



# APPLEBOX

## The Basic DISK II Pages Speedadjustment, Trackalignment, Cleaning and Service project

The DISK][ Drive - a classic storage system

**Important Warning ! Never dismount or open drives unless they have been disconnected from the computer ( i.e. unplugging the drive from the diskcontroller ) and are without power ! Disobeying may lead to a damaged computer or damaged drive !**

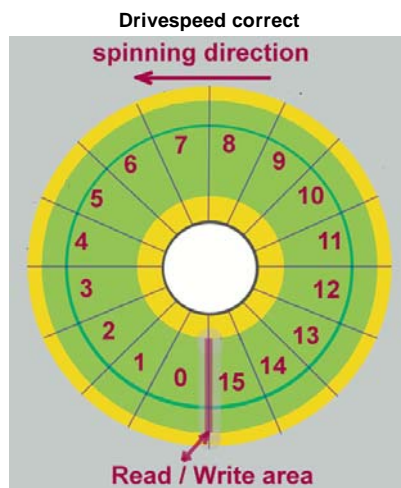
Only in very few tasks power will be needed and this will be mentioned within the text at the correct place pointing to the needed precautions!

page about speedadjustment of the drive

[back to previous page](#)

As explained [in the previous page](#) at the beginning in the section about the diskmedia the formatted disk is divided into 16 sectors. And at this point i'll just remind to the fact that i explained - the timing of the disk-controller is determined by the software in the prom on the controller-card. The result from this two facts - is that the speed of the DISK II drive is utmost important for the correct operation.

To explain this as simple as possible - i'll do the explanation with three pictures below assuming that the time is given ( i.e. fixed ) by the timing of the controller and the computer in each picture is the same ( calculated by this math: 300 turns per minute => 5 turns per second => 1 turn = 0,2 part of a second or 200 milliseconds ) and to simplify the examination i'll drop off from the interleave and just give the sectors a simple descending order... :



If drivespeed is too low, less distance of material passes the read/write-head and therefore the sector becomes shorter ( i.e. smaller ) leaving a remaining part of the disk unused..... that seems at first sight not bad.... **but in fact it is really bad** because the amount of bytes to be written are pressed in a smaller amount of space and due to the attitude of the magnetic-coating **that material starts to fail...** this occurs the less and the shorter the path of reading or writing is - the circles towards the middle ( i.e. the tracks from track 21 or 22 upwards will contain the more mistakes each step further towards the middle of the circle). This area is indicated by the violet color in the drawing above...

So if the speed is correct - the 16 sectors will fit correct in the given space and just also at the inner circles ( tracks above 21 or 22 the length of the line is just long enough to bear the amount of bytes written to the track..... ( [more about that topic later at the page about compensation](#) )

If the drivespeed is too fast - the path written to or read from the disk becomes longer, because the turn brings larger part of the disk passing the read/write-head.... but in fact it leads to the mistake - that a part of the previous sector is deleted and overwritten by the new content of the following sector ( **bear in mind the interleave explained in the previous page !** )  
- this is indicated in the simple drawing above by the fact, that sector 14 won't fit anymore in the given remaining space and starts to overlap the sector 0 and if you **try to imagine where sector 15 is (?)** - i dropped it, to keep the drawing simple ... otherwise it would overlap the rest of sector 0 and large part of sector 1 !  
In truth of course the real thing is, that every sector written to disk will overlap previously data written to disk in another previous sector (i.e. deleted and written with new content about 5% to 25% or even more ) depending to the percentage how much the speed of the drive is too fast....

So after this examination everybody will understand that wrong diskspeed is harming your data same bad as a dirty read/write head and most of you will probably determine to spend your drives some kind of "wellness"-treatment at least once or twice a year, depending to the area the solve their duty.... the harder the circumstances the more some treatment will be needed to keep the equipment in good shape....

