**TABLE 2-1**
**Computer Symptoms and Possible Causes**

| Symptom | Possible Problem | Cure | Chapter |
|---|---|---|---|
| Light on keyboard does not come on | Light bulb bad | Replace bulb | 6 |
| | No power | Check obvious | |
| | | Check power supply | 6 |
| | Keyboard cable bad | Replace cable | 6 |
| | Keyboard bad | Replace keyboard | 6 |
| | Mother board bad | Replace mother board | 5 |
| Bell does not beep | Speaker bad | Replace speaker | |
| | Mother board bad | Replace mother board | 5 |
| No display | Monitor not turned on | Turn monitor on | 6 |
| | No signal to monitor | Check cables | 6 |
| | No power to monitor | Check power | 6 |
| | Monitor bad | Check monitor | 6 |
| | Mother board bad | Replace mother board | 5 |
| Drive LED does not come on | LED bad | Check LED | 4 |
| | No power to drives | Check power | 4,6 |
| | Disk drive bad | Check disk drive | 4 |
| | Drive controller card bad | Replace card | 4 |
| | Mother board bad | Replace mother board | 5 |
| Keyboard does not work | Keyboard not plugged in | Plug in keyboard | |
| | Keyboard bad | Check keyboard | 6 |
| | Keyboard cable bad | Test cable | 6 |
| | Mother board bad | Replace mother board | 5 |
| Programs cannot be loaded | Drive door broken | Check for obvious | |
| | Diskette bad | Try backup | |
| | Wrong DOS version | Change DOS | |
| | Drive not working | Check with diagnostics diskette | |
| | | Check drive | 4 |
| | | Replace drive | |
| | Drive cable bad | Check drive cable | 4 |
| | Memory bad | Check with diagnostics diskette | |
| | | Replace if necessary | 5,6 |
| | Mother board bad | Replace mother board | 5 |
| Colors are wrong | Monitor or TV out of adjustment | Adjust monitor | 6 |
| | Mother board bad | Replace mother board | 5 |

> **WARNING**
>
> If you try to make a single-sided diskette into a flippy floppy, you could damage your computer drives.

Software problems can be greatly reduced simply by taking care of the diskettes. The disk is tough but not indestructible. It's also unpredictable. One day you can play catch with the diskette and not damage it. The next day a speck of dust or particle of cigarette smoke could fall onto the diskette and wipe out everything. Improper diskette care not only can destroy software and stored data but also can damage the disk drives. According to Verbatim Corporation, at least 80% of all diskette failure is attributable to fingerprints.

Care of diskettes is neither complicated nor time-consuming. Manufacturers have taken great pains to ensure that diskettes will last for a very long time with a minimum of problems. Extensive testing is done before diskettes are sold. It's not uncommon for a manufacturer to guarantee that the diskette will not fail even after several million passes per track. This translates to nearly a year of continuous running before the diskette's life expectancy is reached. Since normal operation calls for the diskette to be running just seconds out of every operating hour, the disk should, and could, last a lifetime.

The life span of a diskette also varies according to how it is used. Although the manufacturer might guarantee the diskette for 3 million passes per track, each time you use the diskette it goes to the catalog track. Some applications refer to this track over and over. Thus, the life of a diskette depends largely on how many times the one track can be used. As soon as this track wears out, the rest of the diskette is essentially dead.

The diskette can withstand any temperature between 50 and 120 degrees Fahrenheit (10 to 50 degrees centigrade) and still operate without error, although such extremes should be avoided. Even if the temperature goes outside this range, the diskette is still likely to recover if you give it enough time to cool down or warm up. (See "Heat and Cold" later in the chapter.)

Humidity does little damage. The accepted range for diskette operation is between 20% and 80% (5% to 95% for storage). Drier environments tend to dry out the diskette (although this takes quite a while). Worse, static can build up, causing changes in data. More humid areas may cause dust to stick to the diskette and the liner to swell. Swelling may impede diskette spinning and result in an error display. Table 3-1 summarizes diskette specification standards.

**TABLE 3-1**
**Diskette Specification Standards**

| | |
|---|---|
| Tracks per Inch | 48 |
| Tracks for Data | 35 |
| Track Width | .0108 to .0128 inch |
| Track Density | 6,000 bits per inch |
| Temperature | |
| Operation | 50°F to 112 °F |
| | 10°C to 50°C |
| Storage | − 40°F to 140°F |
| | −40°C to 60°C |
| Humidity | |
| Operation | 20% to 80% |
| Storage | 5% to 95% |
| Disk Speed | 300 rpm |

**PHYSICAL DAMAGE**

The soft liner inside the jacket doesn't just keep the diskette clean. It also serves as a cushion for the diskette in order to prevent damage. However, it can't protect the disk against everything. This is up to you.

Anything that puts pressure against the diskette can cause a dent in the jacket, the liner, or both. At best the diskette will have a hard time spinning in the drive. If this is all that happens, you may have enough time to make a copy of the ruined floppy.

This is why a felt-tip pen is suggested for writing on the labels. (Write on the label *before* sticking it onto the diskette.) The tip of a ball-point pen or pencil can easily damage the diskette. Even a soft felt tip can dent the diskette. The pressure you use in writing may not seem like much, but remember that all the pressure is concentrated at the tip of the pen or pencil. You are pressing down with only a few ounces of force, but the surface area of the pen tip is only a few thousandths of an inch. The force is effectively multiplied.

Weight of any kind pressing against the floppy can cause damage. Diskettes are best stored vertically. This not only protects the diskettes but also reduces the risk that you forget and drop a stack of books on top of a diskette.

The problem is further compounded if dust or other particles are trapped in the liner. Dust may seem soft. To understand what it can do, just take a look at the metal and glass parts of a car left in a dust storm.

Pretend that the soft liner of the diskette is made from sandpaper. You wouldn't risk the information stored on such a diskette by placing even small amounts of weight on it.

in incorrectly is for the 74LS125 IC chip on the analog card to explode violently. Usually you can repair the damage simply by replacing the chip. However, sometimes the explosion can cause other damage, such as to the analog card itself.

Other ICs may also be damaged, although these rarely explode. There might not even be any sign of damage. The analog board or interface card in the computer may just stop working. Without some very expensive test equipment, all you can do is replace some of the chips to see if this corrects the malfunction.

## PRELIMINARY STEPS

Before you go into the actual diagnostics to find out what has gone wrong with a drive, you can try several easy things.

The first step is always to observe the symptoms and then to eliminate those things that are not causing the problem. Notes are important.

If the LED on the front panel of the drive comes on, you know that power is getting to the drive. You can then eliminate the power supply as the source of the problem. You should have already checked all cable and board connections, cleaned the heads, checked the door, tried a different program (or a backup copy of the same program), and performed all other steps to check for the obvious.

Run the diagnostics diskette if you have one. The diagnostics diskette will check the drive in its various functions. (This assumes that the drive will operate and load the diskette.) Make a note of all error codes. Run the Media Verify test (on the System Master program) a number of times on a diskette that has been formatted on a good drive. This will indicate the general condition of the drive. For example, errors on many sectors could indicate that the drive is unable to read correctly. The drive may need alignment in this case. Errors could also indicate a dirty read/write head.

Next, if you have two drives, you can try a simple swap (see Figure 4-5). Open the cabinet and change the connections to the drives so that drive 2 is connected as drive 1 and vice versa. Run the diagnostics diskette again to see if the error changes. For example, if drive 1 was showing a problem before the swap and you connect drive 2 as drive 1, drive 2 should now show the error. If it does, you'll know the problem is with drive 1. If the symptoms are the same, chances are that the fault is somewhere other than the drives.

See also "The Power Supply" in Chapter 6, since a faulty drive could cause the entire system to go dead. Try using each drive as drive 1, with the drive 2 connector eliminated. Disconnect the cables from drive 2 and run the diagnos-

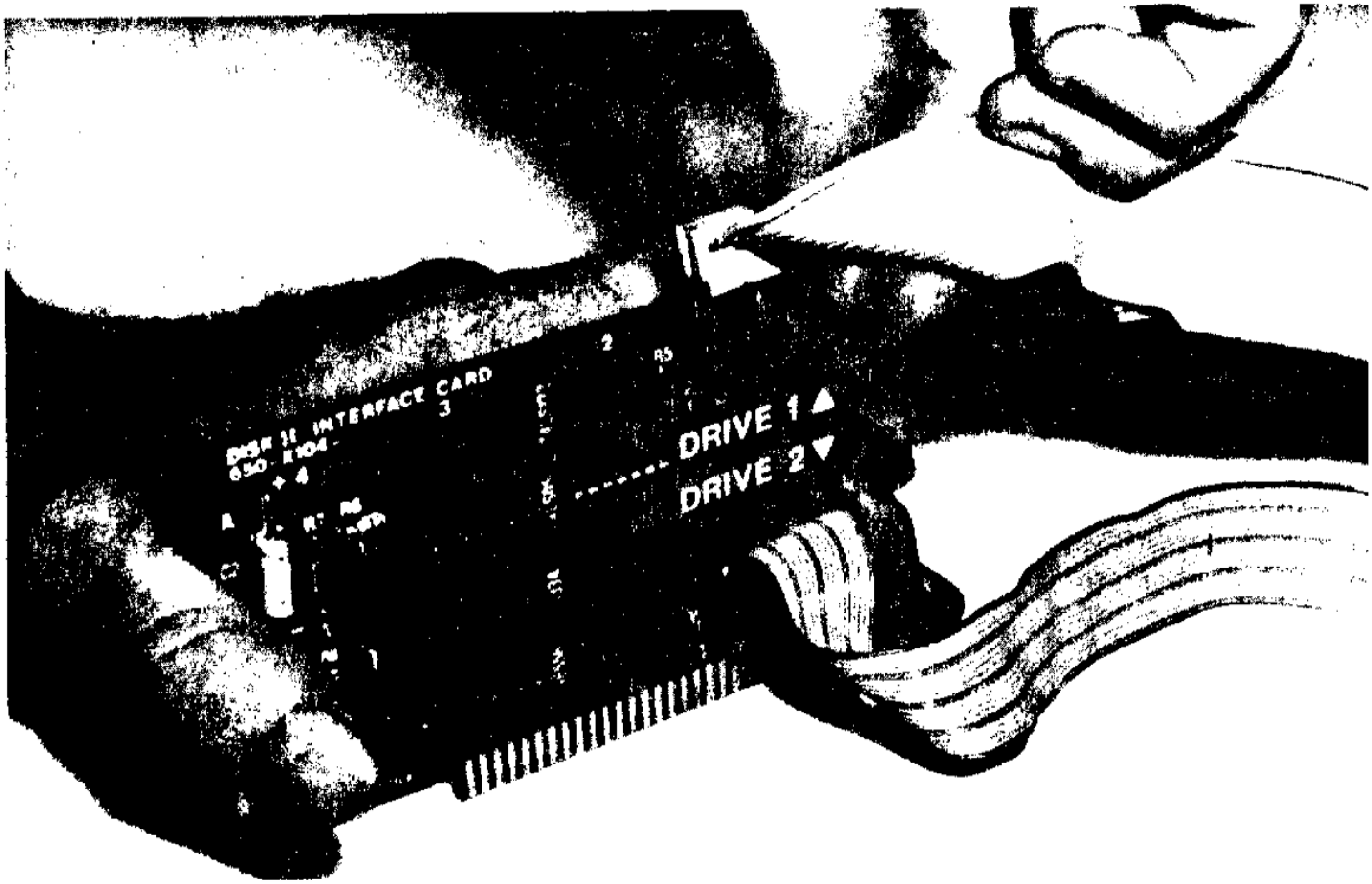


**FIG. 4–5** Swapping the drive cables.

tics. Then switch the lines so that the second drive acts as drive 1, with the first drive disconnected. Run diagnostics again and watch for a change in the operation, in the error code, or in both.

Don't forget to take notes and make sketches. This is especially important if you are going to be disassembling anything.

## ADJUSTING THE CARRIAGE LIMITER

A common problem with Apple drives is a maladjustment of the carriage limiter. When this happens, the drive seems to be operating fine, except that it won't load properly. If this adjustment is incorrect, the drive may load sometimes and refuse to load other times.

