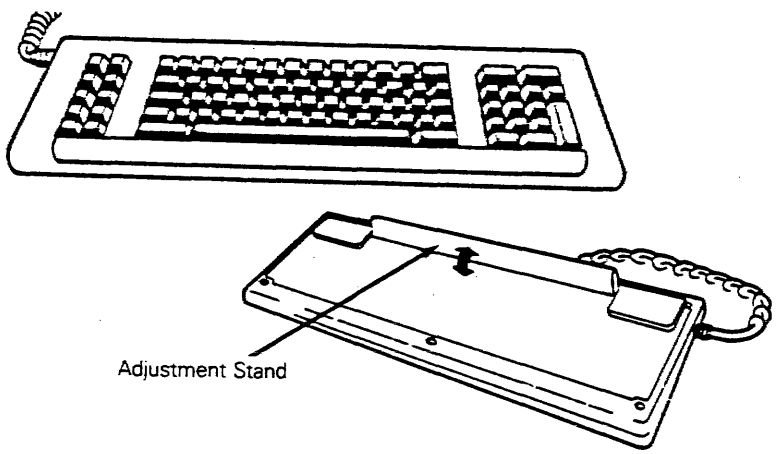
Figure 1-2 The Rear of the Computer



It's important to leave extra space behind the fan. This allows the computer to stay cool during operation.

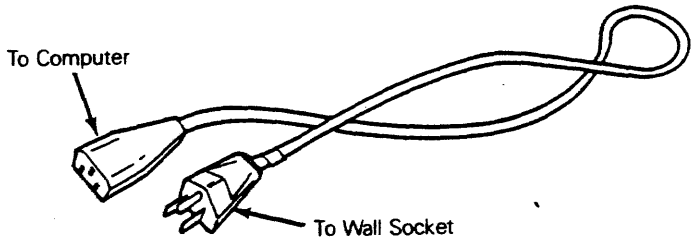
The keyboard's coiled cable and height adjustment stand let you use the keyboard in several different positions (Figure 1-3). You can set the keyboard flat on the table or you can move the keyboard adjustment stand so that the keyboard tilts toward you.

Figure 1-3 The Keyboard



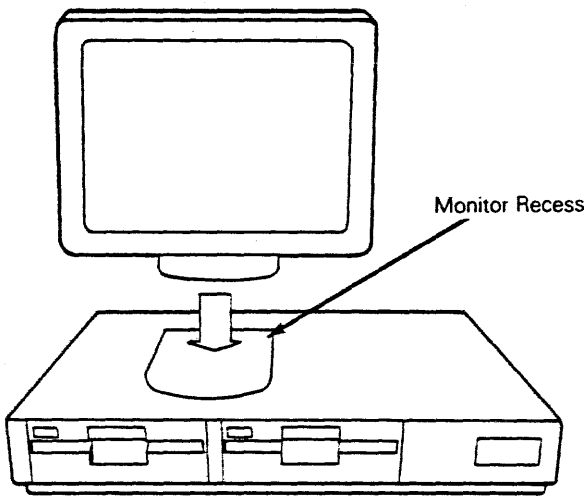
The computer power cord has a plug for the wall outlet and a connector for the back of the computer (Figure 1-4).

Figure 1-4 The Computer Power Cord



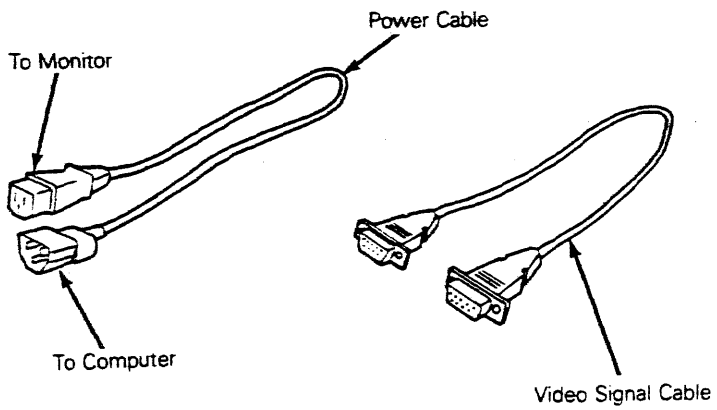
The video monitor fits into a recess on top of the computer (Figure 1-5) and it can stand alone or on a pedestal that you can order as an option.

Figure 1-5 The Monitor



Two cables (one for video signals and one for power) connect the monitor to the computer (Figure 1-6).

Figure 1-6 Monitor Cables



If you're going to install other options (such as the color graphics option), refer to Chapter 2.

Installing the System

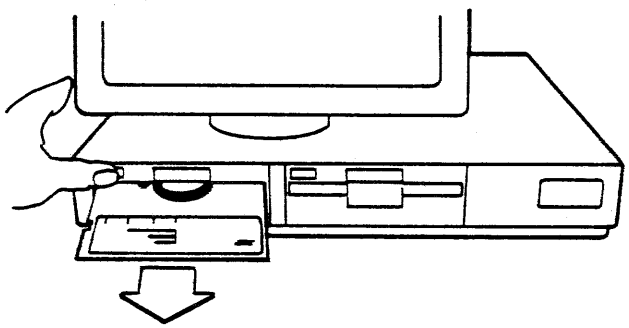
Now that you've unpacked the system, found a place for it, and have become familiar with its parts you can set it up.

1. Place the computer where you're going to use it.

2. Press the button labeled PUSH on the diskette drive(s) to eject the protective cardboard insert, as shown in Figure 1-7. Save the cardboard insert--if you move the computer later, this insert helps prevent any damage to the drive.

Note--Some diskette drives have a lever instead of a PUSH button. If yours has this lever, flip the bottom of the lever up to the right to release the diskette.

Figure 1-7 Removing the Cardboard Insert



3. Connect the keyboard cable to the rear of the computer as shown in Figure 1-8.

4. Connect the computer power cord to the rear of the computer (Figure 1-9).

5. Set the monitor on top of or next to the computer.

6. Plug the video cable into the computer port labeled MONO DISPLAY and into the nine-pin monitor port on the rear of the display pedestal (Figure 1-10). Make sure you tighten both screws on each cable connector with the screwdriver.

Figure 1-8 Plugging In the Keyboard Connector

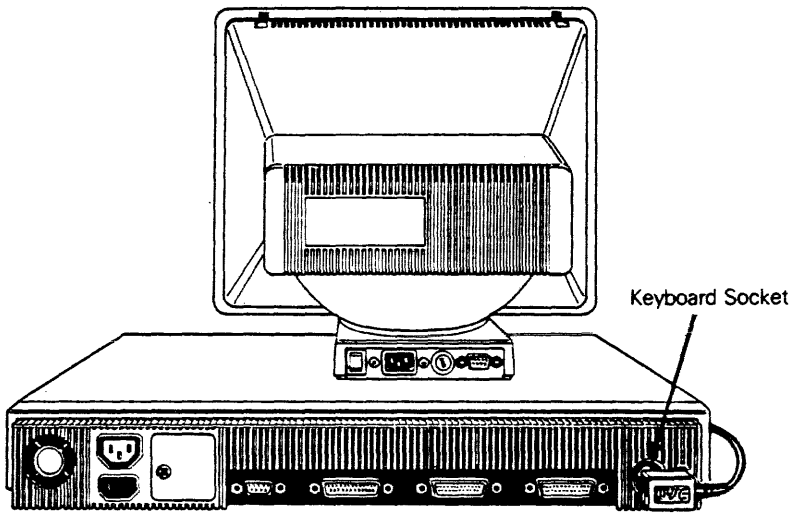


Figure 1-9 Connecting the Computer Power Cord

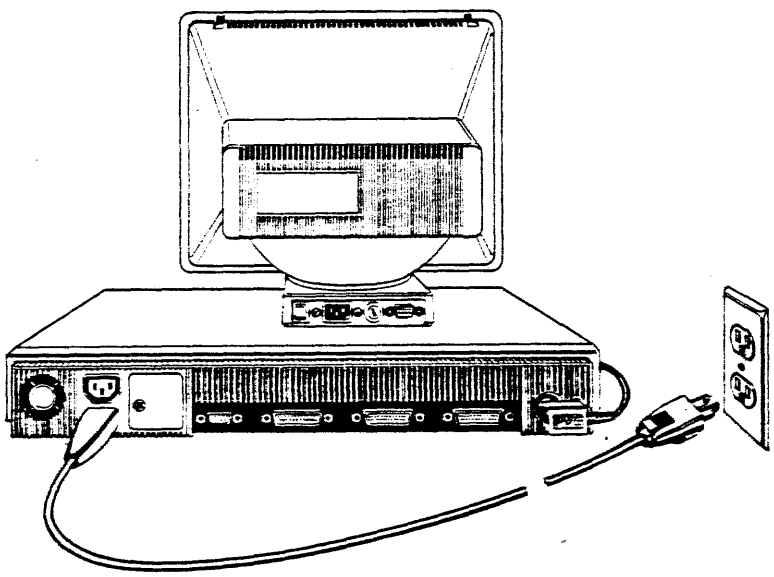
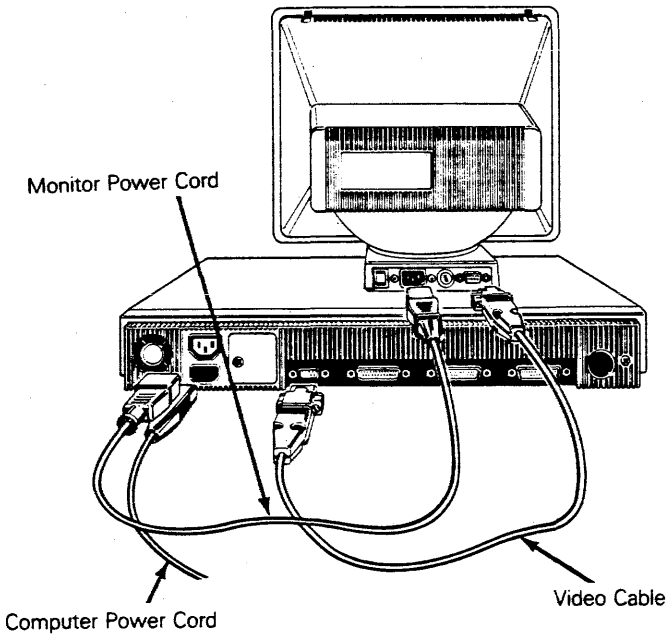


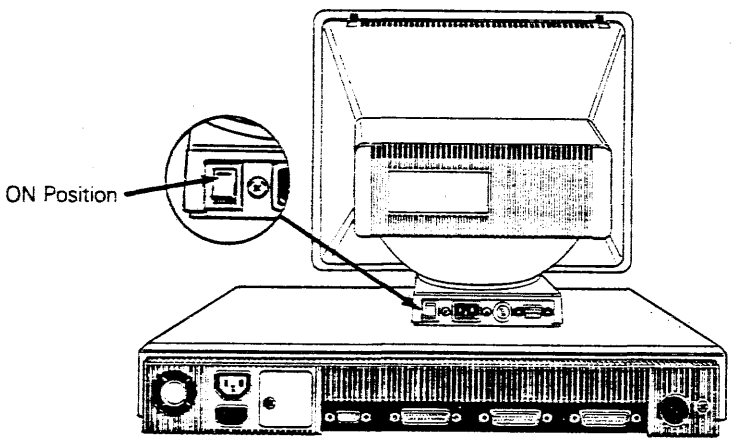
Figure 1-10 Monitor Cable Connections



7. Plug one end of the monitor power cord into the monitor (see Figure 1-10). Plug the other end into the outlet on the rear panel of the computer.

8. Turn on the power switch (see Figure 1-11) on the rear of the monitor. The power switch on the computer should remain off.

Figure 1-11 Monitor Power Switch



9. Plug the computer power cord into a grounded wall outlet. You are now ready to start the computer.

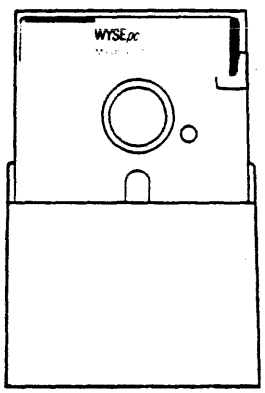
Starting the Computer

Before you can use the computer, you must load the operating system into the computer's memory. The operating system is a group of programs that make it possible for the computer to run (refer to Chapter 3 of the WYSEpc User's Guide for an introductory discussion of what the operating system does). Your computer is shipped with the current version of Microsoft's Disk Operating System, MS-DOS. The sealed envelope that came enclosed with the manuals contains the MS-DOS system diskette.

The MS-DOS diskette contains the operating system, along with system enhancement utility programs that perform functions such as copying and formatting disks, and the current version of GW-BASIC.

1. After you read the licensing agreement, remove the system diskette from its envelope (see Figure 1-12).

Figure 1-12 The MS-DOS System Diskette



2. With the diskette label facing up and toward you (Figure 1-13), carefully slide the diskette into the left-hand diskette drive (drive A) until you hear a click.

3. Press the PUSH button until it engages. (The computer cannot access a diskette unless the PUSH button is engaged--press the PUSH button again when you want to release a diskette.)

   Note--Some diskette drives have a lever instead of a PUSH button. If yours has this lever, press the right side of the lever down to engage the diskette.

4. Turn the computer on (see Figure 1-14).

Figure 1-13 Inserting the MS-DOS Diskette in Drive A

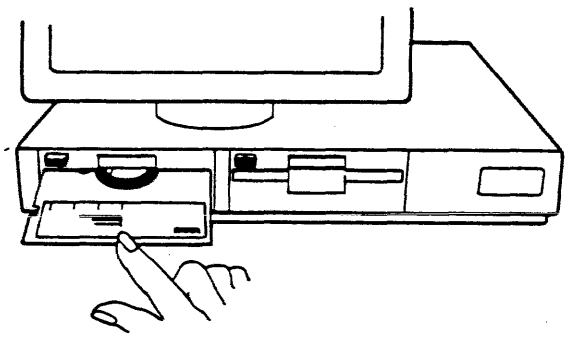
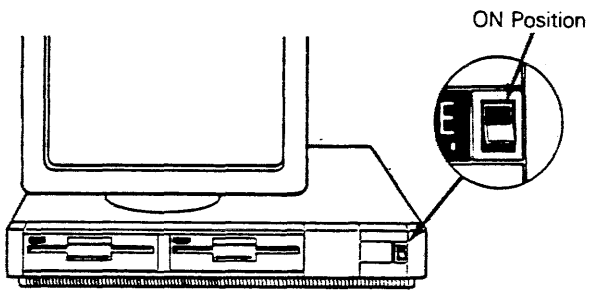


Figure 1-14 Turning On the Computer



5. The following message now appears:

```
Wyse Technology  Rev xx.x
```

The computer now runs a self-test, including a check of system random access memory (RAM), displaying the message

```
xx kb Good
```

The final value displayed is the total size of system RAM measured in kilobytes. A single short beep indicates that everything is in order. If you start the computer without properly inserting the MS-DOS diskette, you will see the following message:

```
Non System disk or disk error
Press a key to retry
```

If you see this message, make sure the MS-DOS system diskette is in drive A and that the PUSH button is engaged. Then press any key.

If you see something else on the screen, don't hear a beep, or hear more than one short beep after the self-test, turn to Appendix A.

6. The MS-DOS system files are now being loaded from the MS-DOS diskette into the internal memory of the microcomputer. As this takes place, you momentarily see the message

```
Booting MS-DOS
```

You then see the message:

```
WYSE pc IO System  Rev x.xx

Microsoft MS-DOS version 2.11
Copyright 1981,82,83 Microsoft Corp.

Command v. 2.11
Current date is Tue 1-01-1980
Enter new date:
```

Enter the current date in the format mm-dd-yy, where

mm is a number from 1 through 12 that indicates88 the month.
dd is a number from 1 through 31 that indicates the day of the month.
yy is a number from 80 through 99 that indicates the year.

A dash (-) or slash (/) separates the month, day, and year.

Use the number keys on the top row of the keyboard to enter the date. The keys on the numeric keypad will not generate numbers unless you first press the NUMLOCK key.

After you have typed the date, press RETURN to send the information to MS-DOS.

Note--It is not necessary to enter the date whenever you start the computer. If you don't want to enter the date, just press RETURN without typing anything. (Note, however, that the date will then be incorrect.)

7. Now the screen displays the message

```
Current time is 0:02:00.00
Enter new time:
```

Enter the time in the format hh:mm, where

hh is a number from 1 through 23 that indicates the hour.
mm is a number from 0 through 59 that indicates minutes in the hour.

A colon (:) separates the hour and minutes. MS-DOS uses a 24-hour clock. For instance, you would enter 1:30 p.m. as 13:30.

After typing the time, press RETURN. If you don't want to enter the time, just press RETURN.

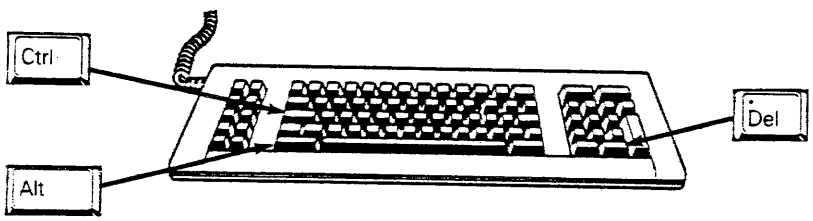
Note--If you make a mistake entering the date or time, you can correct it by erasing what you typed with the BACKSPACE key and retyping the response. If you have already pressed RETURN, you can still correct the error with the DATE or TIME command. When the MS-DOS prompt A> appears on the screen, type the word DATE (to correct the date) or TIME (for the time), and press RETURN. The date or time requests reappear on the screen and you can enter the correct information.

Now the system prompt A> appears on the screen. The A> prompt indicates that MS-DOS is loaded and ready to accept commands; it also indicates that drive A is now the active (or default) disk drive (refer to Chapter 3 of the WYSEpc User's Guide for a full discussion of using disk drives).

What you've just done is called "loading" MS-DOS or "booting the system." This means that a copy of MS-DOS was transferred into the computer's memory. You must load MS-DOS from diskette every time you turn the computer on, unless you transfer MS-DOS to a hard disk, as explained later in this chapter.

Note--If you ever need to restart the computer, you can reboot your system without turning the computer off--hold down the CTRL and ALT keys and press the DEL key at the same time (Figure 1-15). This is called a "system reset" or "warm boot."

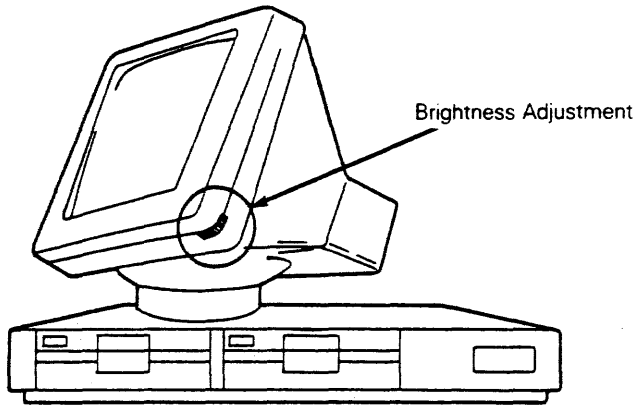
Figure 1-15 Rebooting the System



Adjust the system as follows so that it's comfortable for you.

- Tilt and turn the monitor.
- Check the monitor brightness (see Figure 1-16).
- Raise or lower the keyboard with the stand.
- Adjust the keyclick volume by holding down the CTRL and ALT keys, and then pressing the + or - key on the numeric keypad. The + key increases the volume; the - key decreases the volume.

Figure 1-16 Comfort Adjustments



Backing up the MS-DOS Diskette

Make at least one working copy of your original MS-DOS diskette and store the original in a safe place. It is important to periodically copy all of your diskettes to safeguard your program and data files.

Making a backup copy of a diskette involves two steps:

1. Preparing the blank diskette with the FORMAT command.

2. Copying the diskette with the DISKCOPY command.

Formatting a New Diskette

Before you can store any information on a new diskette, you must format it. This prepares the diskette to accept data from the computer.

Caution--Do not format a diskette that already contains program or data--the program diskettes are already formatted for MS-DOS. The FORMAT command erases everything on a diskette, so use it with caution. To prevent accidentally erasing a diskette, write-protect it, as described in Chapter 3 of the WYSEpc User's Guide.

Following is the formatting procedure:

1. Make sure the MS-DOS diskette is in drive A. If you have two diskette drives, type the command

   ```
   FORMAT B:
   ```

   If your system has a single diskette drive/hard-disk, type the command

   ```
   FORMAT A:
   ```

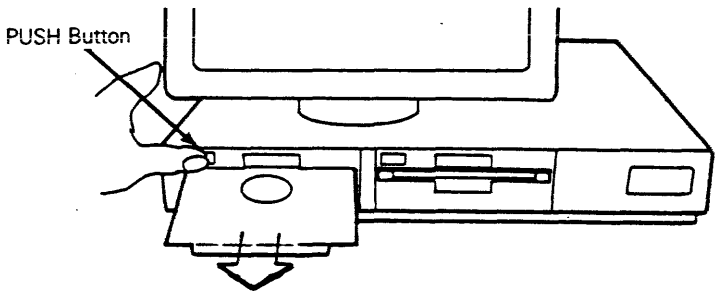
2. Press RETURN. The computer displays the following message:

   ```
   Insert new diskette for drive <d>:
   and strike any key when ready
   ```

3. If your system has two diskette drives, keep the MS-DOS diskette in drive A and simply insert the blank diskette in drive B.

   If you have only one diskette drive, eject the MS-DOS diskette from drive A by pressing the PUSH button again (Figure 1-17). Replace it with the blank diskette to be formatted.

Figure 1-17 Ejecting a Diskette



4. Press the spacebar or any other key. These messages appear on the screen:

```
Formatting...
Verifying...
Format complete.
362496 bytes total disk space
362496 bytes available on disk
Format another (Y/N)?
```

5. To format another diskette, replace the one you have just formatted with a new diskette and press the Y key. For now, press the N key.

   The system prompt A> reappears, indicating that MS-DOS is waiting for another command. Apply a label to the diskette and note that it is formatted (write on the label before applying it to the diskette).

Copying a Diskette

In this section you'll copy the MS-DOS diskette with the DISKCOPY command. This is the same procedure you'll follow when you want to copy any diskette. Make sure you have a blank, formatted diskette on hand.

Note--Many software companies incorporate copy protection schemes in their programs. These schemes prevent you from successfully running copied programs. Almost all software companies also copyright their software. Read the software program's specific instructions before copying it.

Copying with Two Diskette Drives--With a two-diskette system, you can copy directly from drive A to drive B.

With the MS-DOS diskette in drive A, type the command

```
DISKCOPY A: B:
```

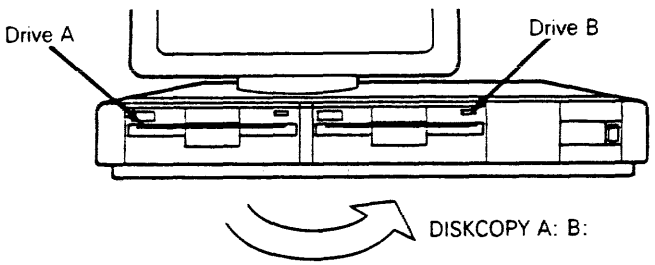
and press RETURN. You will see the following message:

```
Insert source diskette in drive A:
Insert formatted target diskette in drive B:
Strike any key when ready
```

The source diskette is the disk that you are copying from. In this case, the MS-DOS diskette is already in drive A.

Make sure that the newly formatted (target) diskette is in drive B, and press any key (Figure 1-18).

Figure 1-18 Copying with Two Diskette Drives



When the diskette is copied, the following message appears on the screen:

```
Copy complete
Copy another  (Y/N)?
```

Press the Y key if you want to copy another diskette. For now, press N; the system prompt reappears on the screen.

Remove the source diskette from drive A and the target diskette from drive B. Remember to label the new copy. (Write on the label before you put it on the diskette--never write directly on a label that is on a diskette unless you use a felt-tipped pen.)

Your computer can now run any of your applications software--refer to "Running an Applications Program" later in this chapter.

Copying a Diskette with a Single-Diskette System--If you have a hard-disk (single-diskette drive) system, you must exchange diskettes several times during the copying process. (Normally, you will copy your programs directly onto the hard disk, but you should still make backup copies on a diskette.)

The MS-DOS diskette should be in drive A and the A> prompt should be displayed on the screen.

1. Type the command

```
DISKCOPY
```

and press RETURN.

2. The following message appears on the screen:

```
Insert formatted target diskette in drive A:
Strike any key when ready.
```

The target diskette is the blank diskette onto which you're copying the information.

Remove the MS-DOS diskette from drive A and replace it with the formatted (target) diskette. Press any key.

3. MS-DOS now displays the message

```
Insert source diskette in drive A:
Strike any key when ready.
```

The source diskette is the original diskette that you are copying from (in this case, the MS-DOS system diskette). Remove the blank (target) diskette, replace it with the source diskette, and press a key.

4. When the computer has read as much of the diskette as it can read at one time, it stops and displays the message

```
Insert target diskette in drive A:
Strike any key when ready.
```

Remove the source diskette and reinsert the blank, formatted target diskette. When you press a key, the drive-active indicator will light as the information is written onto the target diskette.

5. MS-DOS requires several passes to copy the entire diskette. Each time through, the DISKCOPY program prompts you to reinsert the source and target diskettes. Continue this process until you see the message

```
Copy complete
Copy another(Y/N)?
```

To make another copy, press the Y key; otherwise, press N. If you press N, the system prompt reappears on the screen.

6. Remove the target diskette from drive A. This is your working copy of MS-DOS. Remember to label the new copy. (Write on the label before you put it on the diskette.)

Preparing the Hard Disk

Before you can work the hard disk of your computer, you need to prepare the disk by initializing it, creating and formatting an MS-DOS partition, and setting aside any bad areas of the disk. You can then copy all of the MS-DOS files onto the hard disk and begin using it.

Initializing the Hard Disk

With the MS-DOS diskette in drive A, type the command

```
HDINIT C:
```

Caution--The HDINIT utility erases everything on the hard disk. You should enter HDINIT only once, the very first time you set up the system.

HDINIT begins by displaying the message

```
You are about to initialize hard disk C:
This will destroy all data on that disk.
Are you sure you want to do this (Type 'Y' for yes)?
```

Press the Y key. You will then see the message

```
Press any key to begin initializing C:
```

At this point you can exit from HDINIT and return to the system prompt by holding down the CTRL key and pressing the BREAK key. To continue initializing the hard disk, press the spacebar or any other key. The message

```
Initializing...
```

is displayed. After approximately two minutes, the message

```
Initialization complete.
```

indicates that you can proceed to partition the hard disk.

Partitioning the Hard Disk

The hard disk contains a large block of permanent memory. You may want to divide this memory into more than one area so that you can load more than one operating system.

Before you format the hard disk, you must tell MS-DOS how many areas you want. This is called partitioning. To partition the hard disk, you'll run the FDISK program. An area created by FDISK, whether it's part or all of the disk, is called a partition.

Note--This section explains how to partition the hard disk if you want to run MS-DOS and use the rest of the the hard disk for storage managed by MS-DOS (this is the usual way to set up the hard disk). If you want to run more than one operating system, see "Partitioning the Hard Disk" in Chapter 3 of the WYSEpc User's Guide.

1. With the MS-DOS diskette in drive A, type the command

```
FDISK
```

   and press RETURN. The FDISK main menu now appears:

```
Choose one of the following:

1. Create MS-DOS Partition
2. Change Active Partition
3. Delete MS-DOS Partition
4. Display Partition Data

Enter Choice:[1]
```

   The number 1 (the default selection) is already displayed. You can change the number by pressing another number.

2. Press RETURN. Now the display looks like this:

```
Create MS-DOS Partition

Do you wish to use the entire hard disk
for MS-DOS?.....................? [Y]
```

   The letter Y is the default answer.

3. Press RETURN.

4. Press the ESC key to return to the FDISK menu.

5. Press ESC again. The following message is displayed:

```
Please insert MS-DOS diskette into drive A:
Press any key when ready.....
```

6. The MS-DOS diskette should already be in drive A. Press any key. The system will now reboot. Whenever you change the partition, MS-DOS must be reloaded so that it will recognize the new partition. Be sure to reset the system date and time.

Formatting the Hard Disk

Now that you've partitioned the hard disk, you must format it, just as you would a diskette. Follow these steps to format the hard disk.

1. With the MS-DOS diskette in drive A, type the command

```
FORMAT C:/S/V
```

   and press RETURN. This tells MS-DOS to format drive C (the hard disk), copy the MS-DOS system files onto the newly formatted disk (/S option), and prompt you for a disk volume label (/V option).

2. This message appears on the screen:

```
You are about to format your hard disk.
This will destroy all data in the MS-DOS partition.

Are you sure you want to do this (Type 'Y' for yes)?
```

   Press the Y key, then press RETURN. You now see the message

```
Press any key to begin formatting C:
```

3. Press any key. This message appears on the screen:

```
Formatting...
Verifying...
```

   The formatting process takes up to five minutes as MS-DOS checks the entire disk.

4. When formatting is done, you will see the message

```
System transferred

Volume label (11 characters, ENTER for none)?
```

   You can type in a disk volume label (i.e., a disk name) or simply press RETURN for no label.

5. The message

```
Format complete.
xxxxxxxx bytes total disk space
xxxxx bytes used by system
xxxxxxxx bytes available on disk
```

   indicates that the hard disk is now formatted and ready to use. After you copy MS-DOS as described in the next section, you can boot directly from the hard disk.

Reserving Bad Areas on the Hard Disk

When you unpacked your hard-disk system, you found a sheet titled "Hard Disk Test Sheet." Refer to this sheet now. If no hard-disk errors are listed on the sheet, skip this section and go directly to "Copying MS-DOS onto the Hard Disk."

If you see any disk errors listed, these indicate the location of potential trouble spots on the disk. Disk manufacturers pass each disk through sophisticated tests that can discover potential bad spots in an otherwise faultless disk. Although these areas work properly at the moment, it is possible that, over time, they can develop into hard errors and you may lose data. Therefore, to increase disk reliability, you should mark these areas so that they will not be used.

The HDSPARE utility is used to reserve bad areas on a hard disk that has been partitioned and formatted. To run HDSPARE, type the command

```
HDSPARE C:
```

HDSPARE begins by displaying the message

```
Please enter the list of bad locations on the hard disk from
the disk test printout.  The bad clusters will be marked as
bad on the hard disk to prevent MS-DOS from using them.
```

Refer to the disk test sheet for the location of the bad areas on the disk. Under "Error Map," you will see the labels "Cylinder," "Head," and "Byte Offset." This information allows MS-DOS to locate any point on the hard disk. The HDSPARE prompt

```
Enter: cylinder number,head number,byte number >
```

asks for this information. Type the three numbers for the first bad area, separating each with a comma. For example,

```
Enter: cylinder number,head number,byte number >5,2,1052
```

Press RETURN after you have entered the proper numbers. HDSPARE will print the message

```
Is this entry ok (Y or N)?
```

to verify the entry. Press the Y key if the entry is correct. The "cylinder, head, byte" prompt will then be redisplayed so that you can enter the location of the next bad area on the disk.

Once you have entered the coordinates for each bad area on the disk, press RETURN only at the prompt. HDSPARE now displays a table similar to the following:

```
Cylinder    Head    Byte     Status

   5          2     1052     DOS/used cluster; cannot be marked bad
  10          2        2     track index area; cannot be marked bad
  49          1     1000     DOS/unused cluster; marked bad
```

If this list is correct, type Y and it will be written to the disk. Otherwise, type N and reenter the list.

If this list is the same as the list on the disk test sheet, press Y. The bad areas will be reserved from use.

Note--If an area is marked "DOS/used cluster" or "track index area," MS-DOS needs the area and will continue to use it. This will happen rarely, and when it does happen, will even more rarely lead to problems. Refer to the description of the HDSPARE command in Chapter 5 of the WYSEpc User's Guide for a description of these terms.

To exit from the HDSPARE program without marking bad areas of the disk, use the CTRL BREAK command (hold down the CTRL key and press the SCROLL LOCK/BREAK key).

Copying MS-DOS onto the Hard Disk

Perform the following procedure to copy all of the MS-DOS files onto the hard disk:

1. Make sure that the MS-DOS system diskette is in drive A and that the system prompt is displayed.

2. Type the command

   ```
   COPY A:*.* C:
   ```

   and press RETURN. *.* is a global file specification that tells MS-DOS to copy every file on the specified disk--in this case, to copy every file from drive A to drive C.

MS-DOS lists each file as it is copied. All of MS-DOS, as well as GW-BASIC, is now on the hard disk. This completes the preparation of the hard disk.

Booting from the Hard Disk

Booting from the hard disk is faster and easier than booting from the diskette drive because you don't need to insert the MS-DOS diskette every time you start the computer. This is the procedure to follow when you boot from the hard disk:

1. If there's a diskette in drive A, disengage it by pressing the PUSH button. The system will not try to boot from the hard disk if there is a diskette in drive A.

2. Reboot the computer by holding down the CTRL and ALT keys and pressing the DEL key at the same time (see Figure 1-15). MS-DOS now loads from the hard disk, and displays the C> prompt, indicating that drive C is now selected as the primary disk drive.

Note--You can now start your computer by simply turning on the power switch. As long as there is not a diskette in drive A, MS-DOS will automatically load itself from the hard disk.

Running an Applications Program

Now you're ready to actually use the computer to run MS-DOS applications software. Before you use any of your applications software, be sure to take the following precautions:

- Write-protect the original applications disk (as explained in Chapter 3 of the WYSEpc User's Guide).

- Make a backup copy with the same procedure you used to copy the MS-DOS system diskette. Remember that the MS-DOS diskette must be present in the disk drive (or on the hard disk) for the FORMAT and DISKCOPY commands to work.

To start a program, simply insert the diskette into the drive and type the name of the program's command file. Refer to the program manual to find out what this command is. When you type the name of any executable file, MS-DOS loads that file from the disk into your computer's memory, and turns control over to the program contained in the file. (Executable files are indicated by the file name extensions .EXE or .COM; refer to Chapter 4 of the WYSEpc User's Guide for more information about files and file names.)

When you finish with a program, you return to the operating system level. Each program has its own commands for returning to MS-DOS.

If you become stuck in a program, you can generally get back to the MS-DOS level with the CTRL BREAK command (hold down CTRL and press BREAK). If the CTRL BREAK command does not work, you can use the CTRL ALT DEL command to entirely reboot the system. This reloads MS-DOS from disk. You can then restart the program. However, if any data files are open, you should reboot only as a last resort--data in any open files may be lost if you have not yet saved them to disk.

Once you are back at the MS-DOS command level, you can again use any of the MS-DOS commands or start any MS-DOS applications program.

Note--Some applications programs cannot run unless you first load GW-BASIC. When you try to run a program, if you see the error message

```
No BASIC ROM.  Press a key to boot
```

you need to load GW-BASIC before you can run the program. (See the GW-BASIC loading instructions in the GW-BASIC User's Guide.) Load GW-BASIC into your system, and try the application again.

Check with your dealer to find out which application software packages best suit your requirements.

2 REMOVAL/REPLACEMENT PROCEDURES

All assemblies within the computer can be removed for repair or replacement by the service technician with common hand tools.

A table listing the internal switch settings for the 10-bit DIP switch on the CPU logic board is located on page 2-4.

This chapter explains the removal and replacement procedures for the following items:

Safety Notices

Warning--To avoid possible electrical shock hazard, unplug the power cord and disconnect all cables from the computer before performing any of the following procedures.

The computer and monitor contain high-voltage components that are extremely hazardous (even after you turn off power) unless the proper precautions are taken. Do not open the computer case or monitor for any reason unless you are a qualified service technician. Do not attempt to service the unit until you take all necessary precautions (e.g., remove jewelry, maintain grounding by wearing a wrist strap attached to ground) for working on high-voltage equipment.

Caution--After you perform any removal/replacement procedure, b sure to inspect all harness wiring to see that no wires or cables are pinched between the computer case and other parts of the unit.

Periodically check for frayed insulation on wires. If frayed wires are found, replace them with the same gauge, insulation, thickness, length, and rating of wire. Always observe the original routing and length of harness wires.

You should have the following tools and materials to perform the removal/replacement procedures in this chapter.

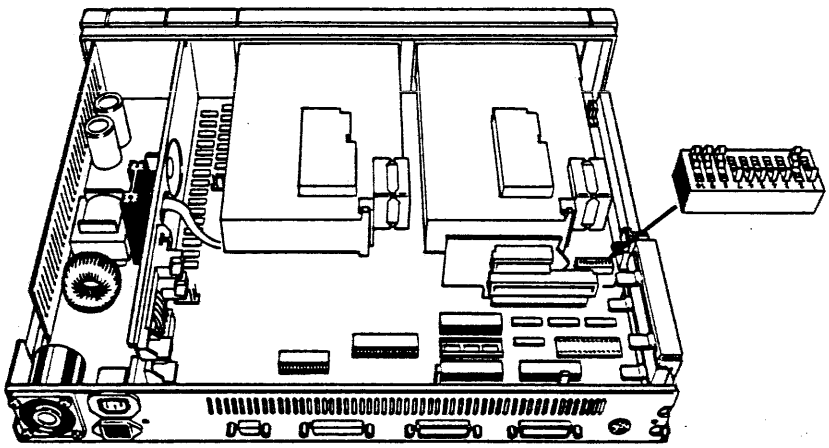
Tools and Materials Required

No. 1 magnetic Phillips screwdriver
No. 2 magnetic Phillips screwdriver
Flat-blade screwdriver
7/32-inch nutdriver
3/16-inch nutdriver
Needlenose pliers
Fuse puller
Integrated circuit extracter
Integrated circuit inserter
Fuse (fast-blow, 250 volts, 3 amperes)
Tie wraps

Internal Switch Settings

A ten-bit dual-inline package (DIP) switch is located on the CPU logic board at position 1K (see Figure 2-1).

Figure 2-1 DIP Switch Location



You can set this switch to reflect the addition of memory and other installed options. You can easily set the DIP switch with a sharp pointed object, such as a paper clip, letter opener, or screwdriver. Do not use a ballpoint pen or pencil because ink or lead can build up and damage the switch.

Figure 2-2 shows the DIP switch set for 256K RAM, a monochrome monitor, two diskette drives, and no 8087 coprocessor. Table 2-1 shows the internal DIP switch settings for various computer configurations.

Table 2-1 Internal DIP Switch Settings

System Configuration Switch										Configuration
1	2	3	4	5	6	7	8	9	10	
Off	On	Off	Off	Off	Off	Off	On	On	On	256K, monochrome display, 2 floppies, no 8087
Off	On	Off	Off	Off	Off	On	On	On	On	256K, monochrome display, 1 floppy, 1 hard disk, no 8087
Off	On	Off	Off	On	Off	Off	On	On	On	256K, 80-column color display, graphics mode (corresponds to MODE CO80), 2 floppies, no 8087
Off	On	Off	Off	Off	On	On	On	On	On	256K, 40-column color display, graphics mode (corresponds to MODE CO40), 1 floppy, 1 hard disk, no 8087
Off	Off	Off	Off	Off	Off	Off	On	On	On	256K, monochrome display, 2 floppies, 8087
Off	Off	Off	Off	Off	Off	On	On	On	On	256K, monochrome display, 1 floppy, 1 hard disk, 8087
Off	Off	Off	Off	On	Off	Off	On	On	On	256K, 80-column color display, graphics mode (corresponds to MODE CO80), 2 floppies, 8087
Off	Off	Off	Off	On	Off	On	On	On	On	256K, 40-column color display, graphics mode (corresponds to MODE CO40), 1 floppy, 1 hard disk, 8087

Figure 2-2 DIP Switch

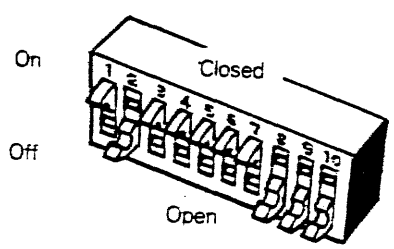


Table 2-1 Internal DIP Switch Settings (Continued)

Notes to System Configuration Table:

Note 1
Off = Open switch = Logic 1
On = Closed switch = Logic 0
Color display = High-resolution graphics display with color graphics car
Hard disk = Winchester hard disk with hard disk controller card

Note 2

Switch	Name	Setting		
1	Loop	On = factory setting; always Off in normal use		
2	Loop	On = no 8087 numeric coprocessor present Off = 8087 coprocessor installed		
3	RAM0	Switches 3 and 4 indicate the total size of memory		
	RAM1	installed on the CPU logic board. The CPU logic board detects the presence of the optional malfunction backplane with its additional 256K RAM. No DIP switch setting is required.		
		3	Off	256K memory (standard)
		4	Off	
		3	On	192K memory
		4	Off	
		3	Off	128K memory
		4	On	
5	DISP0	Switches 5 and 6 set the default display		
6	DISP1	mode. See Chapter 5 of the WYSEpc User's Guide for a discussion of the MODE command.		
		5	Off	Monochrome display
		6	Off	
		5	On	MODE CO80
		6	Off	
		5	Off	MODE CO40
		6	On	
7	DR0	Switches 7 and 8 indicate the number of		
8	DR1	diskette drives installed.		
		7	On	One diskette drive installed
		8	On	
		7	Off	Two diskette drives installed
		8	On	
9	Reserved	Always On		
10	Reserved	Always On		

Removing and Replacing the Computer Case

You will need a No. 2 magnetic Phillips screwdriver and a small flat-blade screwdriver to remove and replace the computer case.

Removing the Computer Case

To remove the case follow these steps:

1. Turn the computer switch off.

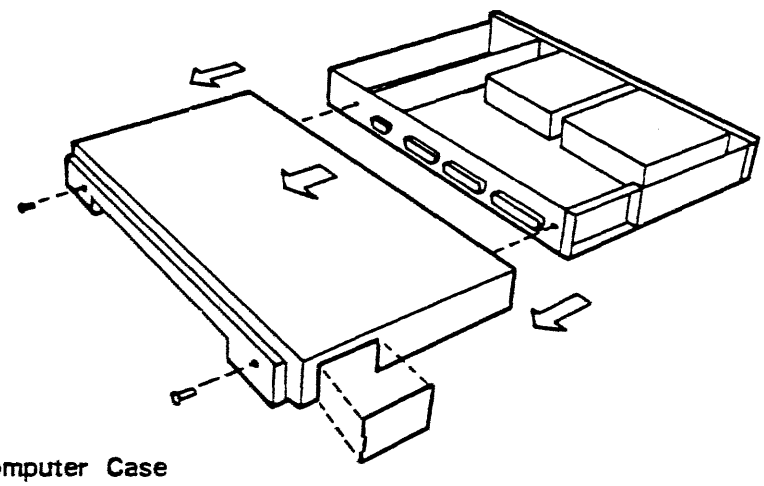
2. Unplug the computer power cord from the wall outlet, and disconnect all cables from the computer. Loosen the screws on the video signal cable with the flat-blade screwdriver.

3. Remove the monitor and keyboard and place them safely away from your work surface.

4. From the rear of the computer, remove the two screws securing the case to the back panel with a Phillips screwdriver (Figure 2-3).

5. Slide the case toward the rear of the computer assembly until it clears the unit. Ensure that the case does not interfere with any internal cable harnesses as you remove it.

Figure 2-3 Removing the Computer Case



Replacing the Computer Case

To replace the case follow these steps:

1. Ensure that all circuit boards are securely in place and that all internal connectors are firmly seated.

2. From the rear of the computer, align the left side of the case so that the groove at the bottom of the case slides onto the flange on the bottom left of the case.

3. Align the right side of the case and slide it into position.

4. Carefully slide the case forward, making sure that no internal wiring harnesses are pinched between the case and other parts of the computer.

5. Replace the two mounting screws that secure the case to the back panel.

6. If optional I/O connectors aren't used, snap the plastic I/O door cover back into place.

7. Reconnect all cables to the computer.

Removing and Replacing the Power Supply

Warning--High voltage is present on the power supply. Use extreme care and follow safety procedures.

You will need a No. 1 magnetic Phillips screwdriver to remove and replace the power supply.

Removing the Power Supply

To remove the power supply follow these steps:

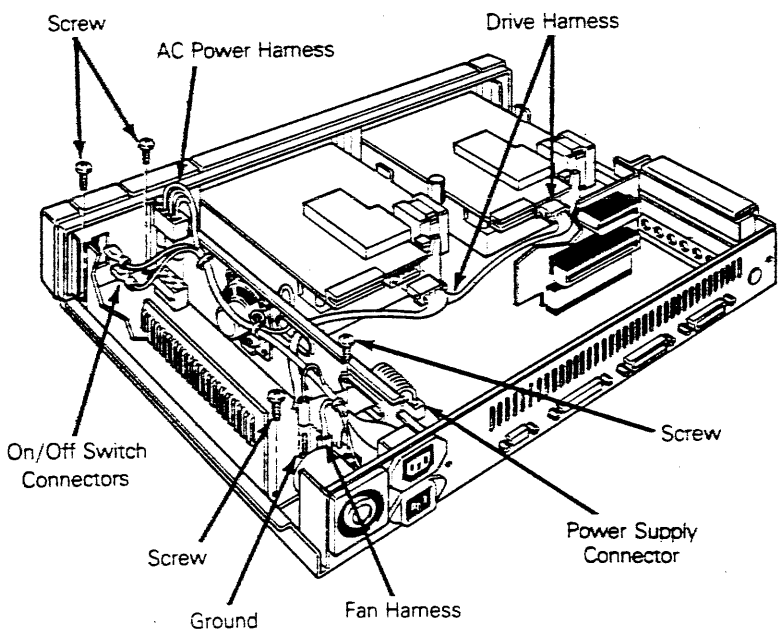
1. Turn the computer switch off.

2. Unplug the computer power cord from the wall outlet and remove all cables from the computer.

3. Remove the computer case following the instructions given in *Removing the Computer Case* in this chapter.

4. Disconnect the two snap-on power harness connectors from the front panel on/off switch (Figure 2-4).

Figure 2-4 Removing the Power Supply



Caution--Disconnect the harness connectors by grasping the connectors and pulling straight off. Do not pull on the harness wires.

5. Remove the plastic tie wrap that holds the power supply harness to the frame and speaker harness.
6. Disconnect the two-pin fan harness connector.
7. Disconnect the green ground wire.
8. Disconnect the three-pin AC harness connector.
9. Disconnect the two four-pin harness connectors from the disk drives and insert them through the opening in the metal dividing panel.
10. Disconnect the 11-pin power supply connector from the CPU logic board and insert it through the opening in the metal dividing panel.
11. Remove the four mounting screws securing the power supply board to the bottom of the computer with the Phillips screwdriver.
12. Lift the power supply board from its compartment.

Replacing the Power Supply

To replace the power supply follow these steps:

1. Set the power supply board inside its compartment.
2. Replace the four mounting screws securing the power supply board to the bottom of the computer with a Phillips screwdriver.
3. Reconnect the three-pin AC harness.
4. Reconnect the green ground harness.
5. Reconnect the two-pin fan harness.
6. Reconnect the snap-on connectors to the front panel on/off switch.
7. Insert the four-pin connectors on the disk drive harness through the opening in the metal dividing panel.
8. Reconnect the 11-pin power supply connector.
9. Replace the tie wraps around the harness wires.
10. Replace the computer case following the directions given in *Replacing the Computer Case* in this chapter.
11. Reconnect all cables to the computer.

Removing and Replacing the Power Supply Fuse

Warning--High voltage is present on the power supply. Use extreme care and follow safety procedures.

You will need a fuse puller or screwdriver to remove the fuse and a fast-blow fuse (250 volts, 3 amperes) as a replacement.

Removing the Fuse

To remove the fuse follow these steps:

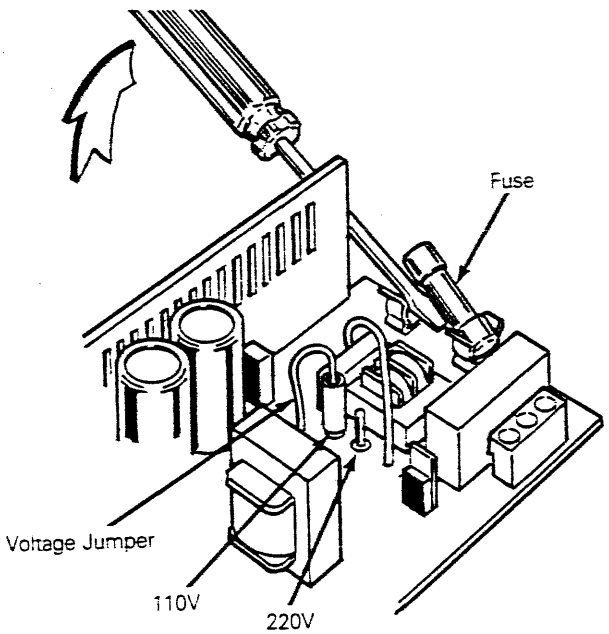
1. Turn the computer switch off.
2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.
3. Remove the computer case following the instructions given in *Removing the Computer Case* in this chapter.
4. Pry the fuse from the clips with a fuse puller or screwdriver and inspect it for breakage or burnout (see Figure 2-5).

Replacing the Fuse

To replace the fuse follow these steps:

1. Insert a new fuse into the fuse clips.
2. Replace the computer case following the instructions in *Replacing the Computer Case* in this chapter.
3. Reconnect all cables to the computer.

Figure 2-5 Fuse and Voltage Jumper



Changing the Voltage Jumper

To change the voltage jumper follow these steps:

1. Pull the voltage jumper at location P1 (110 V) straight off the power supply board (Figure 2-5) with needlenose pliers.

2. Install the voltage jumper on the power supply board at location P2 (220 V) with your fingers.

Removing and Replacing the Fan

You will need a No. 1 magnetic Phillips screwdriver to remove and replace the fan.

Removing the Fan

To remove the fan follow these steps:

1. Turn the computer switch off.

2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.

