

Taking charge of your DRAGON

0-SFF Direct page: used by Basic
\$100-\$1FF Page 1: I/O drivers, Extended Basic
\$200-\$3FF Buffers for cassette, etc.
\$400-\$5FF Text screen — default area
\$600-\$7FFF Graphics screen/program/variable storage
\$8000-\$BFFF Basic ROMs
SC000-\$DFFF Cartridge ROM locations
SFF00-03 PIO 0
SFF20-23 PIO 1
SFFC0-DF SAM chip register
SFFF0-FF Reset vectors

Reset vectors are actually mapped from SBFF0

SBFF0			Default settings
F2	SW13	100	
F4	SW12	103	
F6	FIRQ	10F	Initialise cartridge
F8	IRQ	10C	Update clock, PLAY, etc
FA	SW1	106	
FC	NMI	109	
FE	Reset	B3B4	Initialise warm start Basic

MEMORY MAPPED

PIO 0	Bit	Function
A side (FF00)	06	Keyboard row input
	7	Joystick comparator input
	0,1	Joystick switch input
B side (FF02)	CA2	MUX least significant byte select
	0-7	Keyboard column output
PIO 1	CB1	Printer output
	CB2	Printer output
A side (FF20)	0	IRQ — vertical sync
	1	MUX M.S.B. select output
	2-7	Cassette data input
	CA1	Printer strobe
B side (FF22)	CA2	Printer acknowledge IRQ (not used)
	0	Cassette relay control
	1	Printer busy input
	2	Single bit sound output
	3	RAM size select sensing
	4	CSS
	5	GMO/I/E
	6	GMI video controller
	7	GM2 control lines
	7	A/G
CASSETTE I/O	CB1	Cartridge port FIRQ
	CB2	Sound enable output (to TV)

JSR \$8015 Turn on cassette relay
JSR \$8018 Turn off cassette relay
JSR \$801B or JSR [SA00C] Prepare cassette for writing

\$90 91 Leader byte count
\$95 96 Cassette motor delay
JSR \$801E Put out a byte to cassette from A

This is best used as part of BLKOUT ie not directly used). JSR [SA008] will write out a block of data, complete with checksum, once the cassette has been prepared by JSR \$8015. Parameters to be set up for BLKOUT

\$7C Block type = 0: file header 1: data, FF: end of file
\$7D Number of bytes to be put out
\$7E/F Base address of bytes
JSR \$8021 or JSR [SA004] Prepares the cassette for data input, getting into BIT sync.
JSR \$8024 Returns next byte in A
JSR \$8027 Gets the next bit in from cassette into carry

BLKIN: JSR [SA006]

Having been set up by JSR \$8021, waits for \$3C from tape to get into BYTE sync then reads in the data following into the memory, pointed to by \$7E, and does a checksum on the result, also reading block type and byte count. If all OK Zero flag set

\$81 Error code: cleared if verified
JSR \$8006 or JSR [SA000] Polls the keyboard and returns the character code in accumulator A
\$150-159 Keyboard rollover table — writing \$FF to these locations will cause a sort of auto repeat
\$149 Alpha lock flag (default \$FF)
JSR \$8012 Updates the joystick readings stored in \$15A-D
JSR \$8009 Blinks the cursor
\$8F Blink count
JSR \$800C Writes the character from A to the text screen, scrolling if necessary
\$88 & 89 Point to the next location for screen output.

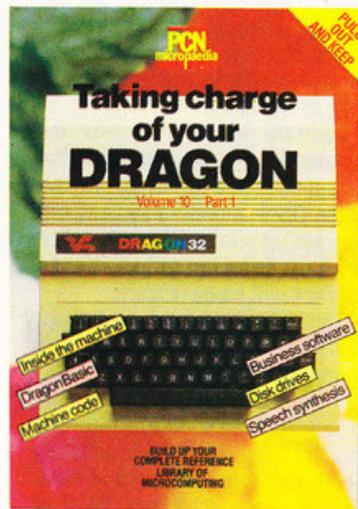
Default screen address (Text) \$400 — \$5FF

JSR \$800F Writes out the character in A to the lineprinter
\$99 Lineprinter 'comma field' width
\$9A Last 'comma field' width
\$9B Line printer width
\$9C Line printer: print head position (Buffer full) auto line feed flag Default FF (= on). If 0 then carriage return will be printed at end of line
\$148 End of line termination sequence

Printer end of line sequence

14A **1** Number of characters to be printed in E.O.L. sequence
\$14B **\$0D** Return
\$14C **\$0A** Line feed
\$14D **0** null
\$14E **0** null

PART 3



VOLUME 10

At left is the memory map of the Dragon 32 as supplied by Dragon Data. This map is indispensable to machine code programmers, who can use the locations with an Editor/Assembler or a Basic program that incorporates a POKE command.

Entering machine code routines with POKE can be accessed using the DEFUSR and USR commands, and Editor/Assembler machine code programs must use a cassette-based or cartridge-based Editor/Assembler.