Open the drive and remove the analog card (the board on top of the mechanism). Figure 4-6 shows the drive analog card. You'll see a large white or yellowish wheel with a groove in it. This is the carriage limiter cam, which is

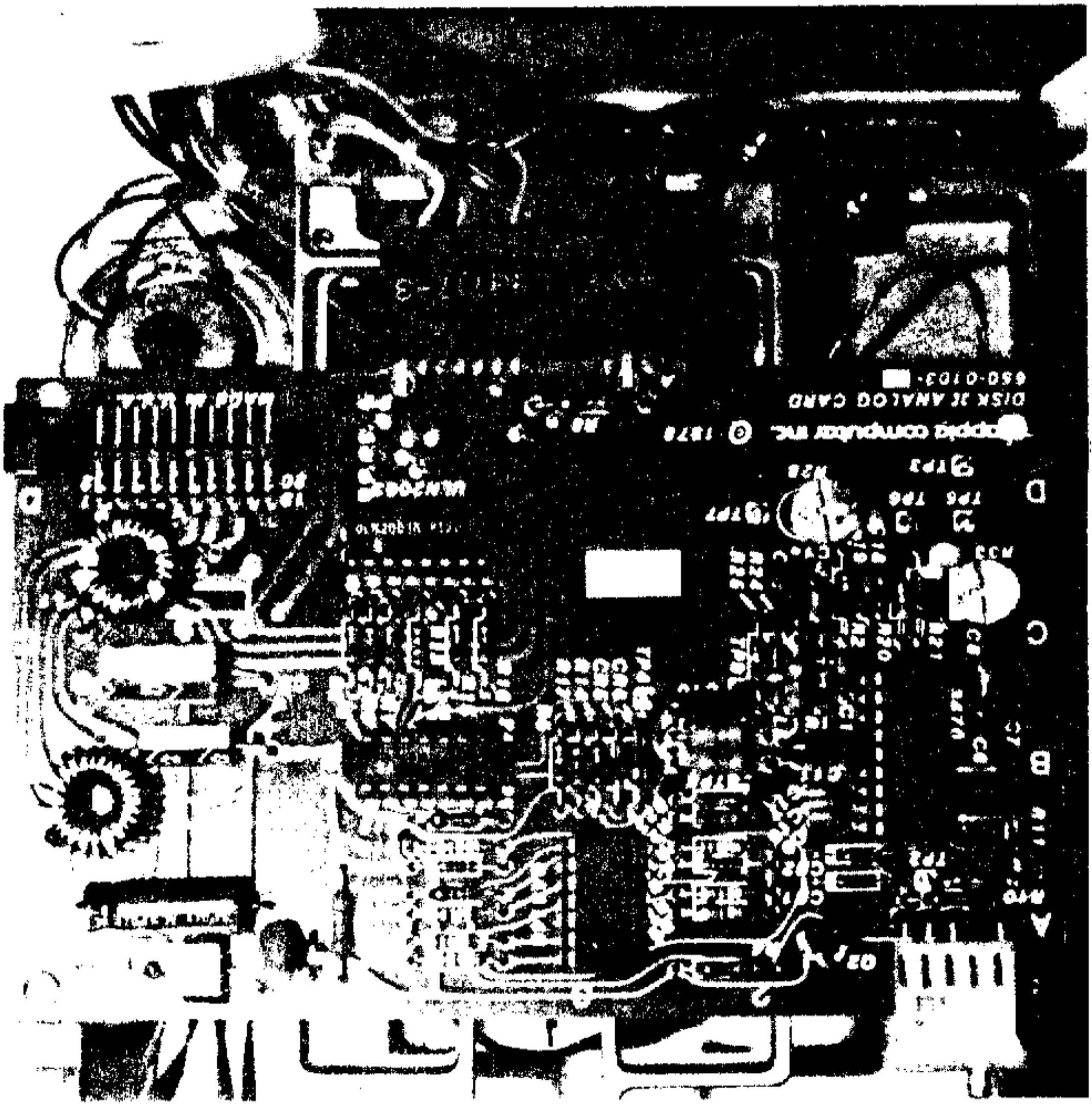

**FIG. 4–6** Drive analog card.

shown in Figure 4–7. Rotate the cam clockwise to move the head to the back of the drive. With the head at its farthest position, look at the position of the small dot on the cam. It should be just to the right of center of the cam follower—the small metal tab protruding from the rear of the cam (see Figure 4-7). If the dot is to the left of center or off to the side of the metal tab (refer to Figure 4-8), your drive needs adjustment.

To adjust the drive, unscrew the small screw (see Figure 4–9) and move the cam. Be very careful, as this movement tends to damage the screw threads all too easily. Once you have the cam adjusted, carefully tighten the screw again.

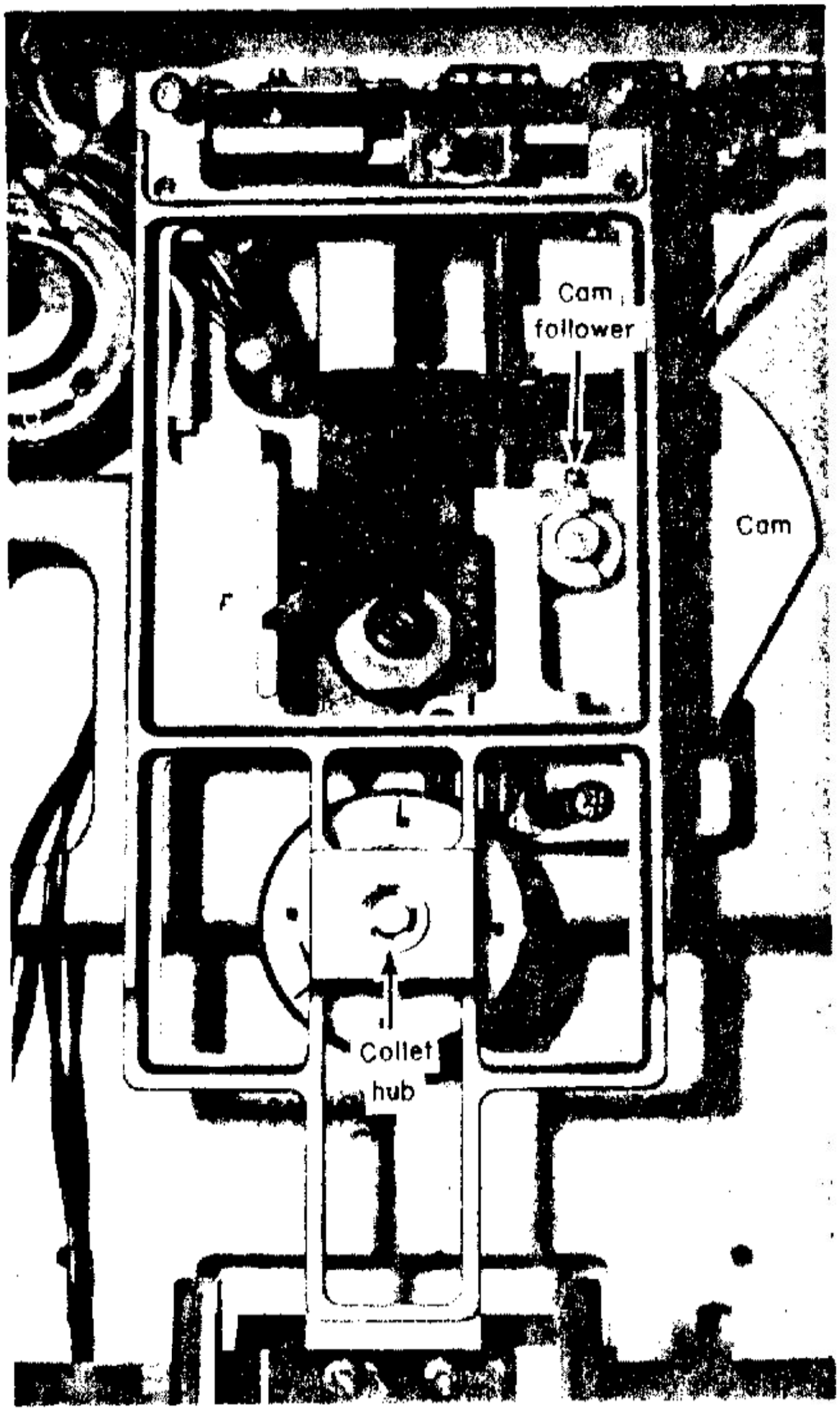


**FIG. 4–7** Carriage limiter cam, cam follower, and collet hub.

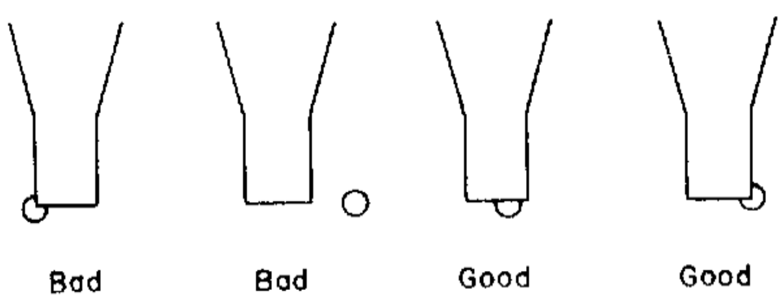


**FIG. 4–8** Cam dot locations.

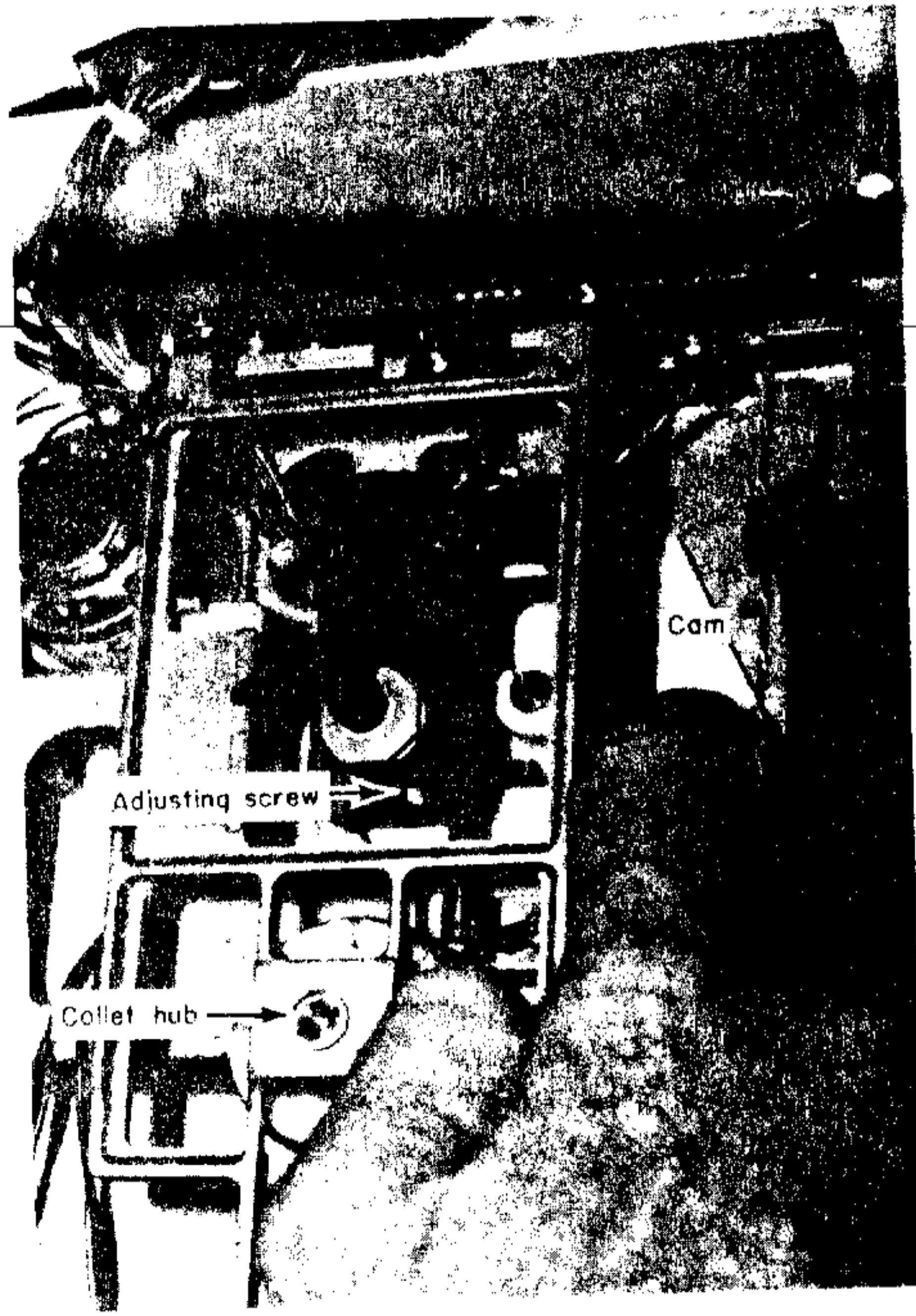


**FIG. 4–9** Adjusting screw.

## ADJUSTING THE COLLET HUB

If the carriage limiter cam is in proper adjustment and programs still won't load properly, the problem could be with the hub and spindle (see Figure 4–7). This is especially common with drives that are a few years old. A secure contact is needed if the diskette is to spin correctly. Quite often, if the hub is out of adjustment, opening and closing the door a few times reseats the spindle and allows you to load the program.

