The following collectives are the text content for all files from: APTEST.DOC.BXY
The APTEST.DOC.BXY contains both; text and AppleWorks WP file versions of the following text file collective. ATEST.DOC.BXY will unshrink a

The APTEST was prepared and is presented as a FREEWARE collection of utilities from: Stephen Buggie, Ph.D. Dr. Buggie is a 1WSW team member

I'm sure you will all find them very useful. Please also note: The APTEST.SDK archive is a DOC 3.3 disk, after it is unshrunk! The APTEST.DO

You can cotact Dr. Buggie as noted below:

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Enjoy!

Charles T. 'Dr. Tom' Turley
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Editor - GS WorldView

November 1992   Apples BC News

APPLE PLATINUM 3.5" 800K DISK DRIVE REPAIR
===

by Lorne Walton
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    Back in the days of yore and of the Apple][and][+, many of us thought of ourselves as hackers. Not modem hackers, but hardware hacke
    In those days to be called a hacker was considered a compliment. Now, "hacker" equates with "criminal" in most people's minds, and with
    Just a week before writing this article, I was engrossed in a heavy session of disk-copying for the club library when my number two 800

What to do?
    I could take the drive to my regional repair despot. Being cheap, and being also not that near to my favourite despot, this was the les
    I could ask for help from fellow Apples BC members. My plea on the BBS brought an offer of assistance from a member who was willing to

Caveats
    Don't do this if your drive is under warranty. You will surely invalidate your warranty if your despot finds out you've made a simple p
    Don't do this if you're uncomfortable exploring uncharted territory. If you can get a "chart" and feel brave, go for it. Don't take the
any responsibility for mishaps, though we'll be happy to take the credit when everything works!
    Watch out for static electricity. There are a few ways to minimize this problem, but if you're not familiar with the concept, it may be
    The advice applies only to the platinum Apple 3.5" 800K drives, and not the older, ivory coloured, UniDisk drives, which may or may not

Home Improvement Time
    All you'll need to fix this problem is a Phillips screwdriver, a smallish slot-type screwdriver, and a medium-sized pair of needle-nose
    Give yourself some uncluttered space. There's nothing more frustrating and embarrassing than accomplishing a task and then finding as y
    Now, I know you're all intelligent people, but I have to say this anyway: "TURN OFF THE COMPUTER'S POWER BEFORE YOU DISCONNECT THE DRIV
    Flip the drive over and remove the 4 screws, putting them in a safe place. The top cover may be removed by sliding it backwards, and th
    The top plastic cover of the drive is attached to the metal innards by two pairs of wires and two connectors, one black and one red. Si

Miracle of Modern Engineering
    While you're here, blow out that 6 years' accumulation of dust bunnies, and then take a look around. On the flipside is a carp's-eye vi
    The remainder of what's visible is mostly the mechanical parts. Slide a disk into place several times, ejecting it using the ejection s
attached to a lever arm. This is the gizmo that snaps into the semi-circular notch on the disk-bottom and sucks it into place, and appears t
    In my case, the lever arm had become bent so that it fell beneath the disk instead of snapping into the disk's notch. All I had to do w

It isn't all that complicated...
    Really! I've given a lot of detail, but this repair was not at all complicated once I figured out where the problem was. Reassembly inv

The main rules for the hardware hacker to follow are:
1. Give yourself some elbow room.
2. Set aside parts carefully, and in a logical order, especially if you're likely to be disturbed or if you're absent-minded like me.
3. Avoid walking around in bare feet on a carpet while you're in the midst, and take other static electricity precautions.
4. Consider using the buddy system. Two heads are always better than one, and although this may increase the static risk, two people get to
5. Don't be afraid to explore, but above all else, be gentle and be careful. If you're having to force something, you're probably making a m
I hope I've lifted some of the mistique for some Apple // and Mac users who have never considered trying to repair simple mechanical problem
Any questions?
==
This article first appeared in the November 1992 issue of Apples BC News. It may be reprinted provided that it and this notice remain intact

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APTEST DIAGNOSTICS SOFTWARE
 Includes Drive-Speed Test
 Track-Centering Alignment
 For 5.25" Apple II Drives

TUNING APPLE II FLOPPY DRIVES
==============================
 QuickView Self-loading Docs:
Appleworks or ASCII Text Files
Read Docs Before Using APTEST
   V. 1.01   November 1995
      Stephen Buggie

                TUNING APPLE II FLOPPY DISK DRIVES
                ==================================
                            V. 1.02
Stephen Buggie OUTLINE

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                    INTRODUCTION

        This disk will assist the user in maintaining his/her Apple floppy
drives. The disk describes the varieties of 5.25" drives that work with
the Apple II. Instruction is given on tune-up adjustments of speed,
track-centering, and end-stop. Minimal tools are needed. By studying
this disk and applying its procedures, you will be able to restore life to
your dead drives on the shelf!

