** H17/H77 Device Driver **

Enhanced System Device Driver

-from-

D-G Electronic Developments Company

700 South Armstrong

Denison, Texas 75020

(214) 465-7805

-by-

Bill Parrott

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INTRODUCTION

This document describes the D-G Electronic Developments H17/double-sided/double-track density (DS/DTD) device driver. This driver, based on the original H17 ROM code by Heath, was developed by D-G Electronics and released into public domain in December, 1981. This driver and accompanying documentation and source code may be freely copied and distributed, so long as no charge is made, and credit is given to D-G Electronic Developments for its development. This driver has been thoroughly tested in a variety of systems, including the H8 (2 and 4 MHz) and H89, using Wangco 82, Siemens, Tandon TM-100 type disk drives.

Note that this driver and all associated utilities and documentation is available on floppy disk (both in source and object) for a nominal charge.

D-G Electronic Delevopments Co. welcomes all comments and/or suggestions for improvement of this driver. All correspondence should be directed to:

D-G Electronic Developments
Software Support
700 South Armstrong
Denison, Texas 75020

SECTION I

DRIVER FEATURES AND FACILITIES

Overview

The most prominent feature of this device driver is its support for double-sided and/or double-track density (DS/DTD) disk drives such as the Tandon TM-100-4. With this driver and a Tandon type drive, it is possible to store up to four times as much information on a 5" hard sectored floppy disk as was previously possible. Support for the DS/DTD drives and the larger capacity disks is automatic. IMPORTANT: To make full use of this driver with the DS/DTD drives (ie. to use side 1), the user MUST have installed in his computer a device capable of generating the necessary side-select signals. One such device is the D-G CMD-1. The user need not be concerned with specifics of what hardware is in use, or the physical disk drive addresses. All hardware and media recognition is done dynamically by the driver. This recognition capability is also found in the boot code, so that it becomes possible to BOOT a standard disk created by this driver on an 96 tpi DS/DTD drive. This flexibility gives the user complete freedom in his system configuration and provides a portability of media from system to system. To aid in this portability, automatic step rate adjustment is performed by the driver if necessary so that a disk SET to run at 4ms per track, could still be booted and run on a drive with a slower step rate.

Another significant feature of this driver is the ability to create 'fast' disks using a user-defined track 'skew' value. This skew value is used during disk initialization to physically rotate the sectors around the surface of the disk, so that the amount of time spent waiting for the proper sector after a head movement will be reduced to an absolute minimum. For a complete description of this process, please refer to the section covering SET options in this document.

Other features of this driver include: Dynamic alteration of SET options without the need to re-boot; Correct operation of error counter registers; Correction of bugs in routines R.READ, R.READR, R.WRITE, R.CDE, and R.STZ.

Components

This driver consists of two basic components. The first is the actual driver code. This is the part which interfaces with HDOS to do all I/O. The second is the initialization code. This is that code which is used by HDOS (specifically by INIT.ABS) to initialize new disks. This initialization code also contains a program called a 'read-only driver'. This read-only driver, recorded on the boot

track of the disk, is used by HDOS during the initial stages of system start-up. Under HDOS, these files are combined into a single file known as XX.DVD (where XX is the name of the driver). The combining of the two files into the final DVD is performed by a utility called MAKMSD. MAKMSD is included with HDOS 2.0 distribution disks and is therefore not provided here. In addition, we have provided a utility to aid in the conversion to this driver and to eliminate the need to reinitialize every disk. This utility is called CBT (copy boot track). The function of CBT is to copy the bootstrap information from disk to disk. Since this driver is not compatible with some other drivers, this utility will enable the user to replace the boot code on old disks without having to reinitialize them.

The following files are included on the disk(s). Note that many of the .ACM files are found on the standard HDOS 2.0 distribution media. They have been included here for completeness.

File Name	Description
H17DVD.ASM	Source code for the actual device driver.
H17INIT.ASM	Source code for the driver initialization code and boot track.
CBT.ABS	Copy Boot Track.
CBT.ASM	Source code for CBT.
CLR.ABS	Clear file flags.
CLR.ASM	Source code for CLR.
H17.DVD	Complete device driver object file. Note that this file is output from MAKMSD and contains BOTH files H17DVD.SYS and H17INIT.SYS
H17DVD.SYS	Device driver only object file.
H17INIT.SYS	Driver initialization object file.
*.ACM	XTEXT files necessary to assemble these programs.