With the drive cabinet and analog card removed, look straight down at the collet spindle and close the door. The shaft should be centered. As you open and close the drive door, the hub should move cleanly and evenly in and out of the receptacle. If it does not, or if it seems to change, the mechanism may need to be adjusted.

There are four screws on the metal bracket. Two of these are at the back, with the other two holding the bracket to the door. Loosen all four screws and then close the door. The bracket can now be moved until the shaft is right in the center of the hole. Tighten the rear screws and check the alignment by opening and closing the door. With the door open, reach inside and push the shaft with your finger. If it is adjusted properly and the screws are tight, the shaft should still sit properly in the hole.

## REPLACING THE COLLET HUB

If your drive is old or has been used extensively, you might not be able to adjust the hub. Repair is by replacement. (See "Adjusting the Diskette Stop Guide" in this chapter before going to this expense.)

Remove the front panel. (If the wires to the LED are too short to allow this, refer to "Changing the Drive LED" in this chapter before continuing. The front panel must be out of the way before you can safely remove the hub assembly.) The hub assembly is held in place by a retaining clip, which can be easily removed with a screwdriver. Once the clip is no longer in the way, the assembly slides off easily. Be careful as you take out the spring and washer. If you stretch or damage the spring, the repair will be much more expensive.

When replacing the collet hub, follow the disassembly steps in reverse. The sketches you've made (you did make sketches, didn't you?) will show that the small end of the spring goes down. The hub assembly should slide easily onto the mounting arm. Replace the retaining clip carefully so as not to damage the hub or shaft. If you had to remove the LED to get off the front panel, be sure that you've reinstalled it correctly. The holding pins for the drive door should be tilted back toward the collet hub to allow easy installation. Once the front panel is in place again, adjust the collet hub assembly and drive door (see next section) carefully.

## ADJUSTING THE DRIVE DOOR

Before tightening the two front screws of the bracket, check the door for proper alignment. It should be flush with the front panel. You should be able to see if the door is crooked. As with a broken door, a drive door that is not seating correctly can cause the drive to think that it is empty.

The two holding screws were loosened in the previous step. If you skipped the hub adjustment, loosen the two bracket screws on the door. The door can now be moved and adjusted so that it is flush with the panel.

Tighten the two screws. Insert a diskette and gently close the door while watching the two guide bars. (These guide bars stick straight down on the back surface of the panel.) There should be no binding between these guide bars and the diskette. If there is, the door needs further adjustment. Loosen the screws and adjust the door so that the guide bars just touch the diskette, without binding against it.

## ADJUSTING THE DISKETTE STOP GUIDE

If you still have errors after checking or adjusting the collet hub and drive door, the problem could be the diskette stop guide. When this is not adjusted properly, the collet hub and spindle cannot make proper contact with the diskette.

The diskette stop guide is a piece of plastic or metal that stops the diskette from moving in too far when the diskette is inserted into the drive. It's rare for this guide to go out of adjustment. Usually, the only time it does is if someone has tinkered with it. However, if it is far enough out of adjustment, not only will you get drive errors, but you could also permanently damage the diskettes.

The Alps drive has a stop guide that cannot be adjusted at all because it is a physical part of the mechanical assembly casting. The stop guide on a Shugart drive can be adjusted.

Remove the drive cover and analog card. With the inside now exposed, insert a diskette and gently close the door while watching to see if the diskette is centering and if the collet hub spindle is seating correctly. There should be very little movement of the diskette with the spindle clamped.

If the diskette is too far forward or back, manually place the diskette in the correct position. Loosen the mounting screw and gently move the guide until it just touches the diskette, and then tighten the screw again. If you happen to have some Gliptol or Locktite, put a little on the screw. (These liquids are used on screws to help keep them from wiggling loose.)

## REPLACING THE HEAD LOAD BUTTON

Occasional I/O errors could be the result of a worn head load button. This button is a small felt pad on the bottom of the read/write head assembly (see Figure 4-10). Its function is to push down against the diskette while the read/write head presses up from beneath. This holds the surface of the diskette flat against

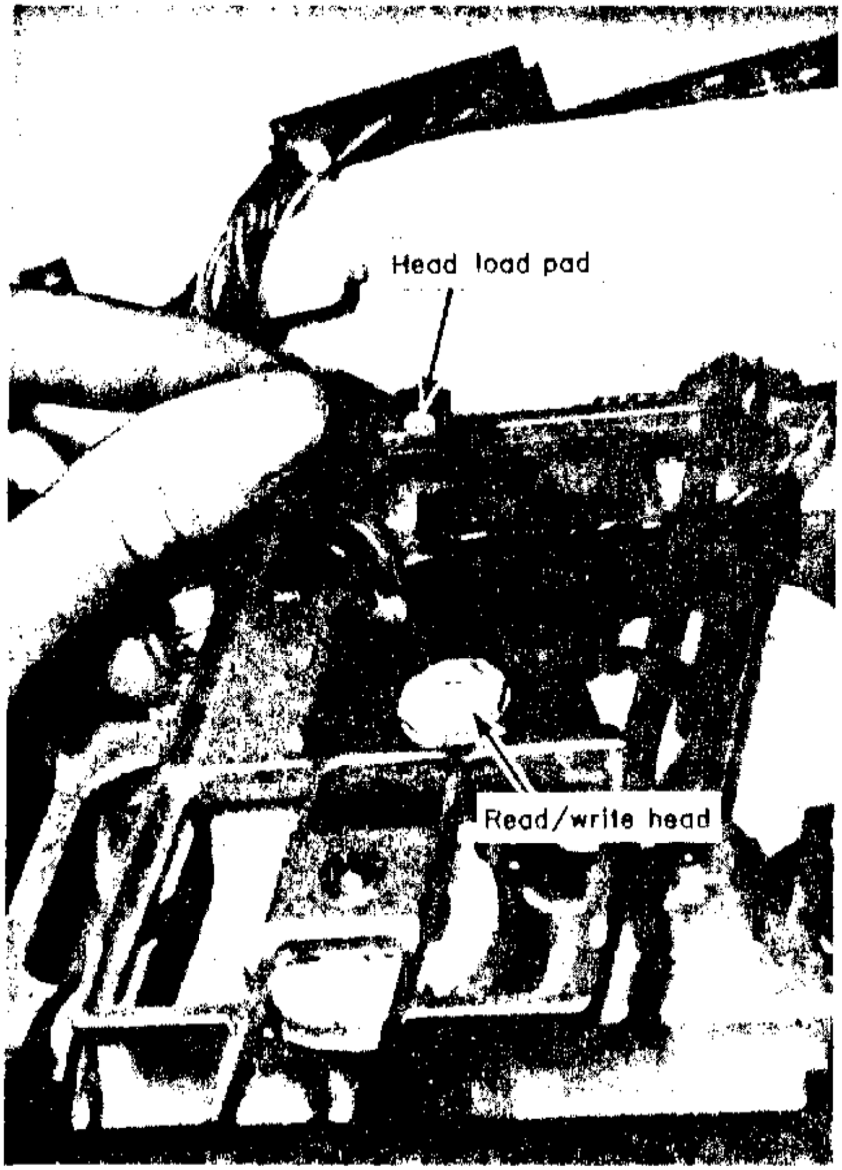


**FIG. 4–10** The read/write head assembly and the head load pad.

the head. If the pad wears, the diskette may not be held perfectly flat. Data may be lost. A heavily worn pad can also damage the diskettes. If the pad falls out (rare, but it happens), the diskette can become badly scratched or destroyed.

A worn pad will often be skewed to one side. It might also look hard and dried-out. Either way, it should be replaced.

The top of the head load pad is a plastic cylinder with a round cone on top. The cylinder and cone have a notch cut into them. The assembly is forced up into the arm and spreads apart to hold it in; thus glue is not required.

To change the pad, lift the head load arm and grasp the pad carefully with a needlenose pliers as shown in Figure 4-11. The button usually comes off easily. The new head load button gets inserted into the holder. A slight push will snap it into place.

You can usually get a head load button from your local dealer. Prices vary.

## DIAGNOSTIC STEPS

For all following steps, shut down the power and wait five seconds before flipping the switch on again. This resets the built-in protective circuitry and allows you to make accurate testings. It is also suggested that you perform each step at least twice, since the probes of your meter may not touch the right spots.

It is extremely important that you not create an accidental short by touching the wrong pins and test points. *If your hands are shaky or you have any doubts, let a professional take care of the job.* You can do a lot of damage by being careless.

### STEP 1—TESTING THE LED

The normal response for a properly working drive is for the LED (the little red light) to come on just after the beep. If the light does not come on, there is an easy way to tell if the problem is in the LED or the power supply. (If it lights up, skip to step 2.)

Get out your meter and set it to read 1.5 volts DC. The common (ground) probe will touch test point TP2, TP3, or TP4 or any equivalent ground (such as the casing of the proper supply). The other probe should touch the right side of resistor R8, located at the extreme back center of the drive analog card (see Figure 4–13). Start the computer again and watch the reading you get. It should hit 1.5 volts just before the beep sounds and whenever the spindle is turning in the drive. If the reading is correct but the LED still does not light, the LED needs to be replaced. (See "Removing or Replacing the Drive LED.")

### STEP 2—TESTING FOR POWER

If everything is fine to this point, or if the first tests don't apply (the LED lights correctly), you will be checking for a voltage change across other points. Steps 2 and 3 are to determine if the circuitry used to activate the drive motor is working. If the motor is obviously working correctly and if it operates when the LED lights up, skip to step 4.

Power comes into the drive on several pins of the drive cable (see Figure 4–14). Pin 1 is ground. The voltage between pin 19 and ground should be +12 volts DC. The voltage between pin 11 and ground should be + 5 volts DC.