3. Remove the computer case following the instructions given in *Removing the Computer Case* in this chapter.

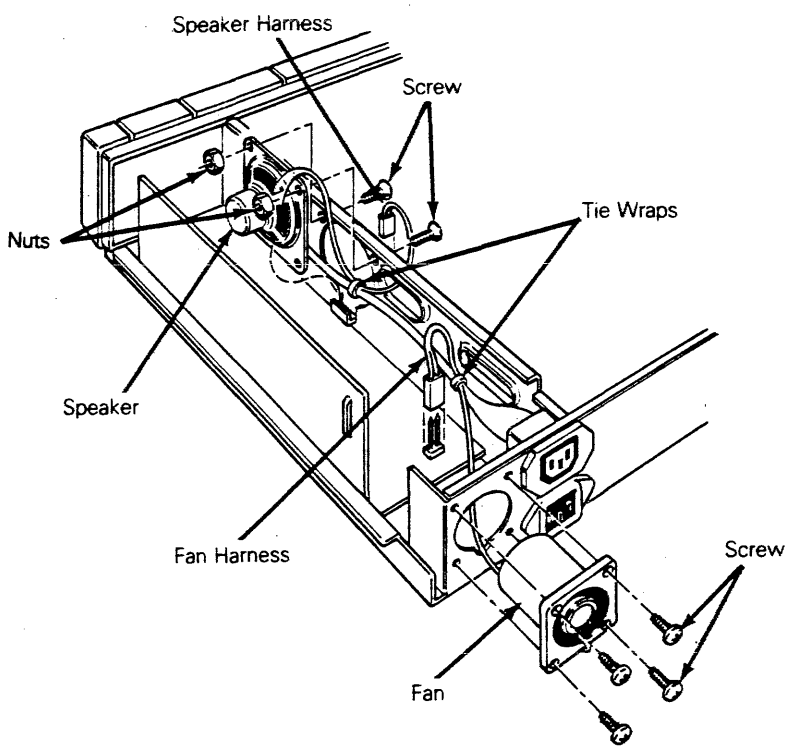
4. Remove the tie wrap from the harness bundle to free the fan harness wire.

5. Disconnect the two-pin harness connector from the power supply board (Figure 2-6).

6. From the back of the computer remove the four mounting screws securing the fan to the rear panel of the computer with a Phillips screwdriver.

7. Remove the fan.

Figure 2-6 Removing the Fan and Speaker



Replacing the Fan

Follow these steps to replace the fan:

1. Pass the fan wires through the semicircular cutout below the fan opening before passing the fan assembly through the computer rear panel. Align the screw holes with the rear panel openings of the computer.

   Caution--Be sure the fan wires go through their semicircular cutout or they may be cut when the mounting screws are seated.

2. Replace the fan mounting screws with a Phillips screwdriver.

3. Reconnect the two-pin fan harness connector on the power supply board.

4. Replace the tie wrap around the harness wire bundle.

5. Replace the computer case following the instructions given in *Replacing the Computer Case* in this chapter.

6. Reconnect all cables to the computer.

Removing and Replacing the Speaker

You will need a No. 1 magnetic Phillips screwdriver and a 7/32-inch nutdriver to remove and replace the speaker.

Removing the Speaker

To remove the speaker follow these steps:

1. Turn the computer switch off.
2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.
3. Remove the computer case following the instructions given in *Removing the Computer Case* in this chapter.
4. Remove the tie wrap from the harness bundle lying over the power supply to free the speaker harness wire.
5. Disconnect the two-pin speaker harness connector from the CPU logic board.
6. Remove the two speaker mounting screws and nuts with the screwdriver and nutdriver.
7. Carefully free the harness wire and lift the speaker from the metal panel (Figure 2-6) until it clears the lower retaining clip.

Replacing the Speaker

Follow these steps to replace the speaker:

1. Place the speaker assembly inside the power supply compartment and align the screw holes with the metal panel openings.
2. Replace the two speaker mounting screws and nuts.
3. Reconnect the two-pin speaker harness connector on the CPU logic board.
4. Replace the tie wrap around the harness wire bundle.
5. Replace the computer case following the instructions given in *Replacing the Computer Case* in this chapter.
6. Reconnect all the cables to the computer.

Removing and Replacing the Disk Drives

You will need a No. 2 magnetic Phillips screwdriver and a 7/16-inch nutdriver to remove and replace the disk drives.

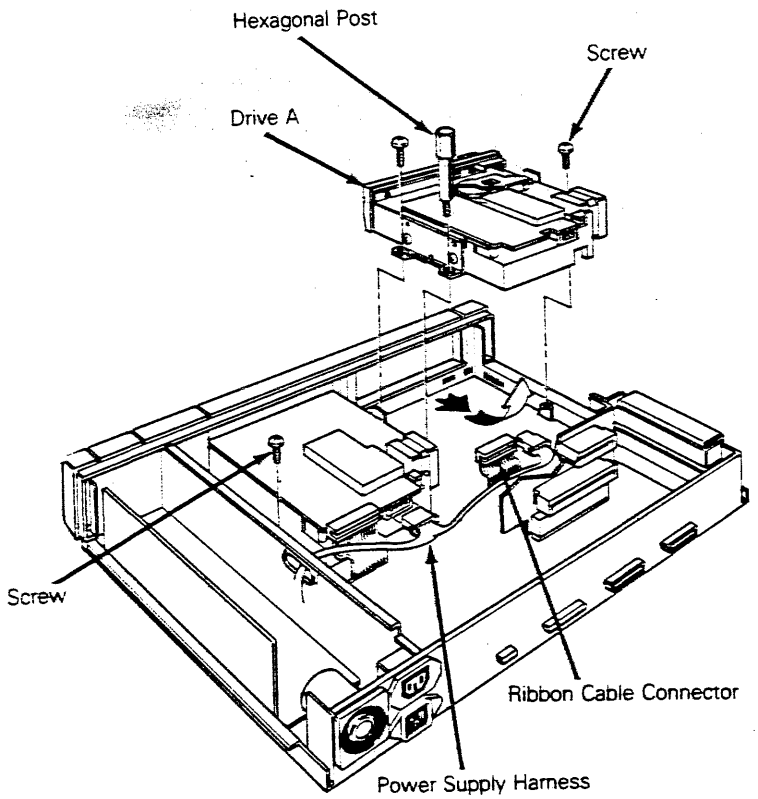
Note--Be sure the diskette drive(s) don't have diskettes in place.

Removing the Disk Drives

To remove any drive follow these steps:

1. Turn the computer switch off.
2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.
3. Remove the computer case following the instructions given in *Removing the Computer Case* in this chapter.
4. Disconnect the four-pin power supply harness connector from the back of both drives (Figure 2-7).
5. Disconnect the keyed-to-fit ribbon cable connector from the disk drive. If a plastic key exists, make sure it stays in the connector.
6. Remove the hexagonal post between the two drives with the nutdriver.
7. Remove the screw from the inside metal bracket (between the two drives) with a Phillips screwdriver.
8. Remove the screw from the outside bracket of the drive with a Phillips screwdriver.
9. Slide the disk drive toward the rear of the computer until the front panel of the drive clears the front of the computer case.

Figure 2-7 Removing the Disk Drive



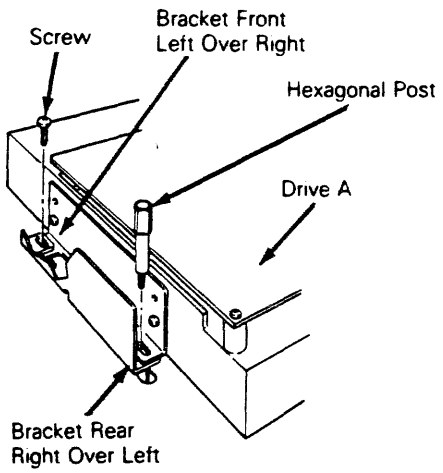
Replacing the Disk Drives

To replace a disk drive follow these steps:

Note--If you are installing a new drive, remove the side brackets from the old drive and attach them to the new drive in the same location.

1. Slide each disk drive in so the plastic bezel is flush with the top edge of the front panel making sure the metal mounting brackets align with each other and the screw standoffs on the floor of the computer as shown in Figure 2-8.

Figure 2-8 Disk Drive Mounting Bracket



2. Install the hexagonal post between the disk drives; hand tighten until secure.

   Note--The hexagonal post provides support for the weight of the monitor.

3. Ensure that the top of the drive bezel is flush with the front panel. Tighten the screws with a Phillips screwdriver until they bottom out against the drive brackets. Tighten the hexagonal post.

4. Connect the keyed-to-fit ribbon cable connector to the pins on the CPU logic board.

5. Plug the hard disk controller cable firmly onto hard disk drive C, if applicable.

6. Slide the keyed-to-fit ribbon cable connector onto the disk drive circuit board. Ensure that it is firmly seated.

7. Connect the four-pin power supply harness to the drive.

8. Replace the computer case following the instructions given in *Replacing the Computer Case* in this chapter.

9. Reconnect all cables to the computer.

Removing and Replacing the Option Boards

You will need a No. 1 magnetic Phillips screwdriver to remove and replace the option printed circuit boards.

Warning--Printed circuit boards are static sensitive. Maintain grounding by wearing a wrist strap attached to ground. Then touch the metal frame of the computer before touching a printed circuit board.

Note--The computer has two expansion slots for installing optional printed circuit boards. Most IBM PC/XT-compatible option boards can be used if they have the narrow XT-type metal connector brackets. If your computer contains the 10-megabyte hard disk drive, a hard disk controller circuit board has already been installed in one of the two expansion slots.

To remove an option board follow these steps:

1. Turn the computer switch off.

2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.

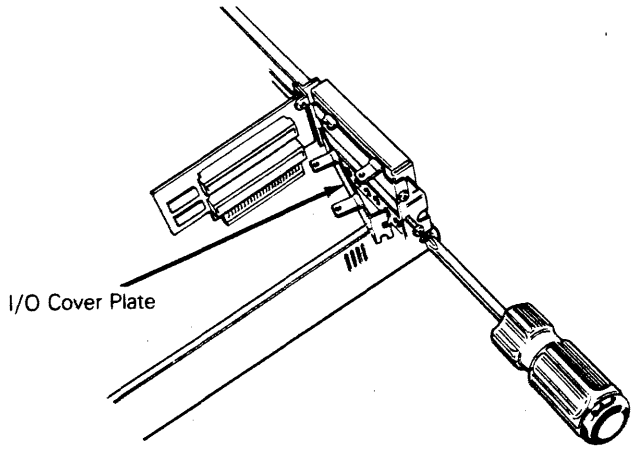
3. Remove the computer case following the instructions given in *Removing the Computer Case* in this chapter.

4. Check the inside of the computer to see if it already contains option boards. Look at the following list to see what steps to follow next.

Situation	You Need To
No boards	Install new board in lower slot
One board in lower slot	Install new board in upper slot
One board in top slot	Move board in top slot to lower slot; install new board in top slot

5. From the rear of the computer loosen (but don't remove) the screw that secures the option board to the metal I/O end bracket with a Phillips screwdriver as shown in Figure 2-9.

Figure 2-9 Removing the I/O Cover Plate



6. Pull the board toward the back of the case until it is free of the socket on the backplane and the card end clip.

7. Lift up the right edge of the option board and pull it toward the rear of the case until it's free of the end bracket.

8. Remove the option board.

If there is a second option board installed, repeat this procedure to remove it.

Replacing the Option Boards

Warning--Printed circuit boards are static sensitive. Maintain grounding by wearing a wrist strap attached to ground. Then touch the metal frame of the computer before touching a printed circuit board.

To replace an option board follow these steps:

Note--Option boards are installed with the components facing down (toward the floor of the computer). If this is the first option board installed, be sure to install it in the lower position. Always mount the hard disk controller board in the lower option board position.

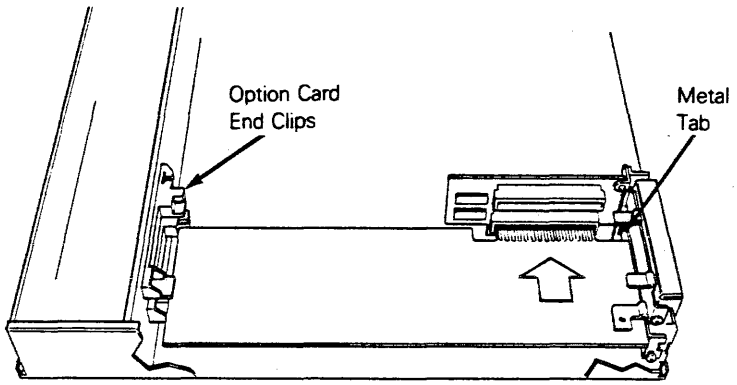
1. Remove the snap-out plastic I/O access door from the side of the computer unit case, if applicable.

2. Place the option board in the case (bottom side up) and lower the back of the board first, as shown in Figure 2-10. Place the left end of the board against the wall of the computer case above the plastic card end clip.

Lower the connector end of the option board so any external connectors align with the connector openings. Move the board to the far right, and the edge connector will line up. The left end of the board should rest on the shelves of the end clips.

Note--The color graphics option board has two connectors that are accessible through the I/O access door when the board is installed: An RGB connector that's compatible with the WY-600 or IBM-compatible color graphics monitor, and a composite video connector that fits a standard phono plug. This option board also has connector pins for an RF modulator and for a light pen. Refer to Appendix B for specifications for these connectors.

Figure 2-10 Option Board Installation



3. Gently slide the board forward until the connector pins are firmly seated in the connector slot on the backplane, the metal tab on the I/O cover plate fits through the slot in the end bracket, and the free end of the card is caught by the card end clip (Figure 2-10).

4. Tighten the retaining screw that holds the option board at the I/O cover plate.

5. Before you close the case, reconfigure the computer for the new option. The location and settings of the switches that configure the computer are described in Table 2-1 and Appendix D.

Disabling Built-In Functions

If you add any option board that will conflict with the COM1, LPT1, or MONO DISPLAY port, you must disable the internal circuitry associated with the port. If you need additional information to determine if an option will conflict with the built-in circuitry, refer to Figures 5-2 and 5-3 in Chapter 5 of this manual.

COM1 Serial Port--To install an internal modem board (or any other option that will function as COM1), disable the built-in COM1 circuitry as follows.

1. Change the COM1-OFF (JC5) jumper near IC 1W to OFF (Figure 2-11). This action disables the COM1 communications connector on the back of the computer so you can use the serial connector on the option board.

2. Remove the JC6 jumper near IC 2D.

3. Configure the modem board as COM1 (refer to the manufacturer's documentation).

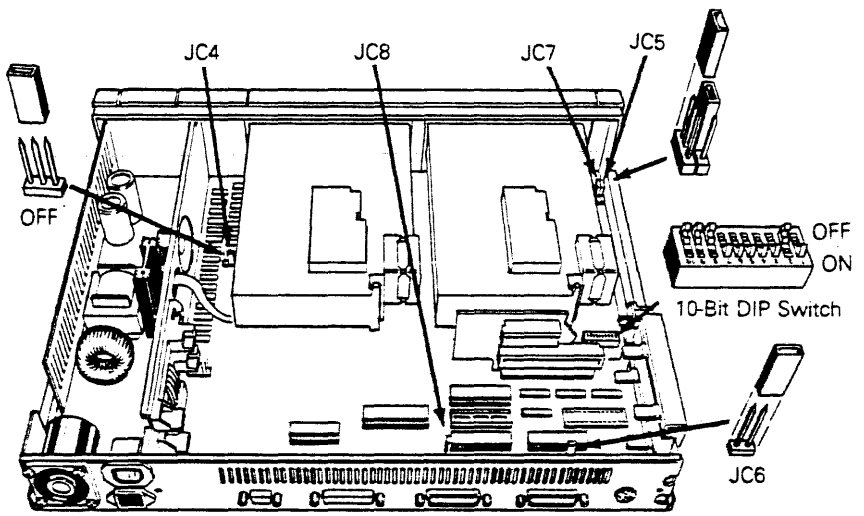
MONO DISPLAY Port--To install an enhanced monochrome display option, change the VID-OFF (JC4) jumper near IC 12R to OFF (Figure 2-11). This action disables the built-in monochrome display circuitry.

LPT1 Parallel Port--To install an option board with its own parallel printer connector, disable the built-in parallel port.

1. Set the LPT1-OFF (JC7) jumper near IC 1W to OFF (Figure 2-11).

2. Remove the JC8 jumper near IC 4D.

Figure 2-11 Jumper and IC Locations



Note--The Hercules graphics card has its own video and parallel printer ports that conflict with the built-in circuitry of the computer. If you install the Hercules card, disable both the MONO DISPLAY and LPT1 ports (see *Disabling Built-In Functions*).

Removing and Replacing the Standard Backplane

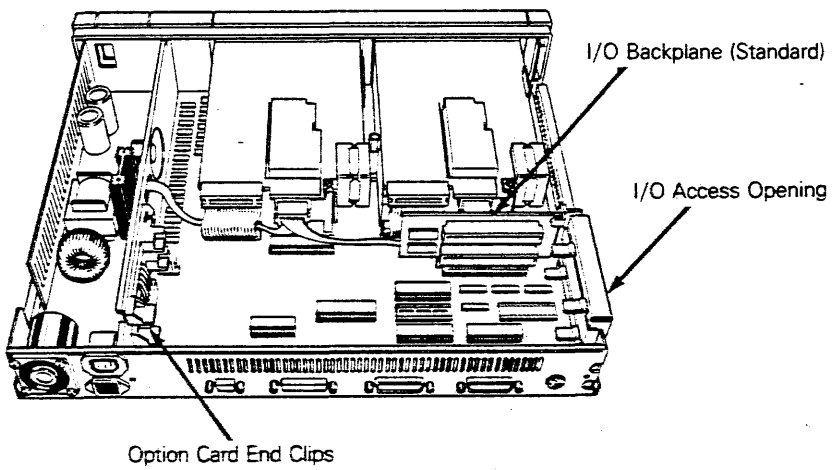
You will need a No. 1 magnetic Phillips screwdriver to remove and replace the standard backplane.

Removing the Standard Backplane

To remove the standard backplane follow these steps:

1. Turn the computer switch off.
2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.
3. Remove the computer case following the instructions given in *Removing the Computer Case* in this chapter.
4. Remove any option cards that may be installed.
5. Remove the screw that secures the standard backplane end bracket to the computer frame.
6. Pull the backplane straight up off the connector pins on the CPU logic board.

Figure 2-12 Removing the Standard Backplane



Replacing the Standard Backplane

To replace the standard backplane follow these steps:

Note--Ensure that the end bracket is screwed onto the backplane

1. Carefully align the pins on the standard backplane with the socket on the CPU logic board and press into place.
2. Secure the end bracket to the computer case with the mounting screw.
3. Reinstall any option cards.
4. Close the computer case following the instructions in *Replacing the Computer Case* in this chapter.
5. Reconnect all cables to the computer.

Removing and Replacing the Multifunction Backplane with Real-Time Clock

You will need a No. 1 magnetic Phillips screwdriver to remove and replace the multifunction backplane with real-time clock.

Warning--The multifunction backplane is static sensitive. Maintain grounding by wearing a wrist strap attached to ground. Then touch the metal frame of the computer before touching the backplane.

Removing the Multifunction Backplane

Follow these steps to remove the multifunction backplane:

1. Turn the computer switch off.
2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.
3. Remove the computer case following the instructions in *Removing the Computer Case* in this chapter.
4. Remove any installed option boards following the instructions in *Removing Option Boards.*
5. From the right rear of the computer, remove the screw securing the multifunction backplane end bracket to the computer frame (Figure 2-13).
6. Slide the opposite end of the multifunction backplane through the plastic end clip while lifting the board straight up off the CPU logic board connectors with both hands.

Replacing the Multifunction Backplane

Warning--The multifunction backplane is static sensitive. Maintain grounding by wearing a wrist strap attached to ground. Then touch the metal frame of the computer before touching the backplane.

Note--Be sure that the CPU logic board contains 256K RAM before installing the multifunction backplane.

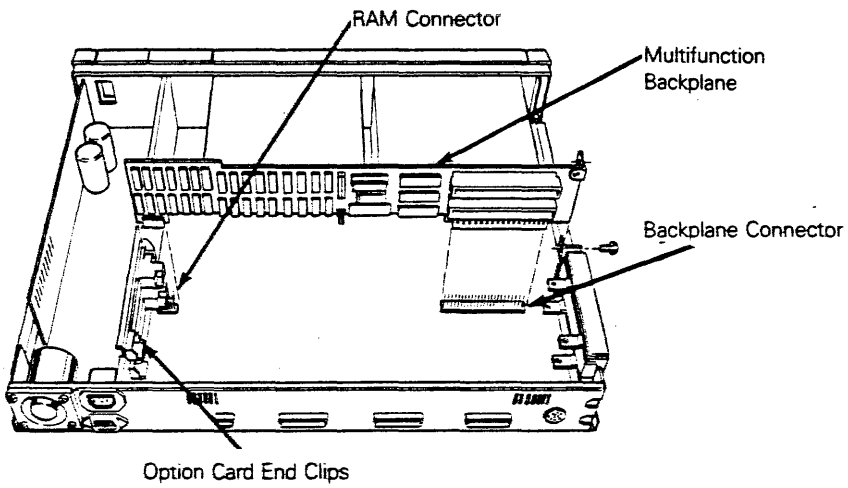
Replace the multifunction backplane by following these steps:

1. From the rear of the computer, insert the left end of the multifunction backplane into the plastic end clips with both hands while carefully aligning the connector sockets on either end of the backplane with the pins on the CPU logic board (Figure 2-13). Press the backplane firmly into place.

2. From the rear of the computer, install the mounting screw to secure the backplane bracket on the right side of the computer case. The free end of the backplane should be secured by the plastic end clips.

3. Replace any option boards removed by following the instructions given in *Replacing Option Boards* in this chapter.

Figure 2-13 Removing the Multifunction Backplane



Removing and Replacing the CPU Logic Board

You will need a No. 1 magnetic Phillips screwdriver and a 3/16-inch nutdriver to remove and replace the CPU logic board.

Removing the CPU Logic Board

To remove the CPU logic board follow these steps:

1. Turn the computer switch off.

2. Unplug the computer power cord from the wall outlet and unplug all cables from the computer.

3. Remove the computer case by following the directions under *Removing the Computer Case* in this chapter.

4. If applicable, remove any installed option boards by following the directions under *Removing Option Boards* in this chapter.

5. Remove either backplane that may be installed by following the directions under *Removing the Standard Backplane* or *Removing the Multifunction Backplane* in this chapter.

6. Remove the disk drives by following the directions under *Removing the Disk Drives* in this chapter (Figure 2-7).

7. Pull out the upper card guides from the left side of the computer case (Figure 2-14) from the rear of the computer.

8. Disconnect the 11-pin power supply connector from the CPU logic board and pass it through the metal wall to the power supply area.

9. Pull out the lower end clip on the left side of the computer case from the rear of the computer.

10. Remove the top and bottom I/O cover plates, if applicable.

11. From the rear of the computer, remove the two mounting screws and nuts securing the keyboard connector socket to the back panel. Be sure to keep the nuts on the screws for safekeeping.

12. Remove the two-pin speaker harness.

13. Push the keyboard socket in the rear panel opening and disconnect the 12-pin keyboard connector from the CPU logic board.

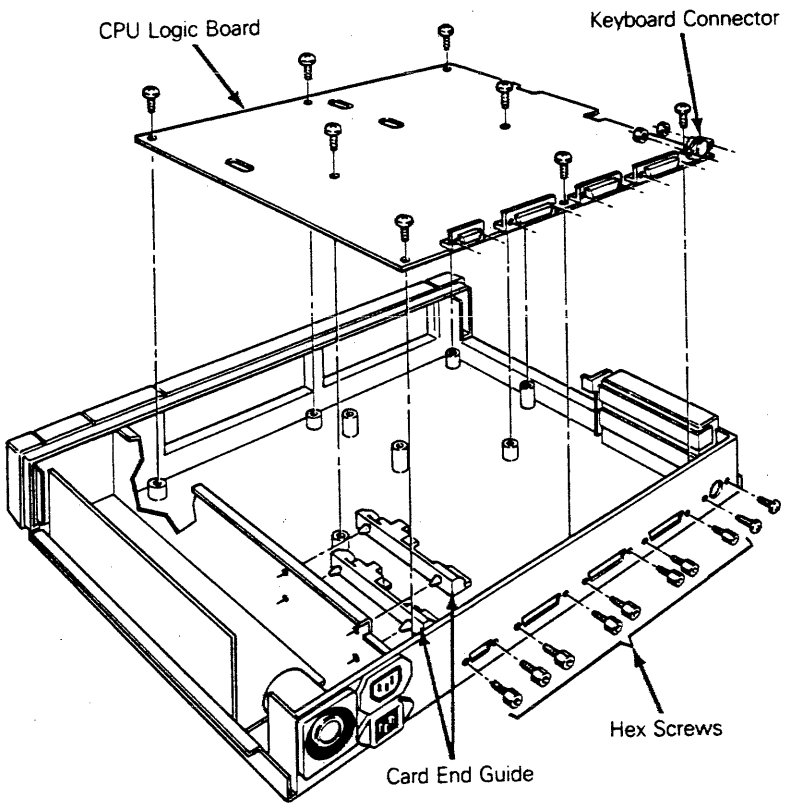
14. Remove the eight hex screws from each side of the four connectors with a 3/16-inch nutdriver on the computer rear panel. Keep the screws together in a safe place.

15. Remove the eight mounting screws securing the CPU logic board to the bottom of the computer case. Keep the screws together in a safe place.

16. Slide the CPU logic board toward the front of the computer case so that the four connectors at the rear of the board clear the openings in the back panel of the computer frame.

17. Carefully lift the CPU logic board up and out of the computer frame.

Figure 2-14 Removing the CPU Logic Board



Replacing the CPU Logic Board

Replace the CPU logic board following these steps:

1. From the rear of the computer, tilt the CPU logic board so that the four connectors fit through the opening in the rear panel of the computer frame. Lay the board in its proper position.

2. Install the eight hex screws on each side of the four rear panel connectors with a nutdriver.

3. Align the holes for the mounting screws and use a Phillips screwdriver to install the eight screws that secure the CPU logic board to the bottom panel of the computer case.

   Caution--Be sure that all eight mounting screws are securely seated through the CPU logic board and into the computer frame in order to provide adequate ground for the integrated circuit traces. The computer will not operate properly if all the mounting screws are not installed.

4. Insert the keyboard connector through the inside of the computer case rear panel and install the two mounting screws and nuts.

   Caution--Ensure that the keyboard socket is positioned correctly or the keyboard connector will not fit properly.

5. Reconnect the 12-pin keyboard connector to the CPU board.

6. Push the end clips into position on the metal dividing panel.

7. Reconnect the 11-pin power supply connector and the two-pin speaker connector to the CPU logic board.

8. Replace the lower metal I/O cover plate on the right rear side of the computer case, or replace the first option board in the lower option expansion position following the directions in *Replacing Option Boards* in this chapter.

9. Replace the upper metal I/O cover plate on the right rear side of the computer case, or replace the second option board in the upper option expansion position, following the directions in *Replacing Option Boards* in this chapter.

10. Replace the disk drives by following the directions under *Replacing the Disk Drives* in this chapter.

11. Replace the computer case by following the directions under *Replacing the Computer Case* in this chapter.

12. Reconnect all cables to the computer.

Removing and Replacing the Keyboard Cable and Printed Circuit Board

You will need a No. 1 and a No. 2 magnetic Phillips screwdriver to remove and replace the keyboard cable and printed circuit board.

Removing the Keyboard Cable and Printed-Circuit Board

To remove the keyboard cable or keyboard printed circuit board follow these steps:

1. Turn the computer switch off.

2. Unplug the computer power cord from the wall socket.

3. Disconnect the keyboard cable from the rear of the computer unit.

4. Turn the keyboard upside down and remove the five mounting screws from the keyboard base (Figure 2-15).

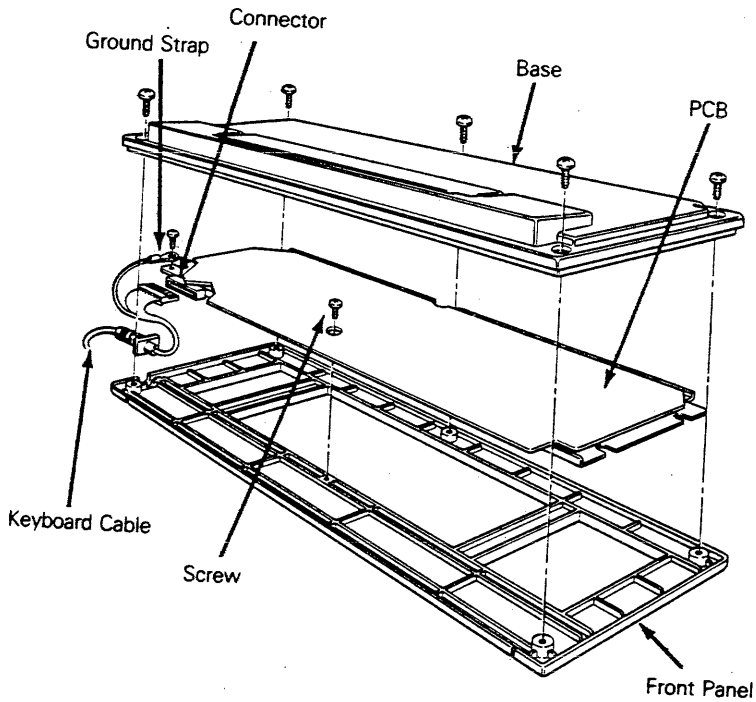
5. Push the keyboard cable free of the cutout cable opening while lifting the base. Keep the mounting screws in their recesses for safekeeping.

6. Remove the mounting screw securing the ground strap to the screw post.

7. Remove the mounting screw that secures the keyboard PCB assembly to the front panel.

8. Lift the keyboard PCB assembly, disconnect the 12-pin cable connector.

Figure 2-15 Keyboard Cable and Printed Circuit Board



Replacing the Keyboard Cable or Printed Circuit Board

To replace the keyboard cable or the keyboard PCB follow these steps:

1. Turn the keyboard front mounting panel upside down on your work surface.

2. Connect the 12-pin cable connector of the new cable (if applicable) to the pins on the new (if applicable) keyboard PCB.

3. Align the mounting screw hole of the keyboard assembly and the PCB over the front panel and install the mounting screw.

4. Install the ground strap by securing the mounting screw to its post.

5. Fit the keyboard cable through its cutout while aligning the holes of the keyboard base over the front panel.

6. Install the five mounting screws.

7. Turn the keyboard right side up and plug the keyboard cable connector into the rear of the computer unit.

8. Plug in all computer cables.

Removing and Replacing Integrated Circuits

You will need an integrated circuit (IC) extracter and an integrated circuit inserter to remove and replace integrated circuits.

Warning--The RAM chips and the 8087 numeric coprocessor chip ar static sensitive. Maintain grounding by wearing a wrist strap attached to ground. Then touch the metal frame of the computer before touching a printed circuit board or integrated circuit.

Removing Integrated Circuits

Follow these steps to remove an integrated circuit:

1. Grasp the integrated circuit with an IC extracter and lift carefully in a two-step motion.

2. Avoid bending the pins.

Replacing an Integrated Circuit

Follow these steps to replace an integrated circuit:

1. Align the integrated circuit pins with the socket.

2. Carefully and firmly press the integrated circuit into place with an IC inserter.

Installing the 8087 Numeric Coprocessor

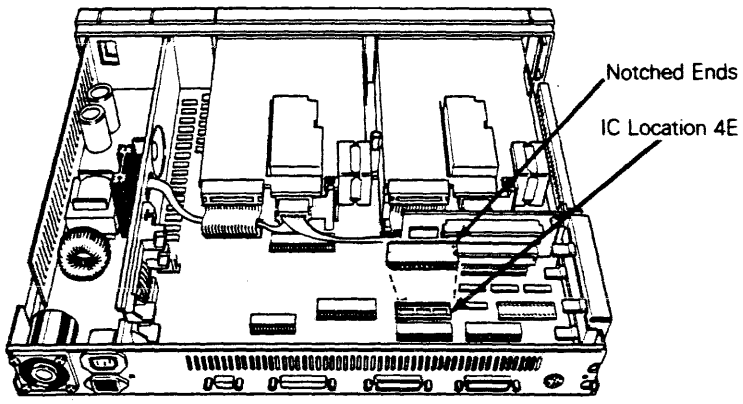
Warning--The 8087 numeric coprocessor chip is static sensitive. Maintain grounding by wearing a grounding strap on your wrist attached to ground. Then touch the metal frame of the computer before installing the chip.

See the Intel data sheet for detailed specifications on the 8087 numeric coprocessor. Perform the following steps to install the 8087 numeric coprocessor.

1. Remove the computer case by following the directions in *Removing the Computer Case* in this chapter.

2. Install the numeric coprocessor by aligning the pins over the socket holes before carefully and firmly pressing them into place. The notched end of the chip should face toward the I/O cover plate, away from the power supply. Make sure it is oriented as shown in Figure 2-16 before closing the computer.

Figure 2-16 Installing the 8087 Numeric Coprocessor



3 TROUBLESHOOTING

This chapter describes symptoms and solutions for problems you may encounter when servicing the computer. We have organized this chapter to help you repair the computer as quickly as possible. The Troubleshooting Flowchart appears after the list of required tools. The locations of any related procedures you need for troubleshooting are referenced on the flowchart.

Required Tools and Recommended Materials

Required Tools

You will need the tools listed below to perform the troubleshooting procedures in this chapter.

- Magnetic Phillips screwdriver, size 1 (to remove the power supply, speaker, and fan)
- Magnetic Phillips screwdriver, size 2 (to remove the computer case)
- Nutdriver, 3/8-inch, (to remove the disk drives)

Recommended Materials

- Digital multimeter (or an ohmmeter and voltmeter)
- Known good copy of the system diskette
- Two formatted blank scratch diskettes to test the diskette drives; only one scratch diskette is needed when testing a hard disk

Troubleshooting Quick Reference

Table 3-1 provides a troubleshooting quick reference guide to suspect areas; the modules mentioned in the guide should not be automatically replaced when the listed symptoms are present.

Table 3-1 Troubleshooting Quick Reference Guide

Symptom	Suspect Item
No display, wavy display, wrong size display, or crooked display	Video cable connection Monitor power cord connection Brightness control Computer power cord connection Monitor Voltage levels CPU logic board
No fan	Power cord connection Fan Power supply Cables EMI filter

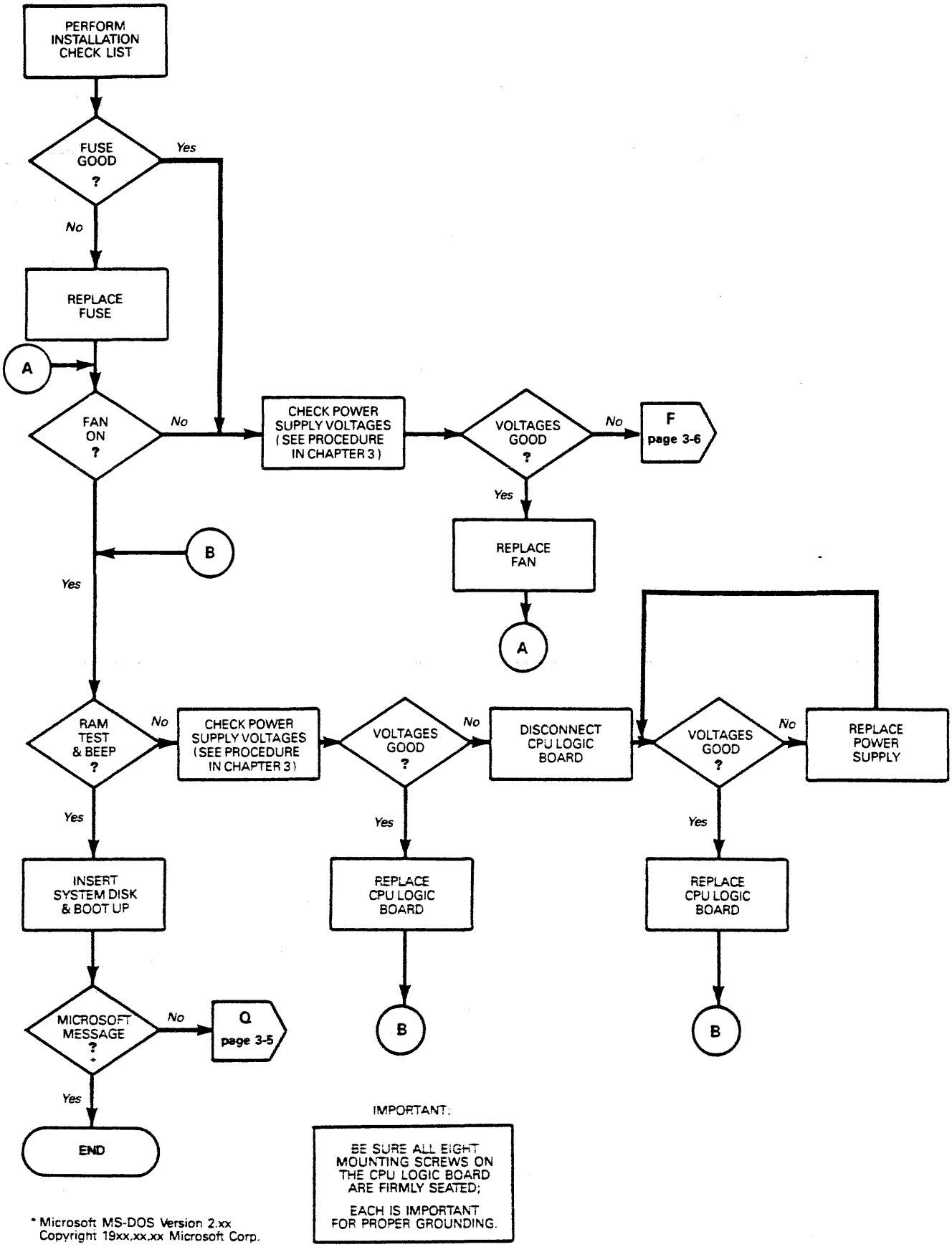
Table 3-1 Troubleshooting Quick Reference Guide (Continued)

Symptom	Suspect Item
No beep	Speaker Logic board Power supply Drive(s)
Fails self-test	Logic board Power supply Drive(s)
Doesn't boot	Diskette Disk drives Power supply Logic board
Read errors Write errors	Diskette Disk drives Power supply Logic board
Inoperative keys	Keyboard cable connection Keyboard Logic board
Active power supply overload LED	Drive Power supply CPU logic board

Troubleshooting Flowchart

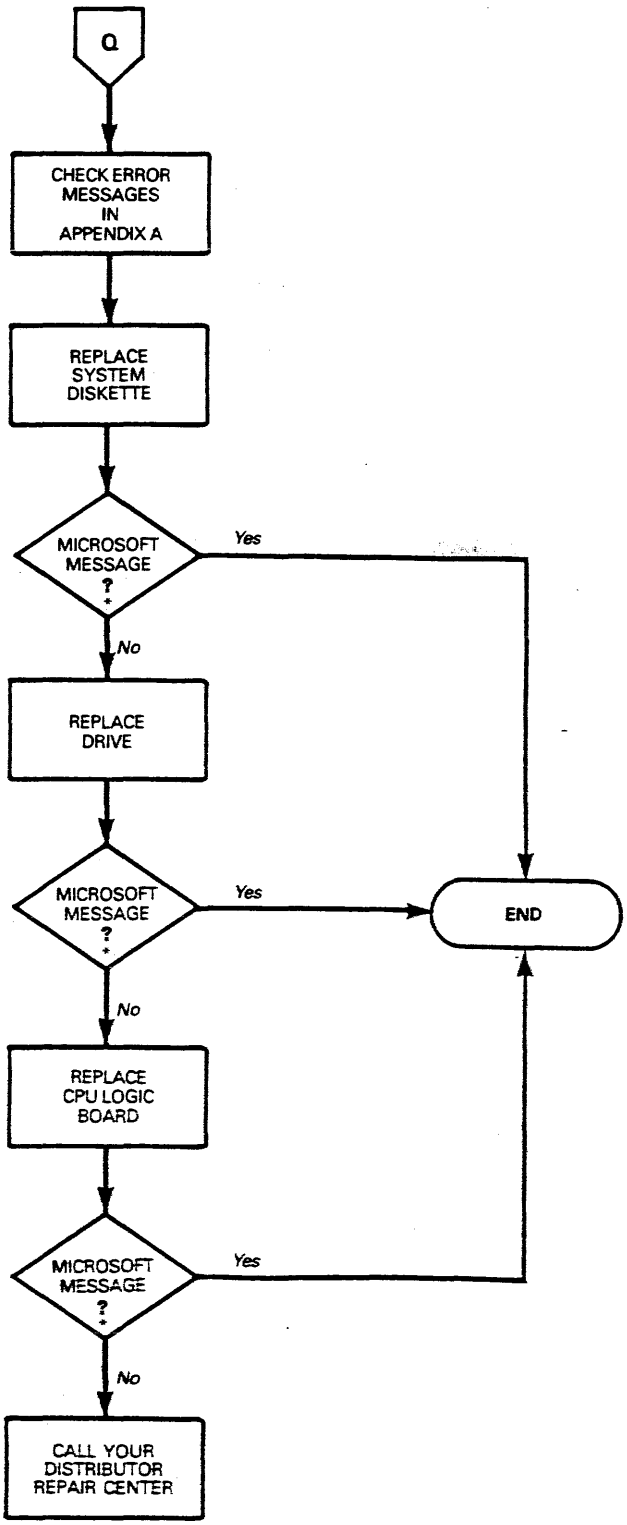
Follow the troubleshooting flowchart (Figure 3-1) and match the symptoms with the suggested solutions. The locations of related procedures you need are referenced on the flowchart.

Figure 3-1 Troubleshooting Flowchart



* Microsoft MS-DOS Version 2.xx
Copyright 19xx,xx,xx Microsoft Corp.

Figure 3-1 Troubleshooting Flowchart (Continued)



* Microsoft MS-DOS Version 2.xx
Copyright 19xx,xx,xx Microsoft Corp.

Figure 3-1 Troubleshooting Flowchart (Continued)

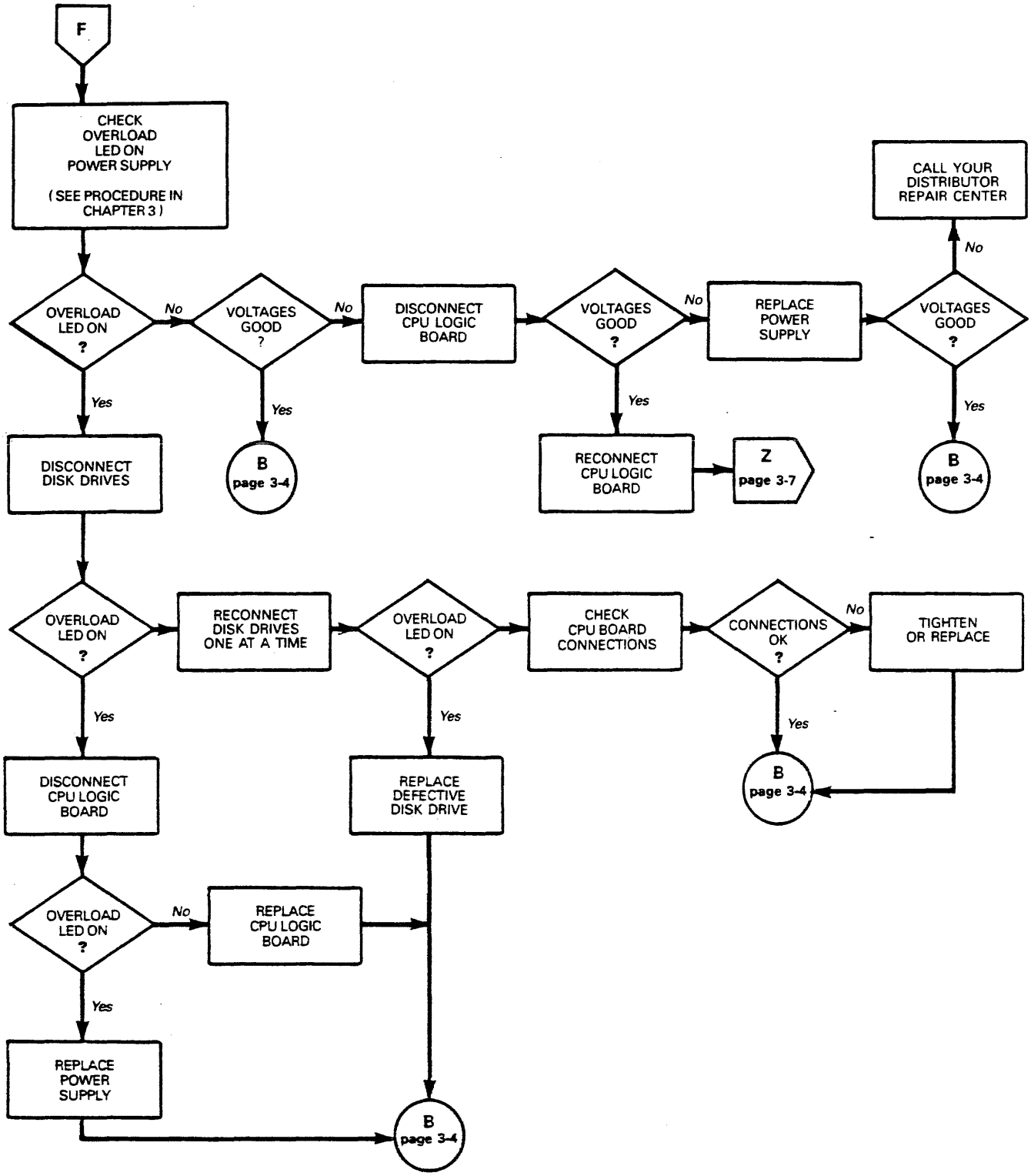
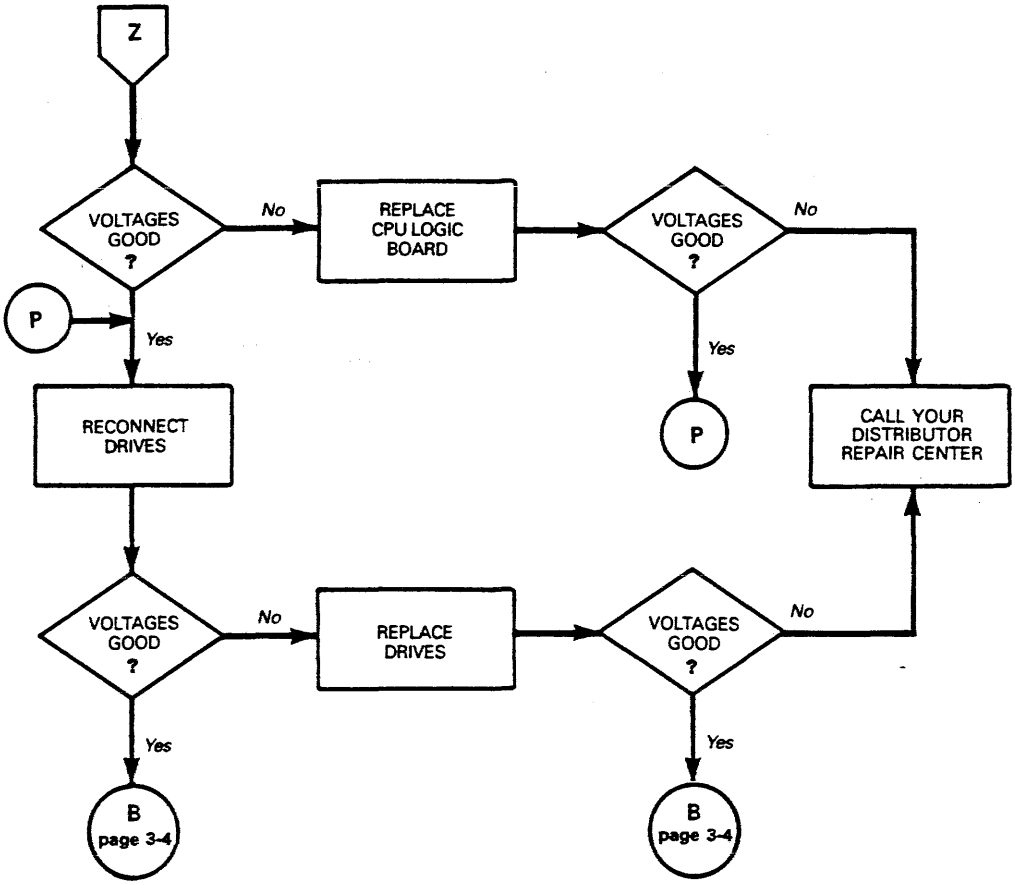


Figure 3-1 Troubleshooting Flowchart (Continued)



Installing the Operating System

Perform the following steps to install MS-DOS. See Chapter 1 for a more complete procedure.

1. Turn the computer power on.
2. Insert the system diskette into the diskette drive, and close the drive latch.
3. Look for the "Booting MS-DOS" message on the monitor screen.
4. Type in the correct date and time when prompted by the system (see Chapter 1 for details).
5. The following message should appear 5 seconds after power on:

```
Wyse Technology   Rev x.xx
```

   If it doesn't, check the computer power cable, the power cable between the monitor and computer, and the video signal cable. If these are functional, check out the monitor and/or change the CPU logic board.

Error Lists

This section provides possible solutions to a problem and/or screen messages you may encounter while troubleshooting.

Before Installing the Operating System

Message/Problem	Solution
Nonsystem Disk or Disk Error Press a Key to Retry	Install the operating system, or replace the drive.

After Boot--Device or Software

Nonsystem Disk or Disk Error Press a Key to Retry	Replace the system disk (media may be worn), or replace the drive.
Disk Controller Failed while Booting	Check all drive logic and power connections, replace CPU logic board, or replace disk drive.

Many of the operating system (MS-DOS) error messages can help you locate the problem (see Appendix A for other MS-DOS error messages). Keep a good copy of the system diskette available. Malfunctions are often the result of bad media or missing portions of the system diskette data.

Installation Checklist

Computer Checklist

The following checklist helps you to quickly determine whether the computer is installed correctly.

Environment

_____ Ambient room temperature is between 50 and 92 degrees Fahrenheit.

Keyboard

_____ Keyboard cable connector is positioned correctly in the keyboard socket on the rear panel of the computer.

Monitor Cables

_____ One end of the video signal cable is connected to the MONO DISPLAY port on the computer.

_____ The opposite end of the video signal cable is connected to the 9-pin monitor port on the rear of the monitor.

_____ One end of the monitor power cable is plugged into the monitor.

_____ The opposite end of the monitor power cable is plugged into the AC output on the rear of the computer.

_____ Power rocker switch on the rear of the monitor is on.

Switches

_____ Monitor power switch is on.

_____ Computer power switch is off.

_____ DIP switch on CPU logic board is set correctly for your configuration, see Appendix D.

Options

Multifunction Backplane

_____ Multifunction backplane is correctly installed.

Hard Disk

_____ Hard disk controller PCB is correctly installed.

_____ Hard disk drive is correctly installed.

Color Graphics Adapter PCB

_____ Color graphics adapter PCB is correctly installed.

AC Power Cord

_____ Female end of the computer power cord is plugged into the AC power input receptacle on the computer rear panel.

_____ The male end is ready to be plugged into the wall outlet. Plug it in after the other connections are made.

Checking the Power Supply Voltages

Perform the following steps with a voltmeter to check the power supply voltages:

1. Turn off the computer and remove the power cord from the wall socket.
2. Remove the computer casing (see Chapter 2 for details).
3. Find power supply connector J12 on the CPU logic board.
4. Connect one lead of the voltmeter to any of the system grounds, J12-5, -6, -7, or -8.
5. Plug the computer power cord back into the wall socket and turn on the computer.
7. Use the other lead to check the following voltages:

J12-1	for +5V ± 5%V
J12-2	for +5V ± 5%V
J12-3	for +5V ± 5%V
J12-4	for +5V ± 5%V
J12-5	for GROUND
J12-6	for GROUND
J12-7	for GROUND
J12-8	for GROUND
J12-9	for +12V ± 5%V
J12-10	for +12V ± 5%V
J12-11	for -12V ± 10%V

7. Turn off the computer and unplug the power cord.

8. If any voltages are out of tolerance, see the Troubleshooting Flowchart. Replace the suggested assembly.

9. Replace the computer case.

10. Replace the two mounting screws that secure the case to the rear panel. Tighten until secure.

Checking for Continuity

Sometimes you can fix the problem without opening the computer. The problem could be a damaged cable, power cord, or AC input receptacle. Check these items for continuity when directed by the Troubleshooting Flowchart.

