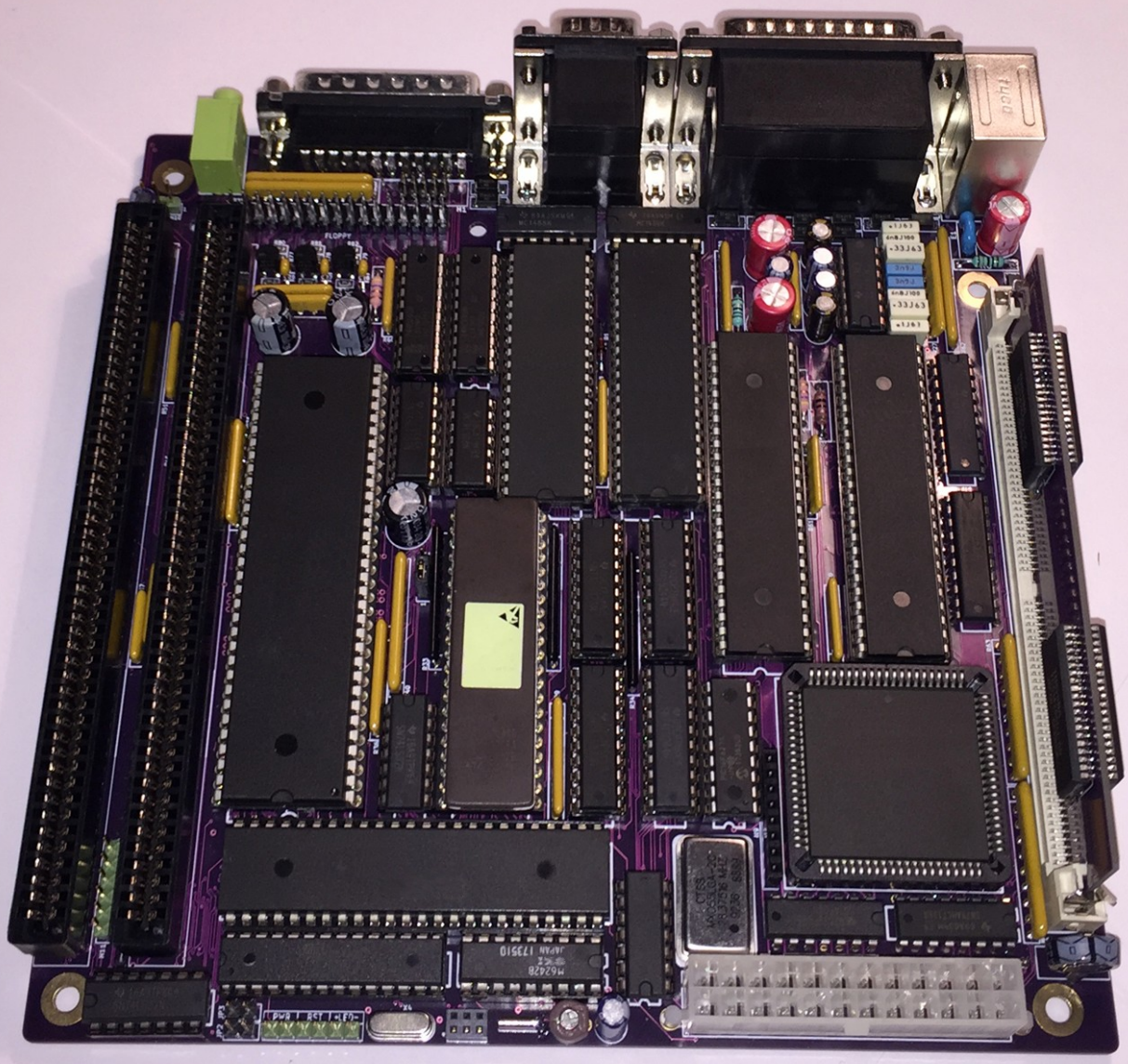
Manual



OVERVIEW

Introduction

This is a Mini-ITX form factor circuit board I personally called **Denise** during the development. But it doesn't have a name yet, actually it has nothing printed on it except important things like component reference designators. Just a clean professional looking design.
The goal of this project was to build a motherboard that is functionally fully compatible with my favorite computer from the early 90's. Namely the A500Plus but in a small modern form factor, much better expansion capabilities and some semi-modern amenities. Properly expanded, it's actually more compatible than the real thing with both really old floppy based software (demos) and modern stuff like whdload. So now I can enjoy the convenience of playing all my old favorite games from hard drive without any glitches. And if I feel like it, I could expand it quite a bit with graphics card, accelerator etc. and still fit everything in a small Mini-ITX chassis. Of course, everything is built throughout with genuine sillicon. This gives unbeatable compatibility and stability. The price hasn't been taken much into account, everything is designed exactly as I wanted it myself with only quality components. It's extremely expensive to build, but it's also extremely cool and well-designed. Everything has been thought through to the smallest detail and has been built in stages with several prototypes to get everything perfect. It's not a product for the poor nor for the masses. It is primarily for myself and a lucky few who happen to know me and can get an unpopulated PCB to build themselves. Since there is a minimum quantity when ordering PCB:s, I will surely have some left over. And that's why I took the time to write this manual, and also to have the project documented.

OVERVIEW

Features

- 1 x PS/2 connection for PC-keyboard or A4000 keyboard. Autosense, no jumpers needed.
- 1 x PS/2 Connection for PC-Mouse with autoswitch between mouse and joystick. Multi-button and scroll wheel support.
- 2 x Joystick connectors.
- 1 x Serial port (DB25)
- 1 x Parallel port (DB25)
- 1 x Internal connector for Floppy diskdrive with some extra features. With an expansion circuitboard you get both an internal & external floppy connector. You can switch if DF0: should be internal or external. Autosense if drive is not connected to save boot time.
- 1 x 3-pin header for internal audio connection.
- 1 x 3.5mm jack for external audio.
- 1 x C= standard Video port (DB23) (Only high quality RGB video) Designed with precision components and HF transistors with well thought out layout. It provides stunning picture quality on both CRT monitor and 15kHz TFT.
- 2 x 100-pos Female Card Edge Connectors (ZII compatible)
- Pin header for connection of power button, reset button and power LED
- 24-pin standard ATX power supply connector
- Support for full ECS chipset and 2Mb chip memory on a standard 72-pin 2Mb Simm (A4000 style)
- Bigrom support to run AROS kickstart or ROM bank switch (27C800).Bank switching is controlled by scroll-lock & remembers its state.
