A replacement mini-floppy disk device
driver for the Heath H8 & H89 computers.

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ABSTRACT:

DKH17V3.DVD is a NEW version of the DKH17 mini-floppy disk device driver which replaces the standard Heath device driver, and offers the following NEW features over our DKH17V2 driver:

Support for CPUs that have software-switchable CPU speeds.

A faster media check during INITialization.

The following features from our DKH17V2 driver are provided:

Automatic detection of both diskette type and disk drive type when booting or mounting a diskette.

The head is unloaded during the disk-ready check used by the HDOS RESET command, allowing diskettes to be removed and inserted with the head unloaded.

The device driver measures the speed of the CPU, and computes the correct value for internal timing constants for a CPU running between 2 and 6 MHz.

The number of mini-floppy disk drives attached to the computer may be specified. Since HDOS allocates 256 bytes of RAM memory for each possible drive, users with one or two drives will save RAM memory space.

Several Heath bugs are corrected or circumvented.

The following features from our original DKH17 driver are provided:

A 35% reduction in time for multiple-track I/O operations, and up to a 50% reduction in boot time for fast drives.

The ability to SET the idle head load and motor on times, and individually SETable step times for each disk drive.

The ability to perform a diskette media check during INIT.

Support for 80-track per side and/or dual sided drives, including use of 40-track and/or 1-sided diskettes in 80-track and/or 2-sided disk drives (a 40-track diskette may not be written in an 80-track disk drive).

All of the above are supported on H8 and H89 systems under HDOS 2.0 without any changes to the hardware (except that standard H8 hardware will not support dual-sided drives), ROMs, or Heath software (except for the replacement of SY.DVD). Note, however, that TEST17 references the disks in a non-Heath-standard manner and thus should be used with the new device driver only to measure disk rotation speed. Similarly, non-Heath programs which reference the disks in a non-standard manner, which assume a single-sided 40-track drive, or which make assumptions about the mini-floppy clock interrupt routine (such as HUG's DUP program) may not work with the new device driver.

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INSTALLATION:

In this document, the new device driver (as well as the device driver it replaces) is called "SY.DVD", as that is the name of the mini-floppy disk device driver when you boot from a mini-floppy disk. If you install the device driver on any other type of disk (e.g., an 8" diskette for the Heath H-47), the mini-floppy disk device driver has a different name (usually "DK.DVD"); that name for the mini-floppy disk (e.g., "DK:" or "DK.DVD") must be used in place of "SY:" or "SY.DVD".

This new device driver will support up to 6 mini-floppy disk drives, if the H-17 controller board is properly modified. Information on the modification of the H-17 controller board is available from:

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HDOS 2.0 disk device drivers measure the rotation speed of a disk drive whenever a diskette is mounted in order to determine when the disk drive is ready; if the rotation speed is not within tolerance, HDOS 2.0 assumes that a diskette has not been inserted in the drive. The speed tolerance for the new mini-floppy device driver is much tighter (1%) than that of the Heath mini-floppy device driver. If you find that a disk drive waits indefinitely on MOUNT commands, or rejects all diskettes during INIT, then probably the disk drive speed on that drive is out of tolerance. Run TEST17 (an uninitialized diskette can be used) to adjust and verify the disk rotation speed.

The new mini-floppy device driver is compatible with all Heath monitor ROMs. In order to achieve that compatibility, certain initialization code is placed on the boot track whenever a disk is initialized with the new device driver. The initialization code clears a byte at 2036 (hexadecimal) / 40.066 (octal); this byte is used by the newer Heath monitor ROMs and the new device driver, and must be initialized prior to using the new device driver. If you boot with one of Heath's older monitor ROMs a disk which has not been initialized with the new device driver, but which has the new device driver on it, you may have to clear the above location yourself after a power-on (use the H8 front panel or the H89 monitor "Substitute" command). This problem will not occur once you have initialized all of your bootable disks with the new device driver.

The best way to install the new device driver is to first carefully read and understand in their entirety both this section and the SET command section, and then carefully follow the steps below in the order given. Perform steps #1-8 once; then perform step #9 for each bootable disk you wish to create.

1. INITialize a new diskette. This diskette must NOT be initialized with a previous version of our DKH17.DVD or early (1981) versions of DKH17V2.DVD (as the boot track created by those versions is incompatible with the new version of DKH17V3.DVD). You may need to use the original HDOS 2.0 distribution diskette (or a copy of it).

2. SYSGEN a bootable HDOS system on the new diskette. Place INIT.ABS, SYSGEN.ABS, and SET.ABS on the new diskette.

3. Boot the new system diskette; then load and delete the old mini-floppy device driver from the system diskette:

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>LOAD SY:
>DELETE SY.DVD
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   Immediately perform step #4 (DO NOT reboot).