        These docs should be read first. The diagnostics/adjustment
software, APTEST, is on the reverse side of the disk.

                 TYPES OF 5.25" APPLE II DRIVES

        These are the main types of drives made for the Apple II. Each
model is described briefly with its strengths and weaknesses.

        DISK][CLASSIC: This is the original drive invented by Steve
Wozniak and marketed by Apple beginning in 1978 at a price of about
$400.00. Currently (1995) these drives sell on the Internet and at yard
sales for about $15-$20 each, in working condition. This drive is simple,
spacious, uses standard low cost components, has socketed ICs, and is
easiest to work on. It spawned many clones. It is full-height, and the
disk-clamping mechanism is not spring-loaded. It is belt-driven, as are
all the Apple brand drives.

        EXTERNAL DISK IIC: This is a 3/4 height drive with a spring-loaded
mechanism. The external and internal drive mechanisms are
interchangeable; the external mechanism has an LED indicator which was
deleted from the internal model, although it can be added later. It is
highly reliable, although the spring-loaded door mechanism must be closed
slightly slower than what is required with other drives. Fast closing of
the door may result in the disk being seated eccentrically. The external
Disk IIc was the first to use the db-19 round cable and 19-pin D-plug.
The mechanism inside the casing has a connector for a flat 20-pin IDE plug
similar to the plug used on the Disk II. Access time is faster than the
Disk][.

        UNIDISK 5.25" DRIVE or APPLE 5.25 DRIVE: These two drives are very
similar: 3/4 height, round cable with db-19 plug. These drives have a
female db-19 socket on the back, allowing drives to be daisy chained. The
Unidisk 5.25" drive has a beige plastic casing; the Apple 5.25 drive had a
platinum grey casing. These are the most "modern" of the Apple II drives,
and were supplied with the IIgs and platinum IIe models.

        APPLE DUODISK DRIVE: This consists of two Unidisk 5.25" drives in
an attractive combined housing with a single db-19 plug on round cable.
It lacks the daisy-chain port of the single versions of this drive, and is
therefore less flexible. It was produced during a brief two year interval
(1984-86) and then discontinued. The control circuits on the drives'
analogue boards are slightly different than on the Unidisk 5.25" drive,
and persistent faults occurred. Duodisk users reported problems such as
disk directories being erased and other erratic performance. (This was my
first drive; it performed erratically and I ended up swapping it for a
working Disk II!)

        HALF-HEIGHT DRIVES: These drives were made by various
manufacturers: Teac, Mitac, Sony, Meiji, Laser, and others. Good ones are
very impressive! They are only half the height of a regular drive, so
scarce space on the cluttered desk is conserved. Drive speed is extremely
stable, thanks to the quartz-locked hysteresis synchronous pancake motor.
The Mitac drive has a very sophisticated band-linked stepper-motor
mechanism. These drives are available with either IDE-20 flat ribbon
cable or with db-19 round cables. The disadvantage of this style of drive
is that the closing angle of the clamping mechanism is unavoidably very
steep, so disks are at greater disk of being bent during clamping than is
the case for full-height drives. Non-belt direct drive mechanisms support
smooth steady speed which remains stable for long intervals. Furthermore,
direct drive mechanisms are unaffected by tilt or other changes in the
drive's physical position than is the case for belt-driven mechanisms.

                 "WHY BOTHER WITH THOSE OLDER DRIVES?"

        We Apple II users typically put up with lots of flack from IBM and
Mac users. Of their various comments, one of the most common is that
5.25" drives are totally out of date, their capacity is too small to be

useful, etc. These comments are not wholly accurate. First, the Apple II
series was designed so that newer models were capable to reading all the
older software. Thus, even IIgs users can use the oldest Apple II
software. Also, some A2 users' software favorites may be the older ones,
using DOS 3.3 operating system, which is available only on the 5.25"
sized. Another reason for preserving the 5.25" drives is that Apple II
programs are brief when compared with Mac or IBM programs, so nearly all
Apple II programs will fit wholly on one side of the disk.