Troubleshooting With the Overload LED

The overload LED is located at position D110 on the power supply PCB. This LED can help diagnose problems. You can see it when you remove the computer case. The computer must have AC power applied with the power switch on in order for the LED to function.

When the computer is operating correctly, the overload LED never lights. Look for the light when directed by the Troubleshooting Flowchart.

4 ILLUSTRATED PARTS LIST

This chapter provides information you need to order parts for your computer.

When ordering parts, please give the part number and part name. Figures are provided only for those assemblies indicated.

Description	Part No.
Complete Keyboard Assembly	10-011-01
Bottom Keyboard (Figure 4-1)	30-009-01
Top Keyboard (Figure 4-2)	30-010-01
Keyboard Cable	94-038-01
Keyboard PCB	99-043-01
Fan Assembly (Figure 4-3)	30-004-01
WY-500 Monochrome Monitor Pedestal (Figure 4-4)	30-014-01
Add-On Pedestal for WY-500/WY-600 Standalone Configuration	30-035-01
WY-600 Color Monitor Pedestal	30-107-01
A/C Assembly (Figure 4-5)	31-007-01
Speaker Assembly with Harness (Figure 4-6)	31-008-01
Diskette Drive Assembly (Figure 4-7)	31-009-01
Hard Disk Drive Assembly with Brackets (Figure 4-8)	31-016-01
Hard Disk Controller Assembly (Figure 4-9)	32-023-01
Keyboard Harness with Ferrite Socket (Figure 4-10)	94-115-01
Standard Backplane (Figure 4-11)	99-041-01
Power Supply	99-042-01
AC Power Switch	80-808-01
Multifunction Backplane	99-044-01
CPU Logic Board	99-049-01
Fuse	80-009-05

Figure 4-1 Keyboard Bottom 30-009-01

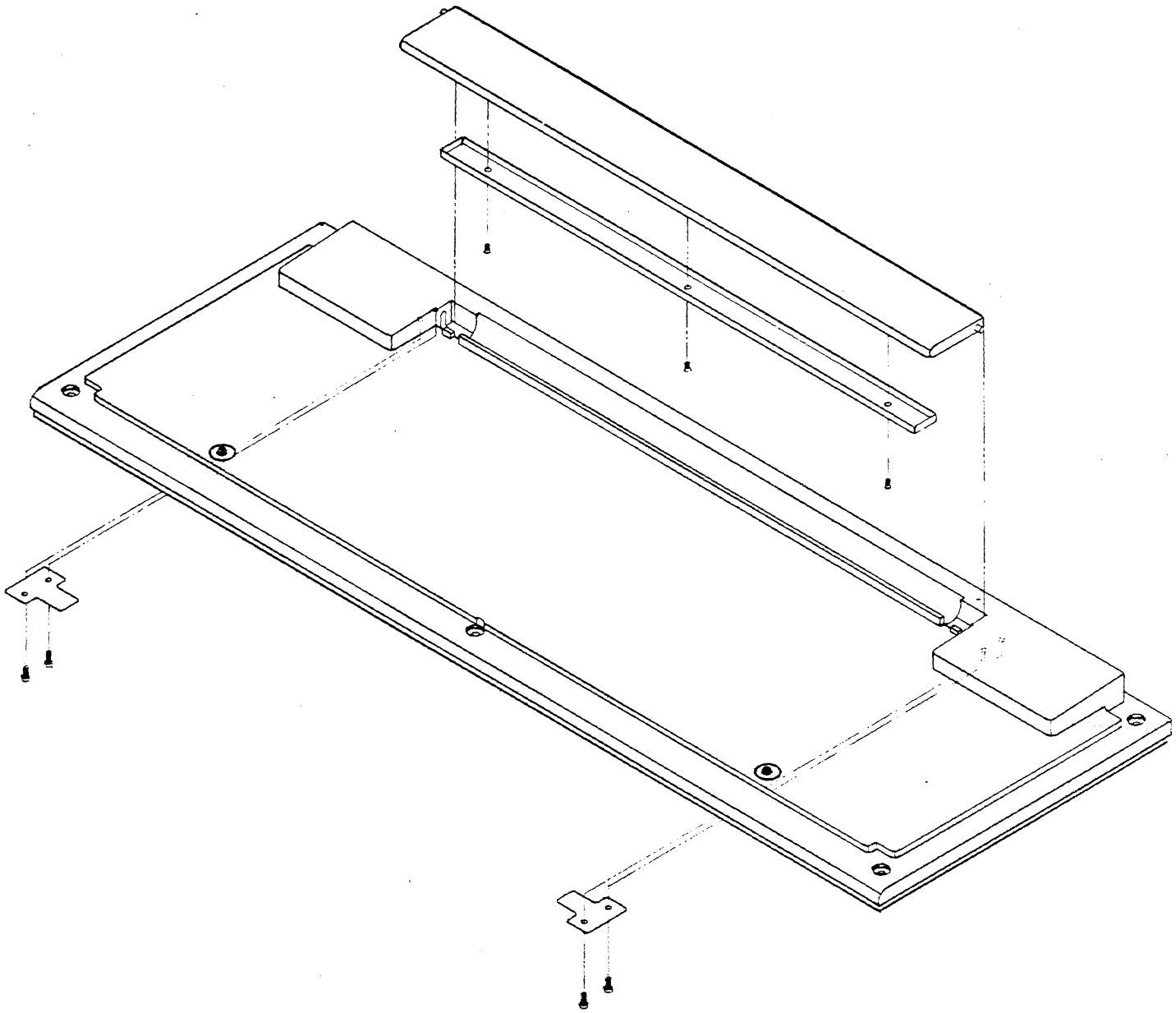


Figure 4-2 Keyboard Top 30-010-01

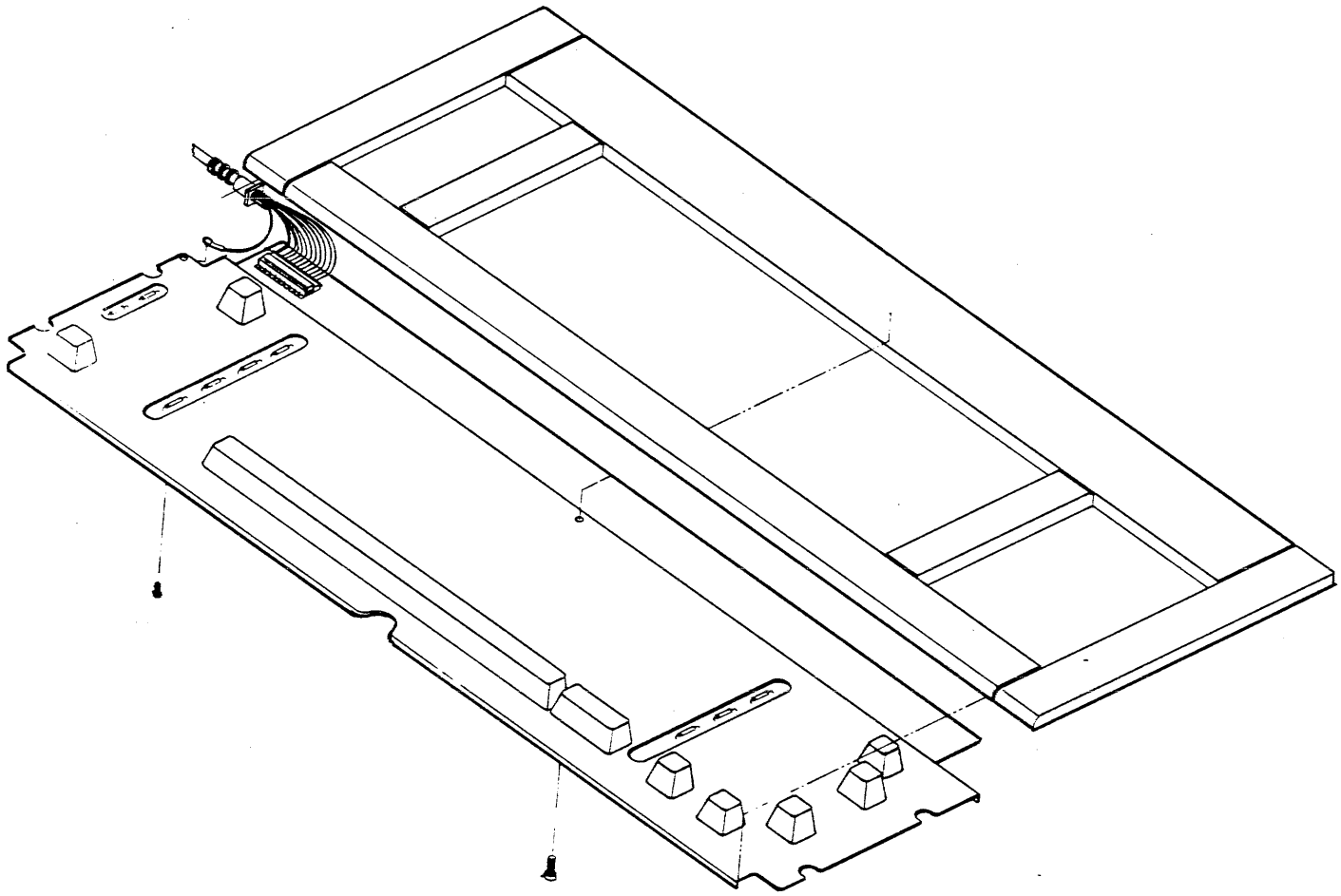


Figure 4-3 Fan Assembly 30-004-01

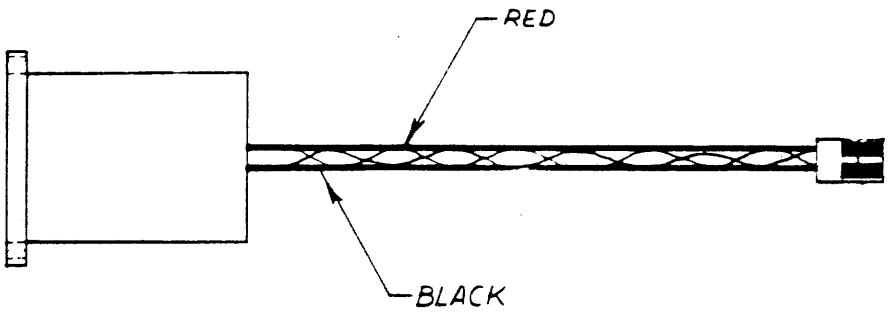


Figure 4-4 WY-500 Monochrome Monitor Pedestal 30-014-01

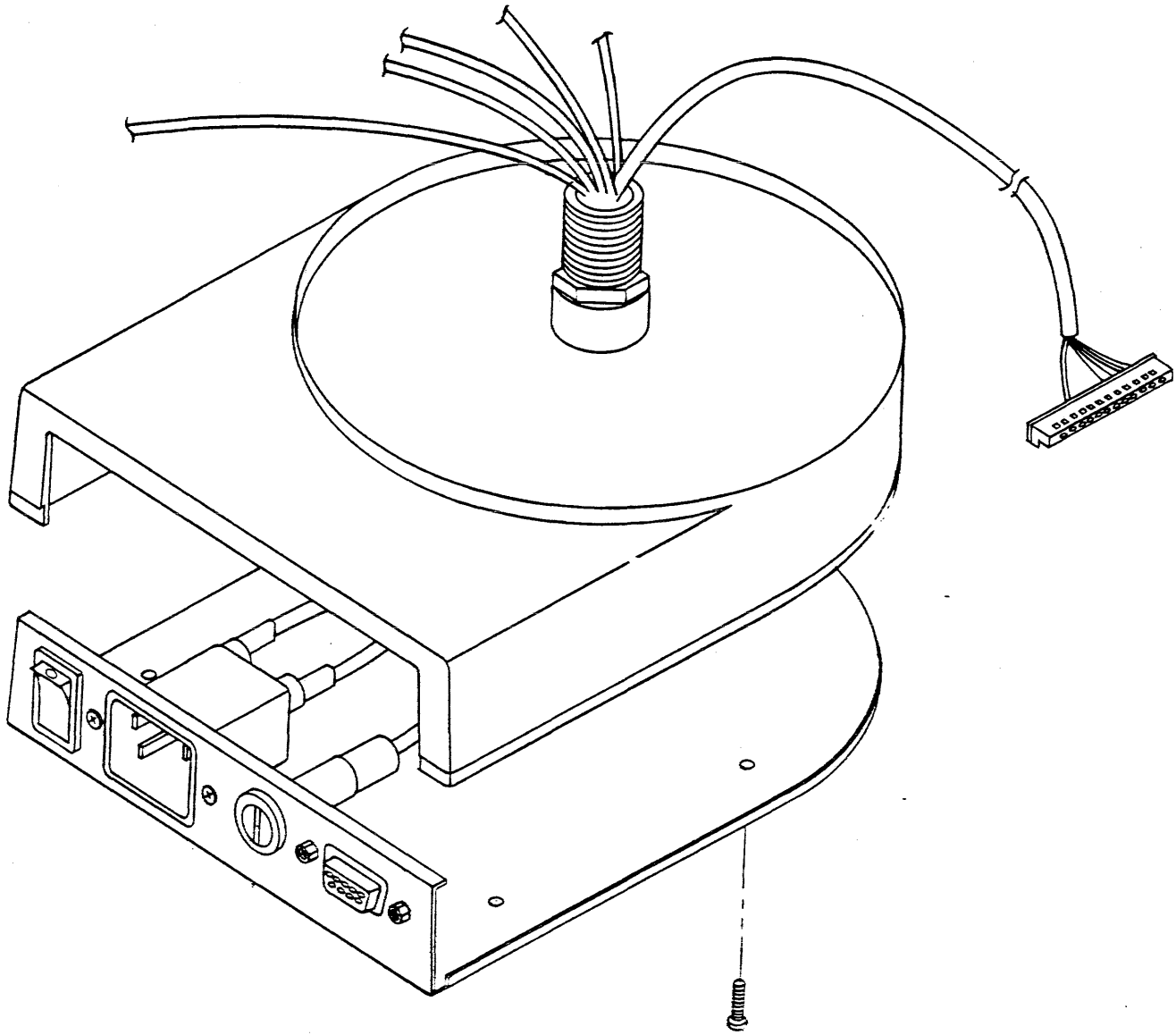


Figure 4-5 A/C Assembly 31-007-01

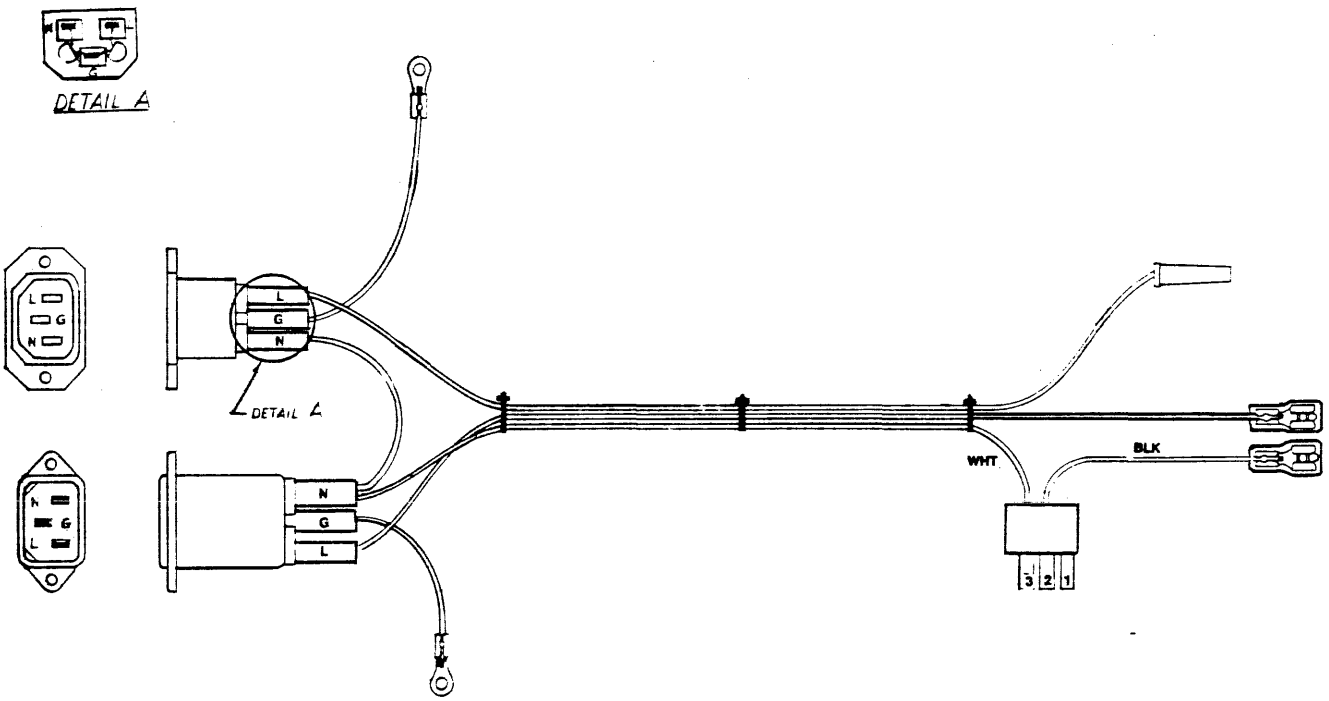


Figure 4-6 Speaker Assembly 31-008-01

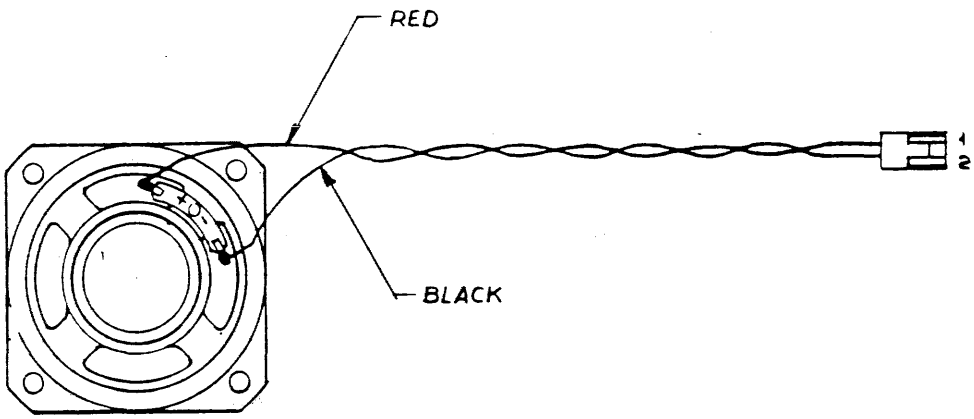


Figure 4-7 Typical Diskette Drive Assembly 31-009-01

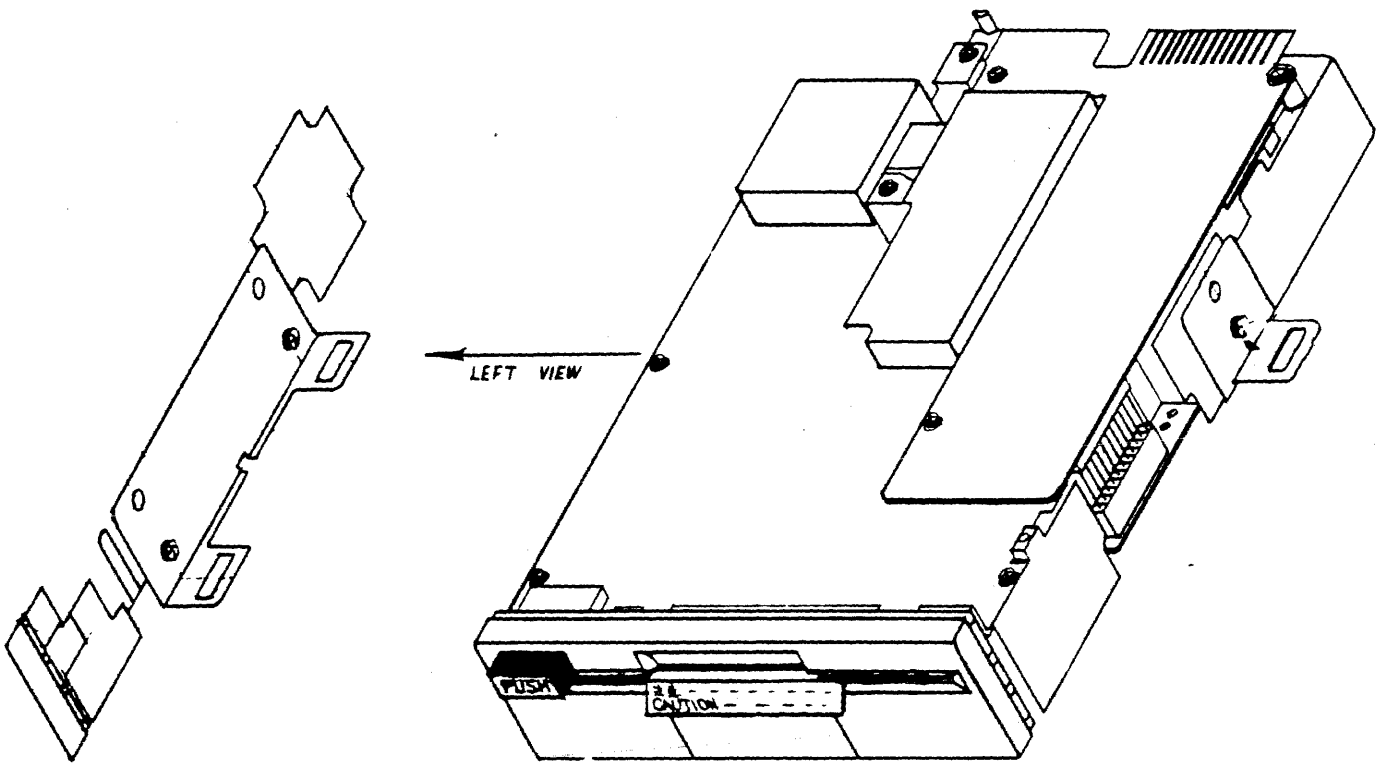


Figure 4-8 Hard Disk Drive Assembly 31-016-01

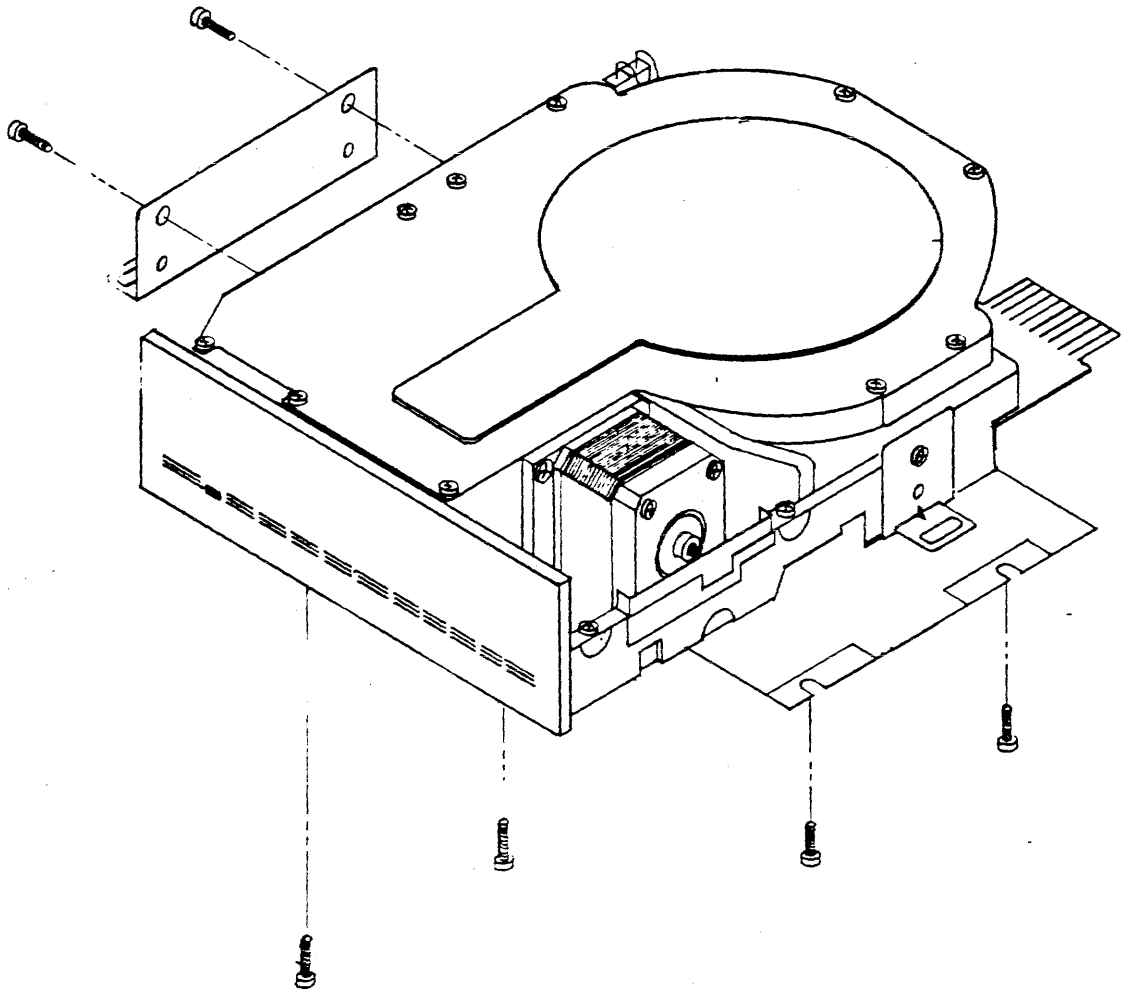


Figure 4-9 Hard Disk Controller Assembly 32-023-01

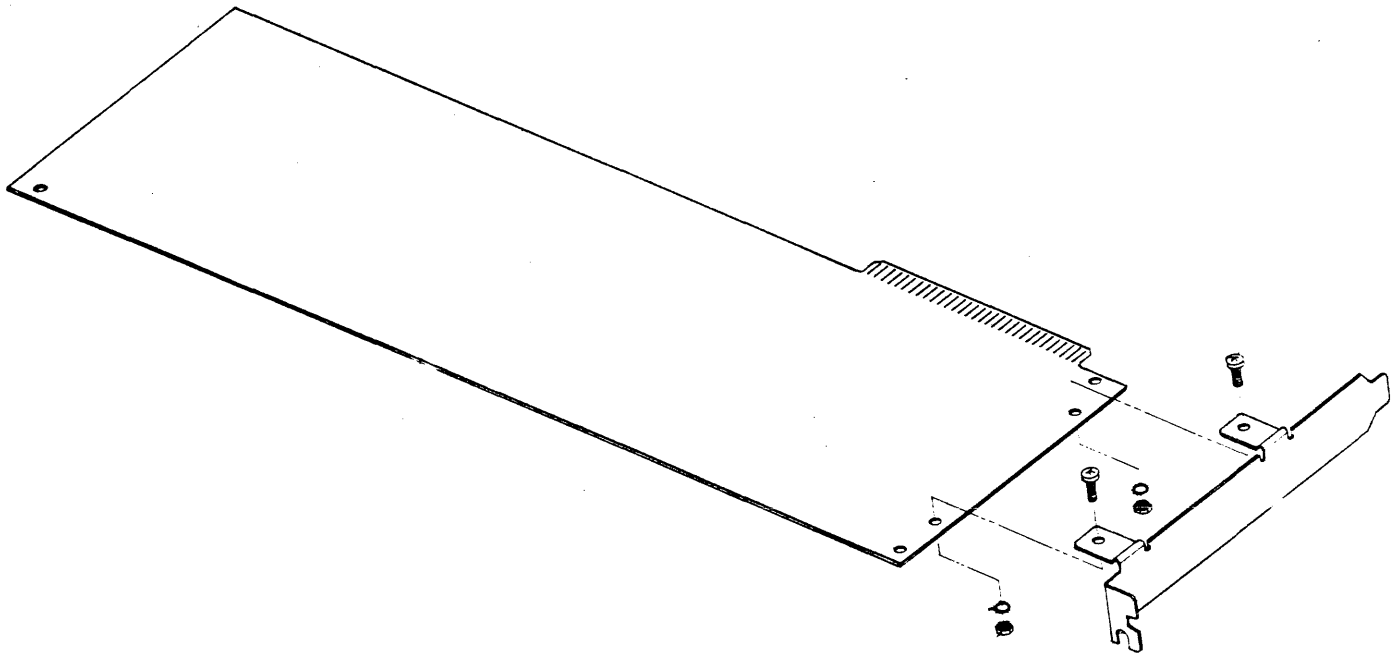
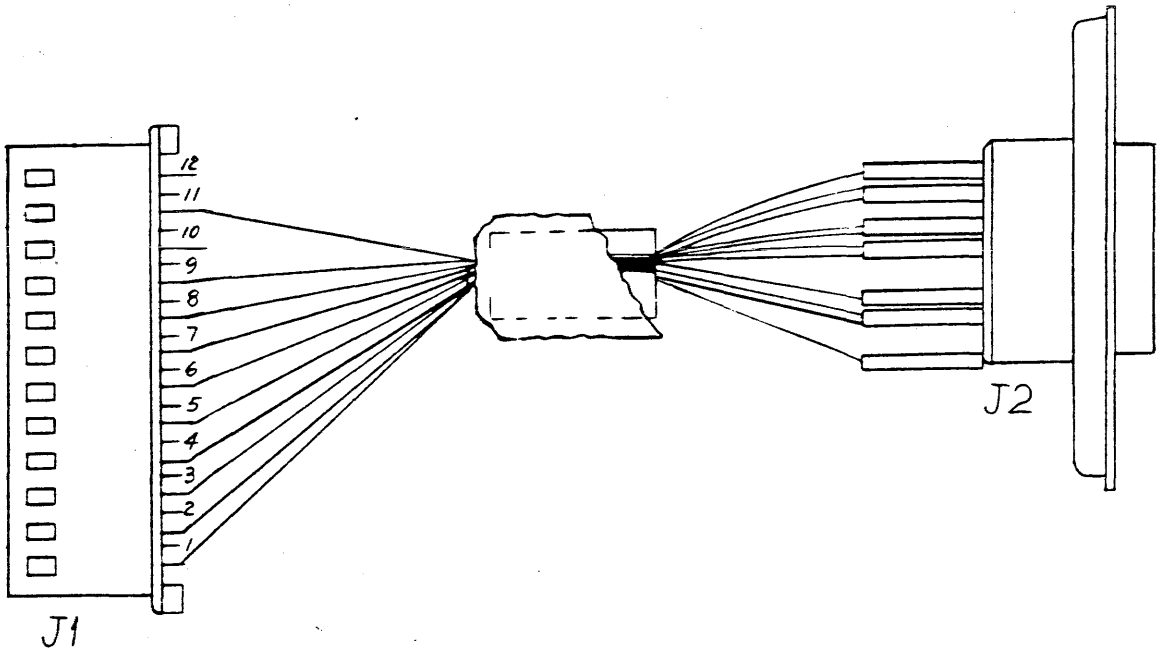


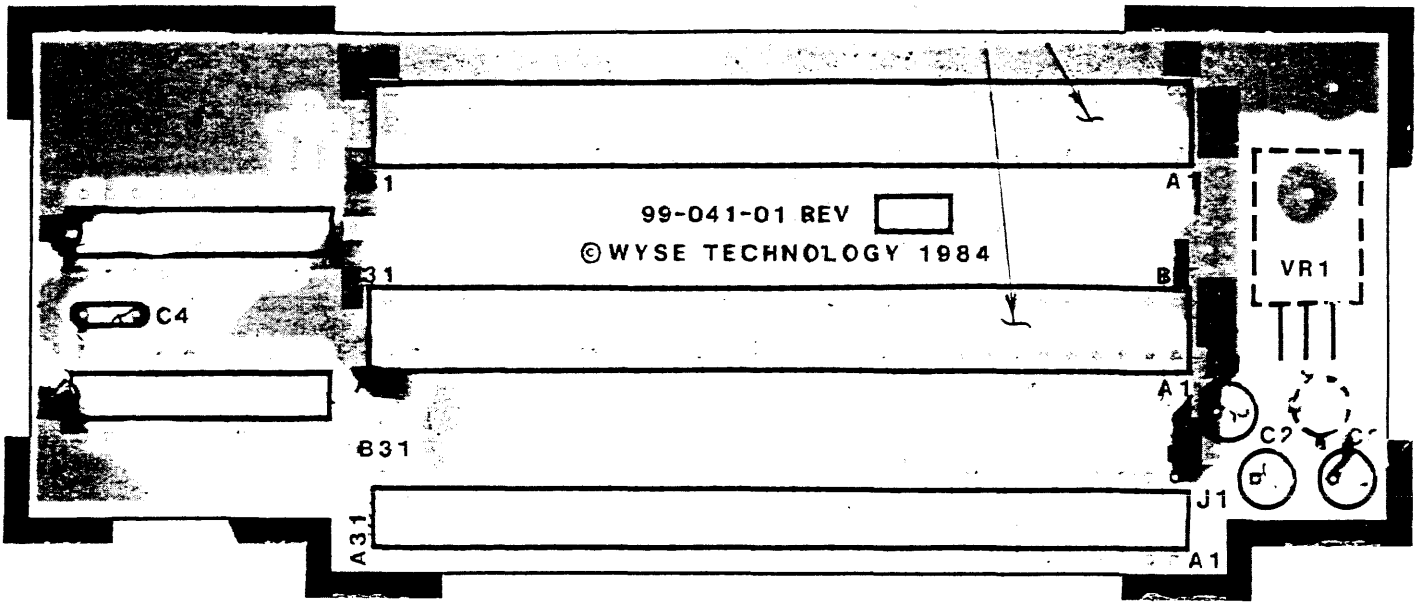
Figure 4-10 Keyboard Harness with Ferrite Socket 94-115-01



Wire List

From	To	Color
J1-1	J2-Gnd	Black
J1-2	J2-3	Purple
J1-3	J2-2	White1
J1-4	J2-1	Yellow
J1-5	J2-4	Green
J1-6	J2-5	White
J1-7	J2-6	Blue
J1-8	J2-7	Grey
J1-9	J2-8	Red
J1-10	J2-9	Orange
J1-11	J2-10	Brown
J1-12	NC	

Figure 4-11 Standard Backplane



5 THEORY OF OPERATION

This chapter contains the following sections:

Introduction

You may want to identify certain components as you read about them. The text identifies each component with the X-Y coordinate system. This system helps you locate components on the printed circuit board that are referred to in the schematics. Following is a brief explanation of the coordinate system.

A set of alphabetical coordinates (A, B, C, etc.) runs the length of the CPU logic board. A set of numerical coordinates (1, 2, 3, etc.) runs along the width of the board. These coordinates form an X-Y grid. Each component's X-Y coordinate is printed next to it on the board.

System Functional Description

This unit is a desktop personal computer designed to be software/hardware compatible with the IBM PC/XT. The computer unit contains the CPU logic board, a power supply, a speaker, two 5 1/4-inch, 360K, half-height diskette drives (or one diskette and one hard disk drive); two RS-232C serial communications ports, one parallel printer port, a monochrome display output, a keyboard interface, two IBM PC/XT-compatible expansion slots in a standard backplane (I/O bus connector), and 256K of RAM.

CPU Logic Board Overview

The CPU logic board is the heart of the computer. Hardware on the board consists of a 5 MHz 8088 microprocessor, 256K dynamic RAM, monochrome display logic, interface for two diskette drives, two RS-232C serial ports, one parallel printer port, a keyboard interface, a speaker output, and an expansion bus interface connector. An on-board socket to accommodate an optional 8087 floating-point numeric coprocessor is also provided.

A standard backplane plugged into the expansion bus interface connector provides two slots for full-size IBM PC/XT-compatible expansion boards.

Jumper selection allows the use of 256K dynamic RAM chips in place of 64K dynamic RAM chips for future memory expansion to 640K on-board memory. See Appendix E for a jumper summary.

The display output is compatible with either the WY-500 or IBM compatible monochrome monitors.

The video display circuitry, COM1 serial port, and LPT1 parallel port may be disabled to accommodate a variety of IBM expansion boards that occupy the same address space.

The CPU logic board is IBM PC/XT-compatible at the memory and I/O map level with the exception of BASIC ROM.

CPU Logic Board Architecture

Architecturally, the CPU logic board consists of the following subsystems: CPU, memory, diskette drive, I/O port, display, keyboard, and system port logic.

Communication between subsystems is achieved through a bus system, which is illustrated in the block diagram in Figure 5-1. The bus system consists of system address bus (ABUS), system data bus (DBUS), and system control bus (CBUS).

The ABUS and DBUS are generated from the multiplexed 8088 address/data bus (ADBUS). The CBUS consists of memory and I/O read/write command lines. The DBUS is buffered for fanout reasons to generate several additional data busses: XDBUS, YDBUS, memory data bus (MDBUS), and video data bus (VDBUS).

The XDBUS communicates with boot ROM, DMA controller, DMA extended address register, interrupt controller, timer, keyboard scanner, configuration switch port, and system control/status registers.

The YDBUS communicates with the CRT controller, video control/status ports, asynchronous communication controller, parallel printer port, diskette drive controller, and diskette control port.

The MDBUS communicates with system main memory.

The VDBUS is a 16-bit video memory bus, consisting of an eight-bit character bus and an eight-bit character attribute bus. The character bus is accessed on even addresses. The attribute bus is accessed on odd addresses.

Figure 5-2 illustrates the computer system memory map. Table 5-1 provides an I/O address map.

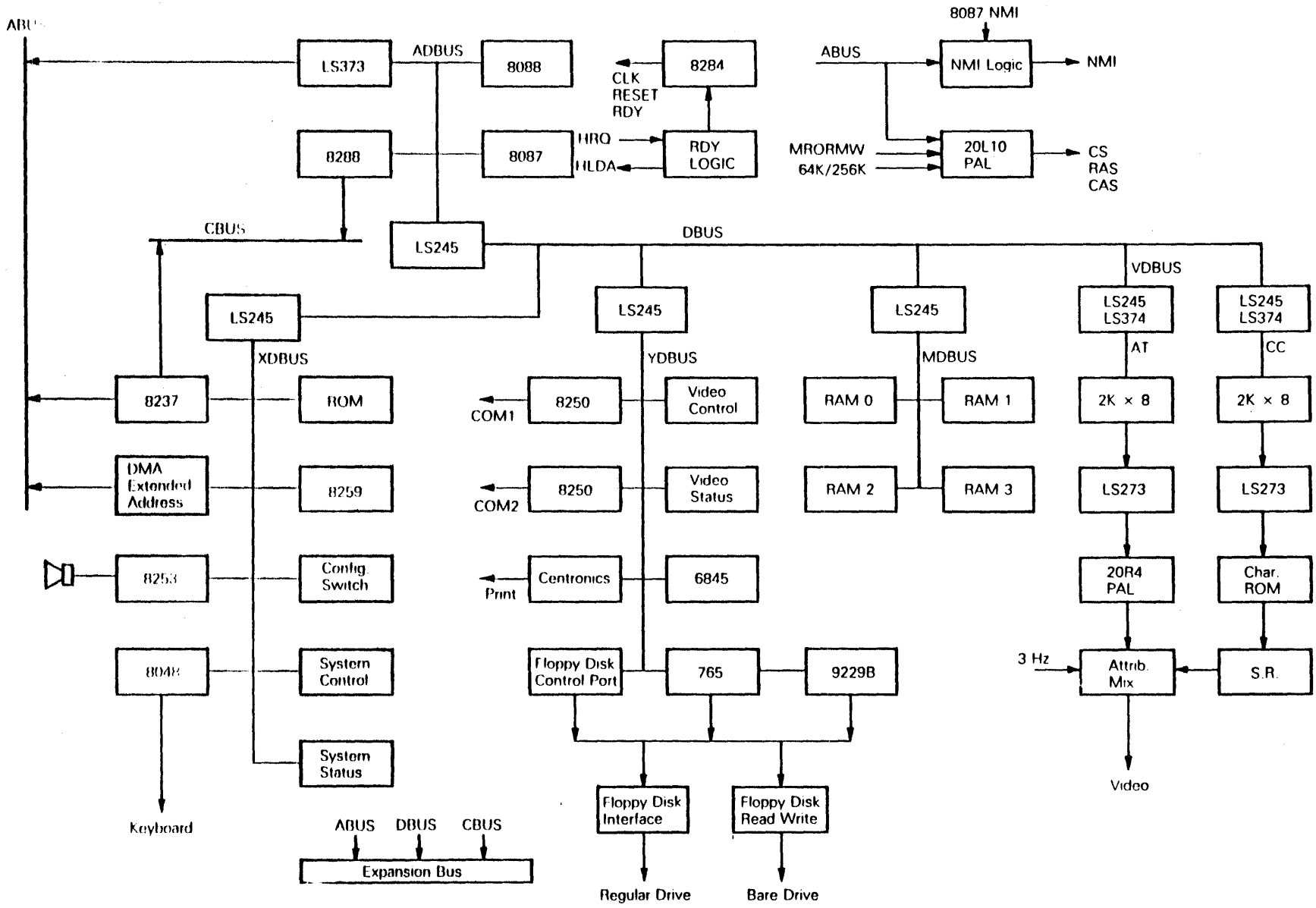


Figure 5-1 CPU Logic Board Block Diagram

Figure 5-2 System Memory Map

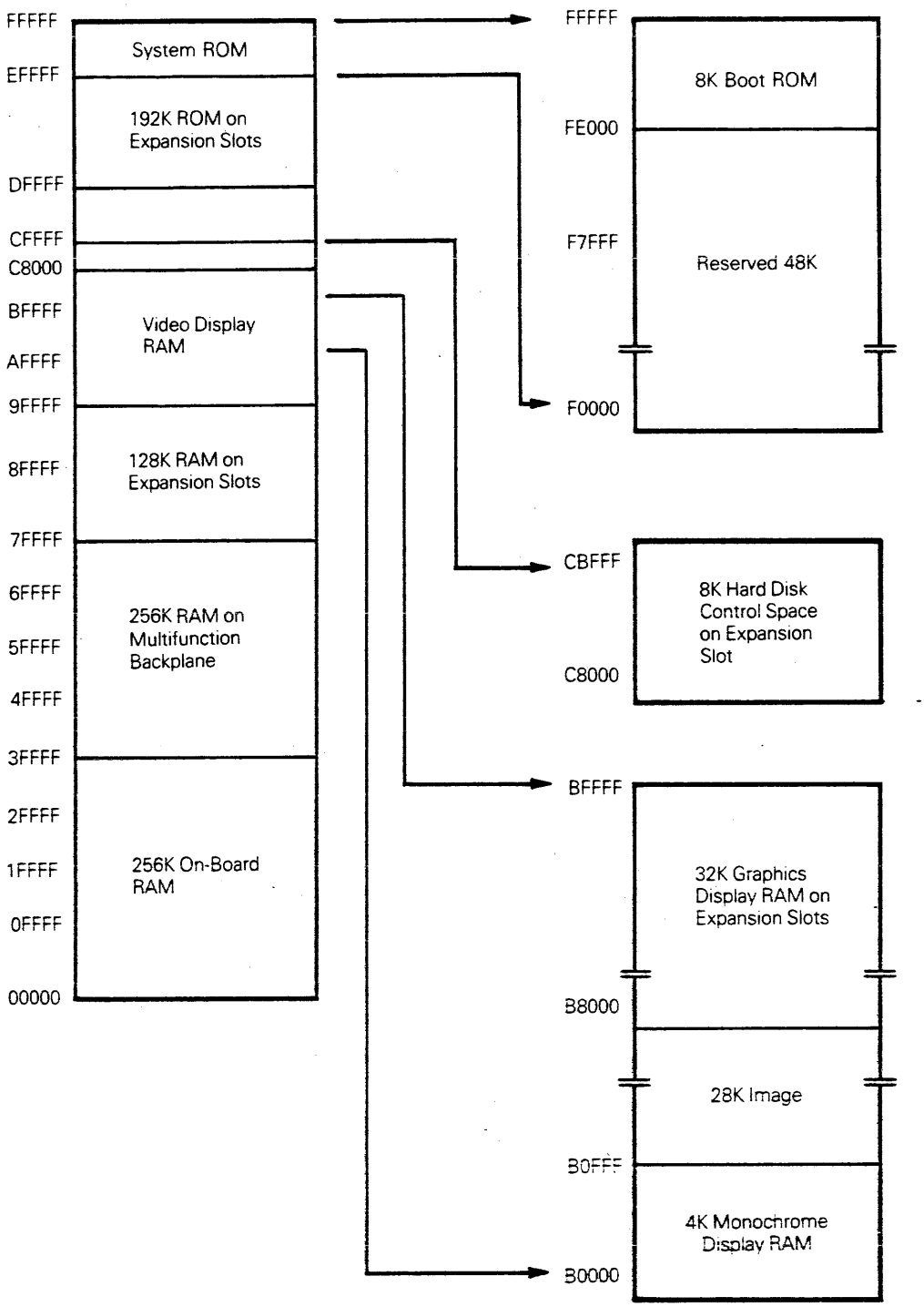


Table 5-1 I/O Address Map

I/O Hex Address	I/O Devic	Description
000-00F	8237-A	DMA controller
020-021	8259	Interrupt controller
040	8253	IRQ0 MSDOS system timer
041	8253	RAM refresh counter
042	8253	Speaker tone counter
043	8253	Timer control port
060	port	Keyboard scan code port
061	port	System control port
062	port	System status/configuration switch port
080-083	port	DMA extended address port
0A0	port	NMI enable port
2F8-2FF	8250	COM2 controller
3B4	6845	Monochrome display address port
3B5	6845	Monochrome display parameter port
3B8	port	Monochrome video control port
3BA	port	Monochrome video status port
3BC	port	Parallel printer data port
3BD	port	Parallel status port
3BE	port	Parallel control port
3D4	6845	Color display address port
3D5	6845	Color display parameter port
3F0	port	Diskette control port
3F4	8272	Diskette controller
3F5	8272	Diskette controller data port
3F8-3FF	port	COM1 controller

CPU Logic Board Configuration

The CPU logic board is configured through a ten-bit dual-inline package (DIP) switch located at IC position 1K. These switches are read by the processor to determine the options that have been installed in the system. If the switch settings do not correspond to the installed options, behavior of the computer may be unpredictable. See Appendix D for switch setting details.

Speaker Interface

The 2-1/4 inch speaker has a two-pin unpolarized connector and is driven from either an output bit at system control port 61H or from a timer clock channel. The output is programmable by the 8253-5 timer with a 1.19 MHz clock input. The timer gate is controlled by an output-port bit (hex address 043).

Diskette Drive

The basic computer system has two 360K half-height diskette drives. The diskette drive uses modified frequency modulation to read and write digital data. Optionally, the computer can contain one diskette and one hard disk drive. See Appendix B for option specifications. Refer to Appendix C for diskette drive specifications.

Data is read from the diskette by data-recovery circuitry, consisting of a read amplifier, differentiator, zero-crossing detector, and digitizing circuits. All data decoding is done by the controller on the CPU logic board.

Diskette Drive Controller

The diskette drive controller is located on the CPU logic board in the computer case. It connects to the disk drives through two internal, daisy-chained flat cables.

The controller is designed for double-density, modified frequency modulation-coded diskette drives and uses write precompensation with a digital phase-lock loop for clock and data recovery. The controller is a fully programmable device. The controller supports the write-protect feature of the drive. The controller is buffered on the I/O bus and uses direct memory access for record data transfers. An IRQ interrupt indicates when an operation is complete that requires processor attention.

Refer to Appendix C for the diskette drive controller connector specifications and a description of the output and input lines.

Keyboard

The keyboard connects to a DIN connector on the rear of the computer with its coiled cable. The ten-wire cable has +5 VDC, ground, one return data line, and seven scan lines.

The 83-key keyboard is arranged with a standard typewriter keyboard layout in the center, ten function keys on the left side, and a 15-key numeric keypad on the right side. The numeric keypad is marked for numeric entry, calculator pad, screen edit, and cursor control. See Appendix C for keyboard interface connector specifications.

Power Supply

The direct current (DC) power supply consists of an internal three-output switch-mode 100-watt power supply. The supply is located in its own compartment in the computer unit and supplies power to the system, the keyboard, and the system options. It supplies 11 amps at +5 VDC ±5%, 3 amps of +12 VDC ±5%, and .22 amps of -12 VDC ±10%. Note that -5 VDC is not generated within the system power supply. A voltage regulator located on the standard backplane or optional multifunction backplane supplies the -5 volts.

Figure 5-3 is a block diagram of the power supply. Figure 5-4 illustrates the locations of the power supply connectors and major components. See Appendix C for power supply specifications.

The CPU logic board draws approximately 5.5 amps of +5 VDC, allowing an equal amount of power (5.5 amps) for the option boards, disk drive circuitry, and the keyboard. The +12 VDC and -12 VDC power the EIA drivers for the serial communications subsystems. A regulated -5 VDC ±10% is also available for option boards in both of the expansion slots.

The monochrome monitor has its own power supply. It receives alternating current (AC) power from the computer unit power. One amp of AC power for the monitor is switched on and off via the power on/off switch located on the rear of the monitor base (Figure 1-4). See Appendix C for power supply specifications.

