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# **Introduction to Archimedes**

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**This module gives an introduction to the models in the Archimedes/A3000 range, and some information on configuring the machines and available upgrades.**

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The Archimedes range of machines first saw the light of day in Autumn 1987. There were two ranges of machines launched, the A300 and the A400 series. The A300 range was the 'base' model, with certain items (such as a hard disk controller) missing, and the A400 range was the full-blown Archimedes. The machines within a range were designed to be upgraded to the top-of-the range spec., but a machines from one range could not be upgraded to one from another (i.e. it is not possible to upgrade an A300 machine to an A400 machine.)

In 1989, these machines were replaced by a new set of machines: the A3000 and the A400/1 range. The A3000 was designed to take the place of the A300 machines, retailing at a lower price and with a reduced spec., and the A400/1 range replaced the old A400 range, offering essentially the same machine, but with some areas of the circuitry reworked either to cure problems with the A400 series or to improve it. The A3000 machine is the new 'BBC Micro'; the A400/1 range is called 'Archimedes.'

In 1990, the Archimedes range was extended by the addition of a new model, the A540. The A540 boasts a faster processor (the ARM 3. as opposed to the ARM 2 as used in all of the other machines), bigger video displays (up to Super VGA standards) and more memory - a 4MB A540 is standard, and the machines are expandable to 16MB as opposed to the 4MB maximum of the A400 series.

There have also been UNIX (an industry standard operating system which, unlike MS-DOS, is not tied to any particulary processor) workstations produced, based on Archimedes machines. The R140 is an A440 (or A440/1), and the R225 and R260 machines are based around the A540. The R260 is a very high performance UNIX workstation, offering 13.5 MIPS, 8 MB as standard, a 100 MB SCSI hard drive and high resolution colour graphics for under £5,000.

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## The A300 and A400 machines

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The A300 and A400 machines were the original Archimedes. They offered:-

A 4 MIP 32-bit RISC processor for extremely high performance;

A versatile video system which could generate displays with up to 256 colours in resolutions up to 640x512;

8-channel stereo sound generation, using samples to allow any sound to be generated;

An 800k 3.5" floppy disk drive;

BBC BASIC V, which was compatible with earlier BBC BASICs, but about 150x faster;

BBC Micro and IBM PC emulation in software;

Networking via Acorn's established Econet system.

The particular models available were the A305 and A310, with 0.5 MB and 1 MB of RAM respectively, and the A440, with 4 MB of RAM. In addition to the above, the A440 offered:-

A hard disk controller and 20 MB hard drive;

An ultra-high resolution (1152x976) monochrome video mode for driving 'workstation' monitors;

A backplane for expansion cards (fitted as standard; it was an option on the A300 machines) which could take up to four expansion cards, including a co-processor.

The A300 machines retailed for under £1,000; the A440 for £2,300.

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## A3000 and A400/1

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The A3000 is a development of the A300 machines. Like the A300 machines, it lacks a hard disk controller on the board, and is fitted with the maximum 1 MB of RAM which the board can accommodate. Unlike all of the other machines, it does not come in a 3-box (keyboard, system unit and monitor) arrangement; instead, it is supplied in an Amiga or ST-like case with integral keyboard. It has a RAM expansion connector internally which allows expansion up to 4 MB simply by plugging on a suitable expansion card.

The A3000 has a single external expansion slot, which can take a standard Archimedes module ('exPansion mODULE.'). It also has an internal expansion slot, which takes a much smaller card than the standard Archimedes slot, and is designed for the provision of 'small' add-ons. One firm, however, has designed and is marketing a hard card (hard disk controller plus drive) which fits in this slot.

The A3000 currently retails at £569.

The A400/1 series is a reworking of the A440, with a few bugs in the design fixed. It has a revised memory system, which can accept either 1, 2 or 4 MB of RAM. Hence there are now three machines in the range:- the A410/1 (1 MB), the A420/1 (2 MB) and the A440/1 (4 MB.) The three machines come with different sizes of hard disk:- the A410/1 has no drive, but the controller is there; the A420/1 has a 20 MB drive, and the A440/1 has a 52MB drive. The prices reflect the differences in spec.; the A410/1 retails at £1099, the A420/1 at £1299 and the A440/1 at £1699.

The machines find different markets. The A3000 is the most popular machine of the range, and is the favourite for schools and the home. The A400/1 is more used for scientific work (image processing, data analysis), high-end hobbyist use and professional work.

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## Arthur and RISC OS

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The Archimedes and A3000 machines are shipped with their operating systems stored in ROM, rather than being supplied on a disk. There are a number of advantages to having a ROM-based operating system: it takes no time to load from disk, there is no 'system' disk which must be present (and may need to be continually re-inserted) for the system to work, and the OS doesn't use up system RAM. Against this convenience stand the cost of a ROM-based operating system (a couple of tens pounds for the ROMs, as opposed to pence for a disk), and the difficulty of fixing OS bugs after the operating system has been released.

The original machines were shipped with an operating system called 'Arthur 1.2.' Arthur 1.2 was a development of the 8-bit BBC Micro operating systems; it was primarily command-line driven, and single-tasking only. It sported a number of bugs.