Dragon has promised to release an Editor/Assembler in both forms, although the cartridge will include a debugging facility.

DISKS FOR DRAGONS

With the imminent arrival of Dragon Data's long awaited disk drives the question for the Dragon owner will be, is it worth the cost?

The price of £275 for the first drive and DOS does mean you're talking about a peripheral costing almost twice the price of the computer, and subsequent drives will cost £200.

Premier Micro Systems has had a disk operating system for the Dragon for some months, but it's priced at £299, and on face value doesn't appear to offer as much as Dragon's own system.

Contrary to early reports the Dragon disk system operates on the unexpanded 32K machine. However the OS-9 operating system will not be available for the 32K machine, so for the serious user an upgrade will be necessary.

The disk drives are mounted in a coated steel case. The drive is a single half-height drive with internal power supply and is easily expandable to a double by inserting an extra drive. Two double units can be linked together for a 4-drive system. Each drive has 186K of memory capacity with single sided, double density disks. They are formatted onto 40 tracks with 18 sectors per track and 256 bytes per sector.

The disk drives are connected to the Dragon through the cartridge port on the right hand side of the machine. The controller or Disk Operating System (DOS) looks like a cartridge and is connected by a ribbon cable to the disk drives.

The first function you have to carry out with a new disk is to format it. One of the tracks on the disk is reserved for a directory. This means that when you insert the disk and call up the directory it will tell you what is on the disk.

The Dragon disk drives provide some very powerful additions to the Dragon, and at the same time provide facilities often not found on disks within the same price range. **AUTO** produces line numbers for a program automatically. **AUTO** on its own starts numbering at 100 and increments in steps of 10.

WAIT suspends execution of the program.

WAIT5000 pauses for 5000 milliseconds (5 seconds)

ERROR GOTO directs control to a particular line if an error is subsequently detected.

FRES gives the number of free bytes available for strings.



STARTING OUT ON DISK

After a lot of teething troubles, Dragon Data finally launched its official disk drives on September 1 — just over a year after the Dragon 32 appeared. As expected they are 5¼in drives, which are connected to the Dragon via a special cartridge containing the necessary additions to the Microsoft Basic needed to operate the drives. Some useful new non-disk functions have also been added to the extended Basic.

There are two main advantages that disks have over cassettes — speed, and the facility for mass storage. The Dragon's disk drives hold up to 184K and are fast even by disk standards. In addition to this, a non-computer user can operate programs using the disk with much less difficulty than a cassette (no messing around with rewind, play and record).

Saving and loading programs with the disk drives is very similar to using the cassette, except that many more flexible commands are available. To save a program the **SAVE "PROGRAM.TYP"** command is used, where 'progname' is any filename of up to eight characters, and 'typ' is any three character file specifier. If typ is left out, .BAS for Basic is used. Note that filenames are not as flexible as on cassettes — spaces and special characters are not allowed.

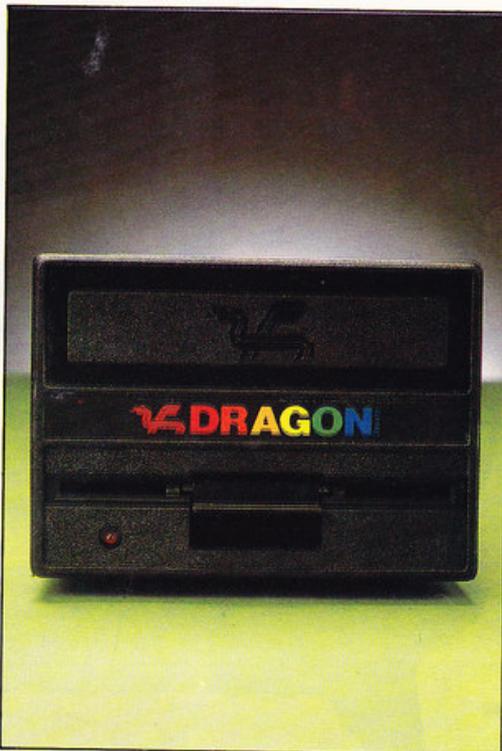
For machine code programs the same command is used. There is no need to add an 'M' to the end of the **SAVE** command, simply **SAVE "PROGRAM.TYP"**, start,end,entry is used. If typ is left out, .BIN is assumed. This command can be used for storing graphics on disk. To identify these use HRG as the file specifier. As a 6K high resolution display takes only one or two seconds to load from disk, we can expect software houses, which have been slow to offer

graphic adventures, to produce such games with displays for every location visited — with 170+K on a disk the possibilities are almost endless.

Programs can be loaded back in with **LOAD "PROGRAM.TYP"**. Here typ must be specified for all except Basic programs, else a ?NE ERROR (file non-existent) will occur. **RUN "PROGRAM"** will autorun a program on loading. This can be used for both Basic and machine code programs — a point not made clear in the manual. The **CHAIN** command is similar to **RUN** except that variables are conserved — again this would be useful for adventure games which are too large to fit in the memory all at once. You can even specify the line at which execution should start.

