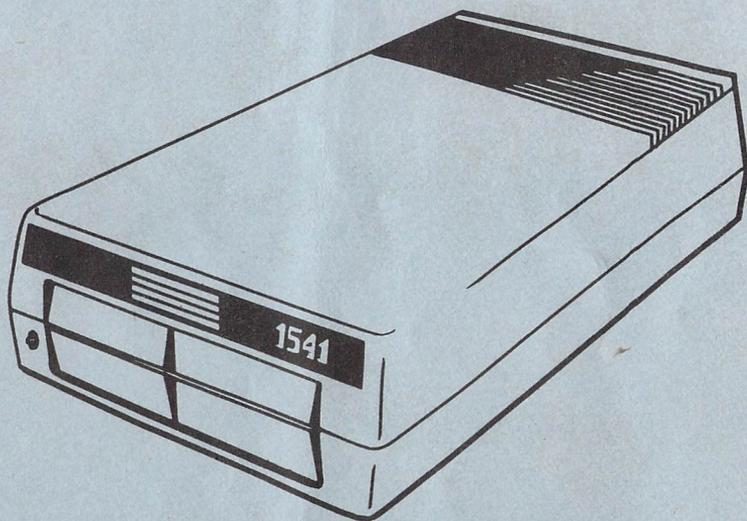


1541 DISK DRIVE ALIGNMENT PROGRAM

VERSION 2.0

NO SPECIAL EQUIPMENT NEEDED



FOR THE C-64
AND THE 1541 DISK DRIVE



C S M
SOFTWARE, INC.

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A NOTE ABOUT THE ALIGNMENT PROCEDURE.

Difficulties with the alignment procedure are occasionally reported. Aside from actual hardware problems with a disk drive, we find that most problems can be traced to one of these causes :

1. NOT FOLLOWING INSTRUCTIONS CAREFULLY - Every effort has been made to provide a complete, step-by-step explanation of the alignment procedure in this manual. While the alignment procedure is relatively simple, each step depends upon the previous steps having been completed properly. Please read the instructions for each step thoroughly before starting it. Do the steps in the order we have given. Don't be in a hurry; work carefully. Thousands of people have successfully aligned their drives with this program; you'll soon be one of them.
2. COPYING THE CALIBRATION DISK - The calibration disk is prepared on special equipment to ensure its accuracy. This accuracy cannot be duplicated on home equipment. We understand the urge to back up software and preserve the original; in the case of the calibration disk, however, it is futile to try. While the information on the disk may be copied, the precise alignment of it cannot. A copy of the calibration disk will not give reliable results! CSM offers an archival set of disks including both the program and calibration disks at a reasonable cost. Please see the last page of this manual.

NOTICE: PLEASE READ

CAUTION

Exercise extreme care when working on the disk drive. 117 volts is present inside the disk drive. Shock hazard exists whenever the disk drive is removed from its case.

1541 DISK DRIVE ALIGNMENT PROGRAM
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ALIGNING THE 1541 DISK DRIVE

The 1541 disk drive has three independent adjustments which work together to align the drive. Each adjustment can be set individually, but the final test is to check how well they function together. The three adjustments are:

- 1) Rotation speed - This refers to the speed at which the drive motor turns the disk. The ideal speed is 300 rpm, but the actual speed varies depending on the drag of the diskette and other factors.
- 2) Track centering - The READ/WRITE HEAD must be positioned directly over the center of the track for satisfactory operation. The R/W head position is determined by the STEPPER MOTOR, through a steel band attached to a CAM pressed on the motor's shaft. When you format a disk or when the drive encounters a 'bad block' error, the cam is 'bumped' against the END STOP. This causes the loud hammering noise you've grown accustomed to. It can also cause the cam to slip on the shaft. When this happens, the R/W head is no longer in the same position relative to the motor. Consequently, the head is no longer centered when the motor steps to a track. This is by far the most common source of alignment problems on the 1541.
- 3) End stop position - The position of the end stop provides a physical reference point for the drive mechanism. It only comes into play when formatting a disk or attempting to recover from an error. The end stop itself ALMOST NEVER needs adjusting.

SUMMARY OF ALIGNMENT PROCEDURE

- Step 1 - Disassemble drive.
- Step 2 - Load program.
- Step 3 - Set device number.
- Step 4 - Check speed.
- Step 5 - Adjust speed if necessary
- Step 6 - Check alignment.
- Step 7 - Adjust alignment if necessary.
 - Adjust bump & set alignment (center head)
 - Adjust alignment (fine-tuning).
- Step 8 - Check/adjust end stop if necessary.
- Step 9 - Format test disk & check.
- Step 10- Assemble drive.

CAUTION:

Exercise extreme care when working on the disk drive. 117 volts is present inside the disk drive. Shock hazard exists whenever the disk drive is removed from its case.