Figure 5-3 Power Supply Block Diagram

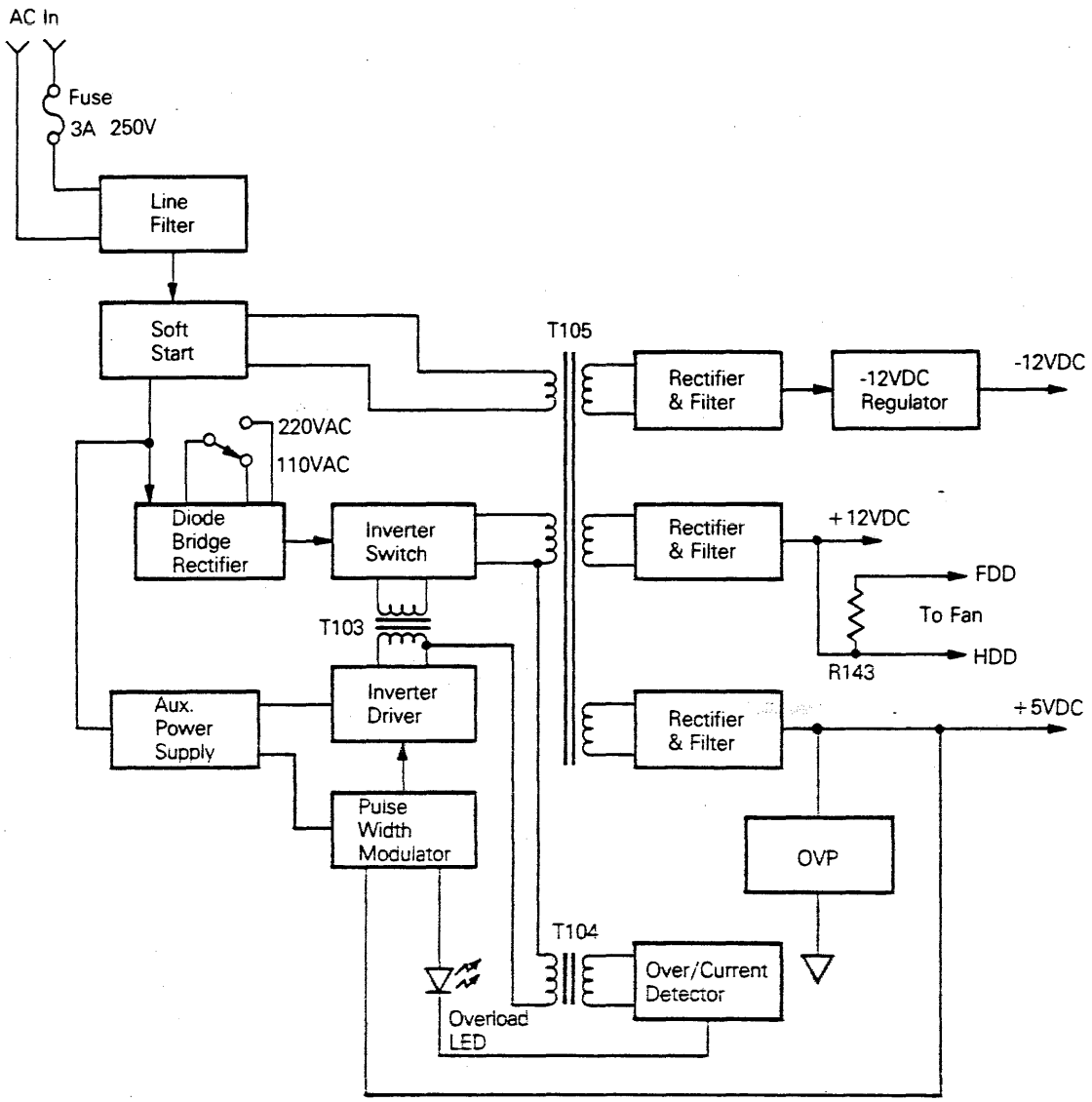
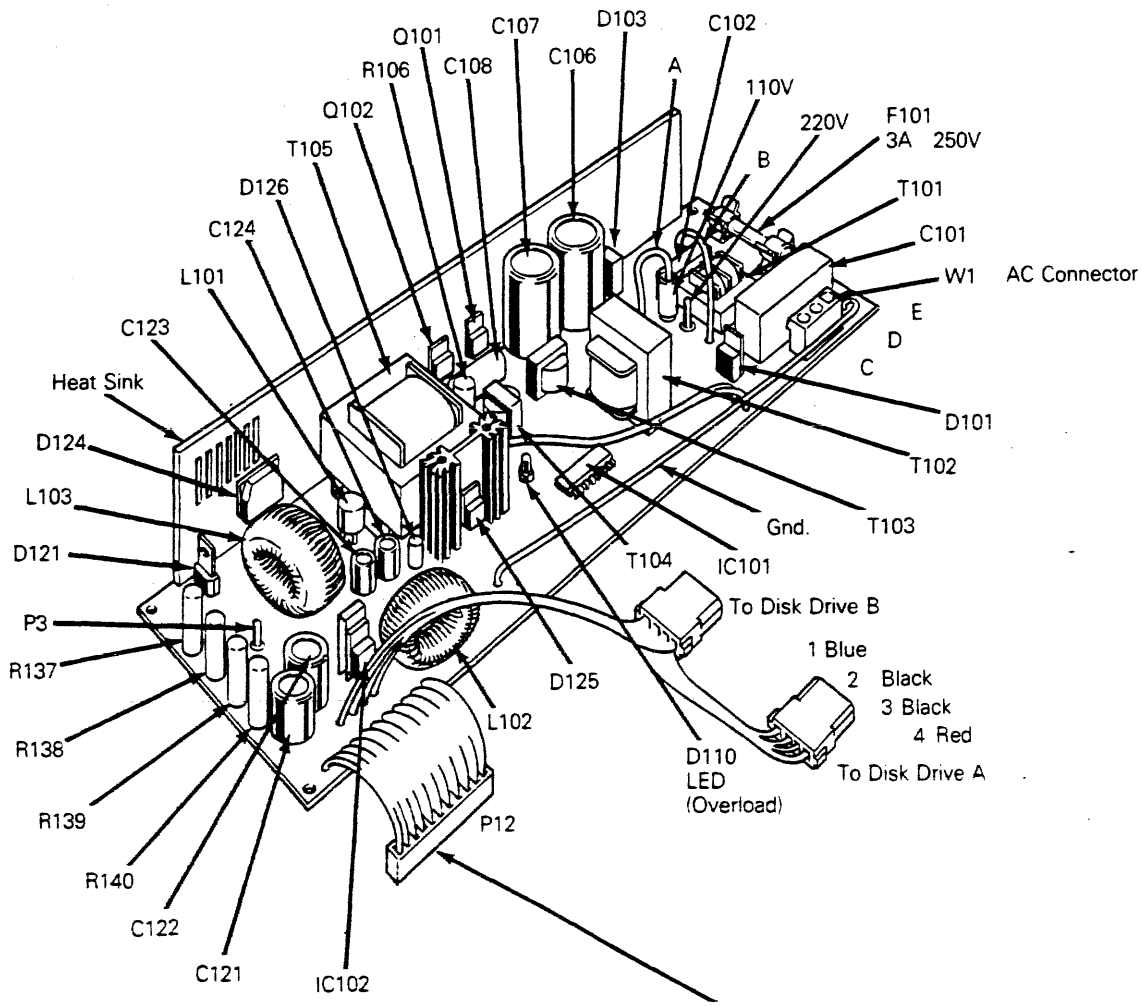


Figure 5-4 Power Supply Connector and Major Component Locations



Pin No.	Color
1-4	Red
5-8	Black
9-10	Blue
11	Yellow

Over-Voltage/Over-Current Protection

A "crow-bar" circuit on the +5 VDC output provides over-voltage protection. The +5 VDC output exceeds a specified threshold voltage, SCR D121 fires, shorting the +5 VDC output. This action prevents the DC output from exceeding safe voltage levels and avoids stress on circuit components powered by the +5 VDC bus. The nominal voltage is 110 VAC and the rating is fast blow, three amps, 250 volts.

Overload transformer T104 provides over-current protection. If excessive load current is drawn from the power supply, it is reflected through this transformer. A sufficient voltage is then developed across R120 and turns on transistor Q107. Q107 sends a signal to inverter driver IC101 to turn off. IC101 will switch on or off, depending on the signal from Q107.

Detailed Theory of Operation

CPU Subsystem

The CPU subsystem consists of an Intel 8088 microprocessor (IC 4F) operating at 4.77 MHz, a blank socket reserved for an optional 8087 numeric coprocessor (IC 4E), an 8284 timing generator (IC 5J), an 8288 bus controller (IC 5L), an 8259 interrupt controller (IC 2L), an 8237 DMA controller (IC 2R), 'LS670 DMA page register (IC 4P), 16K of available boot ROM space(IC 2P), and an 8253 system timer (IC 2M). See pages 1 and 2 of the CPU logic board.

Microprocessor--The microprocessor in the computer is the same Intel 8088 CPU in the IBM PC/XT. It's an eight-bit microprocessor with a 16-bit internal architecture and is capable of addressing up to one megabyte of memory. It operates at 4.77 MHz in maximum mode. Maximum mode allows for coprocessors in the system. The CPU is run without wait states for memory accesses, which translates to four 8088 clocks (840ns). I/O cycles incur one wait state which result in an access time of 1050ns. Refer to the Intel Microsystem Components Handbook Vol. 1 for a detailed description of the 8088.

The 8088 or 8087 (when installed) may drive the ADBUS and status lines, -S0, -S1, and -S2. Selection is determined by the RQ/GT signal. The 8088, 8087, or 8237 may drive the ABUS and CBUS. Wait state logic determines selection.

Timing Generator--The Intel 8284A, Harris 82C84, or equivalent timing generator chip generates the system clock for the 8088, clocks for various peripheral support chips, system reset, and provides READY synchronization between the 8088 CPU and the 8087 numeric coprocessor during bus arbitration.

The oscillator frequency input to the 8284 is defined as three times the required CPU system clock frequency of 4.77 MHz. Therefore, a 14.51818 MHz crystal oscillator (Y2) is used. The peripheral clock output (PCLK) is one-half the system clock frequency, 2.386 MHz.

Bus Controller--The Intel 8288 bus controller chip generates command and control signals with bipolar drive capability and proper timing by decoding the following 8088 status lines: -S0, /S1, and /S2. Refer to the Intel Microsystem Components Handbook Vol. 1 for a detailed description of the 8288.

The 8288 chip is used in the system bus mode where no command is issued until 115ns after -AEN is asserted. -AEN is a signal used during bus control transitions between the 8088/8087 and the 8237.

Status lines are pulled up by 10K resistors to ensure proper state at power-on time. Command lines are pulled up by 10K resistors to prevent floating signals during bus control transitions between the 8088/8087 and 8237.

Interrupt Controller--The Intel 8259A interrupt controller chip is a peripheral support chip to the 8088. It's used to handle eight vectored priority interrupts to minimize CPU overhead in servicing peripheral devices. The chip is accessed by the 8088 via the XDBUS. The chip contains internal registers which occupy I/O address space 020:021. Refer to the Intel Microsystem Components Handbook Vol. 1 for a detailed description of the 8259A.

The 8259 supports the following eight interrupt channels in edge-triggered mode with IRQ0 being the highest priority and IRQ7 the lowest priority:

IRQ0	Timer
IRQ1	Keyboard
IRQ2	Expansion
IRQ3	COM2
IRQ4	COM1
IRQ5	Expansion
IRQ6	Diskette
IRQ7	LPT1

Upon receiving an interrupt request (IRQ) from one of the peripheral devices, the 8259 asserts its INT line to the 8088 if the particular interrupt is enabled. It expects to receive an interrupt acknowledge (INTA) from the 8288 bus controller chip. After detecting INTA, the 8259 places a preprogrammed interrupt vector, corresponding to the interrupt request, on the XDBUS. The interrupt vector will then be read by the 8088.

Direct Memory Access (DMA) Controller--The Intel 8237A-5 DMA controller chip, operating at 4.77 MHz, is a fully programmable peripheral support chip to the 8088 CPU. It improves system performance by allowing external devices to directly transfer data to and from main memory. The chip is accessed by the 8088 via the XDBUS. The chip contains internal registers which occupy I/O address space 000:00F. Table 5-2 lists the internal registers to the 8237-A chip.

Table 5-2 8237-A Internal Registers

Address	Description
000	Channel 0 current address register
001	Channel 0 current word count register
002	Channel 1 current address register
003	Channel 1 current word count register
004	Channel 2 current address register
005	Channel 2 current word count register
006	Channel 3 current address register
007	Channel 3 current address register
008	DMA command/status register
009	DMA request register
00A	DMA mask register
00B	DMA mode register
00C	Clear byte pointer bit command
00D	DMA temporary register/master clear command
00E	Clear mask register command
00F	Write mask register command

The 8237-A chip supports the following four DMA channels:

DRQ0	Dynamic RAM refresh
DRQ1	Expansion bus
DRQ2	Diskette
DRQ3	Expansion bus

A detailed description of the 8237A-5 DMA controller chip may be found in the Intel Microsystem Components Handbook Vol. 1.

The DMA page register ('LS670 IC-4P) at port address 80:83 is used in conjunction with the 8237-A to provide DMA capability across 64K byte boundaries.

Note--The logic '0' state output current of both the National and Motorola 'LS670 chips (IOL=20ma) induce too much ground noise in the system for reliable operation and should not be used. Acceptable parts are Signetics and TI 'LS670s, which have lower output current (IOL=5ma).

System Timer--The Intel 8253-5, Harris 82C54, or equivalent system timer operating at 1.193 MHz is a programmable interval timer/counter to generate accurate time delays under software control. The chip is accessed by the 8088 via the XDBUS. The chip contains three 16-bit internal counters and a control register that occupies I/O address space 040:043. Table 5-3 lists the counter/registers internal to the Intel 8253-5.

Table 5-3 Intel 8253-5 Internal Registers

Address	Description
040	Counter 0
041	Counter 1
042	Counter 2
043	Control Word Register

A detailed description of the 8253-5 system timer may be found in the Intel Microsystem Components Handbook Vol. 2.

The 8253-5 is programmed to provide three timing intervals:

OUT0	50ms square wave triggers IRQ0 for MSDOS timer
OUT1	16ms pulse triggers DRQ0 for dynamic RAM refresh
OUT2	Speaker tone generator

Wait State Logic--During either 8088 or 8237 bus cycles, one wait state is always generated by IC 2W and IC 2X for all I/O cycles except dynamic RAM refresh cycles. Video display RAM access cycles and any expansion board access cycle can initiate a wait state through the "set" input of IC 2W. The wait state is released by IC-3W through the "reset" input of IC 2W. The RDY signal generates READY via the 8284 and controls 8088 bus cycles. RDYDMA controls 8237 bus cycles. Refer to pages 1 and 3 of the CPU logic board schematics.

Wait State Logic--During transitions between 8088 and 8237 cycles, IC 3W generates DMAWAIT at the end of an 8088 bus cycle if LOCK is not asserted by an 8088 instruction and HRQ is pending. This will disassert the READY signal via the 8284 and transfer control to the 8237. Meanwhile, IC 2W generates HLDA to allow the 8237 to take control of the bus system. IC 3W generates AENBRD and AEN signals to prevent the 8088 and 8288 from driving the busses during DMA cycles. DMAWAIT, AENBRD, and AEN will be disasserted after HRQ is released by the 8237, and control will revert to the 8088. Refer to pages 1 and 3 of the CPU logic board schematics. See Figure 5-5 for detailed bus arbitration sequences.

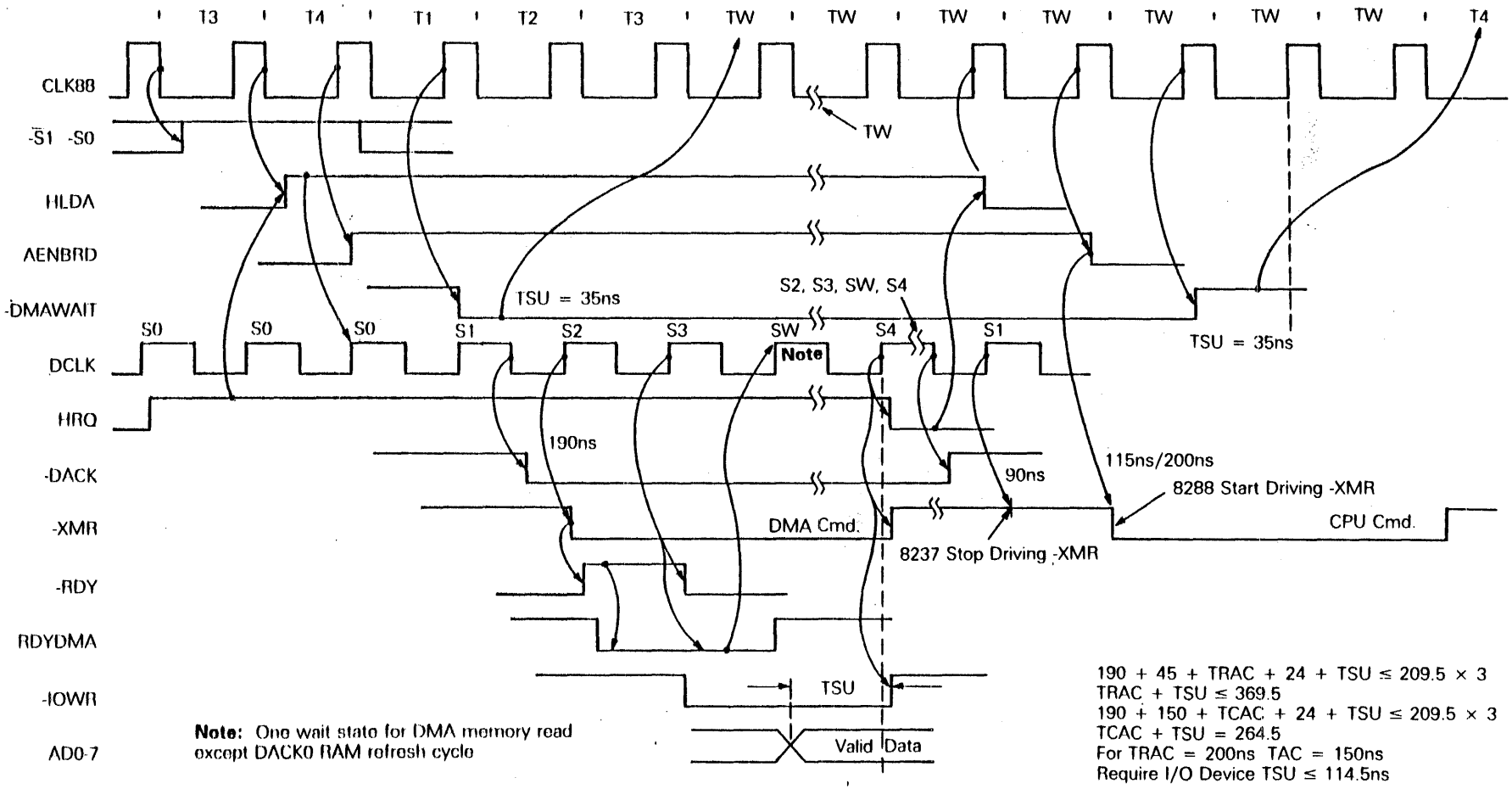


Figure 5-5 CPU/DMA Bus Arbitration Sequences

Decoding and Data Bus Control Logic--PAL20L10s (IC 2S and IC 2T) decode address lines to generate chip selects and strobe signals for all I/O devices. PAL file LCDC1 contains equations for IC 2T. PAL file LCDC2 contains equations for IC 2S. Refer to Appendix C for PAL file listings.

The YDBUS communicates with only I/O devices, so transceiver driving direction for IC 6H is controlled by XIOR. IC 2S generates transceiver output enable YDATAEN.

The XDBUS does not support DMA cycles so IC 2J is enabled by AENBRD. The driving direction is controlled by XRD, which is generated by IC 2T.

NMI Logic--Two types of nonmaskable interrupts (NMI) exist for the computer:

1. 8087-NMI occurs when an unmasked exception is encountered by the 8087 during numeric instruction execution.

2. NMI3 occurs when the CPU attempts to access boot ROM addresses where the IBM copyright message resides.

The 8087 generates 8087-NMI through its INT pin. Six exception conditions may trigger 8087-NMI: invalid operation, overflow, zero divisor, underflow, denormalized operand, or inexact result. Refer to the Intel Microsystem Components Handbook Vol. 1 for details. See pages 3 and 6 of the CPU logic board schematics.

An NMI3 event will transfer control to boot ROM whenever the CPU attempts a memory read access between FE00:0000 and FE00:001F.

The NMI enable port (IC 1X) at port address A0 controls two NMIs. Writing 80H to this port enables both NMIs. Writing 00H to this ports disables NMIs.

Note--This port is write only.

NMI3 may be reset by writing a zero to bit 5 of control port 61H, IC 1J.

NMI status may be obtained by reading system status port 62H, IC 1N. An NMI3 event has occurred if bit 6 is set. If an NMI has occurred and bit 6 is not set, the NMI is identified as an 8087-NMI.

Memory Subsystem

On-board system memory is organized into four banks of 64K using 64K x 1 dynamic RAMs. RAMs with access times of up to 200ns may be used.

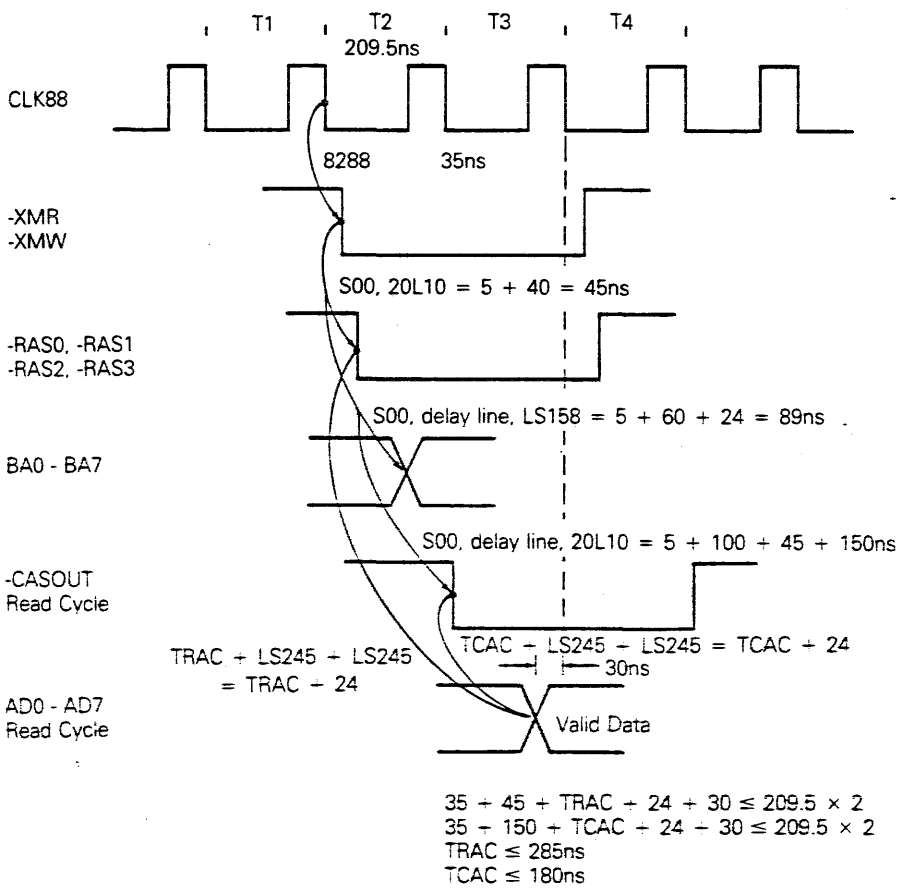
Three ICs and one delay line control the memory subsystem. IC 5N and IC 5P generate an eight-bit multiplexed address to the dynamic RAM array. The RAM read or write cycles are initiated by either XMR or XMW.

A PAL20L10 (LCRAM, IC 8R) decodes address ports A16 through A19 to generate RAS0 through RAS3 for the four RAM banks. Refer to Appendix C for LCRAM PAL file listings. A five-tap 100ns delay line generates ADSEL and CAS signals. ADSEL is the select input to the address multiplexers. CAS is qualified by the PAL to meet timing parameter, DATA to CAS set-up time during RAM write cycles. CAS is turned off by the PAL during RAM refresh cycles. The PAL also generates RMOCS, RAMSEL, and an additional multiplexed address line (A8) to support 256K dynamic RAMs. The data transceiver (IC 10G) is enabled by RAMSEL. XMR controls the driving direction.

The multiplexed addresses and CAS signal is routed to connector J17 to minimize the circuitry on the multifunction backplane board.

Refer to the timing diagram in Figure 5-6 for detailed RAM cycle timing calculations. See page 4 of the CPU logic board schematics.

Figure 5-6 CPU RAM Cycle Timing Diagram



I/O Port Subsystem

The computer has two serial ports (COM1 and COM2) and one parallel port (LPT1). The labeled connectors are located on the back of the system unit (see Figure 1-2). Specifications for the connectors are located in Appendix C.

COM1/COM2 Serial Ports--Serial ports COM1 and COM2 are implemente using either Western Digital or National Semiconductor 8250s (IC 2D and IC 4D). The serial ports and their corresponding control and status registers are accessed via the YDBUS. COM1 registers occupy I/O address space 3F8 to 3FF. COM2 registers occupy I/O address space 2F8 to 2FF. Appendix C lists the registers internal to the 8250 chip.

A detailed description of the 8250 communication chip may be found in the Western Digital Data Communications Products Handbook.

The 8250 has an on-chip baud rate generator, which requires a 1.8432-MHz clock to achieve minimum baud rate error. The clock is derived from the 16.588-MHz video clock divided by 9 (IC-10M).

Note--The 8250A is a newer version chip that is not 100 percent compatible with the older 8250 and should not be used.

RS-232C drivers used on the computer are 75150's, which deliver about 15ma typical output current. The 75150's have worst-case ±5 volt logic levels versus approximately 4ma that are typical for 1488s. The worst-case current specification is not available. The 75150's are disabled at power-on time until the video display is enabled. This action prevents the generation of spurious signals by the 8250's before the 8250's are initialized. The computer uses 1489 RS-232C receiver chips. These chips deliver an inactive high signal to all 8250 data and control inputs when the RS-232C connectors are left open.

LPT1 Parallel Port--Parallel port logic consists of three port registers accessed on the YDBUS. Parallel data port (R/W) is at address 3BC; D0-D7 are the data bits.

Refer to Appendix C for the bit definitions for the (R/O) status port at address 3BDH and the (R/W) parallel control port at address 3BEH. Also see page 10 of the CPU logic board schematics.

Monochrome Display Subsystem

The display subsystem consists of a Synertek 6845 CRT controller operating at 1.843 MHz (IC-6E), 4K video display RAM (IC-8G and IC-8F), 8K character ROM (IC-8J), video shift register (IC-9H), 16.588 MHz video clock (Y3 and 10J), video control state machine

(IC-11H), PAL 20R4 to decode and latch character attributes (IC-8D), vertical sync divider (IC-11F), and miscellaneous MSI chips. See pages 7 through 9 of the CPU logic board schematics.

The CRT controller provides fully programmable control of the display. The CPU communicates with the CRT controller chip via the YDBUS. Eighteen internal registers exist in the chip for specifying various display parameters. In order to access these registers, the CPU must first write to an internal address register at port address 3B4 to select one of the eighteen other registers. Display parameter registers may be accessed at port address 3B5. Appendix C contains the boot ROM and CRT controller values.

These values result in:

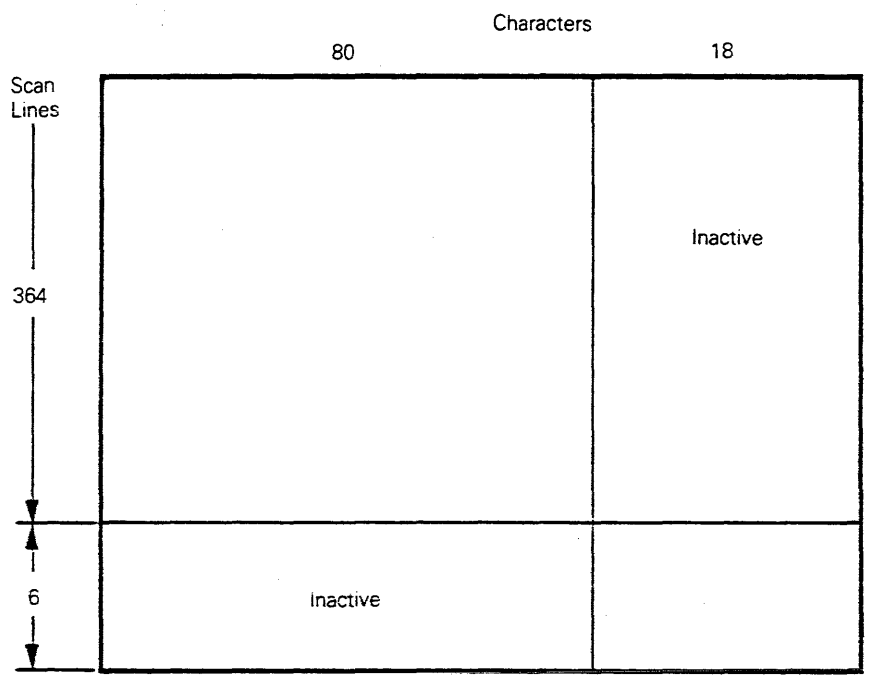
- 80 displayed characters per horizontal line
- 26 character rows per frame
- 14 scan lines per character row
- 364 visible scan lines per frame
- 6 scan lines for vertical retrace
- 18 characters for horizontal retrace

A summary of these values follows:

Total scan lines: 370
Active scan lines: 364

Character matrix: 7 x 9
Character cell: 9 x 14

Figure 5-7 Frame



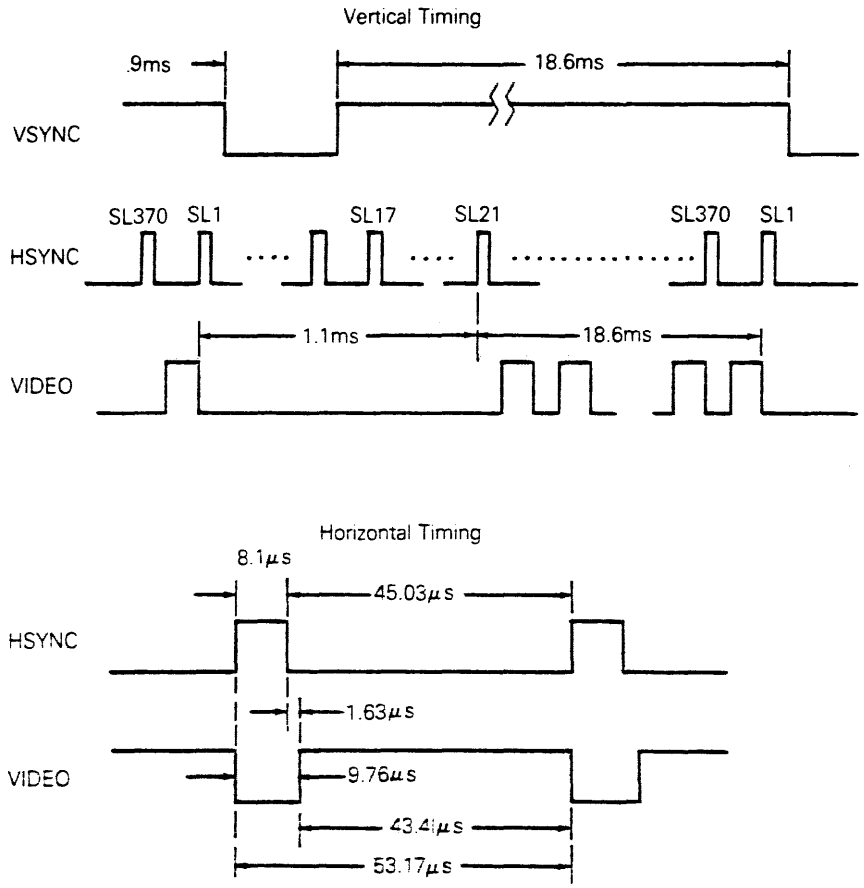
The monochrome display will not support a light pen. Table 5–4 provides the horizontal and vertical frequencies.

Table 5-4 Horizontal and Vertical Frequencies

Video Parameters	Built-In Card Output
f-dot =	16.588MHz
f-char = f-dot/9	1.843MHz
f-hort = f-char/ (R0 + 1)	18.807KHz
f-vert = f-hort/ ((R4 +1) x (R9 + 1) + R5)	50.834Hz

Refer to the monitor timing diagram (Figure 5-8) for details.

Figure 5-8 Monitor Timing Diagram



Video display RAM is accessed by the CPU via the VDBUS. It occupies address space, B000:0000 through B000:0FFF, with a duplicate image from B000:1000 through B000:7FFF. Even addresses hold the character byte. Odd addresses hold the character attribute.

The attribute byte is defined as follows:

	D7*	D6	D5	D4	D3*	D2	D1	D0
Nondisplay	BL	0	0	0	I	0	0	0
Underline	BL	0	0	0	I	0	0	0
Normal video	BL	0	0	0	I	1	1	1
Reverse video	BL	1	1	1	I	0	0	0

*BL = blink
I = intensity

Video display RAM is shared by the CRT controller and the CPU. The 1.843 MHz character clock (CCLK) is used to multiplex video display RAM accesses between the 8088 and the 6845. CCLK high time is allocated to CPU accesses. CCLK low time is allocated to CRT controller accesses.

Video display RAM read/write bus cycles may be disabled by jumpering JC4 to the OFF position to accommodate a variety of enhanced IBM monochrome video display expansion boards which use the image area for additional display RAM.

The video control register (IC-8C) at port address 3B8 contains two bits to enable the video display (bit 3) and to enable cursor blinking (bit 5). The video status register (IC-9A) at port address 3BA contains status bits for the video output, PC/XT, IBM/50, and HSYNC DLY signals. See Appendix C for the bit maps for the video control port and the video status port.

State machine (IC-11H) generates the character clock, CCLK, and control signals, Q5, CEROM, S/L, WE, and CPUADDR.

IC-11G generates IOCHRDY to synchronize 8088 video RAM accesses to 6845 video RAM accesses.

IC-11F divides the vertical sync signal down to 3Hz for cursor blinking and 1.5 Hz for character blinking.

IC-9B, 10A, 10B, 10C, and 10D mix attributes with the video dot stream.

IC-11B synchronizes the video stream and disables the horizontal sync signal (HSYNC) to the WY-500 monitor at power-on time. HSYNC is enabled when the boot ROM sets the ENVIDEO bit at video control port, 3B8, which allows HSYNC to reach its steady state frequency. This sequence is necessary to protect the WY-500 monitor.

Video driver, IC-9A uses a separate ground trace for RFI reduction.

Keyboard Subsystem

An Intel 8048 microprocessor with on-board ROM (IC-1E), operating at 4.9152 MHz, is programmed to perform the keyboard scanner function in the computer. A detailed description of the 8048 microprocessor may be found in the Intel Microcontroller Handbook. Also see page 6 of the CPU logic board schematics.

The 8048 scans the keyboard by monitoring pins P10 through P16 and its T0 input. A logic 0 at T0 indicates a depressed key. A logic 1 indicates a released key. Upon receiving a valid keyboard state change, an 8-bit scan code is written to the keyboard scan code latch (IC-1F). Data bit 7 is set to a logic 0 if the state change is due to a key being pressed. Data bit 7 is set to a logic 1 if the state change is due to a key being released.

An 8048 write operation to the scan code latch will set IRQ1 to the 8088 and cause the 8048 T1 input to go low indicating a busy state. The 8088 will then service the keyboard interrupt by setting bit 7 (PB7) in the system control register (61H), reading the keyboard scan code register (60H), and then resetting PB7. The process of toggling PB7 will reset IRQ1 and set T1 back to a logic 1 indicating not busy to the 8048. This allows the 8048 to resume write operations to the scan code latch.

At power-on time the 8088 will toggle bit 6 (PB6) in the system control register (61H) to direct the 8048 to perform a self-test. If any key is stuck on the keyboard, the scan code will be written out; otherwise, AAH will be written out.

System Port Subsystem

Three system registers exist on the CPU logic board: A system control register, system status register, and a keyboard scan code register. On the schematics the system control register (IC-1J, IC-1P, IC-1N) is labeled PORTB; system status register (IC-1L, IC-1M, IC-1N) is PORTC; and keyboard scan code register (IC-1F) is PORTA. See Appendix C for the bit definitions for system ports A, B, and C. Also see page 6 of the CPU logic board schematics.

The system ports have been defined to be compatible with the IBM PC/XT. The computer will interpret the system ports 60 and 62 differently, depending on the PC/XT SEL configuration bit. The computer will emulate the IBM PC if the PC/XT SEL configuration bit 9 (located on the DIP switch on the CPU logic board) is OFF and will emulate IBM PC/XT if bit 9 on the DIP switch is ON. Refer to Appendix D for DIP switch settings.

Note—IBM PC mode is currently not supported by the firmware BIOS ROM.

Diskette Subsystem

The diskette subsystem consists of an Intel 8272 or NEC uPD765 diskette controller chip operating at 4 MHz (IC-7K), Standard Microsystem 9229B Digital Data Separator chip (IC-8L), 16-MHz crystal (Y4), and disk control port (IC-7H). The diskette controller and external disk control port are accessed via the YDBUS.

The diskette controller chip contains control circuitry to interface the CPU to the two diskette drives. A status and data register internal to the chip occupy I/O address

space 3F4 and 3F5. A detailed description of the uPD765 diskette chip may be found in the NEC Microcomputer Products Data Book.

The 9229B chip contains a digital data separator, write precompensation logic, and a head-load timer. It is used in conjunction with the diskette controller to interface to the diskette drives. A detailed description of the 9229B chip may be found in the Standard Microsystem Data Catalog.

The external disk control port at I/O address 3F0 contains bits to select a drive, enable drive motors, reset the diskette controller chip, and enable interrupts from the diskette controller chip. See Appendix C for the bit definitions for the diskette controller registers. Also see page 11 of the CPU logic board schematics.

Precompensation delay is determined by the write precompensation signal (LCT) which is driven by bit 4 of the system control register (61H). LCT should go high during disk write operations for tracks 20 through 39 (precomp dly = 375 ns) and stay low for tracks 0 through 19 (precomp dly = 125 ns).

The 9229B chip divides the 16 MHz clock input to generate a 4 MHz diskette controller clock and a 500 KHz write data clock to the diskette drives (WCLK pin of diskette controller). IC 9N synchronizes WCLK to the 4 MHz diskette controller CLK for proper operation of the diskette controller chip.

IC 10N delays the DRQ signal from the diskette controller chip by two microseconds to satisfy the TMr and TMw DMA operation timing parameters of the diskette controller chip.

The step rate (SRT), and head load time (HLT), are two critical parameters for reliable disk operation. HLT values are set by issuing the SPECIFY command sequence to the diskette controller chip.

The SPECIFY command sequence is

	D7	D6	D5	D4	D3	D2	D1	D0
Command Byte	0	0	0	0	0	0	1	1
Data Byte 1	<--SRT--------->				1	1	1	1
Data Byte 2	<--HLT---------->							0

The IBM PC with full-height drive uses 8-ms SRT (first data byte = CFH) and 4-ms HLT (second data byte = 02H). Your computer uses half-height drives made by Epson, Sanyo, or Shugart. The optimum values are 6-ms SRT (first data byte = DFH) and 28-ms HLT (second data byte = 0EH). These values have been tested on Epson, Shugart, and Sanyo drives with satisfactory error rates.

Standard Backplane

The computer standard backplane provides two standard IBM expansion slots and a -5 volt regulator. The backplane is directly compatible with the IBM expansion bus, except for the /CARDSLCTD signal which is not required to support only two slots. The backplane plugs into the expansion bus connector (J13) on the CPU logic board. See Appendix C for a list of all signals and their pin assignments for expansion slots J2 or J3.

6 SCHEMATICS

This chapter contains a harness interconnection drawing, tables providing connector pin assignments, and schematics for the CPU logic board, standard amd multifunction backplanes, keyboard printed circuit board, power supply, and color graphics printed circuit board.

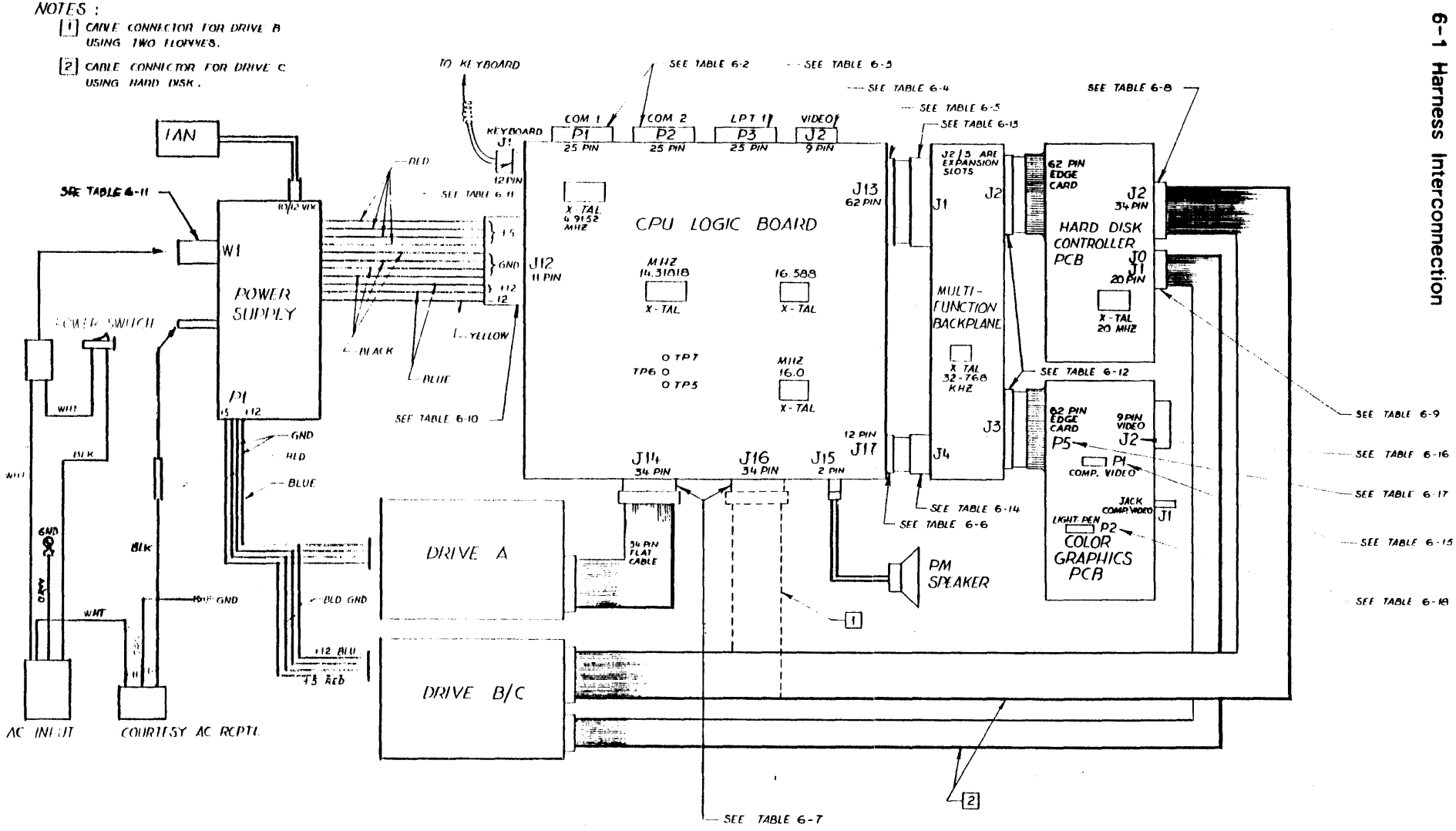


Figure 6-1 Harness Interconnection

Table 6-1 Keyboard Connector J1 Part No. 80-121-24

Pin No.	Signal
1	Ground
2	Ground
3	+5 Volts
4-10	Keyboard Scan
11	Keyboard Data
12	Not Used

Table 6-2 COM1 and COM2 Serial Connectors P1 and P2 Part No. 80-151-69

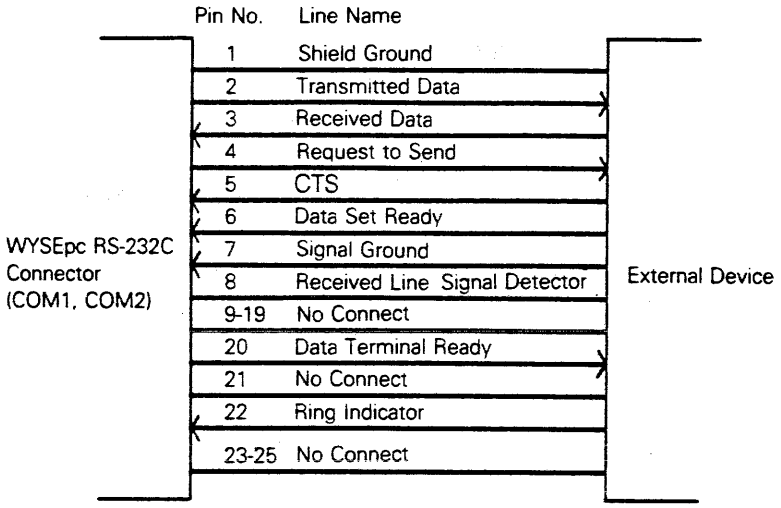
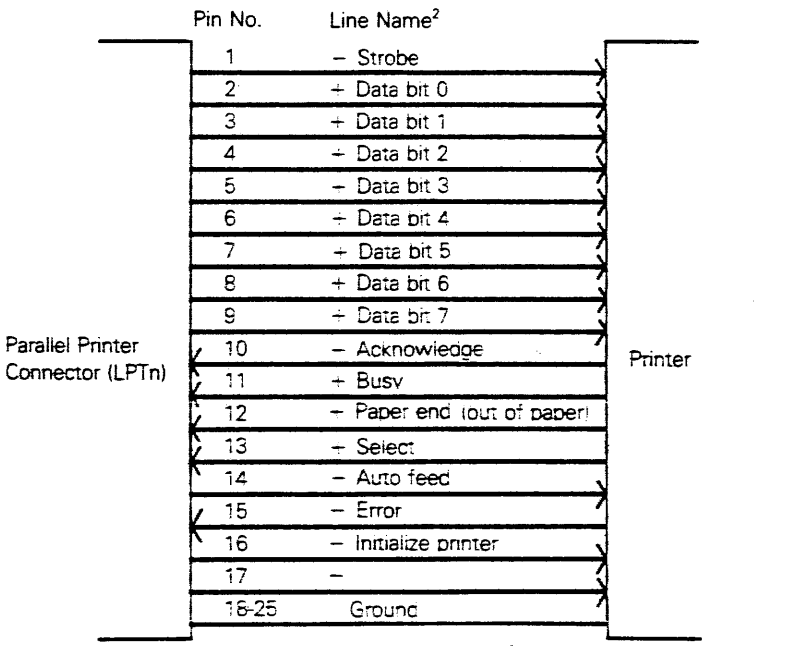
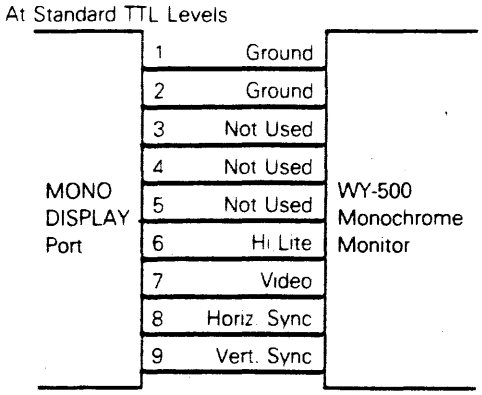


Table 6-3 LPT1 Parallel Connector P3 Part No. 80-150-11



[1]All outputs are generated by software; all inputs are real-time (nonlatched) signals.
[2]At standard TTL levels.