To permanently erase a program from the disk and restore the space used, there is a **KILL "PROGRAM.TYP"** program. Here typ *must* be specified for all types of file. You can protect a file from accidental **KILL**ing with the **PROTECT ON** function, where an inverse 'P' appears in the directory against its name. You can then use **PROTECT OFF** and **KILL** to erase the program.

The directory may be called by typing **DIR** — the program name, file specifier and length of file in bytes will appear for all programs on the disk. At the end of the directory, the number of free bytes remaining on the disk is shown. There is no facility for listing the directory to the printer directly. To achieve this simply use **POKE 111,254:DIR** and output will go to the printer — another useful point missed from the manual. This is worth knowing for making an index of each disk — with 170K on every disk, could you remember what's on each one?



The specifications of Dragon's drives and the manual supplied states that up to ten files can be used simultaneously, but on the drive I used, any attempt to open more than five files at once resulted in a ?TF ERROR (too many files).

Files may be used as serial or random access, the latter being much easier and more useful as it can simulate memory for data. Unlike cassettes, the files are simultaneously open for input and output, and are therefore very flexible. For random access, a file must have initially been CREATED. However, from then on there is no mucking about with OPENING or CLOSEing files as with the cassette unless you wish to use more than five (or is it ten?) files in the same program.

The examples listed show how to create and set up a random access file, and then use it. The CREATE command in line 30 of **program 1** reserves disk space for the file called 'example'. The space required is the product of the number of entries and the maximum length of any entry, 'N' and 'L' respectively. Adding 20 in line 30 gives us space to store 'N' & 'L' at the beginning of the file. Lines 50 and 60 do this. Line 70 defines a function to find the beginning of a record 'R' on the disk, allowing random access to any entry. In line 110, FWRITE writes to the file, FROM the position found for record 'I' FOR the length 'L', the data A\$. Line 140 prints the number of bytes used by the file — demonstrating the LOF (length of file) function.

Program 2 uses the file we have just created. Line 30 defines the same function as used before and lines 60 and 70 recall the values of 'N' & 'L'. The record to be accessed is input in line 80 as 'R'. In line 110 the FREAD command does the opposite of the FWRITE command, getting the correct data into A\$. You are then given the option of changing the entry to demonstrate simultaneous read/write. Note that there is also an FLREAD function which relates to the FREAD function as LINE INPUT does to INPUT in Basic.

The other 'file' commands are SREAD and SWRITE, which read or write to specific sectors on the disk. There are 40 tracks on a disk numbered 0 to 39 and each track has 18 sectors numbers 1 to 18. Each sector holds 256 bytes. **Program 3** shows the use of SREAD to print the entire contents of a disk as it is stored. It is interesting to see just how the disk stores its data —

Program 1

```
10 'PROGRAM TO CREATE AN EXAMPLE DISK FILE
20 L=25:N=10 'L IS LENGTH OF RECORD, N IS NUMBER OF RECORDS
30 CREATE "EXAMPLE",N*L+20
40 'NOW STORE N & L AS FIRST ITEMS IN FILE
50 FWRITE "EXAMPLE",FROM 0;N
60 FWRITE "EXAMPLE",FROM 10;L
70 DEF FNR(R)=(R-1)*L+20 'FUNCTION TO FIND CORRECT BYTE FOR RECORD R
80 'STORE EXAMPLE DATA
90 FOR I=1 TO 10
100 READ A$
110 FWRITE "EXAMPLE",FROM FNR(I),FOR L;A$
120 NEXT I
130 CLOSE
140 PRINT"FILE CREATED - NUMBER OF BYTES USED =" ;LOF("EXAMPLE.DAT")
150 END
160 DATA BILL BLOGGS,JOHN DOE,SAM SMITH,JOE JONES,WILFRED WILLIAMS,BILL
    BUTLER,TO
    NY WRITER,DEREK DRAGON,CUTHBERT CANDLEWICK,EDDIE EDWARDS
```

Program 2

```
10 'PROGRAM TO USE EXAMPLE FILE
20 'DEMONSTRATES "RANDOM ACCESS" USE
30 DEF FNR(R)=(R-1)*L+20
40 CLS:PRINT"INSERT DISK WITH FILE 'EXAMPLE' AND PRESS ANY KEY..."
    'EXEC 41194
50 'FIRST GET VALUES OF N & L BACK
60 FREAD "EXAMPLE",FROM 0;N
70 FREAD "EXAMPLE",FROM 10;L
80 INPUT "WHICH RECORD DO YOU WISH TO ACCESS";R
90 IF R<1 OR R>N THEN 80
100 'GET ENTRY IN RECORD R INTO A$
110 FREAD "EXAMPLE",FROM FNR(R),FOR L;A$
120 PRINT:PRINT A$
130 INPUT "CHANGE THIS ENTRY (Y/N)";S$
140 IF S<>"Y" THEN 80
150 INPUT "NEW ENTRY";A$
160 FWRITE "EXAMPLE",FROM FNR(R),FOR L;A$
170 GOTO 80
```