STEP 1 - DISASSEMBLE DRIVE

- a) Remove the power and serial bus cables.
- b) Turn the unit upside down and remove the four screws that hold the case together
- c) Turn the unit right side up and lift off the top of the case. Remove the six screws holding the unit to the case.
- d) Remove the two screws holding the metal shield. Remove the metal shield and disconnect the wires to the LED (green light).
- e) Remove the unit from its case.
- f) Reattach the power and the serial bus cables.

STEP 2 - LOAD PROGRAM

- a) Disconnect all printers, modems, joysticks, expansion boards or other attachments not essential for the operation of the program. This program uses most of the computer's internal memory. Some printers and modems will cause interference with the operation of this program.
- b) If you are going to align one drive and load the program from a different drive, hook up both drives at this time.
- c) Turn off the computer and disk drive(s).
- d) Turn on the drive that the program will be loaded from.
- e) Turn on the computer.
- f) The program must be LOADED from device 8. If the drive you are loading it from has been set to another number through hardware, bridge the device number jumpers or use the software method given in the disk drive manual to change the drive to device 8 BEFORE loading the program.
- g) Insert the program disk.
- h) Don't try to list the directory (\$). It has been specially modified to prevent listing.
- i) Type LOAD "BOOT",8,1 and press RETURN
- j) If the program won't load, remove the program disk and repeat steps c-g. Before loading 'BOOT', try typing:

 OPEN 15,8,15,"IØ:" (press RETURN)
- k) Wait for program to load - approximately 2 minutes.
- l) The red light may flash during the program load. This is normal for this program.
- m) If you are loading the program on one drive and are aligning another, turn on the 'sick' drive when the program prompts you to do so. Then turn the power off on the drive that was used to load the program.
- n) DO NOT PRESS THE 'RESTORE' KEY. This will cause the program to lock up. If you should accidentally press the RESTORE key it will be necessary to re-load the program.
- o) Remove the program disk and put it away. You won't need it again in the alignment procedure.

