

Information.
Release 13.06.1998

This is a first draft release of the BBC Disc Drive documentation.

The document as it exists at the moment is in a very early stage and there is still a fair amount of information and diagrams to be added.

I have decided to release it at this early stage due to a couple of reasons.

1. Many people have been asking me for the results of a survey regarding disc drives that I did.
2. It will help people sort out any problems they may be having connecting up drives.
3. Others may have information that is missing in this document and therefore be able to notify me of gaps and help me fill them in.

The current version of this document will always be available from the BBC Documentation Project site <http://members.magnet.at/marku/bbc.htm> .

If you do have anything to add then please let me know.

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1. Basic Computer Hardware

If you want to fit a disc drive to your BBC then the BBC must be fitted with a DFS (Disc Filing System). This basically consists of a floppy disc controller chip, some logic chips and a DFS ROM containing the software. These were supplied as kits for the BBC micro in two sorts, one based on the 8271 floppy disc controller (FDC) and the other was based on the 1770 (or sometimes even the 1772) chip. There were also available some kits that combined both of these controllers on one board for compatibility with protected software, even though the 1770 has an 8271 emulation.

You can check if your BBC has a DFS fitted or not by simply removing the cover and checking IC78 which is above and to the left of the keyboard connector. If it has a chip fitted then your BBC has an 8271 upgrade fitted, if there is a carrier board in this slot then you have a 1770 DFS upgrade fitted, and if it is empty then you will have to fit a DFS upgrade yourself.

The BBC B+ and Master series computers were fitted with a 1770 controller as standard (later models were fitted with the 1772), so you will not need to obtain anything for these computers.

Electron owners will need an extra interface that plugs onto the computer externally. The Acorn manufactured interface is called a Plus 3 and includes a built in 3.5" drive. There were also interfaces produced by other companies, some included drives and others you had to buy a drive separately and attach it to the interface yourself.

1.1. The 8271 DFS upgrade

The 8271 was the first upgrade to be introduced for the BBC. This is based on Intel's 8271 single density floppy disc controller which became rarer and rarer as the 80's progressed due to it being no longer manufactured. The 8271 chip is now very hard to find and, when it can be found is often sold at quite extortionate prices. The upgrade kit consisted of:

1 x 8271 Floppy Disc Controller for IC78
1 x 74LS123 for IC87 (Not required if Econet is already fitted).
1 x 74LS10 for IC82
1 x 74LS00 for IC77 (For a Model A without an analogue upgrade fitted).
2 x 7438 for IC's 79 & 80
2 x 74LS393 for ICs 81 & 86
2 x CD4013B for ICs 83 & 84
1 x CD4020B for IC85
1 x 8 way Dual In-Line (DIL) switch (optional – soldering necessary)
1 x Disc Filing System ROM (Acorn or otherwise) for IC88

Fitting.

1. Insert all the IC's into the sockets provided on the main PCB.
2. On issue 1 or 2 circuit boards only, connect the two pads of link position S8 with a wire link.
3. On issue 1, 2 or 3 circuit boards only, cut the leg of IC27 pin 9 as close to the PCB as possible and the track connected to it on the component side of the circuit board between IC27 and IC89, then reconnect the cut IC leg to the East pad of link S9 with a short length of insulated wire.
4. On issue 4 boards onwards, cut the TCW link at position S9.
5. Set the following links using MOLEX jumpers:-

S18 – North
S19 – East
S20 – North
S21 – 2 x East/West
S22 – North
S32 – West
S33 – West

1. Insert the 8 way DIL switch into the holes on the bottom right hand side of the keyboard and solder into place. Leave all the switches in the off position.

Technical description of the 8271 Disc Interface

IC78 is a floppy disc controller circuit which is used to interface to one or two, single or double sided 5 ¼ inch floppy disc drives. Logic signals from the controller to the disc drive are buffered by two open collector driver packages IC79 and 80. The incoming signal from the disc drive is first conditioned by monostable IC87 producing a pulse train with each pulse of fixed width. These pulses are then fed to the data separation circuits ICs 81 and 82. These form a digital monostable. IC86 divides the 8MHz clock signal down to 31.25kHz. ICs 83, 84 and 85 are then used to detect index pulses coming in from the drive which show that the drive is ready for a read or write operation.

1.2. The 1770 DFS upgrade

The 1770/1772 was manufactured by Western Digital and is a more modern double density controller, allowing an extra 80% storage capacity on a floppy disc. It is though a different physical size to the 8271 controller and consequently it has to be mounted on a small carrier board before it

can be fitted into the IC78 slot on the BBC. This means that unless you have an original upgrade kit or a circuit design for a carrier board, that it would not be possible to fit this upgrade. I would like to publish a carrier board design, but at the moment I do not have one.