Check for these voltages on both sides of the cable. First leave the cable plugged into the main cabinet. If the readings you get are correct, go to the next

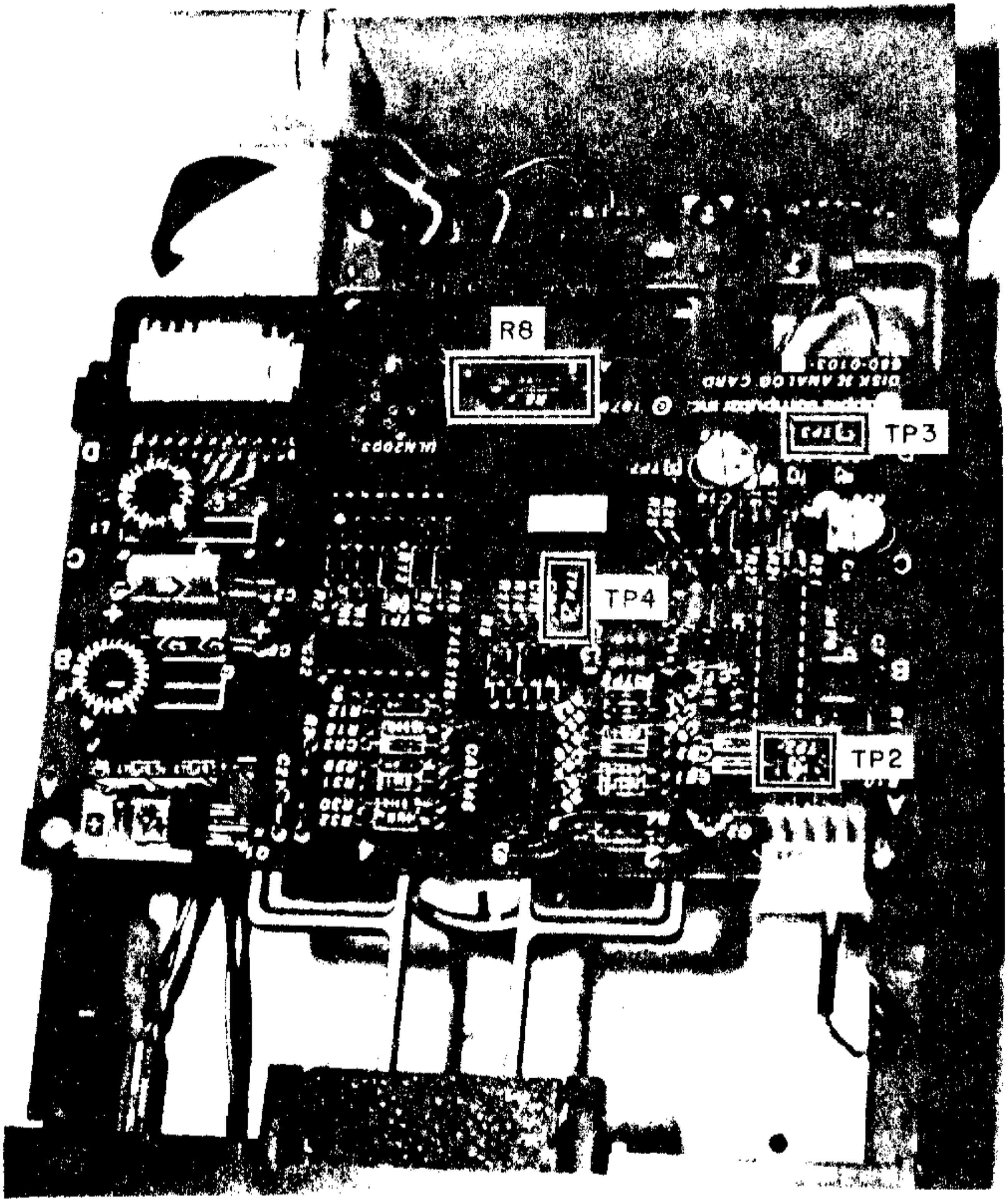


**FIG. 4–13** Location of resistor R8 and test points TP2, TP3, and TP4.

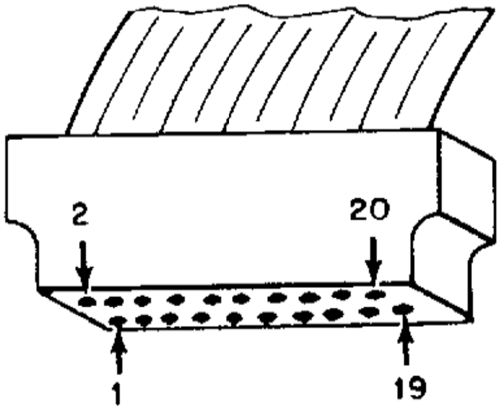


**FIG. 4–14** Pin locations on drive signal cable.

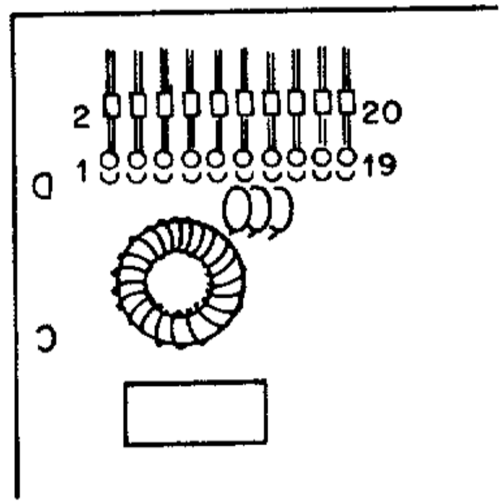


**FIG. 4–15** Pin locations on drive I/(

step. If they are not correct, check for the same voltages where the pins come out of the main cabinet (see Figure 4–15).

This is again that process of elimination. If power is leaving the power supply but not getting to the drives, you'll know that the problem is in the cable. If the pins coming from the power supply don't show the correct voltages, you can immediately suspect the power supply as the cause.

If these tests lead you to believe that the cable is at fault, set your meter to read ohms (resistance). The setting used doesn't matter. Touch one probe to a pin on one side of the cable and the other probe to the same pin on the opposite side of the cable. A reading of zero ohms means that the wire between those two pins is good. A reading of infinite ohms (full scale or no movement, depending on the meter you are using) means that the wire is broken somewhere along the cable. (This process—checking for continuity—is the best way to test any wire or cable that is not currently carrying a current. You can even use it to test the wiring between your stereo and speakers.) Usual repair is to replace the cable.

You can save a little time by checking only pins 1, 11, and 19, since these are the ones carrying power. But you are better off to take a few extra minutes to test the entire cable.

At the rear of the mechanical assembly is a small motor control board, also called a servo board. The voltage between the brown wire (at the top of this board) and ground should be +12 volts DC. Immediately beneath this wire is an orange wire. The voltage between this wire and ground should be about +5 volts DC. You can also check for the +5 volts at the front of resistor R1. Testing here is the same as testing at the orange wire. Figure 4–16 shows the

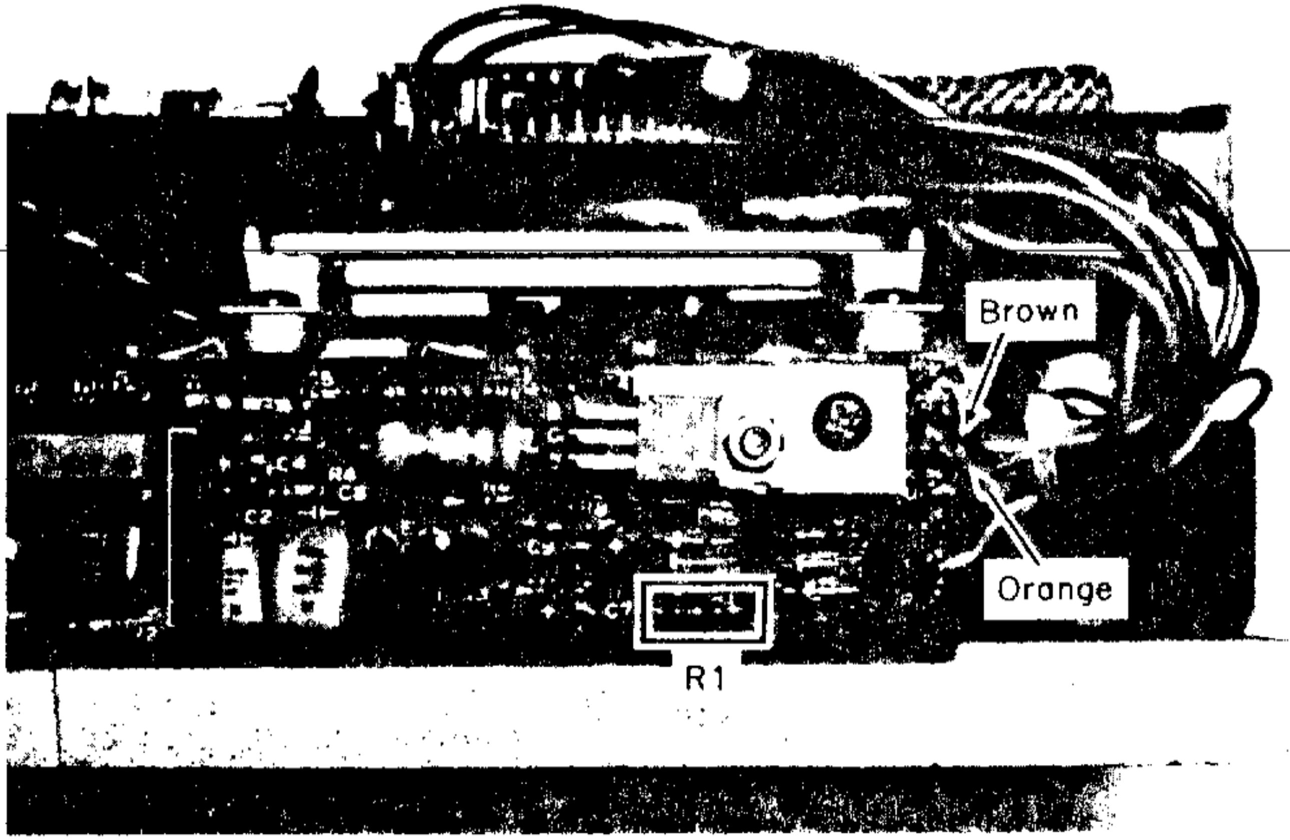


**FIG. 4–16** Drive servo board.

brown and orange wires and R1. If the voltages are correct here but incorrect on the analog card (from step 1), the trouble is with the analog card.

When you have finished the above tests, you'll have a good idea of where the problem is. If power is leaving the power supply, the problem is with the drive or cable. A simple test eliminates the cable as the possible cause. Testing the brown and orange wires will tell you if the trouble is in the motor control (servo) board, the drive controller card, or the drive analog card or if you should test the power supply again.

Occasionally a problem with the power supply may not show up in testing. The Apple's power supply is capable of producing 60 watts. If too many devices are connected to it, the power supply simply can't keep up with the demands. If the readings you get are correct but your computer consistently fails when it is loaded, chances are the power supply is either being overloaded or is wearing out.

Try to operate the computer with fewer devices attached. For example, if you have two drives, disconnect drive 2 and try again. (Don't forget to shut off the power before disconnecting or connecting any device.)

## STEP 3—TESTING THE MOTOR CONTROL CIRCUITRY

Set the meter to read 5 volts DC and connect the black lead (common) to TP4 or some other ground. With the power off and the drive connected, touch the red probe of the meter to pin 13 of the 74LS125 chip. (see Figure 4-17). Turn on the power. The LED should come on and stay on, and the reading on your meter should be 0 volts. If this doesn't happen, the chip or the drive interface board is bad.