Program 3

```
10 'PROGRAM TO PRINT CONTENTS OF A DISK
20 'DEMONSTRATES "SREAD" FUNCTION
30 CLEAR500
40 ERROR GOTO 110
50 FOR TRACK=0 TO 39
60 FOR SECTOR=1 TO 18
70 SREAD 1,TRACK,SECTOR,X$,Y$
80 PRINT X$;Y$
90 NEXT SECTOR,TRACK
100 END
110 PRINT"ERROR OCCURED - NUMBER";ERR
120 IF ERR>=128 THEN PRINT"DISK ERROR"
130 END
```

Program 4

```
10 'ROUTINE TO HANDLE ERRORS WITH CODES
20 ERROR GOTO 1000
30 '*****
40 'YOUR PROGRAM HERE
50 '*****
1000 'ERROR ROUTINE
1010 IF ERR<128 THEN ER$=CHR$(PEEK(33449+ERR))+CHR$(PEEK(33449+ERR+1))
    ELSE ER$=
    CHR$(PEEK(57107+ERR))+CHR$(PEEK(57107+ERR+1))
1020 PRINT:PRINT"?"+ER$+" ERROR - CODE"ERR"AT LINE"ERL
1030 INPUT "CONTINUE (Y/N)";AN$
1040 IF AN$="N" THEN END
1050 GOTO 2000 'GOTO RESTART LINE NUMBER
2000 'RESTART
```

how much space is wasted between programs and how the directory is compiled. The first number, in this case 1, specifies the drive number. The data is read into two strings, each 128 characters long. A similar syntax is used for SWRITE.

One of the most useful non-disk functions added to the extended Basic is error trapping. In **Program 4**, ERROR GOTO n sends the program to line n when an error occurs. ERR then gives the error number and ERL the line number at which it occurred. However, there is not a function to give the two letter code of the error. The final routine can be put at the end of programs and will print the error number and line number as well as the usual two letter code. This works by peeking the Basic or disk ROM as necessary to put the characters into the ER\$ string.

The programs above give a few examples of what you can do with the new drives. But there are lots of other advantages to using them.

DRAGON: PART 3

Cassette recorders

The choice of cassette recorder is wide and not as critical as with some other computers, and you don't have to buy an own-make machine.

Any reasonable quality cassette machine will work, and it's not necessary to buy an expensive machine; in fact, stereo models can cause problems, since the Dragon works in mono and when it reads a stereo recording only half the signal is available.

The essential requirements for speedy and trouble-free operation are:—

- A machine with a remote-control facility and the facility to plug in an external microphone and ear-piece (remote control since the Dragon has a 'MOTOR ON, MOTOR OFF' command, which means that you don't constantly have to stop and start the machine manually; the microphone socket should also disable any built-in mic when use, otherwise you may find spurious external noises on your program recordings which could affect them when reloading.

- A volume control to operate the output into the computer — most machines have one.

- A digital counter — although not essential, this is useful, since if you have more than one program on a tape it saves you having to plough through endless other programs or data files to find the one you want.

- Another useful but not essential function is a tone control so that a badly recorded cassette can possibly be rescued, since the higher the tone control setting the more likely you are to get a successful load.

Badly recorded commercial programs are, mercifully, becoming a thing of the past although a few slip through. Some of the early Dragon Data programs were constantly calling up an I/O error and the volume control setting into the machine was critical, but this has now been overcome with the use of digital recorded masters instead of analogue.

For the home user the purchase of the slightly more expensive computer cassettes is worth the extra because however good your tape recorder a poor-quality cassette with the possibility of 'drop outs' in it will only frustrate you if after many hours of painstaking work your program failed to record properly and you lost all the data.

Own-brand cassette machines from Boots, Tandy, Smiths or Dixons are generally inexpensive and work satisfactorily.

Dots and daisywheels

Connecting a printer to the Dragon 32 is not difficult — the computer works with virtually any parallel printer. Surprisingly, the Dragon manual is sparse on information about the use of printers. Page 132 simply says a printer can be connected to the parallel I/O port and that there are variations of some commands to allow output. Then it mentions briefly the commands.

On the left side of the machine is the printer port, a 20-pin Centronics interface into which you plug the printer cable. When the Dragon first came out it was not easy obtaining the correct fitment, since it appears to be



HOW TO GIVE YOUR DR

non-standard, but now that the machine is established printer cables are more widely available and can usually be bought with the printer ready made up — even Tandy now sells the cable as a made-up accessory.

If, however, you can't obtain ready made-up cable — and they are a bit expensive — it should be possible to do it yourself with a soldering iron and some simple tools. The pin connections are listed in the additional information booklet that comes with the Dragon manual. The pin connections at the other end of your cable to your printer should be found in the printer manual. If in doubt, ask your dealer.

Control of the printer is obtained with the Print #-2 command. Control codes vary from printer to printer, although usually Control Code 12 will execute a form feed and 13 a carriage return. The Dragon will operate all the usual printer commands, but there are some 'handshakes' which do not return because of the Dragon's 20-pin connector. This, however, does not affect the operation.