Before Acorn released their 1770 Upgrade kit, there were many others on the market, most notably from Solidisk and Watford Electronics. The 1770 upgrade also enables the BBC to use Acorn's ADFS – Advanced Disc Filing System with floppies which isn't possible with the 8271, although caution must be used here as the ADFS was released after many of these upgrade boards became available. Hence, with some 1770 upgrades there is an incompatibility with Acorn's ADFS, most notably the Solidisk board. Most of the incompatible boards did have a revision released after the issue of ADFS to overcome this problem. e.g. Solidisk Issue II is compatible with Acorn's ADFS.

Fitting instructions for Acorn's 1770 DFS Upgrade are available in a separate document at <http://www.nvg.unit.no/bbc/doc/1770FittingInstructions.zip>

Another point is Acorn's upgrade did not make use of the double density feature available with the 1770 FDC, whereas most of the other upgrades did.

1.3. Other upgrades

There were numerous other upgrades available.

Solidisk released the DFDC (Dual Floppy Disc Controllers) interface board. This was basically a carrier board with both 1770 and 8271 FDC's thus giving full compatibility. You changed between the two by the use of a small switch.

OPUS released their DDOS system which is again on a carrier board. I know little about this upgrade though. They also had some combined RAM disc and floppy drive systems that plugged directly into the 1MHz bus connector.

Matt Callow [callow@gfms.bt.co.uk] mentioned that he has a 1797 floppy controller mounted on a separate board (made by Computer Village Ltd.). At boot up the BBC reports 'LVL Dos'. I have no other information about this upgrade.

Kenda DMFS.

No information. Was this a 1771 based DFS ?

2. The DFS's

2.1. Acorn

DFS-0.9	8271 BBC B	
DFS-0.98	8271 BBC B	
DNFS 1.2	8271 BBC B	
DFS 2.0j	1770 BBC B/B+	This was the first release of the 1770 DFS and was in EPROM.
DFS 2.10	1770 BBC B/B+	The same as v2.0j but in ROM.
DFS 2.20	1770 BBC B/B+	The release of the BBC B+ 128 saw version 2.2 DFS released. This was also used in the Master 128. Shift-Z Break function included to emulate the 8271.

		Extra commands necessary to deal with the 64K of paged RAM in the B+.
DFS 2.21	No record of it's release or existence.	
DFS 2.22	1770 BBC B/B+	Developed to fix an esoteric OSFILE bug. Also the 128k associated SRAM utilities have been tidied up to make them more user friendly. This version will not work in all BBC Model B's fitted with a 1770 upgrade board.
DFS 2.23	1770 BBC B/B+	Cures the problem of v2.22 not working in all BBC's.
DFS 2.24	Master MOS 3.20	Loading with OSFILE &FF returns A=1. File saves>64K work
DFS 2.25	1770 BBC B/B+	CLOSE#0 and *CLOSE and *SHUT leaves files with correct length. Writing to extent works correctly. Unknown command as LIBFS works correctly
DFS 2.26	1770 BBC B/B+	Last for the B/B+ OSGBP PB speeded-up. All four head step rates implemented i.e. *CONFIGURE FDRIVE 0 1 2 3 for 1770 6 12 20 30 mS for 1772 6 12 2 3 mS
DFS 2.27/8	Master	Software patch for spurious Motor-on after 1770 reset. Following fixed: If a) A file was open b) the disk had been changed c) BREAK was pressed then the old disk catalogue would be written to the new disk.
DFS 2.29		OSGBP PB tube problem introduced at 2.26 fixed. *CONFIGURE FDRIVE 2 has software delay added to hardware delay. This allows for support of slow step rate drives with 1772 fitted, i.e. *CONFIGURE FDRIVE 0 1 2 3 for 1770 6 12 50 30 mS for 1772 6 12 32 3 mS
DFS 2.45	Master MOS 3.50	You can now save files longer than 64k bytes. All four step rates are now used. OSGBP PB now executes more quickly. CLOSE#0 leaves files with the correct length.

2.2. Amcom DFS

When running an AMCOM DFS from sideways RAM you must write protect the sideways RAM bank as the DFS has a copy protection. The major incompatibility with this DFS is that you can't use coloured titles on a disc as the DFS uses an upper bit in the title string to signify extended mode so anything out of the ordinary in a disc title will confuse it.

2.3. HDFS

Angus Duggans DFS. For a full description of this DFS see <http://www.nvg.unit.no/bbc/doc/HDFS.ps> This is in PostScript format.

2.4. MRM E00 DFS.

This was a basic 8271 upgrade except that the DFS ROM was on a carrier board with it's own RAM chips. The RAM supplied on board serves as a dedicated disc workspace freeing existing RAM from &E00 to &1900. This will also run from sideways RAM as long as the sideways RAM bank is not write protected. There are some limitations to this DFS though. First, command lines in BUILD files should be less than 100 characters in length. Second, the maximum number of files which you may access at any one time is four (the standard allows five).

2.5. Watford

2.6. Solidisk

2.7. UDM United Disk Memories

3. The Drives

3.1. Drives in general

The BBC had many assorted drives attached to it, ranging from 8", 5¼", 3½" and 3" drives. The most widely used was the 5¼" drive and later with the Electron Plus 3 and the Master series the 3½ drive became the standard used.