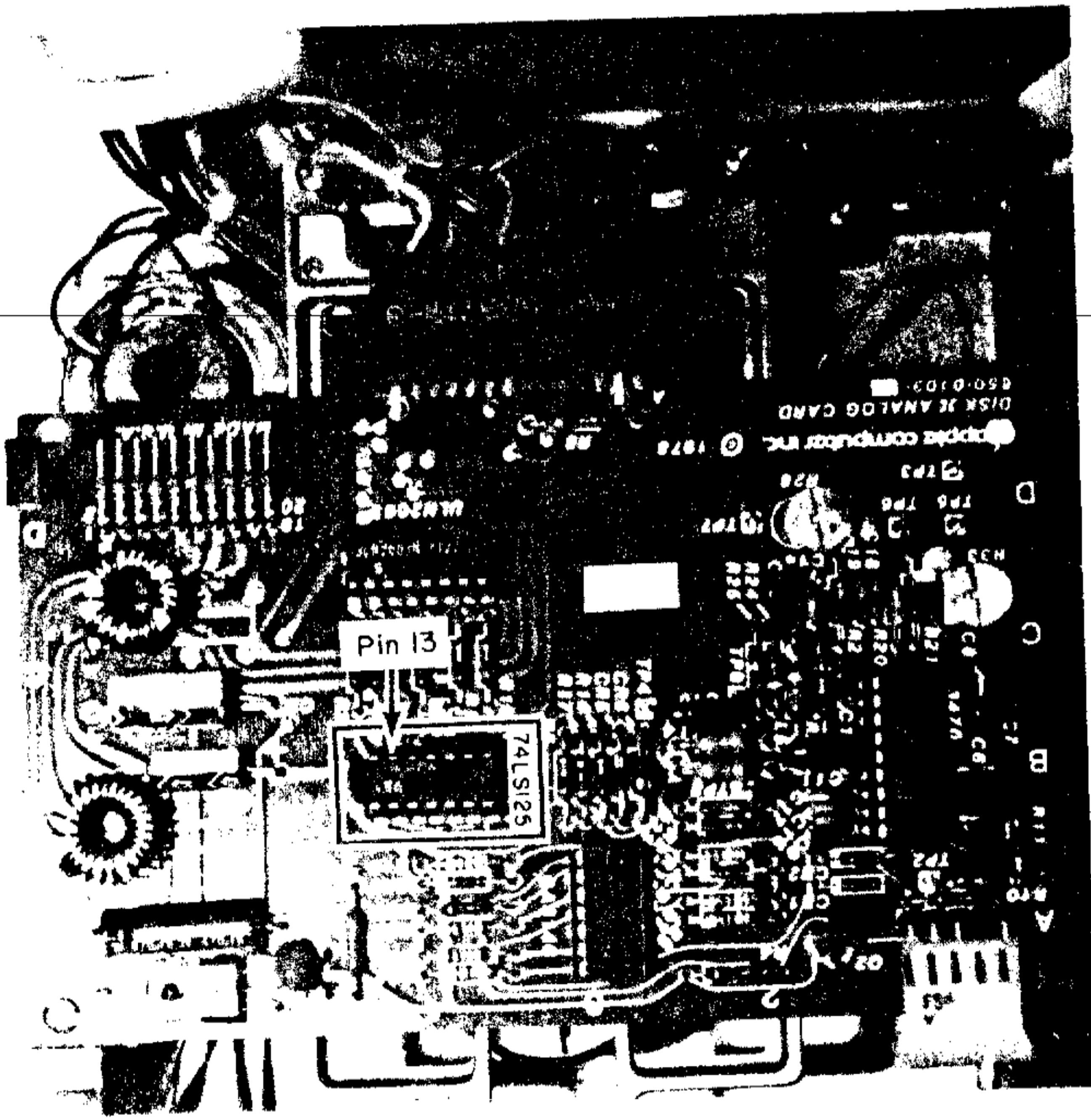


**FIG. 4–17** Location of pin 13 on the 74LS125 chip.

Reset your computer. For the IIe, do this by pressing CONTROL-OPEN APPLE-RESET. For the II or II+, simply hit RESET or CONTROL-RESET. You should now get a reading of about +5 volts DC, with the drive motor and LED both off. Once again, if the results are other than this, the drive interface board is at fault.

For a two-drive system, load up drive 1 of the computer with any diskette that has DOS on it and that can be catalogued. The System Master or any initialized diskette should do. Try to get a catalog of a diskette in drive 2. The reading at pin 13 of the 74LS125 should be about 5 volts while the drive motor is off, should drop to 0 volts while the drive is looking for the directory (with the motor on), and should then go back to 5 volts when the motor shuts off again. If this doesn't happen, the drive interface board is faulty.

Set your meter to read 12 volts DC. The black probe (common) is still connected to TP4 or ground from the last step. The red probe touches pin 13 on the ULN2003 chip (see Figure 4-18). When the motor is off, you should get a reading of 0 volts. When the motor is going, the reading should be about 12 volts. If these readings are not correct, the drive analog card is bad.

## STEP 4—TESTING THE WRITE-PROTECT SWITCH

The notch on the side of the diskette activates (or deactivates) the write-protect switch inside the drive. When the notch is open, you can write data on the diskette and erase what is there. Cover this notch (e.g., with tape), and the data on the diskette cannot be changed. However, if this switch goes bad, the data and programs on the diskettes may be erased. If the drive malfunctions while the write-protect switch is faulty, you could find yourself with a blank diskette through no fault on your part other than inserting the diskette and applying power. If you find that this switch is faulty, DO NOT attempt to use the disk drive until you have made the repair.

If you suspect that the write-protect circuitry is faulty or if you want to make an occasional safety check, you can perform a very simple test. Take a diskette that has nothing of value on it. Cover the write-protect notch and try to write onto the diskette and then to erase it. If the switch is functioning properly, you won't be able to erase or change anything on the diskette.

At the back of this book (page 190) is a simple test routine that will check the write-protect switch. In this program, if the write-protect circuitry is functioning, you'll get a write-protect error. (The monitor should show WRITE ENABLED with the write-protect notch uncovered and WRITE DISABLED with the notch covered.)

Set the meter to read 5 volts DC. With the power off, connect the black lead to TP4 or ground and touch the red lead to the front of resistor R11 located on

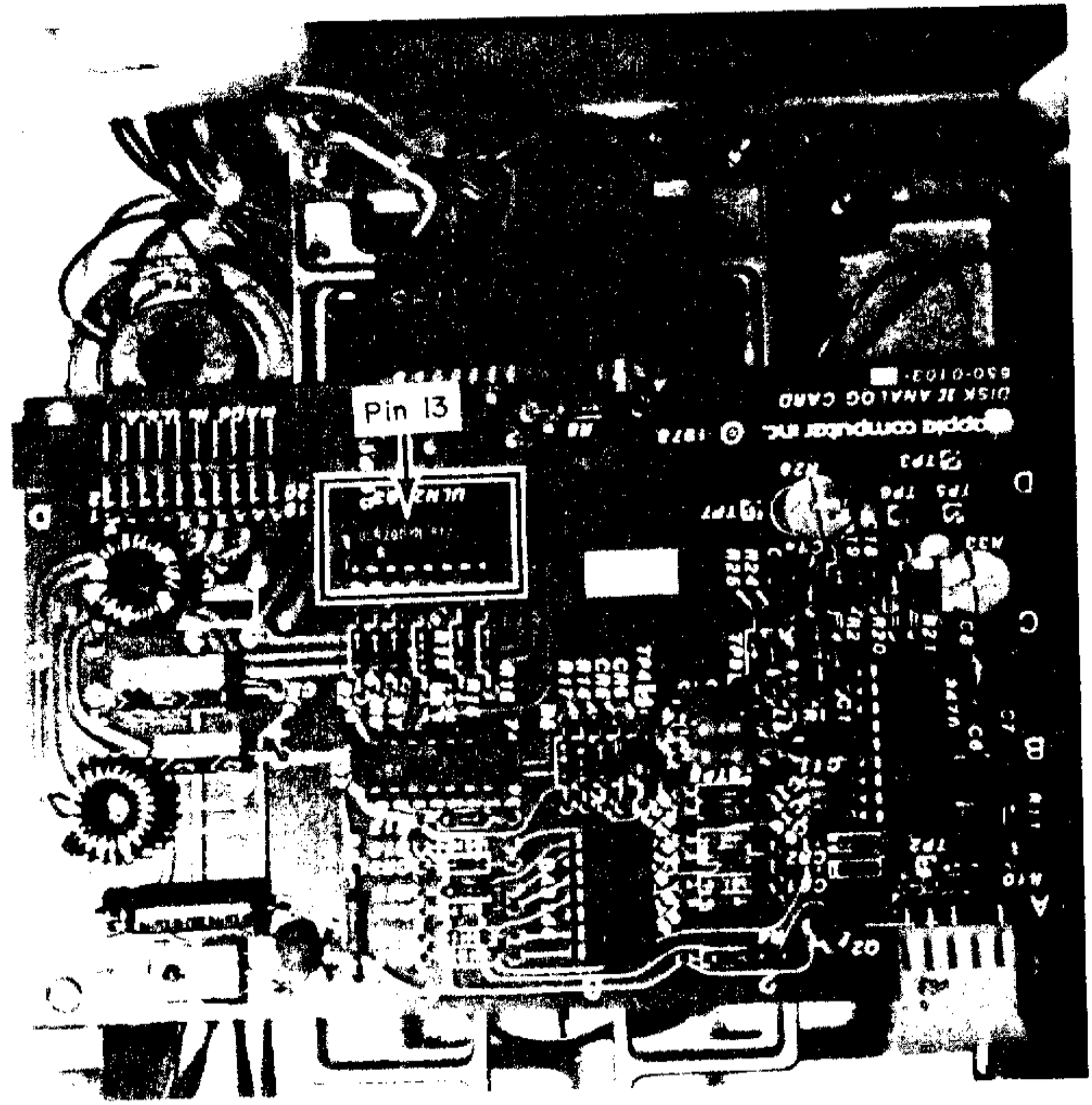


**FIG. 4–18** Location of pin 13 on the ULN2003 chip.

the right edge of the analog card (see Figure 4-19). Turn on the power. The reading should be 0 volts. If you get a reading, transistor Q2 (type 2N3906) located near the front right corner (see Figure 4-20) is bad.

Replacement of the transistor requires care. Too much heat will damage the inside of the new transistor and could even damage or destroy the board; too little heat will cause the soldered leads to give problems later (if not immediately). If you don't know how to solder correctly, leave the job to a professional.