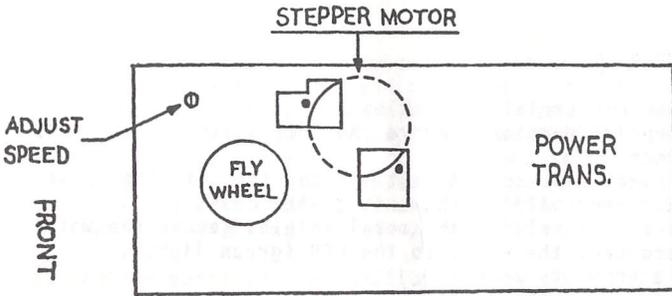


FIG. 1 BOTTOM VIEW

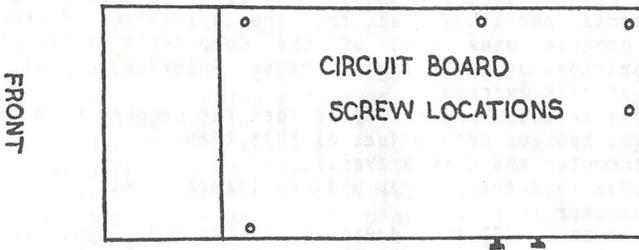


FIG. 2 TOP VIEW

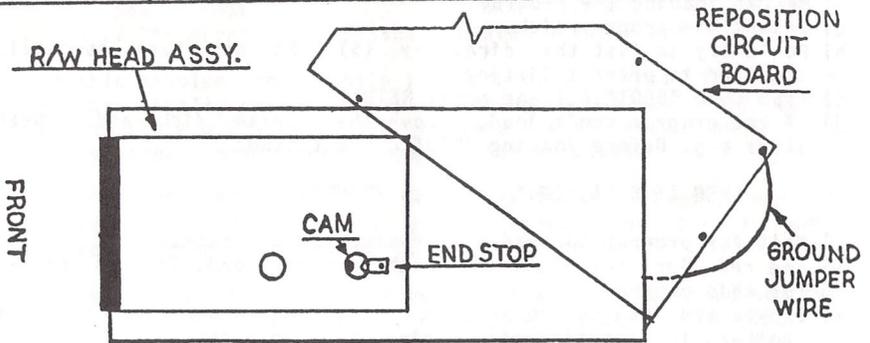


FIG. 3 TOP VIEW

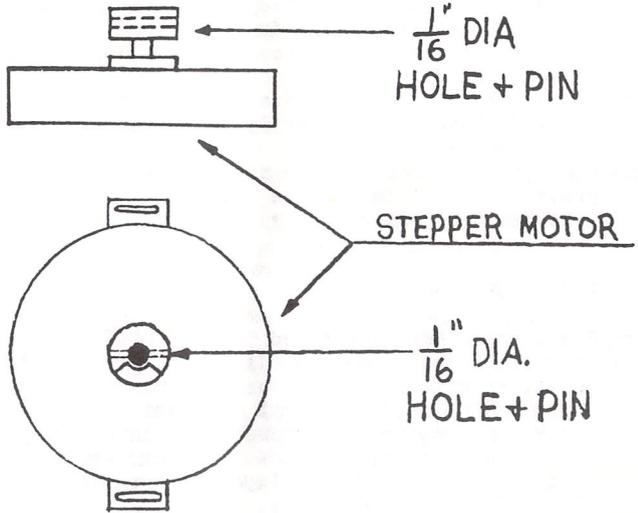


FIG 4

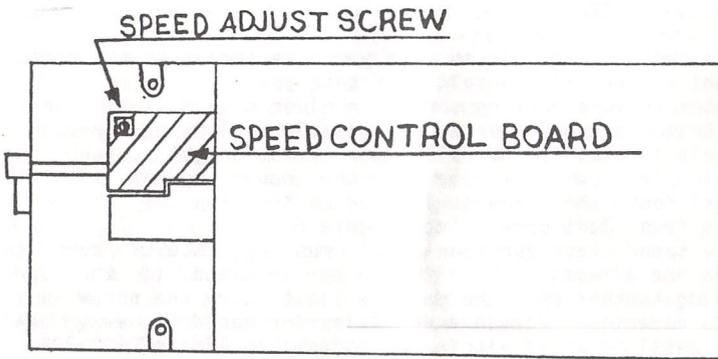


FIG 5 TOP VIEW

1541C SPEED ADJUSTMENT LOCATION

STEP 3 - SET DEVICE NUMBER

- a) Whenever you enter the menu you will be asked to enter the device number of the drive you are aligning. Although the program must be loaded from device 8, you can align either device 8 or 9.
- b) If you are aligning a drive that has a device number of 10 or 11 you will have to temporarily bridge across the jumpers for the device number.
- c) Once you have entered the proper device number, you can just press RETURN at the device number prompt. The computer will remember the number for you.

STEP 4 - CHECK SPEED

- a) Press the 1 key when asked "WHICH FUNCTION ?".
- b) Insert a blank formatted disk. Don't use the CALIBRATION DISK or any other disk that contains valuable information !!
- c) Press 'SPACE' at the prompt to start the speed check.
- d) After a few seconds the speed will be displayed on the screen. The ideal speed is 100.00 %, but some variation is normal. As long as the speed displayed stays in the range 99.92 to 100.20 %, it is acceptable.
- e) If the speed is not within the limits above, try another disk. Some disks have an exceptionally large amount of drag and give poor results.
- f) If the speed is still not within these limits, you will need to adjust it. See step 5.
- g) Press SPACE to end the test and return to the menu.

STEP 5 - ADJUST SPEED

- a) Turn the unit on its side so that you have access to the bottom. The front of the drive should be facing you.
- b) Locate the speed adjusting screw. On older models it is located on the bottom of the drive and is visible by looking through a small hole in what is normally the front right corner (see figure 1). If you have one of the newer models with the 'flipper' door, the screw is located on the top of the drive near the front left corner (see figure 5).
- c) With the speed check function (#2) running, SLOWLY turn the screw in one direction. Note the change in speed. If the speed is getting farther from the desired limit, turn the screw in the opposite direction. Continue adjusting the speed by very small amounts until it stays within the acceptable limits (99.92% to 100.20%).
- d) If you have trouble, see the troubleshooting section.
- e) Press SPACE to return to the menu.

STEP 6 - CHECK ALIGNMENT

The BEST check of your disk drive's alignment is its ability to read commercially prepared software. When the drive is in alignment it will not return many LOAD ERRORS, if any. As the read/write (R/W) head starts to move out of alignment, more and more errors will be noticed. Eventually, the head may be so far out of alignment that the drive will only read disks that have been formatted on it since it went out of alignment.

It is also possible for the head to be so far out of alignment that it starts to come back into alignment one half or whole track off. Since the head is logic-seeking, it may be able to read most disks but have trouble with protected software. If you are having trouble reading commercial disks or disks from a drive known to be in alignment, you should suspect an alignment problem.

Another good check is the PERFOR ANCE TEST on the disk that comes with your disk drive. Problems with the drive reading or writing to track #1 or #35 are generally a sign of misalignment.

You may also use the CHECK ALIGNMENT function (#3) of this program. Use the following method to check the alignment of your drive. Remember that the head may be so far out of position that it is starting to come back into alignment (one track off), so none of these tests are an absolute guarantee of good alignment. The best test is how well it is able to read commercial disks.