The task to adjust the speed of the drive is rather easy and there are two basic ways to perform the task:

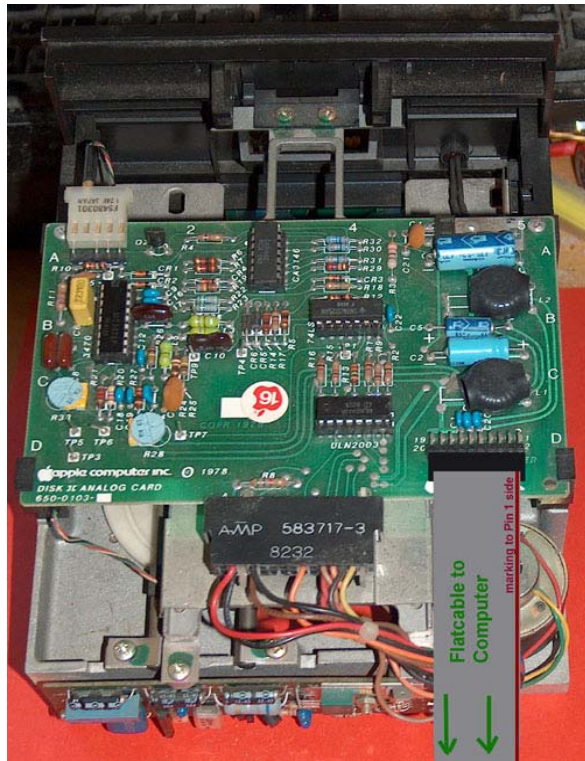


You can do this in a general and simple way without software if you don't have any and if you want to get at least "some kind" of adjustment. It will permit you to adjust the drive at least within a limitation of about +/- 4% to 5 %.

The second option doing the task with software is with more comfort and it permits you an adjustment within a nearly perfect boundary of less than +/- 0,2 %!

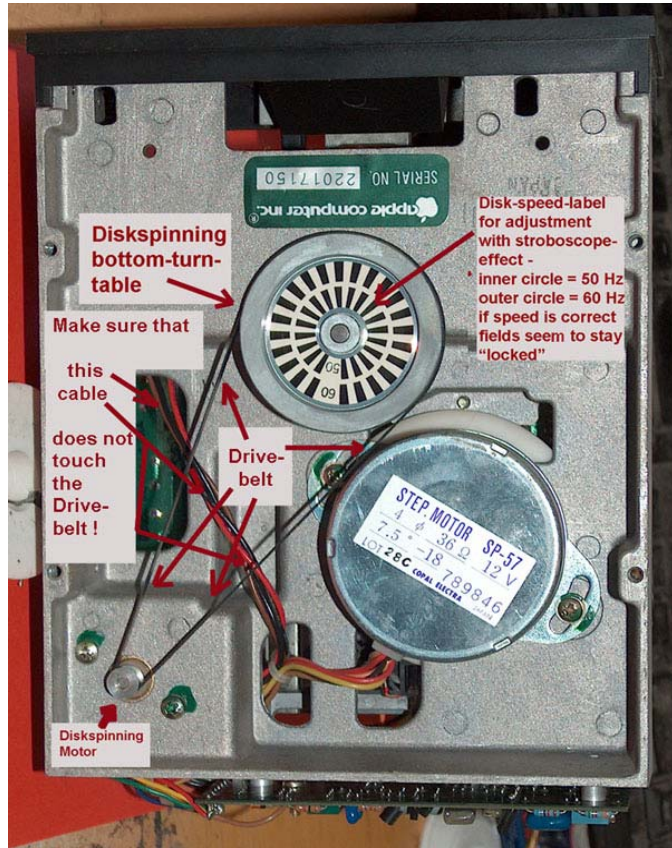
So at the beginning lets just view some pictures to get familiar with the drive and the related parts of it - after untightening the 4 screws at the bottom of the drive you can slide off the hood of the drive towards the backside and after setting the hood and the bottompart besides you will see something like this:

