

# MYARC HFDC HARD DISK CTRL

(Written for the Swedish user group PROGRAMBITEN 88-4 and 89-1)

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A new card from Myarc can control both hard disks and ordinary floppy drives with a TI-99/4A. A Geneve can only use it with hard disks!! Up to 3 hard disks, each with up to 134 Mbytes, and 4 floppy drives with up to 720 kbytes each can be used.

The card is sealed but the connectors are brought out on the back of the card. You get two connecting cables for the hard disk and a 70 page manual and 3 disks: Disk Manager V, Geneve MDOS and Geneve GPL+Myword. You can use the first disk manager only with a TI-99/4A.

You can choose any CRU-address between >1000 and >1F00 (16 different).

## FLOPPY DISK CONTROL

The disk drives are connected to the same connector as used in the TI-controller for internal drives. Notice that the extra contacts for external drives on the TI are missing from the Myarc. All other connectors are used for hard disks so don't hook floppies up to them.

You can use up to four drives which will be DSK1-4 on CRU >1100 and DSK5-8 on all other CRU-addresses. You can use two disk controller cards at the same time. I have used Myarc on CRU >1000 and TI on CRU >1100 which works well. TI will control DSK1-3 and Myarc DSK5-8. The latter are to be strapped as if they were DSK1-4 but will be addressed as DSK5-8 by all programs.

There are DIP-switches for selecting the following items for all four drives individually:

- 40 tracks, 16 ms step time, max 360 kbytes
- 40 tracks, 8 ms step time, max 360 kbytes
- 80 tracks, 2 ms step time, max 720 kbytes

It is possible to use disk formats between 90 kbytes and 720 kbytes:

- SS/SD 90 kbytes 9 sectors/track TI-original drive
- DS/SD 180 kbytes 9 sectors/track Max with TI-card
- SS/DD 180 kbytes 18 sectors/track TI-original drive \*\*
- DS/DD 360 kbytes 18 sectors/track Corcomp and Myarc
- DS/QD 720 kbytes 18 sectors/track

Format marked with \*\* should be avoided for maximum interchangeability between different TI-users. You can use up to 180 kbytes with the original TI-drive but it is better to change to double sided drives with 360 kbytes which also have 180 kbytes DS/SD, the most common type among TI-99/4A users. You can get a new half

height drive for USD 90. Earlier versions of the disk manager could also use 16 sectors/track (320 and 640 kbytes).

5.25 inch QD (quad density = 80 tracks/side) can read 180 kbytes SD and 360 kbytes DD but can only write QD. An 80-track drive has a read/write head of very small width compared to a 40-track drive. You can have the following cases:

- 1.tracks from wide head on a fresh disk
- 2.tracks from small head on a fresh disk
- 3.tracks from small head written over wide head tracks

The first two cases can always be read by both types of drives. In the third case you get read errors with a wide head drive and a rather uncertain operation with a small head drive if the head is somewhat off center of the track. You can also use 3.5 inch 720 kbytes drives.

Sector zero for a 720 kbytes QD drive will use blocks of 512 bytes which is the smallest unit you can use. This means that the file header takes 2 sectors and the data sectors are even in number so the file will be 1-2 sectors longer than on a SD or DD disk.

#### MYARC DISK MANAGER V

The disk manager is on a disk and works fine and will completely replace TI DM 2 and DM 1000. It can initialize, copy and test disks. Files can be copied, erased and protected. Catalog will also show the number of sides, density and sectors/track and the length of a PROGRAM file in bytes. A comparison with DM 2 and DM 1000 shows the following:

	TI DM 2	OTTAWA DM1000	MYARC DM V
Number of DSK	1-3	1-8	1-9
FILE copy file	YES	YES	YES
sectors per pass	45	40	58
copy with rename	YES	-	-
copy overwrite test	-	-	YES
move file	-	YES	YES
delete file	YES	YES	YES
recover file	-	YES	-
list D/V80 + D/F80	-	YES	YES
list all D/V + D/F	-	-	YES
protect file	YES	YES	YES
remove XB-protection	-	YES	-
rename file	YES	YES	YES
DISK multifile copy	YES	YES	YES
files per pass	one	one	several
copy used sectors	-	YES	-
copy all sectors	-	YES	YES
sectors per pass	-	104	57
init with test	YES	YES	YES
init without test	-	YES	-
multidisk init	-	YES	-

sweep disk	-	YES	-
catalog	YES	YES	YES
printer control code	-	YES	-
set disk protection	YES	YES	-
remove disk protect	-	YES	-
rename disk	YES	YES	YES
TEST read test	YES	-	YES
write test	YES	-	YES