A word processing program, such as the Telewriter mentioned in Micropaedia Part 2, will allow you to insert any direct printer control commands into the text so that the computer can control any changes in text, form feeds, underlining etc, without having to change any of the DIP switches on the printer. This can also be done in your own Dragon programs.

A line "Print#-, CHR\$(12)" within your program will instruct the printer to move to the next page or top of form. "Print #-2" instructs

the computer that you are about to use the printer, "CHR\$(12)" tells it that you are giving it an ASCII code and the number in brackets (12) is the specific code.

A word of warning: if the program finds a "Print #-2" command without the printer hooked up it will result in your machine 'hanging up', and only the use of the RESET control will get you back into the program. This sort of information is lacking in the manual.

The use to which you are putting your Dragon is probably the most important factor in choosing your printer, but with the large number of less expensive dot matrix printers coming on the market it is wise to shop around.

For around £300 you can buy a reasonable machine, such as the Epson RX-80, a Seikosha or one of the Star machines — most of them will give you many of the features of the more expensive machines including the facility to dump graphics onto the printer (dealt within PCN issue 25). For simple letters, accounts and so on a machine of this type would be ideal.

Prices of daisywheel printers are also falling and an outlay of just over £500 could buy you a letter-quality machine.

Monitors for the machine

Having bought your Dragon, the first problem is how to display its software.

The Dragon is compatible with most domestic television sets, black-and-white and



AGON EXTRA TEETH

colour. Although tempting, it may be a false economy to rush out and buy a 'reconditioned' set for £20. Some older sets lack the stability of picture that the newer solid state sets achieve. Before buying it would be wise to ask the shop to let you try your Dragon on the set.

Because of the Dragon's reduced screen size — in normal text mode only about two-thirds of the screen area is used — you should have a television with at least a 14in screen. This will allow you to get a reasonably good image size.

A popular set which even Dragon Data uses is the Sony Trinitron. This set, a little expensive at £250-£300, produces a good, clear solid image.

On the back of the Dragon is a five-pin DIN socket which can be plugged into a monitor (pin 1-audio, pin 2-ground, pin 3-video, pins 4 and 5 not used). But is it worth the expense of buying a dedicated monitor? Probably not, because the Dragon outputs composite video; which means that the signal from the machine has already gone through various stages of degradation and tests show that there is very little difference between the picture quality on a monitor and that which comes from a Sony Trinitron, for example.

If you are using the Dragon for business there may be a case for running it through a green monitor, the prices of which are now well below the £100 mark, and the definition is excellent — a major factor to be borne in mind if you are sitting for hours on end in front of the screen.

If you are planning a trip to the United States

don't be tempted into buying a cheaper and more powerful Dragon over there. You will have problems in the UK — the power supply will almost certainly be different and the American machine will be designed to produce an NTSC colour signal on 515 lines. This is incompatible with television sets used here, which operate on the European PAL television standard of 625 lines.

A look at light-pens

Over the past few months a new add-on for the Dragon has been making an appearance — a light-pen. This device, as its name implies, looks like a pen and can be used to 'read' the screen. It consists of a photoelectric cell which when pointed at the screen sends a signal back to the computer through a lead which is connected to one of the joystick sockets.

Some games, the Microdeal Backgammon for example, can be played with a light-pen. You point the pen at the counter that you wish to move and then indicate to where you want to move it, the computer reads the information and the move is made. A light-pen could be of use on some business programs — menu selection for example, where the pen is pointed at the relevant number and the computer takes over.

The Microdeal light-pen comes with sample programs which include a music program in which the menu selection option is used to get

the computer to play a tune. By using the pen you can compose your own tune. The pen can also be used to draw graphics.

Datapen has recently introduced what it calls a more sophisticated and more sensitive light-pen which claims to give you more control. Priced at £25, it comes with application software including user routines and example programs.

Shooting sticks surveyed

After a tape recorder, the joystick is probably the biggest-selling peripheral for the Dragon. As more and more companies enter the market with their own versions you are going to be spoiled for choice.

Most arcade-type games make use of a joystick, and on some it is essential. They can also be used on utility programs, and it's not too difficult to write their use into home-grown programs. The Dragon manual gives a number of examples of the use of joysticks and shows how they can be written into a program.

Two basic types of stick are available: switch and potentiometer.

The switch type consists of four or eight switches. Moving the stick gives a value of either 'off' or 'on' and although not as accurate as the other type it has less to go wrong and therefore is better suited to rough handling.

The potentiometer type allows diagonal movement and is more sensitive. Others, known as semi-professional and usually built to a higher specification, are starting to appear on the market and have the added advantage of being self-centring.

Which type you buy depends on what use you want to make of it and how serious a games player you are or wish to become.

Prices vary from around £10 for a pair into the £20-plus bracket. Most can now be tried out in High Street stores.