- Internal RGB-Video header with important signals for rtg cards, scandoubler etc. No more ugly external video cables on the back to get monitor switching with graphic cards.
- An IO output from the microcontroller allows on/off control on some expansion boards with NUM-lock. Great for turning off hard drive controllers and fast-ram cards when you want to run floppy-based demos.
- A pinball game mode for the PC-keyboard can be activated. This disables reset with the WIN/APPS keys. But you can still use them as Left A and Right A. F11 and F12 still work as AA and the reset is done with CTRL, F11,F12
- Realtime Clock backed up by ATX-standby power-rail and supercap.
- ESD protection on all IO-ports like Joy/Mouse port, Parallel port etc. Protects them rare precious custom chips.
- The entire audio-signal chain from Paula is built with high quality film capacitors and audio grade electrolytic capacitors. The filter has the same characteristics as an A500 Rev8. But less distortion.
- Manually routed multi-layer PCB ensures good signal integrity and makes it less susceptible to electromagnetic interference. Sturdy power-rails with plenty bulk-capacitance on CPU-socket to support power demanding accelerator cards such as 060-cards.
- All IC:s is through-hole mounted or sits in through-hole mounted sockets. Most surface mount components are on the back and the smallest are of the rather large 0805 size. This makes the board easy to build without special equipment.

Functional description

Jumpers & XR

JP2:
Switches between two modes when running PS/2 PC-keyboards. Normally it is not set. Then the keyboard has its default configuration, Typematic delay 500ms, 10.9cps.
Left A key is mapped to left Win and F11. Right A key is mapped to right Win, Apps (since right Win is missing on many small keyboards) and F12.
You can now reset with CTRL-LWin-RWin, or CRTL-LWin-Apps or CTRL-F11-F12.
With JP2 set, two things happen. Typematic is changed to 16 cps (This is not supported by all PC keyboards). And it disables the reset function for Lwin,RWin,Apps but they still work as Left A and Right A as usual. Perfect when playing pinball games because CTRL is so close to L-Win so it's very easy to accidentally do the reset. Now you have to press CTRL-F11-F12 to reset.

JP1:
Switches pin 1 of the ROM socket between A19 and ROM bank select.
1-2 ROM bank select
2-3 Bigrom (For e.g. AROS)

XR4
This should normally not be mounted. It is a precaution.
The Analog Video part uses HC logic. I have tested a couple of different variants of the Agnus 8375. And both have no problems driving CMOS levels.
But there is not much margin. And I don't have the opportunity to test all the revisions that have been made. So it's conceivable that there are some that could cause problems. The only signal this affects in that case is _CSYNC
So if you don't get a picture on a Video monitor but still get a picture on a VGA monitor with a VGA adapter, this could be the problem.
Then measure if you have _CSYNC on the Video connector. If not, measure pin 9 on U15. If _CSYNC is there, mount 4.7k on XR4 and this will probably fix the problem.