SECTION II

INSTALLATION AND CONFIGURATION

Preparation

Due to the way in which certain device drivers are coded, they are made incompatible with other drivers. Incompatible, not in the recording format of the disks, but in their operation. For example, some device drivers assume the use of the 2ms interrupt vector without regard to whatever processes may be using it. For this reason, the instructions given here must be followed very carefully to ensure proper implementation of this driver in the users system. The installation of this driver is not a particularly complex or involved procedure, but nonetheless requires that the instructions be followed. If these procedures are not followed, proper operation of this driver cannot be assured.

In order to begin to install this driver, the user will need a disk to be used as an HDOS system disk. We will refer to this disk as the 'creation disk' since this is the disk from which we will create our first disk with this driver. The creation disk must have been initialized with the standard H17 driver as distributed with HDOS 2.0 or with the D-G driver. Specifically, the creation disk must neither contain nor have been initialized with any version of the HUG SY: driver or the Ultimeth driver. This is due to the manner in which these drivers process interrupts. In addition, this disk, (if initialized with the standard HDOS driver), must be a 48 tpi, single-sided disk. This is to ensure that the system may be booted with the new driver so that additional disks may be created. Once a suitable disk has been obtained, the disk must be SYSGENed so that it may be used to boot HDOS. (Instructions for performing the SYSGEN procedure may be found in the HDOS Reference Manual). The creation disk should contain the following files, in addition to the normal system files: H17.DVD, CLR.ABS, CBT.ABS, INIT.ABS, ONECOPY.ABS. (The file ONECOPY is not needed if the users system contains more than one disk drive).

Installation

Once a suitable creation disk has been prepared as described above, it should be booted as normal. When the HDOS system prompt is received, enter the command 'CLR SY.DVD'. This will cause all flags to be removed from the file SY.DVD so that it may be replaced. When the HDOS prompt returns, enter the command 'DELETE SY.DVD'. This will remove the old H17 driver from the disk. Again, when the HDOS prompt returns, enter the command 'RENAME SY.DVD=H17.DVD'. After this command has been completed, the new H17 driver will become the SY: driver for this disk effective at next boot.

At this time, re-boot the system using the creation disk containing the new H17 driver. Shortly after the 'Date?' question is answered during bootup, the driver should 'sign on' with the message 'D-G,H17.1A/xxxx9', where the 'xxxx' may be any characters. This indicates that the driver has been loaded into memory and is executing. This sign-on message will be issued each time the driver is brought into memory. (Note: If the user wishes, the various driver options may be set at this time. Refer to the next section for details on this procedure.)

The next step is to initialize a disk with the new driver so that the boot track contains the proper code, and we will have a base from which to continue building. To initialize a disk, enter the command 'INIT SY0:'. This will cause HDOS to dismount all disks and request insertion of a disk to be initialized into SY0:. A scratch disk (not the creation disk) should be used here. Answer all questions through entry of the volume label. The driver will ask the user whether the disk contains one or two sides. The default answer here is one. The driver will also ask if the disk is being initialized on 1) a 48 tpi drive or 2) a 96 tpi drive. The default answer here is also one. Since we are using a standard drive for this step, both defaults should be taken. Proceed through the disk initialization and then re-boot HDOS using the creation disk. When the HDOS system prompt is again obtained, enter the command 'CBT SY0:'. CBT will dismount SY0: and prompt the user for a source disk. Insert the disk just initialized into SY0: and then hit RETURN. CBT will read the boot code from this disk and then prompt the user for a target disk. Insert the creation disk into SY0: and then hit RETURN. CBT will then verify permission to rewrite the boot track on SY0:. Hit RETURN. (To abort the program, hit CTRL/C). After the user had verified permission to rewrite, CBT will write the boot track read from the newly initialized disk onto the target disk. When this is complete, CBT will will exit. Installation of the driver onto the creation disk is now complete.