SUPPLIERS

Telewriter, light-pens, joysticks

Microdeal, 41 Truro Road, St Austell, Cornwall PL26 5JE. (0726) 67676

Epson (UK), Wembley, Middlesex HA9 6BR. 01-900 0466

Seiksha Printers DRG. 0934 419914

Star Printers, Micro Peripherals, 61 New Market Street, Basingstoke, Hants. (0256) 56468

Smith-Corona, Discom, (0386) 3591

'Color File'

Tandy (UK), Bilston Road, Wednesbury, West Midlands WS10 7JN.

Mailer/Address Book, Database, Invoice/Statements, Spreadsheet, Business Accounts

MST Consultants, Newton Road, Bovey Tracey, South Devon TQ13 9BB. (0626) 832617

Stock Control, Payroll, Mailing List, Cashbook, VAT Accounts, Non-VAT Accounts

Abacus Software UK, 21 Union Street, Ramsbottom, Nr Bury, Lancs. Bolton 383839

Speculator

Tandy (UK)

Datapen, 0256 770488

THE DRAGON AT PLAY

The Dragon is one of the best-equipped home micros available for small business applications (see last week's Micropaedia), with its built-in printer interface and full-travel keyboard. But the Welsh micro is also pretty good at gaming and entertainment.

And in the year since its launch, a vast range of games have been released for the machine — and reviewed in the pages of *PCN*. Over the next three pages we present a short list of some of the more highly rated games for the Dragon with a brief description of each.

But keep in mind that prices are subject to change without notification (these days that means they're usually on the way down) and that some games will require joysticks to be used to their greatest advantage.

Games are available through many High Street computer dealers — including Boots and Dixons, both of whom say they are committed to stocking and supporting the machine with

software and peripherals. Games are also available by mail-order through a variety of reputable dealers.

Wherever you get your game, it's a good idea to try them out before you buy. Games often look great in artist's representations on cassette covers — though not all will live up to their billing.

You can also expect to get an increasing variety of media for games in the near future, as more people buy disk drive systems and software producers increasingly look to affordable cartridge software as a way of protecting their interests.

This is not to say that cassette software is by any means on the wane, but rather that you will have a choice of formats. After all, both disks and cartridges are much faster to load than cassettes.

With all that in mind, here's a list of Dragon games well worth checking out.

Games Pack 1, £6.50 from Abacus software, 21 Union Street, Ramsbottom near Bury, Lancashire 0204-383839.

This collection of classic board and computer games in an inexpensive package provides good value for money.

For £6.50 you get Micropoly (a new version of guess-which property buying board game), Tic-Tac-Toe, 10-Pin Bowling and the oft-implemented Mastermind coloured pegs guessing game. On the more 'traditional' computer game side, you have a choice between the Simon sound-matching game, a maze game called Muncher and two adventure games: King of the Valley and Wells of Omicron.

Backgammon, £8 from Microdeal, 41 Truro Road, St Austell, Cornwall 0726-67676.

This is another computer version of a classic board game. Microdeal has produced a creditable version of Backgammon which allows for various levels of skill in playing against the Dragon. This means that even if you're a beginner to backgammon, you won't have to experience the shame and humiliation suffered by many who learn the game from human opponents.

And once your Dragon package has taught you all the basics, you can move on to the next level of difficulty — until you become so good at the game that you trade your Microdeal cassette in for the cash to buy refreshments for the rash of human opponents that will undoubtedly want to challenge your newfound backgammon skills.

Empire, £6.95 from Winterson, 30 Uplands Park Road, Enfield, Middlesex 01-363 0313.

This game also normally makes its appearance on a board, as the world domination game,

Risk. As in Risk you start the game by selecting 13 territories on a world map and letting the Dragon — which plays against you — do the same.

What follows is a partially random war in which you try to wrest your opponent's territories from his (its?) control.

There are levels of difficulty in this game as well, to prevent you from being stomped on by your opponent's forces on your first tentative attempt.

Bonka, £7.95 from J Morrison Micros, 0532-480987.

This is a version of an arcade game known often as (insert your own name here) Panic. It ran on the Apple II for years as Apple Panic, recently made an appearance on the BBC as Monsters and now arrives to the Dragon in time to be dubbed Bonkers.

The premise of the game is that you are a little man trying to stay alive in a snakes and ladders type grid (sans les snakes) while various Meanies chase you in the hopes of having hacker for lunch. Your only defence against these beastly creatures is to dig holes in the scaffolding along which you travel, and then bop the monsters through those holes when they fall in them.

Hangman, £7.95 from Salamander Software, 0273-771942.

Another non-computer classic that has made its way onto the Dragon, this version of the popular word-guessing game gives you a 1,000 word dictionary and the option of one or two players.

The writers have also included a timer so that you can specify how long you want to give yourself to find a word. The mechanics of this



program would be pretty easy for anyone to write in Basic, but Salamander's execution of its features a high-resolution screen, an automatic skill adjustment and a quick turn-around between finishing one word and generating the next.

Championship Darts, £5.95 from Shadow Software, 0709-558676.