XC1:
IF MOS8375 = 318069-10 Then XC1=0,22uF Mounted
IF MOS8375 = 390544-01 Then XC1=NOT Mounted
Seriously do not mount XC1 if it is not needed, even if it works it may eventually damage the Agnus.

XR1
NOTE! Do not mount this.
It is there to fix possible RTC problems.
If you mount it, the R66 MUST be removed.

Functional description

Floppy-Connector

XR2: Mount 0R to put _MTRX on NC-pin 6 of the floppy-connector.
XR3: Mount 0R to put _IORESET on NC pin 14 of the floppy connector.
These signals are required for an expansion board that can be mounted above the floppy connector.
This card allows both an external drive(DF1:) and an internal drive (DF0:) to be connected simultaneously.
On this board there are jumpers that can route all signals correctly in order to switch the location of DF0: and DF1:
Many external disk drives have electronics that prevent the drive from functioning 100% like DF0:
All system friendly stuff works, but some demos hang right away. I've been trying to find a workaround for these problem drives, it seems that the timing of the RDY signal is not quite right, and many demos depend on it. And also some games.
Of course everything works flawlessly with DF0: as internal and DF1: as external as it should be.
And if you plan to have only one internal drive, you don't need to mount XR2 and XR3. All drives I have tested don't have anything connected on
these NC pins. But you never know if a drive will turn up that happens to have some function on these. That's why these XR.

The MCU can detect if there is a drive connected. It does this by checking Pin 5 which should be GND. In the drives I tested
it has been GND. But it is possible that there are drives where not all GND pins have been connected. Then the MCU thinks that there is no drive connected and signals incorrectly to the system software. The purpose of this feature is to avoid waiting for the computer to boot without a floppy drive connected.
And you also avoid the annoying icon with lots of ???.
If you happen to have a problem drive, you can set Jumper JP3. This overrides the detect function.

So to sum up, if you don't want any extra functions on the floppy connector so it works the same as in an A500,
do the following:
Mount JP3
Do not mount XR2
Do not mount XR3

Header pinouts

H10 (Audio Out, disables when 3,5mm jack is connected)
1: Audio Left
2: Audio GND
3: Audio Right

H1 (Internal RGB-Video)
1: Green
2: GND
3: Blue
4: GND
5: RED
6: VSYNC
7: HSYNC
8: Video Chassis GND
9: +5V
10: _CCK

Functional description

H11
IO and debug header
1: GND
2: This pin is controlled by NUM-Lock. When activated, it sinks current. If not activated, it is Three-State. There is 68R in series with it so it is fairly safe to connect to various expansions. Convenient for disable expansions that have jumpers for it. State only changes when a reset or power cycle is done. I personally use it to turn my IDE card off and on.
3: PB5 (Reserved for future functions)
4: RX
5: TX (Connect this to RX on a USB-UART-TTL cable to get debug information from the MCU)
6: +5V

H9
Signals that are useful to have for various internal expansions that piggyback mounted.
1: _INT6
2: _INT2
3: _OVR
4: Autoconfig first in chain, before ZII-slots.
5: CDAC
6: _CCKQ
7: _CCK
8: 28MHz