Table 6-4 Monochrome Video Connector J2 Part No. 80-151-45



Note: Signal voltages are 0.0 to 0.6 VDC at low level and +2.4 to 3.5 VDC at high level

Table 6-5 CPU Logic Board Connector J13 for Standard or Multifunction Backplane Connector Part No. 80-121-46

Signal Name	Pin No.	Pin No.	Signal Name
Ground	2	1	Not Used
BRESET	4	3	D7
+5V	6	5	D6
IRQ2	8	7	D5
Not Used	10	9	D4
DRQ2	12	11	D3
-12V	14	13	D2
Not Used	16	15	D1
+12V	18	17	D0
Ground	20	19	IOCHRDY
-XMW	22	21	AENBRD
-XMR	24	23	A19
-XIOW	26	25	A18
-XIOR	28	27	A17
-DAK3	30	29	A16
DRQ3	32	31	A15
-DAK1	34	33	A14
DRQ1	36	35	A13
-DAK0	38	37	A12
CLK88	40	39	A11
IRQ7	42	41	A10
IRQ6	44	43	A9
IRQ5	46	45	A8
IRQ4	48	47	A7

Table 6-5 CPU Logic Board Connector J13 (Continued)

Signal Name	Pin No.	Pin No.	Signal Name
IRQ3	50	49	A6
-DAK2	52	51	A5
TC	54	53	A4
ALE	56	55	A3
+5V	58	57	A2
OSC	60	59	A1
Ground	62	61	A0

Table 6-6 Multifunction Backplane Connector J17 Part No. 80-121-47

Pin No.	Signal
1	CASOUT
2	+5V
3	A6
4	A3
5	A0
6	A4
7	A2
8	A5
9	A1
10	A7
11	-POR
12	GND

Table 6-7 Diskette Drive Connectors J14 and J16 Part No. 80-121-40

Pin No.	I/O	Signal
1-7		No connect
8	In	-Index
9		No connect
10	Out	-Drive select
11-15		No connect
16	Out	-Motor enable
17		No connect
18	Out	-Dir in
19		No connect
20	Out	-Step
21		No connect
22	Out	-Write data
23		No connect
24	Out	-Write enable
25		No connect
26	In	-Trk 00
27		No connect

Table 6-7 Diskette Drive Connectors J14 and J16 (Continued)

Pin No.	I/O	Signal
28	In	-Write protect
29		No connect
30	In	-Read data
31		No connect
32	Out	-Side1
33		No connect
34	In	-Ready

Table 6-8 Hard Disk Drive Controller PCB Connector J2

Pin No.	Signal
1, 3, 5, 7, 9... -33	All Odd Numbers Are Ground
2	-Reduced Write Current
4	Reserved
6	-Write Gate
8	-Seek Complete
10	-Track 00
12	-Write Fault
14	-Head Select 2 0
16	Reserved
18	-Head Select 2 1
20	-Index
22	-Ready
24	-Step
26	-Drive Select 1
28	-Drive Select 2
30	Reserved
32	Reserved
34	-Direction In

Table 6-9 Hard Disk Drive Controller PCB Connector J0 or J1

Pin No.	Signal
1	Drive Select
2	Ground
3	Reserved
4	Ground
5	Spare
6	Ground
7	Reserved
8	Ground
9	Spare
10	Spare
11	Ground
12	Reserved
13	MFM Write Data
14	-MFM Write Data

Table 6-9 Hard Disk Drive Connector J0 or J1 (Continued)

Pin No.	Signal
15	Ground
16	Ground
17	MFM Read Data
18	-MFM Read Data
19	Ground
20	Ground

Table 6-10 DC Power Supply Connector J12 Part No. 80-121-42

Pin No.	Signal Name
1	+5VDC
2	+5VDC
3	+5VDC
4	+5VDC
5	Ground
6	Ground
7	Ground
8	Ground
9	+12VDC
10	+12VDC
11	-12VDC

Table 6-11 Disk Drive Power Supply Connector P1

Pin No.	Signal Name
1	+12 VDC
2	Ground
3	Ground
4	+ 5 VDC

Table 6-12 Standard or Multifunction Backplane Connector J2 or J3 Part No. 80-121-48

Signal Name	Pin No.	Pin No.	Signal Name
	B	A	
GND	1	1	Not Used
BRESET	2	2	D7
+5V	3	3	D6
IRQ2	4	4	D5
-5V	5	5	D4
DRQ2	6	6	D3
-12	7	7	D2
Not Used	8	8	D1

Table 6-12 Standard/Multifunction Backplane Connector (Continued)

Signal Name	Pin No.	Pin No.	Signal Name
+12V	9	9	D0
GND	10	10	IOCHRDY
-MWB	11	11	AENBRD
-MRB	12	12	A19
-IOWB	13	13	A18
-IORB	14	14	A17
-DAK3	15	15	A16
DRQ3	16	16	A15
-DAK1	17	17	A14
DRQ1	18	18	A13
-DAK0B	19	19	A12
CLK88B	20	20	A11
IRQ7	21	21	A10
IRQ6	22	22	A9
IRQ5	23	23	A8
IRQ4	24	24	A7B
IRQ3	25	25	A6B
-DAK2	26	26	A5B
TC	27	27	A4B
ALEB	28	28	A3B
+5V	29	29	A2B
OSC	30	30	A1B
GND	31	31	A0B

Table 6-13 Standard or Multifunction Backplane Connector J1 Part No. 80-121-49

Signal Name	Pin No. B	Pin No. A	Signal Name
GND	1	1	Not Used
BRESET	2	2	D7
+5V	3	3	D6
IRQ2	4	4	D5
-5V	5	5	D4
DRQ2	6	6	D3
-12V	7	7	D2
Not Used	8	8	D1
+12V	9	9	D0
GND	10	10	IOCHRDY
-XMW	11	11	AENBRD
-XMR	12	12	A19
-XIOW	13	13	A18
-XIOR	14	14	A17
-DAK3	15	15	A16
DRQ3	16	16	A15
-DAK1	17	17	A14
DRQ1	18	18	A13
-DAK0	19	19	A12

Table 6-13 Standard or Multifunction Backplane Connector J1 Part No. 80-121-49 (Continued)

Signal Name	Pin No.	Pin No.	Signal Name
CLK88	20	20	A11
IRQ7	21	21	A10
IRQ6	22	22	A9
IRQ5	23	23	A8
IRQ4	24	24	A7
IRQ3	25	25	A6
-DAK2	26	26	A5
TC	27	27	A4
ALE	28	28	A3
+5V	29	29	A2
OSC	30	30	A1
GND	31	31	A0

Table 6-14 Multifunction Backplane Connector J4

Pin No.	Signal
1	-CASOUT
2	+5V
3	A6
4	A3
5	A0
6	A4
7	A2
8	A5
9	A1
10	A7
11	-POR
12	Ground

Table 6-15 Color Graphics Board RF Modulator Connector P1

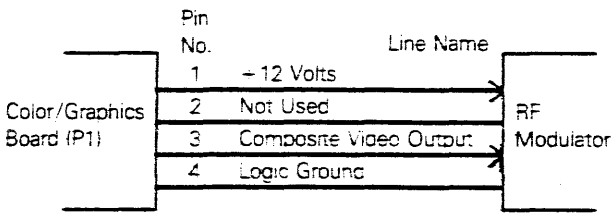


Table 6-16 Color Graphics Board Color Monitor Connector J2

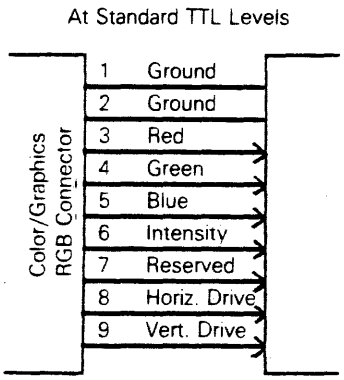


Table 6-17 Color Graphics Board Connector P5

Signal Name	Pin No. B	Pin No. A	Signal Name
Ground	1	1	Not Used
BRESET	2	2	D7
+5V	3	3	D6
Not Used	4	4	D5
Not Used	5	5	D4
Not Used	6	6	D3
Not Used	7	7	D2
Not Used	8	8	D1
+12V	9	9	D0
Ground	10	10	IOCHREADY
-MWB	11	11	AEN
-MRB	12	12	A19
-IOWB	13	13	A18
-IORB	14	14	A17
Not Used	15	15	A16
Not Used	16	16	A15
Not Used	17	17	A14
Not Used	18	18	A13
Not Used	19	19	A12
CLK88B	20	20	A11
Not Used	21	21	A10
Not Used	22	22	A9
Not Used	23	23	A8

Table 6-17 Color Graphics Board Connector P5 (Continued)

Signal Name	Pin No.	Pin No.	Signal Name
Not Used	24	24	A7B
Not Used	25	25	A6B
Not Used	26	26	A5B
Not Used	27	27	A4B
Not Used	28	28	A3B
+5V	29	29	A2B
OSC	30	30	A1B
Ground	31	31	A0B

Table 6-18 Color Graphics Board Light Pen Connector P2

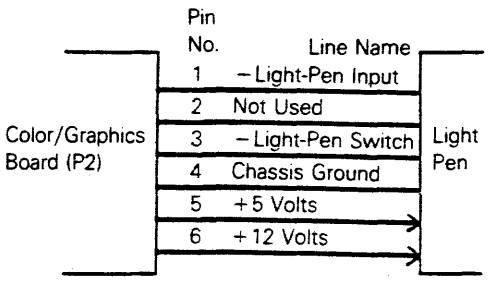
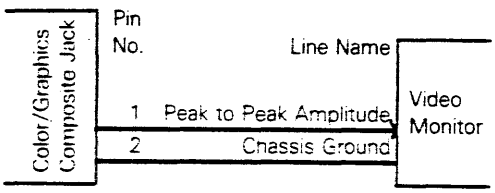


Table 6-19 Color Graphics Board Composite Video Jack J1



Composite Video Signal of Approximately 1.5 Volts

Sheet No.

Sheet No.

14MHZ

+5V

CR1 IN4002

R5 10K

C55 10µf

R6 *

C56 5-30PF

JC2 JC1 JC3

14.31818 MHZ

Y2

R7*

(2) GND PAD ON X TAL

5J

OSC RES
PCLK
X1
RDY1
AEN1
AEN2
VCC
F/C
CSYNC RDY
ASYNC CLK
RDY2 RES
GND
X2
18PIN 82C84 8284A

2 PCLK
3 -DMAWAIT
3 -RDY
+5V
3,8 CLK88
2,3 RESET
3 NMI

LOAD OPTION :

	8284A	82C84
R6	510Ω	20Pf
R7	510Ω	20Pf
JC1	JUMPER	JUMPER
JC2	OPEN	OPEN
JC3	OPEN	OPEN

4F

AD0 AD1 AD2 AD3 AD4 AD5 AD6 AD7
READY
CLK
RESET
RQ/GT1
QS0 QS1
NMI
MN/MX
GND GND
RQ/GT0
TEST
VCC INTR
40 PIN 8088
LOCK
AA19 AA18 AA17 AA16 AA15 AA14 AA13 AA12 AA11 AA10 AA9 AA8
-S0 -S1 -S2
-RQ/GT

CLK88 -RQ/GT

RP3-10 4.7K +5V
RP 3-8 4.7K +5V
RP3-9 4.7K +5V

3F

LS373
D Q
G OE

AA19 AA18 AA17 AA16 AA15 AA14 AA13 AA12
A19 A18 A17 A16 A15 A14 A13 A12

3E

LS373

AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0
A7 A6 A5 A4 A3 A2 A1 A0

AENBRD
ALE

2F

LS 244
1A 1Y
AA11 AA10 AA9 AA8
A11 A10 A9 A8
TG

CLK

4L

S20

CLK88 OSC ALE

6L

S00

DEN DT/R -S0 -S1 -S2 CLK88

8288 20PIN

ALE
INTA AEN CEN VCC IOB GND
AIOWC AMWC MWTC IORC MRDC

5L

RP5-2 RP5-4 RP5-3 10K +5V
RP5-10 RP5-8 RP5-9 RP5-7 RP5-6 10K +5V

-LOCK
A12~9
A0~7
-S0
-S1
-AEN
AENBRD
-XIOR
-INTA
NPNMI
-INTA

6H

LS245
A→B EN
D0 D1 D2 D3 D4 D5 D6 D7
YD0 YD1 YD2 YD3 YD4 YD5 YD6 YD7
10 BUS (VIDEO, RS232) (PRINTER, FLOPPY)
-YDATAEN

5H

LS245
AD0 AD1 AD2 AD3 AD4 AD5 AD6 AD7
-DEN DT/R

-XIOR

SYSTEM DATA BUS D0~7
SYSTEM ROM & NON DMA PARIPHERAL XD0~7

2J

LS245
XD0 XD1 XD2 XD3 XD4 XD5 XD6 XD7
D0 D1 D2 D3 D4 D5 D6 D7

2L

8259A 28PIN
TIME KBD COM2 COM1 PRINTER
D0 D1 D2 D3 D4 D5 D6 D7
A0 VCC GND INT INTA SP/EN
-59CS -XIOR -XIOW A0
10K R10 +5V

IRQ0 IRQ1 IRQ2 IRQ3 IRQ4 IRQ5 IRQ6 IRQ7

-XRD
AENBRD
-AEN

-XIOR INT

Figure 6-2 CPU Logic Board Schematic
Sheet 1 of 13

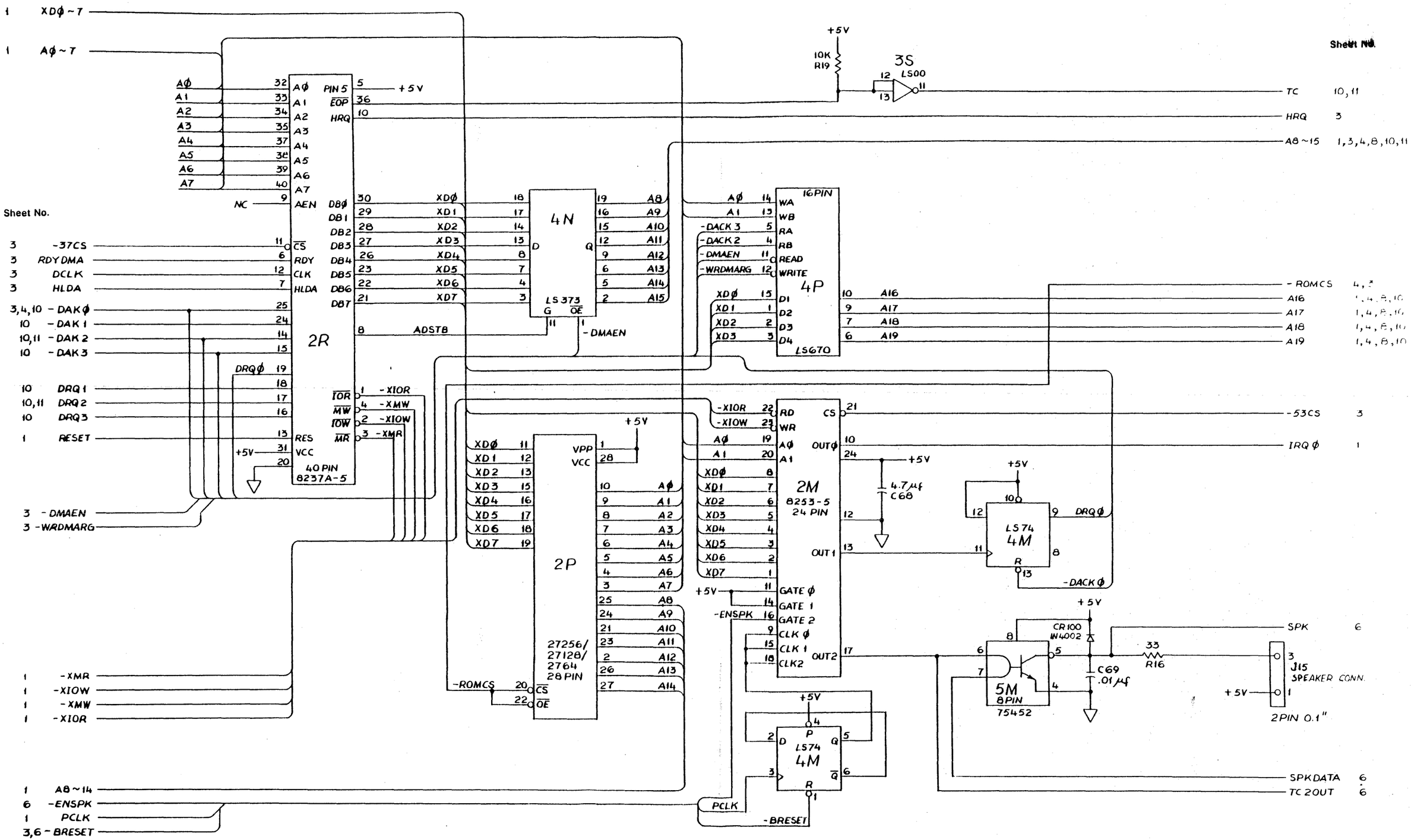
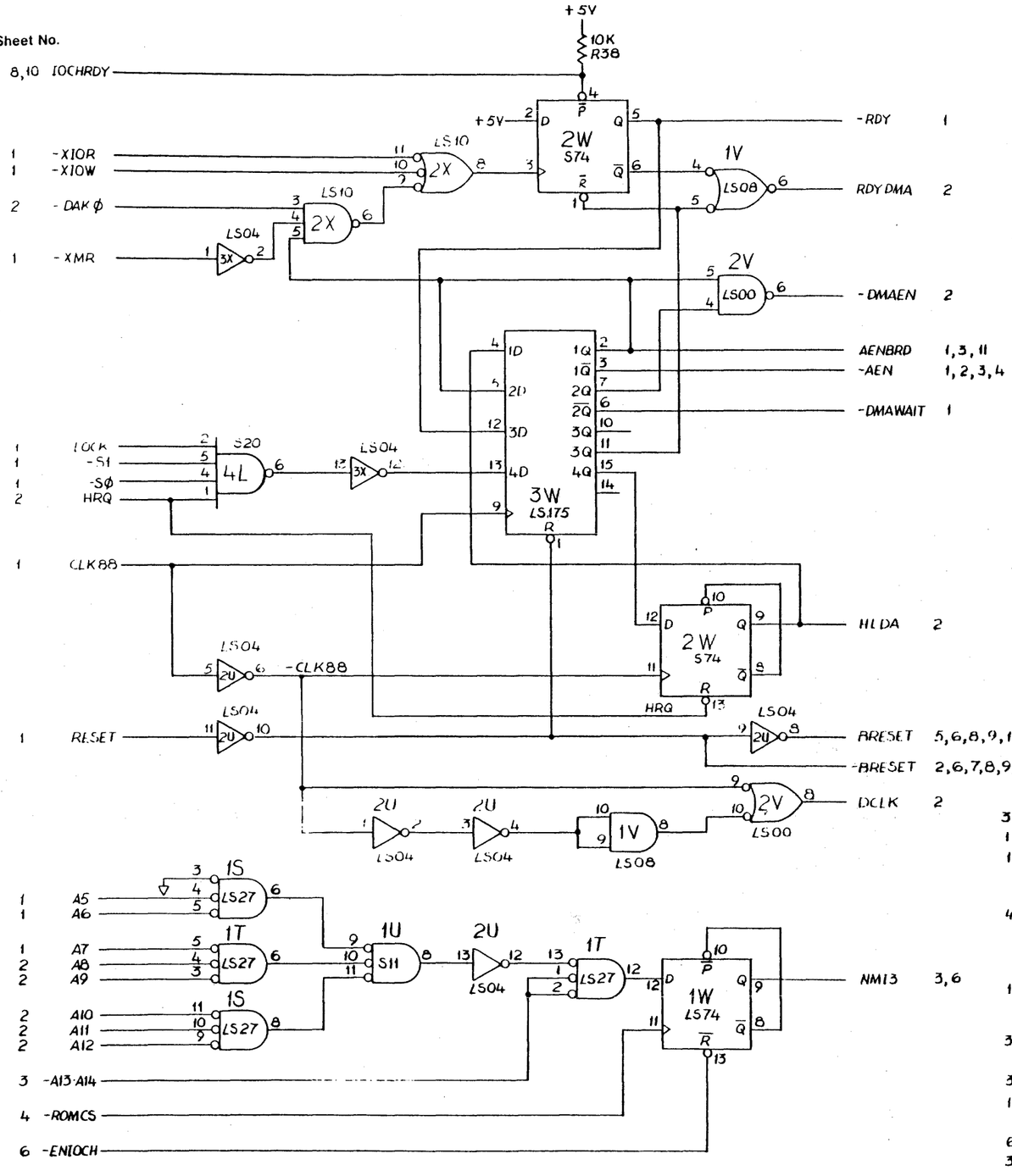
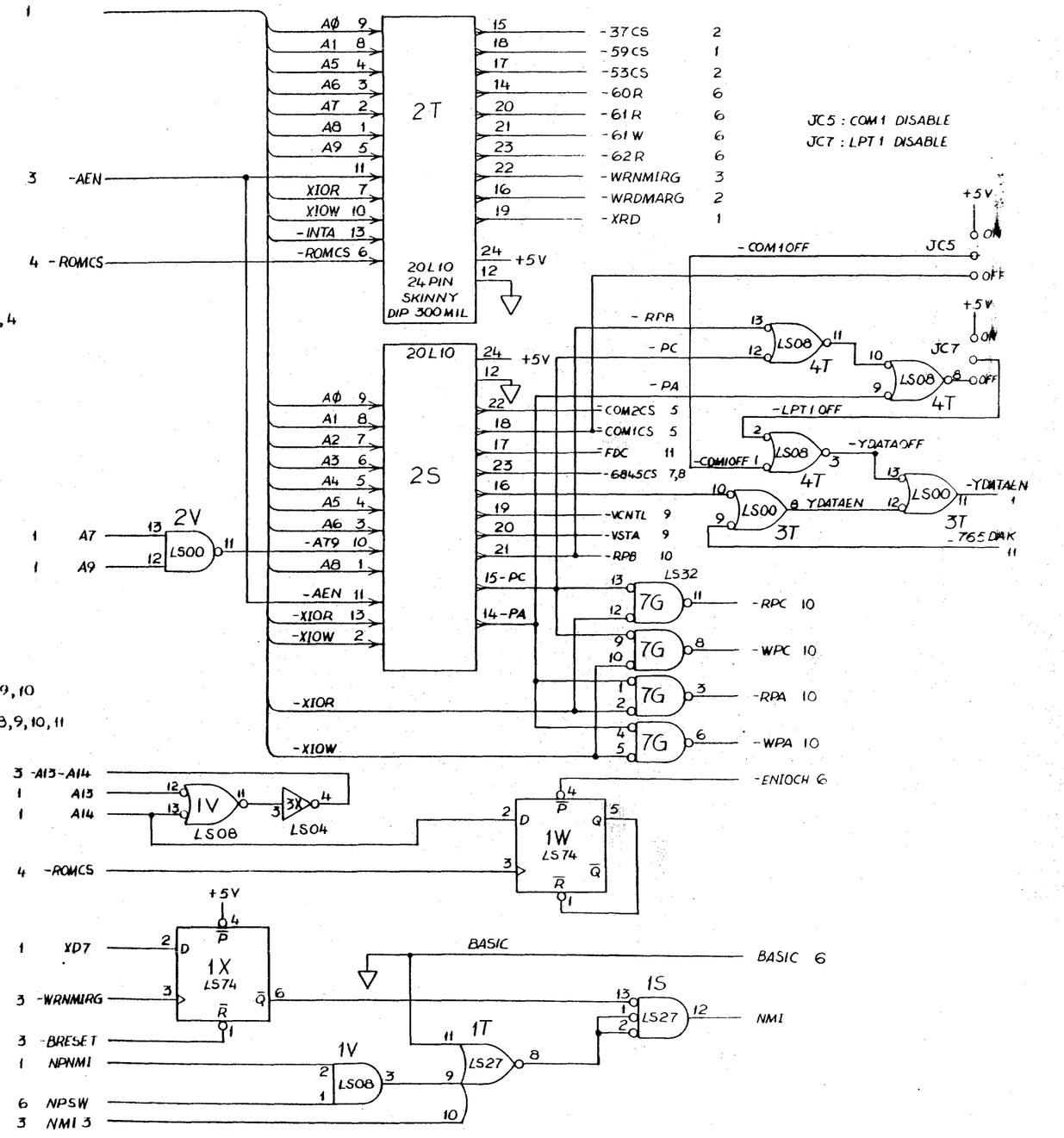


Figure 6-2 CPU Logic Board Schematic
Sheet 2 of 13

Sheet No.





NOTE :

BIOS REQUIREMENT :
READ PORT C AFTER POWER ON TO INIT BASIC
BEFORE ENABLING NMI

Figure 6-2 CPU Logic Board Schematic Sheet 3 of 13

Sheet No.

8 -CPUMSEL
2 A19
2 A18
2 A17
2 A16
2 A15
3 -AEN
2 -DAK ϕ
2,3 -ROMCS
1 -XMR
1 -MWTC
3 -AEN
1 -XMW

20L10
24 PIN SKINNY DIP 300 MIL
8R

NOTE: INPUT PINS ARE PIN 1 THRU PIN 11, AND PIN 13.
OUTPUT PINS ARE PIN 14 THRU PIN 23
UNLESS INDICATED PINS 15 THRU 22
CAN BE INPUT OR OUTPUT

24 +5V
12
11 CASIN
10 ADSEL
14 A8
20
18 -RAS3
19 -RAS2
17 -RAS1
16 -RASϕ
15 -CASOUT
9 -64K

MRORMW 1 IN 10P
14 +5V
7
20 40 60 80 100
12 4 18 6 8
ADSEL

- RAMSEL

6L S00 CASEN 6
6L S00 MRORMW 13

CIRCUIT SIDE TRACE THAT CAN BE CUT FOR SELECTION
R102
R21 10K +5V

6M LS32

-RAS3 4
-CASOUT 15
12S 12R 12P 12N 12M 12L 12K 12J

-RAS2 4
-CASOUT 15
12T 12AA 12Z 12Y 12X 12W 12V 12U

-RAS1 4
-CASOUT 15
11BB 11AA 11Z 11Y 11X 11W 11V 11U

-RASϕ 4
-CASOUT 15
10BB 10AA 10Z 10Y 10X 10W 10V 10U
1
A8 64K x 1 RAM
3 WE
5 Aϕ
7 A1
6 A2 200ns
12 A3
11 A4
10 A5
13 A6
9 A7
DI DO
2 14

RP0 1 2
RP7 6 5
RP8 7 8
RP3 5 6
RP9 3 4
RP8 5 6
RP7 8 7
RP8 3 4
RP9 7 8

DMϕ DM1 DM2 DM3 DM4 DM5 DM6 DM7

VDD 8 +5V
GND 16

2 Aϕ
2 A14
2 A2
2 A9
2 A4
2 A11
2 A6
2 A13

5N LS158
2 1A
3 1B
5 2A
6 2B
11 3A
10 3B
14 4A
13 4B
OE SELB
15 1
1Y 4 BAϕ
2Y 7 BA1
3Y 9 BA2
4Y 12 BA3

2 A1
2 A8
2 A3
2 A10
2 A5
2 A12
2 A7
2 A15

5P LS158
2 4 BA4
3 7 BA5
5 9 BA6
6 12 BA7
11
10
14
13
OE SELB
15 1

MDϕ MD1 MD2 MD3 MD4 MD5 MD6 MD7
18 17 16 15 14 13 12 11

10G LS245
B
OE 19 -RAMSEL
A→B 1
A
2 3 4 5 6 7 8 9
Dϕ D1 D2 D3 D4 D5 D6 D7

ADSEL

Sheet No.
-XMR 2
Dϕ ~ 7 1

+5V 2
12
RAM EXPANSION BOARD CONN.

5 Aϕ
9 A1
7 A2
4 A3
6 A4
8 A5
3 A6
10 A7
1 CASOUT

13 -POR -POR 11

J17
12 PIN 2 ROW
01" CENTER

Figure 6-2 CPU Logic Board Schematic
Sheet 4 of 13

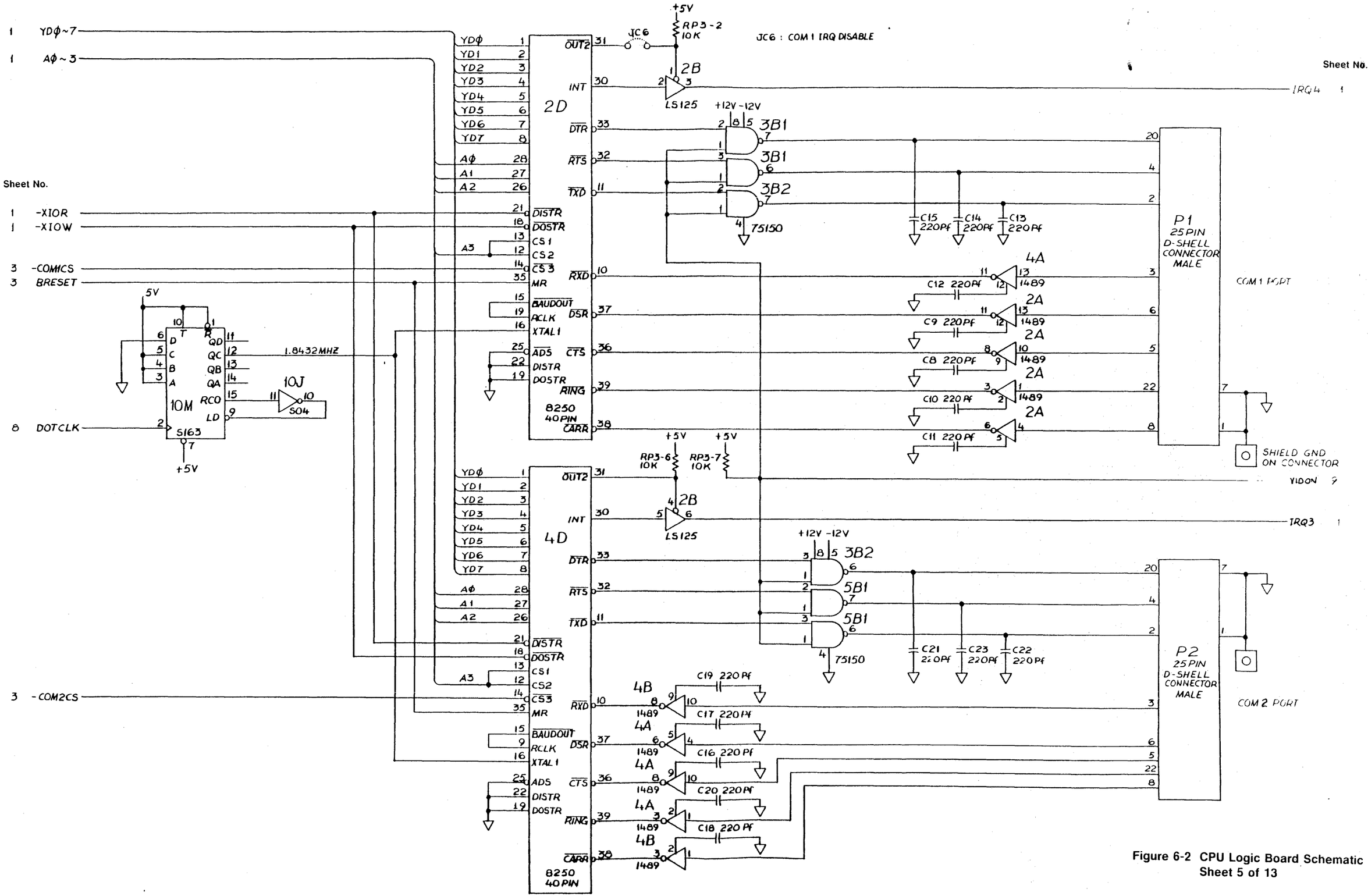


Figure 6-2 CPU Logic Board Schematic
Sheet 5 of 13

Sheet No.

Figure 6-2 CPU Logic Board Schematic
Sheet 6 of 13

8 -WE

A1 A2 A3 A4 — LS157 6F — RMAØ RMA1 RMA2 RMA3

MAØ MA1 MA2 MA3 — SELB OE

RMAØ RMA1 RMA2 RMA3 RMA4 RMA5 RMA6 RMA7 RMA8 RMA9 RMA10 — 8F 2K x 8 24 PIN — WE GND OE +5V VCC CS

ATØ AT1 AT2 AT3 AT4 AT5 AT6 AT7 — 9E LS244 — DØ D1 D2 D3 D4 D5 D6 D7

CCØ CC1 CC2 CC3 CC4 CC5 CC6 CC7 — 9F LS244 — DØ D1 D2 D3 D4 D5 D6 D7

A5 A6 A7 A8 — LS157 6G — RMA4 RMA5 RMA6 RMA7

MA4 MA5 MA6 MA7 — SELB OE

RMAØ RMA1 RMA2 RMA3 RMA4 RMA5 RMA6 RMA7 RMA8 RMA9 RMA10 — 8G 2K x 8 24 PIN — WE GND OE +5V VCC CS

ATØ AT1 AT2 AT3 AT4 AT5 AT6 AT7 — 10E LS374 — DØ D1 D2 D3 D4 D5 D6 D7

CCØ CC1 CC2 CC3 CC4 CC5 CC6 CC7 — 10F LS374 — DØ D1 D2 D3 D4 D5 D6 D7

Sheet No.

8 CPUADDR

A9 A10 A11 AØ — LS157 7F — RMA8 RMA9 RMA10

MA8 MA9 MA10 — SELB OE — -CCSEL

1 AØ~11

6J S02 — 6L SØØ

8 CCLK

1 YDØ 1 YD1 1 YD2 1 YD3 1 YD4 1 YD5 1 YD6 1 YD7 — 6E 6845 — MAØ MA1 MA2 MA3 MA4 MA5 MA6 MA7 MA8 MA9 MA10

1 AØ — RS
8 6845E — E
1 -XIOW — R/W
3 -BRESET — RES
3 -6845CS — CS
8 -CCLK — CLK
LPSTB
GND
+5V — VCC

RAØ RA1 RA2 RA3 — 9
CUR — 8
HSYNC — 8,9
VSYNC — 8,6
DISPEN — 8

CCØ CC1 CC2 CC3 CC4 CC5 CC6 CC7 — 9G LS 273 — LCC5 LCC6 LCC7 — LCC5~7 9

+5V

CBITØ 9
SDOT 9
SERIN 9

9H — QH SERIN CLR CLKIN S/I — LS166

-CLRVIDEO 8
DOTCLK 8
S/I 8

RA3 RAØ RA1 RA2 — 8J 2764 — A3 A5 A4 A6 A7 A8 A9 A10 — DØ D1 D2 D3 D4 D5 D6 D7

VCC +5V
PGM
VDD
OE
CE — -CEROM 8
GND A12

Sheet No.

DØ~7 1

XACK 8
-RDCC 8
-RDAT 8
ATØ~7 9

Figure 6-2 CPU Logic Board Schematic
Sheet 7 of 13

Sheet No.

3 BRESET

8,9 Q5

3 -BRESET

5,7,9 DOTCLK

11 PULUP

3 -6845CS

8 -XIORW

1 -XMW

4 CPUMSEL

1 D3

1 AØ

1 -XMR

7 DISPEN

7 CUR

7 HSYNC

7 VSYNC

8 Q5

3 -BRESET

8 MXIORW

1 CLK 88

JC4 : VIDEO DISABLE
OFF
ON

R9 390
R8 390
10J S04
Y3 16.588MHZ
C62 100Pf
10J S04
10J S04
120 RFI HEAD

4Q 6 10H S02 4
5Q 5

3 1D 2Q 3D 4D 5D 1Q 2Q 3Q 4Q 5Q 2 5 7 10 12
9 1
11H S174

C145 51Pf

10J S04 9J S112 10J S04
6M S32
+5V
3V LS74
LS04 3X 3S LS00
LS00 3S
1K R13 +5V
6845ACC
-CPUACK
-CPUMSEL
LS139 9V
-RDCC 7
-RDAT 7

9C NOTE : SHARE LS 273 WITH PAGE 9 LS273
10A S32 -CLRVIDEO 7
DISPENDLY 9
CURDLY 9
HSYNCDLY 9
VSYNCDLY 9
11D LS04 -DISPENDLY 9
11D LS04 -CURDLY 9
1X LS74 6845 E 7

11C LS08
11E LS00
11E LS00
10J S04
11D LS04
PULUP R12
3 -XIOR
3 -XIOW
-DATAOFF
3T LS00
3T LS00
3X 3S LS00 LS04
MXIORW 8
-XIORW 8

10B S86
9J S112
10D S20
11D LS04
10C S11
11G LS74
11G LS74
6C LS125

-CE ROM 7
S/I 7
-WE 7
-CCLK 7
CCLK 7,9
CPUADDR 7
XACK 7
IOCHRDY 3

Sheet No.

Figure 6-2 CPU Logic Board Schematic
Sheet 8 of 13

Sheet No.

Sheet No.

8 VSYNC DLY
8 CUR DLY
8 -CUR DLY
7 AT0 7 AT1 7 AT2 7 AT3 7 AT4 7 AT5 7 AT6 7 AT7
8 CCLK
8 Q5
3 -BRESET
7 CBIT0
7 LCC5 7 LCC6 7 LCC7
7 RA3 7 RA2 7 RA1 7 RA0
7 SDOT

÷16 11F LS393 ×2
11C LS08
1.5HZ
CURS
10D S20
11C LS08
BL
I(B)
I(F)
LS273 9D
LS273 9C
AT0X AT1X AT2X AT3X AT4X AT5X AT6X AT7X
CLR
ENVIDEO
-BKRESET
8D 20R4 24 PIN SKINNY DIP 300MIL
SERIN
-BLANK
RV
UL
+5V
10A S32
10C S11
8C LS175
ENBLINK
-ENBLINK
9B LS157
ALPHA DOT
11E S00
11D S04
11B S74
11A LS86
10A S32
10B S86
9A LS244
R4 10K
R3 4.7K
R1 22
R2 22
C3 120PF
C4 120PF
C5 0.01MFD
10B S86
11B S74
DOTCLK
BWVIDEO
DISPEN DLY
VSYNC DLY
SERIN
YD2 YD1 YD0 G
HILITE
GND GND
HORT
VIDEO
VERT
-VCNTL
VIDON
-DISPEN DLY
-VSIA
IBM/-SD
HSYNC DLY
POL-XT
HSYNC

J2
VIDEO 9PIN CONN.

YD2		1
YD1		1
-VCNTL		3
VIDON		5
-DISPEN DLY		8
-VSIA		3
IBM/-SD	J2-3	
HSYNC DLY		8
POL-XT		6
HSYNC		7
YD2		1
YD1		1
YD0		1
G		10
HILITE	J2-6	
GND	J2-1	
GND	J2-2	
HORT	J2-8	
VIDEO	J2-7	
VERT	J2-9	
VSYNC DLY		8
SERIN		7
DISPEN DLY		8
DOTCLK		8

Figure 6-2 CPU Logic Board Schematic
Sheet 9 of 13

Sheet No.

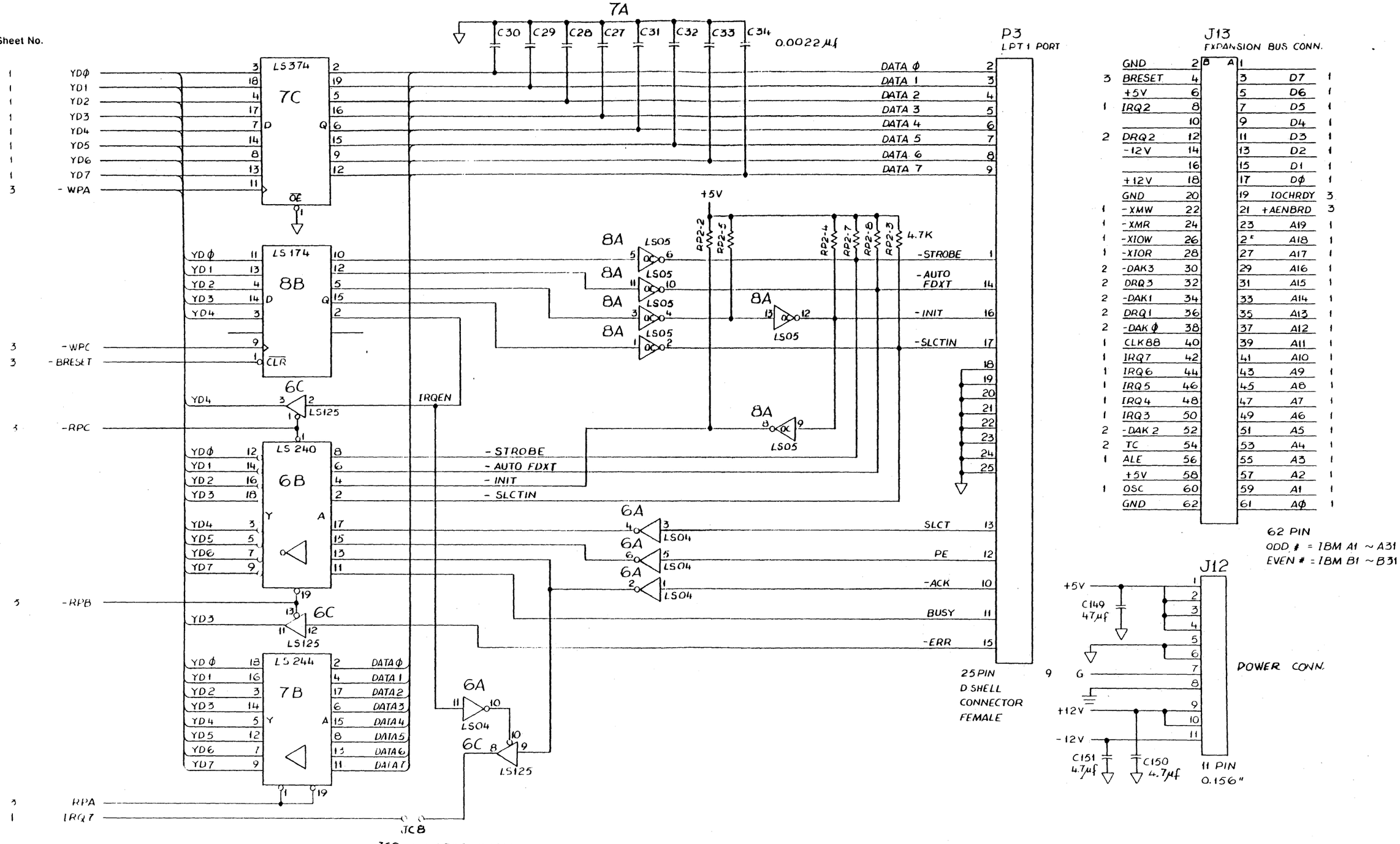


Figure 6-2 CPU Logic Board Schematic
Sheet 10 of 13

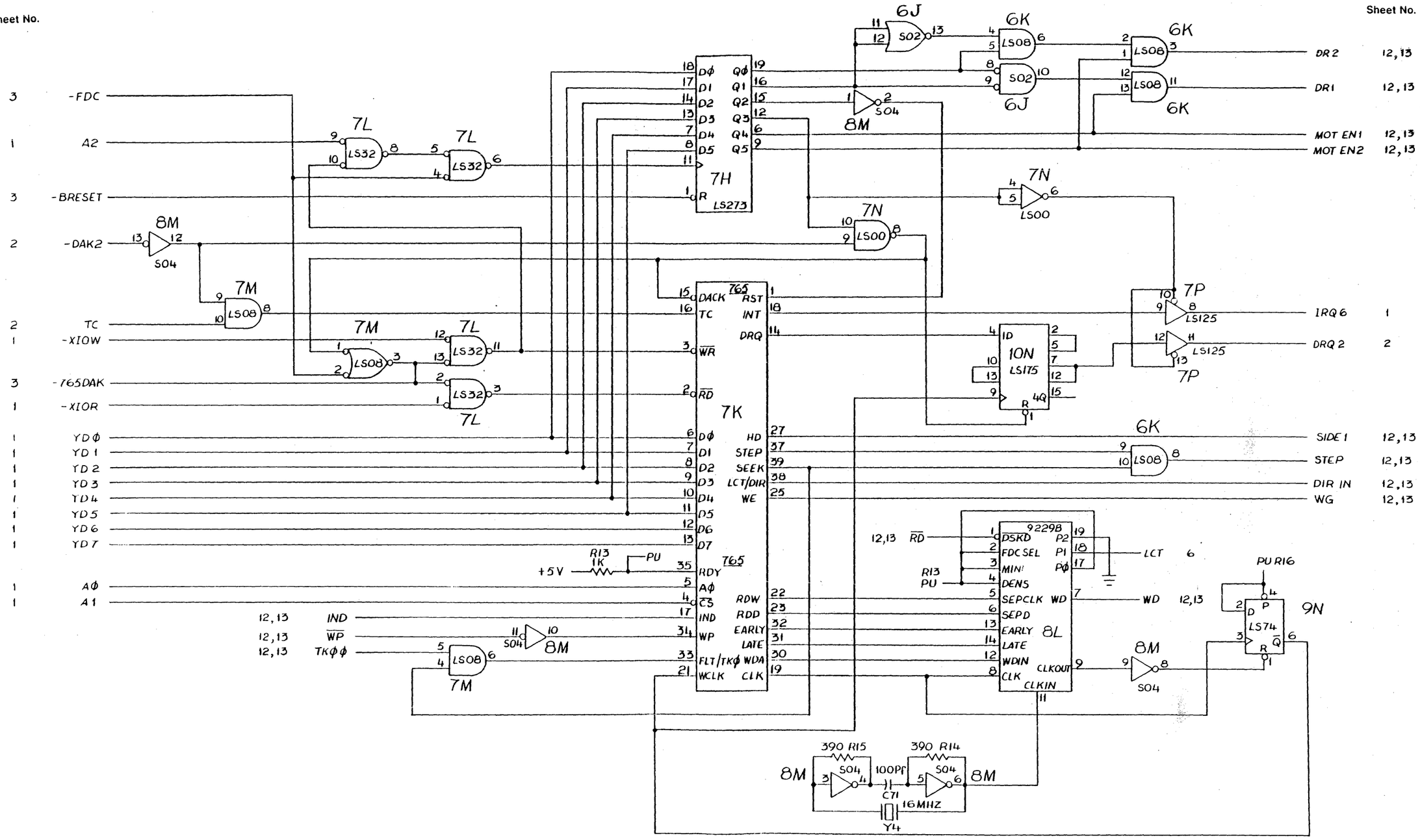


Figure 6-2 CPU Logic Board Schematic
Sheet 11 of 13

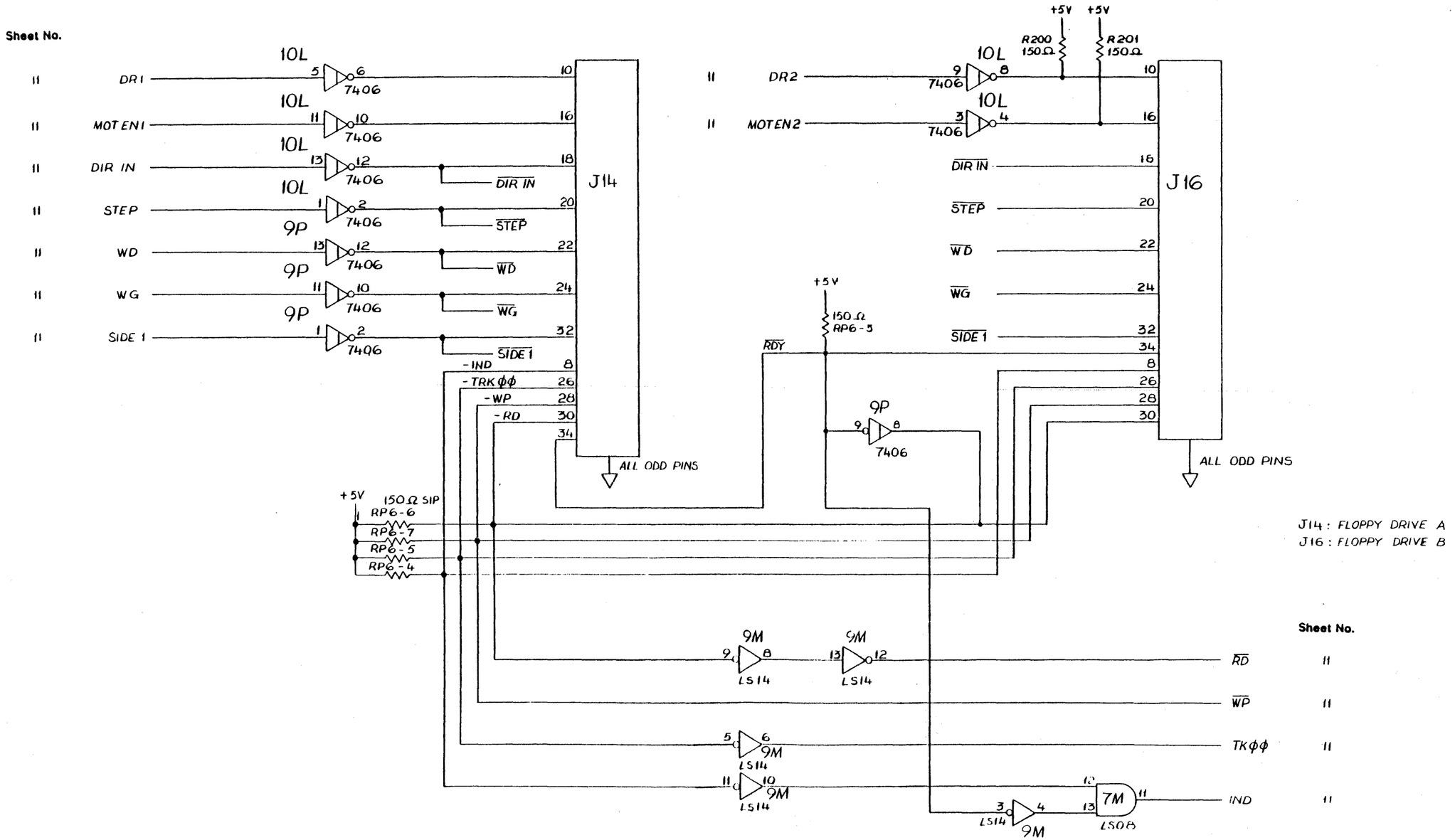
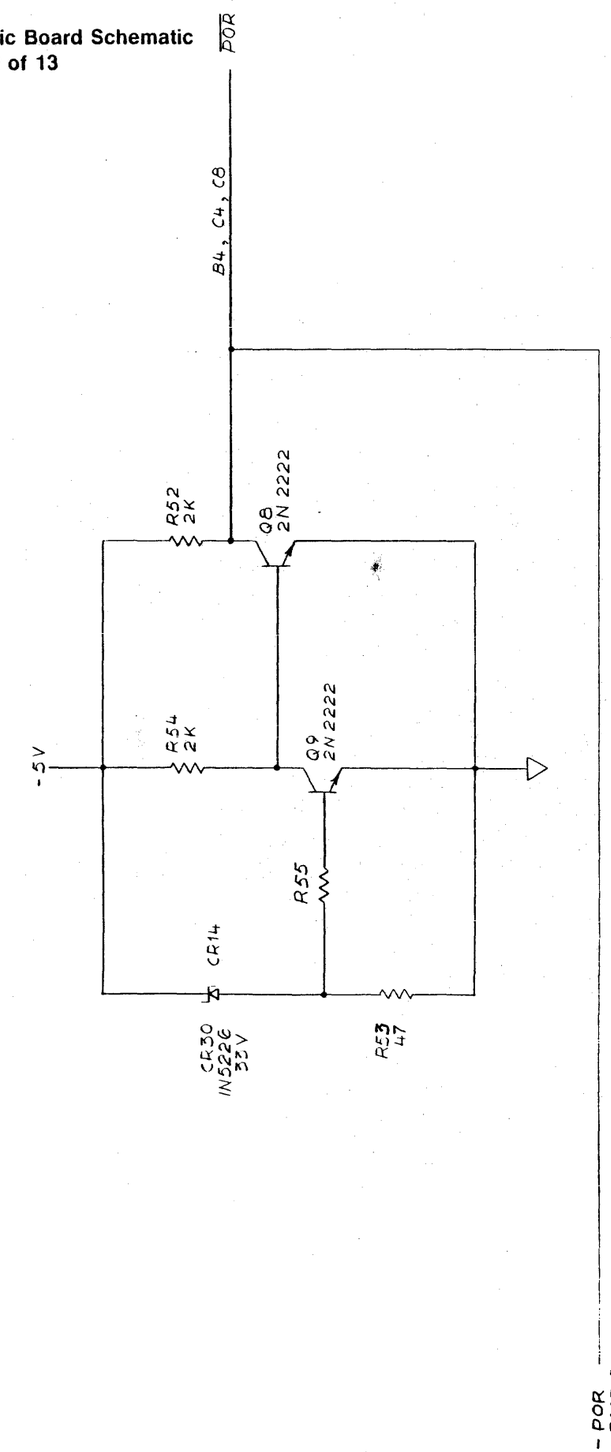


