Fasten your seatbelts…

…let's go for a drive. Roger Gann gets in gear and sets off to explore CD-R, the storage disc set to leave the CD-ROM drive standing. Choosing, installing and running, it's all here.

With the first DVD-ROM drives now on sale at more reasonable prices, the writing is on the wall for the humble CD-ROM drive. And with so little profit margin left for the CD-ROM drive makers, their attention will switch to producing something more profitable; I think *that* something is the recordable CD-ROM drive (CD-R).

CD-Rs have been around for years, having first appeared in the rarefied world of hi-fi at astronomical prices. They eventually made the crossover to the PC market, but then prices came down a bit. The original HP SureStore 4020I, which then cost £700, today costs under £425. "Bare" CD-R drives can be bought for much less (some, at street prices below £300).

Cooking your own CD-ROM discs is now fairly affordable. But who needs home-brewed CD-ROMs? Anyone with a modern, well specified PC. CD-R is cheap bulk storage: at around £7 each, a 650Mb CD-ROM disc works out at about 1p per megabyte. CD-R is a good choice as a storage or backup device for several

CD Creator for PC and Mac

reasons. Firstly, the ubiquity of CD-ROM drives; your disc will be readable on many PCs. This also makes CD-R an excellent medium for transferring large files; you can even use it to back up expensive CD-ROM based reference works. Secondly, unlike tape, CD-R is a random-access device, which makes it fast to get at archive material. The discs are more durable, too: they have a longer life span than tape cartridges, they're physically durable, and they can't be wiped by coming into contact with, say, a magnetic field.

It's true that CD-ROM drives aren't storage speed demons compared with modern hard disks, but they're fast enough for running infrequently used applications and for accessing historical data. The CD-ROM is thus a perfect medium for today's big multimedia data files. Also, you can store just about any form of data on a CD-ROM: you can mix and match video, Photo-CD images, graphics, sound and conventional data on a single disc.

Choosing a CD-R drive
There's a reasonable choice of CD-R drives available from companies like Hewlett-Packard, Mitsumi, Sony and others. Prices start at under £300 (ex VAT), rising to around £600 (ex VAT). You can choose between external models which sit on your desktop, or internal models that sit in a spare 5.25in drive bay. Although they have the special ability to write to CD-R blank discs, these drives otherwise behave like ordinary CD-ROM drives. Almost all are SCSI devices so you'll need a SCSI host adaptor card, but parallel port drives are also available and work surprisingly well.

Perhaps the most important feature of a CD-R drive is the speed at which it can

Hewlett-Packard P SureStore CD-Writer 6020

write, as "burning" a full 650Mb CD-R disc can be a slow process. For example, audio CDs are 1x, 150Kb/sec devices and can hold 74 minutes of music, so this is how long a single-speed burn will take (a 2x will take half this time, and so on); the faster the CD-R, the quicker you can burn your discs.

Although CD-ROM drives are now hitting 16x, with peak data transfer rates in excess of 1,800Kb/sec, you won't find any CD-R drives offering this kind of performance. While most can read at 4x or 6x, the vast majority of CD-R drives are 2x writers. That is, they can write to disc at a speed of 300Kb/sec. Some CD-R drives can manage to write at 4x (600Kb/sec) but these are about 50 percent dearer and you need a well-specified PC to keep a 4x CD-R happy. Finally, check just what mastering software is included in the deal.

Installing a CD-R drive
If you've installed an ordinary SCSI CD-ROM drive, installing a CD-R version won't come as a great shock as it will install in a similar way. If you already have a SCSI host adaptor installed, all you have to do is connect the new CD-R drive to a spare connector on the SCSI cable if it's an internal drive, or plug it into the socket on the SCSI host adaptor card if it's an

external), having first given the drive a unique SCSI ID number (say, between two and six) and turning termination on if it's the last device in the SCSI daisy-chain. An external CD-R drive is a good choice if you plan on using it to back up different PCs.

Some CD-R drives will be bundled with their own private SCSI card and there's a compelling reason for installing these even if you have a SCSI host adaptor already installed. The second card ensures the CD-R drive gets the highest possible data throughput. It's important to use a bus-mastering SCSI host adaptor as this will improve throughput, which is the name of the CD-R game. If you have a high-spec SCSI host adaptor to start with, you can get away with just using the one card.

The simplest CD-R drives to install are those which make use of your PC's parallel port. These drives install in minutes: plug in the cables, power-up the drive, install the software drivers and you're away. I keep emphasising the importance of good data transfer rates and that goes double for parallel ports; you must have a PC with an EPP or ECP parallel port. This is important because a standard/4-bit parallel port may not have a fast enough data transfer rate to keep the CD-R satisfied. Parallel port CD-R drives are available from HP and others.