Disk drives were sold by many different companies for the BBC, including Watford, Viglin and Cumana amongst others. Most of these drives though were badged drives from Japanese manufacturers, the most common being Epson, Mitsubishi and TEAC. There were two normal standards for the 5¼" disk drive, 40 and 80 track. The 40 track drive lays down it's magnetic tracks at a pitch of 48 tracks per inch (48 TPI) whilst the 80 track drives operate at 96 TPI, i.e. exactly half the track width of the 40 track drive. Both 40 and 80 track drives were available with a single head (which records on one side of the disk only) or with a double head enabling recording on both sides. A double headed drive has therefore twice the storage capacity of a single headed drive.

Using 8271 based DFS (FM encoding) disk capacities are:

	BBC Formatted Unformatted	
40 Track Single Sided	100KB	250KB
40 Track Double Sided	200KB	500KB
80 Track Single Sided	200KB	500KB
80 Track Double Sided	400KB	1MB

Using 1770 based DFS (MFM encoding) disk capacities are:

	BBC Formatted Unformatted	
40 Track Single Sided	180KB	250KB
40 Track Double Sided	360KB	500KB
80 Track Single Sided	360KB	500KB
80 Track Double Sided	720KB	1MB

3.2. Finding a suitable drive

Obviously the best drive for the BBC is an 80 Track double sided drive as this would give us the full 400K. Unfortunately these drives are not so common as 5¼" 720K drives were never used in PC's. Also 80 track single sided drives are quite uncommon, again for the same reasons. A 40 track double sided drive should be quite easy to find as they were used extensively in older PC's, but then we only have half the storage capacity that is possible. There were on the other hand many 720KB 3.5" disc drives made, as these were used by various computer manufacturers, so if you want to use 3.5" discs then these should be a lot easier to find. An added advantage is also that 3.5" double density discs are also easier to find than 5¼" double density discs, but for how long is another question entirely.

Many high density PC floppy drives i.e. 3.5" 1.44MB drives and 5¼" 1.2MB drives can also run in low density modes. Most of the 3.5" drives will switch between the two formats automatically, whereas the 5¼" drives are normally set as 1.2MB drives at the factory and need some jumpers changing before they will operate in a dual mode. The jumpers that need setting are labelled differently on different models, but you should look for High/Low density, and the rotation speed jumper. This is set to 360 RPM for high density operation, and so must be changed to dual 300/360 RPM mode so that low density can also be used.

As far as my test show, these drives will work with a 1770/1772 FDC but cause problems with the 8271 FDC. The reason seems to lie with the 8271 DFS and the timings contained within the DFS code. Jonathan Harston has written a program that will patch an Acorn DNFS 1.20 ROM image to change the DFS timings, and my tests show that this does indeed solve the problems. You must also remember to set the timings on the BBC keyboard links. The program has been included in the archive that contains this document. Just transfer the program to a disc that also contains an image of the Acorn DNFS 1.20 ROM. Run the program, you will be asked a few questions to which you answer yes or no, and then you will be the program will print the *SAVE command that you must use to save the new image. The program does not save the new image automatically.

3.3. Attaching Drives

First you will need a power supply. You can use the power supply from the underside of the BBC with a suitable lead. If you don't have a lead then this can be a problem as it is very hard to find the connector. The exact details are:

PSU socket: AMP 1-350241
PSU female pins: AMP 360666-1
cable connector: AMP 1-250234
male pins: AMP 350664-1

Alternatively you can use a power supply from a PC.

Besides a power supply you will also need a data transfer cable. This is a simple 34way ribbon cable, with an edge connector for the drive and another connector for the underside of the BBC. Be careful if you are using a PC floppy drive cable as this contains a twist in the cable. This is because all PC floppy drives are set as drive 1, and the twist reverses this for the first drive, effectively making it drive 0. The BBC doesn't operate like this. So if you are wanting to connect two drives you will have to "remove" the twist, or in a single drive system, just use the connector before the twist.

Once you have your BBC, DFS, drive and cables, you must configure the drive before connecting it up. If it is an old PC drive then it will be jumpered as DS1 (Drive 1) by default. If it is to be Drive 0 on your BBC, you must change the jumper to DS0, and in a dual drive system you would change the jumper on only one of the drives, so one is DS0 and the second is DS1.

Also the last drive on the cable, i.e. the one furthest away from the BBC must be terminated. Drives are also terminated by default. This is fine if you have a single drive system, but in a dual drive system the terminator must be removed on the drive nearest the BBC on the cable.

Terminators vary between drives. Some look like an IC and are usually in a DIL socket, or sometimes they are a thin row that is attached to the drives circuit board. Another possibility is that the terminator can be turned on or off by use of a DIL switch or jumper on the drives circuit board e.g. some Mitsubishi drives.

Once you have set all of this, you can then attach your drive and BBC together and start trying to format some disks.