- a) Press the 3 key when asked "WHICH FUNCTION ?".
- b) Insert the CALIBRATION DISK supplied with this program. Be sure that the write protect notch IS NOT covered. DO NOT USE A COPY OF THE CALIBRATION DISK!! This disk is produced on special equipment (costing over \$8000) that ensures the data is placed on the disk very precisely. While it is possible to copy the DATA from the calibration disk, you will not be able to accurately reproduce HOW and WHERE the data is placed on the disk. Even if your drive is in alignment you should not attempt to copy the calibration disk. Results obtained with a copy disk will not be reliable!
- c) Press 'SPACE' to start the alignment check. The program will begin. It will continue until you press SPACE again to stop it. This allows you to run several trials and obtain an average value indicating the quality of alignment.
- d) You will see various track and sector numbers appear on the screen. If the disk drive is able to read and write to all the specified sectors on a particular track, the message 'OK' will appear alongside the sector numbers. If the disk drive cannot read or write to one of these sectors, an error message will be displayed.

- 91.5
- e) After track 35 has been checked, a 'TIMING NUMBER' (T. N.) will appear on the screen. The program keeps a running count of the time required to access the information from the disk. The faster the access time, the lower the T. N. will be. The lower the T. N., the better (assuming there are no errors). On most disk drives the T. N. will accurately reflect the relative alignment of the drive. The further out of alignment that your drive is, the greater the time required to find data on the disk. Conversely, if your drive is in alignment it will take less time to find the data and the T. N. will be lower.
 - f) The T. N. should be approximately 100. This is NOT an ideal number; it is simply a ballpark figure. It will vary from drive to drive and a T. N. of 100 may not be obtainable on every drive. T. N.'s in the range 98.25 to 104.50 are acceptable. The lower the T. N., the better. Remember, the T. N. is meaningless if any errors are encountered.
 - g) The T. N. is a very sensitive number. It may vary slightly even on the best of disk drives. Make at least 3 checks of the timing number every time you check or adjust the disk drive alignment. Obtain an average value rather than relying on just one reading.
 - h) If you are not experiencing trouble with your drive presently and the T. N. is within the acceptable limits, then you can assume your drive is properly aligned. Jot down the T. N.'s for future reference. From time to time, run the alignment check and compare the results with your original T. N.'s. If there is a substantial difference, your drive may be going out of alignment.
 - i) If you got any error messages in the alignment check or your T. N. is not performing properly, you need to align your drive. Use the following procedure.

STEP 7 - ADJUST ALIGNMENT

Before aligning the drive, the speed must be set properly using function 1. Adjusting your drive's alignment is done in two stages, using function 2 (ADJUST 'BUMP' & SET ALIGNMENT) and THEN function 3 (ADJUST ALIGNMENT). Function 2 is a 'coarse' adjustment in which you approximately center the R/W head over track 1, with the stepper motor in the proper phase for track 1 (i.e. not half a track off). Once centered on track 1, the head will also be centered when moved to other tracks (assuming there are no actual hardware problems with your drive).

Function 2 itself consists of two steps. First you attempt to center the R/W head over the track and note the gap between the cam and its end stop (explained below). This gap is then compared with the gap obtained after the cam is 'bumped' against the end stop. The results in these two methods must be in close agreement before proceeding to function 3. Many problems with the alignment procedure can be traced to people not doing function 2 properly before going to function 3. Do not deviate from this order; DO FUNCTION 2 THEN FUNCTION 3.

Function 3 is a 'fine-tuning' step. The drive is timed as it reads various sectors across the disk. The lower the timing number (T. N.), the better. You will make tiny adjustments in the position of the stepper motor until the timing number is as low as possible for your drive. That's all there is to it!

IMPORTANT NOTE: DO NOT MOVE THE END STOP ITSELF IN FUNCTION 2!!! Move the STEPPER MOTOR to make this adjustment. The end stop does not need to be adjusted in 99.9% of the cases. This is the biggest single mistake people make when aligning their drives. Even some repair shops routinely make the mistake of moving the end stop! If you have already moved the end stop or suspect someone has done it for you, see the troubleshooting section at the end of this manual before proceeding any further.

ADJUST 'BUMP' & SET ALIGNMENT (function 2)

- a) To do function 2 properly, you need to be able to see the clearance between the END STOP and the wedge- or arc-shaped stop on top of the STEPPER MOTOR CAM (see figure 3). It will probably be necessary to remove the circuit board to judge this gap accurately (see steps c-h of CHECK END STOP). Alternatively, you can remove the entire R/W assembly from the frame (see the first step of 'THE FIX').
- b) With the disk drive on its side and the front facing you, locate the stepper motor on the bottom side of the drive (see figure 1).
- c) Scribe a line on the stepper motor and the drive housing to provide a reference point (starting point).
- d) Next, find the stepper motor mounting screws. Remove all the adhesive from these screws. Loosen the screws just enough so that the stepper motor can be turned freely. Don't over-loosen the screws since it will be difficult to keep the motor in a stable position.
- e) Keep one hand on the stepper motor at all times to prevent it from slipping. If you want to remove your hand, snug down the stepper motor mounting screws first.
- f) From the main menu, press the 2 key when ready. Insert the calibration disk and press SPACE. Remember, do not use a copy of the calibration disk. The results obtained with a copy of the calibration disk are not reliable!
- g) Press the 'B' key to bump the cam against the end stop. After using the 'B' key the busy (red) light will flicker slightly. This indicates that you are in the bump mode. Doing the bump will ensure that the stepper motor is not 'out of phase' (i.e. half a track off). Due to the logic-seeking capabilities of the drive it is possible to be 1/2 a track out of alignment and still be able to read most software.
- h) Now press the 'S' key to enter SET ALIGNMENT mode. It may be necessary to press the key several times. When the program enters set mode, the read/write head will move out to track 18 and then move back to track 1 and begin reading information from the calibration disk.

