DISK DRIVE DIAGNOSTIC

USER GUIDE

Sheepshead Software
PO Box 486
Boonville, CA 95415

(707) 468 8717

FOREWORD

Dysan Corporation recently announced the DDD [1] that provides **quick and complete** testing of floppy diskette drive performance.

The DDD differs from a normal floppy diskette in two important respects.

1. The media of the DDD is exceptional high quality.

2. A special machine writes data with progresive standard offsets.

The DDD may be used with desk top or portable computers with software specific to make or model of computer.

This document explains how to use the Dysan DDD with software and documentation provided by Sheepshead Software. No prior training is required to use this document.

I wish to gratefully acknowledge the help and encouragement from the staff of Dysan's CE division in Sunnyvalle, California.

John B. Palmer
Sheepshead Software
Post Office Box 486
Boonville, CA 95415

(707) 468 8717

August 8, 1983

Major revisions made May 1, 1984. Grateful acknowledgement to Wayne Randall and the Sacramento Kaypro Users' Group and also many others who helped find errors in the first edition.

Some new material had to be added just before this new edition went to the printer. This may mean a few minor errors for the sake of newer and more comprehensive information.

---

1. DDD -Digital Diagnostic Disk, trademark of Dysan.

Chapter 1

Introduction to Drive testing

1.1 What You Need To Test Drives

This section will explain what disk drive testing is. To avoid being wordy let's use the expression 'disk drive' instead of the exact 'flexible media drive mechanism.' There are two or three basic ways to test a disk drive. The older and more expensive methods required you to have thousands of dollars worth of electronic equipment before you could find out if there was sometime wrong with your computer. Disk drives are mostly mechanical. Anything mechanical will likely get out of adjustment before the electronics parts of your computer fail. So how do you test the mechanical specifications of a disk drive?

1.2 Conventional 'Cats Eye' Test

A precision drive could record any unique pattern on a disk. You could use such a disk to check a suspect disk drive. If you then look at the waveform with an oscilloscope, you will get a visual representation called a 'Cats Eye'. You could use this to evaluate the disk drive. Additional patterns on the disk would test different disk drive specification.

There are a number of problems with this type of test. The oscilloscope is a rather expensive piece of equipment, requires special training, and it takes quite a while to perform all tests with the oscilloscope. This type of test is satisfactory for occasional testing in the shop. It is an expensive test if you include the labor cost.

A better method is to use a special drive tester in place of the oscilloscope. Such a device can quickly perform all tests for about the same cost. It requires very little training.

1.3 Testing with the Dysan DDD

If your company is very small and on a tight budget, floppy drive testing may not be economical using the two methods mentioned. Happily, the new system I shall now outline will do the job quickly and at a very low cost. How? By using your computer as a graphic display device. You will see on the CRT screen what is happening on either disk drive.

This newest method will let you use your portable computer and software in this kit to perform all the important tests on the disk drives. We call this the 'Quick and Best' method. It is the lowest cost method and can perform all tests without taking the drives out of the computer.

The 'Quick and Best' method used in this kit contains just two basic parts. One is the DDD disk. ('DDD' is a trademark of Dysan Corporation) The other is the diagnostic TEST disk. If at least one drive is working, you can test either drive for alignment, speed, and other important drive specifications. The TEST disk has the required software and the 'DDD' disk has special digital patterns.

You will need to test your disk drives whenever you suspect that your computer can not read or write some data correctly. Rough treatment, such as a sudden blow, will put the floppy drives out of alignment. Long hours of use may also cause your disk drives to change speed. With our new 'Quick and Best' method you can be sure your disk drives are all right.

1.4 Testing in Large Quantity

After you use this new method, you may agree that it is much better than some other methods. However, there are some possible exceptions. It will depend on how much testing you need to do and what equipment you already have. The method used in this Drive Diagnostic Kit requires you to have a computer with at least one drive working.

Any company with a large number of disk drives to test will purchase a special drive tester. A good choice would be the PAT-1, trademark of Dysan, from Dysan Corporation for about nine hundred dollars, price subject to change. If you are interested, give them a call. The number is (800) 551-9000. Ask for details about the PAT-1 disk drive test instrument.

1.5 Use Correct Alignment Disk

Please note that the 'Cat's Eye' alignment diskette and the Dysan 'DDD' diskette are both used for testing of a disk drive. You must use the right diskette for the method of test you wish to use. We include the 'DDD' disk in our Drive Diagnostic Kit. Sometimes we get phone calls from people who try to use our software with the wrong type of alignment diskette.

1.6 Phone Numbers

Any questions about the Drive Diagnostic kit should be directed to me, John B. Palmer, at Sheepshead Software. You may call me at my laboratory, 707 468 8717. If no answer please call our office and leave a message. The office number is 707 463 1833.

This is the end of Chapter One.

Chapter 2

How to Quick Test Drives

This section will tell you how to use the TEST disk to test the two disk drives in your computer. No prior technical training is required. You should **read this section all the way** through before you try to test your computer's disk drives.

2.1 Hardware Requirements for Drive Testing

One drive, either A or B, must be in working order to run the Drive Diagnostic Test. **You must load the computer's Disk Operating System.** If the A drive is not working right, refer to chapter 10. If drive B is out of order, test it first. If both drives are working use the following procedure.

2.2 Normal Test Procedure

Start out with your **computer's power turned off.** Both drive doors should be open. Turn on the power. Put one of you 'system' disks in the 'A' drive and close the door. Remember, you have to have a 'system' disk to get the DOS message on the VDT screen. Now put the TEST disk into the 'A' drive and type one of the following:

TEST (for early Kaypro 2 or 4)
TESTA (for newer Kaypro 2/84, 4/84 or 10/84)
TESTAX (for early Kaypro 10)

2.3 The Drive Diagnostic Test Menu

After about ten seconds you may remove the TEST disk from the 'A' drive and replace it with the DDD disk. By now you should see the main menu on the computer screen. The main menu looks like this:

DRIVE DIAGNOSTIC TEST MENU

D = Drive Select	H = Head Select
C = Clamp Center	S = Speed
R = Radial	P = Position Error
A = Azimuth	I = Index Time
W = Write Data	V = Verify Data

X = Exit to DOS

select ?

You will select one of the above items by typing just a single letter. You may then see a sub menu. Select a track, perform the test, then use the ESC to return to the main menu. We suggest you perform the test in the following order:

The DDD must be in the drive you wish to test. Use 'Drive Select' or 'Head Select' to test the other drive or the other head. You will not need the TEST disk again for the remainder of the diagnostic tests. You will need the 'system' disk again when you wish to 'Exit' the TEST program.

You will select one of the above items by typing just a single letter. You may then see a sub menu. Select a track, perform the test, then use the ESC to return to the main menu. You may first select the proper drive and head and then perform the tests in the following order.

SPECIAL NOTE! If for any reason you believe a drive has a an electronic failure that might cause erasure of the Dysan Disk, try the scratch disk speed test in the next paragraph. Otherwise skip the next paragraph.

SCRATCH DISK SPEED TEST. You should not place the Dysan disk in a defective drive until you do know for sure that the suspect drive will not harm the Dysan disk. To test such a drive you must start with a scratch disk. Your scratch disk should have been formated earlier and should have the operating

system and some backup files. Place it in the drive, select drive and do the Speed test, which is the only test that can be done without the Dysan disk. After succesfull Speed Test, place the scratch disk in the good drive and check to see if any files were lost. If the scratch disk is still good, you may go ahead and put the Dysan disk in the suspect drive.

Start with the letter 'C' for the clamp center test. The purpose of this test is to make sure that the DDD is correctly in place. If is not in the exact center of the clamp, the remainder of the tests may be invalid. Type the letter 'C' now. Next you will get another menu for track selection. For now pick selection 'A'.

You should get a 'center good' message on track 21 if you have put the DDD into the correct drive. If you get the "RECLAMP" message, open and slowly close the drive door. Make sure you have the DDD in the drive with the red light on.

When you get the 'center good' message, hit the ESC key once. This will bring you back to the main menu shown above. If you can not get the 'center good' message you may chose to stop and inspect the drive for signs of wear. Look closely and the samll plastice cone that fits inside to the disk when the the drive door or lock is closed.

A badly worn drive may clamp only on track 21 but not on tracks 24 or 27. This may mean the plastic cone that centers the disk to the spindle has become worn. Clamp error on track 21 may indicate 3 or more thousanths of an inch cone wear. But there are other problems that may also cause the clamp to appear to be weak. As loose drive door or lock cause also cause the disk to not seat well on the spindle.

Even a large error in Azimuth or Radial can cause this test to fail. You may wish to go ahead with the remainder of the test even if the clamp does not look good.

2.4 Speed and Index Time

Select the letter "S" from the main menu. You will now see a numeric display of the Spindle speed in RPM. **Correct speed is 300 ± 5 RPM.** A range is 295 to 305 is all right. If the speed is lower than 290 RPM or higher than 310 RPM you may not be able to do the other tests. If necessary, go do the speed adjust now. [1]

When you get a good speed reading, hit the ESC key once. This will bring you back to the main menu shown above.

Next select the letter "I" for the index test. You may select track 0 by using

the letter "A". Now you will see a numeric display for Index to ID time in microseconds. A value of 200 microseconds is ideal. The Index time should be between 100 to 300 microseconds. Don't be alarmed if it is not inside of this range. Do not try to adjust the index until after all other tests have been made. [1] Please bear in mind that the Index is not the most important test. The Radial and Azimuth are much more critical.

2.5 Radial and Azimuth Alignment

Radial and Azimuth alignment tests measure the exact placement of the Read/Write head over the floppy disk surface. For best operation, the head must be in the correct position. We consider Radial postion to be the more important test. [2]

Let's consider Radial position. For a 48 TPI disk drive, there are 40 tracks on the disk. That would allow up to about 20 mills for each track. But only about 12 mills of track has recorded data. Logically, there is a space between each track. If the Read/Write head is not in the correct radial position, it would try to read the blank area between the recorded tracks.

2.5.1 Interpretation of Display

Select the letter "R" now. Select track 16. You should now see a graphic display that looks like this one of the examples at the end of this chapter.

In the first example, example A, the radial position is very good, but not quite perfect.utopian. The example shows that the Read/Head can read data 10 mills negative, away from spindle, to 8 mills positive, toward the spindle. This would imply that the head is one mill off of ideal alignment.[3]

Should the drive in the above example be adjusted? No. An error of one mill is

---

1. An invalid speed and index reading may mean the index sensor is defective.

2. It is unlikely that a read/write head will lose Azimuth. But if so, the drive may have to be discarded.

3. The DDD is accurate to ± 1 mil.

not important in a track will 12 mills of data. We will not attempt to adjust the alignment unless we have some other reason to pull the drives out of the computer.

Now hit the space bar and select track 39. You might see a display like that given in C or maybe even example F.

Why was the display so narrow on track 39 ? Some Kaypros have a little trouble reading data on track 39. Example C may be normal for some early model Kaypro 2 computers only on track 39.

But example F is not very good at all. There may be trouble with either the drive or maybe ever the main computer board. Note that the Dysan "DDD" does not have any offsets between 0 and 6. There is no offset number five. The drive is likely only one mill off. Most likely example F would not been seen on the outer most tracks because such lower number tracks have high analog output due to greater linear velocity.

2.5.2 Read Error Track or Drive

If you get the "READ ERROR TRACK or DRIVE" message on track 39, but not on lower number tracks, you may have some problem with the digital data separation circuit of the Kaypro 2. You may need to replace IC number U88 [4]. Or it may indicate that the drive electronics are weak. Improper dress of the flat cable may also cause data failure on the inner tracks.

You may also see the "READ ERROR TRACK or DRIVE" message if you failed to put the Dysan disk in the drive you selected. Otherwise you may have adrive so far out of radial alignmemnt that the TEST program can not read enough sectors on the track to produce a valid display. Other drive problems may also produce the "READ ERROR TRACK or DRIVE" message.[5]

Chapter 6 gives some helpfull information about the home sensor. In some cases you may need to adjust the home sensor before using the clamp, radial and index tests.

The radial test sould be good on at least the outer five of the six tracks available. But it is very rare for a drive to test good on any two tracks by not all six.Maybe the stepper motor shaft came loose and relative phase was lost.

---

4. Western Digital FDC9216, no substitute listed.

5. Try the position test on track 16 offset 7. If position test is ok, problem with the home sensor may have upset radial test.

Adjust shaft screw and try again.

As you can see, the Radial alignment test is very important and useful. Whenever a disk drive has received rough treatment check the Radial alignment. Besides telling the relative position of the Read/Write head it also gives you a relative indication of how well the drive electronics can read data. The width of the display is in proportion to the ability to read data.

2.5.3 Azimuth Test

You may now wish to try the Azimuth test. A typical reading is + 40 mins and - 40 mins. The Read/Write Azimuth is all right when the two readings are the same or within ±4 mins. What if you have trouble with the azimuth? Try the test on a different drive and on a different computer. Azimuth failure is very rare and is not to be expected to be caused by normal usage. We have included this test to help you isolate unusual abuse of the disk drive.

On some types of disk drives it may be posible to correct azimuth by doing a radial alignment. If needed, you may have to compromise the radial alignment to correct the azimuth.

2.6 Position and Other Tests

The Position error test, also called Hysteresis test, measures the ability of your drive's read/write head to return to the same point. Start at track 0 with an offset of 5. Later try tracks 16, 19, or 30 with offset of your choice. You may note that in some cases a very small offset may give a larger error.

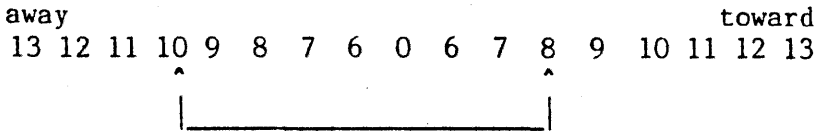
In any case the position error, hysteresis, should be less than 1.0 on a new drive. A value of 2.0 indicates a badly worn drive. We have no suggestions about how to correct position error. Position error, together with radial and other problems, can cause data to be lost.