3.4. Other drive jumpers

Head Loading

Some drives use a head load solenoid. This means that it requires either a Motor On or a valid Drive select signal before the head can be loaded against the media for communication with the disk. This is the purpose of the two, switch or link options found on many drives, HM or HS. These stand for Head to Motor and Head to Drive Select respectively. This means with the HM link set, the head of the disk drive will be loaded against the disk any time the motor is started up. It may well be that the computer wishes to access another drive, but as all the Motor On lines are usually connected together the motors of all the drives will be activated. Thus, any drive that has the HM option set will load the head of the drive against the media. When the computer comes to use that drive, then the drive will already be in a condition to pass information to and from the disk.

Head to Select

With the switch or link set in the HS position then the loading of the head against the media will only take place when that particular drive is actually selected for communication between its disk media and the computer. That is to say that with the HS option selected and a drive set to be drive one or DS1 of the system, then only when drive one is selected will the head of the drive actually be loaded ready for use.

For and against

There are arguments for and against both methods of head selection. With the HM option there is more wear on the disk due to the head always being loaded when any drive is selected or used. Any drive access however small will result in all the heads of all the drives being loaded against the media. If you have the HM option selected you will not require a Head Settling time before the drive is Ready For Use. It speeds up drive to drive access time and is a lot quieter if a lot of drive to drive transfers are taking place.

In the case of the HS option then disk wear is reduced to a minimum as the head is only in contact with the media when an access is required to that particular drive. This results in a lot of clicking taking place during drive to drive transfers. It also means that when the drive is selected then a small amount of time must be allowed for the head to settle against the disk before access is attempted. This is known as Head Settling time and can be as much as 50 m/s in older drives.

Self Loading

It may be that you have a drive that contains neither the HS or HM link options. If this is the case the drive is most likely to be the type whereby the head is loaded against the disk every time the

drive door is closed. This means that the head of the drive is in contact with the disk at all times. This results in an even higher degree of disk wear than a drive with the HM option set.

Multiplexing

Another connection that can be found on floppy drives is the MX link. This is one that often causes trouble and confusion. Its purpose is to allow two or more drives to be connected together on the same cable. Incorrect setting of this can cause surprising results, even causing you to think there is a fault with another drive on the system.

The MX link should not be set in most drives, however in some of the early TEAC drives the opposite is true. It is also quite normal for the MX link not to be made in single drive systems.

3.5 BBC keyboard link configurations

Here are tables detailing the various link settings on the lower right hand side of the keyboard.

First all the settings:

BIT	Switch	Setting	Description
0	8		Start up Mode
1	7		
2	6		
3	5	0	!BOOT on Shift Break
		1	!BOOT on Break
4	4		Disk Stepping times
5	3		
6	2	0	HADFS Floppy driver
		1	external driver
7	1	0	DNFS. Starts in DFS
		1	DNFS. Starts in NFS

Here are the settings for the 8271 controller.

SW3	SW4	Step rate	Settle time	Head load
1	1	4ms	16ms	0ms
1	0	6ms	16ms	0ms
0	1	6ms	50ms	8ms
0	0	20ms	20ms	16ms

NB: Some documents state the last two times for head load are 32 and 64, not 8 and 16.

Here are the settings for the 1770 controller (up to DFS v2.29)

SW3	SW4	Step rate	Settle time	Head load
1	1	6ms		
1	0	12ms		
0	1	20ms		
0	0	30ms		

Here are the settings for the 1772 controller (up to DFS v2.29)

SW3	SW4	Step rate	Settle time	Head load
1	1	6ms		
1	0	12ms		
0	1	2ms		
0	0	3ms		

Setting link 3 and not link 4 will give you the slowest step time possible with the 1772. You should avoid setting the step time of a standard 5.25 inch disc drive to 2 or 3ms with the 1772 chip, as most drives will not work at these speeds.

4. Appendix 1

Disc Drive Chart

This chart should help you find a drive to use with the BBC. 1.2MB and 1.44MB models have not been included. The In use column signifies if a particular drive is known to be used with a BBC