        For sentimental reasons, users might want to continue using their
original drives. They are also cheaply priced and are widely available on
the Internet, at thrift shops, yard sales, and swap meets.

            DESCRIPTION: ROTATIONAL SPEED, END-STOP, & TRACK-CENTERING

        SPEED is straightforward and easily understood. Apple II floppies
are spun at 300 RPM: five times per second. For optimum performance, the
speed during reading must match the speed at which the disk was written.
Some copy-protection schemes used on older software require that speed be
maintained accurately within very narrow limits --- the software will not
load if the speed is either too fast or too slow. The speed must be
adjusted as close as possible to the optimum value, but if speed is off at
all, it is better that the drive be slightly too slow rather than too fast
(Nikrom docs, c1985). Every 5.25" floppy has a speed adjustment variable
resistor, and there are many speed-adjustment programs available, as
described in Appendix A.

        Speed adjustment is unnecessary for 800K 3.5" drives which use very
different technology than the 5.25" drives presented here. 5.25" drives
are like phonograph LP turntables with constant rotational speed. But the
"head-travel speed" on an LP turntable or on a 5.25" disk drive slows
while the head reads the inner tracks relative to outer tracks, resulting
in data being written with greater density on inner tracks. To maintain a
constant data density on the disk media, the rotational speed on the 3.5"
is slower when outer tracks rather than inner tracks are read. Speed
control on 3.5" drives is maintained electronically through servo feedback
circuits and is unadjustable. Yes, speed on 3.5" drives is complicated
and mysterious, but the system works well.

        END-STOP ALIGNMENT: The final resting point of the track-stepping
mechanism is adjustable, at least on the Disk][and other full-height
clones. Two articles (Hancock, 1983, Williams, 1985) mentioned that
end-stop alignment may need adjustment if the drive has difficulty reading
from track 00. The procedure for adjusting the end-stop alignment is
described in either article. The short two-page article is recommended
because it is better illustrated. The end-stop alignment procedure
involves an adjustment on a set-screw located on the track-stepper cam.
The read/write head assembly is pushed all the way back, which rotates the
cam mechanism. As illustrated in the article, the cam adjustment screw is
then adjusted so that a "dot" on the cam is placed in a particular
position. No comparable adjustment is identified or recommended for 3/4
height Apple drives or for half-height clones. End-stop alignment is
entirely separate from track-centering alignment.

        TRACK-CENTERING ALIGNMENT: Apple 5.25" floppies have 35 concentric
tracks. The stepper-motor must position the read/write head mechanism
over the center of each track so that it can be read accurately. This is
never a problem when a drive reads the disks that it has written; it will
read its own disks accurately even if the mounting position of the
stepper-motor is poorly aligned. Track-centering is becomes a problem
when the drive on which the disk is written differs in its track-centering
from the drive which attempts to read the disk. When the drives vary
widely in their track centering, then disk errors ("Unable to load ProDOS"
or "Getting errors while attempting to read disk") may occur.

                        SYMPTOMS OF POOR ADJUSTMENT

        SPEED ERROR: When rotational speed is greatly out of alignment, it
may be difficult or impossible to read or write from the disk. When speed
is slightly off, then most disks will play but a few (mainly older
copy-protected commercial disks) will fail to load. Speed tolerance is
better for slow disks than with fast disks; in other words, the drive can
operate with slow speed error more effectively than with fast speed error.

        END-STOP ERROR: This is indicated by problems in reading either
track 00 (first track) or track 22 (actually the 35th and last track).
When this is a persistent problem with several commercial disks, then the
head carriage end-stop should be adjusted.

        TRACK-CENTERING ERROR: The symptom is that the drive can read its
own written disks accurately, but it gets disk errors with disks written
on other drives. Either drive could be the source of the error, but if
the problem disk is an unprotected commercial program, then
track-centering error is likely.

                    SPEED ADJUSTMENT: SOFTWARE AND PROCEDURES

        TOOLS NEEDED: a small jeweler's flat blade screwdriver, and a
suitable speed-adjustment software program (See Appendix --). Plastic TV
tuner adjusters from Radio Shack are preferred since they will not harm
the analog card if the tool is dropped onto the drive as would happen with
metal screwdrivers.   If using metal screwdrivers, cover most of the tool

with vinyl electrical tape.

