

# Cambridge Co-Processor





Cambridge  
Co-Processor



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## Important

### WARNING: THE CO-PROCESSOR MUST BE EARTHED

The wires in the mains lead to the computer are coloured in accordance with the following code:

Green and Yellow	Earth
Blue	Neutral
Brown	Live

As the colours of the wires may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

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Scientific Division  
Acorn Computers Ltd  
Fulbourn Road  
Cherry Hinton  
Cambridge  
CB1 4JN

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Within this publication the term BBC is used as an abbreviation for the British Broadcasting Corporation.

NOTE: A User Registration Card is supplied with the hardware. It is in your interest to complete and return the card. Please notify Acorn Scientific at the above address if this card is missing.

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# About this User Guide

This User Guide describes how to get started with the Cambridge Co-Processor and the accompanying software.

It does not contain a detailed description of the Panos Operating System or the bundled languages, nor is it a tutorial to programming.

The Guide is in three parts:

Part I describes the components of the package and how to fit the Co-Processor;

Part II gives instructions on how to install the operating system Panos and use simple commands;

Part III introduces the use of the 32000 languages and shows how to install them.

Solutions to common difficulties and problems encountered with the Co-Processor, or during the installation of Panos or the languages are outlined in Appendix B.

## Conventions adopted in this guide

**BREAK** **RETURN** **ESCAPE** and **SHIFT** signify the corresponding keyboard keys rather than the actual words. It is assumed that command lines are terminated by **RETURN**.

In examples where commands have to be typed in response to a prompt (e.g. the Panos prompt `->`), both the command and the prompt are shown, e.g.

```
-> cat -help
```

Where you see the prefix '32000', this refers to software distributed with the Panos system, as distinct from other systems; for instance, '32000 BASIC' refers to BBC BASIC as supplied with the Cambridge Co-Processor, rather than BBC Microcomputer (6502) BASIC.

## Conventions for naming DFS floppy disc drives

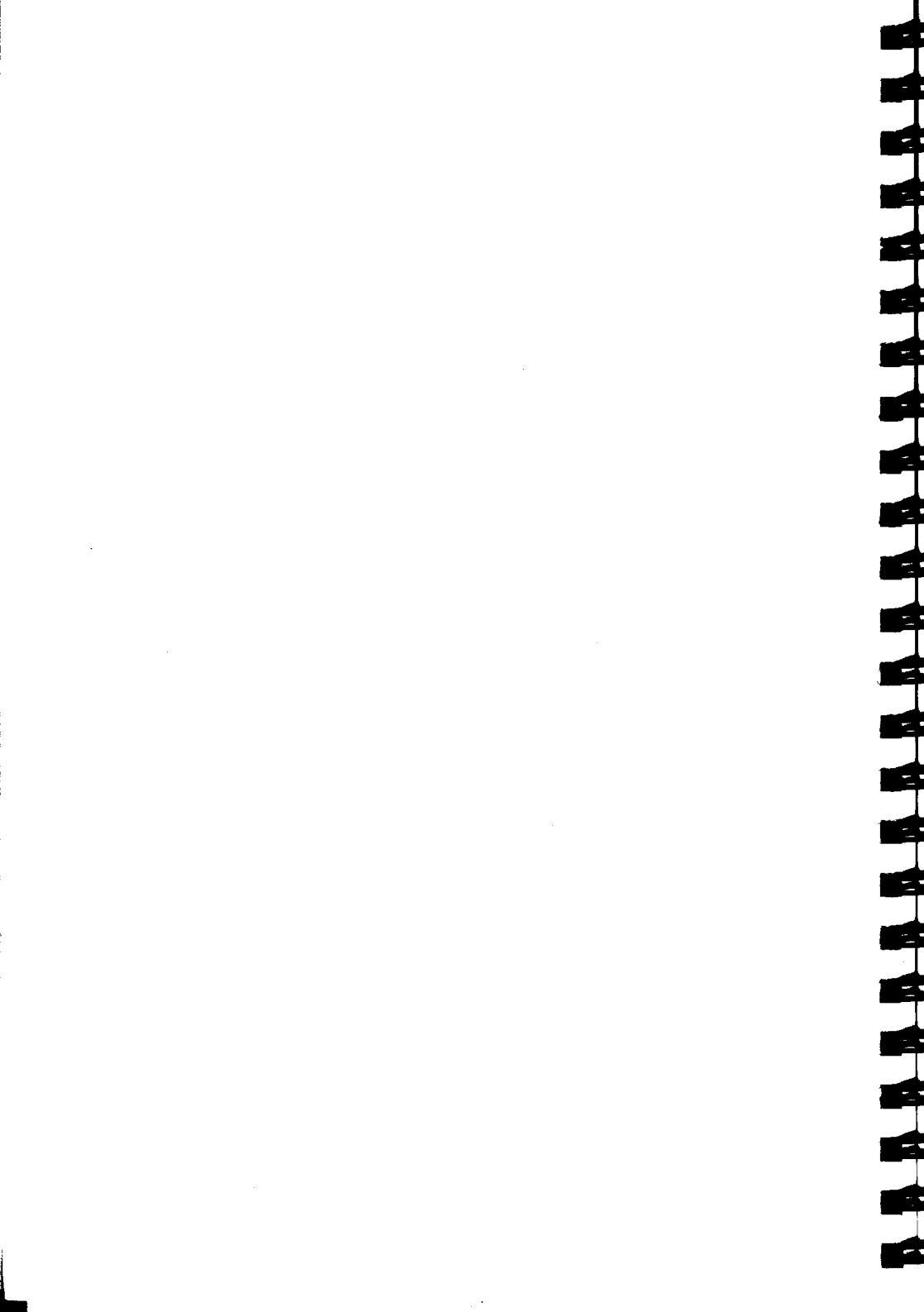
This manual assumes the use of BBC Microcomputer dual drives. Others e.g. from other manufacturers will be similar. Double sided DFS formatted floppy discs have two sides (like an LP). The top side (the one with the