Multifile copy has its own command which is missing in DM 1000 but exists in DM 1000 modified for Funnelweb. DM V also warns you if you try to copy a new file over an old file by the question: File name already exists, Do you want to overwrite (Y/N/All). You can choose Y or N for every old file. If you choose All then all will be copied without any more questions. This is similar to Replace String in TI-Writer. Several small files are copied in the same pass which is not done by DM 2 and DM 1000. You can also use DM V with Horizon RAM-disks as DSK1-9. This is the first disk manager that can handle DSK9 which is missing in DM 1000.

#### SUBDIRECTORIES ON FLOPPY DISK

A disk can only use 127 files regardless of how it is formatted. It is possible, apart from the ordinary catalog (root), to create three subdirectories (DIR) which can hold 127 files each. The disk can then in total contain 508 files because the root can also have 127 files. Each subdirectory has a header which takes one sector. All unused sectors can arbitrarily be used by the three DIR and the root. It is thus much more flexible in use than Horizon MENU.

A file in a DIR can be called by DSK1.SUBDIR.FILENAME or DSK.DISKNAME.SUBDIR.FILENAME and a file in the root by DSK1.FILENAME or DSK.DISKNAME.FILENAME. The name of the DIR can be 10 characters long but you should use as short name as possible so it can be within the INPUT length.

If you have four 90 kbytes disks then you can easily transfer these to the root and 3 DIR. All four disks have individual catalogs so the same file name can exist four times on the disk. Myarc DM V has a special FIND command that will list all places where a particular file name is used.

Another use can be when you write assembler programs and source and object code are saved to different DIRs and the PROGRAM-file is saved to the root. A C99-programmer can create DIRs for C-code, AL-source code and AL-object code and use the root for PROGRAM-files.

#### NEW BASIC COMMANDS

You can use OLD, SAVE, OPEN, DELETE and LIST in the usual way but also with DIR like SAVE DSK1.XB.GAME.

There are seven new CALLs which can be used in BASIC command mode

and RUN of a program. For Extended Basic you can use them only in command mode.

CALL FILES decides how many open files there can be on the disk drives. The maximum number is 9.

CALL ILR is similar to CALL INIT in the Editor/Assembler-module.

CALL LR("DSK1.OBJECTFILE") is similar to number 3 LOAD and RUN in the EA-module. The command loads an object file in DIS/FIX 80 format. It must be used together with CALL ILR.

CALL LLR("START") is similar to CALL LINK in the EA-module and starts a program as number 4 RUN in the EA-module. It must be used together with CALL LR.

CALL MDM will load DM V from DSK1.

CALL DT will set the clock. You can also do this with OPEN #1: "TIME",INTERNAL,FIXED and PRINT #1:SEC\$,MIN\$,HR\$,DAY\$,MON\$,YR\$. You can read the clock with INPUT. This is a hardware clock so it will operate correctly also with 50 Hz and during access to external devices. It has no batteries so it must be set every time you start the computer.

CALL DIR(1) or CALL DIR("DSK1") shows the catalog. CALL DIR ("DSK1.SUBDIR") shows the catalog for the subdirectory. A good thing is that the length of the PROGRAM-files is shown in bytes both for Basic and Assembler.

In the same way as for the TI-card you can read the catalog by opening a file with OPEN #1:"DSK1.",INPUT,RELATIVE,INTERNAL where "DSK1." can be replaced by "DSK1.SUBDIR." to get the catalog for a DIR. Notice that the dot must be used here but not in CALL DIR. When you read this file you get:

```
INPUT #1:"DISK$,ZERO,TOTAL,USED
INPUT #1:"FILE$,FILETYPE,SECTORS,LENGTH
```

There is some differences between TI and Myarc. TOTAL is 360 and 720 for Myarc when TI has 358 and 718. Myarc shows the length also for PROGRAM-files when TI shows 0 for these. Myarc has a new FILETYPE=6 for subdirectory and FILETYPE=7 for emulate.