        ADJUSTING DRIVE SPEED WITHOUT DISASSEMBLY: Some drives have a
small external hole through which the adjustment screwdriver can be
inserted. The adjustment hole is on the bottom of the external casing.
Drives which allow for this adjustment include: (a) internal IIc drive,
(b) external IIc drive, (c) Unidisk 5.25" drive, (d) Platinum 5.25"
drive, and (e) Duodisk drive. Load the software, read a formatted blank
disk, insert the adjustment tool into the opening hole and adjust the
drive speed to the appropriate level. Check the setting with a second
formatted disk, because disks differ in their levels of rotational drag.

        DISASSEMBLY OF THE DRIVE: Turn off all computer power. Power must
always be off when connecting or disconnecting drives or their
controller cards! If you have a Disk][, you must flip the drive upside
down, then remove the four screws. Flip it to its original orientation,
then slide the cover BACK, over the ribbon cable.   The speed adjuster is
a small set-screw on a daughterboard (small circuit board) located at the
back of the drive. Turn on the computer, load the speed-adjustment
software, and adjust the set-screw.

        DISASSEMBLY OF THE UNIDISK 5.25 OR PLATINUM 5.25 DRIVES: Flip the
drive, then remove the four mounting screws on the drive's bottom. Remove
two back-panel screws also. Then, carefully slide the plastic cover off
the metal-encased mechanism. The speed-adjuster variable resistor will be
clearly visible through a hole in the shielding metal on the bottom. The
stepper motor's mounts will also be visible through holes in the internal
metal shielding.

        DISASSEMBLY OF HALF-HEIGHT DRIVES: These vary by brand, but
generally the casing screws are located on the bottom of the drive, near
the edges. Carefully count the screws; save them with washers for
reassembly later. Half-height drives have 2 or three circuit boards; the
speed adjuster is a variable resistor on one of the boards. On the MEIJI
drive, there are two variable resistors. Don't move the adjuster on the
upper board; instead, look for the tiny potentiometer slot on the
underside of the drive. The pancake motors used in half-height drives are
very stable in speed, so, once adjusted, they remain at their preferred
speed.

        TRACK-CENTERING ADJUSTMENT: APTEST SOFTWARE AND PROCEDURES

        Track-centering alignment is adjusted by loading special software
from the APTEST IIe disk which positions the head midway between tracks.
On a well-adjusted drive, the head should then read the upper- and
lower-tracks an equal proportion of times. But if the read-drive is
misaligned relative to the drive which wrote the disk, then either the
upper- or lower-track will be read disproportionately often.

        First, read the docs provided by APTEST on use of the
track-centering software. Those docs accompany the disk alignment program
(#D), and they are reproduced as Appendix B on this disk. The docs may be
printed from Appendix B using Appleworks.

        These tools and supplies will be needed: an assortment of Phillips
screwdrivers of various medium sizes, also paint or Locktite to secure the
bolts. They are needed for disassembly of the drive and also for
adjustment of the stepper-motor mounting bolts. Cotton swaps and alcohol
should be available to clean the read/write head.

        Test the present track-centering alignment prior to disassembly of
the drive. If track-centering is already o.k., then don't do any
adjustment!

        Track-centering is tested by loading the APTEST software, and
selecting program #D: track alignment (centering). Follow the prompts to
identify which slot and drive number should be tested. Then, insert a
disk which is known to be well aligned with other drives: pre-recorded
commercial software disks are fine for this purpose; they will not be
damaged during track-centering tests. The disk will spin for about a
minute, and this screen will appear, with numbers. Copy down the numbers,
and repeat the test with 5-10 unprotected prerecorded disks that are known
to be well aligned.

        ==

        FRACTION RIGHT = _____

        THE FRACTION RIGHT SHOULD BE EQUAL TO 1.

        DIFFERENTIAL FRACTION = _____

        DIFF. FRACTION GOING = _____

        DIFF FRACTION COMING = _____

        ==

        END-STOP ADJUSTMENT NEEDED?

