

BuildA4

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ACTION	NAME	DATE	SIGNATURE
WRITTEN BY		August 24, 2024	

REVISION HISTORY

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Chapter 1

BuildA4

1.1 How To Build An A4000!

Build Your Own A4000

Typed & Edited by Craig

This file tells you how you can modify an A1500/A2000 Amiga so that's it has the same specifications as the A4000.

THE PROS AND CONS:

ADVANTAGES

Faster than stock A4000 *
Better Colour Resolution *
Compatible with existing software *
Better Performance / Price Ratio *

DISADVANTAGES

* Non-AGA software compatible
* Custom chip operations are slower than A4000
* Zorro II standard only

FINAL SPECIFICATION:

Graphics - 24 bit (16.8 million colours)
Processor - 68040 @ 33 Mhz (20+ MIPS)
Chip Ram - 2Mb
Drives: SCSI and High Density Floppy Drives

INFORMATION ON THE PROJECT:

Make no mistake, the A4000 is an excellent machine. You might well wish to buy one - but could you build your own cheaper?

I'm not suggesting that you go out and buy a soldering iron and send off a large order for electrical components to Maplin, but could you construct a machine of similar performance from third party expansions that are readily available? Could you upgrade your present machine to A4000 performance, without having to actually buy a real A4000?

To start with, you will need some form of Amiga, and unfortunately nobody but Commodore seems to make them.

So which of the range would you start with? The A500 is a good solid

workhorse, but lacks the expansion capability that we would need for this project. The A2000 would be a better choice, but you can get a even better bargain with the A1500.

For £399 Silica will sell you a 1500 with a load of software and a PC Bridgeboard thrown in. Second-hand you can easily pick up an A1500 with some form of hard drive for about £450. Check through local papers, the small ads and classifieds in Amiga Shopper Magazine.

The A1500 has plenty of room for expansion. It boasts a total of seven slots for PC and Amiga expansions, plus a CPU slot for accelerator cards and a video slot to plug custom video cards in.

You've got the basis now, but you'll need to expand quite heavily to get anywhere near the specifications of the A4000.

Those AGA chips are all the rage in 1993 and are probably the first thing to worry about. The A4000, in case you're not aware, uses the completely updated AGA (Advanced Graphics Array) chip set which has a number of extra graphics modes.

The most important of these is HAM8 mode, which enables suitably equipped machines to display hi-res images up to 264,144 colours. Not bad, really. The 256-colour mode is more useful on an everyday basis, though, because it doesn't use up any valuable processor time.

There are no ways that you can upgrade an older machine to the AGA chip set. It isn't just a matter of popping in a few chips or anything like that. The AGA chip set involves a complete new architecture which affects the way the entire motherboard of the computer is laid out. But if the major difference is just a few graphics modes, why bother?

There is a number of very cheap display cards available for the Amiga. These don't bother with HAM8 and all that cunning kludge business - instead they go straight for 24-bit, which gives you a total of 16.8 million colours to play with.

One tempting choice of 24-bit card is probably the MacroSystem's Retina, which is the original, useful, inexpensive 24-bit graphics card. The Retina is much more than just a display device, though. As well as performing framebuffer tasks, such as displaying static images, the Retina can also handle animations.

Probably more important is the ability of the Retina card to display normal Amiga application screens. This is done by using an emulation program and a software library to redirect Workbench.

It is a form of retargetable graphics, in that the software fools the applications into opening windows on the Retina display rather than the usual RGB Out at the back of the Amiga.

This feature works without the co-operation of the particular application in question, so it is quite cunning. However, it is not always entirely successful.

Retina does not support screen dragging, so you can't look at two tasks simultaneously. It therefore has problems with programs such as Deluxe

Paint, which open tool bars and requesters using over-lay screens on top of the main screen (such as the Palette requester).

The upshot of this ability to display application screens, is that you can happily run many applications, including Workbench itself, through the Retina. While the programs may not be able to take advantage of the extra colour resolution, some of them can take advantage of the greatly increased pixel resolution.