A thing that was unknown to me is that files opened with OPEN and DISPLAY have a maximal length of 150 according to the manual, but can handle 156 when I test it. The same is true for the TI-card. You can also open a file with RELATIVE 400 and space for 400 records is reserved from the start (see XB manual p140). This will store all records close to each other on the disk which speeds up search of a record. The same thing works both with the Myarc-card and the TI-card. If you open the file a second time with RELATIVE 1000 then Myarc will reserve more space on the disk which the TI-card will not do.

HARD DISK

Up to three hard disks can be used. Each hard disk is connected with an individual address cable and a common data cable. You can use up to 134 Mbytes per hard disk. The best size is 20 Mbytes which is the usual size for most personal computers. The cost in Sweden is about SEK 2000 + VAT. The most common type is from Seagate:

- ST-225 20Mbytes 65ms 5.25inch
- ST-125 20Mbytes 35ms 3.5 inch

The hard disk must have a ST506/412 interface but RLL cannot be used. Many 32 Mbytes drives have RLL so avoid these. If you want a bigger drive then you must choose 40 Mbytes. You can get a removable 5.25 inch frame for a 3.5 inch drive.

The PE-box cannot power the hard disk so you must get another power supply (+5V and +12V). The critical voltage is 12 V from which a 5.25 inch needs about 2.5 A and a 3.5 inch needs 2.0 A.

Format of the hard disk takes 4 minutes including test for a 20 Mbytes ST-125 drive. After formatting I got Used 66 sectors Free 78654. With my earlier EPROM H6 I had 2 bad sectors (used 70 free 78650) and with reformat after a week I had no bad sectors (used 68 free 78652). I hope these 2 extra sectors (more than the manual) are no bug. New with EPROM H11 is that it reserves a number of sectors (default 2048) for file headers and directories which will speed up the search and loading in the same way as Mike Dodd's MCOPIE for floppy disks. The noise from the hard disk is much less with this new EPROM. The very fast format is done with test at the same time. I am somewhat suspicious about this but I have no bad sectors today so I cannot try it. If you have a hard drive with bad sectors then you can compare the number of bad sectors after format and after a special test program that takes 20 minutes. Myarc says that they use multiple sector I/O in the first case but not with the test routine. It is possible that there is some kind of track-reading in the first case which is not suitable for TEST. The test of the hard drive does a read and write test without destroying data so when you start it you may not break. A small bug in DM V format of hard drives forces you to have it loaded from DSK1 even when you have changed reload to DSK5.

Each DIR takes 4 sectors and files are typically one sector longer than on a floppy disk according to the catalog.

The hard disk has a root directory and subdirectories to any number of levels. The root and each subdirectory can have 127 files + 114 DIR. These new DIR can also have 127 files + 114 DIR and so on. This means that you can call files by WDS1.GAME.XB.PB.LANDER or WDS.NAME.GAME.XB.PB.LANDER.

The Myarc card also has 32 kbytes RAM (bankswitched). There is always space for 11 open files so CALL FILES decides only the number of files on the floppy disks. The remaining files i.e. usually 11-3=8 can be opened at the same time on the hard disk.

In Micropendium Mar/89 there is a program in assembler for parking of a hard disk. Parking means that you position the

read/write heads in a place where you have no data.