Not included in any of the above are the ISV test and the compliance test. The tests are explained in the OEM Service manual. The Radial test may help you isolate ISV and compliance problems.

If you suspect an ISV problem, you can replace the motor belt and use the Radial test to see if the data-read becomes more reliable. If not the ISV was likely all right. Drives That do not have belts motors that drive the shaft

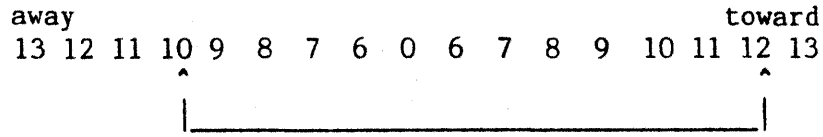
2.7 Examples of Radial Display

EXAMPLE A



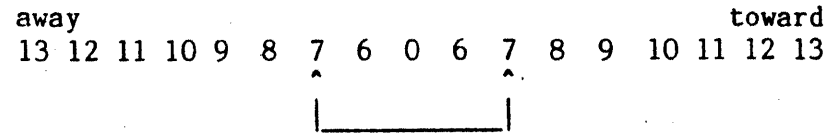
Here is a very good typical radial reading. The read quality is good. The R/W head is slighly off track centerline. It is about 1 mill outward, away from spindle.

EXAMPLE B



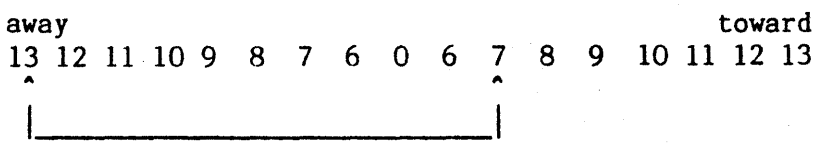
This is also a very good typical radial reading. Note how wide the display is, the read quality is even beter than the prior example. In this example the R/W head is also slighly off track centerline, but now it is about 1 mill inward, toward spindle.

EXAMPLE C



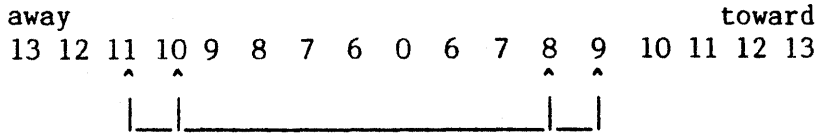
A very poor read. However, the R/W head is perfectly on track centerline. Most likely the drive is mechanically sound, but something is wrong with the electronics. See also example E.

EXAMPLE D



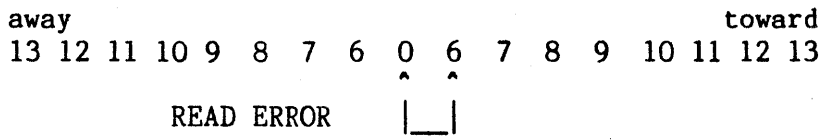
In this example the R/W head is far off track centerline. It may be from 2 to 4 mills outward, away from the spindle. The drive is usable as is, needs to be adjusted to prevent future problems. We are not sure about the size of the error because there is no way to read beyond 13 mills of radial displacement.

EXAMPLE E



This example has jitter. The display will not remain stationary, and we can not see exactly how far the R/W head is off track centerline. One unit of jitter would be all right, but here you see two units of jitter. Something is wrong with the motor, drive belt, or shaft bearings. You may need to replace the drive. But sometimes the jitter may be caused by EMF noise that enters the electronics of either the drive or the computer.

EXAMPLE F



Here is a very bad example of the radial reading. The read quality is very bad and sometimes the READ ERROR message shows. However, the R/W head maybe only slightly toward the spindle. There is no way to read radial displacements between 0 and 6.

A constant READ ERORR message may mean you should check to see if the DDD is correctly placed in the drive. Or maybe the R/W head is just too far off track. Consult Chapter ten for help.

This concludes this chapter on testing. Details of how to make adjustments are covered in other chapters of this guide.

Chapter 3

Why you Need Drive Testing

The purpose of this section is to explain why floppy drive testing may be important to you. I will try and help you decide if it is really necessary to remove the disk drives and do a complete adjustment. After reading this part you may decide how often you wish to test your computer's disk drives.

3.1 Small Computer Takes Bumps

A portable computer, or any computer that has to move from here to there, may be subject to hard bumps that can hurt it. You may throw the disks drives out of alignment without even knowing it. Sometimes the computer may continue to **work all right for a while and then fail when you use an older disk.**

If you are familiar with audio and video recording, you may already know how gradual loss of performance may go unnoticed until you make a technical evaluation of the equipment. The same rule can apply to floppy disk drives. **Sometimes a disk drive weakness is invisible to the user.** This diagnostic kit is an important aid to computer owners who never have had any trouble.

Part of the operating system, namely the BIOS [1], will retry a disk read several times when a failure happens. If any retry is successful, DOS [2] goes its merry way and will not tell you that one of your drives is on the verge of a breakdown.

---

1. BIOS means a Basic Input Output System

2. DOS means a Disk Operating System.

3.2 Now You Can Test More Often

Before the introduction of this new method of drive testing it was very costly to test the alignment of disk drives. Now it is very **practical to make the test once a month** or even more often if you wish. Anytime the computer is transported you ought to test the Clamp, Speed and Radial.

If you have a brand new computer, you may wish to test it after only a few hours of operation. Sometimes a new computer may have a small item fail after the machine gets hot. **You can 'burn' in a new computer by leaving it running all day. But avoid leaving the computer unattended.** There is a very small but costly danger of fire with any new equipment.

3.3 Testing With a Submit Job

A better way to 'heat test' a new or used computer is with an endless 'Job'. For information on how to create a 'Job' under CP/M, consult the CP/M guide under the title 'Submit'. A possible endless 'submit' file named 'JOB.SUB' for testing might be:

```
ASM DUMP
TYPE DUMP.PRN
ERA DUMP.HEX
SUBMIT JOB
```

The above example requires ASM.COM, SUBMIT.COM, DUMP.ASM and JOB.SUB all be on drive A and that enough disk space is available for the file DUMP.PRN and DUMP.HEX.

You would start this 'job' on the A: drive by giving the command:

```
SUBMIT JOB      < hit return >
```

The above example requires use of the CP/M operating system and some material found on the master system diskette. On the TEST disk you will find a R/W-TEST program that is suitable for use on your computer. To start the R/W-TEST give the command:

R/W-TEST < hit return >

Either of the above provides a good exercise of the disk drive and most of the electronics. After the 'Job' has run for two hours, perform the drive tests again and see if there has been any change in the most important drives specifications.

This is the end of Chapter Three.

Chapter 4

Where Adjustments are Found

This section will help you find where the different adjustments are located. You also will need to refer to the service OEM manual, which was included with your Drive Diagnostic Kit. **This section will refer to pictures or drawings found elsewhere in this Kit.** These will show where important parts of the computer and the disk drives are located. You will have to open up your computer to located some parts. Chapter nine explains how to open up your computer, but please read over this chapter before your begin.

4.1 Find the Motor Speed Adjustment

Refer to the photos/drawings of the service manual. Notice the "Servo PCBA" on the back of the full size drive. Also locate the photos/drawings that identify the **"Spindle Speed Control".** This is what controls the motor speed. **You can make this adjustment** with the drives inside the computer case if you have the standard size drives. It is very easy to do. [1]

4.2 Find Stop and Home Sensor

Refer to the photos/drawings of the service manual. Notice the "Track 00 Stop." It is NOT the home sensor. Do NOT adjust this screw untill you know how. The home sensor is not easy to see on the full size drives if it is under the logic board.

---

1. Sometimes "Spindle Speed" is called "Motor Speed". This is a misnomer. On belt-driven drives the motor runs faster than the spindle.

Refer to photos/drawings that apply to the type of drives you have. Notice the home sensor on full size model drive is a switch assembly. It is called the "Track 00 Switch Assembly" Notice the E-rings. They are what you are going to break if you try to use the "Adjustment Screw" before you **first read the instructions in chapter six.** Other types of drives use an infra-red sensor for the "Track 00" function. The infra-red sensor has no parts to wear out and seldon needs attention.

If your drive uses a switch assembly for the "Track 00" function you may need to learn how to adjust it. Notice the mounting screw for the switch assembly. You must loosen this screw before you use the adjustment screw. And you must remove the "Logic PCBA" before you can get to the mounting screw.

Study the photos/drawings and find the "Logic PCBA" on the full size drive. You do not have to remove all connectors to lift it up. [2] This card is held in place by just two screws. You must lift it up to get to the mounting screw of the switch assembly.

4.3 Points for Radial Adjustment

Refer again to photos/drawings that apply to your drives. Radial adjustment points for full size and half size drives differ.

All 5 / inch drives work the same, but the location of the adjustments does vary. The older full size drives from the various makers are nearly identical. The newer half size drives have many variations, even units from the same maker may differ.

---

2. You might damage the Read/Write heads if you do not turn off the power first. See Chapter 9 for more precautions.

FULL SIZE DRIVES have a cam screw and a module that is held down by three screws. The cam screw is for adjustment of the radial alignment. You will first loosen the three retaining screws. Locate the "Cam Screw" and the "Module Retaining Screw" on the top side of a drive. Also notice that there are two more retaining screws on the bottom of the drive.

HALF SIZE DRIVES do not have a cam scren nor a movable module. You must loosen the two screws or nuts that hold dwon the steper motor and then gently twist or slide the stepper mootor until the radial alignment is correct. The basic concept of operation is the same as for the full size drives. Most of our documentation was written before the newer drive became popular.

4.4 Find Index Sensor Adjustment

Refer now to page 2-10 and figure 2-9. There you will find the "Index Sensor's Retaining Screw" and the "Adjustment". **This adjustment should not be attempted untill you have read over chapter 8** of this User Guide.

4.5 Find Drive Belt

This is easy! You should have no trouble finding the drive belt. It is easy to take on and off. There are no adjustments for the drive belt. If it is old you replace. Refer to the service manual to see how easy it is to replace. Some newer drives do not have drive belts. Of course you can not find something that is not there!

This concludes this part of the User Guide on where to find the adjustments. Details about how to make the adjustments are in other chapters of this guide.

Chapter 5

Speed Adjustment is Simple

5.1 Motor Speed Adjustment

This section will explain how to adjust the drive speed. You will find that this is one of the easy things to do. You do not have to take the drives out of the case, but you do have to open up the Kaypro 2 in order to get to the speed adjust screw on the back of either drive.

5.1.1 Use a Plastic Tool

Find the plastic adjustment tool. Use it to for speed adjustment. If you use a **metal shaft screwdriver** you might **damage the electrical parts.** You need to turn the computer on again to adjust the speed. Be careful where you put your hand!

Now look at the back of drive A:, there is a small screw mounted on a little plastic block on an electronic card at the rear of the drive. You will find it very easy to adjust the motor speed. Now with the TEST program menu on the screen, select the Speed Test [1]. You will then see a number that represents the main shaft speed in RPM (revolutions per minute). Refer to photo number 4 for the placement of the plastic tool.

At this point you can try turning the adjustment screw one turn to the left and notice what happens to the speed. Did the speed change a little? If not, maybe you do not have the tool in the correct position. Please note which drive is on and has a proper disk. The TEST program can only check the speed of the drive you have selected from the main menu.

---

1. Only for Speed Test, the TEST disk, the DDD disk, or a scratch good disk may be in the drive under test. This is sole exception to the rule stated in chapter 2.

5.1.2 If the Speed is Hard to Adjust

Are you finding it hard to adjust the speed? Do you have the tool into the slot of the screw. Does the speed change very quickly? The speed ought to increase evenly as you turn the screw to the left. And turning to the right should cause the motor RPM to go down. The correct speed is 300 RPM. From 295 to 305 is all right.

If you believe that the speed adjustment is not working correctly, try to adjust the speed on the other drive. Don't forget to tell the TEST program you wish to select the other drive. And you must remember to put the TEST disk or DDD in the other drive. (Seep footnote [1] on prior page.) Also, you may wish to try the 'strobe light speed test'. I will tell you about it later on.

5.1.3 DOS Error Caused by Incorrect Speed

Sometimes the speed of the motor is sensitive to heat. It may go slower when it is hot. Or it may stop completly. If the motor stops when it should not, you will be reading the unwelcome words 'BDOS ERROR ON B: bad sector'.

In either case, it is most likely the fault of the electronic card that controls the motor speed. In your Tandon manual it is called the 'SERVO PCB'. Replacing this part may cost less than a new drive, but you may have to wait a long time to get it.

5.1.4 Repairs Not Recommended

Do not try to repair the 'SERVO PCB'. You will waste your time. If you can find the right parts and if you have technical help you would attempt your own repairs as a last resort. A special circuit chip is **the most critical part.** It is not a common digital or analog device. It is listed in the literature of National Semiconductor. This is a **'Linear Analog Servo' that has no listed substitute.**

5.1.5 Some parts fail when they get hot

By the way, many integrated circuit chips used in modern computers sometimes fail when they get hot. This may not indicate a poor design. **Some parts will fail with heat** as they get older. Good quality parts will keep on working even if very warm. If you find this problem, you have the choice of either cooling your computer or finding the defective part. The speed test can help find if the

'SERVO PCB' is heat sensitive.

Sometimes you may not wish to use the speed test program to check the speed of the drive motors. If you computer is not working at all, you may still be able to test the speed of the motors. I will explain the other way to test motor speed.

5.2 Strobe light speed test

The other method is called the 'Strobe Light Speed Test'. Before you can do this test, you must remove the drives from the computer. Also, you must have either a neon light or a fluorescent lamp powered by 50 or 60 cycle alternating current. [2] Any other light in the room must be reduced. Pull down the shades and close the door.

Now go read all of Chapter 9 called 'Open Up Your Computer' before proceeding any further.

5.2.1 Place Drives for Strobe Test

Refer to the photo 13. Notice how the drives are positioned in the photo. **Place the drives so that you can see the flywheels easily. Be careful that you do not let any exposed parts of the electronic cards touch metal parts.** You could damage some parts by an electrical short circuit. After you have the drives in the proper work position, turn on the power to your computer. Do NOT put any disks in the drives. Both drive motors should now come on. If they don't come on, go read Chapter 10.