Topview of the drive



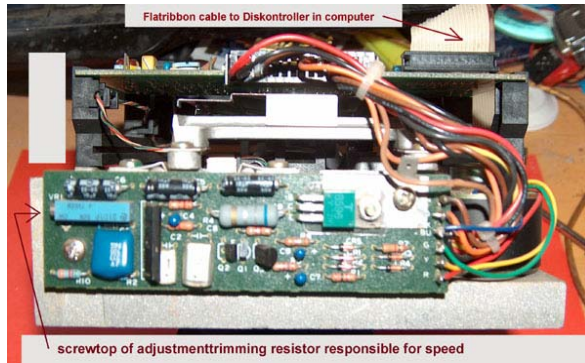
Flatcable to Computer  
marking to Pin 1 slide

Bottomview of the drive



Diskspinning bottom-turn-table  
Make sure that this cable does not touch the Drive-belt!  
Drive-belt  
Diskspinning Motor  
Disk-speed-label for adjustment with stroboscope-effect - inner circle = 50 Hz outer circle = 60 Hz if speed is correct fields seem to stay "locked"

Rearview of the drive



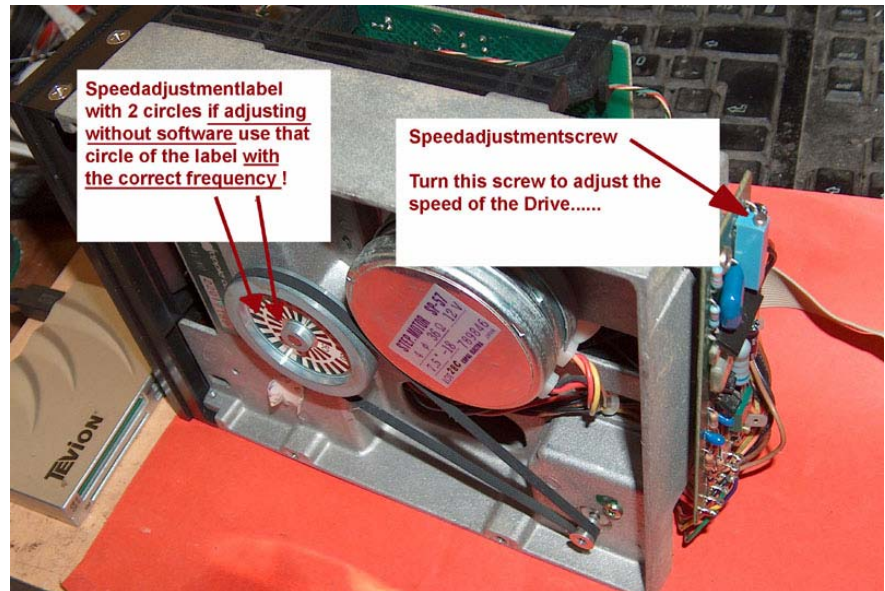
Flatribbon cable to Diskontroller in computer

screwtop of adjustmenttrimming resistor responsible for speed

**Driveadjustment without software:**

This task can only be performed in a room with very low light using a lamp with a simple lightbulb ( no neon - no LED ! Just the very simple model from Thomas Alvin Edison ! ). Connect the drive to the controller as drive 1 and insert a formatted disk.. there is no need at the beginning that the disk contains a system like DOS..... If the drive is set to lay on the side so the adjustmentscrew shows towards top and you can view the bottom then issue the **PR#6** - command and the drive will start spinning a while before the drive stops again and the computer issues an error message. During the time while the disk is spinning look exactly at a narrow part of the label and watch that circle of marks that is corresponding to the frequency used in your home ( either the ring marked 50 HZ or the ring marked 60 Hz ! If you try to view exactly you will get the *impression* that the marks are running ahead or backwards... you must adjust the marks that way by turning the adjustmentscrew that you get the impression of the marks "standing still" ( i.e. neither moving forward nor moving backward ! ). If you need more time to fix to this point just repeat the boot-command as given above and repeat that until you caught the desired point of "standing marks". If this is completed your drive will be at least adjusted within a range of +/- 5%. Then you can try to boot with a good disk.

so if you have to adjust the speed of the drive without software the picture at the right side explains the recommended position to work with the drive....