- i) The red light should be steady in set alignment mode. If the red light is flickering, the drive is having trouble reading the track. In this case, carefully turn the stepper motor until you find a range of positions where the light stays on continuously. You may find two ranges where this happens. Use the range of positions closest to the original position marked in step (c). If this range doesn't give satisfactory results in the next few steps, try the other range.
- j) Once the red light is steady, it indicates that the drive is able to read the information on track 1. However, the R/W head may still not be centered directly over the track. SLOWLY turn the stepper motor in one direction until the light JUST begins to flash. At this point, visually note the clearance between the cam and the end stop. Now turn the stepper motor SLOWLY in the opposite direction until the light begins flashing again. Note the end stop clearance at this point too.
- k) If you rotate the stepper motor too far in either direction, you will notice the motor automatically steps (moves) the read/write head back onto the track. If this happens, turn the motor back to its original position and repeat steps (g)-(j).
- l) Estimate the center point between the two extremes found in step (j). This is not as hard as it may sound; remember, all we need here is an approximate adjustment. Tighten the stepper motor screws down.
- m) Once the center point of alignment has been found, press the 'B' key to bump the cam against the end stop. Compare the gap between the end stop and cam now with the gap set in the last step. The gap should be similar in both cases. Also, after 'bumping', the gap must be in the range 0.006 to 0.010 inch (we have had the best results with 0.010). Use your feeler gauge(s) to confirm this gap. The 'bump' must be solid and hard to achieve satisfactory results (the bump should sound loud).
- n) DON'T MOVE THE END STOP ITSELF when trying to get similar gaps in the above procedure; move the stepper motor. If you suspect it is necessary to adjust the end stop itself use function 4, ADJUST END STOP. Don't jump to this conclusion without exhausting all other possibilities!
- o) It may be necessary to repeat steps (g)-(m) several times in order to find the proper stepper motor position. Once you have obtained satisfactory results, tighten the mounting screws on the stepper motor. 'Bump' the cam again and recheck the gap to make sure it hasn't changed.
- p) The head is now centered over the track and the motor is in the proper phase (on the track, not on a half track). Press 'SPACE' to return to the menu.

ADJUST ALIGNMENT (function 3)

- a) Be sure function 2 has been done properly BEFORE proceeding with function 3. If function 2 wasn't done properly, it is possible to be half a track off and not get any errors in function 3. Doing function 2 carefully will ensure you are on the right track.
- b) From the main menu, press the 3 key. Insert the calibration disk (make sure the write protect notch is NOT covered) and press 'SPACE' to start. Remember, don't try to use a copy of the calibration disk.
- c) As explained in CHECK ALIGNMENT (step 6 above), the drive will begin reading various sectors on selected tracks. The program keeps track of the time it takes to access each sector. When the program is finished with track 35, it prints a timing number (T. N.) based on the total time required to access the sectors.
- d) If any errors are encountered on the first T. N. check, you must go back to function 2 and redo it. The T. N. is meaningless if any errors are encountered.
- e) The T. N. should be around 100, although this number will vary from drive to drive. A T. N. of 100 is not obtainable with every drive. T. N.'s in the range 98.25 to 104.50 are acceptable. The most important thing is to get the T. N. AS LOW AS POSSIBLE FOR YOUR DRIVE.
- f) Assuming there are no errors, obtain an average T. N. from at least 3 trials. Now you should try to reduce the T. N. by adjusting the stepper motor slightly.
- g) Loosen the stepper motor mounting screws, holding the motor tightly so it doesn't move (you may want to mark the motor's position before doing this). If you let the motor move much, you may have to redo function 2.
- h) Turn the stepper motor a very small amount in one direction. Remember, we are 'fine-tuning' in this function, and it should only require turning the motor a fraction of an inch.
- i) Hold the motor very carefully or screw it down. Obtain another T. N. average from several trials.
- j) If any errors are encountered or the T. N. has increased, you need to turn the motor in the other direction. Turn it a small amount and obtain another set of T. N.'s.
- k) Repeat this procedure several times. Don't be in a hurry to do this or you may spoil all your previous efforts.
- l) When you have found the lowest T. N. possible on your drive, tighten the stepper motor screws down.
- m) Go back to function 2 and verify that the gap after a 'bump' is still in the acceptable range. If not, you'll have to repeat the alignment procedure from function 2 on. If you have tried this repeatedly without getting good results, you either have a hardware problem (see the troubleshooting section) or ... you need to adjust the position of the end stop with function 4. DON'T MOVE THE END STOP UNLESS YOU HAVE GOOD REASON TO THINK IT IS NECESSARY!
- n) Press 'SPACE' to return to the main menu.