5.2.2 The Wagon Wheel Effect

Now let me ask you a question. Do you remember seeing a western movie with wagons and wagon wheels? (So you want to know what this has to do with high

---

2. In parts of the world where national electrical current of 50 or 60 cycle is not available, use only the TEST program to verify motor speed.

technology testing tricks? Just a moment.) Do you remember the wagon wheels going backwards? That was an example of the 'Strobe Motion Illusion'. Now then, take a look at the flywheels of either drive. You should see some lines. Not real lines, just a trick the eyes play. The illusion happens when the drive speed is at or near 300 RPM. (You may have already noticed, before you turned your computer's power on, there are two sets of lines on a drive flywheel, one for a 50 cycle light source and the other for 60 cycle.)

If the lines remain almost still, you do not need to adjust the drive speed. You might try to change the drive speed and look at the illusionary lines. They will appear to speed up or slow down as you make small adjustments of the speed adjust screw. Adjust each drive until the lines appear to be stationary.

5.3 Test Speed When Warm.

At this point you may wish to leave the drives running for about twenty minuetes to see if the speed will change when the drives are hot. **It will not damage the drives to leave the drive motors running.** The expected life of the drive motors is over five thousand hours. [3] But you may wish to reduce the display brightness to protect the VDT screen.

When the drives are warm, the speed may change a little. It should not change more than 1.5 per cent. The normal or ideal drive speed is 300 RPM. Be happy if your drives stay within the range of 295 to 305. Do not worry about one drive being a little faster than the other.

If a drive is close tc 300 RPM it is doing well. It has a built-in shaft speed sensor. The drive speed of the mini floppy drives is not directly controlled by the electrical supply voltage, nor does is change with with electrical supply frequency. This is contrary to what some salesmen may let you believe. [4]

---

3. You can force the drive motors to keep running. Remove your disks and hit the reset button.

4. In fact, most moden micro computers will operate normally with moderate variation in voltage, frequency and purity of the electrical supply. Don't buy a simple power filter to cure disk drive problems.

5.3.1 Frequent Speed Test is Easy

Speed adjustment is seldom needed. But it is easy to adjust. With the TEST program you may check it as often as you wish. Remember, you do not need the DDD for speed test only. The 'Strobe Light Test' requires you to remove the drives, and should be done only when you have nothing else to do.

Don't forget to **unplug the computer** before you start to put it back together again. This concludes this chapter.

Chapter 6

Home Adjustment Headaches

6.1 Home and Stop Very Important

This part of the user guide will help you find where the home switch and stop adjustments are located. These two things are very important and must be checked whenever the drive requires any service. However, they are not critical adjustments and seldom need to be made. These adjustments require you to remove the drive from the computer.

The service manual often refers to the Track 00 Switch. We also call it the home sensor. Either is correct.

Refer to both photo number 11 and number 12. Also look in the service manual for photos/drawings for your kind of drive. Locate the stop screw on the rear of the drive. The home sensor, also called the Track 00 Switch, is not visible until you remove the main electronics card. Do not remove the electronic board yet.

The purpose of the home sensor is to tell the drive electronics when the Read/Write head is very close to the outer track of the diskette. This is a small micro-switch beneath the electronic card.[1] This switch must come on when the the Read/Write head is moving away from the spindle and comes to track number two. The switch goes off when the head is moving toward the spindle and comes to track number three.

6.2 Unreliable System Operation

Even if the home sensor does not turn on and off when it should, the disk controller may know when it has come to track number 0. Each track has a track

---

1. It is an infra-red sensor on all 96 TPI units and most 48 TPI half size units.

address written as part of the format operation. Thus the DOS software will find the 'home track', track number 0, even when the home sensor is not working perfectly. If the home sensor is damaged or very badly out of its proper position, the operating system will never be able to 'log on' that drive unit.

You may find that the home sensor is correct but the stop adjustment is not. The stop adjustment may prevent the head from ever getting to the 'home track'. Turn the stop adjustment outward, counter-clockwise, to allow the head to find Track 00.

6.3 Purpose of Stop Screw

If the stop is very far out, the controller could make the Read/Write head go out beyond Track 00 and smash into the edge of the floppy disk cover. After you turn power on, or hit the reset button, or after a BDOS error, the conroller will try to move the head outward until the home sensor comes on. If it does not come on, the stop must prevent the head from hitting the edge of the floppy disk.

First of all, neither the home sensor nor stop adjustments should be made until you are sure that the radial alignment is within reasonable limits. After doing a radial alignment you may need to do home and stop adjustments.

Here is a trick you can use to check the stop adjustment. You need to remove the cover of your computer. You can adjust the stop without removing the drives. Watch out where you put your hand. You will have to have power on and the TEST program in operation to make this check.

6.4 Track 00 Radial Test for Stop

Start with the Radial test. Start the test on track five. Note the reading you get.[2] Now if all is going well with the radial alignment test, do the same test on track zero. Is the reading the same? If not the same, adjust the stop

---

2. This is not going to work if you get the 'READ ERROR' message.

outward, counter-clockwise, about a quarter turn. It should now be almost the same as the display you read on track 5.

Now you are going to turn the stop inward until the stop bumps the Read/Write head and makes the radial test display shift toward the spindle. At this point turn outward slowly until the display is the same as it was on track 5. Now the stop is almost hitting the Read/Write head. Now you may adjust the stop outward, counter-clockwise, about a quarter turn.

You have now adjusted the stop. There is no need to adjust it again until something makes it move. What will make the stop move out of its proper place? Seldom, if ever, will vibration make it shift. The most common problem is when somebody dares to adjust the stop to correct some other problem. I know that you would not do such a dumb thing, because you have read this user guide over before you started adjusting anything. Be sure to train others not to attempt any adjustment until the real problem has been located.

6.5 Home Sensor Tests

You will not use the main test program for this test. Use the DIR command in DOS to find a program with the name 'HOME.COM'. You will find it on the TEST disk. Now give the following command:

HOME <hit return>

Follow the directions in the program. You should see a display on your screen that shows when the home sensor goes on and when it goes off. **This software can only report the absense or presense of the Track 00 signal on tracks 0 and 4.** You may also wish to use a voltmeter to monitor the output of the home sensor. Normally the sensor goes on when the Read/Write head is moving away from the spindle and comes to track number two. It should go off when the head is moving toward the spindle and comes to track number three.

What if the home sensor is not adjusted perfectly? If it at least comes on for track zero and off for track four, the drive will operate. However, any mechanical device can wear. In time the micro switch may fail to turn on or off at the right place. In time your drive may not work correctly.

6.6 Home Sensor Trouble on A: Drive

This problem is more troublesome on the A: drive. If the home sensor does not work right in A: drive you will not be able to 'boot' DOS unless you swap drives A: and B: somehow.[3] In some cases DOS will be very, very slow to 'boot', showing a posible problems with the home sensor.

6.7 You Must Remove Drives

If you decide to adjust the home sensor you must remove the drives from the computer and place them in the positions shown in the photos. Of course, you must remove the disks and **pull the computer's power plug out of the electrical supply** before you begin to open the computer case. How to open up the computer is covered in Chapter Nine. Please read Chapter Nine and then come back here when you are ready.

Now refer to photos/drawings of the service manual. For the full size drive you must remove the large electronic card, also called the 'Logic PCBA', from the drive frame before you can get to the home sensor mounting screw. There are only two screws that hold the large electronic card onto the drive frame. But before you remove the screws, unplug the Read/Write head connector(s from P5 and/or P6). Later you must put the connector(s) back.

6.8 Lift Up Logic Card

Now you may remove the screws. Next, slide the card forward and it will come free. **Lift up the card until you can get to the home switch mounting screw.** Make loose the screw one quarter turn to the left. Put the electronic card back in place and place the Read/Write head connector(s) back onto P5 and/or P6. Do not put the screws in yet.

At this point you will be able to use the adjustment screw to move the home

---

3. How to easily swap drives is explained in Chapter Ten.

sensor, also called Track 00 Switch in the service manual, toward or away from the spindle. You can now put the drives into the position shown in the photos and plug the computer in the electrical power.

Now put your system disk in the proper drive. Drive A: if that drive is operating normally. Drive B: if you had to swap drives. After you see DOS sign on, remove your system disk and place the TEST disk in the same drive. Again start up the home program as mentioned above. Select the proper drive.

6.9 Home sensor May Be Worn

At this point you can adjust the adjustment screw until the home switch is going off or on at the right point. Are you able to do it all right? If not, it may be that the switch has become so badly worn that it will not go on at the right spot. Or maybe a wire has broken off of the switch.

Now that you have the home sensor in the correct place, you may remove the disk and turn off the computer's power. Remove the Read/Write head connector again and lift up the card. Tighten the screw on the home sensor, but be careful not to bump it. After you put the electronic card back in place with its screws, be sure that you also have the Read/Write head placed correctly on P5 or P6.

Make a final test of the home sensor again using the home program as mentioned above. If you find that it somehow moved after you had tighten the screw, you will have to start over. Please do not try to use the adjustment screw without first making the mounting screw loose. If you break the E-rings, refer to the service Manual.

If needed, repeat the above procedure with the other drive. If you find that the home sensor gets out of adjustment very often, you may have to get a replacement for it. Do not overtighten the mounting screw.

After you have done this adjustment a few times, you may find that is goes faster if you do not replace the electronic card each time. The HOME program can test the drive without the Read/Write head connected to the card. **Special Note: This is the only adjustment you should attempt without the 'Logic PCBA' in place.**

Be careful. You might **damage the Read/Write head** if you plug it in while the power is on. Or you may cause the Read/Write head to erase part of the TEST disk! Also, be careful not to touch exposed parts of the electronic card with your screwdriver. Do not let the card touch metal parts of the drive or computer.

This ends this chapter of the user guide about adjustment of the home sensor.

- Use this space for notes -

Chapter 7

Radial Adjustment the Right Way

7.1 Importance of Radial Adjustment

This section will describe where the adjustments for radial position are located and how to make the radial position adjustment. This is perhaps the most important adjustment of all. Of course, all adjustments are necessary. However, this **adjustment is needed if you have trouble using disks written by your computer some time ago.** Also, you may find that disks written in one drive may not work well in the other drive. Correct radial position adjustment may solve these problems.

As an example, let's consider if both you and an amigo have the make and model of computer. Suppose that one computer has incorrect radial position on its drives. Your amigo mails you a disk with some data you requested. You find that you are not able to read the data on your machine. In turn you send some programs to the amigo who tells you about a strange 'BDOS ERROR' caused only by your disks. **At least one machine may need the radial position corrected!**

If both you and your amigo have and use this DRIVE TEST KIT, you can be sure that your computers can exchange data and programs without trouble.[1] Currently we have **this kit only for the Kaypro 2 and 4.** It does not work on other computers.[2]

7.2 Do Not Use Trial and Error

---

1. If both computers are Kaypro 2 or 4.

2. An Apple II (R) version will be ready Summer of 1984, MS-DOS version in late Fall.

Without the proper. equipment, such as this DRIVE TEST KIT, it would be unlikely that anyone would get the radial position perfectly correct by using trial and error methods. Only in an emergency you would resort to making random adjustments of the radial position until the computer would work.

7.3 When to Make Radial Adjustment

Sometimes the B: drive is out of alignment and the A: is all right. Either drive may lose alignment because of a hard blow. If you can not 'boot' on the A:, but you are able to 'boot' on the B: drive [3], you should check the radial alignment of the A:drive. But you may not notice that the B: drive is out of alignment until you get an unexpected loss of data on that drive. Whenever the computer has been shipped or subjected to harsh treatment, you may wish to do a radial alignment on both drives before you lose valuable data.

As mentioned earlier, it is not necessary to correct radial alignment error less than 20 per cent of the track width. For a computer using 48 TPI drives, this means 20 per cent of 12 mills, or a little over 2 mils. We have found that even when the error is as high as 40 per cent, about 5 mills, the drives may still read programs and data correctly.

7.4 Potential Problem with Current Files

Before you start with the radial alignment, there is a potential problem you must consider. Has your computer been out on alignment for a long time? Have you used the FORMAT or COPY programs with the drives out of alignment? After you correct the radial alignment, you may not be able to read files that were written when your drives(s) were incorrectly aligned!

To avoid that problem, I would suggest that you first correct the alignment on just one drive and then see if some of your older programs and data are still readable on the drive you just adjusted. If not, try the programs on the other drive, the one you have not yet adjusted. You may wish to use the PIP or COPY

---

3. You can 'boot' the B:drive with the 'Trouble Bug'

programs to copy material from the untouched drive to the correctly adjusted drive. [4]

Now you can open the case of your computer, if you have not already done so, and set the drives up as in photo number 6.

With the drives set up, apply power to your computer and 'boot' one of your DOS disks. Please take the time to check the connectors on the drives before you insert any disks. After you get DOS to 'boot', start the TEST program. Select which drive, put the Dysan DDD in that drive and go to the radial alignment test on track 16. Make a note of how much radial error you have. If the error is very extreme, you will get a 'READ ERROR' message.

Now study the photos to locate the three screws that hold the module onto the frame. Under the photos/drawings of the service manual they are called 'Head Module Retaining Screws.' Two are near the flywheel and the other is near the cam screw. You will use a 7/64 hex wrench to loosen the three screws. You must not adjust the cam screw until all three of the retaining screws are loose. (Half size drives do not have a cam screw, refer back to Chapter 4.)

It may take quite a bit of force to loosen these screws. After you are done with the radial alignment you will retighten these screws. You must not try to get them as tight as they were. You will notice that each screw had a drop of paint. That is what made them so tight. Too much force can break the screw off. Even if you do not break it off, extra force can warp the module.

You may wish to remove the disks from the drives and turn off the computer's power until you are ready to proceed with the radial alignment. Notice in photo number 12 that the person has placed one drive in a prone position in order to adjust the cam screw. Be careful when the computer's power is on; do not to let parts of the servo board or logic board touch the computer frame; do not let the drives touch each other's electronic parts.