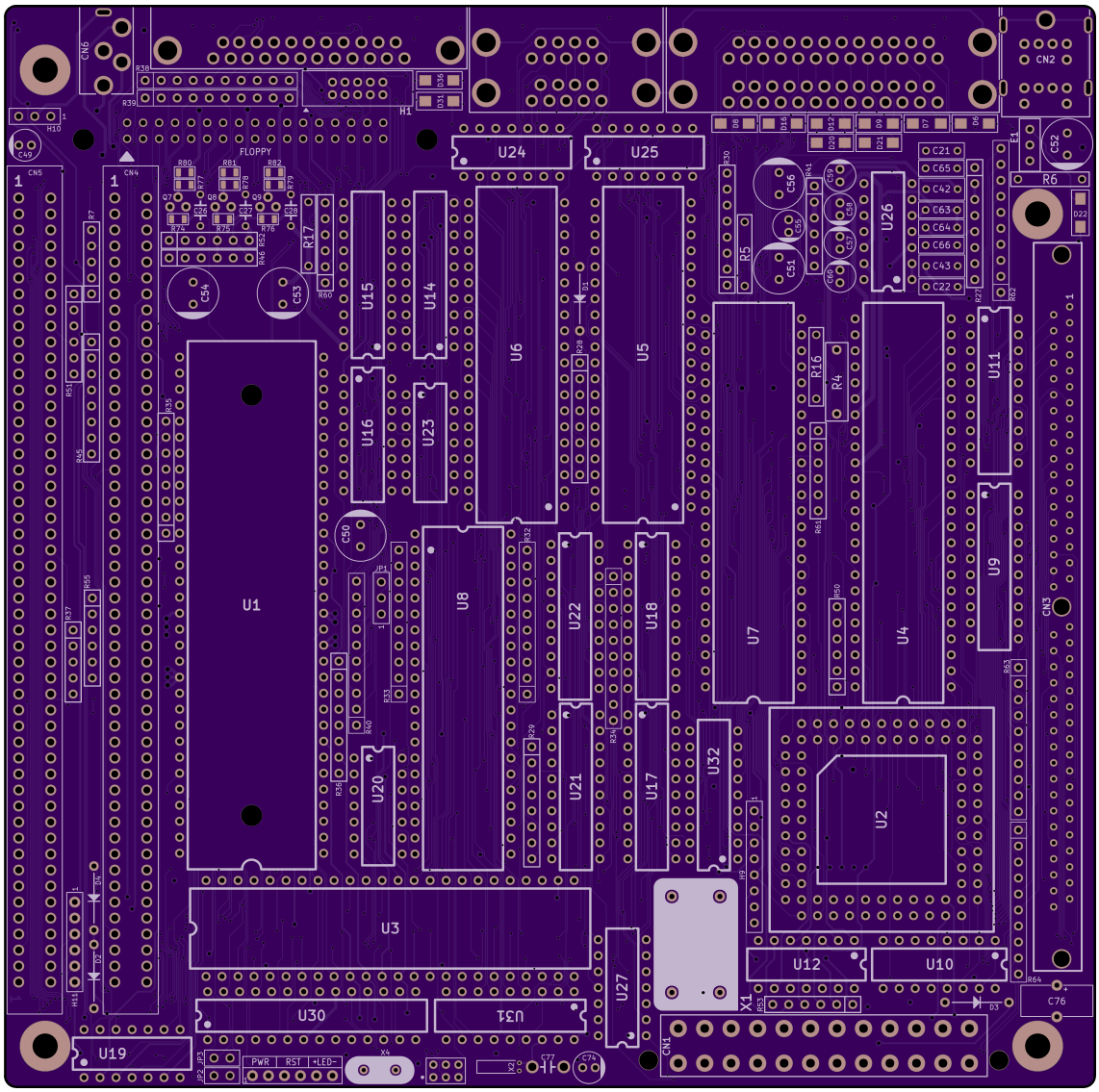
PS/2 connectors
Connect the keyboard before connecting the main power to the power supply. The MCU that operates the keyboard and other functions such as Power, Reset buttons, etc,
are powered by the standby power rail. It only re-detects the keyboard after the power supply has been completely de-powered.
This is meant to save boot time. Some PC-keyboards may take a while to do their self-test.
If no keyboard is connected, it will assume the A4000-keyboard. The MCU remembers which keyboard is plugged in between soft-power cycles.
As soon as the main power is connected, the computer will start up briefly by itself and then shut down again. This is normal and it is during this time it detects the keyboard type.
To see information about what is going on, you can connect a USB-UART-TTL cable to the H11.
There you can also get some other information about what is happening at startup.
Can be useful if something goes wrong.

The 72-pin Simm
There is no memory on the mainboard. For 2Mb chipmem, a standard 72-pin 2Mb simm is used.
The simm memory in the picture is a genuine 2Mb 72-pin simm with the correct memory organization. Consequently, it will also work in the A4000.
Make sure the simm and socket are oriented the right way. Look at the picture where you see that pin 1 is closest to the PS/2 connector.