STEP 8 - CHECK/ADJUST END STOP

- a) Be sure that steps 5 and 7 have been done properly before proceeding!! In most cases the following step is only needed to double-check the previous steps. The end stop itself DOES NOT need to be adjusted in the vast majority of cases (unless someone else has already moved it). If you adjust it prematurely, you will probably cause more problems than you solve.
- b) To check or adjust the end stop you must be able to reach it easily. Use the following procedure to relocate the circuit board to provide easy access to the end stop. Alternatively, you may remove the R/W assembly unit from the frame as described in the section on 'THE FIX'.
- c) Remove any disk from the drive, turn the disk drive off and remove the power cord. You may leave the serial bus attached.
- d) Place the disk drive in the normal position (right side up, and the front facing you). Remove the screws that attach the circuit board to the frame (see figure 2).
- e) Carefully lift the circuit board and rotate it to the left. You may need to re-route some of the wires that are attached to the board in order to move the board far enough to expose the end stop (see figure 3). Sometimes it is easier to remove the connectors before trying to move the board.
- f) Place an insulating material between the board and the metal frame of the disk drive to prevent accidental short circuits (Cardboard cut to the size of the board works well).
- g) Find a spare piece of ordinary wire to use as a ground jumper wire. Attach one end of the jumper wire to the ground pad surrounding the screw hole at the left rear of the circuit board. Attach the other end to the metal frame of the drive (see figure 3).
- h) Since the circuit board is no longer heat-sunk to the metal frame, use a small fan to cool it.
- i) In the main menu, press the 4 key when asked 'WHICH FUNCTION ?'.
- j) Insert the CALIBRATION disk and press 'SPACE'.
- k) Remove the calibration disk from the drive when asked to do so, NOT BEFORE (very important). Press 'SPACE' to continue.
- l) Now you need to measure the clearance between the cam and the end stop with your feeler gauge(s). The acceptable limits for this measurement are 0.006 to 0.010 inch. We recommend 0.010 inch.
- m) To measure, very carefully insert the 0.010 feeler gauge between the cam and the end stop. The gauge should slip smoothly and snugly into the gap without having to be forced or moving the cam.
- n) If you should bump the cam or move it in any way, insert the calibration disk and press 'SPACE' to return to the main menu. Then repeat steps (i)-(l).
- o) If the 0.010 inch gauge won't fit, try smaller sizes until you find one that will fit. If the 0.010 gauge fits in too easily, try the next larger size.
- p) If the measured gap is within the acceptable limits, return to the main menu. If not, DON'T JUMP TO THE CONCLUSION THAT THE END STOP MUST BE MOVED!! In most cases the problem can be corrected by repeating steps 5 and 7 carefully (adjust bump and alignment).

- q) If you cannot obtain the proper gap after steps 5 and 7 have been done repeatedly, then it's time to adjust the end stop. Remove the screw that holds the end stop in place (newer drives have two screws). Remove the end stop. Clean any adhesive from the end stop, mounting pedestal and screw(s). Re-install the end stop and screw(s). Leave the screw(s) loose enough so the end stop can be moved.
- r) Set the end stop 0.010 inch from the cam, using the feeler gauge. USE CARE WHEN ADJUSTING. Tighten down the screw(s) and press the 'R' key to reset the clearance. Check the clearance again. It's also a good idea to go back to the menu, return to this function and check the clearance again to be sure that you didn't accidentally move the cam.
- s) Recheck the 'bump' and set alignment in function 2. You may have to realign the drive if you adjusted the end stop. If you realign the drive be sure to return to this function and check the gap again. Working back and forth, you should be able to find a compromise which will satisfy all the necessary conditions. If not, see the troubleshooting section.

STEP 9 - FORMAT DISK

- a) After all the previous steps have been completed successfully, a final check is made by formatting a test disk.
- b) In the main menu, press the 5 key when asked 'WHICH FUNCTION ?'.
- c) Insert a good quality disk which doesn't contain any valuable data. DO NOT USE THE CALIBRATION DISK. Press 'SPACE' to begin formatting. Formatting the disk will erase any information on it.
- d) After the disk is formatted, press 'SPACE' to go back to the main menu. Run the timing number check (function 3) using the FORMATTED TEST DISK instead of the calibration disk.
- e) If the drive is in alignment and the mechanical parts of the drive are sound, there shouldn't be any significant difference between the CALIBRATION DISK and the newly formatted disk. A difference of up to 2.00 in the T. N.'s is acceptable.
- f) If any errors are reported or there is a significant difference between the two disks, repeat the alignment procedure or consult the trouble shooting section.
- g) Before reassembling the drive, you may wish to try loading a commercially protected disk which was giving the drive trouble previously. Note that the drive may now have trouble reading disks formatted on it while it was out of alignment.