        First, the "FRACTION RIGHT" must equal 1. If it is a lesser
figure, such as .98, and if this error is repeated among several good
disks, then it suggests that Track # 00 is not being read properly. If
this is the case, try cleaning the read-write head with alcohol and repeat
the test. If Track # 00 is still not being read, then follow the end-stop

adjustment procedure (Hancock, 1983; Williams, 1985).

        TRACK-CENTERING ADJUSTMENT NEEDED?

        Look at the "differential fractions" recorded from tests on 5-10
disks. These figures should average +/- 0.40 or less. If the averages
are +/- 0.80 to 0.40, then the misalignment is minor and the drive can be
left as it is. If the averages are less than -0.80 or more than +0.80,
then the drive is seriously misaligned on track-centering, and it should
be adjusted. My experience is that the DIFF. FRACTION GOING is the most
reliable of the various measurements, and I give most attention to that
one.

        Disassemble the drive by removing it from its case. Save the
screws is a safe location! Flip the drive upside down, then find the
STEPPER MOTOR. It is the motor that "jumps" the read-write head from
track to track. Next, identify the two mounting bolts that hold the
stepper motor to the chassis. These bolts will have paint or LockTite on
them. The bolts are mounted in slots. When the bolts are loosened, the
motor can be rotated slightly in its slit. Move the stepper motor very
little! Even a small movement will cause a big change in relative track
alignment! To make the track alignment MORE NEGATIVE, then rotate the
stepper motor slightly in the COUNTER-CLOCKWISE direction. But to make
the track alignment MORE POSITIVE, then rotate the stepper motor in a
CLOCKWISE direction.

        After making a slight adjustment in the stepper motor mounts, then
tighten the bolts, turn on the power, boot up, and repeat the tests with
the 5-10 commercial disks again. Repeat the procedures again and again
until the relative track alignment is within the +/- 0.40 required. When
the alignment is finished, check that the stepper motor mounting bolts are
securely tightened. Put several drops of paint or LockTite on the bolts
so that the bolts will remain tight, maintaining the correct alignment.
Disconnect the power, reassemble the drive and use it!

                TRACK-CENTERING WITH APPLE IIC DRIVES

        If you have an Apple IIc, then the track-centering instructions and alignment program will NOT appear on the APTEST menu! Why? Who k
you can still use the track-centering programs by following these steps:
(a) Prepare a self-booting DOS 3.3 disk, (b) Copy the track-centering
files onto that disk, (c) Boot the disk, then select the disk-alignment programs.

        If you are a novice with your IIc, then write to me (address at heading) and I will mail you a self-booting 5.25" disk that can be p
S. Buggie   11-95

                OTHER DIAGNOSTICS ON THE APTEST DISK

        The APTEST diagnostics disk was produced in the early 1980s by CALL
A.P.P.L.E., a users' group. APTEST is freeware and is presented on the
reverse side of this disk. In this article, I have focused on the two
APTEST programs that relate to drives: the disk speed test, and the
alignment test.

        APTEST is older 8-bit software, but a different set of diagnostics
tests will appear on the screen depending on whether you read the disk on
a IIe/IIgs or on a IIc. The disk alignment test is available only when
APTEST is used with a IIe or IIgs. Here are the two APTEST menus as seen
on the IIe/IIgs and IIc respectively:

APTEST MENU AS READ ON IIE OR IIGS (ROM 01):

                APTEST //E

        1. APPLE //e ROM TEST
        2. 48K RAM TEST - ONE PASS
        3. 48K RAM TEST - REPEATING
        4. TOP 16K TEST - ONE PASS
        5. TOP 16K TEST - REPEATING
        6. DISK SPEED TEST
        7. DISK INTERFACE TEST
        8. KEYBOARD TEST
        9. PADDLE TEST
        A. APPLE PARALLEL CARD TEST
        B. APPLE SERIAL CARD TEST
        C. MICROMODEM TEST
        D. DISK ALIGNMENT TEST
        E. EIGHTY COLUMN CARD TEST
        F. AUXILIARY RAM CARD TEST - ONE PASS
        G. AUXILIARY RAM CARD TEST - REPEATING

 APTEST MENU AS READ ON IIC

                THE APPLE TASTER

        1. Apple //c ROM TEST
        2. 48K RAM TEST - ONE PASS
        3. 48K RAM TEST - REPEATING
        4. TOP 16K TEST - ONE PASS
        5. TOP 16K TEST - REPEATING
        6. DISK SPEED TEST
        7. DISK INTERFACE TEST

```
   8. KEYBOARD TEST
   9. PADDLE/JOYSTICK TEST
   A. SERIAL POST TEST
   B. MODEM TEST
   C. EIGHTY COLUMN CARD TEST
   D. AUXILIARY RAM CARD TEST - ONE PASS
   E. AUXILIARY RAM CARD TEST - REPEATING
```