When you are ready, turn on the power, 'boot' DOS and do the TEST program again. Select the same drive, put the Dysan disk in that drive and go to radial test on track 16 again. Now try to adjust the cam screw very slowly.

7.5 Adjust Cam Screw Slowly

---

4. You can use the drives outside of the computer case. Of course this requires that both drives are operational.

Is the cam screw hard to turn? Are you sure you have the right screw? Look careful at the photos/drawings of the service manual. It requires a slotted screwdriver. The cam screw will never come out; it will just go a little to the left and a little to the right. Try turning in the other direction. Sometimes the cam screw may jam. If so, you may have to tap on the module lightly until the cam screw will turn.

Are you getting the 'READ ERROR' for any position of the cam screw? Are you sure you selected the right drive? Did you put the Dysan disk in the right drive. Turn the cam screw very, very slowly from one extreme to the other. Does the module move when you adjust the cam? Try moving the module with your fingers. The module should go in and out about one eighth of an inch. If you still can not get a valid read, try tracks 0, 5 and 16, in that order.

(You may need to use the Position Test in order to force the disk controler to 'calibrate' the correct track number in an extreme case of bad radial alignment.)

Once you have a valid display, you must turn the cam screw very slowly and watch the screen of your computer. If the error becomes worse, try to turn the cam slowly the other way until you get a perfect radial alignment. Be patient. Very patient.

7.6 How to Tighten Retaining Screws

Now you may start to tighten the retaining screws. For now, just make them snug but not tight. Now look at the alignment. Did it shift? If so, you can make a small change in the cam screw. If needed, you may have to loosen the retaining screws again. With practice you will learn to make the retaining screws snug so that you can still use the cam screw.

When you are happy with the radial alignment, try the test on all the other tracks. Tracks 5, 16, 19 and 30 should all give the same readings. You may notice that track 0 or track 39 have slightly different readings. Sometimes you may see a 'READ ERROR' message on track 39; critical adjustment of the cam screw may help. It is more important to have correct radial alignment on the middle tracks. **If you get radial alignment on one track only, you have a phase error because the stepper motor has slipped!**

Do not fret too much about the width of the display. Some computers may show a very wide display. Also, the Dysan disk in time will begin to wear if you treat if badly. If you get a bad radial alignment on one track but not on the

others, it may be that the disk became damaged. What if the drive reads very good on four tracks, but poor on two? The drive may be all right.

7.7 Final Adjustment

Go to track 16 for your final adjustment of the cam screw. (Use track 5 if The DDD has become worn.) When you are done, tighten the retaining screws. Tighten them in rotation, first make all three snug, then a little more until all three are firm. If you are careful, the radial adjustment will not change as you tighten the three retaining screws.

That is all there is to radial adjustment. Now you should also **check the speed and index timing.** Be sure to adjust speed before you adjust the index. The index must be tested whenever you make a large change in radial adjustment.

After testing the index, you may want to adjust the other drive or place both drives back in the computer case. Refer to Chapter Nine for details about how to put the drives back into the computer. This concludes this chapter.

Chapter 8

Index In Time

The index adjustment requires you to remove the drives. Before you do this, consider if the index is truly in need of adjustment. The drives may perform satisfactory even when the index is incorrect.[1] This section helps you to find the index sensor and make the adjustment. If you fail to read with care you can **ruin the index sensor and the drive will not work.**

8.1 Index Adjustment Not Critical

If you think the index adjustment is needed, do it after all other adjustments have been made. The type of controller used in this computer, the 1793 by Western Digital, tolerates index errors. Most disk operations do not depend on index time. But it can influence the disk format operation.[2]

The format operation requires correct index and speed. If you adjust either or both index and speed, you may notice improvement in the format operation. You should do the index adjustment after the speed adjustment, or after any other adjust.

8.2 Location of Index Sensor

You will find the index sensor near the main flywheel on the bottom side of the

---

1. The Drives may not work if the index sensor is burnt out.

2. The format operation is part of COPY program for the Kaypro 2 or 4.

disk drive. Refer to the photos. You will have to put the disk drives on their sides as in the photos. You may want to review some of the material in the service manual now. Please note that some of the instructions in the manual will not apply in this case.[3]

I hope you will **read this material all the way through** at least one time before you start to adjust the index. It is really a very easy adjustment. Sometimes a person becomes overconfident because it looks so easy. If you try to adjust index now, before you read the details, you might break it or get it so far out of correct alignment that you will not be able to fix it until you finish reading this.

8.3 Index Timing Range

Recall earlier in a prior section of this user guide we said that the correct setting for the index was given as 200 microseconds. Do the index test now. Notice the number given. If the value is greater than 100 microseconds and if it is less than 300 microseconds, do not even touch the adjustment. Also, perform the test on another track. The index may be different on another track. Is it within the range of 100 to 300 microseconds?

Now you may wish to set higher standards. You will not improve the performance of your computer by putting the index right on 200 microseconds. Only if you are using a non-standard format will you need to worry about the index timing.[4] In any case, the motor must be running at or near 300 rpm before the index sensor is moved.

Special Note: The TEST program itself and the Dysan DDD are not always exactly right for index timing. Many other variables, the 1793 disk controller, diskette temperature, envelope opacity, lint on sensor and other factors can also alter the relative index time. You may need to allow up to 100us more to allow for these variations. Make tests of several drives that are know to be good and use the average reading as your reference.

---

3. You may find some of my errors. The service manual is right.

4. The Kaypro 2 format is standard. However, some people have tried to use very dense disk formats in violation of western digital's standards.

8.4 Loosen Index Sensor Hold Screw

Begin the adjustment with the TEST program. Select the drive you wish to work with and go to the speed test. If speed is all right, go to the index test on one of the lower number tracks. Now locate the index sensor and loosen the index sensor hold screw. This is a metal Phillips head screw. Turn it to the left (counter-clockwise) about one fourth turn. Now look at the display on your computer's screen. Do not try to use the hold screw to adjust the timing.

Now use a standard slot screwdriver blade. Put it into the plastic slot of the index sensor. With a twisting motion, try to move the sensor a little to the right or left. Do not use very much force. If it will not move freely, use your Phillips screwdriver to loosen the hold screw a little more.

8.5 Adjust to 200 Microseconds

Adjust the index sensor until it is close to 200 microseconds. Do not try to get it exactly on 200. Anywhere from 150 to 250 is very good. Remember, the sensor is made of plastic. A lot of movement and force may break it off.

When you have the timing withing the correct range, tighten up the hold screw a little bit. Notice the index timing again. Did it go up or down? If you need to, loosen it again very little and make a very small adjustment of the sensor, using your slotted screwdriver. Now again tighten up the hold screw. You may need to repeat this a couple of times until the index sensor is at its correct position and is held firmly in place.

8.6 How to Tighten Hold Screw

Most likely you will find that every time you try to tighten the Phillips hold screw the index timing will shift. You will find some point where the Phillips hold screw will be snug but not tight. Gently move the sensor until the timing is correct.

Do not over tighten the hold screw. Normally, the index sensor is not subject to a lot of stress. A sharp blow will not loosen the index sensor. More likely a sharp blow would loosen or damage other parts of the drive.[5]

This completes this portion of the user guide on index adjustment.

---

5. Because the index sensor has a smaller mass than other critical parts, it is less likely to 'fall' out of adjustment.

Chapter 9

Open Up Your Computer

The part of your User Guide will help you to tear apart your computer. Do not be afraid. The most important safe guard is to unplug the power cord before you open your computer's outer case. If the disk drives are inside the computer enclosure, you must open it up to make any drives adjustments.

The following material applys to all of the Kaypro desk top portable computers. You may wish to look at the photos in the back of this User Guide while reading.

9.1 Remove Cover for Speed Adjust

There are ten screws that hold the metal case of the Kaypro 2. Use a good screwdriver of the right size. You may find that the screws are very tight. (Kaypro has been using an ape to put the metal covers on the Kaypro 2.)

If you are doing the speed adjustment on a full size drive , removal of the outer case is all you need to do. Removal of the outer case does no harm to normal operation of the Kaypro 2. Of course, you will not leave the cover off for everyday use because of the **safety hazard. Be careful** not to drop or spill anything into the internal parts of your computer.

You do not have to remove drives to use our TEST program. In general, any changes or adjustments to the drives will require you to remove both drives. There are two notable exceptions: you can adjust speed without removing a full size drive, you might change drive select without removing a half size drive.

9.2 Remove Cables from Drives

Before your can remove the drives from the enclosures, you must first remove the cables from the drives. (You already did unplug the power cord.) Study photos number 6 and 8.

Notice the large flat cable. It has 50 wires and a special type of connector that slides onto the edge of the drive logic card. This cable is very easy to remove. Pay attention to how it was put on. Notice how the cable came down from one drive and plugs into the other drive. The cable may have a color stripe. The connector may have a location key.

Later you will have to put the cables back the way they were. The photos will help your memory. CAUTION: The key of the 50 wire connector may get lost. Don't forget how it goes on!

Now let's remove the drive power connector. Study photo number 8 very carefully. The power connector has only three, or maybe four, wires. It is hard to unplug. Use both hands. One hand will hold the drive logic card and the other hand will pull out the male part of the connector. Pull downward. Be careful not to break the drive logic card on a full size drive.

Special Note: Remove the push-on ground wire connection. Just pull gently and it will come off. We have found that this wire is not really needed for testing. It is required for safety.

Before you can pull the drive out from the front of your computer, you must remove all four hex screws from the drive enclosure. But you can not do that until you lift up the Main Board of the Kaypro 2.

9.3 Remove Main Board Screws

The Main Board of the Kaypro 2 is held in place by at least four Philips head screws. Two of these small screws of the front edge must be removed. See photo number 3. Notice that these screws may look like the ones used to hold the outer case. The other two screws on the back may not have to be removed. Make them loose so that you can lift up the Main Board.

Before you try to lift up the Main Board, check to see if the printer connector screws and the serial port connector screws are holding the Main Board. Make them loose so that you can lift up the Main Board.

Study photo number 7 very carefully. Here the person has put one hand underneath the main board to reach the four hex screws with the hex key tool. Do not force the Main Board up. If your hand will not fit, you will have to

remove all screws from the back of the Main Board.

Later the Main Board must be put back in place in order to use the computer to help you make the adjustments.

9.4 Remove Four Hex Screws

Now remove the four hex screws from the Drive enclosure. Refer to photos number 6 and 7. You will use a 7/64 inch hex tool to loosen each screw. You may use your fingers to remove the screws.

You should loosen all fours hex screws, but do not remove them. After that, remove the hex screws from the bottom drive first. Do you find it hard to remove the screws under the Main Board? Be careful not to hit the glass tube, the Cathode Ray Tube, with your tool. Fold the handle of the tool to give yourself the leverage needed to loosen the hex screws. (It must have been the same Ape.)

9.4.1 To Replace Hex Screws

Later, when you put the drives back in, you ought to start the screws on the outside first. The hex screws hold drives firmly in place. When you put the drives back in you will have to do the lower drive first. You will hold the drive in place until you can start the screws. Do not tighten the screws on the bottom drive until you have the top drive in place.

9.5 Remove Drives from Front

Refer now to photo number 10. You will remove the top drive first. Use both hands. Pull slowly and firmly. Be careful that you do not break the little things on the logic card. We recommend that you place a cardboard square over the logic board while removing the drives. The drive protector cardboard that came with the drives will do nicely.

Once you have the top drive out, the bottom drive will be easy to remove.

Never try to remove the bottom drive first. We recommend that you always remove both drives whenever you do a drive alignment. Remove both drives you will not need any additional cable harness to perform full drive alignment.

9.6 Drives in Test Position

Now put the drives in the test position shown in photo number 9. You will find that the cables will reach and fit correctly in this position. The power cable has a key. It will only fit one way. It does not matter which power cable goes to which drive. The two power cables are identical.

Be careful with the 50 wire flat cable. Look at the photo very carefully. It is possible to put the flat cable on upside down. Either edge connector goes to either drive. Look at the photo to make sure you have the 50 wire flat cable on right. Notice the color stripe.

9.7 Drive Selection Shunt

Please refer to photos/drawings of the service manual to help you identify the parts on the 'Logic PCBA'.

Notice photo number 9. The person is pointing to the place where the 'Programmable 'shunt' Socket' is located. Notice that the 'shunt' in the A: drive is not the same as the one in the B: drive. If you were to exchange the 'shunt's', the drives will be logically exchanged. [1]

You need to know this information in case you ever have to purchase a new drive. For the newer half sixe drives you will need to refer to the service manual for explicit details that apply to the make and model you are using. For the full size drive you just replace the 'shunt' of the new drive with the 'shunt' of the old drive.

---

1. How is the A: drive different from the B: drive? Each drive has a different 'drive select address' because of the 'shunt'.

9.8 Only One Terminator Pack

Also notice the 'Terminator socket'. One of your drives has something in that socket. The other does not. It may be a '150 ohm resistor pack' or may be a '470 ohm terminator'. Regardless of what they call it, only one drive needs it. If both drives have it, something is wrong. If neither drive has it , something is wrong. Only one drive may have the resistor terminator.

The service manual makes a point of putting the terminator in the correct drive. On a small computer is does not matter which drive has the terminator. However, if the terminator is not in either drive you may get read and write errors sometimes.

This completes this part about how to take your computer apart. Details of how to do each adjustment are found in other chapters of this User Guide. When you are done with all adjustments you should have no trouble putting your computer back together.

Chapter 10

When Everything Goes Wrong

10.1 Can Anything Go Wrong?

You came to this part of the User Guide because everything went wrong. I put this part in the back because I thought you might never need this. But here it is, just in case.

This Disk Diagnostic Kit needs to have at least one of your two drives working. I will shortly explain how you can 'boot' from the B: drive on the Kaypro.

10.2 Not Disk Drive Problems

Make sure you have a **good copy of the CP/M operating system.** If necessary, get a backup copy of CP/M from a working Kaypro and try it on the sick Kaypro. The TEST disk, in its present form, requires the CP/M operation system to load the program into the computer's memory.