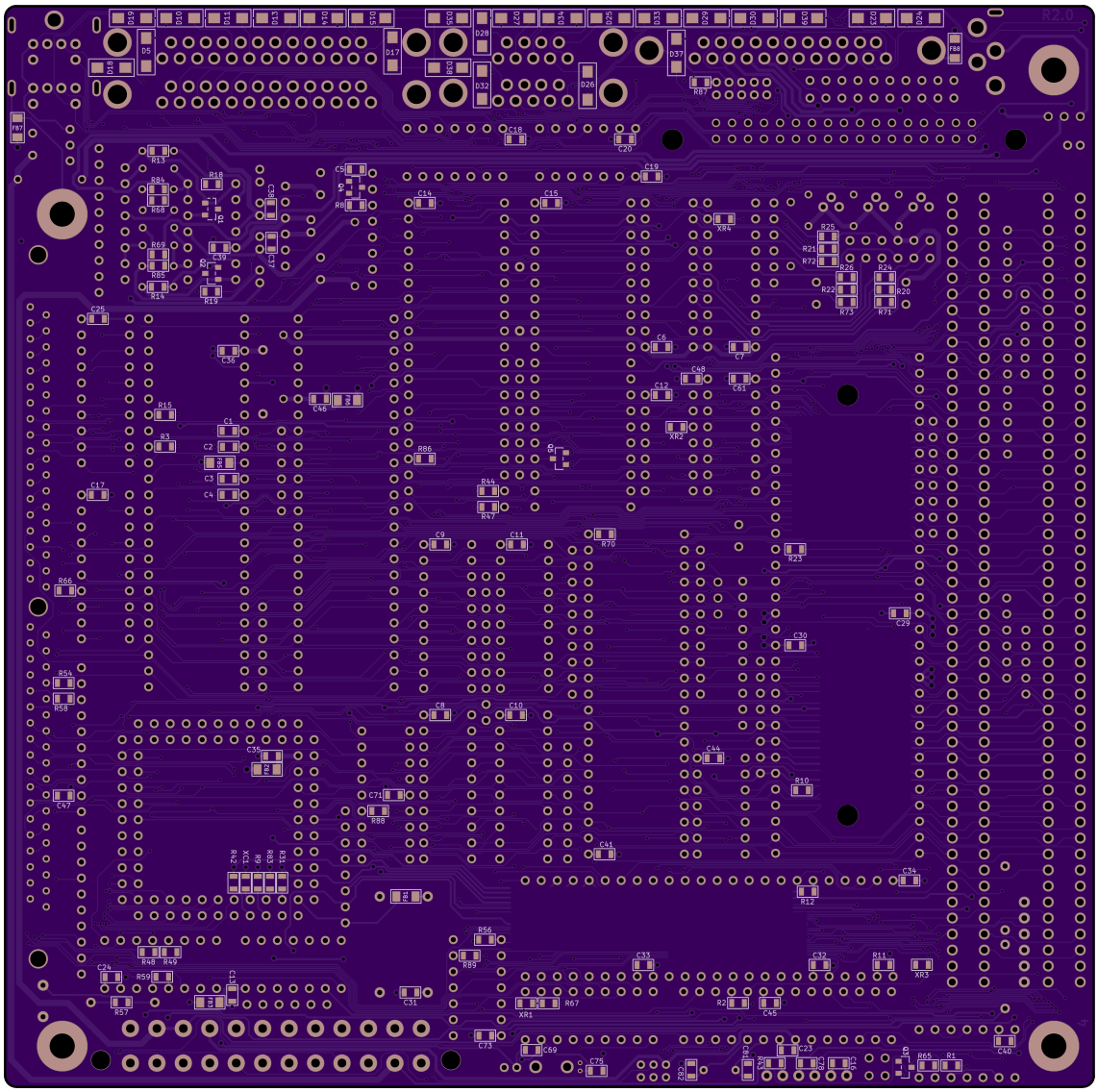
Building advice

Assemble all surface mount components first.
Measure all resistor nets and be sure to orient them right. They can be quite tricky to remove if things go wrong.
Wait to mount the ZII connectors. They are not needed for test run.
For test running you only need the video connector. The PS/2 connector may also be useful for test running. But it is not required.
Be sure to turn the SIMM socket in the right direction. Check the +5V in it before inserting the SIMM. There are sockets where the pins appear to be "backwards". So if you buy one other than specified, pay extra attention to this.
Without simm memory you should get green image.
If you manage to mount the wrong socket or turn it the wrong way, you run the risk of frying both the memory and the agnus and more.
Don't swap 74HC for HCT etc. It won't work. There are some 74LS you can swap to 74F and 74HCT. But it is not well tested.
Don't swap 74F to something else, it doesn't work. If it does work, there is a high risk that the computer will be very unstable.
Do not change the electrolytes to something else. There is a reason they are low profile. Namely that you can mount piggyback cards in the sockets.
For example, accelerator cards and the capacitors fit underneath.
In short, don't swap components in the parts list unless it's necessary or you're sure what you're doing.
I recommend not socketing U9, U10, U11, U12 because of signal integrity even though it would likely work. Mount Q7, Q8, Q9 as close to the circuit board as possible.

PCB Component placement



PCB Component placement



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