label) is referred to as the upper side, the bottom side as the lower side. The dual disc drives have two slots, the top drive and the bottom drive. They also have drive numbers, corresponding to the top and bottom drives. This is represented in the following table:

- Drive 0 refers to the upper side of the top drive
- Drive 2 refers to the lower side of the top drive
- Drive 1 refers to the upper side of the bottom drive
- Drive 3 refers to the lower side of the bottom drive

See also the diagram in section 3.3.2.

# Part I The Hardware and Firmware



# 1 Installing the Hardware

## Introduction

The Cambridge Co-Processor uses the National Semiconductor 32000 chip set including the NS32016 Central Processor (CPU). Because the Co-Processor is a 32-bit computer, it can perform calculations much more quickly than earlier eight-bit designs, and it can address much more memory; it has an architecture designed for efficient compilation and execution of high-level languages such as Pascal. In summary, the Co-Processor offers the following capabilities:

- 32-bit internal architecture, 16-bit external data bus,
- 512K bytes of RAM, expandable to 1M byte,
- NS32081 floating point unit,
- 16K bytes of ROM containing Pandora kernel firmware,

Disc-based software providing:

- Panos operating system including procedure library and command interpreter,
- Editors for program and text preparation,
- Linker for combining several compiled modules,
- Pascal educational/systems programming language,
- Fortran 77 scientific programming language,
- C systems programming language,
- LISP artificial intelligence programming language,
- BBC BASIC programming language,
- Acorn macro assembler.

Full documentation accompanies all of the hardware and software. The manuals supplied with the system (apart from this guide) are:

- Panos Guide to Operations
- Panos Programmer's Reference Manual
- Acorn 32000 Assembler Reference Manual
- BBC BASIC Reference Manual
- C Reference Manual
- FORTTRAN 77 Reference Manual
- ISO Pascal Reference Manual
- Cambridge LISP Reference Manual

When a Co-Processor is fitted, the BBC Microcomputer becomes the input/output (I/O) processor, performing relatively simple tasks such as displaying characters on the screen and taking characters from the keyboard. The Co-Processor (sometimes referred to as the second processor) takes over the job of running application programs. This is enhanced by the specially written operating system, Panos, which provides an efficient programming environment for developing and executing software.

## **1.1 ROMs you will need to use the Co-Processor**

If you have a Model B+ BBC Microcomputer, then skip this section and move to sub-section 1.1.1.

Before the Co-Processor itself is attached to the BBC Microcomputer, the DNFS ROM should be fitted, as this contains the necessary software to support the Co-Processor. The DNFS ROM provides the BBC Microcomputer with the ability to communicate with a Co-Processor. It also contains the disc filing system (DFS) and the network filing system (NFS).

If your machine has a DFS ROM and/or an NFS ROM, it/they should be replaced by the DNFS ROM supplied. Failure to do this may result in incorrect operation. Appendix A describes how the old ROMs are removed and the new ones are fitted. If you do not feel confident enough to do this, please contact your supplier. Note that fitting ROMs yourself may affect your guarantee.

If you are currently using the advanced disc filing system (ADFS), typically with a Winchester disc, you will have to replace it with a special version suitable for use with the Co-Processor in addition to fitting the DNFS. The special ADFS (sometimes referred to as ADFS/32) is supplied with the Co-Processor.

The BBC operating system OS 1.2 (or a higher version number) is also required to use a Co-Processor. A ROM containing this operating system is available on request from your supplier.