STEP 10 - ASSEMBLY

- a) Once you are satisfied with the alignment job, coat the screw heads on the stepper motor and the end stop with an adhesive such as Glyptol, epoxy or even nail polish. This should prevent the screws from loosening during use.
- b) Re-assemble the disk drive in the reverse order of disassembly.

TROUBLE SHOOTING

- a) PROGRAM LOCKS UP COMPLETELY - If the program stops executing for no apparent reason, you may have hit the 'RESTORE' key by accident. Be careful not to do this; the program will have to be reloaded.
- b) PROGRAM WON'T LOAD - If you can't get the program to load, make sure you are following all the instructions given. Disconnect all nonessential peripherals; power up the drive before the computer; initialize the drive; load 'BOOT' from device 8 only. Sometimes the program won't load because the drive is just too far out of alignment. Please try loading the program from a drive known to be good before concluding that the disk itself is bad. Most disks we receive as 'defective' are not.
- c) PROGRAM WON'T EXIT A FUNCTION - Sometimes the computer won't respond to the 'SPACE' bar when you want to exit a function and return to the main menu. This is due to the fact that the drive's memory is extensively modified by the program. Many times, control is turned over to the drive while the computer waits for it to respond. If the drive is out of alignment, it may continuously search for the proper data on the disk without finding it. Bringing the drive into alignment will solve this.
- d) R/W HEAD SEEMS STUCK - Occasionally the R/W head becomes 'stuck'. The drive will appear to be out of alignment. It will not read or write to any disk. This is not really an alignment problem, just a temporary 'bug'. I'd like to emphasize that this can happen at any time, in normal use or while aligning the drive. More than one drive has been brought in for alignment which only needed to be properly initialized. To cure this problem, use the following procedure :
1. Insert the calibration disk.
 2. Type: OPEN 15,8,15,"IØ" and hit 'RETURN'.
 3. Type: CLOSE 15 and hit 'RETURN'.
 4. If the error light flashes, repeat steps 2 and 3.
- If this problem occurs while the alignment program is in use, you can usually correct it by returning to the menu and GENTLY moving the R/W head with your finger. A small amount is all that is required. Continue with the program as usual.
- e) DEVICE NUMBER NOT ACCEPTED - The drive to be aligned must be either drive 8 or 9. Use a jumper across the device number select if your device number is other than 8 or 9.
- f) TROUBLE ADJUSTING SPEED - If you can't adjust the speed so that it stays in the recommended range, this may be a sign of hardware problems beyond the scope of this program. It may also indicate a worn drive belt. This is the rubber belt which turns the disk itself. Worn belts can also cause intermittent load errors which may appear to be caused by misalignment. To check the condition of the belt, use the following procedure :

1. Disassemble the drive as instructed and turn it up on its side.
2. Locate the flywheel on the bottom side of the drive. This is the wheel with two sets of black-and-white marks on it.
3. With the speed check running, press your finger against the wheel and try to stop its rotation (don't stop it for long).
4. If the belt is in good condition, it will take a considerable amount of pressure to stop the wheel.
5. If the wheel stops easily and the drive motor keeps going, the belt is bad.

You may be able to obtain a replacement belt from a local repair shop or directly from Commodore. They are also available from CSM Software Inc. for \$12.50 plus \$3.50 shipping (price subject to change).

- g) TROUBLE SETTING GAP OR END STOP MOVED - If the gap obtained in function 2 after 'bumping' the cam cannot be made to match the gap when centering on the track, this may be a sign that the end stop has been moved. Please try again several times before concluding that this is the case. If so, a special procedure is necessary since both the stepper motor and end stop have been moved from their proper positions.

1. Working in function 2, adjust the STEPPER MOTOR to center the R/W head on the track (set alignment).
2. SKIP the rest of functions 2 and 3. Return to the menu and choose function 4.
3. In function 4, adjust the END STOP if necessary to obtain the proper clearance after 'bumping' (0.006 to 0.010 inch; we prefer 0.010).
4. Go back to function 2 and center on the track again. Then go to function 4 and re-check the gap. Working back and forth from function 2 (set mode) to function 4, you should be able to find a position for the motor and end stop so that the gap is the same (or close). Sometimes a compromise position is necessary.
5. If you can't get the gaps to match, you may have a hardware malfunction such as a worn stepper motor. Try 'THE FIX' given below.