Figure 6-2 CPU Logic Board Schematic
Sheet 12 of 13

Figure 6-2 CPU Logic Board Schematic
Sheet 13 of 13



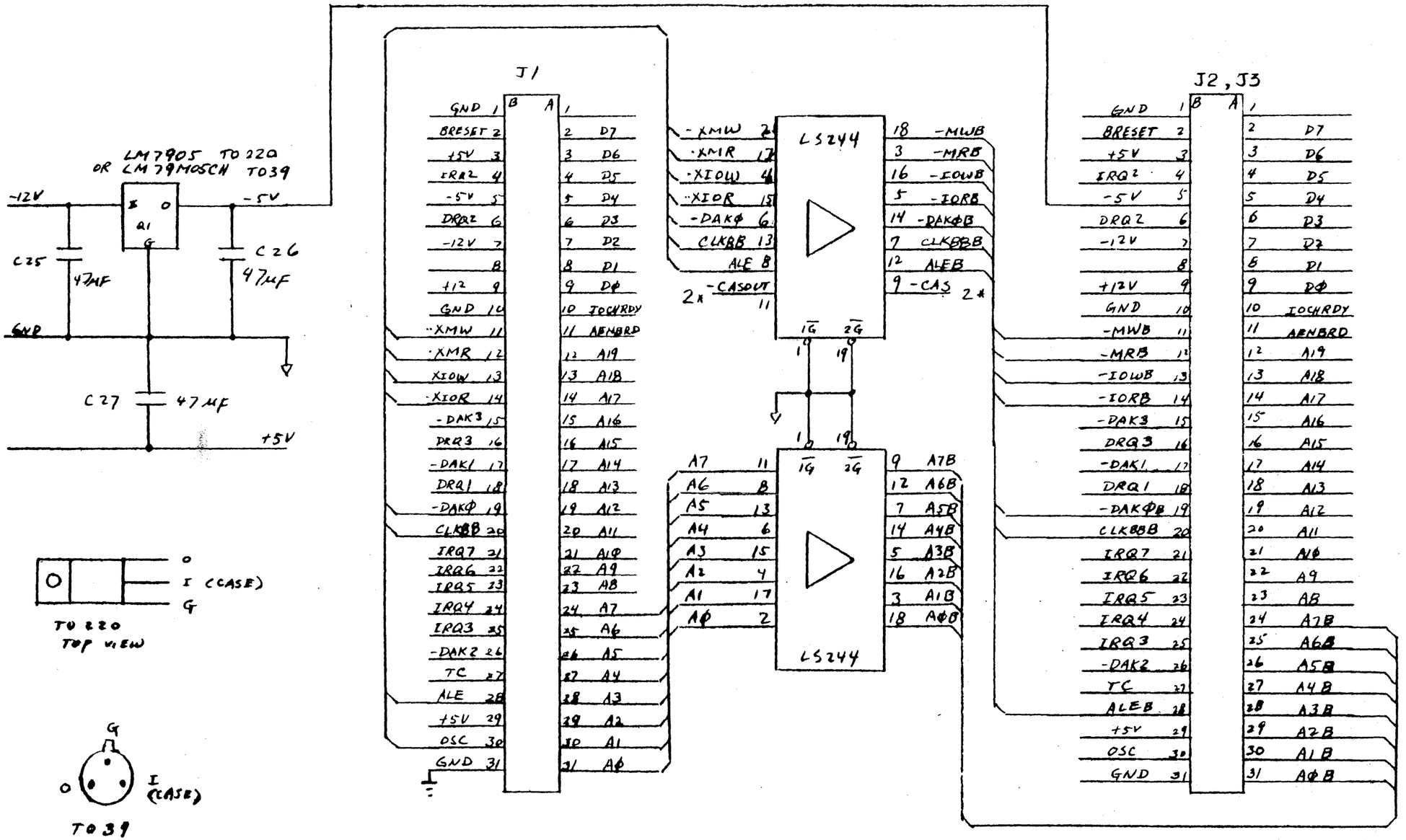


Figure 6-3 Standard Backplane Schematic
Sheet 1 of 1

LM7905 TO220
OR LM79M05CH TO39

-12V

-5V

I

O

G

Q1

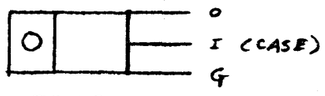
C25 47MF

C26 47MF

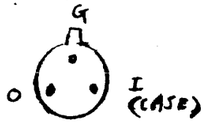
GND

C27 47MF

+5V



TO220
TOP VIEW



TO39
- TOP VIEW

J1

GND 1	B	A	1
BRESET 2			2 D7
+5V 3			3 D6
IRQ2 4			4 D5
-5V 5			5 D4
DRQ2 6			6 D3
-12V 7			7 D2 || 8			8 D1
+12 9			9 DØ
GND 10			10 IOCHRDY
-XMW 11			11 AENBRD
-XMR 12			12 A19
XIOW 13			13 A18
-XIOR 14			14 A17
-DAK3 15			15 A16
DRQ3 16			16 A15
-DAK1 17			17 A14
DRQ1 18			18 A13
-DAKØ 19			19 A12
CLKBB 20			20 A11
IRQ7 21			21 AIØ
IRQ6 22			22 A9
IRQ5 23			23 A8
IRQ4 24			24 A7
IRQ3 25			25 A6
-DAK2 26			26 A5
TC 27			27 A4
ALE 28			28 A3
+5V 29			29 A2
OSC 30			30 A1
GND 31			31 AØ

LS244

-XMW 2	1G	2G	18 -MWB
-XMR 17			3 -MRB
-XIOW 4			16 -IOWB
-XIOR 15			5 -IORB
-DAKØ 6			14 -DAKØB
CLKBB 13			7 CLKBBB
ALE 8			12 ALEB
2* -CASOUT 11			9 -CAS 2*
1			19

A7 11	1G	2G	9 A7B
A6 8			12 A6B
A5 13			7 A5B
A4 6			14 A4B
A3 15			5 A3B
A2 4			16 A2B
A1 17			3 A1B
AØ 2			18 AØB

LS244

J2, J3

GND 1	B	A	1
BRESET 2			2 D7
+5V 3			3 D6
IRQ2 4			4 D5
-5V 5			5 D4
DRQ2 6			6 D3
-12V 7			7 D2
8			8 D1
+12V 9			9 DØ
GND 10			10 IOCHRDY
-MWB 11			11 AENBRD
-MRB 12			12 A19
-IOWB 13			13 A18
-IORB 14			14 A17
-DAK3 15			15 A16
DRQ3 16			16 A15
-DAK1 17			17 A14
DRQ1 18			18 A13
-DAKØB 19			19 A12
CLKBBB 20			20 A11
IRQ7 21			21 AIØ
IRQ6 22			22 A9
IRQ5 23			23 A8
IRQ4 24			24 A7B
IRQ3 25			25 A6B
-DAK2 26			26 A5B
TC 27			27 A4B
ALEB 28			28 A3B
+5V 29			29 A2B
OSC 30			30 A1B
GND 31			31 AØB

2* :
-CASOUT & -CAS
for RAM EXPASION
BOARD ONLY

Figure 6-4 Multifunction Backplane Schematic
Sheet 1 of 3

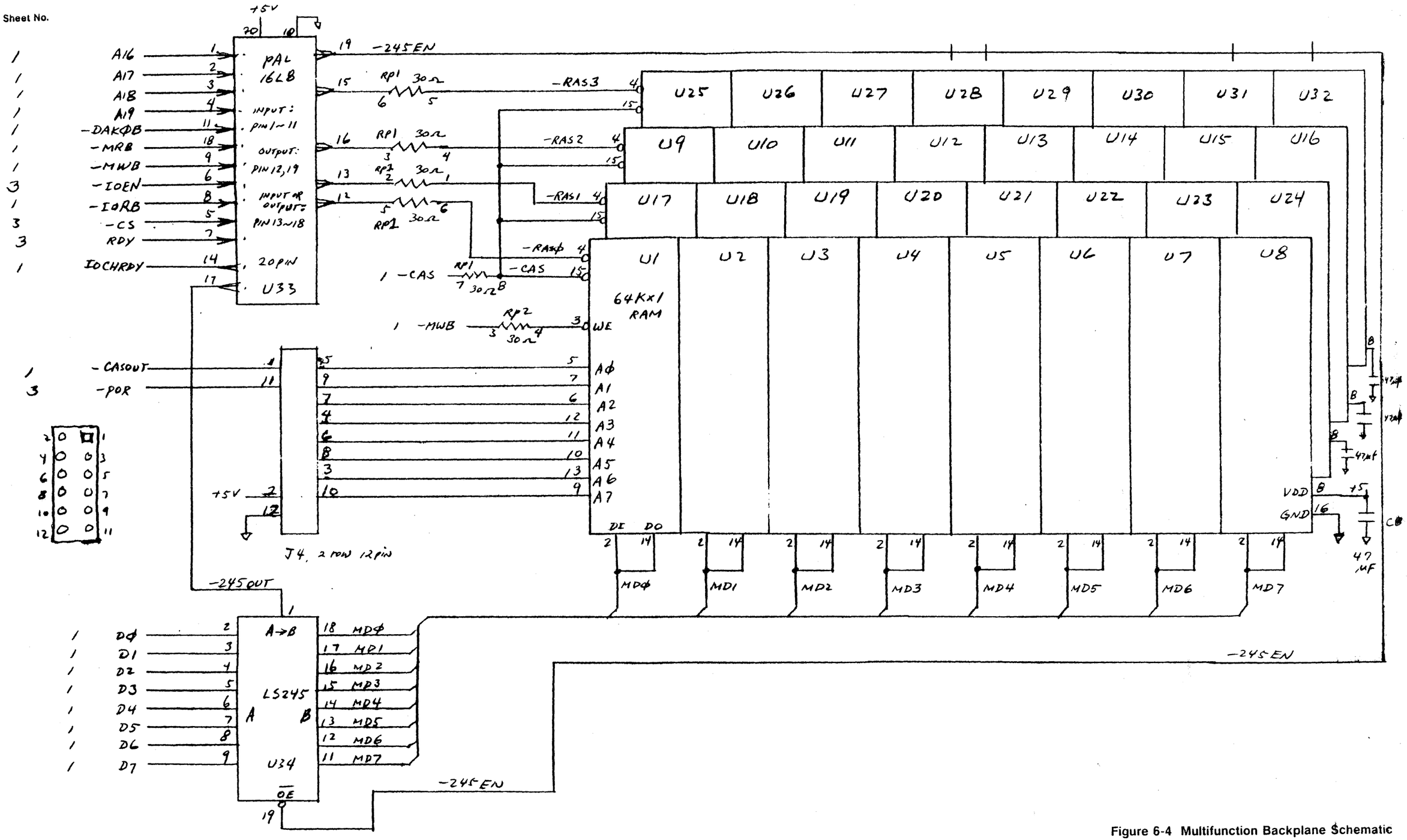


Figure 6-4 Multifunction Backplane Schematic
Sheet 2 of 3

Sheet No.

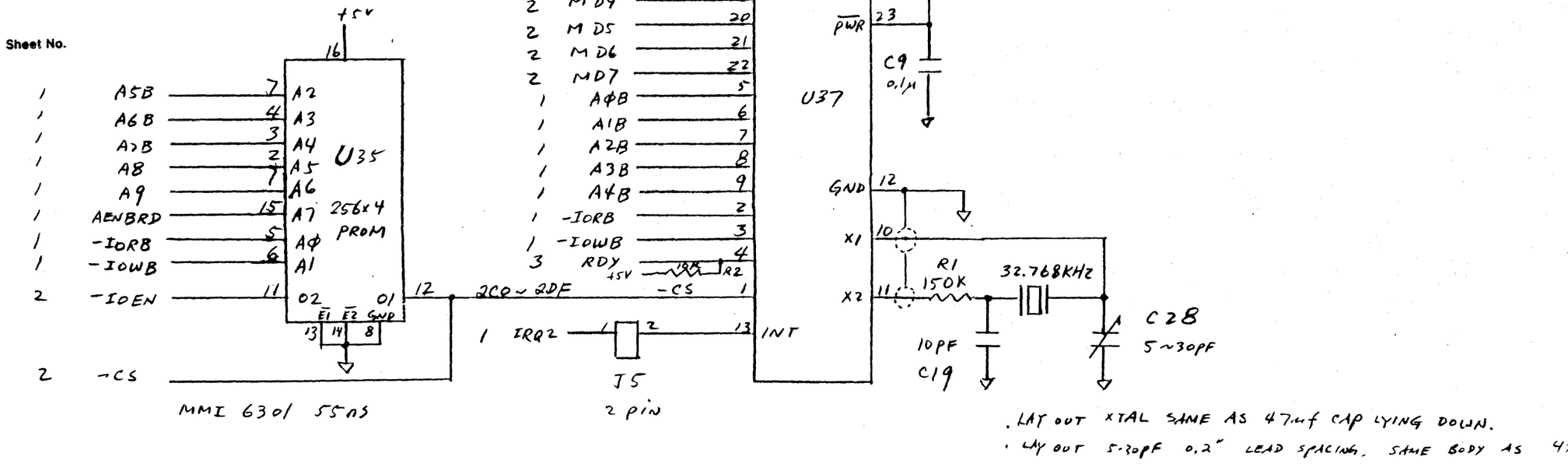
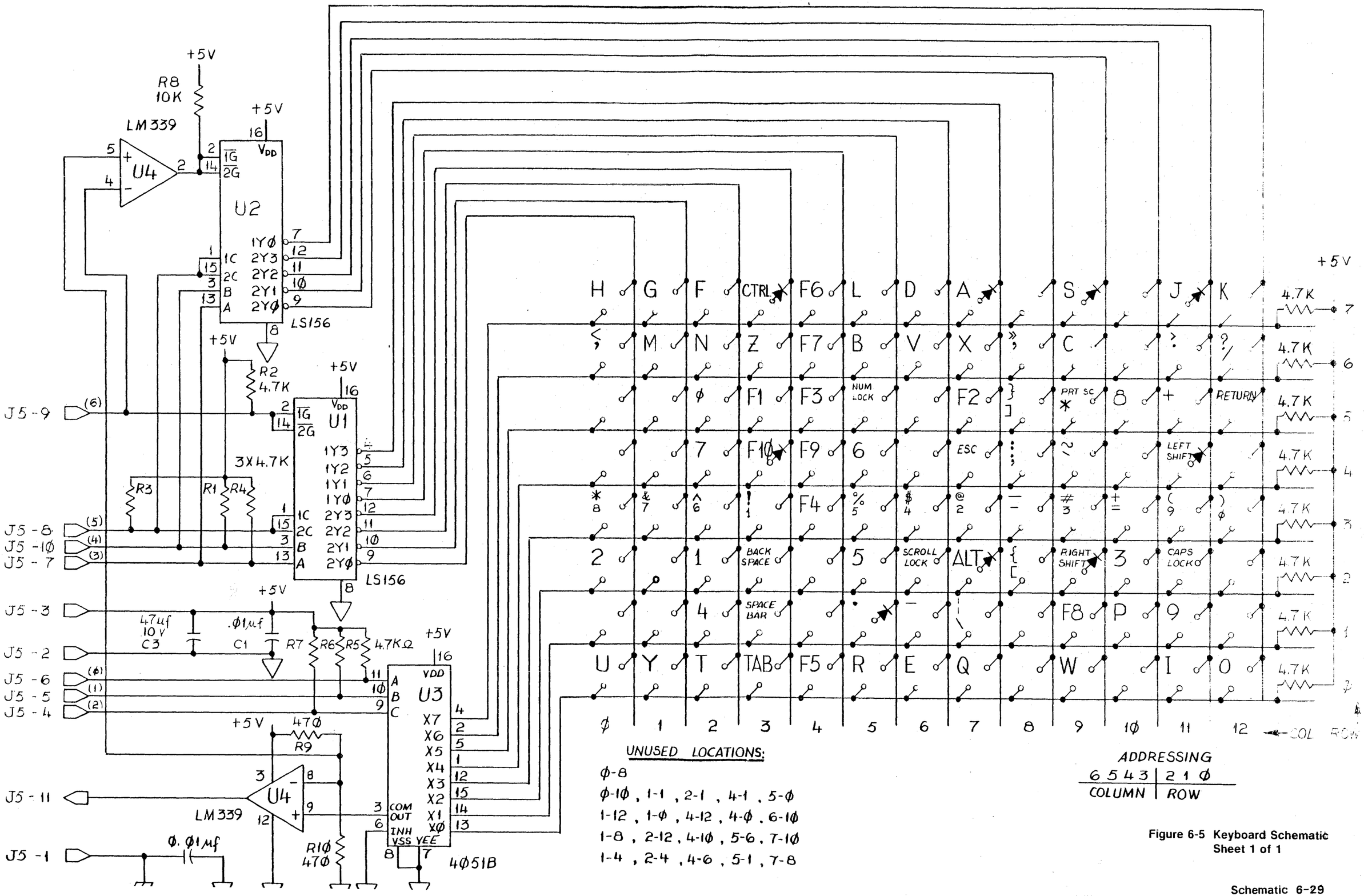


Figure 6-4 Multifunction Backplane Schematic Sheet 3 of 3



UNUSED LOCATIONS:

Ø-8
Ø-1Ø , 1-1 , 2-1 , 4-1 , 5-Ø
1-12 , 1-Ø , 4-12 , 4-Ø , 6-1Ø
1-8 , 2-12 , 4-1Ø , 5-6 , 7-1Ø
1-4 , 2-4 , 4-6 , 5-1 , 7-8

ADDRESSING

6 5 4 3	2 1 Ø
COLUMN	ROW

Figure 6-5 Keyboard Schematic Sheet 1 of 1

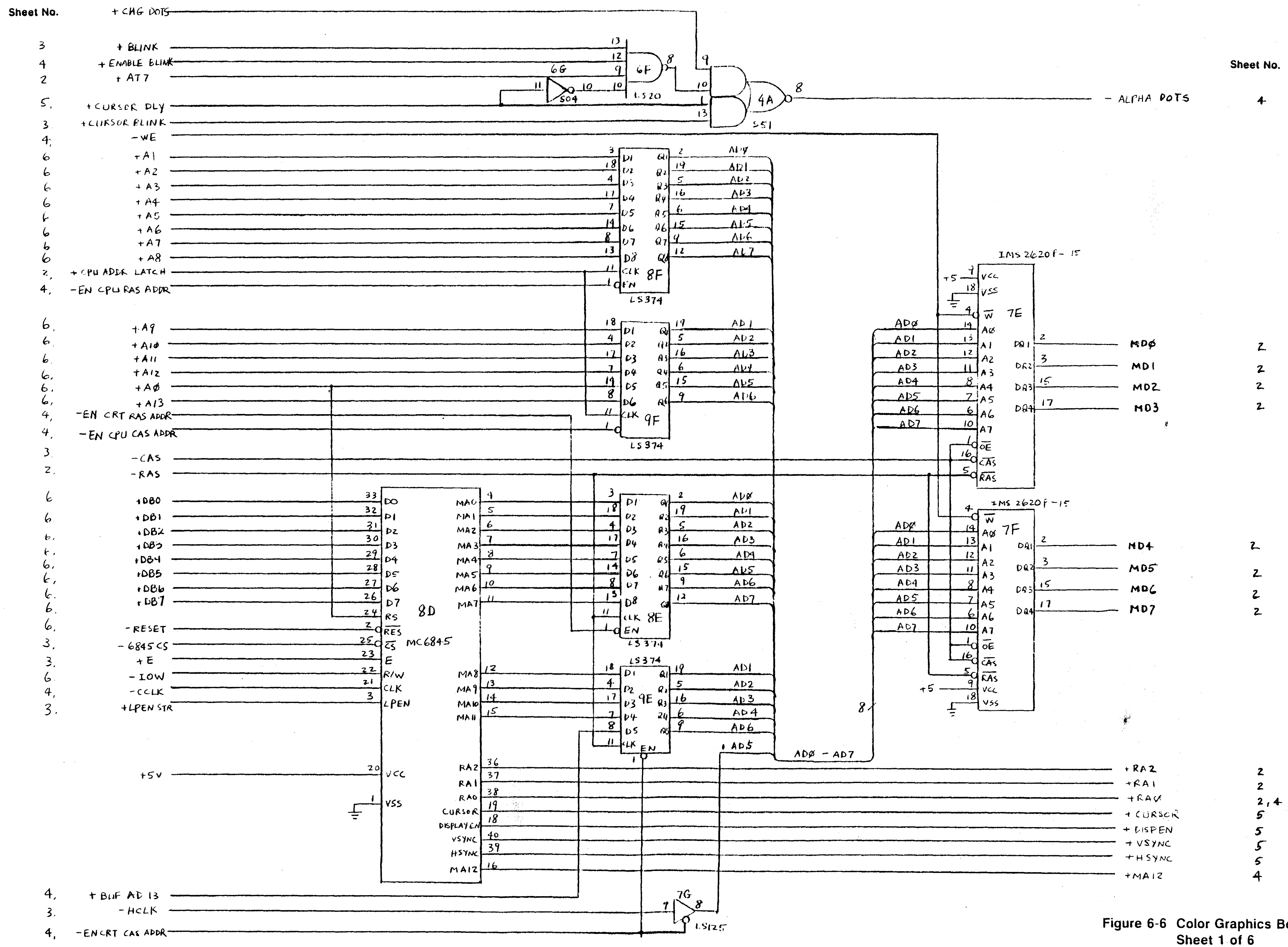


Figure 6-6 Color Graphics Board Schematic
Sheet 1 of 6

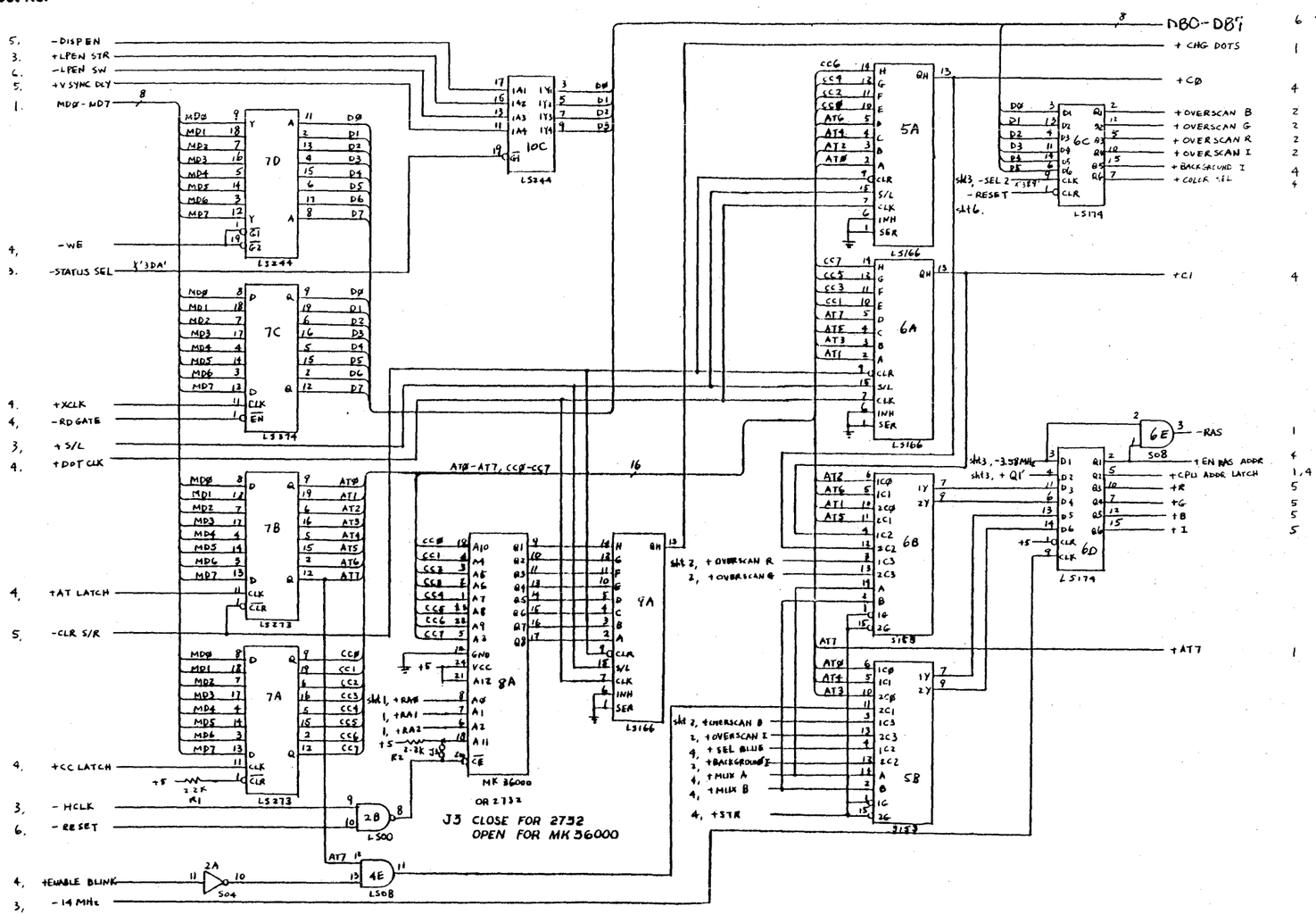


Figure 6-6 Color Graphics Board Schematic
Sheet 2 of 6

Sheet No.

Sheet No.

6, +14 MHz
6, -RESET
4, +RES
6, +A8
6, +A9
6, +AEN
6, +A5
6, +A7
6, +A6
6, +A4
6 +A3
6, -MEMRB
6, -MEMW
6, +A18
6, +A19
6, +A17
6, +A16
6, +A15
6, -IOR
6, -IOW
6, +A2
6, +A1
6, +AØBB
6, +LPEN INPUT
5, +VSYNC DLY
6, +CLK88B

3G 74S174
5G 74S174
2A 74S04
2G 74S86
4C 74S02
3F 74LS32
6G 74S04
6F 74S08
4E 74LS08
5F 74LS138
5E 74LS139
6F 74LS20
2B 74S00
1B 74LS04
4F 74LS158
1G 74S74
1C 74LS393
4G 74S74

+Q5 4
+LCLK 5
-LCLK 4
+CAS CC 4
+S/L 2
-Q2' 4
+7MHz 4
+Q1' 2,4
+Q2' 4
+HCLK 4, 5
-HCLK 1, 4
+3.58 MHz 5
-3.58 MHz 2
-CAS 1
-14 MHz 2, 5
-6845 CS 1
-DATA GATE 6
-CPU MEM SEL 4
-SEL 1 4
-SEL 2 2
-STATUS SEL 2
+LPEN STR 1, 2
+CURSOR BLINK 1
+BLINK 1
+E 1

Figure 6-6 Color Graphics Board Schematic
Sheet 3 of 6

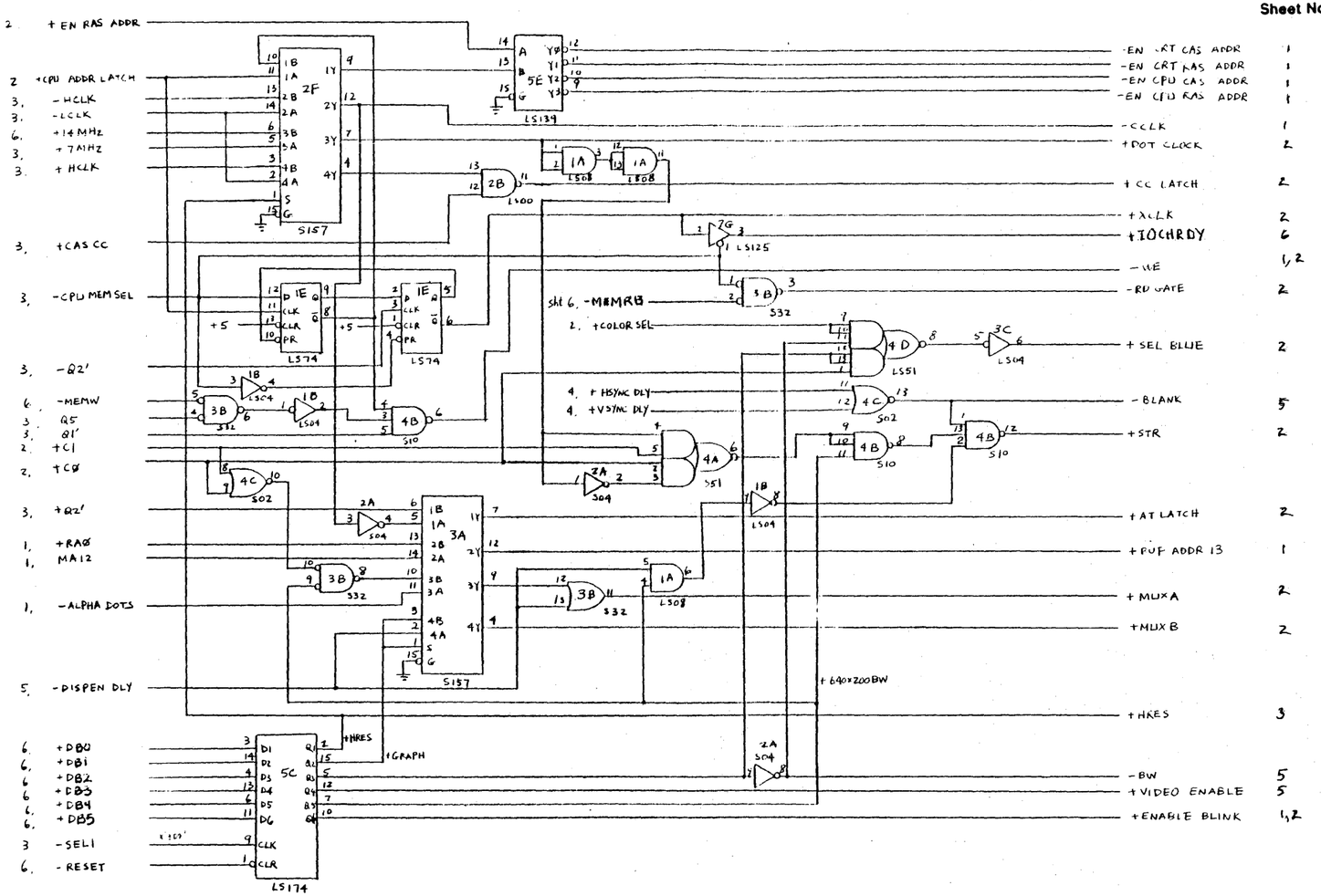


Figure 6-6 Color Graphics Board Schematic Sheet 4 of 6

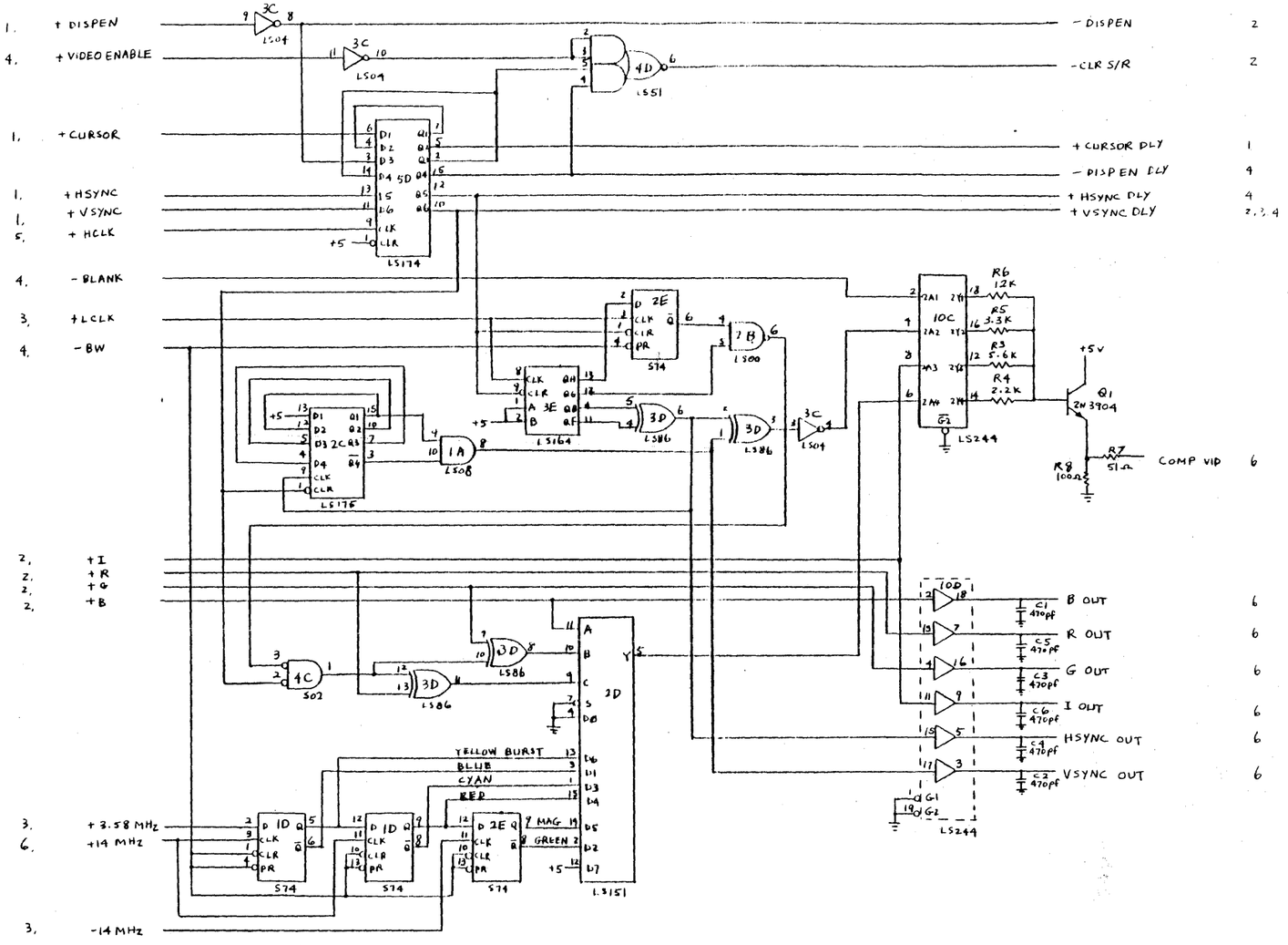


Figure 6-6 Color Graphics Board Schematic
Sheet 5 of 6

5 COMP VID — GND 4, NC 2, +12V 1 — J1 VIDEO JACK, CHASSIS GROUND — P1 1×4 header

5, VSYNC OUT — 9
5, HSYNC OUT — 8
NC — 7
5, I OUT — 6
5, B OUT — 5
5, G OUT — 4
5, R OUT — 3
5 — 2
1
J2 9-pin D-SHELL CONNECTOR

C7-11, 13-19, 21-22, 24-29, 32-36: .1uf
C31, C12, C23: 10uf
+5V, GND, GND, +12V
C20: .1uf
C30: 10uf

P2 1×6 header: 6 +12V, 5 +5V, 4 GND, 3, 2 NC, 1

-LPEN SW — 2
+LPEN INPUT — 3

P5 IO SLOT

A31	A0B	+A0B	3
A30	A1B	+A1B	1, 3
A29	A2B	+A2B	1, 3
A28	A3B	+A3B	1, 3
A27	A4B	+A4B	1, 3
A26	A5B	+A5B	1, 3
A25	A6B	+A6B	1, 3
A24	A7B	+A7B	1, 3
A23	A8	+A8	1, 3
A22	A9	+A9	1, 3
A21	A10	+A10	1
A20	A11	+A11	1
A19	A12	+A12	1
A18	A13	+A13	1
A17	A14	+A14	
A16	A15	+A15	3
A15	A16	+A16	3
A14	A17	+A17	3
A13	A18	+A18	3
A12	A19	+A19	3
B14	-IORB	-IOR	3, 6
B13	-IOWB	-IOW	3
B11	-MWB	-MEMW	3, 4
B12	-MRB	-MEMRB	3, 4, 6
A11	AENBRD	+AEN	3, 6
B20	CLK888	+CLK888	3
B02	BRESET	-RESET	2, 3, 4
B30	+OSC.	+14MHZ	3, 4, 5
B03			
B29			
B01			
B10			
B31			
B09			
A10	IOCHRDY		
A09	D0		
A08	D1		
A07	D2		
A06	D3		
A05	D4		
A04	D5		
A03	D6		
A02	D7		

LS125 (7G): 5, 6, 4
LS125 (7G): 12, 11, 13
LS244 (10D): 6, 14
LS04 (6G): 5, 6
LS04 (3C): 13, 12

4, +IO READY — IOCHRDY
1,2,4 DB0 — D0
1,2,4 DB1 — D1
1,2,4 DB2 — D2
1,2,4 DB3 — D3
1,2,4 DB4 — D4
1,2,4 DB5 — D5
1,2 DB6 — D6
1,2 DB7 — D7
3, -DATA GATE — 19 G̅ 10F
6, -MEMRB
6, -IOR
6 +AEN
LS32 (3F): 9, 10, 8
LS08 (6E): 5, 4, 6
DIR — 1
LS245

Figure 6-6 Color Graphics Board Schematic
Sheet 6 of 6

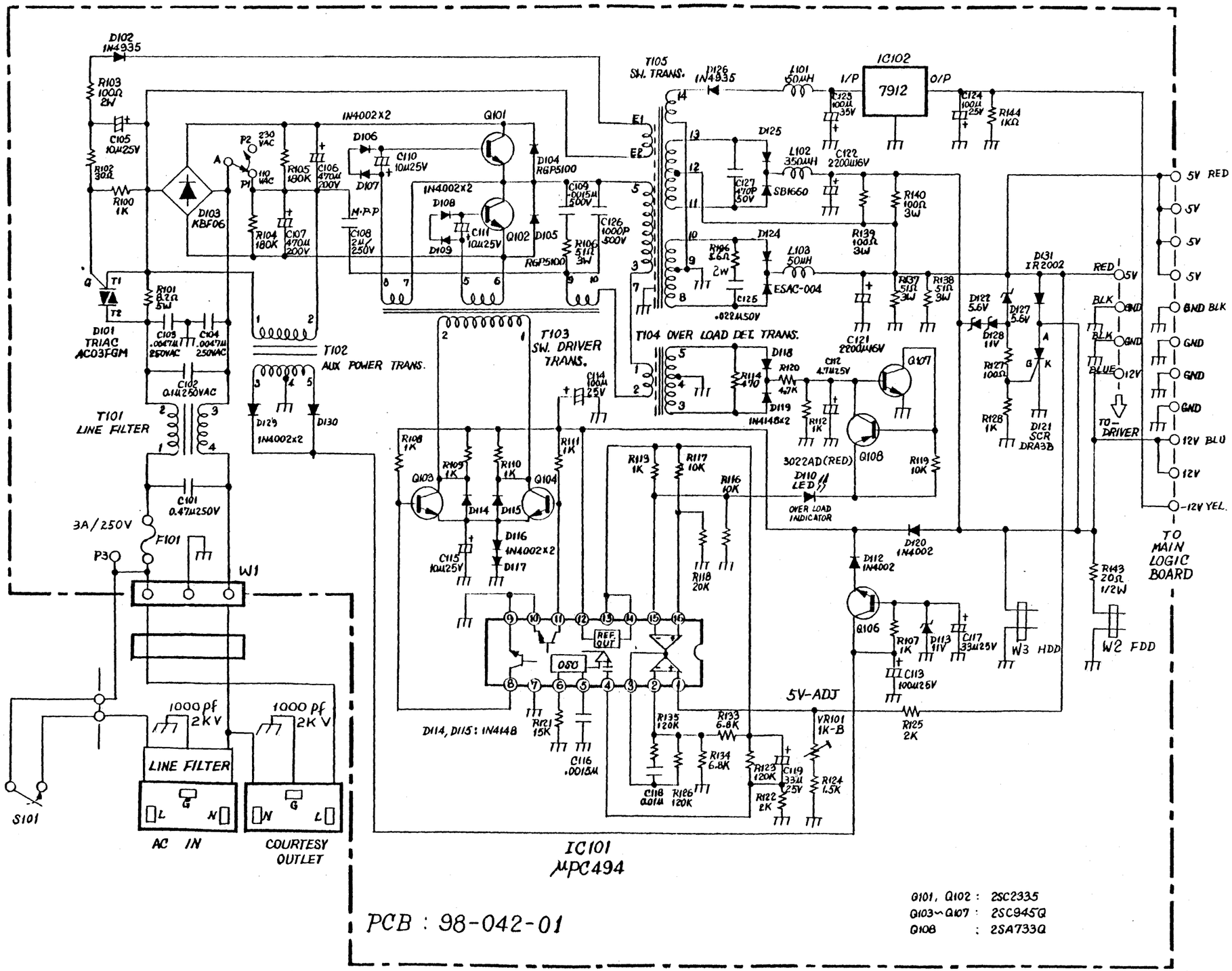


Figure 6-7 Power Supply Schematic
Sheet 1 of 1

Appendix A System and Error Messages

This appendix explains all informational and error-related messages. The messages are listed in alphabetical order, and each one is followed by an explanation and recovery procedures.

Device Errors

Device errors can occur when the system is trying to access a device such as a disk drive or printer. If a device error occurs during a command or program, MS-DOS displays the error message and waits for your response. Device error messages are accompanied by the message

```
Abort, Retry, Ignore ?
```

At this point, you have three options, which you can select by pressing the A, R, or I keys. The options are:

A Abort the program. The system will terminate the program that requested the disk read or write.

R Retry the operation. If possible, correct the problem and then press R. If you don't know what caused the problem, press R anyway--the error may not occur again. We recommend that you always try the Retry option first.

I Ignore the error condition and continue the program. (Be careful when choosing this response because data may be lost.) The system will act as if the error did not occur and, if possible, continues the program.

If you know what caused the problem (i.e. you forgot to insert the diskette or engage the PUSH button), take the proper corrective action (insert the diskette, for example) and then press the R key. If that doesn't work, type A to abort the program, and investigate the problem and/or try another diskette. The I option should be your last choice.

Messages

A

```
All files cancelled by operator
```

Explanation--This is an informational message. You entered the PRINT command with the /T parameter, which cancels the printing of all queued files.

Action--None required.

```
All specified file(s) are contiguous
```

Explanation--This is an informational message generated by CHKDSK. It tells you that the files are all written sequentially (not fragmented) on the disk. This is a desirable condition.

Action--None required.

```
Allocation error in file, size adjusted
```

Explanation--This message is generated by CHKDSK or CHKDSK/F. It means that the file allocation table (FAT) contains an invalid sector number. The file is truncated (ended) at the end of the last valid sector; all data beyond this sector is lost.

Action--If you specified the /F parameter, no action is required. The file is automatically truncated at the end of the last valid sector.

If you did not enter the /F parameter, enter CHKDSK/F to correct the file size.

```
Attempted write protect violation
```

Explanation--You attempted to write data onto a write-protected diskette.

Action--Insert the proper (write-enabled) diskette and retry the operation. If you want to write to the write-protected diskette, remove the write-protect tab, reinsert the diskette, and retry the operation.

B

```
Bad call format reading drive (x:)
Abort, Retry, Ignore?
```

Explanation--The program in drive (x:) contains invalid instructions. MS-DOS cannot read the data from this disk.

Action

- Use the DEBUG utility ,and review, patch, and reassemble your program as necessary.
- If you are using a purchased program, contact the dealer you purchased the device driver from.

```
Bad call format writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--A device driver issued an invalid command to drive (x:). MS-DOS cannot write data to this disk.

Action

- Check the program. You probably have a coding error that needs debugging.
- Review the device interface specification and MS-DOS driver to make sure that what you are trying to do is supported.

```
Bad command error reading/writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--A device driver issued an invalid command to drive (x:). MS-DOS cannot write data to this disk.

Action

- Check the program. You probably have a coding error that needs debugging.
- Review the device interface specification and the disk operating system driver implementation to make sure that what you are trying to do is supported.

`Bad command or file name`

Explanation--MS-DOS displays this message if it cannot find the command or file name you entered.

Action

- Check the spelling of the command or file name and reenter.
- If the command/file name is spelled correctly, check that the default or specified drive contains the command or file you are trying to execute. If you are specifying a command or file name on the hard disk, make sure you have properly specified the directory that contains the file.

`Bad file`

Explanation--The FC utility displays this message if one of the files you specified is defective.

Action--Work with another copy of the file and DELETE the defective file.

`Bad or missing Command Interpreter`

Explanation--MS-DOS cannot find the COMMAND.COM file on the disk. The file may be missing from the root directory, or there may be a problem with this file.

Action--Restart the system with a backup MS-DOS system diskette. Copy the COMMAND.COM file from the backup diskette to the root directory of the disk that failed.

`Bad or missing <filename>`

Explanation--This message appears only at start-up and indicates one of the following:

- You specified an invalid device in the CONFIG.SYS file.
- An error occurred while the specified device driver was being loaded. That driver is not installed by MS-DOS.

Action

- Check the accuracy of the DEVICE statement in the CONFIG.SYS file.
- Correct coding errors in the device driver.

- If you still cannot correct the problem, contact your customer service representative.

```
Bad unit error reading/writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS cannot read or write the data on drive (x:).

Action--If you are using a purchased program, contact the dealer who sold it to you.

```
BREAK is On/Off
```

Explanation--This message tells you the current setting of BREAK.

Action--Enter the command you want. For example, if you see Break is off and you want Break is on, enter the BREAK ON command.

C

```
Cannot CHDIR to (filename) -
tree past this point not processed
```

Explanation--CHKDSK is traveling the tree structure of the directory and cannot proceed to the specified directory. Subdirectories of this directory will not be verified.

```
Cannot CHDIR to root
Processing cannot continue
```

Explanation--CHKDSK is traveling the tree structure of the directory and cannot return to the root directory. CHKDSK cannot continue checking the remaining subdirectories to the root.

```
Cannot do binary reads from a device
```

Explanation--As part of the COPY command, you entered /B with a device name while trying to copy from the device. The copy cannot be performed in binary mode because COPY must be able to detect end-of-file from the device.

Action--Reenter COPY and omit the /B parameter or specify an ASCII copy by entering the /A parameter.

```
Cannot open <filename>
```

Explanation--MS-DOS cannot find the file you want to PRINT.

Action--Check the spelling of filename and make sure the file is stored on the disk you're using.

```
Cannot recover . entry, processing continued
```

Explanation--The . entry (current directory) is defective.

Action--None required.

```
Cannot recover .. entry
```

Explanation--The .. entry (parent directory) is defective.

Action--None required.

```
CHDIR .. failed, trying alternate method
```

Explanation--In traveling the tree structure, CHKDSK cannot return to a parent directory. It will try to return to that directory by starting again at the root.

Action--None required

```
Content of destination lost before copy
```

Explanation--This message appears when you enter the COPY command incorrectly and the source file is overwritten before the copy is complete. For example, COPY FILE1+FILE2 FILE2 destroys FILE2 before it can be copied.

Action--The file is no longer in the directory and is probably lost. Copy the backup file, use the new copy, and try again (see the COPY command in Chapter 5).

```
Convert lost chains to files (Y/N)?
```

Explanation--CHKDSK located xxx blocks of the data area that were marked as allocated but were not associated with a file. The computer assumes that these clusters contain "lost" data; CHKDSK asks whether you wish to free them or to recover each chain into a separate file.

Action--Enter Y or N. Entering Y recovers the lost blocks and creates a directory entry and a file (FILEnnnn). N frees the lost blocks so they can be allocated to new files.

```
Copy another (Y/N)?
```

Explanation--This message appears when DISKCOPY is complete; it allows you to make exact copies of additional diskettes without reentering the DISKCOPY command.

Action--If you want to copy another entire diskette, enter Y. DISKCOPY will prompt you to insert the required diskettes. If you don't want to make any more copies, enter N.

```
Copy complete
```

Explanation--This DISKCOPY message appears when the source diskette contents have been successfully copied to the target diskette.

Action--None required.

```
Copy not completed
```

Explanation--This message means that DISKCOPY cannot copy the entire disk.

Action--Run CHKDSK on the target diskette and/or use another diskette.

```
Copying...
```

Explanation--This message indicates that DISKCOPY is copying a disk.

Action--None required.

D

```
Data error reading/writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS is unable to read or write the data correctly. This message usually means an area of the disk is defective.

```
Data left in <filename>
```

Explanation--This message appears after FC reaches the end of one file in a file comparison and the other file has data left to be compared.

Action--None required.

```
Directory is totally empty, no . or ..
```

Explanation--The specified directory does not contain references to current and parent directories.

Action--Delete the specified directory and recreate it.

```
Disk bad
```

Explanation--This message indicates a floppy-disk controller problem.

Action--Press F1 to continue. The system may not boot successfully because of this problem. If the message clears, proceed normally. If the error message persists, call your service representative.

```
Disk error reading drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS cannot read an area of the disk in drive (x:).

Action--Make a copy of the backup diskette, and try your program again with the backup or the copy.

```
Disk error reading FAT (x)
```

Explanation--One of the file allocation tables (FAT) has a defective sector.

Action--None required. MS-DOS automatically uses the other FAT. We recommend that you copy the files onto another disk as a precaution. You may also want to reformat the disk with the defective sector.

```
Disk error writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS cannot write to an area of the disk in drive (x:).

Action--Make a copy of the backup diskette and try your program again with the backup or the copy.

```
Disk error writing FAT (x:)
```

Explanation--One of the file allocation tables (FAT) has a defective sector. X will be 1 or 2, depending on which of the two copies of the FAT could not be written.

Action--None required. MS-DOS automatically uses the other FAT. We suggest that you copy all the files onto another diskette as a precaution. You may also want to reformat the defective diskette.

```
Disk unsuitable for system disk
```

Explanation--FORMAT detected a bad track on the disk where system files should reside.

Action--Do not try to copy system files on this diskette. Use it to store data.

```
Disks must be the same size
```

Explanation--You cannot copy the contents of a disk with a different format using DISKCOPY.

Action--Copy files onto the disk with the COPY command.

```
Divide overflow
```

Explanation--A program probably tried to divide a number by zero. The program ends and you return to MS-DOS.

Action--Correct the programming error and continue. If you purchased this program, return it to your dealer.

```
(.) (..) does not exist
```

Explanation--This is an informational message from CHKDSK. It tells you that either the . (current) or .. (parent) directory entry is invalid.

Action--None required.

```
Duplicate file name or File not found
```

Explanation--You tried to rename a file to a file name that already exists on the disk; or the file to rename could not be found on the specified (or default) drive.

Action

- Check (and correct) the spelling of the file name you want to change.
- If this is a duplicate file name, enter a different file name in the RENAME command.

E

```
ECHO is on/off
```

Explanation--This message tells you the current status of ECHO.

Action--None required.

```
Entry has a bad attribute/link/size
```

Explanation--This message is generated by the CHKDSK program. It may begin with one or two periods, indicating which entry in the subdirectory is invalid. If one period is displayed, the current directory is invalid. Two periods indicate that the parent directory has an error. If you entered the /F parameter, CHKDSK will try to correct the error. No corrective action is taken if /F is omitted from the CHKDSK command.

Action--Enter CHKDSK/F. CHKDSK will then try to correct the error.

```
Error in EXE file
```

Explanation--The .EXE file you tried to load has an invalid internal format. This may have happened when you modified the file.

Action

- If you bought the program, rerun the program using the backup copy. If you still have trouble, see your authorized dealer.
- If you are using a program you wrote yourself, go through the LINK procedure again.

```
Error, press F1 key to continue
```

Explanation--This message usually follows a power-on error message. It allows the system to try booting again, even though the system may not be functional.