#### EMULATION OF DSK1, DSK AND DSK1-FILE

Some programs need the files to be on DSK1. You can create a subdirectory DSK1 so that the file can be loaded from hard disk even when it is called by DSK1.CHARA1. All other use of DSK1 is directed to the floppy disk. You can also use subdirectories below DSK1 without WDS1. I have used DSK1.FW.CFG which is good when the input only allow a small number of characters. If You use this DSK1-emulation then you should use the physical drive DSK1 as little as possible. All access to DSK1 goes first to the hard disk and then to the floppy drive. This can slow down some programs considerably which can be seen with Spellcheck or sorting with TI-BASE. Use your old 90 kbytes as DSK1 and use your bigger drives for DSK2-8. Usually DSK1 is only needed for copy protected disks like MG Explorer, MG Diskassembler, MG Diagnostics and Turbo-Pasc'99 (only from TI or Corcomp). All other programs can be placed in the DSK1-emulation (max 127 files, size not important) or if possible with another path to the hard disk. All file names in the DSK1-emulation cannot be reached on the floppy disk in drive 1.

Programs like Multiplan call files as DSK.TIMP.MPBASE. In this case you create a subdirectory DSK which directs the call to the hard disk. Under the DSK subdirectory you create a TIMP subdirectory where you put all the files for Multiplan.

There is a third emulation called File Emulation for DSK1 (CRU >1100 only) which is an exact sector for sector copy of a disk stored under one single file name. This works well with FORTH which accesses sectors directly without files. Several such emulations can be stored simultaneously on the hard disk but only one can be active at the same time. When it is active all calls will go to the hard disk including from a sector editor. Also ordinary disks can be stored in this emulation. The search goes first to this File Emulation and if the file is not there then the search goes to the DSK1 emulation. There will be no access to the physical DSK1. When this file emulation is active then drive 1 becomes DSK2 and drive 2 becomes DSK3.

#### PROBLEMS

The Myarc HFDC was delivered to me with EPROM H6 (+DM V 1.21) and later I sent it back to USA for repair and change to EPROM H11 with DM V 1.29. Myarc replaced a socket for one chip that prevented the clock from operating. I sent the card to USA as "SMALL PACKET" insured air mail. You should always investigate the terms for small packet because this is the cheapest way to send cards (Texaments and DIJIT use it but not Myarc).

If you don't use a hard disk then the first access to DSK1 will take 45 seconds before anything happens. With a connected hard disk this problem disappears but you should not buy the HFDC card without a hard disk.

In a letter to me from Myarc they say that some Fujitsu drives are marginal drives and may not be compatible with the Myarc HFDC especially those with stamped steel frames (zinc diecast is OK).

Back-up of hard disk only works to DSK1-3 and not to DSK5-8. CALL MDM only works on CRU >1100 or if you have the MDM5-file in the DSK1-emulation on the hard disk. You must always load MDM5 from DSK1 the first time and then change in SETUP of RELOAD of DM V to your disk number like DSK5 or a path on the hard disk like WDS1.MYARC. It is a good idea always to have several disks ready with different paths so you can get the disk manager if something goes wrong with the DSK1-emulation. MDM5 is sensitive to the load path and I have experienced two problems but the usual load with Editor/Assembler or XB DSK1.LOAD is OK:

- Directory-Utility-Complete-Catalog can crash the screen because it never waits for input prompt (XB-FW-MDM5 or GK-FW-MDM5).

- When DM V is completely loaded then the screen is locked and no key can be used (TW-UTILITY-MDM5).

You cannot set the clock from DM V start menu but if you set it from Basic then it can be used to mark files and directories.

Myarc writes SD-sectors to the disk with deleted data marks F8 instead of FB for a TI-controller. ID/DATA SEPARATORS will be 00.

Another problem comes when you copy disks. When the Myarc writes a sector to disk it does not do a read of the same sector for checking. The problem is the same with both DM 1000 and DM V when the Myarc HFDC is used. It is thus very important to verify the disk when you format it. DM V always verifies but DM 1000 has the option not to do it. A TI-controller always does a READ after each WRITE of a sector. I find this much more secure. Myarc confirms this in a letter to me and says that MS-DOS works in the same way without a READ after WRITE. Can someone who knows IBM PC confirm this.