Size	Unformatted capacity	Formatted capacity	Density	Manufacturer	Model	Height	In use
5¼"	250KB	180KB	SSDD	BASF	6106	Full	No
5¼"	250KB	180KB	SSDD	CDC	9408	Full	No
5¼"	250KB	180KB	SSDD	CDC	9428-1	Half	No
5¼"	250KB	180KB	SSDD	Hi-Tech	548-25	Half	No
5¼"	250KB	180KB	SSDD	M.P.I.	501	Half	No
5¼"	250KB	180KB	SSDD	M.P.I.	51M	Full	No
5¼"	250KB	180KB	SSDD	M.P.I.	B51S	Full	No
5¼"	250KB	180KB	SSDD	Pertec	FD200	Full	No
5¼"	250KB	180KB	SSDD	Shugart	SA200	Half	No
5¼"	250KB	180KB	SSDD	Shugart	SA215	Half	No
5¼"	250KB	180KB	SSDD	Shugart	SA390	Full	No
5¼"	250KB	180KB	SSDD	Shugart	SA400	Full	No
5¼"	250KB	180KB	SSDD	Tandon	TM100-1A	Full	No
5¼"	250KB	180KB	SSDD	Tandon	TM50-1	Half	No
5¼"	250KB	180KB	SSDD	Tandon	TM55-1	Half	No
5¼"	250KB	180KB	SSDD	Tandon	TM65-1L	Half	No
5¼"	250KB	180KB	SSDD	Teac	50A	Full	No
5¼"	250KB	180KB	SSDD	Teac	55A	Half	Yes
5¼"	250KB	180KB	SSDD	Tec	FB501	Half	Yes
5¼"	250KB	180KB	SSDD	Texas Peripherals	10-5355-001	Full	No
5¼"	250KB	180KB	SSDD	World Storage	FD100-5	Full	No
5¼"	250KB	180KB	SSSD	Alps	FDD 2124	Half	No
5¼"	250KB	180KB	SSSD	Shugart	SA400L	Full	No
5¼"	250KB	180KB	SSSD	Siemens	FDD100-5	Full	No
5¼"	250KB	180KB		MPI	51-S	Full	No
5¼"	500KB	360KB		Teac	55E	Half	No
5¼"	500KB	360KB	DSQD	Weltec	M48D-1	Half	No

5¼"	500KB	360KB	DSDD	Alps	2624-BKI	Half	No
5¼"	500KB	360KB	DSDD	Alps	DFC 222 AO5A	Half	No
5¼"	500KB	360KB	DSDD	Alps	DFC 222 BO2A	Half	No
5¼"	500KB	360KB	DSDD	Alps	FDD 2124A	Full	No
5¼"	500KB	360KB	DSDD	Bachelor	FD-104	Half	No
5¼"	500KB	360KB	DSDD	BASF	6128	Half	No
5¼"	500KB	360KB	DSDD	Canon	5201	Half	No
5¼"	500KB	360KB	DSDD	Canon	531	Half	No
5¼"	500KB	360KB	DSDD	CDC	9409	Full	No
5¼"	500KB	360KB	DSDD	CDC	9428	Half	No
5¼"	500KB	360KB	DSDD	CDC	9428-2	Half	No
5¼"	500KB	360KB	DSDD	Chinon	502	Half	Yes
5¼"	500KB	360KB	DSDD	Epson	500	Half	No
5¼"	500KB	360KB	DSDD	Epson	521L	Half	No
5¼"	500KB	360KB	DSDD	Epson	SD-521	Half	No
5¼"	500KB	360KB	DSDD	Epson	SD-621L-xxx	Half	No
5¼"	500KB	360KB	DSDD	Epson	SD321	1/3	No
5¼"	500KB	360KB	DSDD	Fujitsu	2551K	Half	No
5¼"	500KB	360KB	DSDD	Hewlett Packard	J455-3	Half	No
5¼"	500KB	360KB	DSDD	Hi-Tech	548-50	Half	No
5¼"	500KB	360KB	DSDD	Hi-Tech	548-A	Half	No
5¼"	500KB	360KB	DSDD	I.B.M.	0384-002	Full	No
5¼"	500KB	360KB	DSDD	M.P.I.	502B	Half	No
5¼"	500KB	360KB	DSDD	M.P.I.	52M	Full	No
5¼"	500KB	360KB	DSDD	M.P.I.	52S	Full	No
5¼"	500KB	360KB	DSDD	M.P.I.	B52S	Full	No
5¼"	500KB	360KB	DSDD	Maple Tech	MT-502	Half	No
5¼"	500KB	360KB	DSDD	Micropolis	1016-2	Full	No
5¼"	500KB	360KB	DSDD	Mitac	MC-490	Half	No
5¼"	500KB	360KB	DSDD	Mitsubishi	4851	Half	Yes
5¼"	500KB	360KB	DSDD	Mitsubishi	501A	Half	No
5¼"	500KB	360KB	DSDD	Mitsubishi	501B	Half	No
5¼"	500KB	360KB	DSDD	Mitsubishi	501C	Half	No
5¼"	500KB	360KB	DSDD	Mitsumi	D503	Half	No
5¼"	500KB	360KB	DSDD	N.E.C	1053	Half	No
5¼"	500KB	360KB	DSDD	Okidata	3305	Half	No
5¼"	500KB	360KB	DSDD	Okidata	3305BU	1/3	No
5¼"	500KB	360KB	DSDD	Okidata	3305U	Half	No
5¼"	500KB	360KB	DSDD	Okidata	3315B	Half	No
5¼"	500KB	360KB	DSDD	Olivetti	4311-3	Half	No
5¼"	500KB	360KB	DSDD	Olivetti	XM4311	Half	No
5¼"	500KB	360KB	DSDD	Panasonic	455	Half	No
5¼"	500KB	360KB	DSDD	Panasonic	551	Half	No
5¼"	500KB	360KB	DSDD	Pertec	FD250	Full	No
5¼"	500KB	360KB	DSDD	Phillips	3132	Half	No
5¼"	500KB	360KB	DSDD	Qume	142	Half	No
5¼"	500KB	360KB	DSDD	Qume	542	Full	No
5¼"	500KB	360KB	DSDD	Qume	DT/5	Full	No
5¼"	500KB	360KB	DSDD	Remex	RFD 480	Half	No