With your pint in one hand and your throwing arm in a keyboard-poised stance, you'll have a chance to play darts without the least chance of being hit by a pointed projectile.

You control the dart by moving the cursor round an on-screen board and firing with what you hope is the right aim. You'll then be presented with a second set of parameters which represent the single, double, and treble scores and miss categories of the standard dart board.

You have a choice of how long you want to play the game, in units which run from two to 999.

Star Jammer, £7.95 from Salamander Software, 0273 771942.

A three-dimensional jaunt through the universe lends a touch of authenticity to this game.

In addition to ships actually moving from left to right, they also get larger as they move closer to you. The game is joystick-controlled, making it easy to manipulate and quite quick. You have three 'lives' with which to fulfill your destiny of stopping alien ships from colonising the planets in your federation.

A random element in the proceedings is introduced in the form of a Stargate which sucks you into a different quadrant of the galaxy if you get too close to it.

Vultures, £6.95 from J Morrison (Micros), 0532-480987

A variation on the old Space Invader (and Galaxian) theme, with vultures standing in for the little green men who usually populate the top part of the screen in these events. Unfortunately, you aren't being fired at with nice clean laser blasts — but rather the end product of a vulture's visit to the laxatives counter.

The game is written in machine code and thus runs a good deal faster than Basic versions in this genre — although you can set it to work at three speed levels. It is also joystick-operated so there's more precise control of the 'laser-cannon' than in many keyboard versions.

The King, £8, from Microdeal 0726 67676.

The King has consistently featured in the PCN games charts as the top Dragon game, and is recognised by Dragon owners as a thorough implementation of the Donkey Kong arcade game.

The game may sound a bit silly to begin with, but if you've ever played Donkey Kong you'll know how much fun it can be.

Imagine you are a carpenter called Mario. Along comes King Kong and kidnaps your beloved girlfriend and takes her to the top of his steel hideout. It's time to put down your tools and set off to the rescue! You only have two things to aid you in your quest — your trusty carpenter's hammers and your wits.

Kong, however, is also prepared with a never ending supply of barrels to roll and throw down at you and, helped by the terrible killer flames, he is a formidable foe. What you have to do is to climb up and reach your gal. Kong will then climb up and take her again — and so to the next round!

To begin with, you have various options — one or two players and a normal or a practice game. You can choose the colour set, black and white, buff or green.

Playing the game, you will find that there are four different rounds. The first is a straightforward round with Kong hurling barrels down at you, and you jumping out of the way and climbing ladders to be next to your girl. In the second you have to walk over 'pins' to release all the girders and make Kong fall to his doom below.

The next round is quite hard — Mario has to ride the lifts, jump gaps and dodge jacks that jump over you — if you are lucky.

The next round is one of 'fire oil'. Mario has to walk along conveyor belts, dodge killer flames and pick up bonuses.

This game progresses with ever-increasing hazard and has yet again proved that the Tandy Color/Dragon 32 conversion works well. Sound is well used with some nice music (nearly three-part harmony) and the graphics are well done.

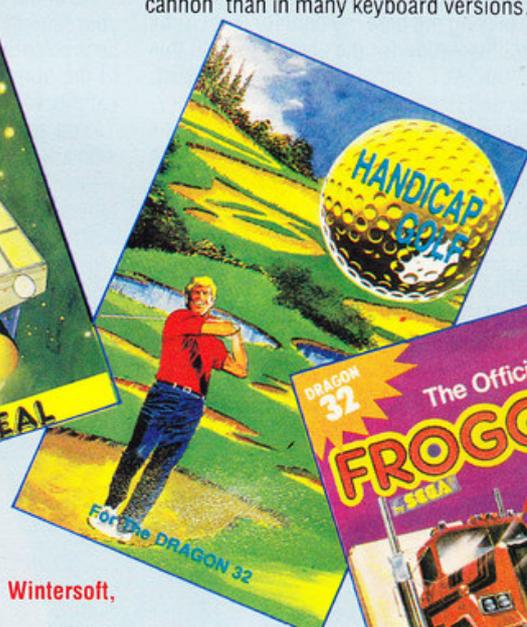
Joysticks, as you might have gathered, are needed as there is no keyboard operation.

Ring of Darkness, £10 from Wintersoft, 01-367 5720.

This is a big Dragon adventure game, so big that it can't actually fit into the Dragon's 32K memory. One part of the game — the 3D maze — has to be loaded from tape when you enter it, and then the main part of the adventure reloaded when you finish the maze.

Like most computer adventure games, you can ascribe certain qualities to the character you control — deciding whether you're an elf, dwarf or human, what proportion of intelligence, strength and agility you have and whether your principal skill is in theft, war or wizardry.

The reason for being involved in this rich fantastic tableau in the first place is a Quest — the Quest for Shedir, the Ring of Darkness. It will undoubtedly take you many hours to fulfill this task, thus making the £10 price of the game worthwhile.





Cuthbert Goes Walkabout, £8 from Microdeal. 0726-67676.