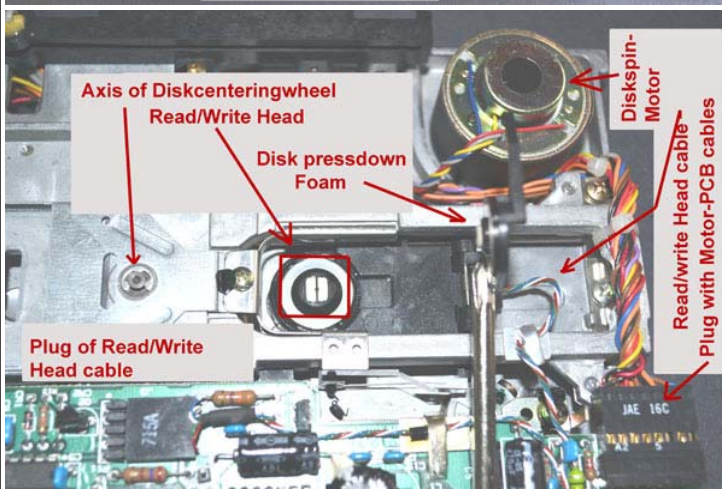
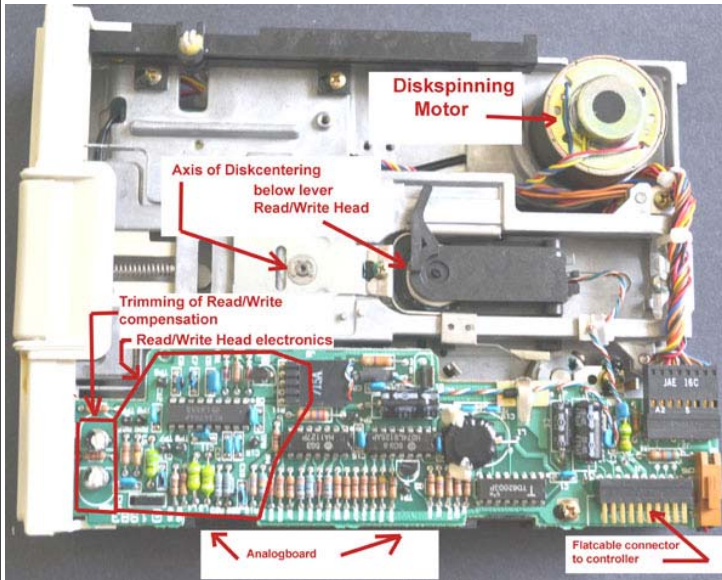
Speedadjustmentlabel with 2 circles if adjusting without software use that circle of the label with the correct frequency !

Speedadjustmentscrew  
Turn this screw to adjust the speed of the Drive.....