       ANNOTATED BIBLIOGRAPHY ON 5.25" APPLE II FLOPPY DRIVES

ALLEN, CHARLIE. (May 1984). The World of Disk Drives. A+ MAGAZINE,
    pp. 40-47. Excellent survey of older full-height drives, such as
    Apple Disk][, Rana Elite series, Micro-Sci, & Vista Solo drive.

CRISSMAN, SUE. (Jan 1986). MacCharlie vs. Abaton Drive 5.25.
    A+ MAGAZINE, pp. 128-133. Not Apple II products; these were
    external 5.25" drives to enable older Macs to read IBM disks.
    Included for comparative interest.

FAUGHN, JERRY, ET. AL. (Oct 1983). Interfacing a Stepper Motor to
    Your Apple. INCIDER, pp. 122-125. This article describes various
    applications for stepper motors salvaged from your junked drives.

HANCOCK, EARLE. (Nov 1983). INCIDER, pp. 32-33. Do-It-Yourself Disk
    Drive Repair. This article focuses on the Disk][and its clones.
    It presents speed adjustment, replacement of the 74LS125 chip, and
    adjustment of the end-stopper. [The end-stopper needs adjustment
    only of your drive has difficulty reading track 00; it is not the
    same as track-centering alignment.]

KISS, RICHARD. (Aug 1988). Disk Drive Tester: Fine-Tune Your 5.25"
    Drives. NIBBLE, pp. 68-78. Be prepared to type in a long program!
    It tests drive speed and identifies the highest accessible track.
    The explanations given are more useful than the program appears to
    be.

LITTLE, GARY B. (Jan 1987). The Drive to Succeed. A+ MAGAZINE,
    pp. 28-35. Comparison of nine different Apple II drives, including
    5.25 floppies and 3.5" drives. Clones are reviewed briefly.
    Complete, accurate, well-illustrated, and written by one of the
    most authoritative Apple II writers.

MASTER DIAGNOSTICS IIE, by Nikrom (c1985). This software was
    mentioned previously. The disk has an excellent set of drive tests
    including head alignment, positioner backlash, disk-clamping, erase
    crosstalk, speed, head-cleaning utility, write-protect switch,
    read-write 35 tracks. The write-protect switch test has a bug;
    I bought the software new, yet the write-protect switch test has
    never worked accurately. The paper manual has an excellent
    illustrated 20-page chapter on drives, including details on the
    Disk II analog board ICs, speed adjustment, care of the drive, etc.
    Many other diagnostic tests are included, such as RAM tests, ROM
    tests, 80-column card tests, mouse tests, monitor tests, sound
    tests, etc. A similar version of this software is available for
    the IIc computer, but the IIc version has fewer disk drive tests
    than the IIe version. This is probably the best diagnostic software
    available for the IIe and IIc, but it is disappointing that Nikrom
    failed to update the software to include tests of 3.5" drives,
    extended RAM cards, hard drives, and other accessories that Apple
    users commonly add to their computers.

NADELMAN, MICHAEL. (Apr 1985). First Aid for Disk Drives: A Guide
    for Do-It-Yourselfers. A+ MAGAZINE, pp. 159-167. Well illustrated
    and explained clearly. Covers these topics: analog card repairs,
    IC replacement, write-protect switch, mechanical adjustment, speed
    control, head cleaning. Focuses on the Disk][and its clones.

VANORNER, JON. (Oct 1985). Positive Write Protection. A+ MAGAZINE.
    Hardware hacking instructions for adding a manual write-protect
    switch to the front panel of the Disk][drive.

WEYRICH, STEVEN. (c1990). APPLE II HISTORY. This is a large text-file
    (c700K) that first appeared on the Genie A2 discussion net. It is
    now available on either (a) a set of 4 5.25" floppies, filling both
    sides, or (b) a single 3.5" disk. The disks are self-booting with
    QUICKVIEW text-reading software. The files can also be read with
    Appleworks. There are 23 chapters and 3 large appendices, plus a
    chapter listing. The disks are 8-bit files and can be played on
    the IIgs, IIc, or 128K enhanced IIe. Of special interest is
    Chapter 5, THE DISK][DRIVE, a 10K text file.