You must also be careful to install the new transistor correctly. There are

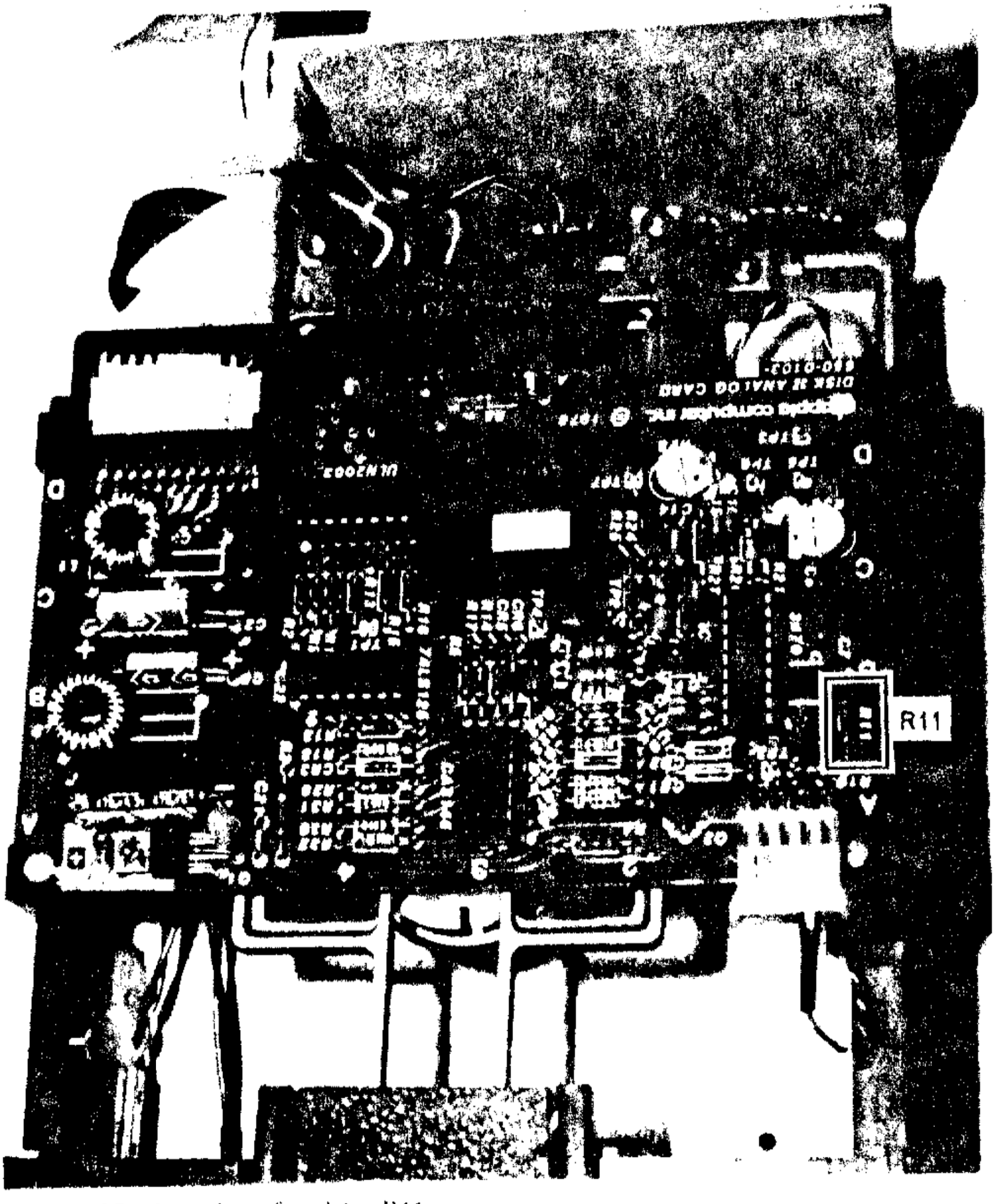


**FIG. 4–19** Location of resistor R11.

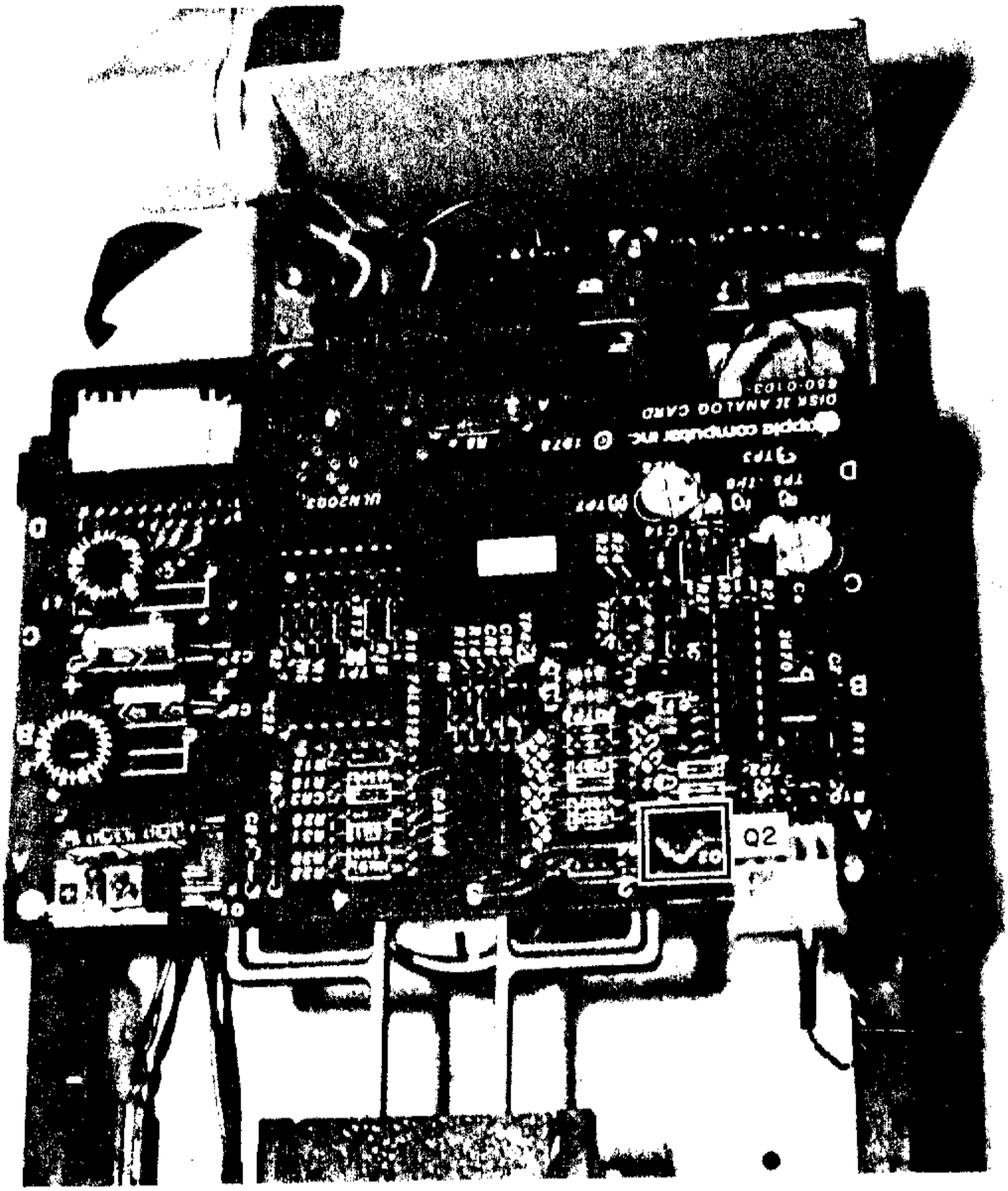


**FIG. 4–20** Location of transistor Q2.

three leads coming from the transistor. Viewed from the flat side of the transistor and from left to right, the leads are E (emitter), B (base), and C (collector). Refer to Figure 4-21 for pin locations. It's critical that the new transistor be installed *exactly* as the old one was.

After checking this transistor (or replacing it), check the write-protect circuitry. Set the meter to read 5 volts DC. The black lead goes to TP4 or ground. The red lead goes to pin 20 (back right pin) of the drive cable. With the power on, you should get a reading of 0 volts. Insert a diskette into the drive to activate the switch. The reading should jump to between 3 and 5 volts. If it does, the write-protect switch is okay.

The final test of the write-protect circuitry will tell you if the switch is at fault or if the drive analog card is bad.

Shut off the power and set the meter to read ohms (resistance). Locate resistor R8 on the drive analog card and the two solder points that are at the front left near this resistor (see Figure 4-22). Touch the probes to the two points. The reading should be near 0 ohms and should increase to near infinity when a diskette is inserted into the drive. If this happens, the switch is okay and the write-protect failure is due to a faulty drive analog card. If it doesn't happen, try the same test again, but this time push down on the write-protect switch with your finger. (The switch is located on the left side of the drive assembly about an inch inside the drive door.) If the test result is still bad, then the switch has to be replaced. If it failed when you inserted the diskette but passed when you opened the contacts of the switch, you may be able to adjust the switch.

## STEP 5—REPLACING AND ADJUSTING THE WRITE-PROTECT SWITCH

Replacing the switch is easy to do. Take off the drive cover and remove the drive analog card. The wires from the drive to the write-protect switch are soldered together. The switch is held in place by two screws. Take these out. Now you have enough room to use a soldering pencil on the leads. Installing the new switch is just the reverse procedure. Be careful not to overtighten the screws.

To adjust the switch, load in the switch testing program from the back of the book. Then remove the drive cover and turn the drive upside down. Insert

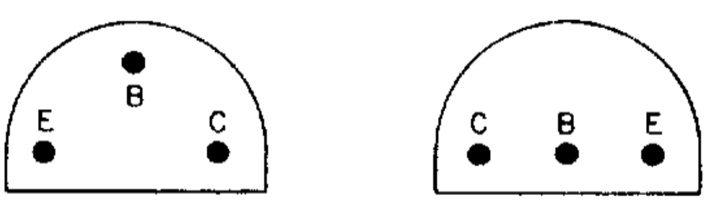


**FIG. 4–21** Typical transistor pin locations.

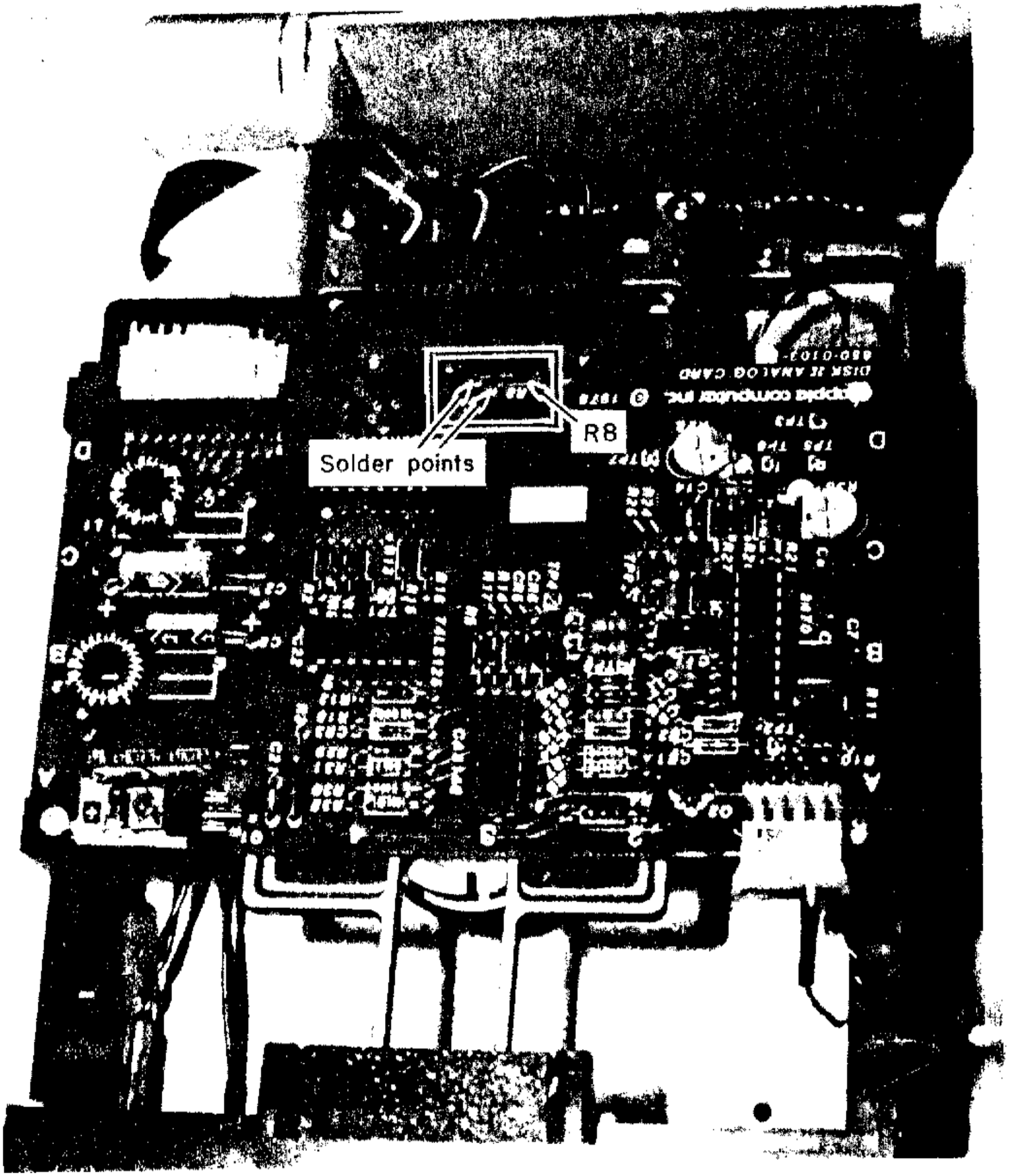


**FIG. 4–22** Location of resistor R8 and the two solder points.

a diskette (with the write-protect notch uncovered) part way. The diskette itself will now be keeping the contacts of the switch open. Loosen the two screws, rear screw first. As you loosen the front screw, the switch should rise slightly. As this happens the monitor should display the message WRITE ENABLED. Press down gently on the front setscrew until the monitor displays WRITE DISABLED. Tighten first the front screw and then the rear screw.

To test the adjustment, turn the drive on its side. Push the diskette all the way in. As the uncovered write-protect notch slides under the switch, the monitor should display WRITE ENABLED. As you pull the diskette out the screen should again show WRITE DISABLED. Do this check with a diskette that has the notch covered, with the covering tape pinched tight.

If you do not get the correct screen displays after a couple of attempts to adjust the switch, you probably won't be able to adjust it. Replace it with a new switch. If the write-protect problem is still there, chances are the drive analog board is bad and will have to be replaced.

## STEP 6—CHECKING THE PULLEY AND BELT

With the drive cabinet removed and the power off, turn the drive over. You'll see a pulley and belt (see Figure 4-23A). Turn the pulley by hand to check for sticking, binding, or uneven turning (Figure 4-23B). Look at the belt to make sure it is securely in place and to see if it is showing any signs of wear.

## STEP 7—CHECKING HEAD MOVEMENT

With the power off, remove the drive casing and drive analog card. This will allow you to see the read/write head (Figure 4-24). Gently move it with your finger (front to back). There should be a small amount of resistance to the motion, but the movement should be possible without any sticking or binding.