5¼"	500KB	360KB	DSDD	Samsung	SFD500K	Half	No
5¼"	500KB	360KB	DSDD	Sanyo	500C	Half	No
5¼"	500KB	360KB	DSDD	Sanyo	FDA-5200	Half	No
5¼"	500KB	360KB	DSDD	Shugart	SA210	Half	No
5¼"	500KB	360KB	DSDD	Shugart	SA450	Full	No
5¼"	500KB	360KB	DSDD	Shugart	SA455	Half	No
5¼"	500KB	360KB	DSDD	Shugart	SA551	Half	No
5¼"	500KB	360KB	DSDD	Siemens	FDD221-5	Full	No
5¼"	500KB	360KB	DSDD	Tandon	TM100-2A	Full	No
5¼"	500KB	360KB	DSDD	Tandon	TM101-2	Full	No
5¼"	500KB	360KB	DSDD	Tandon	TM50-2	Half	No
5¼"	500KB	360KB	DSDD	Tandon	TM55-2	Half	No
5¼"	500KB	360KB	DSDD	Tandon	TM65-2L	Half	No
5¼"	500KB	360KB	DSDD	Tandon	TM75-2	Half	No
5¼"	500KB	360KB	DSDD	Teac	53B	Half	No
5¼"	500KB	360KB	DSDD	Teac	55B	Half	No
5¼"	500KB	360KB	DSDD	Teac	55BR	Half	No
5¼"	500KB	360KB	DSDD	Teac	55BV	Half	No
5¼"	500KB	360KB	DSDD	Tec	FB503	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	0242A	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5401	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5406	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5426	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5451	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5454	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5471	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5472	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	5474	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	6371	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	6374	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	6471	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	6474-T2P	Half	No
5¼"	500KB	360KB	DSDD	Toshiba	M48D-12	Half	No
5¼"	500KB	360KB	DSDD	Weltec	M48D-14	Half	No
5¼"	500KB	360KB	DSDD	World Storage	FD200-5	Full	No
5¼"	500KB	360KB	DSDD	YE Data	YD580	Half	No
5¼"	500KB	360KB	DSDD	YE Data	YD580B	Half	No
5¼"	500KB	360KB	SSQD	CDC	9429-1	Half	No
5¼"	500KB	360KB	SSQD	M.P.I.	91M	Full	No
5¼"	500KB	360KB	SSQD	M.P.I.	B101M-S	Full	No
5¼"	500KB	360KB	SSQD	M.P.I.	B91S	Full	No
5¼"	500KB	360KB	SSQD	Tandon	TM100-3	Full	No
5¼"	500KB	360KB	SSQD	Tandon	TM100-3M	Full	No
5¼"	500KB	360KB	SSQD	Tandon	TM101-3	Full	No
5¼"	500KB	360KB	SSQD	Victor	TM100-3-VIC	Full	No
5¼"	500KB	360KB	SSDD	Hitachi	HFD 305S	Half	No
5¼"	500KB	360KB	SSDD	Micropolis	1015-2	Full	No
5¼"	500KB	360KB	SSDD	Micropolis	1115-5	Full	No
5¼"	500KB	360KB	SSDD	Phillips	3121	Half	No