Hardware requirements
Unlike CD-ROMs, you can't fit a CD-R drive into any old PC and expect it to work consistently. Successful CD-R burning needs a PC capable of providing a fast, consistent, data flow during the burning process. The biggest problem you'll come across in CD-authoring is running out of data during a burn. A CD-R disc has to be written to in a contiguous, track-by-track fashion, writing the data in a smooth, uninterrupted stream. The write session has to be closed properly. If, for any reason, there's a glitch in the data flow during the burn and the unit is momentarily left with nothing to write, the data buffer empties and a "buffer under-run" occurs. That £7 CD you're trying to write to then becomes useless and you'll have to start again.

So what's the solution to this problem? A good start is a fast, well-specified PC. Some CD-R makers recommend a 486 with 8Mb of RAM or better but in my experience it's the "better" that you need. I'd say nothing less than a P90 with 16Mb RAM, especially if you want to do track-at-a-time or multi-session recording. Make sure you

buy a CD-R drive with a decent-sized on-board buffer of about 1Mb. You'll need a big, fast, hard disk, too. Although you can successfully burn CD-Rs using Enhanced IDE/PIO Mode 4 hard drives, most makers recommend a SCSI hard drive with at least 1.3Gb free; this is the minimum space needed to create a full 650Mb CD, especially if your mastering software needs a disk image of the CD-R to be created first.

For serious CD-R authoring you're looking at fitting a second SCSI hard disk, dedicated solely to the CD-R mastering task. Avoid drives which feature thermal recalibration on-the-fly as this interrupts data flow. It's best to use so-called AV (audio-visual) drives, which are designed to deliver fast, sustained transfers. Another tip to ensure a smooth data flow is to defrag your source drive first. During the burn session it's probably better *not* to put Windows multitasking to the test, so don't run anything else at the same time. And run ScanDisk too, just to make sure all the files can be read. If, after this, you still get continuous buffer under-runs, you'll probably have no alternative but to drop the write speed, from quad- to double-speed, or from double- down to single-speed.

Buffer under-runs aren't the only reason discs get ruined. The final, lengthy stage in the recording process closes out the disc with a table of contents which consumes about 13Mb of space per session. If the CD-R drive and software aren't set up properly, or if the proper SCSI termination isn't in place, it's possible to get through most of a recording session but have the closing process fail and the disc ruined at the last moment. Beware if you're intent on making good use of a CD-R's multi-session capabilities: the 13Mb overhead soon mounts up if you burn many sessions onto one disc. It's for this reason that multi-session CD-R is unsuitable for incremental daily backups; you may back up just a few megabytes of data but then sacrifice another 13Mb to close the session.

Mastering software
When buying a CD-R pay close attention to the mastering software that comes with it. This is the utility that lets you arrange and format the data to be burned onto a CD and is as important as the drive itself. Just as fax modems are bundled with "lite" versions of full-blown fax programs, so the odds are that you'll come across a lite version of one
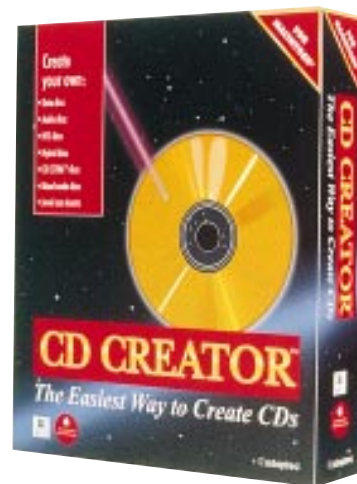
Sony Spressa 920

of the mastering packages sold by Corel, Incat Systems and Elektroson in the box. These will provide enough functionality to let you perform basic mastering chores but will lack the bells and whistles found in full versions. Mastering involves marshalling many files, so these packages will include File Manager-like interfaces for routine tasks like backup and archiving. The full versions will offer multi-session and full audio CD capabilities. They will all support the ISO 9660 standard, a CD-ROM data format readable by PCs running DOS or Windows, by Macs running System 6.x or 7.x, and by almost every flavour of UNIX. This is a limited standard in some ways, but Microsoft's Joliet CD-ROM formatting standard expands on 9660 by allowing semi-intelligent truncation of long filenames, and it is beginning to be supported by the new generation of CD-R software.

Some packages will first create a physical image file of the entire CD-ROM on the hard disc; a time-consuming process. This is a complete, bit-for-bit mirror image duplicate of all the files to be burned to a CD-R disk in a recording session. If you have a fast PC, you might be able to dispense with the time and bother of a complete physical image by using a virtual image file method instead. This is smaller, and carries a set of pointers to the files on your hard disk to be sent to the CD-R drive.

Finally, if you're bothered about buffer under-runs, most packages allow you to run a dress rehearsal of a burn session but without actually writing to the disc. This is a slow process, but could save you time and money in the long run.