Speaking of memory, if you are having trouble with the Kaypro memory, the TEST program may not run right. It needs to have the lower 8 kilobytes of memory to operate. Memory problems with the Kaypro are not common.

10.3 Memory and CPU Check

A memory check program is on the TEST disk. It may help find a problem with the Kaypro memory. It does not tell you which, if any, memory chips are bad. If your computer memory and CPU are normal, the memory check program will give the following pattern:

Pass#0000 Pass#0002 Pass#0003 Pass#0004 Pass#0005

You must hit the reset to stop the memory check. You may wish to leave your computer running for a hour or two to see if any CPU or memory errors show up when the equipment is warm. A memory error may be caused by the Z80 CPU. **Try another Z80 and see.** A Z80 may fail when hot.[1]

Another chip that may fail when hot is the 1793 floppy disk controller. I do not mean to imply that the Kaypro is too hot for normal parts. **A few early 1793 chips were defective.** Good parts should not fail when hot.

Do not try to replace parts on the Main Board that do not have sockets. In fact, you would do well to simply send the Main Board back to Kaypro if you believe there is any problem at all.

Your screen display may be out of adjustment, but that has nothing to do with the dependability of the rest of the computer. Of course, if you can not see the screen well, you may not be able to use any program correctly!

Sometimes the keyboard fails, or at least is appears to be the keyboard. It may be the baud rate generator chip.

For more help will the above problems, talk to your dealer or another Kaypro owner. The rest of this guide will help you with troubles you may find with the disk drives.

10.4 When A: Drive Not Working

---

1. A Z80A or Z80B may be used in place of the Z80, but not vice versa.

If the A: is not working you will not be able to 'boot' DOS unless you find a way to 'boot' from the B: drive. On some computers the maker has provided some easy way to either 'boot' from the B: drive or else swap the A: and B: drive. It is not quite so easy on the Kaypro.

The two drives are really identical except for the 'Drive Select Shunt' and the 'terminator Pack'. By swapping just the 'shunts', A: drive now becomes B:, and vice versa. When the 'shunts' are in place, the bottom drive becomes the A: drive, and the top drive becomes the B: drive. Of course, this means you have to take the drives out of the enclosure, if you have full size drives.

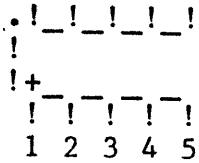
It is posible to swap A: and B: drives without removing the drives. For half size drives you should be able to swap the DS1 and DS2 shunts.[2] On half size drives they are found near the rear of the drive, close to the 50 wire connector. For full size drives use a jumper wire.

10.4.1 Using a Jumper Wire to Swap Drives

You may use a jumper wire to make the B: behave as if it were the A: drive. This trick is usefull for Kaypro computers with the full size drives. You must remove the outer cover of the Kaypro.

With the outer cover off, and the power plug removed from the electric poser, locate chip U71 on the right side of the Main Board. You may Refer to photo 5. It is a type 74S04 chip.[3]

It is chip U71 on early model Kaypro 2 or Kaypro 4 that selects either the A: drive or the B:drive. Short pins 6 and 7 togther and you can force the B: drive to come 'on line' and act as if it was the A: drive. Do not leave the jumper wire shorted to pins 6 and 7 for more than 30 seconds while the power is on.



U71 74S04 on early model Kaypro 2 or 4

jump pins 6 & 7 to force drive B: on line

---

2. Or DS0 and DS1 on some models.

3. This part may be a 74S04, 7404, 7414, or 54S04.

Before you turn on the power, remove the 50 wire connector from the A: dirve. This will prevent it from coming 'on line'.

10.4.2 Boot CP/M from Lower Drive

Now you may plug the power cord into the electric power again. Place your CP/M disk [4] in the lower drive, which used to be the B: drive. Close the drive door. Now you should see the familiar message 'KAYPRO CP/M' on the upper left corner of the screen.

If you can not get the message to appear, review carefully all the above material to see if you forgot something. If you are new to microcomputer hardware and software you may have missed an important step. (If you have removed the drives from the enclosure, you may need to check again to see if you put the 50 wire connector on right. Refer back to chapter 9.)

Now you may place the 'TEST' disk in the same drive that you used to 'boot' CP/M. **Do not type control X control C.** With the 'TEST' disk in the working drive give this command:

A>TEST (hit return key

When the TEST program starts you may remove the TEST disk.

Now replace the 50 wire connector and remove jumper, if you are using the jumper wire trick mentioned above. It is safe to replace the 50 wire connector, while power is on, only if there is no disk in either drive.

Try the speed TEST on the bad drive, adjust spped if needed. If speed is good try the clamp TEST. Most likely you will get a 'READ ERROR', if the drive is far out of alignment. Refer to Chapters 6 and 7 for help.

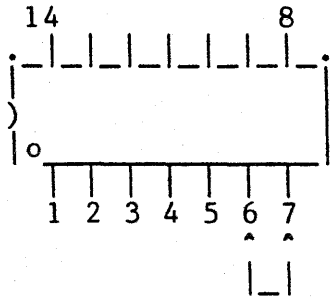
This concludes this part of the User Guide. At this point you should be able to go ahead with the drive diagnostic TESTs.

---

4. A 'CP/M' disk is one that has been formatted and and has gone through the SYSGEN process. The COPY process does both of these operations. should you try to use your master disk

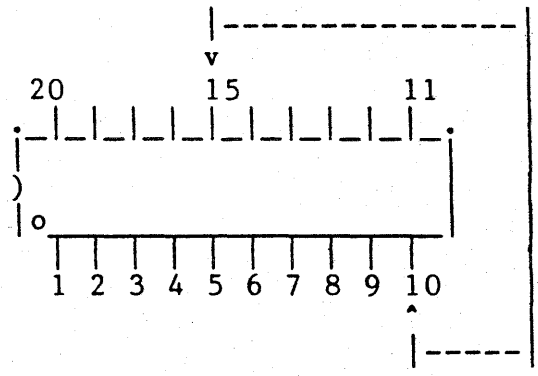
10.5 Where To Place Jumper Wire

To boot from Drive B: you can place a jumper wire on the integrated circut chip that controls the drive select signals on the 34 pin flat cable. Remove the cable from Drive A:, but leave it on drive B:. (You do not want both drives selected at the same time.)



U71 74S04 on early model Kaypro 2 or 4

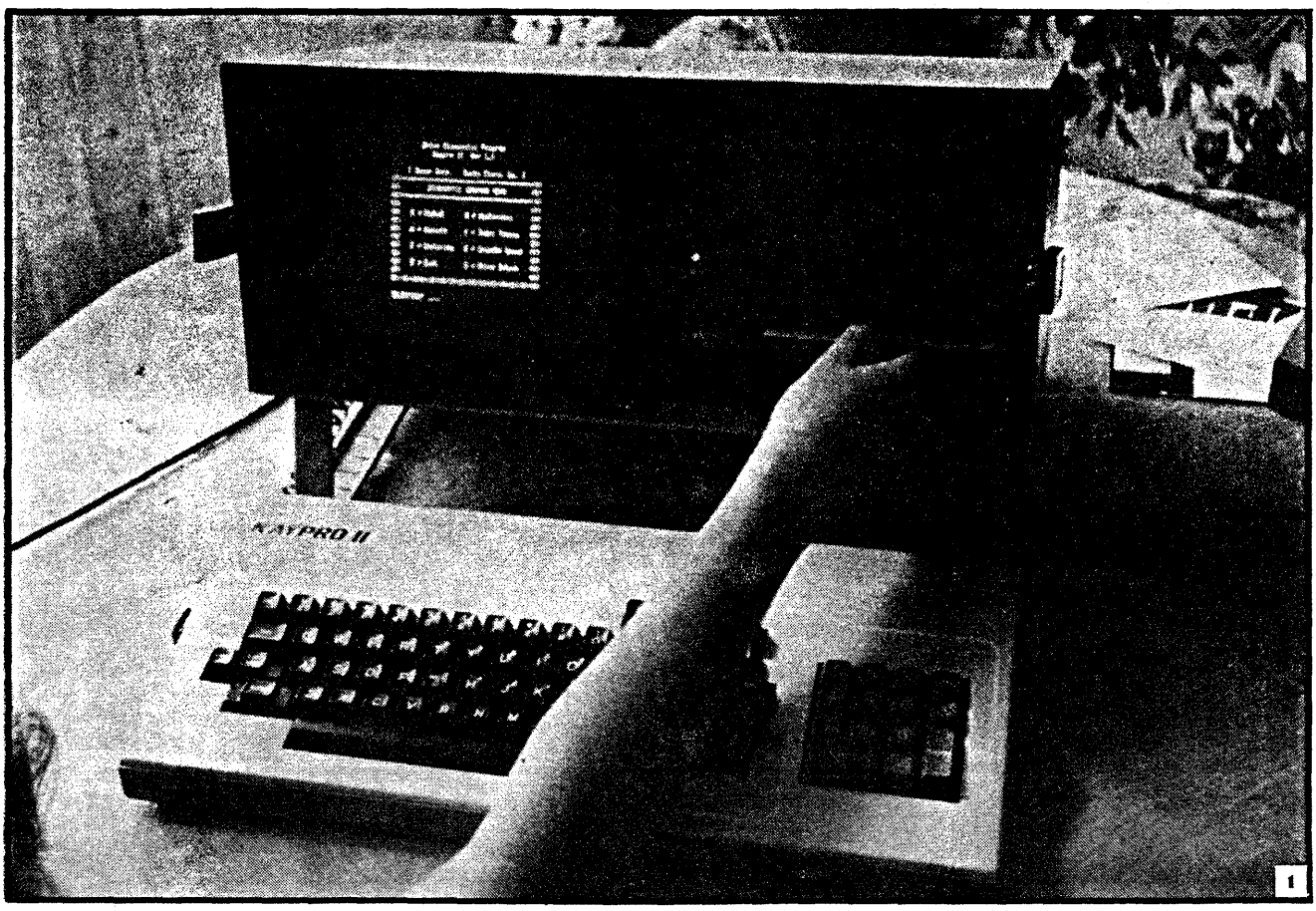
jump pins 6 & 7 to turn on drive B:



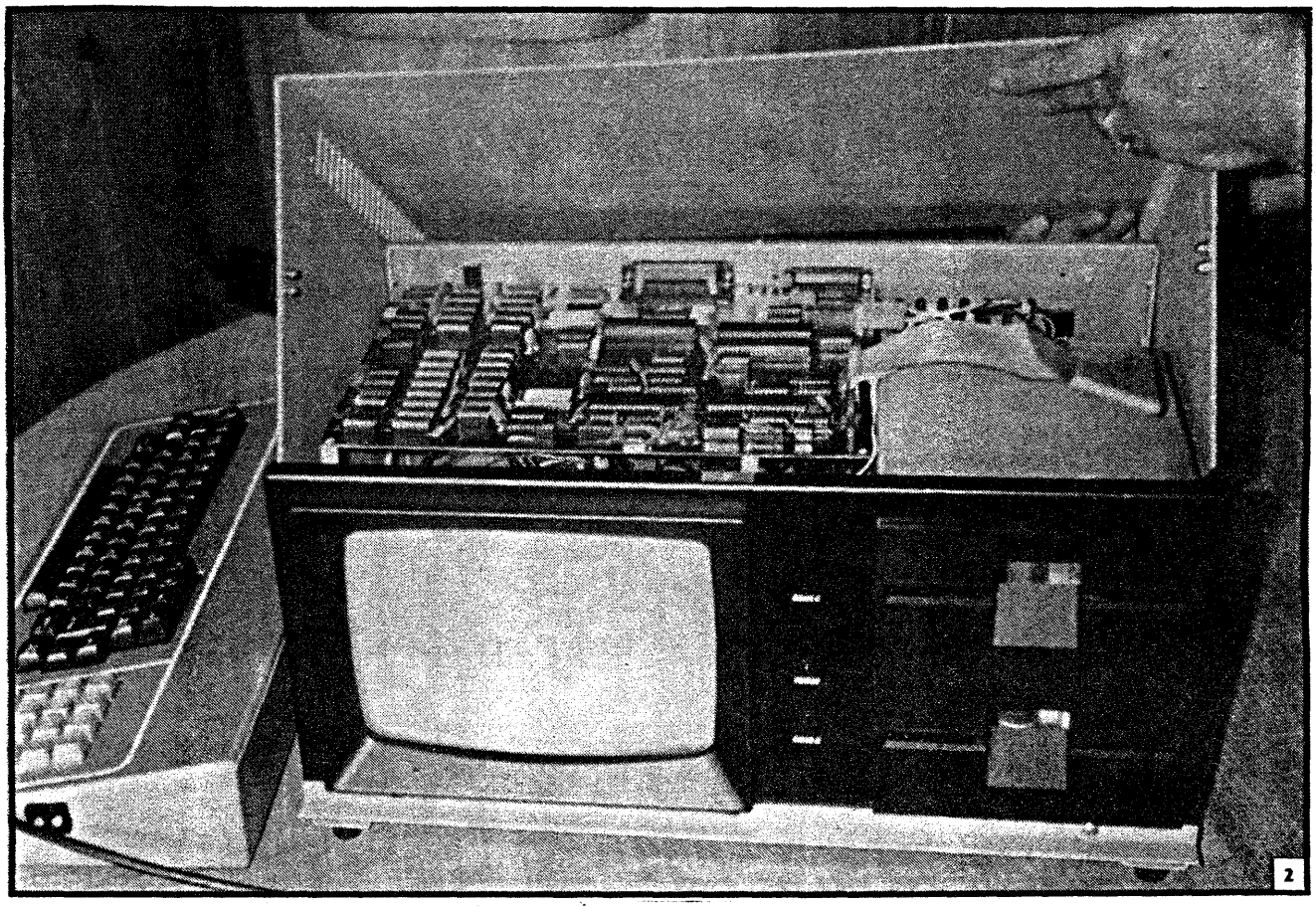
U58 74LS373 on Kaypro 2/84 or 4/84

jump pins 15 & 10 to turn on drive B:
(don't leave jumper over 15 seconds.)