The Retina can display screens at up to 1440 by 566 pixels in a non-interlaced screen mode. Many applications, such as Directory Opus, Professional Page, Professional Draw and Maxiplan 4 can make use of this enhanced pixel resolution.

Speed is the second thing you have to worry about. A graphics card will help out here, because it uses its own graphics memory which is incredibly fast, but obviously you will need a new processor card to match the power of the A4000.

The 4000/030 runs off a 68EC030 clocked at 25MHz, so obviously you are going to need something better than that to impress your mates.

There are quite a few accelerator cards available for the Amiga, but probably the fastest and best in terms of compatibility is the G-Force accelerator from GVP.

This comes in many versions, but the top spec model includes a full 68040 chip running at 33Mhz. The card also includes an extra serial and parallel port and a SCSI interface. 32-bit wide memory can be added to the board up to a total of 64Mb, using GVP's own 16Mb SIMM modules.

Also still available, although no longer in production, is the Zeus 040 card from Progressive Peripherals. This card is very similar to the GVP one, but is slightly faster.

In order to be faster than the 4000/030 all you really need is an accelerator which has a 68030 clock at more than 25Mhz. If you got the 40Mhz '030 version of the G-Force card, you would only have to shell out £699 - not bad really, as this gives you a RAM platform and a SCSI interface as well as a fully functioning 68030 chip, clocked at nearly twice the speed of the one in the A4000/030.

An FPU, incidentally, is a maths co-processor which works in tandem with all processors from the 68020 up, and dramatically reduces the time taken to perform many mathematical calculations.

Memory, and lots of it, is the other big advantage that the A4000/030 still has over our Frankenstein machine. Even the meanest of distributors is supplying the 4000 with 1Mb of Chip RAM and 1Mb of Fast RAM on board.

Matching the Fast RAM capability isn't really a problem. It is usually solved at least in part by your accelerator card. Most accelerators, including the G-Force which we picked out previously as a good bet, have slots for 32-bit wide Fast RAM.

The RAM is usually installed as either a ZIP or SIMM package, readily available if you search through the small ads of Amiga Format. 32-bit RAM

gets over the Autoconfigure memory limit (9Mb with Kickstart version 2). 32-bit RAM can be mapped "Over the top" and be directly accessed by the processor on the card.

In practice, this 32-bit RAM is faster than the 32-bit RAM on the A4000, because it can be accessed in such a direct fashion without fiddling around with all the messy Bus protocol that slows down memory operations on the A4000.

This doesn't solve the other problem, though. In non-AGA machines, the maximum amount of Chip RAM which can be used by the system is 1Mb. This is normally enough for most people, but if you use applications which make extensive use of custom chips, it may be a bit restricting.

This sort of thing affected is samplers, graphic programs such as DPaint and any thing which uses HAM. This software relies heavily on the custom chips, and since the custom chips rely on Chip RAM, you may find yourself short. Chip RAM may also be required by other devices which make use of the custom chips.

The answer to this problem is the Power Computing Megachip2. This is a small board, complete with a 2Mb Agnus and four Zip packages, which simply plugs into your existing Agnus socket. The only problem with this is that as your original Agnus is still in the socket you will have to remove it.

When the board is in place there are four crocodile cables to connect to your Gary chip, and then you are set. Make sure you get the right connections otherwise you could do some damage. You will know if you got it wrong, because the Amiga will probably just display a red screen at boot up. Probably the most important thing is to get the chip the right way round.

High Density disk, if you want to get really fussy, are probably next up, doubling the storage capacity of each floppy you use. Commodore plan to do an official HD upgrade for the A1200, but there are no plans for the older machines: which is a bit of a shame, because after Kickstart 2 they are all capable of running HD drives.

Fortunately, Power Computing have now released an internal version of their much celebrated XL drive. The mechanism comes in two versions, one for the A500/A1500 and one for the A600/A1200. Both versions use a high-quality Sony mechanism which actually transfers at speeds slightly faster than the A4000's internal drive.