After long tests with DM V then I have decided not to use Myarc HFDC for DS/SD 180 kbytes. I have tested it with four different drives TEAC, Fujitsu(2) and Mitsubishi with the same bad result. The comprehensive test takes 10 minutes per loop and I run up to 10 loops which takes more than two hours. With single density (SD) the computer will always (several on each drive) lock-up after 1-5 loops. With DS/DD 360 kbytes I have run 10 loops (twice) on all drives without any problems (total 80 loops). DS/QD 720 kbytes also works perfect. I am not sure if the fault is in Myarc or in the disk drives. Is Myarc too fast or the drives too slow or will 50 Hz mains slow down the TI-99/4A (CALL SOUND and interrupt clock is 20 % too slow).

DS/QD 720 kbytes floppy drives show different numbers of sectors for a file with CALL DIR and DM V but I don't think it is any problem. If you save a very short text from TI-Writer to a QD-disk it will have an extra sector (apart from the problem above) compared to a Save File to a SD- or DD-disk. When this bigger file is copied to SD or DD then the file is still too big but I don't think it is a real problem. I will investigate this

more in the future.

I have seen reports about heat problems with other Myarc cards. Myarc has a sealed card with no cooling of the voltage regulators. One Geneve user in Sweden had a real problem so he has decided to move the card far away from the warm AC/DC-converter (don't use slot 1), remove the card sealing and change the AC-setting to 240 V instead of 220 V. I have also seen concern from Australia about the Myarc 512 kbytes RAM disk and a possible need for an extra heatsink. The mains voltage in Europe will be 230 V according to a new standard before the end of 1995. Sweden must increase from 220 to 230 V and England must decrease from 240 to 230 V.

#### FUTURE EXPANSION

Myarc has prepared the card for tape streamer and 1.44 Mbyte floppy drives. Software for these is not delivered with the card.

A tape streamer is an easy way to back-up a hard disk. The price is about SEK 3200 + VAT in Sweden so you may instead want to buy a second hard disk. DM V has routines for back-up to floppy disks but you need a lot of them for a full hard disk. Each file has a back-up flag so you need only to save changed files to the floppies.

A DS/HD 3.5 inch drive can store 1.44 Mbytes and has 80 tracks/side and 36 sectors/track. HD stands for High Density. These drives cost 20 % more than 720 kbytes 3.5 inch and the floppy disks cost more than double. Today there is no economical reason to buy 1.44 Mbytes. The disks will store max 508 files if you use the root and three subdirectories.

#### REFERENCES

##### Micropendium:

Mar 88: Myarc ships HFDC  
Mar 88: Power supply for hard drive  
Apr 88: Organizing your hard disk  
Sep 88: Myarc HFDC review  
Sep 88: Tips for new hard disk users  
Oct 88: Hard disk backups and downloads  
Dec 88: Using HFDC emulate files  
Mar 89: Parking your hard drive  
Aug 89: Why reformat a hard disk?  
Oct 89: Selecting a hard disk drive  
Dec 89: Access time of hard disks

# MYARC HFDC UPDATE

by Jan Alexandersson, PROGRAMBITEN, Sweden

Here comes some amendments to my previous article about the Myarc HFDC.

You cannot use HFDC for floppy disks with a Myarc Geneve!! Geneve can only use it for hard disks. A TI-99/4A can use HFDC for both floppy disks and hard disks.

Newer versions of DM V cannot use 16 sectors/track for 320 and 640 kbytes. I can now use my HFDC for 90, 180, 360 and 720 kbytes disks which is OK.

File copy for DM2, DM1000 and DMV will take 45, 40 and 58 sectors per pass. Disk copy (not used in DM2) for DM1000 and DMV will take 104 and 57 sectors per pass.

You must create a subdirectory TIMP for Multiplan under the subdirectory DSK. You put all the files for Multiplan in this subdirectory WDS1.DSK.TIMP.

With an active File Emulation the search for files goes first to the File Emulation and then to the DSK1 Emulation.

The mains voltage in Europe will be 230 V according to a new standard before the end of 1995. Sweden must increase from 220 to 230 V and England must decrease from 240 to 230 V.

From Bertil Stenfeldt, Gothenburg: If You have an active Horizon P-GRAM Card then You cannot load DM V for the Myarc HFDC Card. Does someone know any solution to this? You shall always set the clock with Myarc HFDC before You save any files. This will ensure that the BACKUP will work OK.