Installation of the driver on previously initialized and SYSGENed disks is a short two step process. The first step is to copy the new driver onto the disk being converted (the target disk) from the creation disk. This may be accomplished using either PIP or ONECOPY. (Note that if the driver on the target disk is write locked, the program CLR may be used to remove those flags). Once the new driver has been copied to the target disk, the program CBT must be used to update the boot track. If the target disk resides in SY1:, for example, the user should enter the command 'CBT SY1:=SY0:'. This will instruct CBT to read the boot track from the disk in SY0: (the creation disk) and write it onto the disk in SY1: (the target disk). As before, CBT will dismount the disks being operated upon and instruct the user to insert the desired media. Once CBT has finished, the conversion of the target disk is complete. It should be noted that although a mechanism has been provided for installation of this driver on disks initialized by other drivers, it will be to the users ultimate advantage to initialize new disks with this driver after all SET options have been .selected. This will enable the user to take full advantage of

the track skewing performed by the driver.

Several examples of the above procedures for installation of this driver are given at the end of this document.

SET Options (Configuration)

The following is a list and short description of all SET options implemented in this driver. Following the list is a detailed explanation of each option and guidelines for determining the proper values.

Option	Description
STEP	This is the normal track-to-track step rate to be used for a drive. The value is given in milliseconds and may range upwards from 2. The default value is 30.
RESTEP	This is a special step rate used during automatic retry of hard I/O errors. The value is given in milliseconds and may range upwards from 2. The default value is 30.
RETRY	This value determines how many soft errors shall occur before a hard error is flagged. This value may range from 1 to 255. The default is 10.
MOTOR	This determines the length of time the drive motor will run after the last disk access. The value is given is the number of seconds desired times 2 and may range from 4 to 255. (or 2 to 127.5 seconds). The default value is 40 (or 20 seconds).
SKEW	The value given here is used when a disk is initialized to determine how the tracks will be physically recorded. The value may range from 0 to 9. The default is 8.

STEP

This SET option determines the track-to-track step time for each unit in the user's system. The step time for each unit may be SET independently of the other units, so that if a user had one Tandon

drive and one Siemens drive, they might each be set to run at the fastest possible speed. The value here should be given in milliseconds and may not be less than 2. The following should be kept in mind when selecting the values to be used here for each unit: Wangco 82 and Siemens drives are SPECIFIED to step at 30 milliseconds. In most cases, the Wangco will run reliably at 8ms and possibly 6ms. The Siemens drives will rarely step faster than about 14ms. The Tandon TM-100 drives are specified to step at 3ms. It should always be safe to set the STEP time for these drives to 4ms.

Example: SET SY1: STEP 8

RESTEP

This is a special step rate used during automatic retry of hard I/O errors. When a hard error is flagged, this value is substituted for the regular step time and the operation is retried. This step rate applies to all units. The value given here should be given in milliseconds and may not be less than 2. The specified step time for the hardware in use is a good value to be used here. See STEP above for a discussion of this.

Example: SET SY: RESTEP 20

RETRY

This value determines how many retries shall be attempted before a hard error is flagged. This value may range from 1 to 255. The standard driver is set to 10 retries, however, in most cases about 4 or 5 retries seems to be sufficient.

Example: SET SY: RETRY 4

MOTOR

This determines the length of time the drive motor will run after the last disk access. The value is given is the number of seconds desired times 2 and may range from 5 to 255. (or 2.5 to 127.5 seconds). The value chosen here is purely a matter of user preference. The example below will result in an after access run time of 60 seconds.

Example: SET SY: MOTOR 120

SKEW

This value determines how a disk will be recorded when it is initialized, with respect to physical placement of sectors on the disk. By properly placing the sectors on the disk, the I/O time can be cut to an absolute minimum. For example: The amount of time taken for a complete sector to pass under the read/write head of the disk drive is about 20 milliseconds. The amount of time to actually move the heads from track to track varies from about 6 to 30