- h) ERRORS IN T. N. CHECK - If you get ANY errors while checking the timing number (T.N.) in function 3, the T. N. is meaningless. If this happens with the calibration disk, it is probably just a sign that the 'set alignment' step in function 2 was not done correctly before starting function 3 (or you moved the motor too far in function 3). If errors occur with the formatted test disk from function 5 but not with the calibration disk, the end stop itself may need adjusting, especially if the errors are only in track 1. A worn stepper motor can also cause these symptoms (see 'THE FIX'). If all else fails, try increasing the bump clearance in function 2 to 0.012 or more (by moving the stepper motor).

- 1) T. N. OUT OF RANGE - If the formatted test disk does not give results similar to the CALIBRATION DISK, repeat the alignment procedure. The 'BUMP' must perform normally, track #1 must be at or near the center of adjustment and the drive must be able to read and write to all the tracks. All the functions must yield proper results with the SAME POSITION of the stepper motor. Sometimes a compromise must be made to obtain satisfactory results. If the T. N. cannot be brought into the proper range with the calibration disk, there are several possibilities :
- 1) If you are attempting to use a copy of the calibration disk, the T. N. WILL NOT BE RELIABLE. The calibration disk is produced on a special drive whose accuracy cannot be matched by home equipment.
 - 2) The stepper motor may be very worn. Try 'THE FIX'.
 - 3) If the T. N. is exceptionally low or high, CIA #2 in your computer may be flaky. Replacements are not generally available, unfortunately. It is also possible that there is a problem with your electrical power. Try different outlets in your building or another location. The problem may also be in the power supply that came with your computer.
- j) OTHER PROBLEMS - If you can't get your drive aligned following all our advice, you may have a genuine hardware problem (mechanical or electrical). That is, your drive may not be able to be fixed with just an alignment. A good alignment job will not correct bad hardware. Most hardware problems are beyond the scope of this manual. Some problems you may be able to correct include:
- 1) Worn load pad. This is the round fiber pad which descends on the disk when you close the door. It holds the disk against the R/W head. If the pad is worn it can cause intermittent errors. To check it, watch the black plastic arm it is mounted on when you close the door with a disk in the drive. The arm should lift off the metal bracket it rests on BEFORE the door is completely shut.
 - 2) Overheating. This seems to be a problem with older drives in particular. Try running the drive with the cover off (dust it frequently). There are heat sink kits available for the 1541, or you can make your own. DON'T install a fan, since it will either draw dust into the drive or blow hot air over sensitive areas.
 - 3) Electrical interference. If the drive is located near the monitor or other equipment, problems can occasionally result.
 - 4) Bad serial bus cable. This has been known to happen.
 - 5) Lubrication and cleaning. Sometimes simply cleaning and lubricating the drive can help. GENTLY clean the R/W head with a high percentage alcohol and cotton swab. Clean the metal rails that the head slides on and lubricate lightly with silicone. Dust the circuit board and as much of the rest of the drive as possible.

'THE FIX'

This is a 'fix' that has brought many sick disk drives back to life. I cannot guarantee that this will 'fix' your drive or even help. Every disk drive that I align gets this 'fix'. It has worked for me.

Many disk drive alignment problems have been traced to the cam slipping on the stepper motor shaft. The 'fix' relies on pinning the cam to the shaft. Some people use glue or adhesive to retain the cam. Use whatever method you prefer. If you pin the shaft, first align the drive as well as possible to insure that everything is functioning normally.

- a) Remove the read/write head assembly. This is the metal and plastic assembly that the stepper and drive motors, the R/W head and most of the working parts of the drive are mounted on, excluding the circuit board and the transformer. Disconnect all the connectors from the circuit board. Remove the 4 screws that attach the assembly to the metal frame. Lift the assembly up and forward.
- b) There is a small screw attached to the stepper motor cam. This screw retains the metal band that moves the read/write head. CAREFULLY remove the adhesive and the screw. Make sure you don't damage the metal band.
- c) Cut the tie wraps that secure the stepper motor wires to the R/W assembly. Remove the screws that hold the stepper motor. Remove the stepper motor with the cam attached. Don't try to remove the cam from the stepper motor shaft.
- d) Drill a 1/16 inch diameter hole through the cam, the stepper motor shaft, and out the other side of the cam. (see figure 4). Use lubricant to prevent the aluminum cam from seizing on the drill (ordinary bar soap works for me).
- e) Insert a 1/16 diameter roll pin (spring pin) in the hole drilled. Coat the pin with Loctite prior to installation. Make sure the pin does not stick out of the hole.
- f) Install the stepper motor, using care not to damage the metal band. Install the R/W assembly in the metal frame and attach the connectors. Secure the wires with tie wraps or tape.
- g) Realign the disk drive.

A set of archival disks, including both the program and calibration disks, is available for only \$15.00 (price subject to change). Send your check or money order along with your name, address and proof of purchase (registration form) to:

CSM SOFTWARE INC.
P.O. BOX 563
CROWN POINT, IN 46307
(219) 663-4335

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