Partially attach the drive analog card again, leaving it just loose enough so that you can lift it to watch the heads. Reattach all connectors. Push the head to track 34 of the drive. Track 0 is the outermost ring; track 34 is closest to the center. Since the heads are in the back half of the drive assembly, track 0 is the closest to the door and the farthest from the rear of the drive. Track 34 is always closest to the spindle of the drive and to the center of the diskette. The head should be at track 34 as you begin this test. (You can also move the head to track 34 by turning the cam.)

Turn on the power. During loading, the head should move to track 0 and away from it again. (If the drive can't read the disk, the head will stay on track 0.) If the head does not go to track 0, the drive assembly may be bad and may have to be replaced. Perform the test a few times to be sure.

A B

**FIG. 4–23** (A) Pulley and belt of the disk drive (B) Turn gently to check for sticking or binding.

## STEP 8—CHECKING THE DRIVE CABLE

In Step 2 you checked the drive cable (see Figure 4–25 for pin locations) to be sure that the wires that carry power to the drives were sound. You should have taken the few extra minutes to check the other wires in the cable for continuity at that time. (If you didn't, do so now.) The others carry various signals to and from the drive. A broken wire inside the cable can cause all sorts of trouble.

With the meter set for ohms (resistance), place one probe on one end of a wire and the second probe on the opposite end of the same wire. If the wire is intact, the meter will show 0 ohms. If the wire is broken, the meter will read infinite ohms.

## DRIVE SPEED ADJUSTMENT

There are several ways to test the speed of a drive. If you don't have the diagnostics diskette, you can test the drive speed manually by using a fluorescent light. The program in Appendix A can be used to keep the drive motor running. However, do not allow the drive to operate continuously for more than a few minutes at a time or you might damage the power supply.

*Williams, How to Repair & Maintain Your Apple Computer (Chilton)*

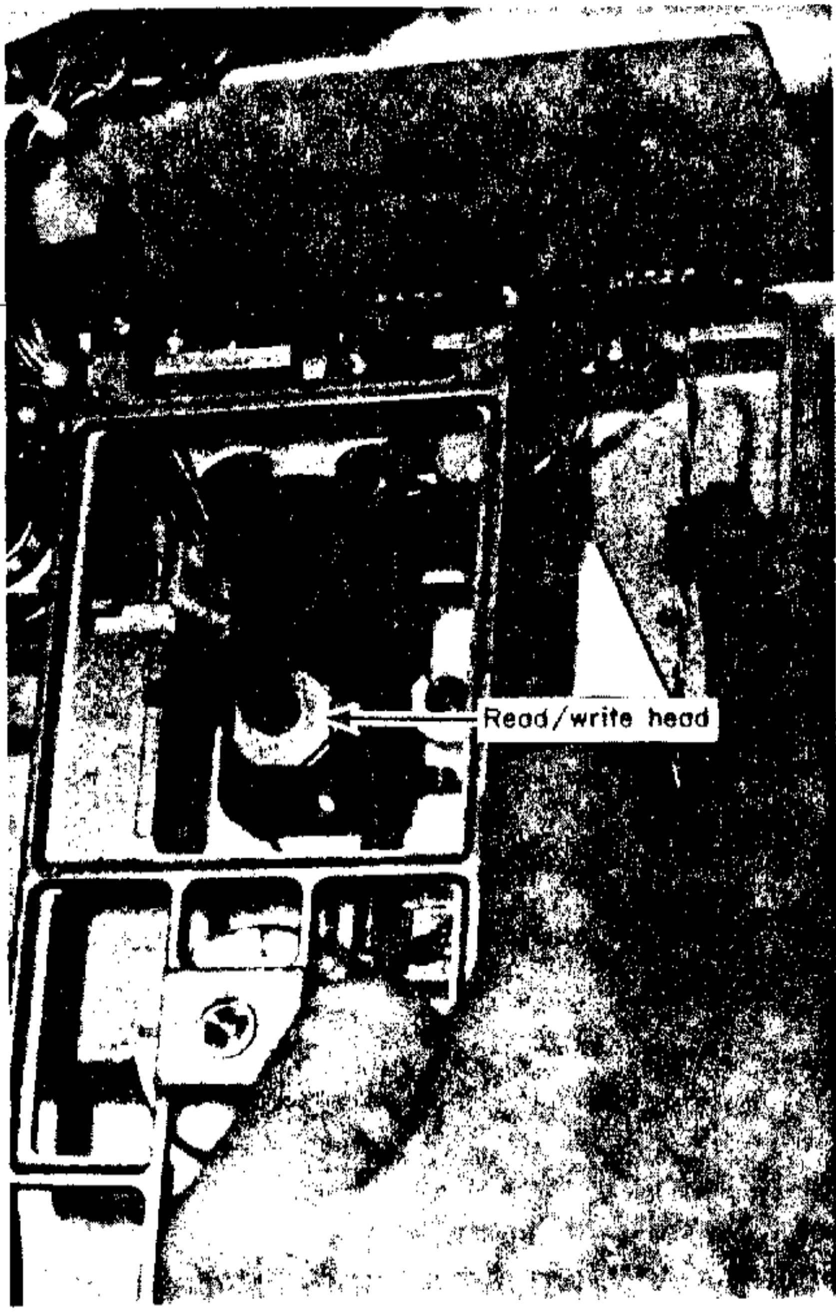


**FIG. 4–24** Read/write head.

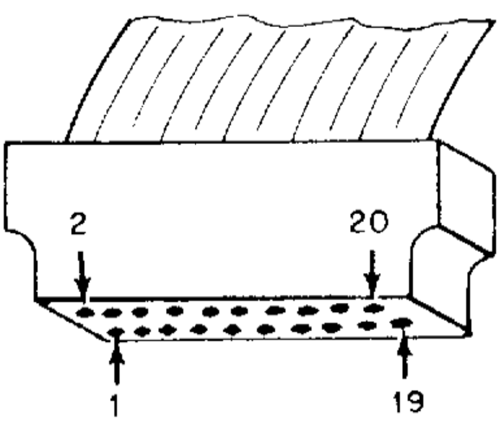


**FIG. 4–25** Pin locations on drive signal cable.

Remove the drive and tip it on its side. Insert a diskette to operate the motor, and watch the pulley under the fluorescent light. If the drive is operating at the correct speed, the marks on the outer ring should seem to stand still. (The inner marks are for 50-hertz power.)

If the speed is incorrect, adjustment is made by turning the variable resistor screw on the servo (motor control) board at the rear of the drive (see Figures 4-26 and 4-27). By watching the marks on the pulley (under the fluorescent light), you should be able to tell which way to turn the variable resistor for correct adjustment.

Easier and more accurate is to use the diagnostics diskette. Select the drive speed test (L). Remove the diagnostics diskette and insert an initialized scratch diskette (a diskette with nothing important on it, since the data will be destroyed), and press RETURN. The speed of your drive will be displayed to the nearest tenth of an rpm (for example, 299.7). If you are using a diagnostics diskette or another program that reads the rpm, the speed may vary a few tenths as