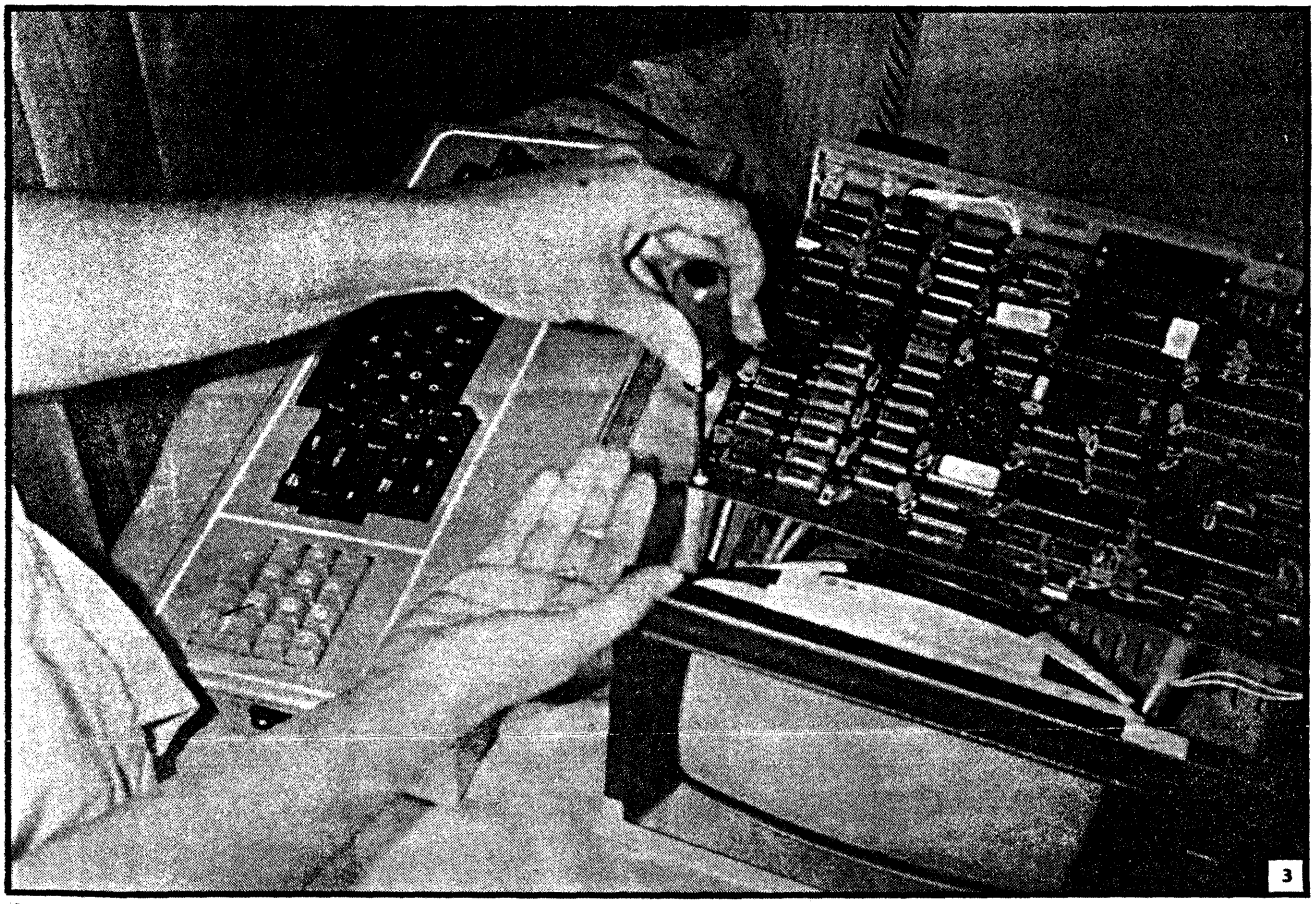
You must remove remove 34 pin cable from drive the A: to put it off line. Note! Please never remove or replace cable while any disks are in the drives!

