

This is one of 2 documents that might assist you in 'experimenting' with an X/Lisa with more than 2Mb of Ram. The Lisa design provides direct support for 2Mb maximum, so a few modifications need to be made to go further. These modifications are somewhat 'tacked on' which means they rely on certain assumptions about the operating system. This mod to the CPU board provides the needed 22nd address line for the memory boards to use. The principles that allow this to work without modification to the MMU are: Mac+ software always runs in the low 4Mb of Ram, where the MMU maps the addresses straight through, so we can take A21 straight off the CPU; MW+ maps the rom space (\$4xxxxx) up near the end of Ram, so when A22 is high, we want to go to the high 2Mb (regardless of A21) instead of the low 2Mb; The video page register has a free bit, which makes it easy to extend to 4Mb; The DMA page register does not have a free bit, which makes expanding it quite difficult, however the relative non-existence of hardware that uses DMA in the X/Lisa makes this tolerable. The other half of the 253 could be used to drive A21 low during DMA, which would probably be enough if a driver using DMA went through a buffer in the system heap. We use the "soft error" signal line which goes to the memory boards for A21; this line was intended for ECC memory boards, which are few. The parity error logic uses the "hard error" signal, so it still works.

Lisa Rom Dependence

I find that the latest Lisa roms (rev. H) do not support going beyond 2Mb. It is only the roms that come with the "square pixel screen modification kit" that do, so these are required for this to work. A little work with Nosy could fix the H Romms.

Problems with MacWorks Plus and 4 Mb RAM

I've had some interaction with Chuck about going to a full 4Mb and he sounds like he might get to it one day, but he seems pretty busy. At the moment, he maps out the \$3E0000 page, which screws up the video if there was ram there, so the maximum amount of memory currently workable is \$3E0000 or 3.875 Mb. The machine I'm typing this on is in this configuration. I'm not sure how much trouble it is worth to get that extra 128k.

RAM boards

To get more than 2Mb of ram, you currently need two memory boards. I have made and tested the appropriate modifications to LRambo style modified Apple 512k boards which are documented in the other file.

Good luck. Let me know if this 'documentation' is lacking in some critical respect. James MacPhail

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X/Lisa CPU board modification to support memory expansion

Rev. D

This modification to Apple X/Lisa CPU board is to support memory expansion beyond 2 Mb.

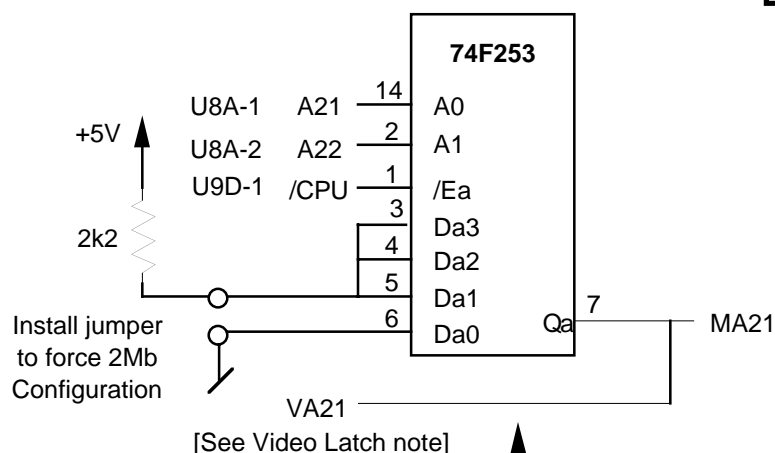
Notes: This simple modification does not support DMA.

(No common X/Lisa interfaces that I know of use DMA)

At the moment, only the "square pixel screen mod kit" roms acknowledge more than 2 Mb. of memory.

MacWorks Plus up to the current version 1.0.15 will run with up to 3.875 Mb (4 Mb - 128k) of ram.

It is not necessary to include the 2Mb jumper shown.



Add U2A - 74F253
Tie unused input pins to ground if desired.

Add extra bit to Video page latch.

Rev. B CPU Boards (no LED):

Cut trace between U11C-3, U11C-4.

Connect U11B-12 to U11C-3.

Connect U11C-2 as VA21.

Rev. D CPU Boards (with LED):

Cut solder side trace to U11C-10
(which grounded U11C-4).

Connect U11B-12 to U11C-4.

Connect U11C-5 as VA21.

/SFERR modification

Component Side