Another space theme here, with perhaps more of its roots in adventure or maze games than Space Invaders. The object of the game is to help Cuthbert light the lamps on the Lunar Landing Pad. Cuthbert is waiting for the Federal Chief's state visit, for which the lunar landing pad must be lit (don't ask me why the Federal Chief can't use radar like everyone else).

Anyway, poor old Cuthbert is being thwarted in his attempts to light the lunar landing pad by invading Moronians who for some reason don't want the Federal Chief to land.

Cuthbert moves around on the screen in a grid which makes up the lunar pad. He can walk or jump on horizontal lines, but can only climb up or down vertical lines. The keyboard or joysticks can be used to control Cuthbert and the game keeps track of high scores with a 'Hall of Fame' in which the highest scores are displayed.



Frogger, £8 from Microdeal. 0726-67676.

This is the 'official' version of Frogger for the Dragon, and the only one that's legally entitled to use the name. It's written in machine code and features all the usual goodies you would expect to find on this now-classic game.

Perhaps the most astonishing thing about this version of the game is that it took so long to get out. After all, Sega had licensed various other official versions of the game for many other machines before it finally put the seal of approval on Microdeal's release.

However, this game makes up for the delay by actually being colourful and faithful to the original concept of frogging. It has the capacity to let you freeze the action, so that you won't lose the game you're currently playing if more pressing matters call you away at an inopportune moment. You can also use joysticks or the keyboard to move the frog in question.

Space Shuttle, £10 from Microdeal. 0726-67676.

The flight simulator has evolved into something new: a space shuttle simulator that takes the computer flying metaphor and combines it with the traditional space game.

The Space Shuttle flight is divided into three phases—Launch, Fetch and Land. The Launch section involves reading large numbers of gauges and dials in the cockpit of the machine and assessing the best moment for launch. As the documentation for the game says, 'In this phase the ALT digital readout, plotboard, attitude and compass instruments are important. Headings are controlled by moving the joystick left and right. Altitude and pitch attitudes are controlled by moving the stick forward (nose DN) and back (nose UP). The keyboard and fire buttons are not used.'

It all sounds rather complicated—and it is. More of the instructions: 'PARK is more difficult than LAUNCH primarily because you use the JOYSTICK, KEYBOARD and FIRE BUTTON and control your velocity. Your forward and aft thrusters are controlled by 'up arrow' and 'down arrow'. The satellite is travelling at your insertion velocity...'

All this leads to the question of what you're doing fooling about with a space shuttle miles above the earth. The answer lies in a deep-seated desire to repair a malfunctioning space satellite.

Strategic Command, £9.99 from Romik Software. 0753-71535.

Another variation on the Risk theme, with joystick control paving your route to world domination.

The game begins with a map displaying the opposing red and yellow forces in each power's capital, army bases and naval bases. You have the option to develop an expeditionary force from any of these bases, but only at certain times in the game.

The object of the game is to see the world flying your colours and the computer sitting in abject defeat and embarrassment in a heap on the floor.

Death Cruise, £6.95 from Virgin Games. 01-221 7535.

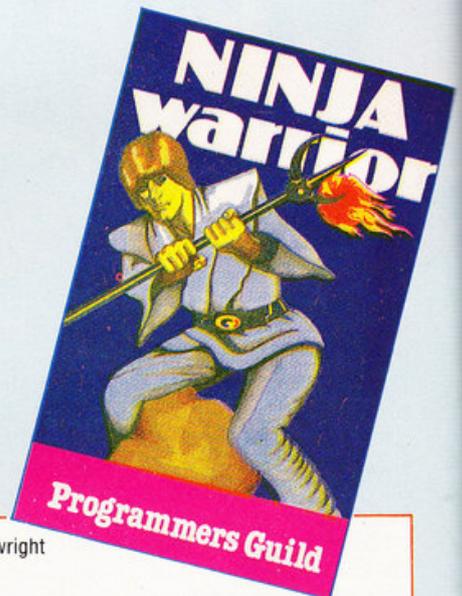
You can put this in the 'Cluedo meets The Orient Express at Sea' file. Virgin has produced a murder mystery adventure game that combines graphics and an Agatha Christie-style plot to reveal electronic intrigue on the high seas.

The game takes place aboard the maiden voyage of the luxury liner *Pacific 1* whose passenger list features the regal HRH King David and the not-so-regal Mr Sinister. The action starts five days into the voyage when you discover that the aforementioned Mr Sinister is behind a plot to destroy the liner—and has disguised himself as either a crew member or passenger.

Your job is to identify Mr Sinister and find the bomb and the room in which the detonator is kept (not necessarily in that order, of course).

As in the Cluedo board game, you can state your suspicions at any time—giving the suspected location of the detonator, the identity of the bomb (what it's disguised as) and the identity of Mr Sinister.

You also have to beware assassins aboard who are in league with Mr Sinister. If you don't walk into a room with a loaded gun, they could blow you away and end your chance to save the ship.



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Photography: Syd Hughes

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