5¼"	500KB	360KB	SSDD	Shugart	SA300	Half	No
5¼"	500KB	360KB	SSDD	Shugart	SA410	Full	Yes
5¼"	500KB	360KB	SSDD	Siemens	FDD121-5	Full	No
5¼"	500KB	360KB	SSDD	Siemens	FDD196-5	Full	No
5¼"	500KB	360KB		Epson	SD-520	Half	No
5¼"	500KB	360KB		Micro Solutions	BACKPACK(5L)	Half	No
5¼"	500KB	360KB		Mitsubishi	4852	Full	No
5¼"	500KB	360KB		Mitsubishi	MF501A,B	Half	No
5¼"	500KB	360KB		MPI	52-S	Full	No
5¼"	500KB	360KB		PACIFIC RIM	U360	Half	No
5¼"	500KB	360KB		SHUGART	SA460	Full	No
5¼"	500KB	360KB		Toshiba	0401GR	Half	No
5¼"	1.0MB	720KB	DSQD	AT&T	KS-23114	Half	No
5¼"	1.0MB	720KB	DSQD	BASF	6138	Half	No
5¼"	1.0MB	720KB	DSQD	Canon	220	Half	Yes
5¼"	1.0MB	720KB	DSQD	Canon	221		Yes
5¼"	1.0MB	720KB	DSQD	Canon	530	Half	No
5¼"	1.0MB	720KB	DSQD	CDC	9409T	Full	No
5¼"	1.0MB	720KB	DSQD	CDC	9429	Half	No
5¼"	1.0MB	720KB	DSQD	Fujitsu	2554K	Half	No
5¼"	1.0MB	720KB	DSQD	Fujitsu	M2552A	Half	No
5¼"	1.0MB	720KB	DSQD	Hi-Tech	596-10	Full	No
5¼"	1.0MB	720KB	DSQD	JVC	MDP-100	Half	Yes
5¼"	1.0MB	720KB	DSQD	M.P.I.	92M-002	Full	No
5¼"	1.0MB	720KB	DSQD	M.P.I.	B102M-S	Full	No
5¼"	1.0MB	720KB	DSQD	M.P.I.	B92M	Full	No
5¼"	1.0MB	720KB	DSQD	M.P.I.	B92S	Full	No
5¼"	1.0MB	720KB	DSQD	Micropolis	1006-4N	Full	No
5¼"	1.0MB	720KB	DSQD	Micropolis	1015-4	Full	No
5¼"	1.0MB	720KB	DSQD	Micropolis	1015-6	Full	No
5¼"	1.0MB	720KB	DSQD	Micropolis	1115-4	Full	No
5¼"	1.0MB	720KB	DSQD	Micropolis	1115-6	Full	No
5¼"	1.0MB	720KB	DSQD	Micropolis	1117-6	Full	No
5¼"	1.0MB	720KB	DSQD	Mitsubishi	4852	Half	No
5¼"	1.0MB	720KB	DSQD	Mitsubishi	4853	Half	Yes
5¼"	1.0MB	720KB	DSQD	Mitsubishi	4853	Half	No
5¼"	1.0MB	720KB	DSQD	Mitsubishi	503	Half	Yes
5¼"	1.0MB	720KB	DSQD	N.E.C	1055	Half	Yes
5¼"	1.0MB	720KB	DSQD	Panasonic	465	Half	No
5¼"	1.0MB	720KB	DSQD	Panasonic	595	Half	No
5¼"	1.0MB	720KB	DSQD	Ricoh	5100	Half	No
5¼"	1.0MB	720KB	DSQD	Seiko	8640	Full	No
5¼"	1.0MB	720KB	DSQD	Shugart	SA460	Full	No
5¼"	1.0MB	720KB	DSQD	Shugart	SA465	Half	Yes
5¼"	1.0MB	720KB	DSQD	Shugart	SA561	Half	No
5¼"	1.0MB	720KB	DSQD	Tandon	TM100-4	Full	No
5¼"	1.0MB	720KB	DSQD	Tandon	TM100-4A	Full	No
5¼"	1.0MB	720KB	DSQD	Tandon	TM101-4	Full	No
5¼"	1.0MB	720KB	DSQD	Tandon	TM101-4A	Full	No

5¼"	1.0MB	720KB	DSQD	Tandon	TM55-4	Half	No
5¼"	1.0MB	720KB	DSQD	Tandon	TM65-4	Half	No
5¼"	1.0MB	720KB	DSQD	Teac	55FR	Half	Yes
5¼"	1.0MB	720KB	DSQD	Teac	55FV	Half	No
5¼"	1.0MB	720KB	DSQD	Tec	FB504	Half	No
5¼"	1.0MB	720KB	DSQD	Toshiba	0202A	Full	No
5¼"	1.0MB	720KB	DSQD	Toshiba	5629	Half	No
5¼"	1.0MB	720KB	DSQD	Victor	TM100-4-VIC	Full	No
5¼"	1.0MB	720KB	DSQD	Weltec	M16-P12	Half	No
5¼"	1.0MB	720KB	DSQD	Weltec	N96-12	Half	No
5¼"	1.0MB	720KB	DSQD	YE Data	YD280	Full	No
5¼"	1.0MB	720KB	DSDD	Phillips	3133	Half	No
5¼"	1.0MB	720KB	DSDD	Weltec	M16-R12/910	Half	No
3½"	1.0MB	720KB	DSQD	Chinon	FB354	Half	Yes
3½"	1.0MB	720KB	DSQD	Citizen	OPDB-22A	1/3	No
3½"	1.0MB	720KB	DSQD	Citizen	OSDA-01D	1/3	No
3½"	1.0MB	720KB	DSQD	Citizen	OSDA-77D	1/3	No
3½"	1.0MB	720KB	DSQD	Citizen	OSDA-90E-U	1/3	No
3½"	1.0MB	720KB	DSQD	Citizen	OSDD-05B	1/3	No
3½"	1.0MB	720KB	DSQD	Citizen	OSDD-57	1/3	No
3½"	1.0MB	720KB	DSQD	Citizen	OSDD-57B	1/3	No
3½"	1.0MB	720KB	DSQD	Epson	180	Half	No
3½"	1.0MB	720KB	DSQD	Epson	200P-053	Half	No
3½"	1.0MB	720KB	DSQD	Epson	200P-055	Half	No
3½"	1.0MB	720KB	DSQD	Epson	200P-073	Half	No
3½"	1.0MB	720KB	DSQD	Epson	280	1/3	No
3½"	1.0MB	720KB	DSQD	Epson	SMD-380-xxx	1/3	No
3½"	1.0MB	720KB	DSQD	Epson	SMD-389-xxx	Half	No
3½"	1.0MB	720KB	DSQD	Fujitsu	M2551A		No
3½"	1.0MB	720KB	DSQD	Fujitsu	N02B-0112-B001	Half	No
3½"	1.0MB	720KB	DSQD	Fujitsu	N02B-0112-B201	Half	No
3½"	1.0MB	720KB	DSQD	Mitsubishi	353-12	1/3	No
3½"	1.0MB	720KB	DSQD	Mitsubishi	353AF	Half	Yes
3½"	1.0MB	720KB	DSQD	Mitsubishi	353B-12	Half	No
3½"	1.0MB	720KB	DSQD	Mitsubishi	353B-82	1/3	No
3½"	1.0MB	720KB	DSQD	Mitsubishi	353C	1/3	No
3½"	1.0MB	720KB	DSQD	Mitsubishi	MF353B,C	Half	No
3½"	1.0MB	720KB	DSQD	Mitsumi			No
3½"	1.0MB	720KB	DSQD	N.E.C	1035	Half	No
3½"	1.0MB	720KB	DSQD	N.E.C	1036A	1/3	No
3½"	1.0MB	720KB	DSQD	N.E.C	1037A	1/3	No
3½"	1.0MB	720KB	DSQD	Newtronic	D357	1/3	No
3½"	1.0MB	720KB	DSQD	PACIFIC RIM	U720		No
3½"	1.0MB	720KB	DSQD	Panasonic	253	1/3	Yes
3½"	1.0MB	720KB	DSQD	Sony	53W	1/3	No
3½"	1.0MB	720KB	DSQD	Sony	63W	1/3	Yes
3½"	1.0MB	720KB	DSQD	Sony	MP-F11W	1/3	No
3½"	1.0MB	720KB	DSQD	Teac	135FN	1/3	No