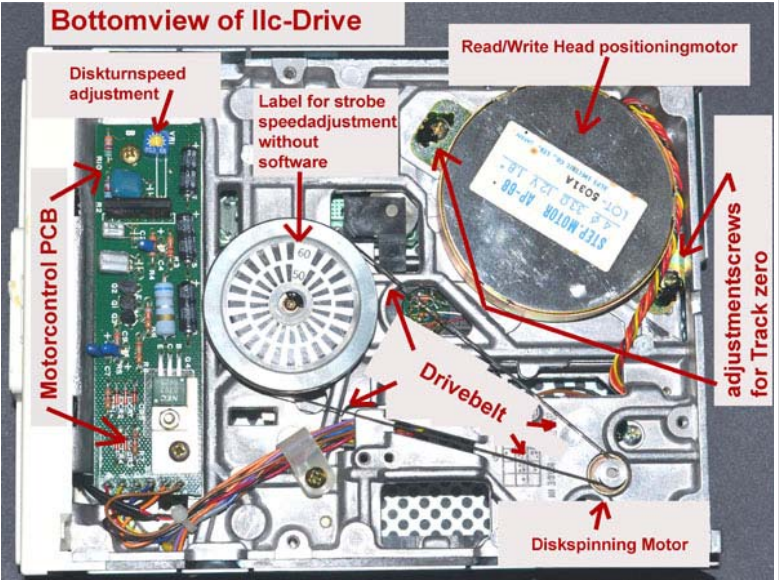


**added Update:** Many thanks to the member **Javstar** at **Applefritter** ! He granted me some excellent pictures of the IIc Drive and enabled me by that, to provide here additional pictures to show also the related parts of the IIc drive ..... so here are also the commented pictures of the related section:

Here is the Topview of the IIc Drive and below a closeup to the Read/Write Head



Here is the Bottomview with the Motorcontrol PCB and the speedadjustment



Apart from the fact that the order of the parts have changed / moved - the IIc Drive is still rather similar in the basic functions and comparable to the DISK II. So the given explanations in the text are same valid .... its just a need to get a bit of orientation to sort out the components.... the Label at the Diskturntable can be used for adjustment the same way as explained above for adjusting the drive without software - and the use with software as explained below will also be the same - the only difference is the fact that at the DISK II the trimmer is a spindletrimming and therefore the range will be several turns - while the trimmer at the IIc is only a regular variable resistor trim and therefore the turningrange is reduced to some 270 degrees ... and therfor of course very much more sensitive !

and again thanks a lot to Javstar !

### Adjustment of Drivespeed by monitoring speed with Software

Although there are a lot of softwareprograms out there to adjust the speed of a drive i will only comment here a selection of the 3 most common ones and i will leave those from the sharewaremarket aside, due to the fact that most of them might be neat but in fact most of them have a poor user-interface ( just even some of the commercial ones are not really good ) .... in fact its one thing turning blind a screw to adjust the speed and another thing besides with another eye always trying to read a fast changing display with some changing numbers.....

Thats the reason that the Copyprogram Locksmith in the Version 6.0 is still my favorite.... the disply shows a line of dots in row as a line and you can tune that line very easy without ruining your eyes or getting headache and still you will be able to keep one eye really fixed to the drive and the adjustmentscrew !

The second big advantage of Locksmith is the fact that you can choose the scales of operation-mode starting at large scalarange - tuning the line to the center - then restart with the middle scale option - tune the line carefully closer to the middle - and thereafter you can change the option of measurement to the smallest range of only +/- 2,5 % and then tune-in the line nearly to hit the center just with very small drift to the lower speed side and get some adjustment somewhere about less than 0,1% slower than perfect ..... that should be the best to get - if you want the drive to stay in secure area ( remember what i explained above about being to fast and taking risk of overwriting the previous sector ! ) - so you should always keep very close below the real center to make sure that even with some slight changes of the speed as result of temperature or attitude of spinningmotor temperature you keep to "safe-side".

Speedadjustment with Copy Plus II Vers. 8.0 acceptable...

Speedadjustment with Nibbles Away II Vers. A1 better...

Speedadjustment with Locksmith Vers. 6.0 my favorite one !

The program Copy II Plus from Central Point Software is very simple and is chosen from the menupage with the choice "Verify Drive Speed" - there after you may choose the drive to be tested - there a blank disk should be inserted - and striking the key starts the test. The result is displayed as a amount measured in milliseconds....

As the display explains you should get the drive within a range from 198 milliseconds to 202 milliseconds and a perfect result will be between 199,5 and 199,8 milliseconds.....

this is a view to the testpage and the amount of milliseconds is flickering while changing fast.... not very user-friendly.....



Nibbles Away was in the old days also a very common copyprogram with a testing option - you choose DISK DIAGNOSTICS from the menupage.... and then you choose the drive to be tested - and insert there a blank disk ....