MYARC DM V 1.30 (recieved from Germany)

MDM5-130 (for Myarc HFDC)

FILE=14 FREE=94 USED=266

filename	sect	type	length
LOAD	2	PROGRAM	67
MDM	7	DIS/FIX	80
MDM306	33	PROGRAM	8192
MDM307	33	PROGRAM	8192
MDM308	25	PROGRAM	5904
MDM309	25	PROGRAM	5982
MDM5	10	PROGRAM	2304
MDMCB30	26	PROGRAM	6282
MDMCR30	20	PROGRAM	4820
MDMDB30	26	PROGRAM	6180
MDMDR30	19	PROGRAM	4450
MDMFV30	15	PROGRAM	3566
MDMV	10	PROGRAM	2304
MDMXB	13	DIS/FIX	80

# MYARC HFDC PROBLEMS

(Written for the Swedish user group PROGRAMBITEN 90-4)

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I have discovered several severe problems with Myarc HFDC hard disk controller with EPROM H11 and DM V 1.30. All problems concern the floppy disks. The hard disk works fine and I haven't find any problem with it.

## SINGLE DENSITY 180 KBYTES

In my previous article I have described the physical read and write problem with single density. You can also test this with Disk Utilities Compare Disk if you have two identical copies of a full DS/SD disk. Almost every time will some of the sectors be marked as different. Each time it will be different sectors marked as not equal. I haven't seen any such problem with double and quad density.

This is a hardware problem so I am very interested in hearing from other users. Have you seen the same problem? To make a complete test you must do this compare 10 times and change the two disks with the two drives. There is a possibility that I have an individual fault in my card. I also cannot set the clock from the disk manager but it is OK from Basic CALL DT or OPEN #1:"TIME".

## DOUBLE DENSITY 360 KBYTES

I have discovered that double density (and also single density) will mix up fragmented files so two different files get one common sector. You can see the problem by the use of TI-Writer Load File and Save File or BASIC OLD and SAVE in this way:

1. Save the file ADAM with 7 sectors
2. Save the file BERTIL with 5 sectors
3. Save the file ADAM with 8 sectors
4. Save the file CESAR with 8 sectors
5. Save the file ADAM with 10 sectors

It doesn't matter if you use DIS/VAR 80-files for TI-Writer or PROGRAM-files for Basic. The disaster can be seen with Hard Master which shows the sectors hexadecimal:

Diskname=360K	Free=588	Used=18			
Filename	Size	Typ	Len	FdrNo	Clusters
ADAM	A	D/V	80	2	22-27 2C-2D 34-34
BERTIL	5	D/V	80	3	28-2B
CESAR	8	D/V	80	4	2D-33

Sector >2D is used by two different files ADAM and BERTIL. This means that the last saved file ADAM is correct but the previous CESAR has one sector changed and thus destroyed.

You can also test your disks with DM1000. Make the catalog and mark all files for copy. You can see to the wright how many sectors that shall be copied. This shall be 2 sectors less than the total number of used sectors shown at the top. If you get a higher value this means that you have corrupted files on the disk. The higher the value the higher is the number of corrupted files.

If you repeat this test with Ottawa DM 1000 3.5 or Myarc DM V 1.30, then all will work perfect. My understanding is that these disk managers use sector read/write (subprogram >10) and TI-Writer and Basic use file read/write (subprogram >14 and >15). Also the new Funnelweb 4.30 Disk Review 80 uses file read/write which means that it will have problem because of the fault in Myarc EPROM H11.

#### QUAD DENSITY 720 KBYTES

Also quad density has a small problem because all free sectors will not be released in sector 0. If we repeat the test with the files ADAM, BERTIL and CESAR with quad density and TI-Writer, BASIC or FW 4.30 DR80 then you will have the following:

Diskname=QD	Free=591	Used=5AF				
Filename	Size	Typ	Len	FdrNo	Clusters	
ADAM	B	D/V	80	2	22-27 2C-2D 36-37	
BERTIL	5	D/V	80	4	28-2B	
CESAR	9	D/V	80	6	2E-35	

The same test with Myarc DM V 1.30 gives this:

Diskname=QD	Free=591	Used=5AF				
Filename	Size	Typ	Len	FdrNo	Clusters	
ADAM	A	D/V	80	2	22-27 2C-2D 36-36	
BERTIL	5	D/V	80	4	28-2B	
CESAR	8	D/V	80	6	2E-34	

Hard Master will show the total number of used sectors wrong for quad density disks. The first table shows that the files always will get an even number of sectors because one allocation unit is two sectors for QD-disks. The second table shows that the files only get the number sectors that is needed. This mean that there are sectors which are occupied according to sector 0 but not used according to the file header. These sectors will not be released if you use DELETE "DSK..." from Basic. DELETE from Basic of all files on the lower disk will get an empty disk with Used=4 and

Free=2876. If you use DM V 1.30 on the same disk you get the result after delete of all files Used=2 and Free=2878.

Catalog of the first TIWR-copied QD-disk shows this (decimal):

	FWEB ED80	CALL DIR	FWEB DR80	MYARC DM V
ADAM	11	12	12	12
BERTIL	5	6	6	6
CESAR	9	10	10	10
Used	30	30	30	30

Catalog of the second DM V-copied QD-disk shows this (decimal):

	FWEB ED80	CALL DIR	FWEB DR80	MYARC DM V
ADAM	10	11	12	12
BERTIL	5	6	6	6
CESAR	8	9	10	10
Used	30	30	30	30

#### HARD DISK

I haven't seen any problem with a 20 Mbytes hard disk. If you repeat the same copy test to the hard disk, then the result can be seen with Hard Master:

```
TEST      DIR  364
Filename Sze Typ Len FdrNo Clusters
-----
ADAM      B D/V  80   368 7954-7959
          795E-795F
          7968-7969
BERTIL    6 D/V  80   36A 795A-795D
CESAR     9 D/V  80   36C 7960-7967
```

I get the same result regardless of how I copy (TIWR, BASIC or DM V). Catalog with CALL DIR or DM V will show this:

```
ADAM      11 sectors
BERTIL    6 sectors
CESAR     9 sectors
```

#### SECTOR ZERO WITH MYARC

I recently received a FORTH disk with DS/DD which I couldn't read with my Myarc HFDC. All screens (including screen 0) had normal FORTH-screens so the disk had no disk header on sector 0 and 1. I could only read track 0 with 18 sectors which contains sector >00 - >11. All other sectors were unaccessable in FORTH or with a sector editor.

The solution to this was to copy sector 0 from a normal DS/DD

disk. Before that I copied the previous sector 0 to another disk with a sector editor. I could read all sectors on the disk after this little change.

In fact there are only three important bytes on sector 0:

- byte >A and >B max number of sectors
- byte >C sectors per track

It is enough if >A - >B has a greater value than the sector you want to read. If >C is put wrong you will read the wrong sectors. These three bytes shall have the following values:

	A	B	C
SS/SD 90 kbytes	>016809		
DS/SD 180 kbytes	>02D009		
DS/DD 360 kbytes	>05A012		
DS/QD 720 kbytes	>0B4012		

The conclusion is that all FORTH-users should use a normal disk header on sector 0-1 and mark all sectors as used by creating a file SCREENS which occupies all sectors so that you cannot by mistake store any more files on the disk. Such a FORTH disk should always be copied with a true sector copier as DM 1000. Don't use file copy because there is an important difference between TI DM 2 and DM 1000. DM 2 will copy file header before data sectors but DM 1000 will place the file header after the data sectors. This means that the file header may be found on different sectors dependent on the copy program. The FORTH screens with low number will then be wrong.

There are several ways to create a wrong sector 0 byte >C:

- Initialize a disk with DM 1000 and a TI controller with double density without verify of the result.
- Use FORTH screens also on sector 0.
- Format with FW 4.30 DR80 which in it's earlier versions will write the value >12 to byte >C regardless of format. I hope this will be corrected in later versions.

If a normal disk with many files get sector 0 destroyed, then you think that the whole disk is destroyed because you cannot read most of the sectors. The solution could be to copy sector 0 from an empty disk and then use Recover File in DM 1000.