### **1.1.1 ROMs needed for the B+**

The B+ model is already supplied with most of the ROMs necessary to operate Panos. However, you will need to fit the ADFS ROM if you are using Panos with a Winchester disc. This will have been supplied with the Winchester. To do this, either follow the instructions in Appendix A, or ask your dealer to fit one. Fitting ROMs yourself may affect your guarantee.

## 1.2 Connecting the Co-Processor

The Co-Processor is joined to the BBC Microcomputer by the short ribbon cable. This cable has a plug on the end which fits into the socket labelled Tube<sup>®</sup> on the underside of the BBC Microcomputer. Because of the short length of the cable, which is necessary due to the high speeds at which The Tube interface operates, the Co-Processor box may only be situated on the immediate right of the main unit.

Before fitting the Co-Processor, ensure that both it and the BBC Microcomputer are disconnected from the mains.

To plug the cable in, place the Co-Processor to the right of the BBC Microcomputer. Lift the front of the BBC Microcomputer to reveal the Tube<sup>®</sup> socket on the right. Open the plastic grips on each side of the socket and then take hold of the cable with your right hand. Push the plug at the end of the ribbon cable into the socket. Note that the plug should be orientated so that pin 1, indicated by a small triangle, is uppermost and level with the triangle near the socket, as shown in figure 1.

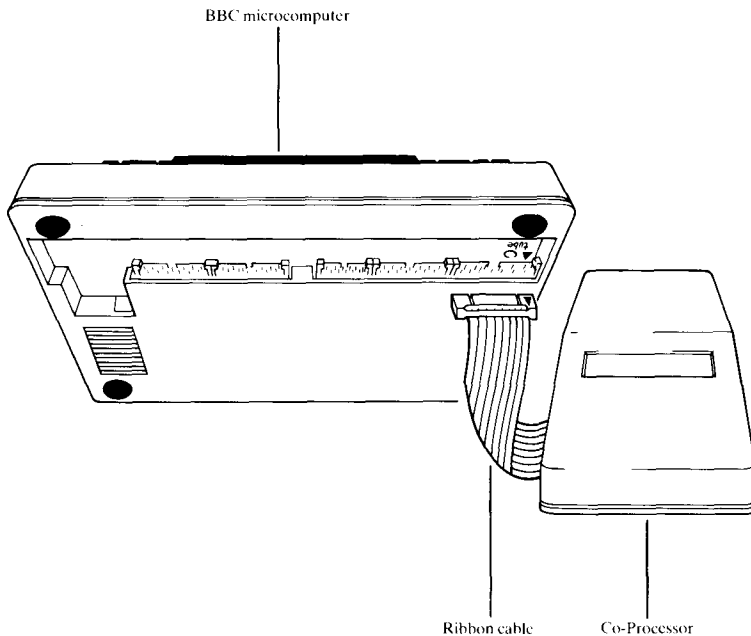


Figure 1 Connecting the Co-Processor



## 2 Starting up

Plug the Co-Processor in and switch it on. The power switch is on the rear panel, on the right-hand side looking from the front. Plug the BBC Microcomputer in and switch it on. The usual start-up message is replaced by:

```
Pandora 32016 version 1.00  
Memory size = 512 kilobytes  
Acorn DFS  
BASIC  
*
```

The version numbers may differ from those given above, as may the memory size, and names of the filing system and language which are printed on the fourth and fifth lines. For example, if the BBC Microcomputer has the NFS and VIEW as its two rightmost ROMS, lines three and four would say:

```
Econet Station xxx  
VIEW
```

### 2.1 Pandora

Pandora is a ROM based program which occupies part of the Co-Processor's 16K bytes of ROM. It performs several tasks, including communicating with the I/O processor (the BBC Microcomputer). Pandora prints a \* prompt, and passes input from the user to the BBC Microcomputer's command line interpreter. Users therefore have access to the usual \* commands such as filing system commands, \*FX, \*TV commands and so on.

Pandora also accepts and executes **(CTRL)** commands (i.e. VDU codes) such as the mode-change **(CTRL) (V)** command. The following programs run directly under Pandora.

```
BBC BASIC (Bas32)  
Assembler output (on request)  
Panos operating system.
```

For those such as Operating System developers requiring fuller details the Pandora kernel is documented in the *Panos Technical Reference Manual*.

## Part II Panos

### Introduction

Panos is the name given to the Co-Processor's operating system. Panos provides many facilities for writing, loading, and running programs. It also provides flexible ways of creating command files, so that a range of activities can be carried out automatically e.g. compiling, linking, and running large batches of programs.

Convenient access to the hardware for both programmers and end-users has been catered for, and it has been specially designed to integrate with the BBC Microcomputer hardware and software systems.