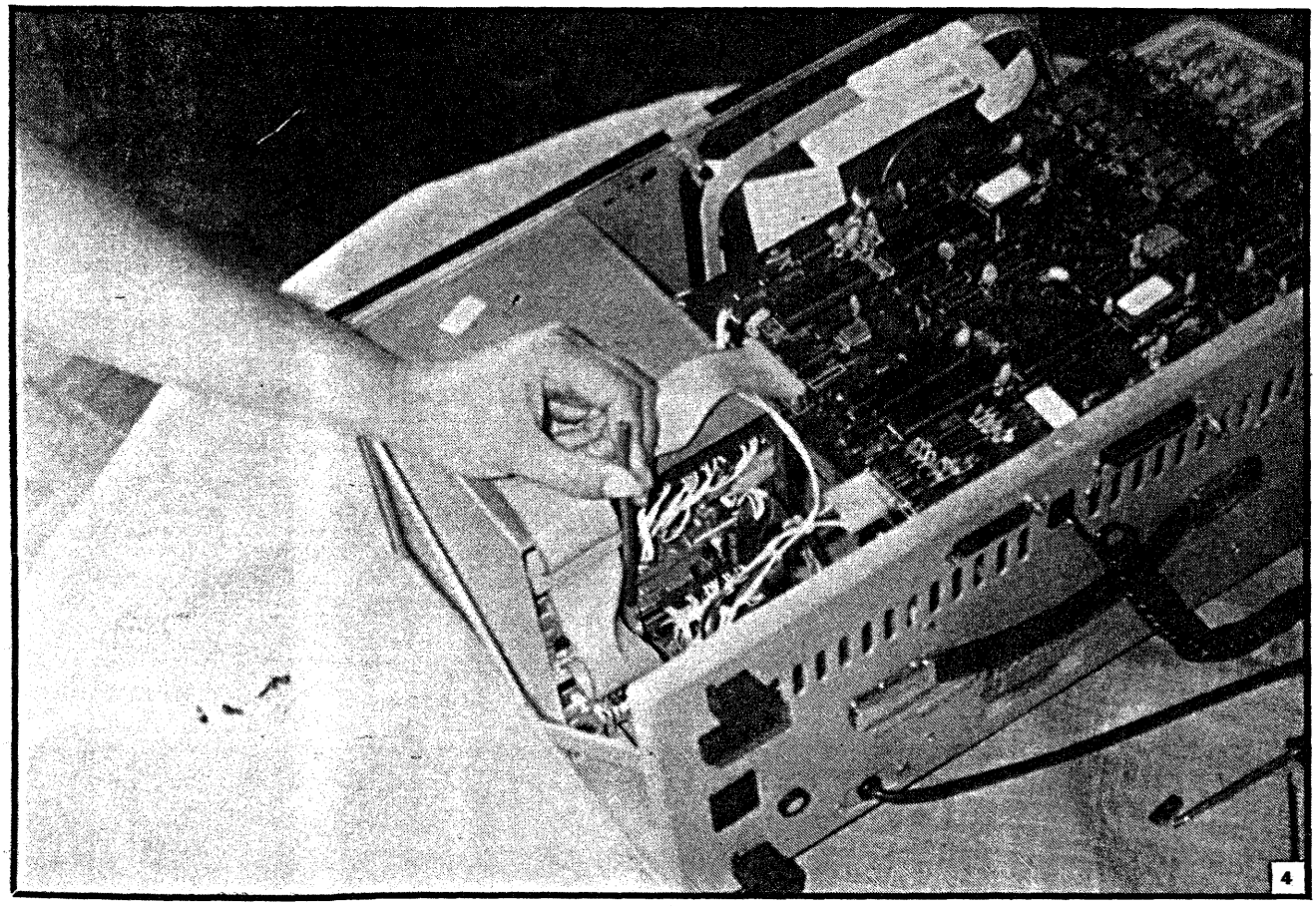


1

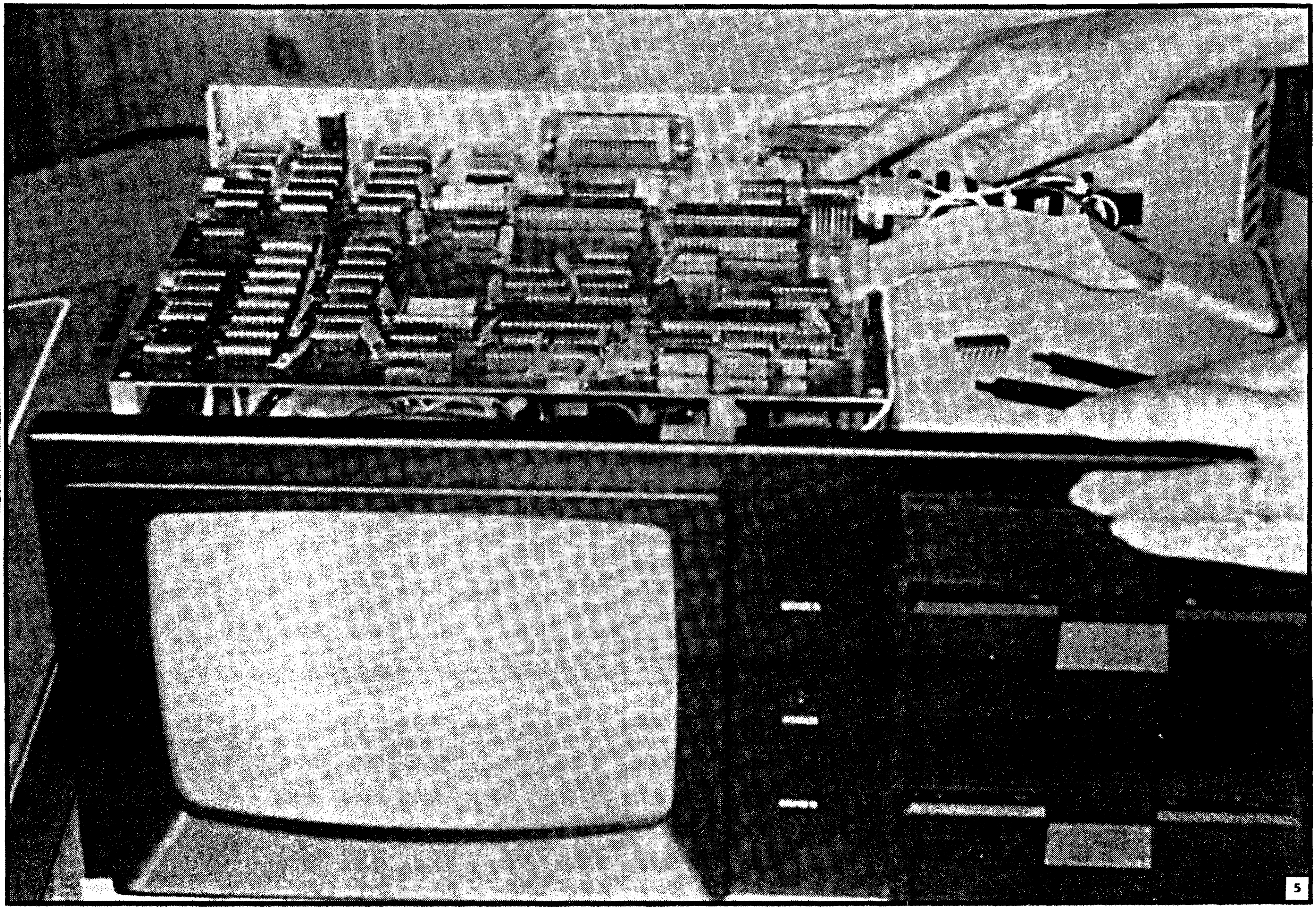


2

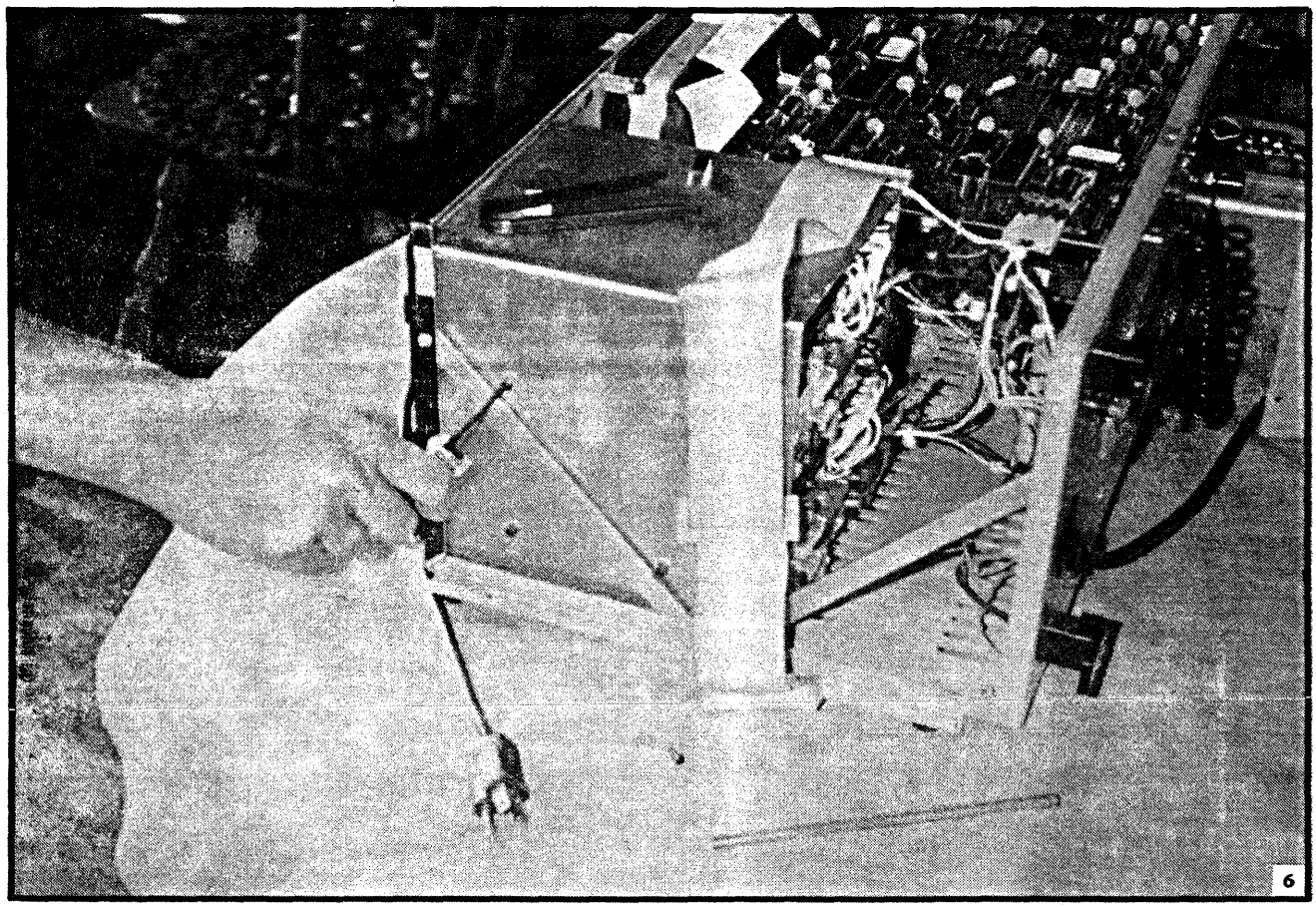

3

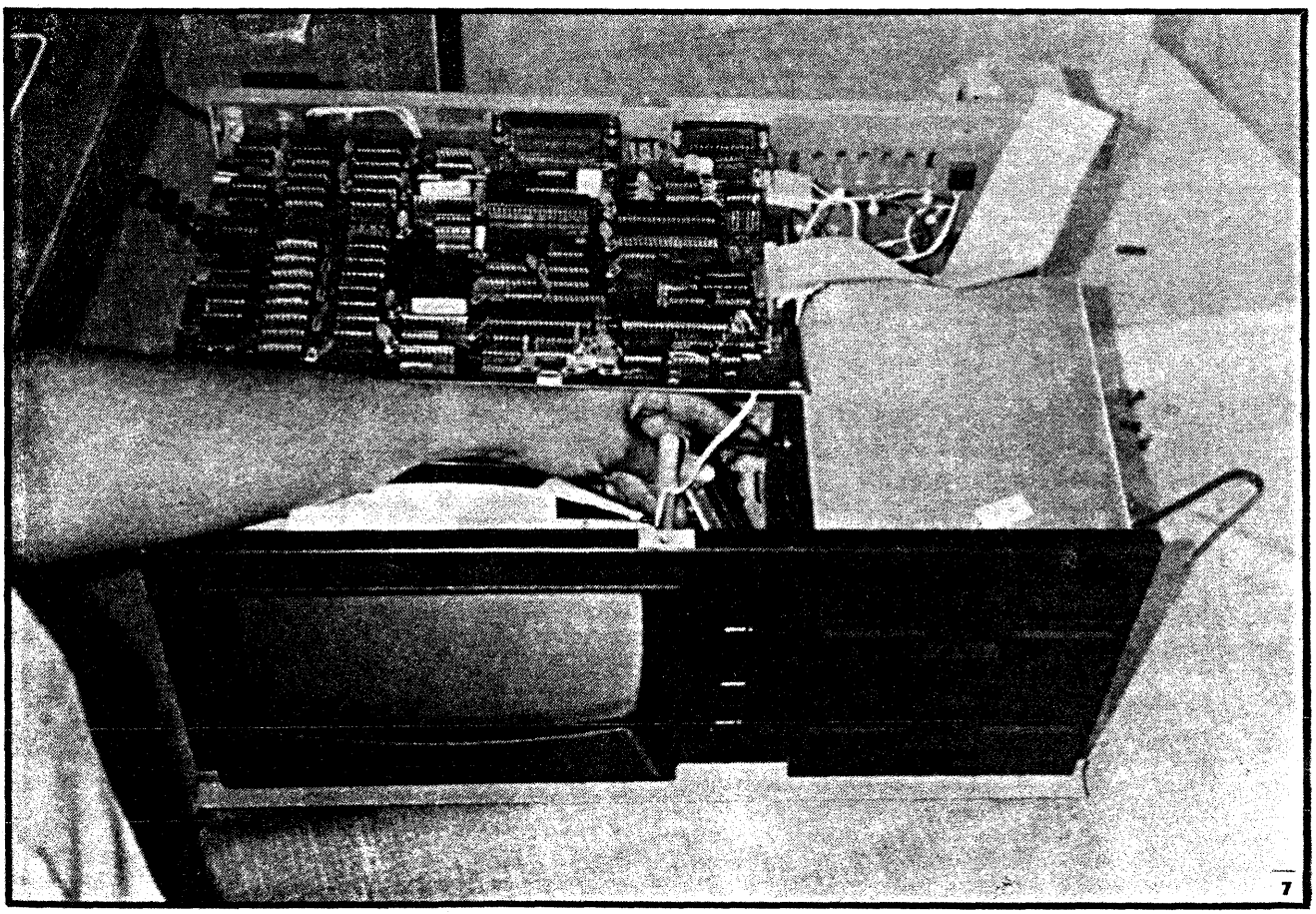

4

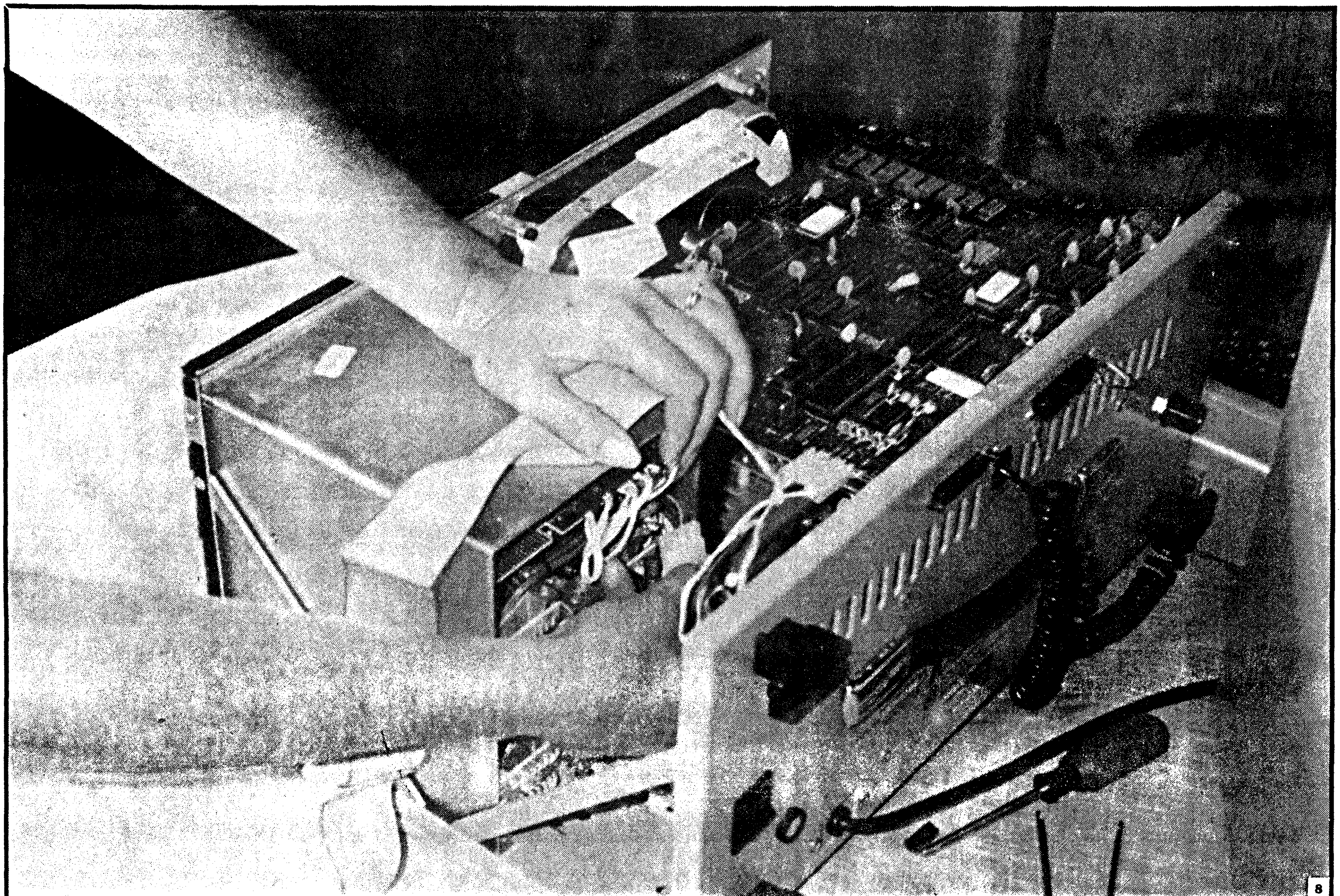
3