milliseconds. Since there are 10 sectors on a track, it takes 200 milliseconds (or 1/5 second) for the disk to make a complete revolution. Problem: When the end of a track is reached, the driver causes the heads to be moved in to the next track. For illustration, say this movement takes 8 milliseconds. The driver must now wait for 192 milliseconds for the proper sector to come into position before it can continue the current operation. In this 192 milliseconds, 9 sectors passed the head, unprocessed. If we skew the sectors properly, however, there needn't be any lost time. If the disk were formated such that the first sector seen after head movement was the desired sector, we would save 192 milliseconds. (This amounts to a 96% reduction in time to move from track to track). Any value ranging from 0 to 9 may be specified here, but experience has shown that for drives seeking at 10ms or faster, a value of 9 is best. For drives seeking at speeds slower than 10ms up to about 30ms, a value of 8 is good. Note that the value given here represents the number of sectors which would go unprocessed (as illustrated above) if the disk were not skewed at all. A value of 0 will result in no skew at all being applied to the disk. (This is how the standard device driver initializes disks). It is important to note that the use of skew on a users disk will in no way affect the ability of other drivers to read those disks. Skew merely serves to speed disk access, and does NOT make the disks unreadable by other drivers.

Example: SET SY: SKEW 8.

The user should note that multiple SET options may be specified on a single command line. For example, the command

SET SY: RETRY 4 RESTEP 16 SKEW 9 MOTOR 10 would be considered valid. This only applies to those options which are global to the entire device (ie. The unit STEP rates must be specified individually). To set the step rates for individual units, the command form is:

SET SYn: STEP x

where 'n' represents the unit number, and 'x' represents the desired STEP time.

SECTION III

EXAMPLES

Following in this section are examples of actual steps involved in installing and configuring this driver in a variety of situations.

Initial Installation

This example illustrates the steps given in Section II for the initial installation of this driver. As stated in the instructions given, two (2) disks will be required for this procedure. The first to serve as 'creation disk' and the other to serve as a work disk which will be initialized.

```
>CAT/S (cr)

Name     .Ext    Size      Date          Flags   23-Dec-81

HDOS     .SYS    31      23-DEC-81       SLW
HDOSOVL0.SYS     26      23-DEC-81       SLW
HDOSOVL1.SYS     11      23-DEC-81       SLW
SYSCMD   .SYS    12      23-DEC-81       SLW
PIP      .ABS    19      23-DEC-81       SLW
SY       .DVD    10      23-DEC-81       SL      (standard H17 driver)
DK       .DVD    15      23-DEC-81
ERRORMSG.SYS     11      23-DEC-81       SW
SET      .ABS    12      23-DEC-81       SW
FLAGS    .ABS    4       23-DEC-81       SW
ONECOPY  .ABS    20      23-DEC-81       SW
LP       .DVD    7       23-DEC-81
INIT     .ABS    29      23-DEC-81       W       (req'd file)
SYSGEN   .ABS    21      23-DEC-81       W
CBT      .ABS    4       23-DEC-81               (req'd file)
SYSHELP  .DOC    3       23-DEC-81       SW
HELP     .       2       23-DEC-81       SW
CLR      .ABS    1       23-DEC-81               (req'd file)
H17      .DVD    18      23-DEC-81               (req'd file)
RGT      .SYS    1       23-DEC-81       SLW
GRT      .SYS    1       23-DEC-81       SLW
DIRECT   .SYS    18      23-DEC-81       SLW

   22 Files, Using 276 Sectors (102 Free)

>CLR SY.DVD (cr)

CLR, Version 2.0.
>DELETE SY.DVD (cr)
>RENAME SY.DVD=H17.DVD (cr)
```

```
>CAT/S (cr)

Name     .Ext    Size      Date          Flags   23-Dec-81

HDOS     .SYS    31       23-DEC-81       SLW
HDOSOVL0.SYS     26       23-DEC-81       SLW
HDOSOVL1.SYS     11       23-DEC-81       SLW
SYSCMD   .SYS    12       23-DEC-81       SLW
PIP      .ABS    19       23-DEC-81       SLW
DK       .DVD    15       23-DEC-81
ERRORMSG.SYS     11       23-DEC-81       SW
SET      .ABS    12       23-DEC-81       SW
FLAGS    .ABS    4        23-DEC-81       SW
ONECOPY  .ABS    20       23-DEC-81       SW
LP       .DVD    7        23-DEC-81
INIT     .ABS    29       23-DEC-81       W       (req'd file)
SYSGEN   .ABS    21       23-DEC-81       W
CBT      .ABS    4        23-DEC-81               (req'd file)
SYSHELP  .DOC    3        23-DEC-81       SW
HELP     .       2        23-DEC-81       SW
CLR      .ABS    1        23-DEC-81               (req'd file)
SY       .DVD    18       23-DEC-81               (New H17 driver)
RGT      .SYS    1        23-DEC-81       SLW
GRT      .SYS    1        23-DEC-81       SLW
DIRECT   .SYS    18       23-DEC-81       SLW

   21 Files, Using 266 Sectors (112 Free)

>BYE (cr)
Volume 000, Dismounted from SY0:
Label: HDOS 2.0 Issue #50.06.00

Install a bootable disk in SY0:.  Hit RETURN to reboot: (cr)


ACTION? <BOOT> BOOT

SYSTEM HAS 56K OF RAM

HDOS Version 2.0
 Issue # 50.06.00
Date? (MM-DDD-YY)? 26-JAN-82 (cr)

D-G,H17.1A/4STV8
Volume 000, Mounted on SY0:
Label: HDOS 2.0 Issue #50.06.00

>INIT SY0: (cr)

Dismounting All Disks:

Volume 000, Dismounted from SY0:
Label: HDOS 2.0 Issue #50.06.00
```

```
Remove the Disk(s). Hit RETURN when ready: (cr)

 Insert the volume you wish to initialize into SY0:;
 remember, any data on this volume will be destroyed.

Hit RETURN when ready.
Ready? (cr)
D-G,H17INIT.1A

The volume now in the drive ...
Apparently has not been initialized before.

Type NO to cancel, type YES to erase and initialize the disk. (YES/NO) ? YES (

Enter a unique volume serial number from 1 to 255: 22 (cr)
Enter a volume label of 60 characters or less:
work disk  (INITed w/ D-G driver) (cr)

Number of sides (1 or 2)? <1> 1 (cr)

Recording density (1=48 tpi, 2=96 tpi)? <1> 1 (cr)

Enter the number of the bad sectors one at a time.  Hit RETURN
after each entry, and when finished.
Sector? (cr)

 Disk Initialization complete.

 Insert the volume you wish to initialize into SY0:;
 remember, any data on this volume will be destroyed.

Hit RETURN when ready.
Ready? ^D
Device<SY0:>? ^D
Do you have any more disks to initialize (YES/NO) <NO> ? NO (cr)

Install a bootable disk in SY0:.  Hit RETURN to reboot: (cr)


ACTION? <BOOT> BOOT

SYSTEM HAS 56K OF RAM

HDOS Version 2.0
 Issue # 50.06.00
Date? (26-JAN-82)? (cr)

D-G,H17.1A/4STV8
Volume 000, Mounted on SY0:
Label: HDOS 2.0 Issue #50.06.00

>CBT SY0: (cr)

Volume 000, Dismounted from SY0:
```