The minimum hardware necessary to run Panos is dual 80 track double sided single density floppy disc drives, giving a total of 800 Kbytes. It also needs to be loaded from a storage device. Depending upon your configuration, this will be a floppy disc, a Winchester disc, or an Econet file server.

Panos is supplied on double sided single density 80 track floppy discs. Before it can be used on your configuration, it must be installed, even if you intend to run it from floppy discs. Panos will not run fully on the discs as supplied; these are intended as a distribution mechanism only.



### 3 Installing Panos

To install Panos onto any filing system, follow the steps below:

1. Complete all the steps in section 3.1 This involves making copies of the distribution discs.
2. Carry out the instructions given in section 3.2. These show you how to start up Panos.
3. Now build a Panos system on your chosen disc filing system. Follow the instructions given in section 3.3 for the DFS (floppy), 3.4 for the ADFS (Winchester), and 3.5 for the NFS (Econet).

Refer to figure 2 for an overall plan.

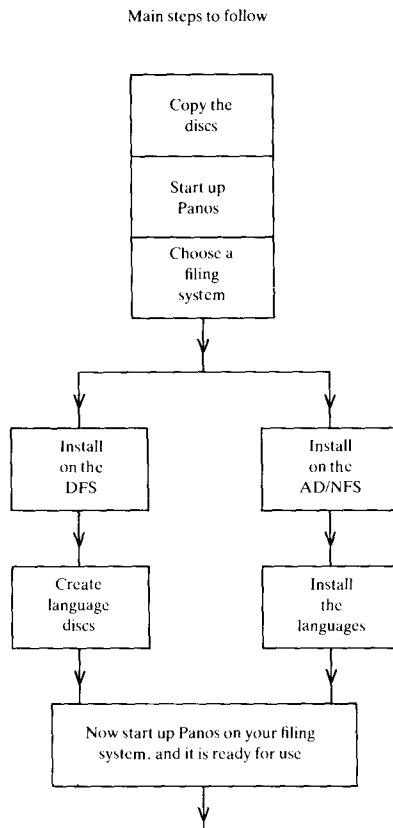


Figure 2 Plan for installing Panos

Before proceeding, you should be familiar with at least the introductory chapters of the relevant filing system User Guide. The *Panos Guide to Operations* also contains useful extra information about Panos, in particular the Panos view of the directory structure, which extends that of the underlying filing system. You may find useful the table entitled *File Types and File Name Extensions* in chapter 2. However, this guide is sufficient to get started.

### 3.1 Copying the original discs

It is very important that soon after receiving the software, you should make copies of all of the distribution discs on DFS format floppy discs. This ensures that should anything disastrous happen to your working discs, you will have the originals to fall back on.

The copying procedure involves three main steps:

1. Formatting seven discs,
2. Labelling the seven discs identically to the distribution discs,
3. Backing up the original distribution discs.

If you have problems at this stage, see Appendix B.

#### 3.1.1 Formatting the discs

The method for formatting DFS discs is explained in the appropriate *Disc Filing System User Guide*. If you have any other manufacturer's floppy disc, format these as usual.

#### 3.1.2 Backing up the discs

The next stage in the backing up process is to copy the distribution discs onto the newly formatted discs. As there are two sides to each disc, two \*BACKUP commands are required for each disc.

To back up a single disc, carry out these steps:

1. Ensure that the distribution disc is write-protected.
2. Insert the distribution disc in the top drive.
3. Insert the identically labelled copy disc in the bottom drive.

Type:

```
*ENABLE  
*BACKUP 0 1
```

When the prompt re-appears, type:

\*ENABLE  
\*BACKUP 2 3

Note that the \* prompt is printed by Pandora, the rest typed in by the user. Repeat this backing-up procedure for each one of the seven distribution discs.

After all seven discs have been copied, put the masters away safely so that in the event of an emergency you can retrieve the distribution software.

From now on, except in the case of BASIC, Panos and not Pandora will be used.

## 3.2 Starting up Panos

Having switched on your BBC Microcomputer and Co-Processor, follow these instructions:

Press and release BREAK

you should now see the Pandora \* prompt

Insert the start up disc (disc 1) into the top drive

Type disc

Type Panos

after a short interval, you should see the Panos -> prompt

Now set the date as shown in section 3.2.1

If the prompt does not appear, repeat the start-up procedure, making sure that the disc is the right way up (labelled side uppermost), and that you have the correct ROMs as described in Part I of this guide.

### 3.2.1 Setting the date

Setting the date and time must be carried out each time you start-up Panos after switching on the Co-Processor, or after a 'hard' break (i.e. **CTRL** - **BREAK**). To set the date and time type:

-> Set date

followed by the date and time. Several formats are permissible; these are documented in full along with the instructions for the 'set' utility in the *Panos Guide to Operations*. Example dates are: