

CP/M Disc formats

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At heart CP/M believes it is reading from and writing to IBM 8" discs. A Disc Parameter Block holds the actual specifications of the discs in use and data is converted to and from IBM 8" format during each read/write operation.

This approach avoided the need to bring out a new version every time a new disc format was invented and also made it much easier to use discs formatted on other machines. Locomotive Software added to these facilities by including an Extended Disc Parameter Block in the Amstrad implementation which, among other things, includes a 'freeze flag'. If this is set, it tells CP/M to check the disc format every time and not assume the disc is a standard format.

All Amstrad CP/M discs have either 40 or 80 tracks in 9 sectors, each sector holding 512 bytes. So a single-sided single-density disc holds 40 x 9 x 512 bytes or 180K; a double-sided, double-density disc holds 80 x 9 x 512 bytes (or 360K) per side making 720K in all.

Of this at least 2K is required for the disc directory, hence the 178K available under AMS-DOS. However, when CP/M is loaded, the computer has to be given the initial instructions to look for CP/M on the disc. These are held in the first sector of the first track of a system disc.

In CP/M 2.2 the first two tracks also hold the routines which are normally loaded into the program area and overwritten when other programs are running so a system disc has to remain in drive A: to enable CP/M to restart at the conclusion of a program; in CP/M 3.1 these routines are stored in banked RAM and called from there when necessary. So a system disc need only be used once to load CP/M 3.1. For compatibility, the space which CP/M 2.2 uses in the first two tracks of a system disc is empty on a CP/M 3.1 system disc. The tracks holding the disc directory then follow the system tracks. While data format discs (those without system tracks) can only be used with AMSDOS or in drive B: with CP/M 2.2, they can be used in any drive with CP/M 3.1 once it has been loaded.

Amstrad supplied two other formats with the CPC — vendor and IBM. Vendor is a system disc with the first two tracks empty; since |CPM causes the computer to read the first sector of the disc in drive A:, games programmers can put their own startup routines in this sector. IBM format was included with CP/M 2.2 to allow CP/M programs to be ported from other CP/M machines; it is no longer supplied.

To make it easy to identify a disc, each format starts with a different sector number — system format starts with sector number &41, data format with &C1, etc. KDS used exactly the same technique with RAMDOS so that, when ROMDOS reads a disc in drive B:, it determines the format from the number of the first sector. This also works with PCW single-sided discs since they start with &01! So ROMDOS can tell whether a disc in drive A: is a system, data or PCW format disc.

Alternative formats for the 6128 have to satisfy the needs of AMSDOS, CP/M 2.2 and CP/M 3.1. The AMSDOS parameters are held in ROM so a way of bypassing and replacing them has

to be found; the CP/M 2.2 parameters are held on disc so that disc file has to be changed; the CP/M 3.1 parameters are also held on disc and can be changed on disc but they can also be changed after they have been loaded into banked RAM any number of times without upsetting CP/M 3.1! Anyone wanting to experiment with different disc formats will find Alan Potter's brief example in the April 1988 edition of *Personal Computer World* of how to enable a CPC to read PCW format discs helpful. Other sources of useful information are CP/M: the Software Bus (Clarke et al., 1983), the *CP/M Plus Manual* (Digital Research and Amstrad Consumer Electronics, 1986) and the *Amstrad CP/M Plus* (Clarke and Powys Lybbe, 1986).

With the introduction of password protection and date/time stamping of files in CP/M 3, changes had to be made to the CP/M 2.2 format disc directories. To retain compatibility, a separate program (INITDIR.COM) was supplied which reformats the directory of a CP/M 2.2 format disc so that every fourth directory entry holds the passwords and date/time stamps of the previous three entries. Since neither AMSDOS nor CP/M 2.2 can understand what is going on in every fourth directory, it is absolutely vital not to use discs reformatted by INITDIR.COM with AMSDOS or CP/M 2.2 — the price could be a corrupt disc directory! And, if you do not need passwords and date/time stamps, you can carry on using CP/M 2.2 format discs, as created by DISCKIT, with CP/M 3.1.

Two limitations of CP/M need to be born in mind. Firstly, CP/M keeps track of files on disc by recording in the disc directory the blocks of space they use but each directory entry can only keep track of a certain number of blocks; longer files use additional directory entries to record the additional blocks so you can run out of directory space on a disc with less than the maximum number of files on the disc. The total number of blocks a disc directory can record is also limited; so, whereas the lower capacity CPC formats have 'standard' 1K blocks, the higher capacity RAMDOS formats use 2K blocks and, for example, a hard disc might use 4K blocks. So a 5K file would take 5 blocks (or 5K) on a CPC, 3 blocks (or 6K) on a RAMDOS format disc and 2 blocks (or 8K) on a hard disc. Higher capacity discs with a lot of short files can carry a lot of empty space!

Secondly, CP/M can only handle 128 directory entries at a time. So if you choose a RAMDOS format or use a PCW 720K disc which has 256 entries, CP/M will only display the first 128. It can still use the rest but their names will not appear in the directory display. The answer is that you are expected to split your files between 'user areas' (or 'groups' as they are called in Locoscript) so that you never get near the 128 limit.

Finally, some notes on how CP/M handles files. CP/M updates a file's directory entry in its own workspace and only updates the disc directory when it writes the changes to disc; to protect the unwary, CP/M 2.2 stops you writing to a new disc unless you perform a 'warm boot' by entering CONTROL-C. CP/M 3.1 allows you to change the disc and updates the disc directory whenever necessary; but it is always worth checking the disc activity light is off or waiting a few seconds after a program has ended before removing a disc to ensure that any changes the program may have made to the disc directory have been completed.

