gripes. Firstly, although density is sensed automatically, track size is not. If you want to read a 40 track disc on an 80 track drive, it is necessary to issue a *FX110,n,255, where "n" is the drive number. What is even worse, is the fact that this command is cancelled as soon as Break is pressed. Therefore it is impossible to use !BOOT files on a 40 track disc if being read by an 80 track drive. My other problem concerned the file length. I wrote a short program to test out the maximum length a file could have. The result was successful in confirming a maximum file size of 359.5K, but when the end of the disc was reached no error message was issued, such as "disc full".

Its efforts at running protected software were good, coping with most of the items I tried. See Table 2. Some of the problems experienced may have been due to the *FX110 command mentioned above.

The manual of some 100 pages or more is well laid out in a ring bound A5 book. As usual the manual starts with an excellent introductory section, followed by the details of the commands and the various appendices covering error messages, machine code calls, etc.

There is nothing startling about this system. Watford have converted a well proven single density system into a double density one without adding any frills. If you already have a Watford single density system this is probably the best way for you to upgrade as a special trade in is allowed on your single density system.

CUMANA

We now come to the last DDFS I have looked at. Cumana, one of the most well known names in disc drives for the Beeb have come up with something called the QFS. If you have looked at the *HELP QFS print out you would be forgiven for thinking that it was just a standard Acorn DFS. In fact Cumana have only added one command and that is a formatter to the utilities.

Cumana have used the 18 sector layout in double density mode and are using a Farranti MB8877A disc controller. The actual kit is the most complicated to fit. It consists of a DCB, which has a flying lead to connect to link S19, and a further dual lead which goes to a header plug which is soldered on to the top a TTL chip. There are a further six TTL chips to fit, one of which is soldered on to another header. Then, of course, there is the 16K EPROM. While I say that this is more complicated than the other kits I have fitted, it is still fairly straightforward. The fitting instructions, comprising half of the eight pages of the supplied users handbook, are very clear with good diagrams. The DCB sits beside an ATPL with no problem.

The software is automatically able to sense either track size or density. But because there are no commands to force you into a particular mode of operation, there is no way that you can prepare a 40 track disc on an 80 track drive. The only additional command Cumana have added to the standard Acorn set is a built in formatter. This is the most sophisticated formatter I have seen, allowing options to name and number the disc, format both sides and continue formatting a new disc incrementing the disc number. After formatting, the disc is automatically verified. Unfortunately you are not able to access this verifier by use of a direct command.

In use the QFS performed very well, although I did get the impression that it was quite slow. However the benchmarks do not confirm this. I think it is probably in the automatic track and density sensing that delays occur. The 8271 emulator is very good, and the only item it couldn't beat was Level 9. Overall then a professionally produced system, with good error messages and helpful catalogue display. No proper manual was provided with the kit, so I assume you are meant to use the single density version. At £69.95 this is one of the cheaper interfaces on the market, however it is let down by not including any method to increase the maximum number of files allowed.

THE FINAL VERDICT

Having now looked at five DDFS's I will try and sum up my findings, though you will probably still be as confused as me.

I still feel that Solidisk have got the best ideas, it is a shame they can't get them to work properly. I wouldn't recommend this one yet, unless your budget is really tight and you are prepared to wait for your upgrades each month.

Out of the rest the choice gets more difficult. I would discount the Cumana QFS for lack of facilities. The choice between Opus, UDM and Watford is very much a matter of deciding what facilities you prefer. My personal choice is still the Opus DDOS, basically for its flexible catalogue system and the additional commands which go with it.

TABLE 1 - Benchmark timings

Benchmark	Acorn single	OPUS DDOS 3.45 single	double	STL DDFS 1.40 single	double	UDM DDFS 2.00 single	double	CUMANA QFS 2.0 single	double	WATFORD DDFS single	double
1	3.70	3.33	3.18	2.41	1.84	13.00	3.80	4.16	3.49	3.40	2.82
2	3.59	3.11	2.37	2.20	1.64	12.59	3.49	4.05	3.49	2.31	1.62
3	6.89	21.19	21.19	20.42	20.40	1.06	0.68	0.92	1.14	1.02	1.05
4	13.87	6.29	6.04	9.03	8.83	9.23	5.53	5.84	5.71	9.24	9.05
5	12.11	5.92	5.68	5.10	4.91	5.34	5.41	5.56	5.39	9.00	8.81
6	20.70	9.57	9.17	9.19	8.71	9.47	9.03	9.68	8.76	15.33	14.97
7	19.11	8.78	8.38	7.91	7.62	8.10	8.43	8.78	8.56	14.34	13.48
8	4.08	2.37	2.43	2.87	3.03	3.19	2.54	2.81	2.77	3.20	3.23
9	3.33	3.10	3.05	2.36	2.29	2.67	2.40	2.29	2.63	3.05	2.65

TABLE 2 - Software compatability

Software	Publisher	OPUS DDOS	STL DDFS	UDM DDFS	CUMANA QFS	WATFORD DDFS
Mini Office	Database	no	yes I	yes I	?	?
Beta-base	Clares	:es	yes	yes	yes	yes
Database	Acornsoft	yes	yes	yes	yes	yes
Starbase	GCC	*	*	*	yes	
Replica II	Clares	yes I	?	yes I	yes	no
Elite - old	Acornsoft	no	no	yes	yes	yes
Elite - new	Acornsoft	yes	yes	yes	yes	yes
JCB Digger	Acornsoft	yes	yes	yes	yes	yes
Jet Power Jack	Micropower	yes	yes	yes	yes	yes
Castle Quest	Micropower	no	no	?	yes	yes
Snowball	Level 9	no	no	no	no	no
Fortress	Pace	no	?	?	yes	yes

* - Untested   I - On good authority

TABLE 3 - System comparisons

	OPUS DDOS 3.45	STL DDFS 2.00	UDM DDFS 2.00	CUMANA QFS	WATFORD DDFS
Cost	£99.95	£89.95	£95.00	£69.95	£97.75
Sectors	16/18	10/18	10/18	10/18	10/18
Max file size	326	disc size	355K	355K	disc size
Max no. of titles	248	unlimited	170	31	62
Controller	WD1770	WD1770	WD2793	MB8877A	WD1770