WILLIAMS, GENE B. (c1985). HOW TO REPAIR AND MAINTAIN YOUR APPLE
    COMPUTER. Radnor PA:: Chilton Book Co. Chapter 4: The Disk
    Drives, pp. 53-95. ISBN 0-8019-7549-2   This is a very
    comprehensive, well illustrated cookbook on all aspects of Disk
    ][drive repair, although it lacks instruction on APTEST track-
    centering. End-stopper adjustment is presented, as in Hancock
    (1983). This chapter describes the electrical testing of the
    Disk][analog card. The book is one of the popular Chilton
    repair series; public libraries can obtain it via inter-library
    loan.

            APPENDIX A: COMPARISON OF SPEED ADJUSTMENT SOFTWARE

       There are many disk speed adjustment programs available and this
listing is incomplete. All of them have the user load the program, then a

formatted disk is placed in the drive. Either Drive 1 or Drive 2 can be
chosen for adjustment.On-screen markers indicate the direction (slow vs.
fast) and extent of rotational speed error. The display continues while
the user adjusts the speed control variable resistor on the drive. Most
of these speed adjustment programs destroy the data on the formatted disk,
so be sure that its expendable! The disk itself is not damaged and can be
reformatted afterwards.

APTEST. This program is selected from the menu screen and is available
    on the IIe/IIgs or IIc screens. This program has a nice visual
    display and works fine. Be sure to remove your program disk and
    insert the blank formatted disk immediately after loading to avoid
    erasing APTEST accidentally.

COPY TWO PLUS V. 9.1. Earlier versions of COPY TWO PLUS also have a
    speed tester, but the latest version (9.1) is described here.
    At the opening screen, select Y-VERIFY. Then, at the sub-menu,
    select S-DRIVE SPEED. Then select the slot and drive, insert a
    formatted blank disk. The speed is reported in numerical form,
    which should average about 199.8 msec and must not vary below 198.0
    msec or above 202.0 msec. This software is accurate and good;
    I prefer the graphical display of APTEST or MASTER DIAGNOSTICS.

LOCKSMITH 6.0. This disk loads quickly but there is a long series of
    on-screen prompts that must be responded to before the test actually
    starts. Special features: The user can select the precision level
    of the measurement (coarse, medium, fine); also, the screen display
    shows a "speed-mapping" to visually portray the stability of speed
    over an interval of several minutes. This is a unique feature not
    found in other software. However, the validity of the Locksmith
    6.0 speed test is in doubt; its results disagree with the results
    of other reliable speed testers such as APTEST and MASTER
    DIAGNOSTICS. Possibly my copy of Locksmith 6.0 has a bug ....

MASTER DIAGNOSTICS IIE/IIC: This package includes an excellent speed
    adjuster program and its the one I prefer. It is very sensitive to
    slight speed variations, it has excellent screen prompts, and its
    docs boast that it is the most valid of all speed adjuster programs.

                APPENDIX B: DOCS-ON-DISK FOR APTEST TRACK-CENTERING

        These docs appear when selected from the APTEST menu. They are
reproduced here to facilitate printing a paper copy. Also, some users
might prefer the 80 column text display rather than the 40 column display
on the APTEST file.

                              A.P.P.L.E.
                              PRESENTS

                             DISK - DRIVE
                          RELATIVE ADJUSTMENT

                                  BY
                            CHARLES SUITOR

                                (1980)

        This program does not measure the absolute alignment of a disk. It
does measure the relative alignment between a drive and any diskette.
There is no standard set for the results presented here. However, we do
expect the results to be useful in several situations.

        The slot and drive that you wish to test will be requested. The
program will then try to read the diskette in that drive on many tracks
and between them. After several seconds, the drive will stop and results
will be shown.

        The "fraction right" is the fraction that the data tracks were read
correctly, and should always equal 1. The other numbers are results from
trying to read between two tracks. They are the fraction of times the
higher track was read minus the fraction the lower track was read.

        The first difference is the average of all such tries. The one
labeled "GOING" comes from motion from low to high tracks, which is the
same direction that initialization occurs. Thus, this number will usually
be small (less than .1 for a diskette tested in the same drive it was
initialized in.