In 1988, Acorn released a new operating system for Archimedes (and A3000), RISC OS. RISC OS provides a number of features which weren't present in Arthur 1.2, primarily a complete, multi-tasking WIMP interface. The 'desktop' user interface, using icons (pictures) and a mouse rather than cryptic commands, is generally considered to be a major step forwards in user interfaces. Similar systems are found on the Apple Macintosh and, at last, on the IBM PC, with the release of Microsoft's Windows 3.0.

Acorn estimates that over 90% of machines supplied are fitted with RISC OS; all new machines are. Hence this document will assume that machines are fitted with RISC OS; if they're not, then it's about time that they were!

RISC OS offers a tree-structured filing system, integrating network, floppy disk, hard disk, CD-ROM and whatever may come in the future into one. The desktop supports co-operative multi-tasking (a task gives up control, rather than having it taken away), which allows the user to run more than one program 'at once.' The desktop is driven by a three-button mouse, each button of which has a defined function. Applications which conform to this definition present a consistent interface to the user, which makes learning a new application quick and easy.

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# Operating System Structure

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Like many operating systems, RISC OS is designed as a 'kernel', which provides the core O.S functions and is extended by a collection of 'modules', each of which extends the operating system in some way.

These modules may reside in ROM, or in a special area of RAM called the Relocatable Module Area, or RMA. The RMA is used by ROM modules as workspace, and is used by modules which are loaded from disk.

In order to see which modules are loaded, find the '\*' prompt (hit f12 if in the desktop) and type 'MODULES<return>'. A list of the modules present will be displayed on the screen.

It is possible to remove modules from the operating system, either temporarily, by using the 'RMKILL <module name>' command, or more permanently, using the 'UNPLUG <module name>' command. RMKILLED modules re-appear when the machine is reset; UNPLUGged modules don't, as information on which modules are unplugged is stored in the machine's CMOS RAM, a few bytes of memory which is powered by batteries when the machine is turned off.

UNPLUGging modules can have serious side effects. It is possible to unplug the sound system, and even the filing systems. There is, of course, a way to find out which modules are currently unplugged and to plug them back in. Typing 'UNPLUG' without a module name will return a list of modules which are unplugged. These can then be restored to life using the 'RMREINIT <module name>' command.

Some pieces of software, especially games, unplug modules in order to free memory for the game to run in. On completion, it may not restore the modules which it unplugged. Typically, this will cause errors like 'SWI &40130 not known', 'SWI name not known' and 'File 'xxx' not found', as programs attempt to use the calls provided by the unplugged modules and find that they no longer exist.

RMREINITing the unplugged modules will cure errors of this type.

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# Software Problems

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There are two prime causes of software problems: shortage (or mis-allocation) of memory, and the !System directory being in the wrong place.

## Memory Shortages

Errors such as 'No room in RMA' and 'Application requires at least 256k to start up' indicate that there is not enough memory, or not enough in the right place, for the action requested. Use the task display (from the task manager icon) to alter the amount of memory allocated to the various areas in the machine. Sensible settings for these are:

Font Cache:	0-96k, depending on whether anti-aliased fonts are being used and if so, how many;
System Sprites:	Ok. This area is provided for Arthur compatibility.
RAM disc:	Ok, unless a RAM disc is to be used.

The other entries will change themselves dynamically, and should not require to be changed by the user. There are two ways of changing the sizes of these areas. The first of these is by dragging the bars in the task display window; this will only last until the machine is reset or turned off. To change the default values (those used when the machine is switched on), it is necessary to change the contents of CMOS RAM, using the 'CONFIGURE' command.

Typing (at a \* prompt) 'CONFIGURE (FontSize | SpriteSize | RAMFSSize) nK' will change the default size of that are to the size given. Note that this doesn't have any effect until the machine is reset.

## The !System Directory

Resources which are loaded from disk and may be required by many applications are stored in the !System directory. Errors such as 'Shared C Library not found' and 'System resources cannot be found' indicate that the operating system does not know where the !System directory is. Open a directory viewer containing the !System directory to remedy this problem. It is usual for the !System directory to be stored in the root of a hard disk; it may either be kept on a single floppy disk or on all floppy disks if a floppy-based system is being used.

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# Machine Configuration

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The previous page showed some uses of the CONFIGURE command. There are many more options which can be changed by the CONFIGURE command, and may affect the operation of the machine in a number of ways.

Some options (like keyboard repeat speed) can be changed using the !Configure program supplied with every machine, and for those options, this is the best way to set them. Some, however, like the number of disk drives fitted to a system, cannot, and for these the following commands may come in handy.

CONFIGURE Floppies <0-4>	Sets the number of floppy drives on the system
CONFIGURE Harddisks <0-4>	Sets the number of hard disks present
CONFIGURE Step <31416112>	Sets the floppy drive step rate (in mS) n=0:
CONFIGURE MonitorType n	Standard colour or mono monitor n=1: Multisync monitor n=2: VGA monitor
CONFIGURE Language n	n=0: powers up at * prompt n=3: powers up into desktop (default) n=4: powers up into BASIC.
STATUS	Lists the configuration options along with their current settings.

The use manual describes all of the configuration options in detail; the list above is intended as a short-form reminder of the most common ones.

The machine can be reset to its default configuration settings by holding down one of a few keys on the keyboard and turning the machine on. The key should be held down for a few seconds after power-on, to ensure that the system has 'seen' it.

Delete-PowerOn	Reset all configuration
R-PowerOn	Reset all but filing system information
0,1,2-PowerOn	Select monitor type (use key on numeric pad)
*-PowerOn '	Power up at * prompt

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