CP/M 'deletes' files by changing the file's user number, normally 0–15, to user number 229. Unerase programs bring back deleted files by changing the user number from 229 to whatever is the current user number. This needs to be done immediately as CP/M treats 229 as an invitation to use any blocks allocated to that file for a new file. However, Locoscript on the PCW restricts users to groups (or user areas) 0–7 and adds 8 to the user number when files are deleted; these 'limbo' files can be recovered in just the same way as CP/M deleted files — by restoring the old user number. But, as CP/M recognises files in user areas 8–15 as genuine files, it will report 'Disc full' when Locoscript says there is space on the disc because

it discounts all files in user areas 8–15.

Though AMSDOS uses CP/M 2.2 format discs, unlike CP/M 2.2, it allows full access to user areas; so unerase programs have to be able to work in all user areas. As AMSDOS also uses 229 to indicate a deleted file, you can use an AMSDOS program to recover a file deleted by CP/M on a CP/M 2.2 format disc, even if you were using it with CP/M 3.1. If you are using CP/M 3.1 discs reformatted with INITDIR.COM, you must **ONLY** use a CP/M 3.1 unerase program, such as the one on the Knife Plus disc from HiSOFT.

References

Clarke, A., J. M. Eaton, and D. Powys Lybbe (1983). *CP/M — the software bus: a programmer's companion*. Wilmslow: Sigma Technical.

Clarke, A. and D. Powys Lybbe (1986). *The Amstrad CP/M plus*. London: MML Systems.

Digital Research and Amstrad Consumer Electronics (1986). *The Digital Research CP/M Plus manual for Amstrad PCW8256 and Amstrad CPC6128* (Second ed.). London: Heinemann.

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Table 1: DPB and XDPB entries for the four main Amstrad formats and Ramdos under CP/M Plus

| | CPC System | CPC Data | PCW 8256 | Ramdos D1 | Ramdos D20 | PCW 9512 |
|-------------------------|------------|----------|----------|-----------|------------|----------|
| SPT | &0024 | &0024 | &0024 | £0024 | £0028 | &0024 |
| BSH | &03 | &03 | &03 | &04 | &04 | &04 |
| BLM | &07 | &07 | &07 | &0F | &0F | &0F * |
| EXM | &00 | &00 | &00 | &00 | &00 | &00 |
| DSM | &00AA | &00B3 | &00AE | &0167 | &018F | &0164 * |
| DRM | &003F | &003F | &003F | &007F | &00FF | &00FF |
| AL1/AL0 | &00C0 | &00C0 | &00C0 | &00C0 | &00F0 | &00F0 |
| CKS | &0010 | &0010 | &0010 | &0020 | &0020 | &0040 |
| OFF | &0002 * | &0000 | &0001 | &0000 | &0000 | &0001 |
| PSH | &02 | &02 | &02 | &02 | &02 | &02 |
| PHM | &03 | &03 | &03 | &03 | &03 | &03 |
| sidedness | &00 | &00 | &00 | &01 | &01 | &01 |
| tracks per side | &28 | &28 | &28 | &50 | &50 | &50 |
| sectors per track | &09 | &09 | &09 | &09 | &0A | &09 |
| first sector number | &41 | &C1 | &01 | &01 | &31 | &01 * |
| bytes per sector | &0200 | &0200 | &0200 | &0200 | &0200 | &0200 * |
| gap length (read/write) | &2A | &2A | &2A | &2A | &09 | &2A * |
| gap length (format) | &52 | &52 | &52 | &52 | &10 | &52 |
| mode | &60 | &60 | &60 | &60 | &60 | &60 * |
| freeze flag | &00 | &00 | &00 | &FF | &FF | 00 * |

* use FF if patching a CPC B:drive

Table 2: Notes to Table 1

* (1) 720K on the PCW 9512 format is too much to handle as 1K blocks; so 2K blocks are used giving 360 blocks in total; on hard discs, 4K blocks are normal. Bear in mind that a 5K file takes 5 blocks (5K) on a CPC disc, 3 blocks (6K) on a RAMDOS format disc and 2 blocks (8K) on a hard disc.

* (2) where two bytes are used, the ‘units’ come before the ‘tens’ so to speak and I have translated the second byte into its decimal equivalent in which 01 = 256 and 02 = 512, etc. So, for example, the PCW 9512 format has 256+100=356 blocks each of 16 records or (16 x 128 bytes =) 2 Kbytes length giving 712K storage.

* (3) the CPC System format retains 2 reserved tracks for compatibility with CP/M 2.2; the vendor format is identical to the system format except that the first two tracks are left empty for games programmers to insert their own code.

* (4) Amstrad and KDS use the first sector number to identify disc formats easily; KDS uses 01, 11, 21, 31, 51 and 71 so ROMDOS (and thus PARADOS) can identify all the Amstrad single-sided and KDS formats by reading the first sector number. Unfortunately, as RAMDOS format D1 has the same first sector number as PCW double sided discs, RAMDOS cannot detect PCW format double sided discs.

* (5) The gap length and mode figures should not be altered.

* (6) If you alter your CP/M disc, you can use 00 for the last byte though KDS recommends you use FF; if you use a program like REJOYCE.COM, 8256.COM or RAMDOS+.COM, this byte should normally be FF.