The drive can also be used by CrossDos to access high-density PC disks, just like the A4000. The final formatted capacity of your disks under AmigaDOS will be up to 1.8Mb (depending on which filesystem you choose). PC formatted disks will be the standard PC capacity, 1.44 Mb.

On the hard drive side of things, the A4000 comes complete with an IDE interface and mechanism. This is a great bone of contention between enthusiasts and Commodore, because although the drives are cheap, they are not as fast as a SCSI mechanism. This is an excellent opportunity to go one up on the A4000 owners by getting a SCSI card, or even a SCSI 2 card which is faster still.

SCSI 2 can give transfer rates of around 5.5 Mb/second. This interface is

included with the G-Force accelerator, or it can be obtained separately in the shape of something like an HC8 card or Trifecta.

What in the end do you make of it all? Looking at the prices, it becomes apparent that, depending on the kind of deal you get when getting hold of some of the older stuff (the prices of a lot of older GVP equipment have been falling for some time) it would probably be slightly more expensive to upgrade your A1500 to the top specifications. However, these specifications are far in excess of the A4000.

If you already have an A1500 or A2000, then it would probably be more financially prudent to upgrade than try to finance a completely new machine. Remember that you don't need an '040 accelerator to beat the A4000/030.

If you compare the price for an A4000/040 (£1,799) against an upgraded A1500 (around £1,599) you'll see that it is possible to create a faster machine for less money. Be aware also that these prices are simply guidelines. If you shop around, go to shown or keep an eye on the local papers, you will probably be able to pick up most of this equipment, particularly the accelerator cards, for much less than the prices quoted here.

It is also something which can be more easily achieved in stages: starting say, with the A1500 and a SCSI drive, getting a display card, then the accelerator and finally the Chip RAM expansion - you won't find that you can't run anything without it, it just makes life a lot easier.

Adding things in stages not only keeps the outlay down, but also means that you only buy the things you actually need. You may find that after adding a graphics card and a hard drive, you don't really need anything else to achieve your purpose.

Ultimately, the changing price of software development will leave your machine not exactly redundant, but certainly disadvantaged in the years to come. On the other hand, Commodore are committed to producing a RISC-based super-machine, probably very late next year or early '95.

It may be worth the wait, but in the meantime an upgraded A1500 may be a good choice for the meantime.

WHERE YOU CAN OBTAIN THE PARTS:

Item:	Available From:
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Amiga A1500:	Silica or s/hand £399
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Retina:	Amiga Centre Scotland 0897 687 583 £345 (1Mb)
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G-Force	Silica Systems 081 309 1111 £699 - 1299
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Megachip2	Power Computing 0234 843388

£159

HC8:	Silca Systems
	081 309 1111
	£199 (42Mb)

XL HD Drive	Power Computing
	0234 843388
	£79.95

Grand Total = £1,880.95

HOW TO PUT IT ALL TOGETHER:

1. Remove the lid from A1500/A2000
2. Remove the drive and power assembly by undoing all the screws at the back and lifting it up. There is only a slot holding it at the front.
3. Fitting a Zorro card is easy. The Zorro cards are located at the back of the A1500. To insert one press firmly on the card to make sure it fits properly in the connector. The cards you wish to add are really up to you, but a hard drive should be high on the list.
4. Take note of the orientation of which way the Agnus chip is facing and remove the Agnus chip (this is the square chip) preferably using the correct tool - a PCL Extractor. If you don't have one of these then a jewelers screwdriver will suffice but if you use these, be careful not to rush or you may cause damage to the Agnus socket.
5. You can now fit in the Megachip board into the Agnus socket (consult the instructions which came with the Megachip board on how to fit it). I hope you made note of the orientation of which way the chip goes around!
6. To fit the XL drive you will need to disassemble the drive and power subassembly. Detach the spacers from under the old drive and add them to the XL.
9. Now fit the XL drive(s) into place.
10. Well done! It's now complete. All you've got to do now is replace the casing!

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