Action

- Follow the "Action" suggested for the specific message, and then turn power off and back on again. If the system error message and this Press F1... message reappear, try pressing the F1 key.
- If the system still does not boot, call your service representative. If the system does boot after the corrective action, proceed with caution, and as always, back up data regularly!

```
<type of error> Error reading file
```

Explanation--MS-DOS cannot read the specified file. The disk may be defective.

Action--Enter R to retry or A to abort. Use I as a last resort.

```
Error writing to device
```

Explanation--You tried to send too much data to a device, and MS-DOS was unable to write that data to the specified device.

Action--The disk is probably full. Use another diskette or delete some files from the diskette you are using and retry.

```
Errors found, F parameter not specified
Corrections will not be written to disk
```

Explanation--The CHKDSK program found errors on the disk, and displays them on the monitor. If you did not specify /F in the CHKDSK command, messages will be displayed, but the errors will not be corrected.

Action--None required.

```
Errors on list device indicate that it may be
off-line.  Please check it
```

Explanation--You entered a PRINT command and the printing device is off-line.

Action

- Check the printer cable connection.
- Verify that the printer power is on.
- Make sure the on-line setting is selected.

```
EXEC failure
```

Explanation--MS-DOS found an error while reading a command from disk, or the FILES= command in the configuration file (CONFIG.SYS) is set too low.

Action--Increase the FILES= value, and restart MS-DOS. If this doesn't work, then there may be a problem with the disk.

```
Exp bad
```

Explanation--If your system has an expansion chassis, the diagnostic tests the chassis connection at power-on. If the system detects a problem in this area, the message is displayed.

Action--Check the expansion chassis connection (see Chapter 5). Once you have secured the connection, turn power off and wait a few seconds before turning power back on. If the message persists, call your service representative.

F

```
File allocation table bad
```

Explanation--You may have a defective disk.

Action--Run CHKDSK. If there are errors, reformat the disk.

```
File allocation table bad, drive (x:) [CHKDSK]
```

Explanation--The disk in drive (x:) may be defective.

Action--Run CHKDSK. If there are errors, reformat the disk.

```
File cannot be converted
```

Explanation--The EXE2BIN input file is not in the correct format.

Action--Correct the format and try again.

```
File cannot be copied onto itself
```

Explanation--The COPY command specified the same name for both the source and destination files within the same directory on the same disk.

Action

- Change the name given to the copy, or
- Place the copy in a different directory, or
- COPY the file onto another disk.

```
File creation error
```

Explanation--This message appears if the EDLIN temporary file cannot be created. You may be trying to add a new file name to a full directory.

This message also appears if you try to replace a file that is already in the directory. If the file already exists, it is a read-only file and cannot be replaced.

Action

- Make sure that the directory has enough space to create the temporary file.
- Make sure that the file does not have the same name as a sub-directory in the directory where the file to be edited is located.
- Run CHKDSK.

```
File contains non-contiguous blocks
```

Explanation--Section of the specified file is scattered on the disk (not allocated contiguously).

Action--Enter CHKDSK/F to fix this error.

```
File not found
```

Explanation--The program you are running cannot find the file you specified. For example, you switched diskettes while a file was queued to PRINT. When it is time to PRINT this file, this message is displayed.

Action--Make sure the file you specified is on the specified disk. In the case of our PRINT example, insert the proper diskette and reissue the PRINT command for that file name.

```
File is cross-linked on cluster
```

Explanation--CHKDSK displays this message if it finds any cross-linked files. This means that the same data block is allocated to more than one file.

Action--Make a copy of the file you want to keep, and then delete the cross-linked files.

```
File is currently being printed
```

Explanation--The specified file is being printed.

Action--None required.

```
File is in queue
```

Explanation--The specified file is waiting to be printed.

Action--None required.

```
File not found
```

Explanation--MS-DOS cannot find the file you specified.

Action--Check to see that the path name is accurate and that the file exists in the directory you specified.

```
Files are different
```

Explanation--FC compares the portion of files loaded into the buffer space. If it cannot find any matching lines, this is displayed.

Action--None required.

```
First cluster number is invalid, entry truncated
```

Explanation--CHKDSK. The file directory entry contains an invalid pointer to the data area. If you specified /F, the file is truncated to a zero-length file.

```
FOR cannot be nested
```

Explanation--You cannot nest FOR statements in a batch file.

Action--Use only one FOR statement per command line. Then retry the command.

```
Format another (Y/N)?
```

Explanation--This message appears after a disk has been formatted. It allows you to format other disks without entering the FORMAT command again.

Action--Enter Y (for Yes) to format another disk. Enter N (for No) if you do not want to format another disk. If you accidentally type Y, you can abort the format process by pressing Control-C in response to the "Strike any key to begin formatting" message.

```
Format failure
```

Explanation--MS-DOS encountered a disk error during FORMAT and could not continue. This message is displayed with an explanatory message.

Action--Try FORMAT again. If the error persists, throw the diskette away.

I

```
Incompatible system size
```

Explanation--The system files IO.SYS and MSDOS.SYS occupy more space on the source disk than is available on the destination diskette.

Action--Format a blank diskette and then copy the files to the new diskette.

```
Incorrect DOS version
```

Explanation--Many version 2.00 utilities will not run on older versions of MS-DOS. The utilities CHKDSK, PRINT, and SYS will only run under the exact version of MS-DOS for which they were configured.

Action--Obtain the correct version of MS-DOS and retry the command.

```
Insert diskette with batch file and press any key when ready
```

Explanation--The diskette that contains the batch file being processed is not in the drive you specified. The batch processor is trying to find the next command in the file.

Action--Reinsert the diskette in the appropriate drive and press any key. Processing then continues.

```
Insert DOS disk in (x:) and strike any key when ready
```

Explanation--You entered FORMAT/S but the disk in the default drive doesn't contain MS-DOS system files.

Action--Insert an MS-DOS diskette containing IO.SYS and MSDOS.SYS in the appropriate drive. Press any key; processing then continues.

```
Insert formatted target diskette into drive (x:)
```

Explanation--DISKCOPY is prompting you to insert a formatted diskette in the destination drive.

Action--Insert a formatted diskette in the appropriate drive.

```
Insert new diskette for drive (x:) and strike any key when ready
```

Explanation--This message appears when you enter the FORMAT command.

Action--Insert a blank disk into the appropriate drive and press any alphanumeric key to begin formatting. If there is any data on the disk, it will be destroyed by the format process.

```
Insert source diskette into drive (x:)
```

Explanation--This message appears after you enter the DISKCOPY command.

Action--Insert the appropriate diskette into the specified drive, and press any key when prompted. The copying process starts.

```
Insert system diskette in drive (x:) and strike any key when
ready
```

Explanation--SYS needs a bootable disk from which to read the IO.SYS and MSDOS.SYS files.

Action--Insert a diskette that contains the IO.SYS and MSDOS.SYS files into the specified drive and press any alphanumeric key to start the system copy process.

```
Insert target diskette into drive (x:)
```

Explanation--This message appears if you are running DISKCOPY and the source and destination drives are the same.

Action--Reinsert the destination disk into the specified drive.

```
Insufficient disk space
```

Explanation--There is not enough space on the disk to perform the command you entered.

Action--If you think this condition is invalid, run CHKDSK to determine the status of the disk. Otherwise, use another disk and retry the command.

```
Insufficient memory
```

Explanation--There is not enough memory to run the program.

Action

- If this happens when you try to run a program, you must free some memory by writing files to disk or by deleting files before restarting the program.

- Try changing the BUFFERS= parameter in the CONFIG.SYS file to a smaller value (if you have specified BUFFERS=), restart the system, and try the command again.

```
Insufficient memory for system transfer
```

Explanation--There is not enough memory to transfer the MS-DOS system files IO.SYS and MSDOS.SYS.

Action--Contact your dealer for memory expansion details.

```
Insufficient room in root directory.  Erase files in root and repeat CHKDSK
```

Explanation--CHKDSK always recovers lost files into the root directory. In this case, the root directory is full.

Action--Delete some files in the root directory to make room for the lost files.

```
Intermediate file error during pipe
```

Explanation--The pipe function uses temporary files on the diskette that are automatically deleted after the piping process is complete. There is an error in one of these temporary files.

Action--Erase some files from the default drive's root directory and reissue the command that failed. If you get the same message, one of the programs in the command line erased one or both of the piping files. Correct the program and reissue the command line.

```
Internal error
```

Explanation--This message indicates an internal logic error in the FC utility.

Action--Contact your customer service representative.

```
Invalid characters in volume label
```

Explanation--A volume label may contain alphanumeric characters only (maximum 11).

Action--Retry using valid characters.

```
Invalid COMMAND.COM.  Insert COMMAND.COM disk in drive (x:) and
strike any key when ready
```

Explanation--The application you just ran used up almost all of memory. MS-DOS is trying to reload the COMMAND.COM file from disk. It either cannot find COMMAND.COM on the disk, or the copy it finds is invalid.

Action--Insert a diskette containing COMMAND.COM into the specified drive.

```
Invalid country code
```

Explanation--You specified a country number in the CONFIG.SYS file that is not in the table of files.

```
Invalid current directory
```

Explanation--The disk is bad.

Action--Replace the diskette or make another copy from the backup system diskette.

```
Invalid date
```

Explanation--You entered an invalid date or delimiter in response to the MS-DOS date prompt. The only valid delimiters in a date entry are hyphens (-) and slashes (/).

Action--Reenter a valid date.

```
Invalid device
```

Explanation--The device name you specified is not valid.

Action--Retry the command using CON, NUL, AUX, or PRN.

```
Invalid directory
```

Explanation--One of the directories in the specified path does not exist or is invalid.

Action--Retry the command making sure to enter the directory name correctly.

```
Invalid drive in search path
```

Explanation--One of the paths specified in the PATH command contains an invalid drive specifier.

This message appears when MS-DOS tries to locate a command or batch file; it is caused by an erroneous PATH command.

Action

1. Enter PATH with no parameters. This displays the path you previously defined.
2. Find the invalid specifier.
3. Reenter the PATH command with the valid drive specifier and the paths you want.

```
Invalid drive or filename
```

Explanation--You did not enter a valid drive specifier or file name.

Action--Correct the entry and try again. If you entered a drive specifier, be sure you entered a colon after the drive letter.

```
Invalid drive specification
```

Explanation--You entered an invalid drive specification in a command (or in one of its parameters).

Action--Reenter the command using a valid drive specifier. If you entered a drive specifier, be sure you entered a colon after the drive letter.

```
Invalid number of parameters
```

Explanation--The command line specifies too few or too many parameters.

Action--Refer to Chapter 5 of the *WYSEpc User's Guide* for specific details.

```
Invalid parameter
```

Explanation--The command line contains one or more invalid options or parameters. You'll get this message when you omit the colon from a drive specifier.

Action--If the program expects a drive specifier, be sure to enter a colon following the drive letter. In other cases, make sure the character following the slash(/) is valid for the program being run. Refer to Chapter 5 of the *WYSEpc User's Guide* for command specifics.

```
Invalid path, not directory or directory not empty
```

Explanation--You are unable to remove the specified directory because of one of the following:

- One of the names you specified in the path was not a valid directory name
- The directory you specified still contains entries for files or other subdirectories (with the exception of the . and .. entries)
- You cannot remove a current directory.

Action--Try one of the following:

- Correct the invalid directory name in the path.
- Delete appropriate files or remove appropriate subdirectories in the directory.

```
Invalid path or file name
```

Explanation--You specified a nonexistent directory or file name.

Action--Use the correct path or file name. Check for the following, then retry the command:

- Correct spelling of names
- Valid directory names
- Existence of file in the subdirectory specified

```
Invalid sub-directory entry
```

Explanation--You specified an invalid or nonexistent subdirectory.

Action

- Run CHKDSK/F, which attempts to correct the error.
- For more specific information about the nature of the error, run CHKDSK with the /V parameter.

```
Invalid time
```

Explanation--When prompted at start-up, you entered an invalid time.

Action--Reenter the correct time. The only valid delimiters are:

- A colon (:) between the hours and minutes
- A colon (:) between the minutes and seconds
- A period (.) between the seconds and hundreths of a second.

K

```
Keyboard bad
```

Explanation--If a code does not precede this message, the keyboard has an internal problem.

Action--Turn the system and monitor power off and then back on. If the error message reappears, your system needs service. You may be able to continue working (in a limited way) by pressing F1.

```
xx Keyboard bad
```

Explanation--During the boot attempt, this message appears if a key is stuck.

Action

1. Check the keyboard for any jammed keys.
2. Turn the power off, remove the object(s), and turn the power back on again.

L

```
Label not found
```

Explanation--The program contains a GOTO command to a noexistent label in a batch file. This causes the system to read to the end of the batch file and to end batch processing.

Action--If you don't want the GOTO to exit the batch file, edit the batch file and put the label in the desired location.

```
List output is not assigned to a device
```

Explanation--MS-DOS does not recognize the device you named as the PRINT list device.

Action--Reenter the PRINT command and, when prompted, enter a valid list device name.

M

```
Memory allocation error
Cannot load COMMAND, system halted
```

Explanation--A program destroyed the area in which MS-DOS keeps track of available memory.

Action--Restart MS-DOS. If this error persists, make a new copy of the MS-DOS disk from the backup system disk.

```
--More--
```

Explanation--The screen is full and there is more data to be displayed.

Action--Press any key to see the next full screen.

```
Must specify ON or OFF
```

Explanation--The command requires that you enter either ON or OFF.

Action--Enter ON or OFF.

N

```
Name of list device [PRN]:
```

Explanation--This message appears the first time you run PRINT.

Action--Enter the name of the device that is to receive the printed output.

```
No files match d:xxxxxxxxx.xxx
```

Explanation--This message appears when you try to add files to the print queue and the file specification does not match any of the files.

Action

- Check the file specification for spelling errors
- Be sure the drive specifier matches the diskette containing the files.

```
No free file handles
Cannot start COMMAND, exiting
```

Explanation--MS-DOS tried to load a second copy of the command processor but failed because there were too many files open.

Action--Restart MS-DOS. If the message persists, increase the number in the FILES= command in the configuration file (CONFIG.SYS), and restart MS-DOS.

```
No paper error writing device <dev>
Abort, Retry, Ignore?
```

Explanation--The printer is either out of paper or not turned on.

Action--Turn the printer ON, press the ONLINE switch, and/or add paper. Enter R to retry.

```
No path
```

Explanation--This message appears if you enter PATH <RETURN> and there is no current command search path.

Action--None required unless you want to define a set of paths. If so, enter PATH and the set of paths you want.

```
No room for system on destination disk
```

Explanation--The destination diskette doesn't have enough free space to hold the system files.

Action--Try the following:

- Delete some files to make room for the system files.
- Use another diskette.
- Format a blank diskette (use the FORMAT/S command), and then copy files to the new diskette.

```
Non-System disk or disk error
Press a key to retry
```

Explanation--This message appears if you have a dual-diskette system and one of the following conditions:

- You didn't insert a diskette in drive A.
- The diskette in drive A does not contain a valid copy of the MS-DOS operating system.
- Something is wrong with the diskette in drive A that is preventing a normal boot.

This message can also occur in a hard-disk system. If the computer cannot boot from the diskette in drive A, it automatically tries to boot from the hard disk. If the hard disk does not contain the necessary software to boot or has an internal problem that will not allow a boot, this message is displayed.

Action--Make sure you have inserted a system diskette in drive A. If you did not, insert one now and press any key to retry. If you want to boot from the fixed disk, make sure the necessary files are on the disk (see Chapter 1).

If you think something may be wrong with the system diskette in drive A, try inserting another copy of the system diskette and press any key. If the message persists, your system may have internal problems, and you should call your service representative.

```
Not ready error reading/writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS cannot read or write data on the specified drive.

Action

1. Make sure the diskette is properly inserted in the drive and that the PUSH button is engaged. Then enter R to retry.

2. If you get the same message, enter A to abort. The disk may be faulty.

3. Rerun the command with a different disk.

O

```
Out of environment space
```

Explanation--There isn't enough room in the program to accept any more data. This normally occurs when you try to add to the environment after loading a program which makes itself resident.

Action--None required.

P

```
Press any key to begin formatting x:
```

Explanation--This message appears after you enter the FORMAT command. The disk in drive x is about to be formatted. Formatting will erase all previously existing data on the disk.

Action--If you don't want to format the disk, press CTRL BREAK. If you want to format the disk, press any alphanumeric key.

```
Press any key to begin recovery of the (xxx) file(s) on drive (x:)
```

Explanation--This message appears before you RECOVER a disk or file.

Action--Insert the diskette to be recovered in the appropriate drive and press any alphanumeric key to begin. If you want to terminate this operation, press CTRL BREAK.

```
Press any key when ready
```

Explanation--This prompt occurs when you are copying disks.

Action--When you have inserted the disks into the appropriate drives, press any alphanumeric key to begin the DISKCOPY process. If you want to discontinue this operation, press CTRL BREAK.

```
PRINT queue is empty
```

Explanation--There are no files waiting to be printed.

Action--None required.

```
PRINT queue is full
```

Explanation--You exceeded the limit of ten files in the print queue.

Action--Wait until a file is printed, and then add another file to the print queue.

```
Probable non-DOS disk
Continue (Y/N)?
```

Explanation--The disk you are using was not formatted by a compatible version of MS-DOS or it is badly damaged.

Action

- Do not continue processing if CHKDSK returns this message for a removable disk.
- If CHKDSK returns this message for a hard disk, the information describing the characteristics of the disk has been destroyed. In this case, you may continue CHKDSK processing.

```
Processing cannot continue
```

Explanation--This message is normally issued when there is not enough memory to process CHKDSK on the disk.

Action--None required. If you want to run CHKDSK on the current disk, you must free up additional memory.

```
Program size or number of segments exceeds capacity of linker
```

Explanation--The load module is too large for processing. The total size may not exceed 834K bytes, and the number of segments may not exceed 255.

Action--Reduce the size of the program and/or the number of segments.

```
Program too big to fit in memory
```

Explanation--The program cannot be loaded because it is larger than the available memory.

Action--Restart your system and reissue the command. If this message reappears, you must install more memory in order to run the program.

R

```
xx Ram bad
```

Explanation--"xx" is the hexadecimal notation of the faulty RAM address (where the bad RAM is located).

Action--Turn power off and then on again. If the error message persists, there is a problem with the system RAM that requires service. Pressing F1 may allow you to continue.

```
Read error in <filename> [FIND]
```

Explanation--MS-DOS cannot read the file.

Action--Try renaming the file and rerun the command.

```
Read fault error reading drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS cannot read the file on drive (x:)

Action

1. Make sure the diskette is properly inserted in the drive, and then enter R to retry.

2. If you get the same message, enter A to abort. The disk may be faulty.

3. Rerun the command with a different disk.

```
Resident part of PRINT installed
```

Explanation--This message appears the first time you use the PRINT command. It means that available memory has been reduced by several thousand bytes to process the PRINT command concurrent with other processes.

Action--None required.

```
Rom bad
```

Explanation--This refers to a faulty ROM on one of the option cards.

Action

1. Turn the power off and check the installation of any option cards.

2. If the message persists, remove the faulty card and return it to the manufacturer.

3. Pressing F1 should allow normal operation without removing the defective option card.

S

```
Sector not found error reading drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS cannot find the sector on the disk containing the data.

Action

1. Make sure the diskette is properly inserted in the drive, and then enter R to retry.

2. If you get the same message, enter A to abort. The disk may be faulty.

3. Rerun the command with a different disk.

```
Sector not found error writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--MS-DOS can't find the sector on the disk containing the data.

Action

1. Make sure the diskette is properly inserted in the drive, and then enter R to retry.

2. If you get the same message, enter A to abort. The disk may be faulty.

3. Rerun the command with a different disk.

```
Sector size too large in file <filename>
```

Explanation--The device driver filename specifies a sector size larger than that of devices previously defined.

Action--You cannot run this driver unless you reduce the sector size to conform with the sector size of MS-DOS.

```
Seek error reading drive (x:)
Abort, Retry, Ignore?
```

Explanation--The drive cannot find the proper track on the disk.

Action

1. Make sure the diskette is properly inserted in the drive.
2. Try a different drive.
3. Run CHKDSK.

```
Seek error writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--The drive cannot find the proper track on the disk.

Action

1. Make sure the diskette is properly inserted in the drive.
2. Try a different drive.
3. Run CHKDSK.

```
Source and target diskettes are not the same format.  Cannot do
the copy.
```

Explanation--You must have the same size and kind of disks to run DISKCOPY. For example, you cannot copy from a single-sided diskette to a double-sided diskette.

Action--Reformat the target diskette so that it is the same type as the source diskette.

```
Specified COMMAND search directory bad
```

Explanation--The SHELL statement in the CONFIG.SYS file is incorrect. You specified a nonexistent location for COMMAND.COM, or COMMAND.COM is not in the specified location.

Action--Correct the SHELL statement in the CONFIG.SYS file and try again.

```
Strike a key when ready...
```

Explanation--This prompt occurs during command processing and is always accompanied by another message. This message is also displayed if you have inserted a PAUSE statement in a batch file. Usually, you are asked to insert disks into appropriate drives before this prompt.

Action--Press any alphanumeric key to begin command processing.

```
Syntax Error
```

Explanation--The command you entered is improperly formatted.

Action--Check to make sure you have used the correct format for this command (see Chapter 5).

```
System transferred
```

Explanation--The system files MSDOS.SYS and IO.SYS have been transferred during FORMAT/S or SYS command processing.

Action--None required.

T

```
Terminate batch job (Y/N)?
```

Explanation--This message appears when you enter a Control-C command while MS-DOS is processing a batch file.

Action--Enter Y to stop processing the batch file. Enter N to continue.

```
Timer or Int Cntrl bad
```

Explanation--This indicates a problem with the timer or interrupt controller.

Action--Turn power off, wait a few seconds, and turn power on again. If the message reappears, call your service representative.

```
Track 0 bad - disk unusable
```

Explanation--Track 0 is where the boot record, file allocation table, and directory must reside. If this track is bad, you cannot use the diskette.

Action--Retry the FORMAT command with another diskette.

U

```
Unable to create a directory
```

Explanation--MS-DOS cannot create the directory you specified. The directory you want to create already exists, one of the directory path names you specified cannot be found, or you attempted to add a directory to the root directory and it is full.

Action

1. Make sure that a file or directory by that name does not already exist in the parent directory (or current directory).

2. Recheck all the directory names to make sure they are valid.

3. Use CHKDSK to see if the directory is full.

```
Unrecognized command in CONFIG.SYS
```

Explanation--There is an invalid command in the CONFIG.SYS file.

Action--Edit the file, correct the invalid command, and restart MS-DOS.

```
Unrecoverable error in directory
Convert directory to file (Y/N)?
```

Explanation--This message is generated by the CHKDSK program.

Action--If you respond Y to this prompt, CHKDSK will convert the bad directory into a file. You can then fix the directory or delete it.

V

```
VERIFY is OFF/ON
```

Explanation--This message displays the current setting of VERIFY.

Action--If the message is VERIFY is ON and you want to turn off VERIFY, enter

```
VERIFY OFF
```

```
VM read error
```

Explanation--This is a disk error--you probably have a defective diskette.

Action--Use another diskette. In the case of a hard disk, call your service representative.

```
Volume in drive (x:) has no label
```

Explanation--This is an informational message displayed in response to the DIR command.

Action--None required.

```
Vol in drive (x:) is <filename>
```

Explanation--This is an informational message displayed in response to the DIR command.

Action--None required

```
Volume label (11 characters, ENTER for none)?
```

Explanation--This message appears when you enter FORMAT/V. You are requested to enter a 1- to 11-character volume label, which will be written on the disk being formatted.

Action

- Enter a valid volume label.
- If you do not want a volume label on the disk, simply press RETURN.

W

```
Warning-directory full
```

Explanation--There is insufficient space in the root directory to recover more files.

Action--Copy some of the files to another disk, delete them from this disk, and run RECOVER again.

```
WARNING-Read error on EXE file
```

Explanation--An error occurred while reading the input file. EXE2BIN will attempt to continue, but the resulting file may be unusable.

Action

1. Use the COPY *.* command to copy the diskette files to a new diskette.
2. Copy the backup version of the .EXE file to this diskette.
3. Format the diskette that had the error to mark any bad tracks.
4. Discard the bad diskette, if necessary.

```
Write fault error
Abort, Retry, Ignore?
```

Explanation--MS-DOS cannot write the data to the specified drive.

Action

- Make sure the diskette is properly inserted in the drive.
- If the diskette is not the problem, enter R to retry.
- If you get the same message, enter A to abort and rerun the command with a different disk.

```
Write protect error writing drive (x:)
Abort, Retry, Ignore?
```

Explanation--The diskette is write-protected.

Action--Insert a diskette that you can safely write to and retry the operation. If you do want to write on the write-protected diskette, remove the write-protect tab and retry the operation.

```
Wyse Technology Rev. x.xx
xxkb Good
```

Explanation--"Rev x.xx" is the version of the ROM in the computer. The "xx" in "xxkb Good" changes as the ROM tests system RAM. The final value displayed is the total size of the system RAM. The system will then attempt to boot, first from the floppy disk and then from the hard disk (if present).

Action--None required.

Number Messages

```
xxxx error on file yyyy
```

Explanation--This message appears on the printer during PRINT if MS-DOS finds an error on the disk. Printing stops.

Action--If this message appears before the file begins to PRINT, check that the disk drive is ready. If it appears after printing begins, there may be a problem with the disk. Try printing from a backup file copy.

```
(xxxx) of (xxxx) bytes recovered
```

Explanation--This message tells you how many bytes MS-DOS was able to recover of the disk or file.

Action--None required.

```
1701
```

Explanation--This indicates a hard-disk error. Option cards use numbers to report errors; the disk controller card happens to use 1701.

Action--Turn power off, wait a few seconds, and turn power back on. If the message reappears, press F1 to continue. Note though that you will not be able to use the hard disk until the system is serviced.

APPENDIX B UPGRADING SYSTEM OPTIONS

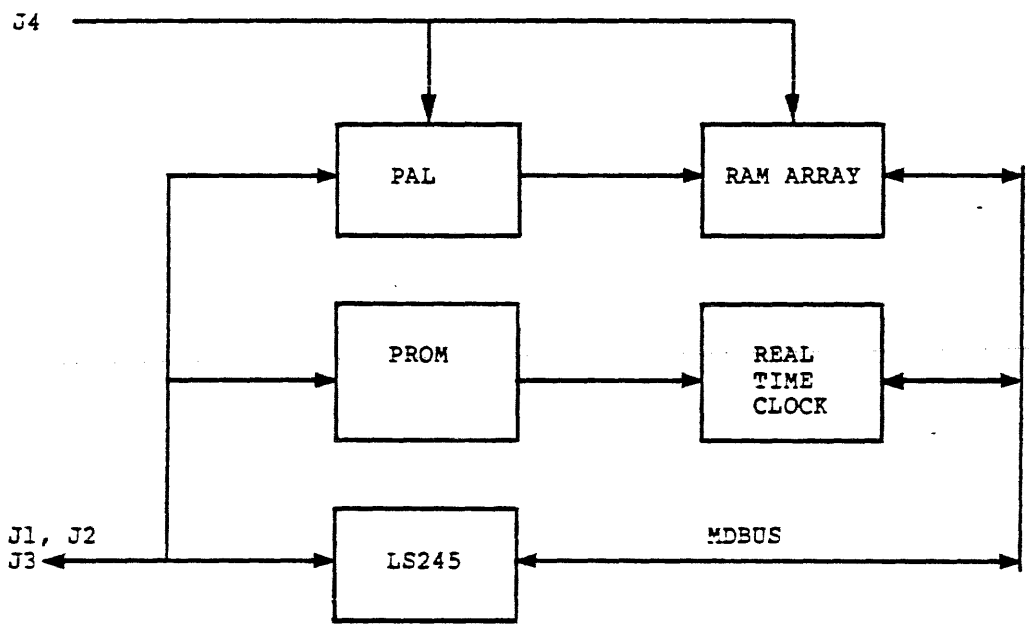
This appendix provides a discussion of the multifunction backplane and color graphics options available for the computer. A programmable array listing (PAL) file listing, an LCRAM expansion function table and a programmable read-only memory (PROM) file listing for the multifunction backplane are included. A functional description and a discussion of the modes of operation of the color graphics adapter board are provided. Specifications for the WY-600 and WY-500 monitors are also included in this appendix.

Multifunction Backplane

Overview

The multifunction backplane contains two standard bus slots for IBM PC/XT expansion cards, 256K additional RAM, a real time clock with on-board 3V battery backup, and a -5V regulator (see Figure B-1). This board plugs into backplane connectors J13 and J17 on the CPU logic board and replaces the standard backplane.

Figure B-1 Multifunction Backplane Block Diagram



Pin assignments for the expansion slots are identical to the standard backplane. Refer to Table C-13 in Appendix C for the multifunction backplane connector pin assignments. See Table C-14 in Appendix C for the signal descriptions of the I/O channel on the multifunction backplane.

Refer to Chapter 2 in this manual for instructions on installing the multifunction backplane.

Expansion RAM

Memory ranging from 0000:0000 to 3000:FFFF (256K) must be filled on the CPU logic board before any additional expansion RAM is recognized.

The 256K of expansion RAM are organized into four banks of 64 kilobytes using 64K x 1-bit dynamic RAMs with access times of up to 200ns. PAL 16L8 (U33) generates RAS 0:3 to the four banks and data bus transceiver direction/output enable control. The dynamic RAM multiplexed address and CAS signals are brought up from the computer CPU logic board via multifunction backplane connector J4, which mates to CPU logic board connector J17.

Table B-1 defines the memory map for the additional 256K RAM on the multifunction backplane.

Table B-1 Multifunction Backplane Memory Map

Hex Address	RAM Bank
4000:0000 - 4000:FFFF	0
5000:0000 - 5000:FFFF	1
6000:0000 - 6000:FFFF	2
7000:0000 - 7000:FFFF	3

Real Time Clock

A National Semiconductor MM58167A microprocessor real time clock chip and a 32.768 KHz crystal oscillator are used to generate the real time clock. The chip provides a four-year calendar and 24-hour clock. Time accuracy is to 1/10000 second. Calendar accuracy is nominally within one minute per month.

Hardware interrupts (IRQ2) from the real time clock to the 8088 are enabled by installing a jumper at J5 on the multifunction backplane.

Address decoding of the registers associated with the real time clock is achieved using a 256 x 4-bit 6301-1 or equivalent 55ns PROM (U35). The PAL16L8 (U33) provides an open collector buffer for the MM58167 RDY signal.

See the National Semiconductor MOS Data Book for a detailed description of the MM58167A integrated circuit.

Table B-2 is an I/O memory map for the registers associated with the real time clock.

Table B-2 I/O Memory Map of Real Time Clock Registers

I/O Address	Register
2C0	Counter (R/W) - 1/10000 seconds
2C1	Counter (R/W) - 1/100 and 1/10 seconds
2C2	Counter (R/W) - seconds
2C3	Counter (R/W) - minutes
2C4	Counter (R/W) - hours
2C5	Counter (R/W) - week
2C6	Counter (R/W) - day
2C7	Counter (R/W) - month
2C8	RAM (R/W) - 1/10000 seconds
2C9	RAM (R/W) - 1/100 and 1/10 seconds
2CA	RAM (R/W) - seconds
2CB	RAM (R/W) - minutes
2CC	RAM (R/W) - hours
2CD	RAM (R/W) - week
2CE	RAM (R/W) - day
2CF	RAM (R/W) - month
2D0	Interrupt status
2D1	Interrupt control
2D2	Counter reset
2D3	RAM reset
2D4	Status bit
2D5	Go bit
2D6	-Standby interrupt
2D7:2DE	Not used
2DF	Test mode

Electrical Specifications

Board Power Requirements

Typical current:	+5V = 0.330 amps
Maximum current:	+5V = 0.512 amps

Battery Specifications

Nominal voltage:	3 volts
Minimum capacity:	160 mAh, nonrechargeable
Diameter:	23.0 mm
Height:	2.5 mm

PAL File Listing

PAL16L8 PAL Design Specification

LCRAMEXP
RAM Expansion Board Dynamic RAM Controller

A16 A17 A18 A19 /CS /IOEN RDY /IORB /MWB GND
/DAK0B /RAS0 /RAS1 IOCHRDY /RAS3 /RAS2 /245OUT /MRB /245EN VCC

```
IF (VCC) 245EN          =   MRB *    /A19 * A18 * /DAK0B
                        +   MWB *    /A19 * A18 * /DAK0B
                        +   /MRB *     CS

IF (VCC) 245OUT         = MRB
                        + IORB * CS
 F (/RDY) /IOCHRDY      = /RDY
IF (VCC) RAS0     =  MRB   *    /DAK0B  *   /A19  *  A18  *   /A17  * /A16
                  +  MWB   *    /DAK0B  *   /A19  *  A18  *   /A17  * /A16
                  +  MRB   *     DAK0B
                  +  MWB   *     DAK0B
IF (VCC) RAS1     =  MRB   *    /DAK0B  *   /A19  *  A18  *   /A17  *  A16
                  +  MWB   *    /DAK0B  *   /A19  *  A18  *   /A17  *  A16
                  +  MRB   *     DAK0B
                  +  MWB   *     DAK0B
IF (VCC) RAS2     =  MRB   *    /DAK0B  *   /A19  *  A18  *    A17  * /A16
                  +  MWB   *    /DAK0B  *   /A19  *  A18  *    A17  * /A16
                  +  MRB   *     DAK0B
                  +  MWB   *     DAK0B
IF (VCC) RAS3     =  MRB   *    /DAK0B  *   /A19  *  A18  *    A17  *  A16
                  +  MWB   *    /DAK0B  *   /A19  *  A18  *    A17  *  A16
                  +  MRB   *     DAK0B
                  +  MWB   *     DAK0B
```

Table B-3 LCRAM Expansion Function Table

A19 A18 A17 A16 /DAK0B /MRB /MWB /CS /IOEN /IORB RDY
IOCHRDY /245OUT /245EN /RAS0 /RAS1 /RAS2 /RAS3

A19_16	DK0B	MRB	MWB	CS	IOEN	IORB	RDY	IOCHRDY
LHLL	H	L	L	H	X	H	H	Z
LHLH	H	L	L	H	X	H	H	Z
LHHL	H	L	L	H	X	H	H	Z
LHHH	H	L	L	H	X	H	H	Z
HHHH	L	L	H	H	X	H	H	Z
HHHH	H	H	H	H	X	H	L	L
HHHH	H	H	H	H	X	H	H	Z
HHHH	H	H	H	L	X	H	H	Z
HHHH	H	H	H	H	X	L	H	Z
HHHH	H	H	H	L	X	L	H	Z
HHHH	H	L	H	L	X	H	H	Z

Table B-3 LCRAM Expansion Function Table (Continued)

245OUT	245EN	RAS0..3
L	L	LHHH
L	L	HLHH
L	L	HHLH
L	L	HHHL
L	H	LLLL
H	H	HHHH
H	H	HHHH
H	L	HHHH
H	H	HHHH
L	L	HHHH
L	H	HHHH

PROM File Listing

LCRTC.PROM
PROM 256X4 55NS
WYSE TECHNOLOGY
4/5/84

Description--Generates /IOEN and real time clock chip select by decoding I/O address 2C0:2DF.

ROM Address Inputs (A7:A0) ROM Outputs (D1:D0)

AEN	A9	A8	A7	A6	A5	/IOW	/IOR	/IOEN	/CS
0	1	0	1	1	0	0	0	1	0
0	1	0	1	1	0	0	1	0	0
0	1	0	1	1	0	1	0	0	0
0	1	0	1	1	0	1	1	1	0

A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1
00000000	1111	01000000	1111	10000000	1111	11000000	1111
00000001	1111	01000001	1111	10000001	1111	11000001	1111
00000010	1111	01000010	1111	10000010	1111	11000010	1111
00000011	1111	01000011	1111	10000011	1111	11000011	1111
00000100	1111	01000100	1111	10000100	1111	11000100	1111
00000101	1111	01000101	1111	10000101	1111	11000101	1111
00000110	1111	01000110	1111	10000110	1111	11000110	1111
00000111	1111	01000111	1111	10000111	1111	11000111	1111
00001000	1111	01001000	1111	10001000	1111	11001000	1111
00001001	1111	01001001	1111	10001001	1111	11001001	1111
00001010	1111	01001010	1111	10001010	1111	11001010	1111
00001011	1111	01001011	1111	10001011	1111	11001011	1111
00001100	1111	01001100	1111	10001100	1111	11001100	1111
00001101	1111	01001101	1111	10001101	1111	11001101	1111
00001110	1111	01001110	1111	10001110	1111	11001110	1111
00001111	1111	01001111	1111	10001111	1111	11001111	1111

A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1
00010000	1111	01010000	1111	10010000	1111	11010000	1111
00010001	1111	01010001	1111	10010001	1111	11010001	1111
00010010	1111	01010010	1111	10010010	1111	11010010	1111
00010011	1111	01010011	1111	10010011	1111	11010011	1111
00010100	1111	01010100	1111	10010100	1111	11010100	1111
00010101	1111	01010101	1111	10010101	1111	11010101	1111
00010110	1111	01010110	1111	10010110	1111	11010110	1111
00010111	1111	01010111	1111	10010111	1111	11010111	1111

PROM File Listing

LCRTC.PROM
PROM 256X4 55NS
WYSE TECHNOLOGY
4/5/84

A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1
00011000	1111	**01011000**	**1110**	10011000	1111	11011000	1111
00011001	1111	**01011001**	**1100**	10011001	1111	11011001	1111
00011010	1111	**01011010**	**1100**	10011010	1111	11011010	1111
00011011	1111	**01011011**	**1110**	10011011	1111	11011011	1111
00011100	1111	01011100	1111	10011100	1111	11011100	1111
00011101	1111	01011101	1111	10011101	1111	11011101	1111
00011110	1111	01011110	1111	10011110	1111	11011110	1111
00011111	1111	01011111	1111	10011111	1111	11011111	1111
00100000	1111	01100000	1111	10100000	1111	11100000	1111
00100001	1111	01100001	1111	10100001	1111	11100001	1111
00100010	1111	01100010	1111	10100010	1111	11100010	1111
00100011	1111	01100011	1111	10100011	1111	11100011	1111
00100100	1111	01100100	1111	10100100	1111	11100100	1111
00100101	1111	01100101	1111	10100101	1111	11100101	1111
00100110	1111	01100110	1111	10100110	1111	11100110	1111
00100111	1111	01100111	1111	10100111	1111	11100111	1111
00101000	1111	01101000	1111	10101000	1111	11101000	1111
00101001	1111	01101001	1111	10101001	1111	11101001	1111
00101010	1111	01101010	1111	10101010	1111	11101010	1111
00101011	1111	01101011	1111	10101011	1111	11101011	1111
00101100	1111	01101100	1111	10101100	1111	11101100	1111
00101101	1111	01101101	1111	10101101	1111	11101101	1111
00101110	1111	01101110	1111	10101110	1111	11101110	1111
00101111	1111	01101111	1111	10101111	1111	11101111	1111
00110000	1111	01110000	1111	10110000	1111	11110000	1111
00110001	1111	01110001	1111	10110001	1111	11110001	1111
00110010	1111	01110010	1111	10110010	1111	11110010	1111
00110011	1111	01110011	1111	10110011	1111	11110011	1111
00110100	1111	01110100	1111	10110100	1111	11110100	1111
00110101	1111	01110101	1111	10110101	1111	11110101	1111
00110110	1111	01110110	1111	10110110	1111	11110110	1111
00110111	1111	01110111	1111	10110111	1111	11110111	1111

A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1	A7..A0	O3..O1
00111000	1111	01111000	1111	10111000	1111	11111000	1111
00111001	1111	01111001	1111	10111001	1111	11111001	1111
00111010	1111	01111010	1111	10111010	1111	11111010	1111
00111011	1111	01111011	1111	10111011	1111	11111011	1111
00111100	1111	01111100	1111	10111100	1111	11111100	1111
00111101	1111	01111101	1111	10111101	1111	11111101	1111
00111110	1111	01111110	1111	10111110	1111	11111110	1111
00111111	1111	01111111	1111	10111111	1111	11111111	1111

Color Graphics Option

General Information

The color graphics option includes a color monitor with color graphics board, video cable, and power cord.

A color graphics board must be installed before you can use a WY-600 color monitor with the computer. Follow the instructions given in *Replacing the Option Boards* in Chapter 2 to install a color graphics board. After you install this option, the graphics monitor can function in alphanumeric or graphics mode. You can still use the monochrome display connector with a monochrome monitor. If you have both monitors connected, you can switch the display from one monitor to the other with the MODE command. The command

```
MODE CO80
```

selects the color monitor. To return to the monochrome display, enter the command