Examples

```
Label: HDOS 2.0 Issue #50.06.00

Insert source disk in SY0:.  Depress RETURN when ready ... (cr)
Insert target disk in SY0:.  Depress RETURN when ready ... (cr)

Verify permission to write onto SY0:.  Depress RETURN when ready ... (cr)

*** Operation Complete ***

Install a bootable disk in SY0:.  Hit RETURN to reboot:
```

General Installation

This example shows the steps as described in Section II for the installation of this driver on disks which have already been initialized with another driver. This installation does not require re-initialization of the user's media.

```
>CLR SY1:SY.DVD (cr)

CLR, Version 2.0.
>DELETE SY1:SY.DVD (cr)
>COPY SY1:*.*=SY.DVD (cr)

1 File(s) copied
>CBT SY1:=SY0: (cr)

Volume 000, Dismounted from SY0:
Label: HDOS 2.0 Issue #50.06.00
Volume 001, Dismounted from SY1:
Label: HDOS work disk

Insert source disk in SY0:.  Depress RETURN when ready ... (cr)
Insert target disk in SY1:.  Depress RETURN when ready ... (cr)

Verify permission to write onto SY1:.  Depress RETURN when ready ... (cr)

*** Operation Complete ***

Install a bootable disk in SY0:.  Hit RETURN to reboot:
```

Installation as DK:

This example shows the steps involved in installing this driver as a device other than SY: on an alternate disk system such as the H/Z-47.

```
>CLR DK.DVD (cr)

CLR, Version 2.0.
>DELETE DK.DVD (cr)
>RENAME DK.DVD=H17.DVD (cr)
```