4. Immediately copy the new mini-floppy device driver to your new system diskette:

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>MOUNT SYn:
>COPY SY.DVD=SYn:DKH17V3.DVD
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   You may also accomplish the above copying with "ONECOPY". This procedure insures that the new mini-floppy device driver file begins at the same disk location as the old mini-floppy device driver file, and is recommended due to an apparent bug in the HDOS "BYE" command.

5. Run the program "DVDDKGEN" (provided on the distribution diskette), specifying the maximum mini-floppy disk drive number (0 through 5) that you wish to be able to refer to on your computer system with HDOS, as follows:

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>DVDDKGEN SYn:
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   where "n" is the maximum mini-floppy disk drive number. You may specify a maximum drive number greater than any drive actually installed on your computer system, but that value MUST NOT EXCEED TWO (e.g., "DVDDKGEN SY2:"), UNLESS YOU

HAVE MODIFIED THE H-17 CONTROLLER BOARD to properly support more than three mini-floppy disk drives. Unless you really need to conserve RAM memory space, it is recommended that you specify "DVDDKGEN SY2:".

6. Reboot your system diskette which contains the new mini-floppy device driver.

7. Use the SET command options "MHZBIT", "TRKS1X", "TRKS2X", "SIDES1", "SIDES2", and "STEP" described below to configure the device driver to correspond to each drive in your hardware configuration.

8. Reboot your system diskette which contains the new mini-floppy device driver.

9. Using your system diskette which contains the new mini-floppy device driver, you must now INITialize and SYSGEN each bootable diskette that you wish to use with the new mini-floppy device driver.

If you ever replace a disk drive with another one that has a slower seek step time, or if you add a disk drive to your system, you should boot a system diskette and then proceed with steps #5-9 above. Any other changes may be made by simply SETting new values for the SET options and rebooting. Note that most of the speed increases mentioned in the abstract above can only be obtained on disks initialized with the new device driver.

SETUP AND USE:

The SET command:

The SET command for SY: now provides three options which must be SET for EACH drive on the system if you do not wish to use the default values provided in the distributed mini-floppy device driver. One or more options are SET with a command of the form:

>SET SYn: <option> <option> ...

where "n" is the HARDWARE drive number (0 through 5). The hardware drive number is the number used to reference the disk drive when you have booted from drive "0". See pages 2-60, 61 of the HDOS 2.0 reference manual. IF YOU DO NOT PROVIDE A HARDWARE DRIVE NUMBER, THE SET COMMAND ASSUMES A VALUE OF ZERO. Note that more than one option may be specified at a time.

Options:

STEP nnn	where "nnn" is the seek step time in milli-seconds (1-255). The value is increased if necessary to make it even.
SIDES1 or SIDES2	specifies the number of sides supported by the installed disk drive. This information

is used only by INIT when INITializing a diskette.

TRKS1X or TRKS2X — specifies whether or not the disk drive has twice (80) the standard (40) number of tracks per side. This information is used only by INIT when INITializing a diskette.

The SET command for SY: also provides four options which may be set for the mini-floppy system as a whole (any unit number specified on the SET command is ignored). Note that more than one option may be specified at a time.

Options:

HELP — prints a list of the valid SET options.

SELECT nnnn — where "nnnn" is the time in milliseconds that the disk read/write head stays loaded after the last disk operation (0-1016). The value is increased if necessary to make it a multiple of four.

MOTOR nnn — where "nnn" is the time in seconds that the disk drive motors stay on after the read/write heads unload (1-127).

MHZBIT n — where "n" is the number of the bit used in port 362 (octal) or F2 (hexadecimal) to a select higher CPU speed on CPUs with software-switchable CPU speeds (0-7). Specifying a valid bit number (values 0, 1, 5, and 6 are ignored) causes the mini-floppy device driver to switch the CPU speed to 2 MHz during disk operations; this option is only required on CPUs that supply the H-17 controller board a clock speed of other than 2.048 MHz when the CPU is not running at 2 MHz.

Any new values entered for any of the above options (except "HELP") do not take effect until the next time that the device driver is loaded (e.g., when the system disk is rebooted). The default values for the drives in the distributed mini-floppy device driver are:

MHZBIT 0 STEP 30 SIDES1 TRKS1X SELECT 180 MOTOR 20

The INIT command:

Before running INIT, each drive on the system should be configured with the SET command. This is because the INIT program writes an abbreviated device driver onto the boot track for use during the boot sequence; this abbreviated device driver will now contain a copy of the seek step time for each drive. The seek

step time is taken from the currently SET values in the device driver at the time that INIT is run. ("SELECT" and "MOTOR" time-out values of three seconds each are used in the boot device driver and when running INIT, and may not be changed.) The ONLY way to change the seek step time on the boot track is to reINITialize the diskette.