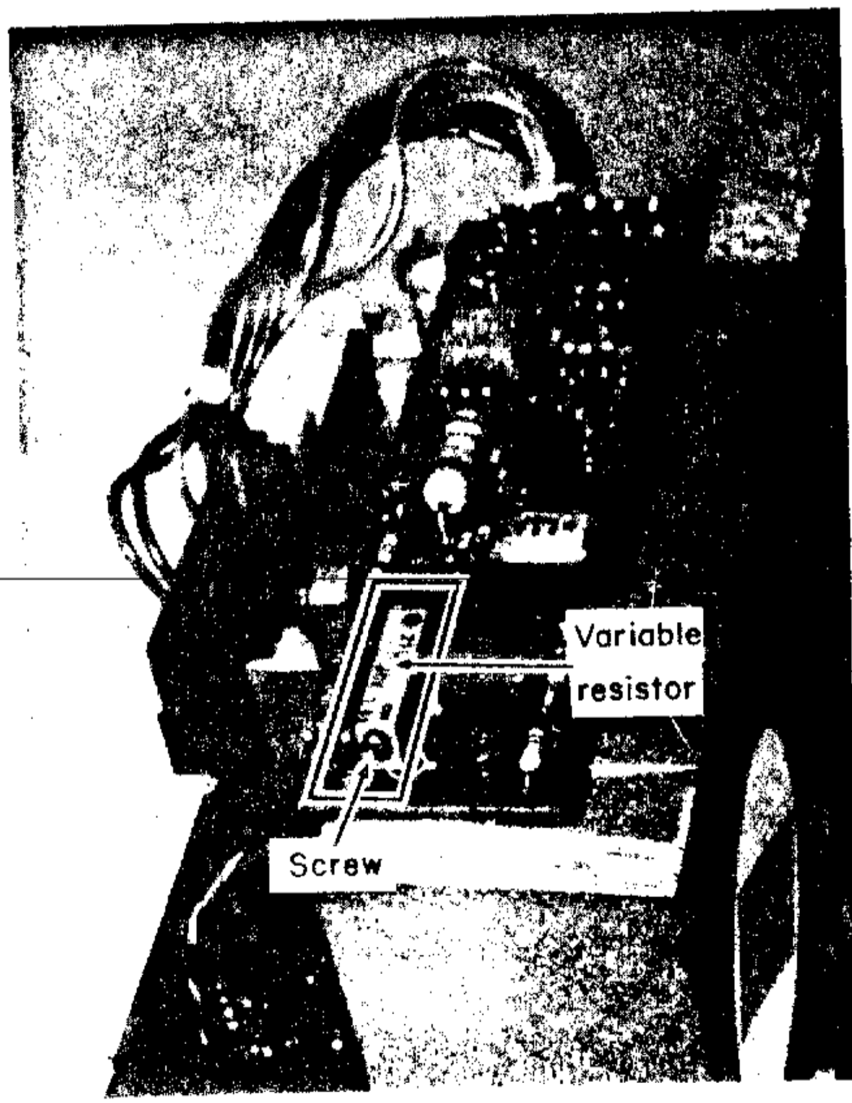


**FIG. 4–26** Variable resistor.

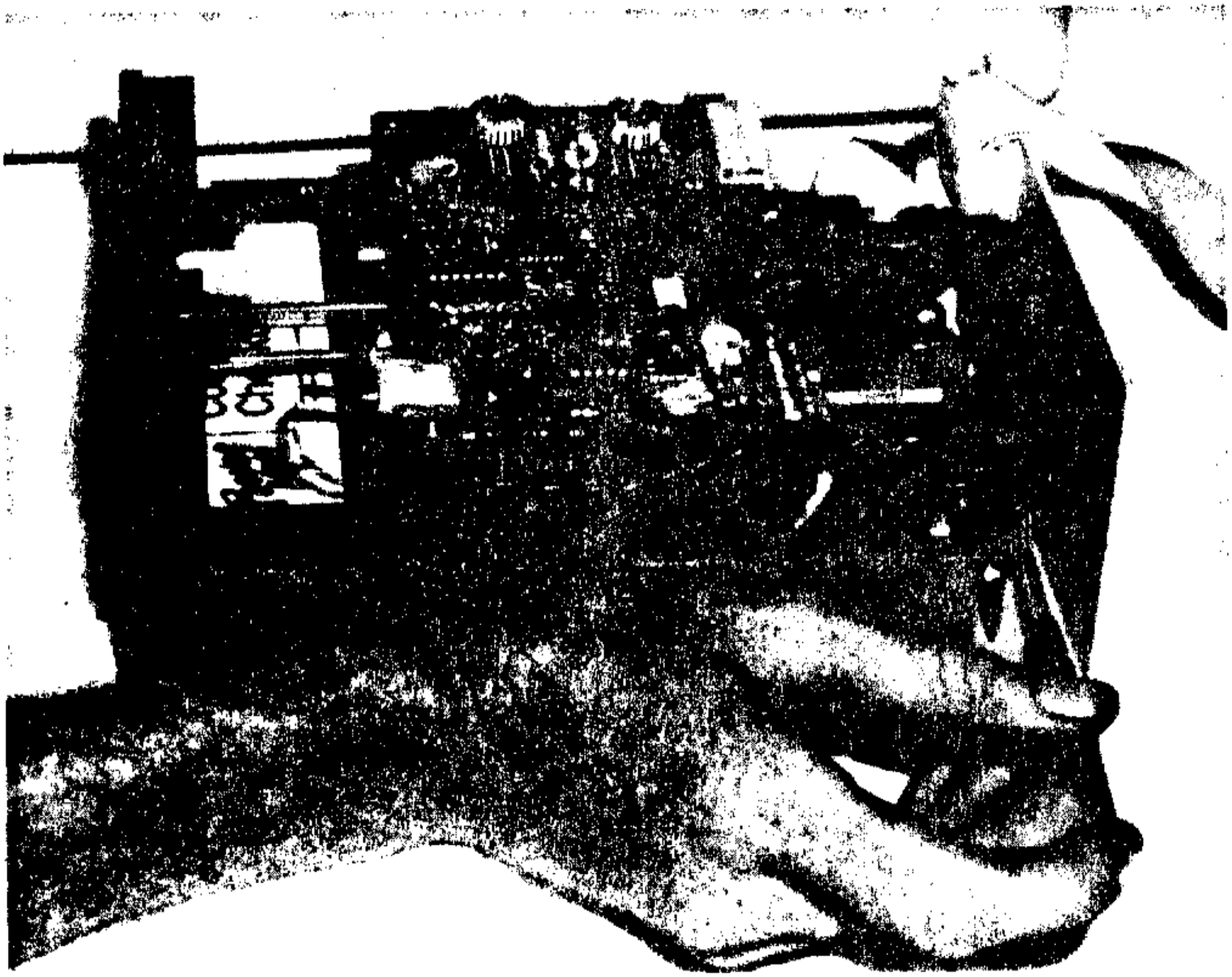

**FIG. 4–27** Use a screwdriver to adjust the variable resistor screw.

the test runs. This is normal. Any reading between 299.0 and 301.0 is okay, with 300.0 being correct. (Some people prefer their drives to operate a little slower, claiming that the slower speed enables the drive to read the diskettes better.)

This test will automatically shut itself off after about three minutes. This is to prevent the power supply from being overworked. But three minutes should give you more than enough time to make the adjustment, which is again done by turning the variable resistor. If time runs out before you've finished the adjustment, give the power supply a while to cool before you start it again.

## DISK DRIVE ANALYZER

Verbatim Corporation sells the Disk Drive Analyzer (shown in Figure 4-28) under its Data Encore subsidiary. The investment is small, considering what the program does. It tests for drive speed, head alignment, spindle clamping,

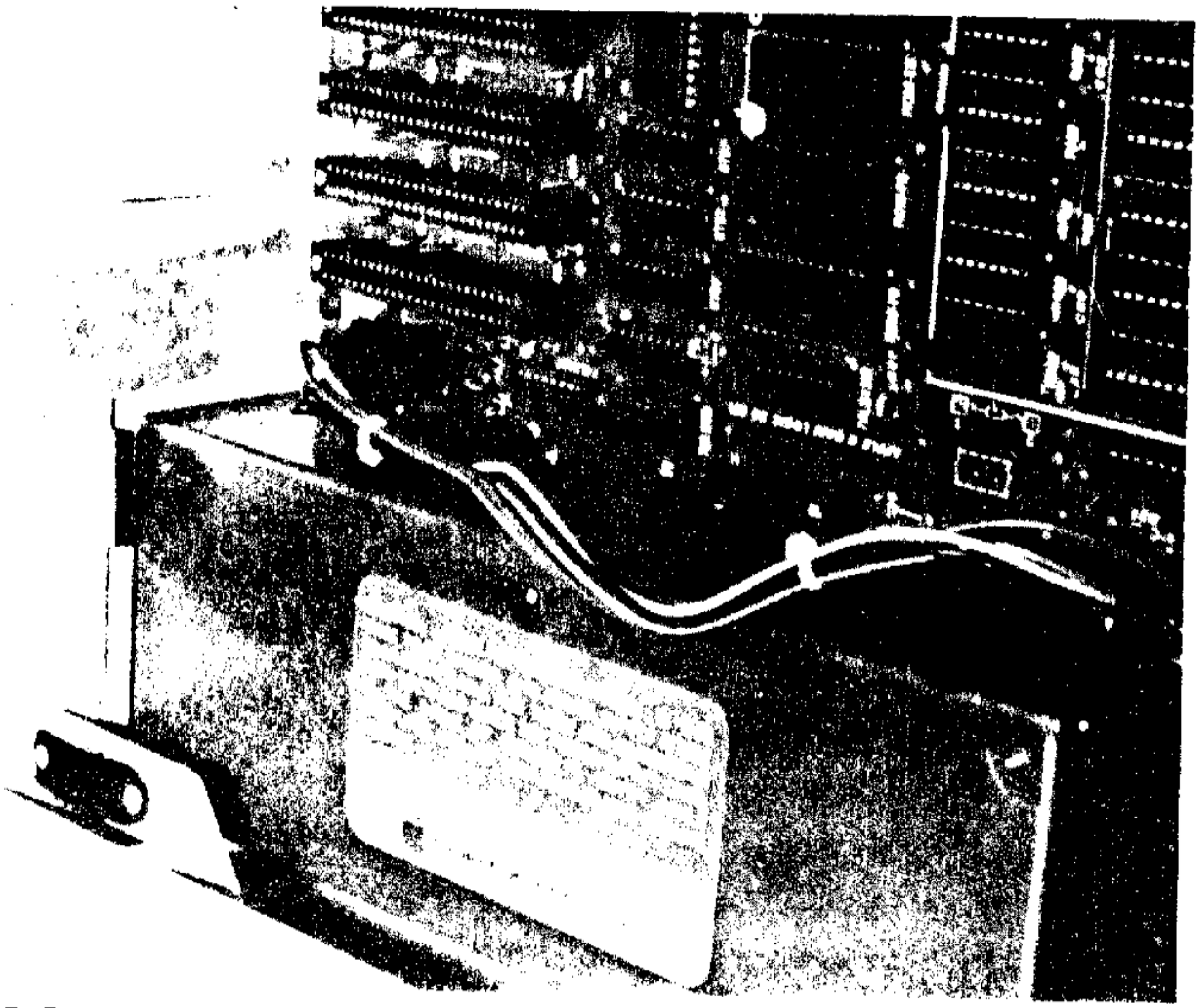

**FIG. 5–3** Location of mother board power connector.

ing from the power supply is a female end and that the pins are numbered (see Figure 5–4). Make a sketch to help you identify the pins on the mother board (a male connector) so that you will plug the two together correctly.

Touch the common probe (black) to either pin 1 or pin 2 of the cable coming from the power supply. Both are ground. Touch the red probe to pin 3 of

**TABLE 5–1**
**Value of Pins 1–6**

| Pin | Value |
|---|---|
| 1, 2 | Common (ground) |
| 3 | +5 volts (±3%) 2.5A |
| 4 | +11.8 volts (±6%) 1.5A |
| 5 | 12 volts (±10%) 250mA |
| 6 | 5 volts (±10%) 250mA |

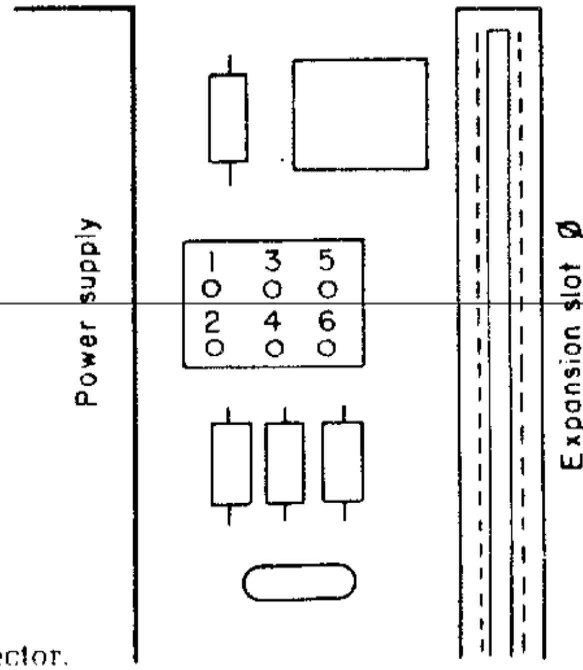


**FIG. 5–4** Pin locations on power supply connector.

the cable and turn on the power. If you get a reading of 4.85 to 5.15 volts, the power supply is working in the 5-volt range. The power supply could be bad if the reading you get is outside this range (see Chapter 6).

If you get an acceptable reading, check the voltage across the 12-volt side. With the black probe still touching either pin 1 or pin 2, touch the red probe to pin 4. The reading you get should be between 11.1 volts and 12.5 volts. If the readings for both the 5-volt and 12-volt outputs are correct, the power supply is providing the correct voltages. This means that the system board is at fault. If the readings don't match, the power supply is probably at fault. Go to "The Power Supply" in Chapter 6 and run that series of tests.

If all readings are correct but the computer will still not power up, there are three possibilities. The power supply may be wearing out and be incapable of producing the needed amount of current. One of the other boards (including the mother board) may be faulty and pulling too much current for the power supply to keep up. Or you may simply be overloading the power supply yourself.

In the case of a worn power supply, about all you can do is get a new power supply. Fortunately, this is rarely necessary. The next two tests will help determine this. But before you yank out the old power supply, go to Chapter 6 and continue testing with the information under "The Power Supply."

To test the other boards for drawing too much current, follow the procedure from Chapter 2 on removing the boards one at a time (with the power off each time you remove a board) to find the one at fault. If the power supply will still not run the computer with all peripheral boards removed, you'll know that

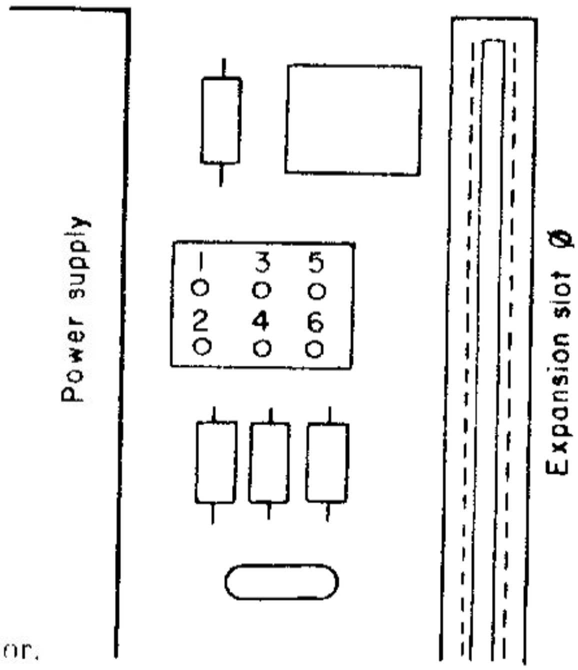


**FIG. 6–6** Pin locations on power supply connector.

on during these tests. You must be extremely careful not to cause any short circuits.

First you'll be checking the voltage between pin 1 and pins 3 and 4 (pin 1 is common). You should get a reading of 4.8 to 5.2 volts between pins 1 and 3, and 11.1 to 12.5 volts between pins 1 and 4. If you don't get these readings, move immediately to step 9.

If these voltages aren't correct, you'll know that the problem is definitely in the power supply. All you can do is replace the faulty unit (with an exact match). If the voltages are correct, proceed to the next step.

### STEP 7—CHECK DISK DRIVE POWER

This step tests if power is getting to the drives. It can be skipped if the drives seem to be operating correctly. If the drives have been causing trouble, you can find out quickly whether the problem is in the drives, the power supply, or the drive cable.

In Chapter 4 you learned that there are two basic types of drives: Alps (with an "Apple Computer, Inc." label) and Shugart (with a "Shugart Associates" label). Testing for power is similar for both, and the pins are in the same location (see Figure 6–7).

Power to the drives comes from the power supply. The pins are labeled, so there shouldn't be any problem identifying which are which. The common lead of your multimeter goes to any one of the ground pins (1, 3, 5, or 7). Check each of the power-carrying pins (13, 15, 17, and 19 for 12 volts; 11 and 12 for 5 volts).