```
MODE MONO
```

Refer to the WYSEpc User's Guide for more information on the MODE command.

Note--The Hercules graphics card has its own video and parallel printer ports that conflict with the built-in circuitry of this computer. If you install the Hercules card, disable both the MONO display and LPT1 ports. See "Disabling Built-in Functions" in Chapter 2 for detailed instructions.

The color graphics board supports the computer operation in the following modes:

80 x 25	Alphanumeric (A/N)	Color
80 x 25	A/N	Black and White
40 x 25	A/N	Color
40 x 25	A/N	Black and White
320 x 200	Graphics	Color
320 x 200	Graphics	Black and White
640 x 200	Graphics	Black and White

The color graphics board communicates with the CPU logic board through the 62-pin system bus connector P5 and drives the color monitor through direct drive 9-pin RGB

connector J2 or composite-video connector J1, which fits a standard phono plug. J1 and J2 are right-angle connectors that are accessible through the I/O access door when the board is installed (Figure B-2). The specifications for these connectors are shown in Figure B-3.

The board also has connector pins for an RF modulator (P1) and a light pen (P2). You must provide the external connectors, RF modulator, and light pen. For locations and specifications for these interfaces, see Figure B-4.

Figure B-2 Color Graphics Adapter Board

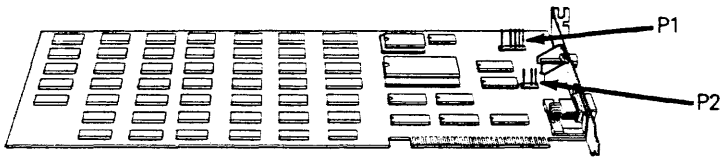
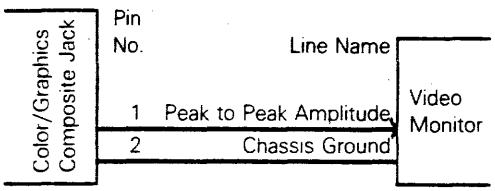


Figure B-3 Connector Specifications for Color Graphics Adapter



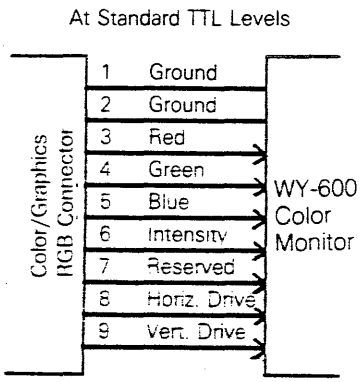
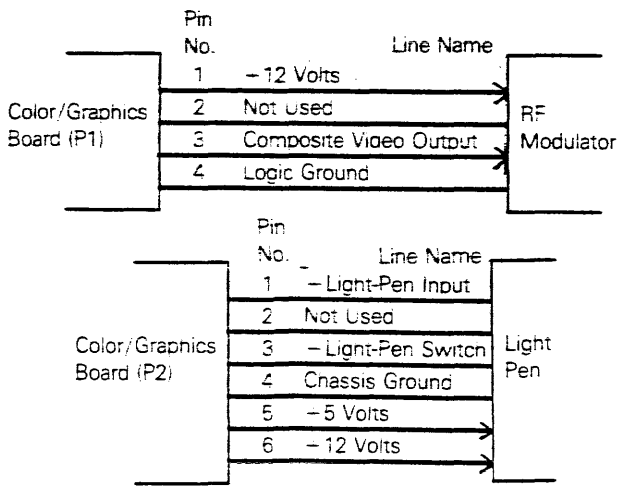


Figure B-4 RF Modulator and Light-Pen Connectors



Functional Description

The color graphics block diagram in Figure B-5 shows the major components of this board. Each component function is described in the following paragraphs.

CRT Controller

A Motorola 6845 CRT controller provides the necessary interface to drive a raster scan CRT.

Mode Set and Status Registers

By programming the I/O registers on the board, the CPU selects the mode of operation, selects the color set for 320 x 200 color graphic mode, and senses the status of this board.

Display Buffer

Starting at address X'B8000'in the CPU, 16K of dynamic RAM address space is provided as the display buffer. The buffer can be equally accessed by both the CPU and the 6845 CRT controller during all modes of operation, except in 80 x 25 A/N modes (color and black and white). In 80 x 25 A/N modes, the CPU should access the display buffer during the horizontal retrace intervals. The CPU may, however, write to the required buffer at any time. A small amount of display glitches will result if the write does not occur during retrace intervals.

Character Generator

An 8K ROM is the character generator for alphanumeric modes. It contains dot patterns for 256 characters. The character set contains the following major grouping of characters: Sixteen special characters for game support; 15 characters for support of word processing editing functions; the standard 96 ASCII graphic set; 48 characters to support foreign languages; 48 characters for business block graphics, allowing for charts, boxes, and tables using single and double lines; 16 of the most often used Greek characters; and 15 of the most often used scientific notation characters.

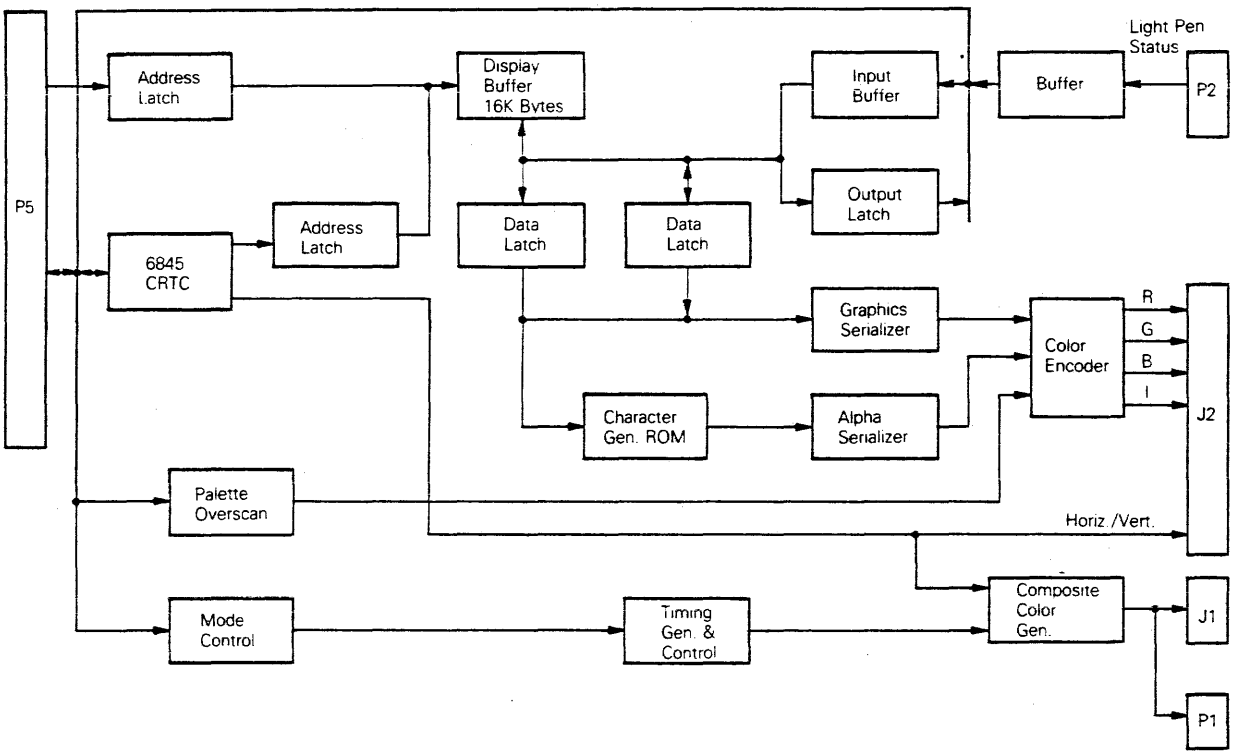
Timing Generator

This block generates the timing signals used by the 6845 CRT controller and by the display buffer. It also resolves the CPU/graphic controller contentions for accessing the display buffer.

Composite Color Generator

This block generates the composite video output signal for a composite video monitor.

Figure B-4 Color Graphics Board Block Diagram

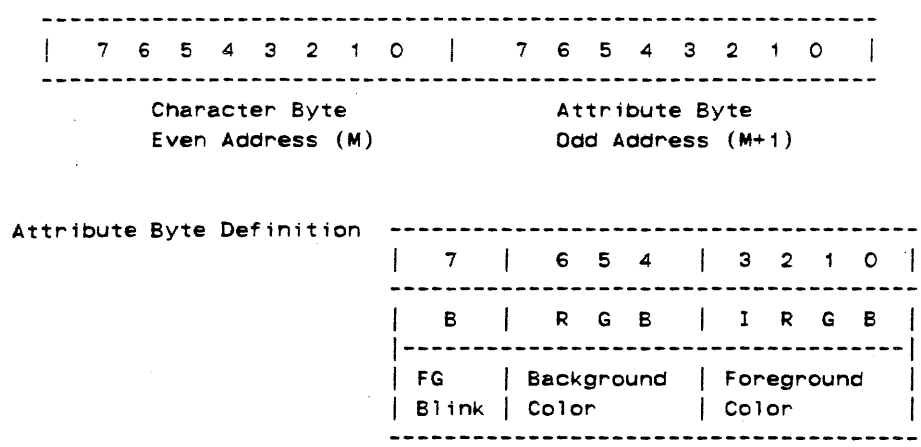


Modes of Operation

Alphanumeric and graphics are the two basic modes of operation. Each mode provides further options in different resolutions, color, and black and white.

Alphanumeric Mode--Every display character position is defined by two bytes in the display buffer for all option modes, color or black and white, 80 x 25 or 40 x 25 (Figure B-5).

Figure B-5 Attribute Byte Definition



Display characters are defined in an 8 x 8 box and are 5 x 7 with one line of lowercase descenders. The option mode features are described in the following paragraphs. Table B-4 lists the available colors.

80 x 25 Alphanumeric, Color, or Black and White Modes

Features of the 80 x 25 A/N, color, or black and white modes:

- Displays 25 rows of 80 characters
- Requires 4K display buffer
- Maximum of 256 character set
- 16 foreground colors and eight background colors for color mode

Table B-4 Summary of Available Colors

I	R	G	B	Color
0	0	0	0	Black
0	0	0	1	Blue
0	0	1	0	Green
0	0	1	1	Cyan
0	1	0	0	Red
0	1	0	1	Magenta
0	1	1	0	Brown
0	1	1	1	Light Gray
1	0	0	0	Dark Gray
1	0	0	1	Light Blue
1	0	1	0	Light Green
1	0	1	1	Light Cyan
1	1	0	0	Light Red
1	1	0	1	Light Magenta
1	1	1	0	Yellow
1	1	1	1	White

40 x 25 Alphanumeric, Color, or Black and White Modes

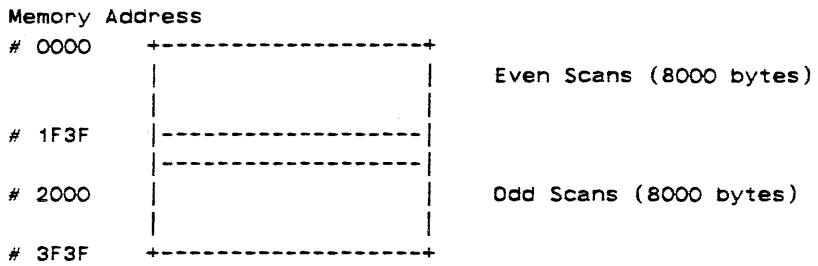
Features of the 40 x 25 alphanumeric, color, or black and white mode:

- Displays 25 rows of 40 characters
- Requires 2K display buffer
- Maximum of 256 character set
- 16 foreground colors and eight background colors for color mode

Graphics Mode

All options of graphics mode are memory mapped and shown in Figure B-6.

Figure B-6 Graphics Memory Map

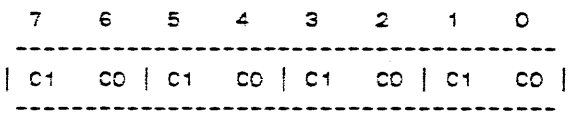


Address #0000 contains pel information for the upper left corner of the display area. The definition of each pel is dependent on the resolution of the graphics.

320 x 200 Color Graphics Mode

Features of the 320 x 200 color graphics mode are:

- Up to 200 rows of 320 pixels each (1 x 1)
- One out of four preselected colors in each box
- Requires 16K display buffer memory
- Memory mapped graphics, four pixels/byte



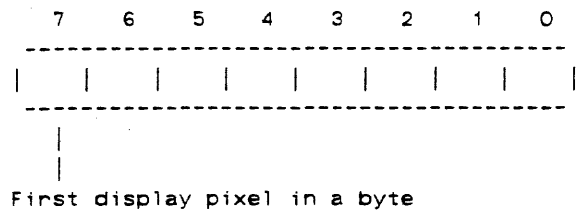
First display pixel C1 and C0 will select 4 of 16 preselected colors for each pixel. The border color can be one of 16 colors.

640 x 200 Black and White Graphics Mode

Features of the 640 x 200 black and white graphics mode are:

- Up to 200 rows of 640 pixels each (1 x 1)
- Black and white only

- Requires 16K display buffer
- Memory mapped graphics, eight pixels/byte



WY-600 Color Monitor Specifications

Line Voltage		115/220 VAC
Line Frequency		50 to 60 Hz
Power Consumption		60 W
Fuse		3 A standard blow
Ambient Air Temperature		10 to 35 degrees C
Nonoperating Air Temperature		-30 to 60 degrees C
Operating Altitude		7,000 feet ASL
Nonoperating Altitude		40,000 feet ASL
Environmental Humidity		20 to 80%, noncondensing
Scan Frequency	Horizontal	15.550 to 15.950 kHz
	Vertical	47.000 to 63.000 Hz
Display Time	Horizontal	44.5 microseconds
	Vertical	12.576 milliseconds
Resolution	Horizontal	640 dots
	Vertical	200 lines
Retrace Time	Horizontal	10.0 microseconds (max)
	Vertical	1.0 microseconds (max)
Display Size	Horizontal	248 mm ±8.00 mm
	Vertical	170 mm ±8.00 mm
Intensity	45 fL nominal, 40 minimum	
Focus	50%	
Linearity	Horizontal	10%
	Vertical	10%
Centering	Horizontal	± 7.00 mm
	Vertical	± 5.00 mm
Pincushion/Tilt	Horizontal	± 1.86 mm
	Vertical	± 1.50 mm
Direction	Neck north	
Warmup Time	30 minutes	

Meets EMI Specifications
FCC Rules and Regulations, Part 15, Sub-part J, Class B
UL and CSA approved

WY-600 Color Monitor

The WY-600 color monitor has a 14-inch (diagonal) screen, a base that allows it to tilt and swivel, a brightness control, and a fuse. It connects to the computer by a video cable that has a DB-9 shell connector at either end. Specifications and pin assignments for the color display subsystem connector on the back of the computer unit and the color video cable are shown in Figure B-7.

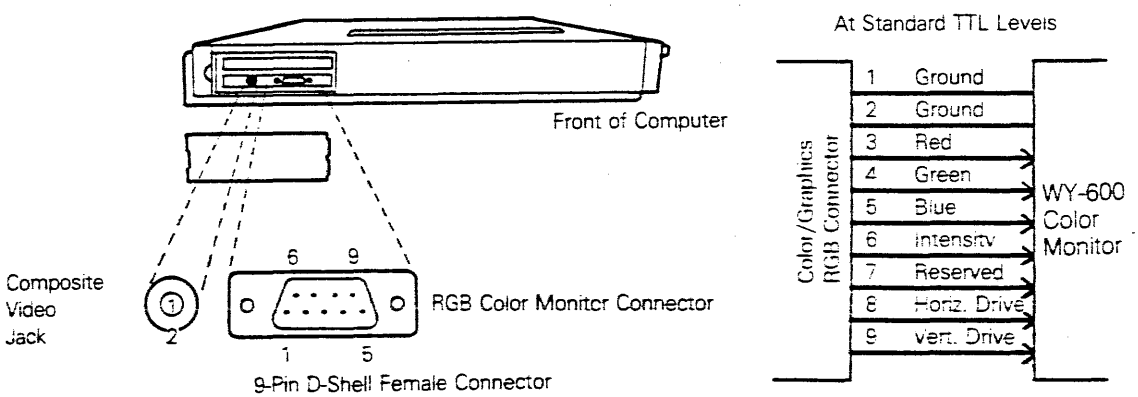
A second cable provides AC power to the monitor. Connect this cable to the AC input jack on the monitor and to the AC output socket on the computer. The computer socket is controlled by the computer on/off power switch; if you plug the monitor into this socket, turning off the computer will also turn off the monitor.

All alignments and adjustments are inside the monitor housing. Only a qualified service technician should open the monitor case to make adjustments.

In order to use the color graphics monitor, you must first install the color graphics option board, following the instructions given in *Replacing the Option Boards* in Chapter 2.

Note--To ensure reliable operation of the monitor, tighten the screws on both connectors of the video cable after plugging them in.

Figure B-7 Color Monitor Connector J2 and Video Cable Specifications



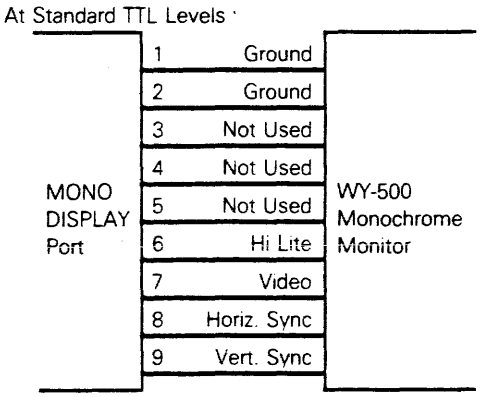
WY-500 Monochrome Monitor Specifications

Line Voltage		115/220 VAC
Line Frequency		50 to 60 Hz
Power Consumption		60 W
Fuse		1.5 A standard blow
Ambient Air Temperature		10 to 35 degrees C
Nonoperating Air Temperature		-30 to 60 degrees C
Operating Altitude		7,000 feet ASL
Nonoperating Altitude		40,000 feet ASL
Environmental Humidity		20 to 80%, noncondensing
Scan Frequency	Horizontal	18.807 to 18.432 kHz
	Vertical	50.834 to 49.820 Hz
Display Time	Horizontal	43.41 to 44.19 microseconds
	Vertical	18.6 to 19.00 milliseconds
Resolution	Horizontal	720 dots Vertical = 350 lines
Retrace Time	Horizontal	8.0 microseconds (max)
	Vertical	1.0 milliseconds (MAX)
Display Size	Horizontal	238 mm ±2.38 mm
	Vertical	176 mm ±2.38 mm
Display Intensity		60 fL nominal ±10 fL 40 fL normal ±6fL
Focus		50%
Linearity		Horizontal 12% Vertical 10%
Centering		Margin tolerance = ± 4.00 mm
Pincushion/Tilt Measurement Direction		± 1.19 mm Neck north
Warmup Time		30 minutes

Meets EMI Specifications
FCC Rules and Regulations, Part 15, Subpart J, Class B
UL and CSA approved

Height	12.0 in.
Weight	12.5 lbs.
Width	12.75 in
Movement	Tilt and swivel
Phosphor	P39 green
Synchronization	TTL levels
Attributes	Blink, reverse, blank, high and low intensity

Figure B-8 Monochrome Video Port Connector J2 and Video Cable Specifications



Note: Signal voltages are 0.0 to 0.6 VDC at low level and +2.4 to 3.5 VDC at high level

The WY-500 monochrome monitor has a 14-inch (diagonal) screen, a base that allows it to tilt and swivel, a brightness control, and a fuse. It connects to the computer by a video cable that has a D-shell 9-pin connector at either end. Specifications and pin assignments for the monochrome display connector are shown in Figure B-8.

A second cable provides AC power to the monitor. Connect this cable to the AC input jack on the monitor and to the AC output socket on the computer. The computer socket is controlled by the computer on/off power switch. If you plug the monitor into this socket, turning off the computer will also turn off the monitor. If you attach a second monitor, you will need to plug it into a wall outlet and turn it on with the on/off switch.

All alignments and adjustments are inside the monitor housing. Only a qualified service technician should open the monitor housing to make adjustments.

Note--To ensure reliable operation of the monitor, tighten the screws on both connectors of the video cable after plugging them in.

To add an enhanced monochrome option, see *Replacing the Option Boards* in Chapter 2 for installation instructions on the option board and changing the video-off jumper.

Table B-5 Video Control Port (3B8H) Bit Map

Bit No.	Function
0	Not Used
1	Not Used
2	Not Used
3	+Video Enable
4	Not Used
5	+Enable Blink
6	Not Used
7	Not Used

Table B-6 Video Status Port (3BAH) Bit Map

Bit No.	Function
0	+Horizontal Sync
1	Reserved
2	Reserved
3	+Video

APPENDIX C SPECIFICATIONS

This appendix provides specifications for the following items:

Computer

Operating Requirements

Operating Temperature	50 to 92 degrees Fahrenheit (10 to 33 degrees centigrade)
Relative Humidity	10 to 80 percent, noncondensing
Operating Altitude	0 to 10,000 feet

Storage Requirements

Temperature	-40 to 140 degrees Fahrenheit (-40 to 60 degrees centigrade)
Relative Humidity	8 to 80 percent, noncondensing

Power Requirements

Domestic Power	115 VAC ±10 percent, 60 Hz
International Power	220 VAC ± 10 percent, 50 Hz
Power Consumption	150 watts, 1.3 amps at nominal current
Plug	3-prong, grounded

Computer/Keyboard

	Computer	Keyboard
Height	2.75 in.	1.25 in.
Depth	15.75 in.	6.5 in.
Width	18.75 in.	18.75 in.
Net Weight	18.75 lbs.	4 lbs.
Shipping Weight	Total shipping weight is 31 lbs.	
Clearances Required	Three inches on each side of the computer, three inches above the monitor.	

N-key rollover

Microprocessor/Memory

CPU	Intel 8088 microprocessor (processing speed, 4.77 MHz), with provision for an 8087 coprocessor
Memory	RAM: 256K (expandable to 640 K) ROM: 8K boot ROM
Operating System	MS-DOS, version 2.11
Additional Software	GW-BASIC

Diskette Drives

Type	Half height
Diskettes	5 1/4-inch 48 TPI, double-sided, double-density, 9 sectors per track, 512 bytes per sector, 40 tracks per side
Storage Capacity	362 kilobytes
Transfer Rate	250K per second
Access Time	Track to track: 6 ms Average access time 97 ms Settling time: 15 ms

Hard Disk Drive

Type	Half height, Winchester
Storage Capacity	10 megabytes
Transfer Rate	5.0 megabits per second
Access Time	Track to track: 23 ms Average access time 65 ms Maximum access time 170 ms
Media	Hard disk
Number of Tracks	1224

Size

Height	1.68 inches (42.7 mm)
Width	5.75 inches (146.05 mm)
Depth	8.0 inches (203.2 mm)
Weight	3.0 lbs. (2.1 kg)

Temperature	
Operating	50 F to 113 F (10 C to 45 C)
Nonoperating	-40 F to 140 F (-40 C to 60 C)
Operating Humidity	8% to 80% (noncondensing)
Shock	
Operating	10 G's
Nonoperating	40 G's
Average Latency	8.33 ms
Error Rates	
Soft Read Errors	1 per 10^{10} bits read
Hard Read Errors	1 per 10^{12} bits read
Seek Errors	1 per 10^{6} seeks
Design Life	5 years (11,000 hours MTBF)
Disk Speed	3600 rpm $\pm$1%
Recording Mode	MFM
Power	+12 VDC $\pm$5% 1.0 A (3.2 A maximum) +5 VDC $\pm$5% 1.0 A (1.2 A maximum)
Maximum Ripple	1% with equivalent resistive load
Input/Output	
Serial	Two RS-232C ports. Asynchronous, 110 to 9600 bps
Parallel	One Centronics printer port compatible with most printers
Option	Two IBM-compatible option slots to connect external devices
Keyboard Format	Low profile keyboard with two-position height adjustment. IBM compatible layout with 83 sculpted keys. Includes 10 function keys and an accounting style numeric keypad.

Peripherals Supported

- WY-500 and other IBM compatible monochrome monitors
- Color graphics option (includes WY-600 color monitor and color graphics card)
- Multifunction backplane

Table C-I Keyboard Scan Code Register (R/O) Port A (60H)

Bit No.	XT Mode	PC Mode if PB7=0	PC Mode if PB7=1
D0	Scan Code	Scan Code	Scan Code
D1	Scan Code	Scan Code	Scan Code
D2	Scan Code	Scan Code	Scan Code
D3	Scan Code	Scan Code	Scan Code
D4	Scan Code	Scan Code	SW 5
D5	Scan Code	Scan Code	SW 6
D6	Scan Code	Scan Code	SW 7
D7	Scan Code	Scan Code	SW 8

Table C-2 System Control Register (R/W) Port B (61H)

Bit No.	Signal	Function
D0	ENSPK	Speaker enabled if low
D1	SPKDATA	Direct speaker data
D2	PB2	PORT C select in PC mode
D3	PB3	PORT C select in XT mode
D4	LCT	Diskette write precompensation
D5	ENIOCH	Reset BASIC NMI & NMI3 if low
D6	PB6	Keyboard self test if low
D7	PB7	Reset keyboard interrupt if high; used as PORTA select in PC mode

Table C-3 System Status Register (R/O) Port C (62H)

Bit No.	XT Mode: if PB3=0	XT Mode if PB3=1	PC Mode
D0	SW 1	SW 5	0
D1	SW 2	SW 6	SW 3
D2	SW 3	SW 7	SW 4
D3	SW 4	SW 8	0
D4	Speaker Tone		Speaker Tone
D5	Speaker Output		Speaker Output
D6	NMI3		NMI3
D7			

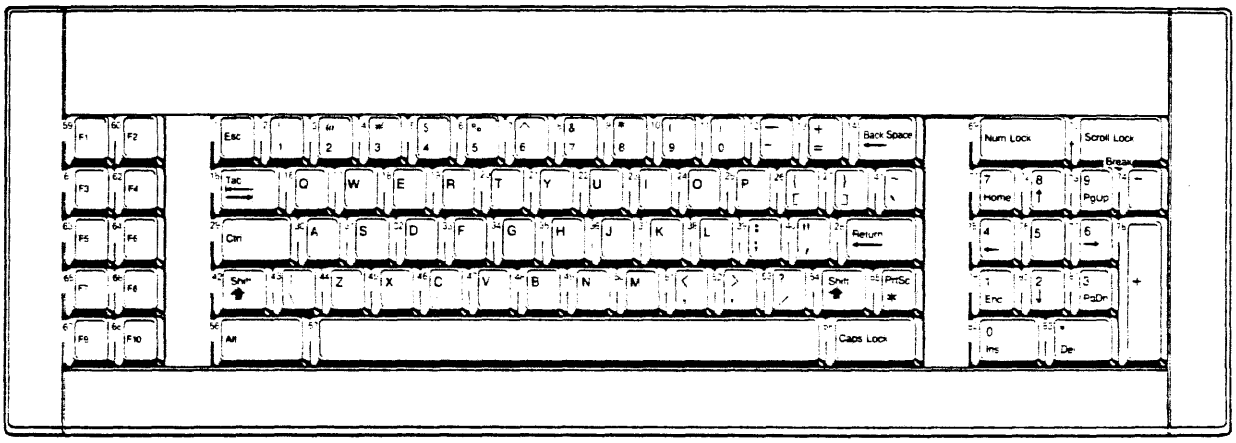
KEYBOARD

See Appendix F for ASCII character codes.

Table C-4 Keyboard Connector

Pin No.	Signal
1 and 2	Ground
3	+5 Volts
4-10	Keyboard Scan
11	Keyboard Data
12	NC

Figure C-1 The Keyboard



Power Supply

Operating Characteristics

Input Requirements

Voltage at 50/60 Hz	Nominal	110VAC RMS	220VAC RMS
	Minimum	95VAC RMS	190VAC RMS
	Maximum	132VAC RMS	264VAC RMS
Frequency	50/60Hz ± 3Hz		
Current	2.2 amps at 95VAC		

Output Requirements

Voltage (VDC) Nominal	Current (amps) Minimum	Maximum	Regulation Tolerance
+5	5.3	11	±5%
-5	0.0	0.3	±10%
+12	1.5	3	±5%
-12	0.0	0.22	±10%

Table C-5 DC Power Supply Connector J12

Pin No.	Signal Name
1	+5VDC
2	+5VDC
3	+5VDC
4	+5VDC
5	Ground
6	Ground
7	Ground
8	Ground
9	+12VDC
10	+12VDC
11	-12VDC

Table C-6 AC Input Power Supply Connector W1

Pin No.	Signal Name
D	Line
E	Chassis Ground
C	Neutral

Table C-7 Disk Drive Power Connector P1

Pin No.	Signal Name
1	+12 VDC
2	Ground
3	Ground
4	+ 5 VDC

Table C-8 LPT1 Parallel Port Connector P3

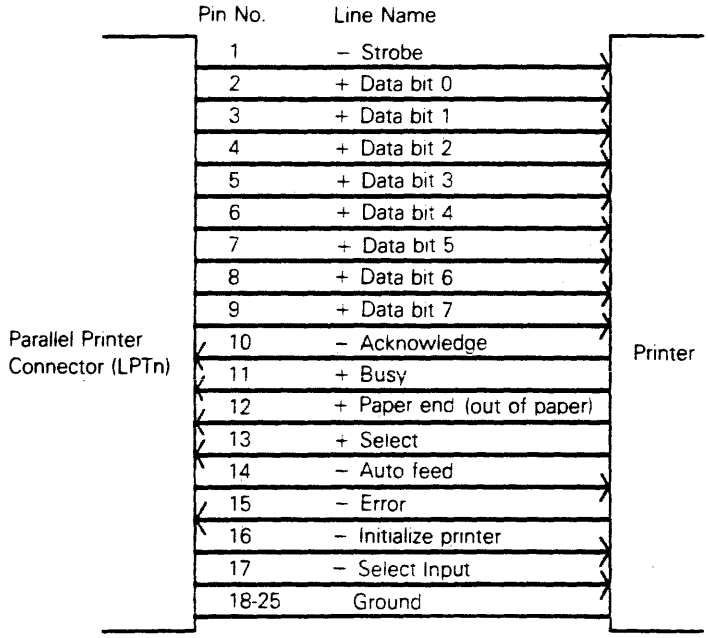


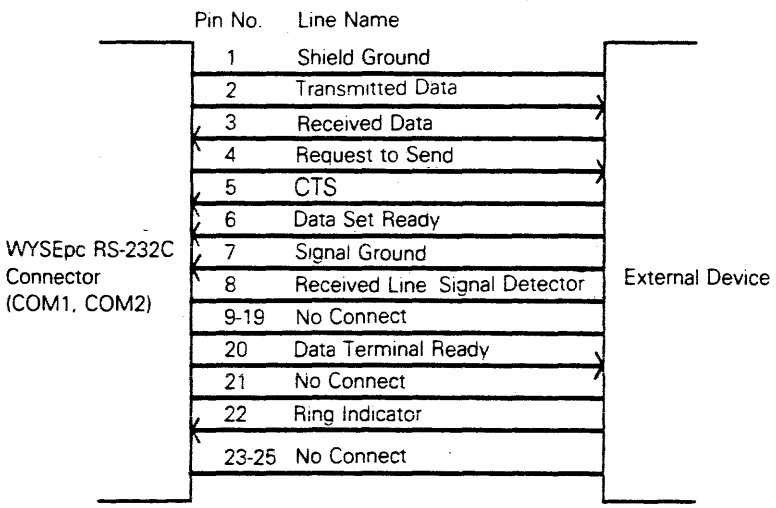
Table C-9 R/O Parallel Status Port (3BDH)

Bit No.	Signal	Description
D0-D2	Not Used	
D3	-ERR	Printer error if logic 0
D4	SELECT	Printer listening if logic 1
D5	PAGE END	Out of paper if logic 1
D6	-ACK	Ready to accept data if logic 0
D7	-BUSY	Printer busy if logic 0

Table C-10 (R/W) Parallel Control Port (3BE)

Bit No.	Signal	Definition
D0	STROBE	Data strobe out if logic 1
D1	AUTO FEED	Auto line feed if logic 1
D2	-INIT	Initialize printer if logic 0
D3	SELECT IN	Select printer if logic 1
D4	IRQ ENABLE	Enable IRQ7 if logic 1
D5-D7	NOT USED	

Table C-11 COM1 and COM2 RS-232C Connectors



Note--If you add an internal modem board that uses one of the serial ports, you must configure it to use the COM1 serial port I/O address. You must also disable the COM1 circuit on the CPU logic board. This procedure is described under "Disabling Built-In Functions" in Chapter 2 of this manual.

Standard Backplane

Electrical Specifications

	Minimum	Nominal	Maximum
Output Voltage	-4.75	-5.0	-5.25
Output Current			1.5 amps

-5 volt regulator output
National LM7905 TO-220 package

Board Power Requirements

Typical current	+5 volts = 0.054 amps
Maximum current	+5 volts = 0.092 amps

Table C-12 Standard or Multifunction Backplane Connector J1

Signal Name	Pin No. B	Pin No. A	Signal Name
GND	1	1	Not Used
BRESET	2	2	D7
+5V	3	3	D6
IRQ2	4	4	D5
-5V	5	5	D4
DRQ2	6	6	D3
-12V	7	7	D2
Not Used	8	8	D1
+12V	9	9	D0
GND	10	10	IOCHRDY
-XMW	11	11	AENBRD
-XMR	12	12	A19
-X10W	13	13	A18
-XIOR	14	14	A17
-DAK3	15	15	A16
DRQ3	16	16	A15
-DAK1	17	17	A14
DRQ1	18	18	A13
-DAK0B	19	19	A12
CLK88	20	20	A11
IRQ7	21	21	A10
IRQ6	22	22	A9
IRQ5	23	23	A8
IRQ4	24	24	A7
IRQ3	25	25	A6
-DAK2	26	26	A5
TC	27	27	A4
ALE	28	28	A3
+5V	29	29	A2
OSC	30	30	A1
GND	31	31	A0

Table C-13 Standard or Multifunction Backplane Connectors J2 and J3

I/O Access Opening

Signal Name	Pin No.	Pin No.	Signal Name
GND	B1	A1	NC
+BRESET	B2	A2	+D7
+5V	B3	A3	+D6
+IRQ2	B4	A4	+D5
-5VDC	B5	A5	+D4
+DRQ2	B6	A6	+D3
-12V	B7	A7	+D2
NC	B8	A8	+D1
+12V	B9	A9	+D0
GND	B10	A10	+IOCHRDY
-MWB	B11	A11	+AENBRD
-MRB	B12	A12	+A19
-IOWB	B13	A13	+A18
-IORB	B14	A14	+A17
-DAK3	B15	A15	+A16
+DRQ3	B16	A16	+A15
-DAK1	B17	A17	+A14
+DRQ1	B18	A18	+A13
-DAK0B	B19	A19	+A12
CLK88B	B20	A20	+A11
+IRQ7	B21	A21	+A10
+IRQ6	B22	A22	+A9
+IRQ5	B23	A23	+A8
+IRQ4	B24	A24	+A7B
+IRQ3	B25	A25	+A6B
-DAK2	B26	A26	+A5B
+TC	B27	A27	+A4B
+ALEB	B28	A28	+A3B
+5V	B29	A29	+A2B
+OSC	B30	A30	+A1B
GND	B31	A31	+A0B

Component Side

Table C-14 Backplane I/O Channel Signal Descriptions

Signal	I/O	Description
OSC	O	Oscillator: High-speed clock with 70ns period (14.31818MHz).
CLK88B	O	System clock: Divide-by-3 of the oscillator; has a 210ns (4.77MHz) period; 33% duty cycle.

Table C-14 Backplane I/O Channel Signal Descriptions (Continued)

Signal	I/O	Description
BRESET	O	Used to reset or initialize logic during outage of low line voltage; synchronized to falling edge of clock; active high.
A0B-A7B A8-A19	O	Address bits 0-19: Used to address memory and I/O devices within the system; the 20 address lines permit access of up to 1MB of memory; A0B is the least significant bit (LSB); A19 is the most significant bit (MSB); generated by the DMA controller or the 8088 processor; active high.
D0-D7	I/O	Data Bits 0-7: Provide data bus bits 0 to 7 for the 8088 processor, memory, and I/O devices; D0 is the LSB; D7 is the MSB; active high.
ALEB	O	Address Latch Enable: Provided by bus controller; used on CPU logic board to latch valid addresses from the 8088 processor; available to the I/O channel as indicator of valid address when used with AENB; processor addresses are latched with the falling edge of ALEB.
IOCHRDY	I	I/O Channel Ready: Normally high (ready) line, pulled low (not ready) by an I/O or memory device to lengthen I/O or memory cycles. A slow peripheral device using this line should drive it low when a valid address and a read or write command is detected; should not be held low any longer than 10 clock cycles. I/O or memory cycles are extended by an integral number of CLK88B cycles (210ns).
IRQ2-IRQ7	I	Interrupt Request 2-7: Used to tell 8088 processor that an I/O device needs attention; IRQ2 highest priority; IRQ7 lowest priority; an interrupt request is produced by lifting a line (low to high) and holding it high until acknowledged by the interrupt service routine.
-IORB	O	-I/O Read Command: Instructs an I/O device to drive data onto the data bus; may be driven by the DMA controller or the 8088 processor; signal is active low.
-IOWB	O	-I/O Write Command: Instructs an I/O device to read data on the data bus; may be driven by the DMA controller or the 8088 processor; signal is active low.

Table C-14 Backplane I/O Channel Signal Descriptions (Continued)

Signal	I/O	Description
-MRB	O	Memory Read Command: Instructs memory to drive data onto the data bus; may be driven by the DMA controller or the 8088 processor; signal is active low.
-MWB	O	Memory Write Command: Instructs memory to store data present on the data bus; may be driven by the DMA controller or the 8088 processor; signal is active low.
DRQ1-DRQ3	I	DMA Request 1-3: Asynchronous channel requests by peripherals to get DMA service; DRQ3 lowest priority; DRQ1 highest priority; request produced by raising a DRQ line to active (high) level; must be held high until corresponding DAK line goes active.
DAK0B,O DAK1-DAK3		DMA Acknowledge 0-3: Used to acknowledge DMA requests (DRQ1-DRQ3) and to refresh dynamic memory (DAK0B); active low.
AENB	O	Address Enable: Permits DMA transfers to happen; DMA controller has control of the write command lines (memory and I/O), read command lines (memory and I/O), data bus, and address bus when active (high).
TC	O	Terminal Count: Produces pulse when terminal count for any DMA channel is reached; active high.

Table C-15 Multifunction Backplane Connector J4

Pin No.	Signal Name
1	-CASOUT
2	+5V
3	A6
4	A3
5	A0
6	A4
7	A2
8	A5
9	A1
10	A7
11	-POR
12	Ground

DISKETTE DRIVE

Electrical Specifications

Epson SD-521:

Typical current	+5V	0.40 amps
Maximum current	+5V	0.55 amps
Typical current	+12V	0.35 amps
Maximum current	+12V	1.40 amps (motor start/seek surge)
Power Dissipation	6.2 watts typical	
Motor Turn On Time	500 mS max	

Sanyo FDA5200:

Typical current	+5V	0.6A
Maximum current	+12V	1.0 amps
Power Dissipation	9 watt	typical
Motor Turn On Time	400 mS	max

Table C-16 Diskette Drives A and B Connectors J14 and J16

Pin No.	I/O	Signal
1-7		No connect
8	In	-Index
9		No connect
10	Out	-Drive select
11-15		No connect
16	Out	-Motor enable
17		No connect
18	Out	-Dir in
19		No connect
20	Out	-Step
21		No connect
22	Out	-Write data
23		No connect
24	Out	-Write enable
25		No connect
26	In	-Trk 00
27		No connect
28	In	-Write protect
29		No connect
30	In	-Read data
31		No connect
32	Out	-Side1
33		No connect
34	In	-Ready

Table C-17 Diskette Drive Connector Signal Descriptions

Signal	Description
-Drive Select	Disables all drivers to the controller and receivers except motor enable when asserted. Signal is active low.
-Motor Enable	Turns on drive motor when asserted. Signal is active low.
-Step	Selected drive moves the read/write head in or out according to the direction line for each pulse. Pulse is active low.
-Direction	Read/write head moves one cylinder toward spindle when asserted. Moves away from spindle when disasserted. Signal is active low.
-Side1	Head 1 (upper) selected when asserted. Signal is active low.
-Write Data	Flux change is stored on diskette for each inactive to active change when write enable is asserted.
-Write Enable	Disables write current in read/write head when asserted. Signal is active low.
-Index	Drive provides one pulse per diskette revolution. Signal is active low.
-Write Protect	Asserted when a write-protected diskette is present. The signal is active low.
-Trk 00	Asserted when read/write head is over track 0. Signal is active low.
-Read Data	This line is pulsed for each flux change read from the diskette.
-Ready	Asserted if a diskette has been inserted in the drive and is rotating normally. Signal is active low.

Table C-18 Diskette Control Port (3F0H)

Bit No.	Signal	Function
D0	DRV SEL 0-DRV SEL 0:1	00 selects drive A
D1	DRV SEL 1-DRV SEL 0:1	01 selects drive B
D2	/RESET	Resets disk controller chip
D3	IRQEN	Enables IRQ6
D4	MOTOR EN A	Turns on drive A motor
D5	MOTOR EN B	Turns on drive B motor
D6:D7	NOT USED	

Table C-19 Diskette Drive Controller Status Register (3F4H)

Bit No.	Signal	Function
D0	FDD 0 BUSY	Drive 0 in seek mode (N/A)
D1	FDD 1 BUSY	Drive 1 in seek mode (N/A)
D2	FDD 2 BUSY	Drive 2 in seek mode (N/A)
D3	FDD 3 BUSY	Drive 3 in seek mode(N/A)
D4	FDC BUSY	Read or write command in process
D5	EXM	Execution mode
D6	DIO	Data register transfer direction
D7	RQM	Data register ready

Table C-20 Read/Write Diskette Controller Data Register (3F5H)

Bit No.	Function
D0	Data
D1	Data
D2	Data
D3	Data
D4	Data
D5	Data
D6	Data
D7	Data

Hard Disk Drive Controller Board

The hard disk drive controller board connects to the hard disk via a flat (data/control) cable. It is buffered on the I/O bus and uses the DMA on the CPU logic board for data transfers. An interrupt level indicates the completion of an operation and the status conditions requiring 8088 processor attention.

An eight-bit read-only status register and an eight-bit data register on the disk controller may be accessed by the 8088 processor. The disk controller status register may be accessed any time. The data register (actually several registers in a stack with only one register available to the data bus) stores parameters and commands, and gives controller status information. Writing to port address 322H generates the controller-select pulse.

Table C-21 Hard Disk Drive Connector J1

Signal	Pin No.
GND, Odd Numbers	1, 3, 5, 7...33
Reserved	4, 16, 30, 32
-Reduced Write Current	2
-Write Gate	6
-Seek Complete	8
-Track 00	10
-Write Fault	12
-Head Select 2 0	14
-Head Select 2 1	18
-Index	20
-Ready	22
-Step	24
-Drive Select 1	26
-Drive Select 2	28
-Direction In	34

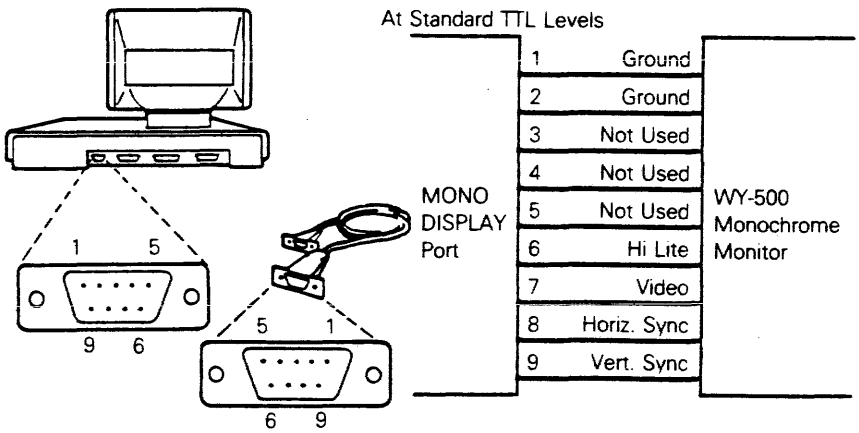
Table C-22 Hard Disk Drive Connector J2 or J3

Signal	Pin No.
GND	2, 4, 6, 8, 12, 16, 20
Drive Select	1
Reserved	3, 7
Spare	9, 10, 5
GND	11
MFM Write Data	13
-MFM Write Data	14
GND	15
MFM Read Data	17
-MFM Read Data	18
GND	19

Table C-23 Hard Disk Controller I/O Channel Signal Descriptions

Signal	Description
A0B-A7B, A8-A19	20-bit positive true address; the LSB ten bits hold the I/O address with 320H-323H when the system executes an I/O read or write.
D0-D7	Positive eight-bit data bus; status information and data passes between the CPU logic board and the controller.
$\overline{\text{IOR}}$	Negative true; asserted when CPU logic board reads status or data under programmed I/O or DMA control.
$\overline{\text{IOW}}$	Negative true; asserted when CPU logic board sends command or data to the controller under programmed I/O or DMA control.
AENB	Positive true signal; asserted when DMA generates the -IORB or -IOWB signals and has control of address and data buses.
BRESET	Positive true signal; forces the controller to its beginning power-up state.
IRQ5	Positive true interrupt request signal; asserted by controller to interrupt the CPU logic board on the return final status byte from the controller.
DRQ3	Positive true DMA-request signal; asserted by the controller when data is available to transfer to or from the controller under DMA control; remains active until the CPU logic board's DMA channel activates the -DAK3 signal in response.

Figure C-2 Monochrome Video Port Connector J2 and Video Cable Specifications



Note: Signal voltages are 0.0 to 0.6 VDC at low level and +2.4 to 3.5 VDC at high level

Table C-24 Video Control Port (Hex 3B8) Bit Map

Bit No.	Function
0	Not Used
1	Not Used
2	Not Used
3	+Video Enable
4	Not Used
5	+Enable Blink
6	Not Used
7	Not Used

Table C-25 Video Status Port (Hex 3BA) Bit Map

Bit No.	Function
0	+Horizontal Sync
1	Reserved
2	Reserved
3	+Video

APPENDIX D INTERNAL SWITCH SETTINGS

Table D-1 System Configuration

Switch										Configuration
1	2	3	4	5	6	7	8	9	10	
Off	On	Off	Off	Off	Off	Off	On	On	On	256K, monochrome display, 2 floppies, no 8087
Off	On	Off	Off	Off	Off	On	On	On	On	256K, monochrome display, 1 floppy, 1 hard disk, no 8087
Off	On	Off	Off	On	Off	Off	On	On	On	256K, 80-column color display, graphics mode (corresponds to MODE CO80), 2 floppies, no 8087
Off	On	Off	Off	Off	On	On	On	On	On	256K, 40-column color display, graphics mode (corresponds to MODE CO40), 1 floppy, 1 hard disk, no 8087
Off	Off	Off	Off	Off	Off	Off	On	On	On	256K, monochrome display, 2 floppies, 8087
Off	Off	Off	Off	Off	Off	On	On	On	On	256K, monochrome display, 1 floppy, 1 hard disk, 8087
Off	Off	Off	Off	On	Off	Off	On	On	On	256K, 80-column color display, graphics mode (corresponds to MODE CO80), 2 floppies, 8087
Off	Off	Off	Off	On	Off	On	On	On	On	256K, 40-column color display, graphics mode (corresponds to MODE CO40), 1 floppy, 1 hard disk, 8087

Figure 2-2 DIP Switch

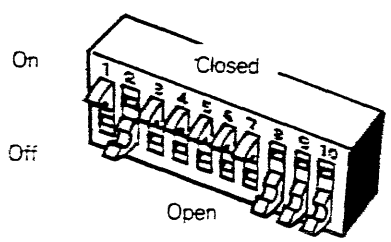


Table 2-1 Internal DIP Switch Settings (Continued)

Notes to System Configuration Table:

Note 1
Off = Open switch = Logic 1
On = Closed switch = Logic 0
Color display = High-resolution graphics display with color graphics car
Hard disk = Winchester hard disk with hard disk controller card

Note 2

Switch	Name	Setting		
1	Loop	On = factory setting; always Off in normal use		
2	Loop	On = no 8087 numeric coprocessor present Off = 8087 coprocessor installed		
3	RAM0 RAM1	Switches 3 and 4 indicate the total size of memory installed on the CPU logic board. The CPU logic board detects the presence of the optional malfunction backplane with its additional 256K RAM. No DIP switch setting is required.		
		3	Off	256K memory (standard)
		4	Off	
		3	On	192K memory
		4	Off	
		3	Off	128K memory
		4	On	
5	DISP0	Switches 5 and 6 set the default display		
6	DISP1	mode. See Chapter 5 of the WYSEpc User's Guide for a discussion of the MODE command.		
		5	Off	Monochrome display
		6	Off	
		5	On	MODE CO80
		6	Off	
		5	Off	MODE CO40
		6	On	
7	DR0	Switches 7 and 8 indicate the number of		
8	DR1	diskette drives installed.		
		7	On	One diskette drive installed
		8	On	
		7	Off	Two diskette drives installed
		8	On	
9	Reserved	Always On		
10	Reserved	Always On		

APPENDIX E JUMPER AND CONNECTOR SUMMARY

Jumper Summary

Jumper Number	Function
JC4	Video disable
JC5	COM1 disable
JC6	COM1 IRQ disable
JC7	LPT1 disable
JC8	LPT1 LPT1 disable
R102	Trace cut for 256K RAM selection

Connector Summary

Connector Function No.	Description
P1	COM1 Serial port connector, 25-pin, male, D-shell
P2	COM2 Serial port connector, 25-pin, male, D-shell
P3	LPT1 Parallel port connector, 25-pin, female, D-shell
J1	Keyboard connector, 12-pin, male header
J2	Video connector, 9-pin, female, D-shell
J12	Power connector, 11-pin, male header
J13	Standard backplane connector, 62-pin, male header
J14	Diskette drive A connector, 34-pin, male header
J16	Diskette drive B connector, 34-pin, male header
J17	Multifunction backplane connector, 12-pin, male header

APPENDIX F ASCII CHARACTER CODES

ASCII Character	CTRL Codes	Bit / Binary Value	7 / 128	6 / 64	5 / 32	4 / 16	3 / 8	2 / 4	1 / 2	0 / 1	Oct.	Dec.	Hex
NUL	@		0	0	0	0	0	0	0	0	000	000	00
SOH			0	0	0	0	0	0	0	1	001	001	01
STX			0	0	0	0	0	0	1	0	002	002	02
ETX			0	0	0	0	0	0	1	1	003	003	03
EOT			0	0	0	0	0	1	0	0	004	004	04
ENQ	E		0	0	0	0	0	1	0	1	005	005	05
ACK			0	0	0	0	0	1	1	0	006	006	06
BEL	G		0	0	0	0	0	1	1	1	007	007	07
BS	H		0	0	0	0	1	0	0	0	010	008	08
HT	I		0	0	0	0	1	0	0	1	011	009	09
LF	J		0	0	0	0	1	0	1	0	012	010	0A
VT	K		0	0	0	0	1	0	1	1	013	011	0B
FF	L		0	0	0	0	1	1	0	0	014	012	0C
CR	M		0	0	0	0	1	1	0	1	015	013	0D
SO	N		0	0	0	0	1	1	1	0	016	014	0E
SI	O		0	0	0	0	1	1	1	1	017	015	0F
DLE	P		0	0	0	1	0	0	0	0	020	016	10
DC1	Q		0	0	0	1	0	0	0	1	021	017	11
DC2	R		0	0	0	1	0	0	1	0	022	018	12
DC3	S		0	0	0	1	0	0	1	1	023	019	13
DC4	T		0	0	0	1	0	1	0	0	024	020	14
NAK			0	0	0	1	0	1	0	1	025	021	15
SYN	V		0	0	0	1	0	1	1	0	026	022	16
ETB			0	0	0	1	0	1	1	1	027	023	17
CAN	X		0	0	0	1	1	0	0	0	030	024	18
EM			0	0	0	1	1	0	0	1	031	025	19

ASCII Code Conversion Listing Continued

ASCII Character	CTRL Codes	Bit / Binary Value	7 / 128	6 / 64	5 / 32	4 / 16	3 / 8	2 / 4	1 / 2	0 / 1	Oct.	Dec.	Hex
SUB	Z		0	0	0	1	1	0	1	0	032	026	1A
ESC	[		0	0	0	1	1	0	1	1	033	027	1B
FS			0	0	0	1	1	1	0	0	034	028	1C
GS			0	0	0	1	1	1	0	1	035	029	1D
RS	|		0	0	0	1	1	1	1	0	036	030	1E
US	-		0	0	0	1	1	1	1	1	037	031	1F
SP			0	0	1	0	0	0	0	0	040	032	20
!			0	0	1	0	0	0	0	1	041	033	21
"			0	0	1	0	0	0	1	0	042	034	22
#			0	0	1	0	0	0	1	1	043	035	23
$			0	0	1	0	0	1	0	0	044	036	24
%			0	0	1	0	0	1	0	1	045	037	25
&			0	0	1	0	0	1	1	0	046	038	26
' (apostrophe			0	0	1	0	0	1	1	1	047	039	27
(			0	0	1	0	1	0	0	0	050	040	28
)			0	0	1	0	1	0	0	1	051	041	29
*			0	0	1	0	1	0	1	0	052	042	2A
+			0	0	1	0	1	0	1	1	053	043	2B
, (comma)			0	0	1	0	1	1	0	0	054	044	2C
- (hyphen)			0	0	1	0	1	1	0	1	055	045	2D
.(period)			0	0	1	0	1	1	1	0	056	046	2E
/			0	0	1	0	1	1	1	1	057	047	2F
0			0	0	1	1	0	0	0	0	060	048	30
1			0	0	1	1	0	0	0	1	061	049	31
2			0	0	1	1	0	0	1	0	062	050	32
3			0	0	1	1	0	0	1	1	063	051	33
4			0	0	1	1	0	1	0	0	064	052	34
5			0	0	1	1	0	1	0	1	065	053	35
6			0	0	1	1	0	1	1	0	066	054	36
7			0	0	1	1	0	1	1	1	067	055	37
8			0	0	1	1	1	0	0	0	070	056	38

ASCII Code Conversion Listing Continued

ASCII Character	CTRL Codes	Bit 7	6	5	4	3	2	1	0	Oct.	Dec.	Hex
		Binary Value 128	64	32	16	8	4	2	1			
9		0	0	1	1	1	0	0	1	071	057	39
:		0	0	1	1	1	0	1	0	072	058	3A
;		0	0	1	1	1	0	1	1	073	059	3B
<		0	0	1	1	1	1	0	0	074	060	3C
=		0	0	1	1	1	1	0	1	075	061	3D
>		0	0	1	1	1	1	1	0	076	062	3E
?		0	0	1	1	1	1	1	1	077	063	3F
@		0	1	0	0	0	0	0	0	100	064	40
A		0	1	0	0	0	0	0	1	101	065	41
B		0	1	0	0	0	0	1	0	102	066	42
C		0	1	0	0	0	0	1	1	103	067	43
D		0	1	0	0	0	1	0	0	104	068	44
E		0	1	0	0	0	1	0	1	105	069	45
F		0	1	0	0	0	1	1	0	106	070	46
G		0	1	0	0	0	1	1	1	107	071	47
H		0	1	0	0	1	0	0	0	110	072	48
I		0	1	0	0	1	0	0	1	111	073	49
J		0	1	0	0	1	0	1	0	112	074	4A
K		0	1	0	0	1	0	1	1	113	075	4B
L		0	1	0	0	1	1	0	0	114	076	4C
M		0	1	0	0	1	1	0	1	115	077	4D
N		0	1	0	0	1	1	1	0	116	078	4E
O		0	1	0	0	1	1	1	1	117	079	4F
P		0	1	0	1	0	0	0	0	120	080	50
Q		0	1	0	1	0	0	0	1	121	081	51
R		0	1	0	1	0	0	1	0	122	082	52
S		0	1	0	1	0	0	1	1	123	083	53
T		0	1	0	1	0	1	0	0	124	084	54
U		0	1	0	1	0	1	0	1	125	085	55
V		0	1	0	1	0	1	1	0	126	086	56
W		0	1	0	1	0	1	1	1	127	087	57

ASCII Character	CTRL Codes	Bit 7 / Binary Value 128	6 / 64	5 / 32	4 / 16	3 / 8	2 / 4	1 / 2	0 / 1	Oct.	Dec.	Hex
X		0	1	0	1	1	0	0	0	130	088	58
Y		0	1	0	1	1	0	0	1	131	089	59
Z		0	1	0	1	1	0	1	0	132	090	5A
[		0	1	0	1	1	0	1	1	133	091	5B
/		0	1	0	1	1	1	0	0	134	092	5C
]		0	1	0	1	1	1	0	1	135	093	5D
|		0	1	0	1	1	1	1	0	136	094	5E
_	(underline)	0	1	0	1	1	1	1	1	137	095	5F
		0	1	1	0	0	0	0	0	140	096	60
a		0	1	0	0	0	0	0	1	141	097	61
b		0	1	1	0	0	0	1	0	142	098	62
c		0	1	1	0	0	0	1	1	143	099	63
d		0	1	1	0	0	1	0	0	144	100	64
e		0	1	1	0	0	1	0	1	145	101	65
f		0	1	1	0	0	1	1	0	146	102	66
g		0	1	1	0	0	1	1	1	147	103	67
h		0	1	1	0	1	0	0	0	150	104	68
i		0	1	1	0	1	0	0	1	151	105	69
j		0	1	1	0	1	0	1	0	152	106	6A
k		0	1	1	0	1	0	1	1	153	107	6B
l		0	1	1	0	1	1	0	0	154	108	6C
m		0	1	1	0	1	1	0	1	155	109	6D
n		0	1	1	0	1	1	1	0	156	110	6E
o		0	1	1	0	1	1	1	1	157	111	6F
p		0	1	1	1	0	0	0	0	160	112	70
q		0	1	1	1	0	0	0	1	161	113	71
r		0	1	1	1	0	0	1	0	162	114	72
s		0	1	1	1	0	0	1	1	163	115	73
t		0	1	1	1	0	1	0	0	164	116	74
u		0	1	1	1	0	1	0	1	165	117	75
v		0	1	1	1	0	1	1	0	166	118	76
w		0	1	1	1	0	1	1	1	167	119	77
x		0	1	1	1	1	0	0	0	170	120	78
y		0	1	1	1	1	0	0	1	171	121	79
z		0	1	1	1	1	0	1	0	172	122	7A
{		0	1	1	1	1	0	1	1	173	123	7B
|		0	1	1	1	1	1	0	0	174	124	7C
}		0	1	1	1	1	1	0	1	175	125	7D
		0	1	1	1	1	1	1	0	176	126	7E
DEL		0	1	1	1	1	1	1	1	177	127	7F

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PRODUCT NOTE

Note # 1
15 February 1985

PREPARING DRIVES FOR SHIPMENT

Whenever you ship or move the computer, you must prepare the diskette and hard disk drives. If you don't protect the diskette drives, motion may damage the head. If you don't protect the hard disk drive, you risk damaging the disk itself.

Follow these steps to prepare diskette drives:

1. Find the protective cardboard diskette insert(s) that came with the computer when you unpacked it.

2. With the print on the diskette insert facing upwards, carefully slide the diskette insert into the diskette drive until you hear a click.

3. Press the PUSH button until it engages.

If you have access to a WYSEpc system diskette, revision B or above, follow these steps to prepare the hard disk drive:

Note--HDPARK, the program to prepare the hard drive, moves the drive heads to an unused inner track on the hard disk. If you engage HDPARK, the drive heads won't be near any critical data sectors on the hard disk when you move the computer.

Follow these steps to prepare the hard disk drive:

1. Generate the A> prompt by returning to MS-DOS system level, drive A, or by turning the computer on with the system diskette in drive A.

2. Type

   HDPARK C:

   and press the RETURN key.

3. Look for this statement and question on the monitor screen:

   ```
   You are about to park the heads of hard disk C:
   This should be done before computer shipment.
   Are you sure you want to do this (type 'Y' for yes)?
   ```

   Type N if you decide you don't want to park the heads.

4. Type

   Y

   and press the RETURN key.

5. Look for this instruction on the monitor screen:

   Press any key to park hard disk C:

6. Press any key on the keyboard.

7. Look for these statements on the screen, and follow the instructions:

   Heads parked.

   Now turn off power and re-pack computer into the shipping carton.

The next time you turn the computer on, the hard disk will be ready to use again, automatically.

If you see the message

>>> Invalid parameter for hard disk <<<

Heads are not parked.

make sure you have identified the correct drive, C:, when you type the command after the prompt.