3½"	1.0MB	720KB	DSQD	Teac	235F	1/3	No
3½"	1.0MB	720KB	DSQD	Teac	335F	19.0	No
3½"	1.0MB	720KB	DSQD	Teac	35F	Half	No
3½"	1.0MB	720KB	DSQD	Teac	35FN	Half	No
3½"	1.0MB	720KB	DSQD	Toshiba	3527H	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	3527TH	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	352TH	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	4202-AOK	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	4207-AOK	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	4207-AOK	1"	No
3½"	1.0MB	720KB	DSQD	Toshiba	4210	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	4261	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	ND-352T,S	1/3	No
3½"	1.0MB	720KB	DSQD	Toshiba	ND-354A	1/3	No

5. Appendix 2

Floppy Disc Controller Technical Information

1771 Pin information					
1	VBB	-5V			
2	!WE	!Write enable		A logic low copies the data on the DAL into the selected register when CS is low.	
3	!CS	!Chip select			
4	!RE	!Read enable		A logic low on this input controls the placement of data from a selected register on the DAL when !CS is low.	
5,6	A0-A1	Register select:			
		A1	A0	!RE	!WE
		0	0	Status register	Command register
		0	1	Track register	Track register
		1	0	Sector register	Sector register
		1	1	Data register	Data register
7-14	!DAL0-DAL7	!Data Access Lines		Enabled by !RE OR !WE	
15	!PH1/STEP	!Phase 1/Step		If the !3PM input is low then three phase motor control is selected and !PH1-PH3 outputs are used to control it.	
16	!PH2/DIRC	!Phase 2/Dir			
17	PH3	!Phase 3			
18	!3PM	!3 phase motor select			
19	!MR	???		!PH1 is active low after !MR.	
20	VSS	GND			
21	VC	+5V			
22	!TEST	!Test		Should be tied to +5V or left floating.	

23	HLT	Head load timing	When this is logic 1, the head is assumed to be engaged.
24	CLK	Clock	Free running 2MHz +-1% square wave for internal uses.
25	!XTDS	!External data	Logic low or open selects separation the internal data separator
26	FDCLOCK	Floppy disc clock	For external data separation
27	FDDATA	Floppy disc data	Raw data if !XTDS is 1 or externally separated data if !XTDS is 0.
28	HLD	Head load	Controls the loading of the RW head against the media.
29	TG43	Track greater than 43	
30	WG		
31	WD		Contains clock and data bits
32	READY	Ready	Same as !b7 in the status register
33	!WF	Write fault	
34	!TR00	!Track 00	
35	!IP	!Index pulse	Held for a minimum of 10us when an index mark is found on the disc.
36	!WPRT	!Write protect	A logic low terminates a command and sets the write protect bit.
37	!DINT	!Disc initialisation	If !DINT=0 the operation is cancelled and the write protect bit is set.
38	DRQ	!Data request	Indicates that more data is needed in the data register, or the data is waiting to be taken.
39	INTRQ	Interrupt request	Set at the completion (successful or otherwise) of any operation. Use a 10k pull resistor to +5V.
40	VDD	+12V	