When INIT initializes a disk, it divides the space on the disk into clusters. Because of the design of HDOS, a disk cannot have more than 256 clusters. Therefore, the larger the space available on a disk, the larger the size of a cluster is. On a standard Heath format diskette (40-track, 1 side), the size of a cluster is 2 sectors, or 512 bytes. On a 40-track, 2-sided diskette or an 80-track 1-sided diskette, the size of a cluster is 4 sectors. On an 80-track, 2-sided diskette, the size of a cluster is 8 sectors. When a file is created, it is always allocated an integral number of clusters. This means that a file may occupy more space on a larger capacity diskette than on a smaller capacity one. In particular, a small (2 sectors or less) file occupies the same percentage of total disk space regardless of the capacity of the diskette, because it always occupies one cluster.

When running INIT, the following messages, some requiring a response, may be issued:

Double sided <YES>? This message is issued if the drive you are attempting to initialize on has been configured by SET as double sided. A "YES" response initializes both sides of the diskette; a "NO" only initializes one side.

Reformat <YES>? This message is only issued if the volume in the drive was previously initialized with the same volume serial number as the new serial number, AND if the diskette was initialized in the same configuration (sides and tracks per side). A "YES" response reinitializes the sector headers on the diskette; a "NO" skips header initialization. NOTE THAT THE PREVIOUS CONTENTS OF THE DISKETTE WILL STILL BE LOST, as INIT always creates an empty directory and writes a new boot track and label.

Media check <NO>? This message is only issued if reformatting was not skipped. A "YES" response performs a sector validity check on each sector; a "NO" skips the validity check.

Error in sector nnnn This message is printed during a media check to identify each bad sector. The sector numbers can be entered in re-

sponse to the normal INIT prompt "Sector?".

TECHNICAL INFORMATION:

HDOS interface:

HDOS 2.0 now provides a device independent interface for disk drives as well as serial devices. This means that disk device drivers may easily be written for new disk devices. A disk device driver file (e.g., SY.DVD) actually consists of two parts. The first part is the normal device driver that is loaded by the system when needed to reference the appropriate disk drive. The second part is only loaded when INIT is run; all additional device dependent code needed by INIT is contained in this second part.

The Heath device driver for the mini-floppy disk normally directly references the H17ROM code for the mini-floppy, except for a few functions which are performed by the device driver. The new mini-floppy device driver retains this basic structure, although additional code has been added to support the additional disk configuration. The sector header format remains the same, although the track numbers on double sided disks are even (0, 2, 4, ...) on the first side and odd (1, 3, 5, ...) on the second side. The configuration of each volume (initialized sides and tracks) is recorded in the volume label record; each time a disk is mounted, the device driver reads the label record and determines how to handle the mounted media. An error message is issued if the media is incompatible with the disk drive.

If the head load idle time (the SET option "SELECT") is SET to a non-zero value, the next time that the new mini-floppy device driver is loaded, the following actions occur: The new mini-floppy device driver flags itself as permanently resident, and then updates the clock interrupt processing routine to include an additional routine. This additional processing routine works with all Heath software except TEST17.ABS. Some non-Heath software which makes assumptions about the location or contents of the clock interrupt processing routine may also no longer work; TEST17.ABS and any such non-Heath software MAY work if the "SELECT" time is SET to zero. The new device driver does not allow writing on a 40-track diskette in an 80-track drive, because such a diskette would then not be readable in a 40-track drive.

The second part of the device driver (that portion that interfaces with INIT) has been completely rewritten. The most important difference not mentioned above is the fact that sector zero of each track is recorded offset three sectors from where sector zero of the previous track was recorded. This means that multiple track accesses only have to wait 60 ms (this allows for seek time and head settling) rather than 200 ms after accessing the last sector of one track to the first sector of the next. This reduces average track read/write time on multiple track accesses from 400 ms to 260 ms, a 35% decrease.

using this device driver at CPU speeds greater than 2 MHz requires that you have an H8 or H89 that already functions properly at that CPU speed. We cannot provide hardware support, assistance, or advice in getting a modified computer to run, and we will not answer communications requesting such assistance. In particular, one popular method of modifying an H89 to run at 4 MHz violates the chip specifications on a Z80A, on the Heath static RAMs, and on the 200ns dynamic RAMs. Some computers may successfully pass the ROM-based dynamic RAM test and yet fail when executing programs from RAM, because the timing is more critical when fetching instructions from RAM than when reading or writing data.

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