        The difference marked "COMING" results from motion from high to low
tracks and is often .1 to .2 more positive than the "GOING" difference.

        However, these results will vary as much as .1 to .2 on successive
trials, so be sure to repeat any questionable tests.

        If the differences are greater than +0.9 or less than -0.9, then
the drive is reading one track consistently when it should be reading
between the two. The drive that initialized the diskette is not
positioning its head where yours is. This outcome suggests that the
alignment of the two is different. That alone does not require any
action; diskettes can be read reliably with differences of 0.9 or more.

However, if you have trouble reading diskettes from a particular source, and the difference on these diskettes is very high, then alignment may be a problem.

       To see whether alignment is your problem, test diskettes from a reliable source such as the Apple distribution disks. Test as many as you can; not even Apple is infallible. If your differences are mostly .3 to .4, then you are probably quite well aligned. In that case, ask your disk source to check his alignment!

       If your differences are much more than 0.3, then you may have problems with diskettes from those who are off by similar amounts in the other direction. If you do have problems, then take the drive to a reliable service facility to have the drive checked and realigned.

       There are many other disk problems besides alignment. If you have trouble with disks when read by the same drive in which they were initialed, then alignment is not the problem. Many problems are caused by work or otherwise defective diskettes.

    But if you have problems with diskettes from one drive not being readable by another, then the following track-centering alignment tests may help you isolate your problem.

                         ALIGNING THE DRIVE

       If you are doubtful about this procedure, then please do not attempt it! These instructions are not official, authoritative, or otherwise blessed! No warranty is made as to their accuracy or applicability. We recommend that you take your drive to an authorized service dealer. The purpose of these instructions is to share our experience with other fools who would tinker with their drive despite all advice to the contrary.

       You can damage the drive by shorting the leads or test points. You can put the drive into worse alignment than it is now. You can void the warranty!

       1. Remove the top cover of the drive.
       2. Remove the bottom cover of the drive.

       On the bottom of the drive is a stepping motor, secured on two sides with screws (bolts). These bolts are in slots so that the motor can rotate slightly when the bolts are loose. This rotation of the stepping motor in the slots is the alignment adjustment.

       Adjust by moving clockwise if the difference numbers were too negative and you wish to make them more positive. Adjust counter-clockwise to make the differences less positive. Not much movement is needed! It is difficult to make positional adjustments of the stepping motor that will change the differences by less than 0.3.

       3. Make the desired adjustment on the stepper motor bolts.
       4. Check the alignment with the APTEST disk.
       5. Repeat steps 3 and 4 until the difference score is sufficiently
          low: a difference score of 0.4 or less.
       6. Reassemble the disk drive when finished.

                TRACK-CENTERING ALIGNMENT DATA SCREEN

       FRACTION RIGHT = _____

       THE FRACTION RIGHT SHOULD BE EQUAL TO 1.

       DIFFERENTIAL FRACTION = _____

       DIFF. FRACTION GOING = _____

       DIFF FRACTION COMING = _____

THE DIFF. FRACTIONS, ESPECIALLY THE "GOING" ONE, SHOULD BE
WITHIN +/- .4 IF THE DISKETTE IS ALIGNED WELL WITH THE DRIVE.

                 ACKNOWLEDGMENTS AND AUTHOR'S NOTES
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       1. Thanks are due to John Daniels of Cleveland OH who introduced me to APTEST and its track-centering alignment procedure. In a series of e-mail messages he patiently explained this procedure and its complexities.

       2. This disk is based on a lecture presented to the Greenville Apple Users' Group (GAUG) at its monthly meeting held on February 27, 1995. These drives were disassembled at the meeting for demonstration of adjustment procedures: full-height Disk II classic, Apple 5.25 Drive, Apple External Drive IIC, half-height MITAC drive, and half-height MEIJI drive.

       3. This disk is FREEWARE and can be duplicated and distributed

without restriction. I hope that it will help users to keep their drives
running indefinitely, and that drives that would otherwise be discarded
will be saved for ongoing use. When copying this disk, my authorship
should be acknowledged.

        4. Corrections of factual errors or other comments can be sent to
me at my postal or e-mail addresses as shown at the heading.

        5. Photocopies of articles listed in the annotated bibliography can
be provided if payment for photocopying and postage is received in
advance.

                                END!

Revised Dec 1995