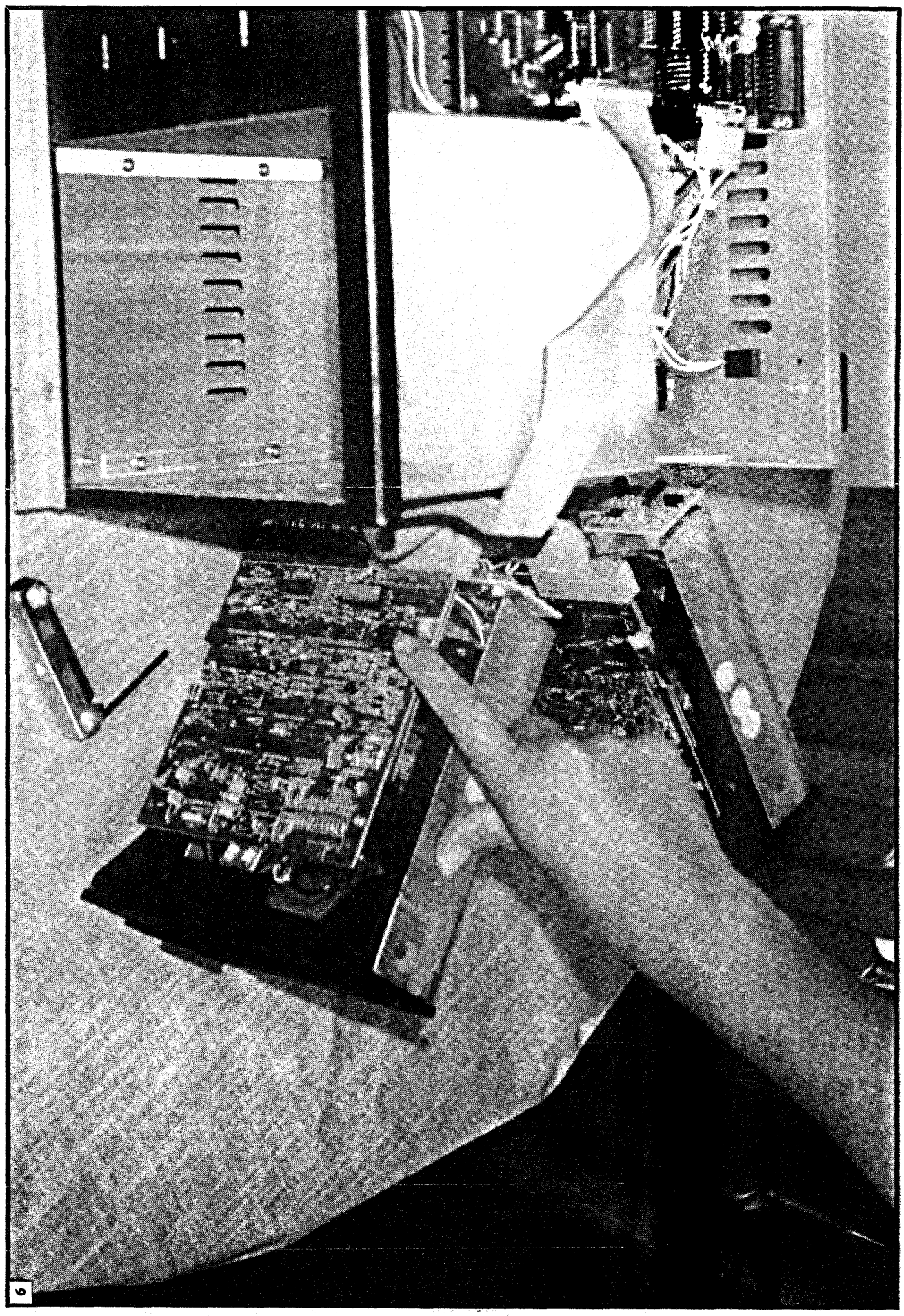


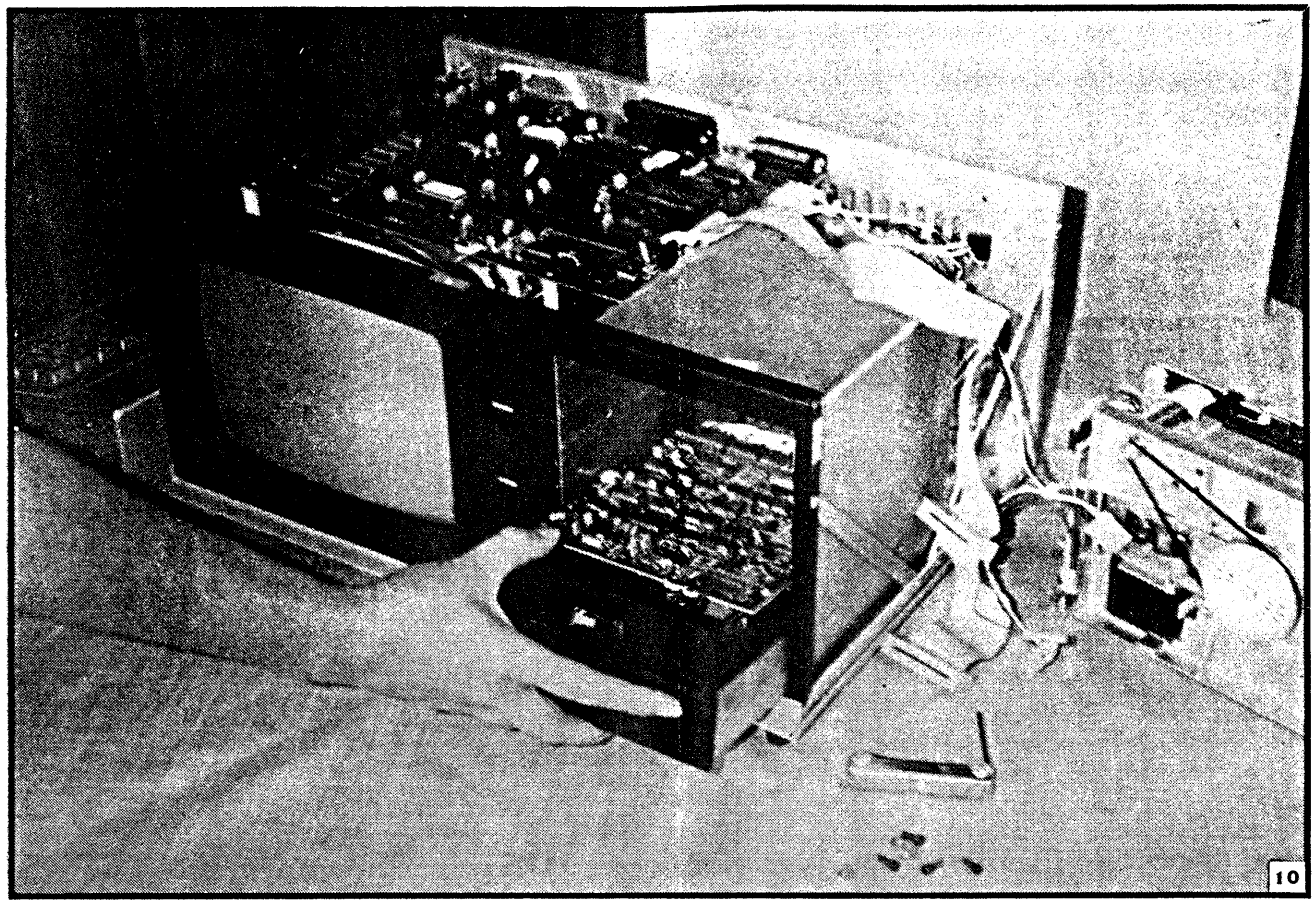
5

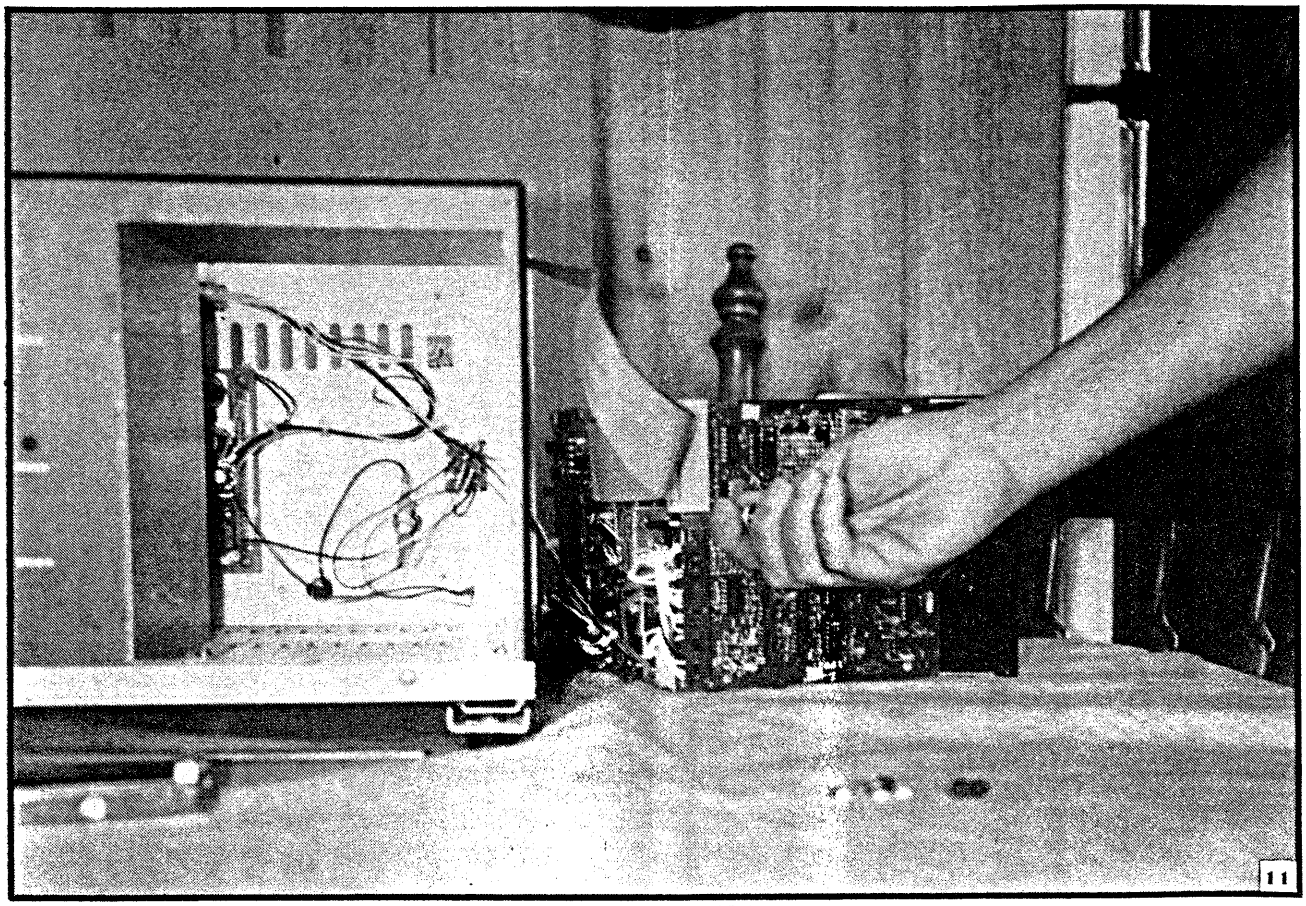

6

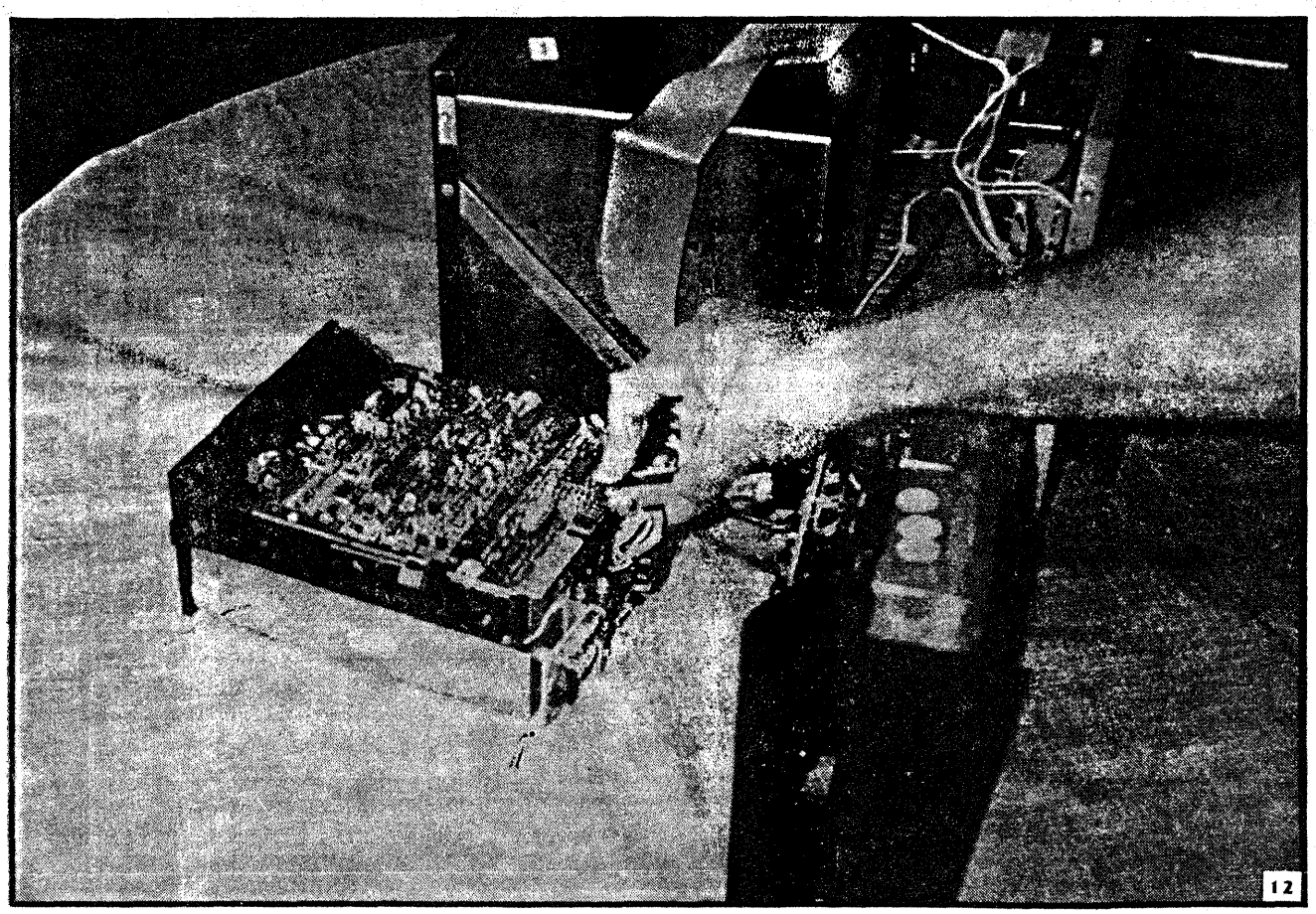

7


8

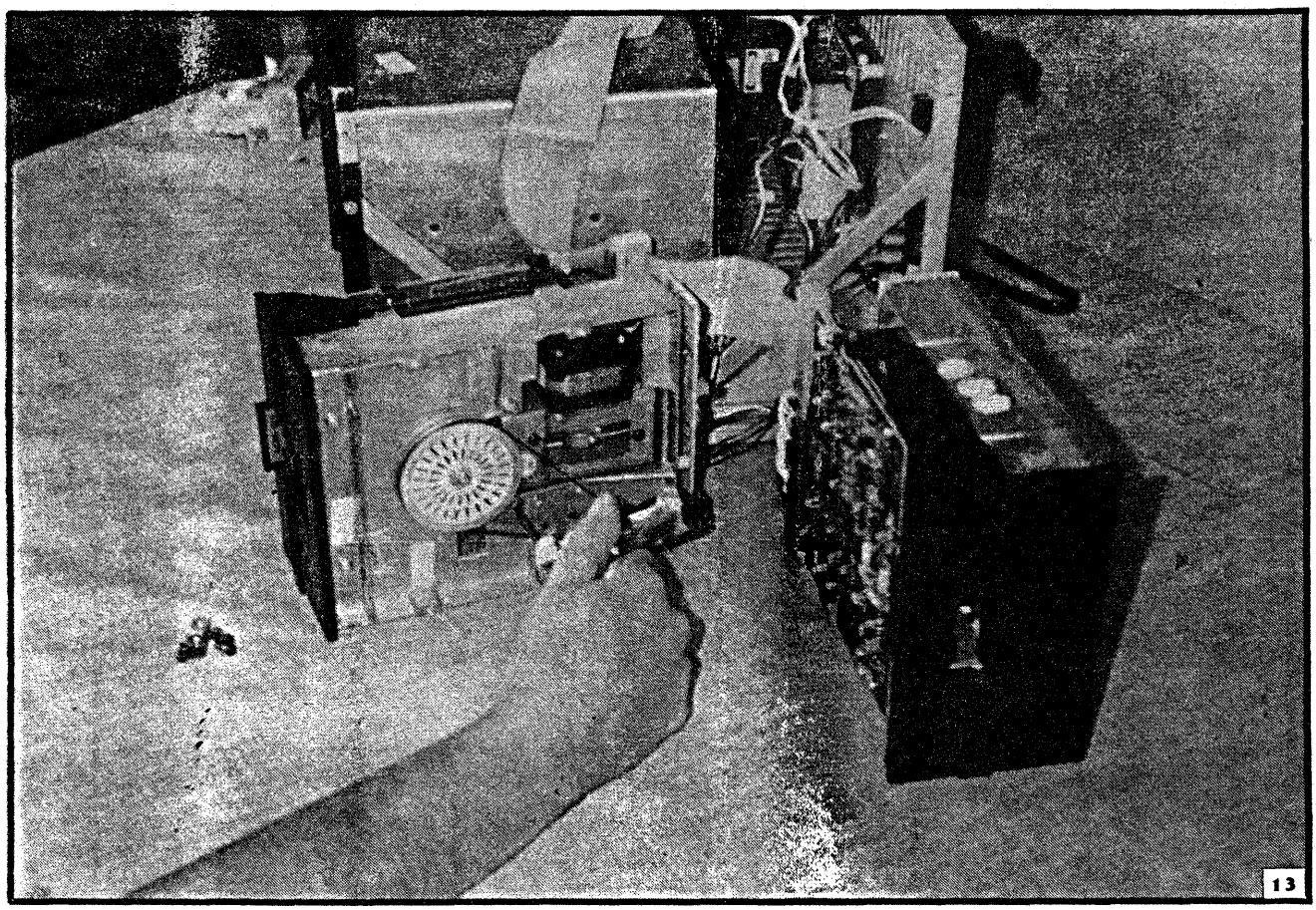



10


11



12



13