Just choose DISK SPEED from right side of the menulist and then choose the drive to be tested either 1 or 2 from slot 6 controller and the start with large range options towards the options with smaller range starting with 1 and then switching to the option 2

( don't use option 3 !  
 Its a special feature to crack a special  
 copyprotectionscheme ! ) I'll explain this later in a special  
 page related to cracking techniques....



The only real good thing in this program is one fact: If you have different drives connected to different controllers in different slots you may choose any drive connected to any slot .... SO you can test also drives not connected to slot 6 !



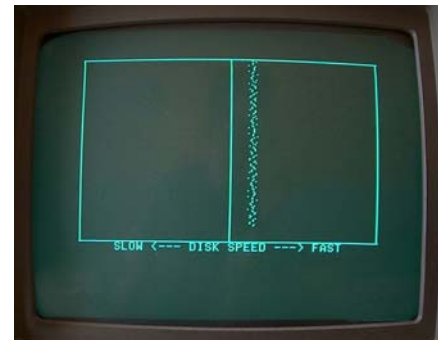
After hitting the key the test will start and although there still is a flickering display of the sectornumbers in hex - the big advantage is that at least there is an arrow moving towards or away from the center and that is much more user friendly because of the optical display related to the turning of the adjustmentscrew trying to get the arrow close to - but slightly below - the center.



The option 1 is the more general one and its range is larger ... in fact the options are set that way that at Option 1 and selection of the range 1 in that option equals to option 2 at range 3 so there is a kind of sieve from Option 1 to range 3, range 2, range 1 and then switching to option 2 with range 3 advancing to range 2 and then the very smallest range 1 ! Up to my experience any working drive will show up at first choice ! ( If not - there is some other more severe trouble there too- like damaged compensation.... )



The big disadvantage with this program is that there is no possibility to choose a range-scale - so if your drive is far out of the range you just know which side it went off the scale because the arrow will be tagged to that side - but turning the screw of the adjustmentresistor with a tagged arrow at one side does not give you any idea if you are running towards back to the scale and the center or if its still just running more far away !



A bad drive might show up with something like this if also the drivebelt is bad because the spread in speed shows that the motor does not bring its power correct to the spinningtable ( if belt becomes weak and flexible ) .... if the drive belt is O.K. the line should be displayed somehow something like the line in the second display below.....



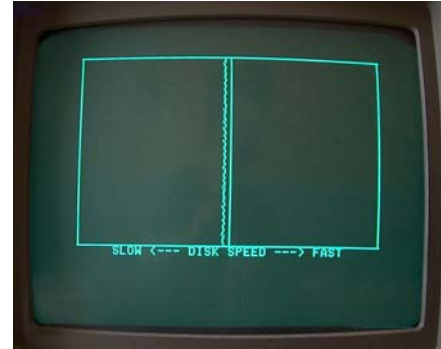
As explained before you start with the COARSE ADJUST and after pulling the speed by turning the adjustmentscrew towards the center and thereafter you may proceed the the next step choosing the MEDIUM ADJUST and finally performing the FINE ADJUST.....



If your display looks somehow similar to this and is close to the center you may switch to option 2 : OPTIMUM and then again work ahead from COARSE ADJUST to FINE ADJUST.



Its easier to follow up the line if you always choose the Option of only taking **1 sample per line** .... **taking more samples only makes sense, when adjusting the compensation** - but not the drive speed !



This displays a perfectly adjusted drive at Option 2 ( OPTIMUM ) and FINE ADJUSTMENT with 1 sample per line ! This drive is adjusted to something about 0,1 % slower than the center. That "slight little bit slower" was explained above at the section with the diskpictures !

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[turnback to previous page about DISK II \( write protection \)](#)

[continue to the page about calibrating the track zero](#)

[continue to the page about advanced adjustment of the offset of the electrical Read/Write-Head compensation cycle](#)

[◀ turn back to the indexpage ←](#)

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