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Chapter 1

in

1.1   Contents

AMIGA 4000 D.I.Y. TOWER

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GREECE

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1.2   Preface

PREFACE

I bought my A4000/030 back in 1993 instead of an A1200, because I wanted to be able to put Zorro boards and various peripherals easily. After some years my setup had increased so much that the poor desktop had no space! Here are the specs:

68030 25MHz, 68882 33Mhz, 2MB Chip, 16MB Fast 60nsec RAM, kickstart v39.109, PicassoIV gfx board, Philips 107B 17" multisync monitor, Quantum 2.1GB IDE HD, Conner 540MB IDE HD, Hitachi 36x Atapi CDROM drive, Internal ZIP 100MB

Atapi drive, USR 56K external Faxmodem, HP DeskJet 695C. Also, I am waiting the new AmigaOS v3.5 with 3.1 ROMs and I want to buy a G4 accelerator board, a CD Writer maybe etc...

After I bought my ZIP drive, I had no empty bays in the desktop and Commodore had placed a full height floppy drive, not the standard half height that PCs have, so in order to place the ZIP, I had to cut the lower part of the plastic desktop face. Also, my desk was crowded, with the printer on the desktop. So, the need for a tower was raising. Tower has many advantages, such as smaller footprint, bigger power supply, more internal - external bays and other. But the price of an amiga specific tower is very high (£180), the price of a CD burner here in Greece! The price of a PC tower is significantly lower, about £30! Taking these facts in consideration, I decided to buy a PC tower and adjust my Amiga. The main problem to solve was that the amiga Zorro boards are parallel to the motherboard (daughterboards holds them and connects them with motherboard), but on PCs, the AGP - PCI - ISA expantion boards are connected straight to motherboard, so they are vertical to it. But all problems have solutions. This project was performed during July 1999, but it wasn't possible to write it down earlier.

The tower is working for over 6 months now, without any serious problems. My office is reformed, having more space for myself at last. Also, summer in Greece sometimes is getting very hot. Some noons, with temperatures near 40C, the case near fast ram SIMMs was boiling as PicassoIV card was directly above, and air getting out from the crowded desktop's PSU was a little bit warm... Now, I worked for hours my new tower in summer and everything was cool!

1.3   Dangers & Important Notes

DANGERS & IMPORTANT NOTES

Please do read carefully the following notes and indications:

1) I do not have any responsibility for any damages that you may have to your equipment (amiga, peripherals, tools etc.) or to yourself.

2) If you are not sure that you understood the project, that you are capable or experienced, that your knowledge on electronics is inefficient, then go buy a ready amiga tower.

3) Be sure you have the right equipment and tools for the job. It will make your life a lot easier and your amiga safer.

4) If you have any questions, ask an experienced person in electronics and amiga. Do not hesitate to contact me in my e-mail address: kostastheodo@yahoo.com

5) DO NOT throw to the trashcan anything from the amiga you just dismantled or from the new bought tower! You never know if something is wanted in future. Also, 2-3 parts of desktop are needed to build the tower.

6) Have all the materials in order, be gentle with the equipment, before you touch anything sensitive in static electricity, such as motherboard, ground yourself (touching a heating body for example) and remember the order you dismantled your amiga, so if anything goes wrong, put it back to its desktop case safe and sound.

7) Look at the Hardware Book site: www.serres.hol.gr/computers/hwb/hwb.html to find more about the PSU connectors and various schematics.

1.4   What You Need

WHAT YOU NEED

1) PC tower with an AT power supply (be careful NOT with ATX PSU). The difference between them is that ATX PSUs are controlled from the motherboard, so PCs can switch off or go to energy preserve modes with software commands (amiga can't support them). Also, they do not have a special +5V supply named PG (Power Good) needed for the amiga fast ram. Take care of the tower's size. Do not choose mini or small towers, because motherboard won't fit and they have few interior and exterior bays. Choose medium or large towers, which have the advantage of bigger PSUs and more bays. Most towers are divided inside in two vertical parts. Usually, upper part has the PSU and the exterior 5.25" bays - 3 (medium towers) to 5 (large ones). The lower has room for the motherboard - some have railways and a mount plate to place on the motherboard (prefer these, because is easier to fit the motherboard and you can drag it in and out the tower), some have prefixed arms for mounting motherboard screw holes - and 3.5" exterior (2 or 3) and interior (none to 3) bays. So, before you buy any tower, measure amiga motherboard and make sure that it fits in the lower department. Also, when you place motherboard on, it must have room on its lower edge

to fit the extention cables for mouse and joystick port to the rear face of the tower For those who live in Greece, the medium or large AT (NOT ATX) TurboX tower from PLAISIO Computers is just right...

2) Philips screwdriver, small metal cutter, wire cutter, soldering iron, cable joining clips (6 male - 6 female small and medium size), scissor, 2 male - 2 female 9pin DB9 connectors (for mouse and joystick), 50cm -9 wire inside- covered wire, electric isolation tape, 20-30 screws for metal and mounting clips for them (just like those which have car speakers).

The following items are not absolutely needed, but are very useful to have:

1) 9pin DB extention for mouse (it has short cable and while desktop was on the table, had enough length, but tower is on floor, so extention is needed - you can D.I.Y. if you want, just buy extra 1 male and 1 female 9pin DB connectors and some extra 9wire covered wire).

2) The same as above for joystick if its wire length is small.

3) Voltage meter (to make absolutely sure which PSU cable for the motherboard outputs the correct voltage). Here in Greece, electronic polymeters that count DC and AC voltage, amber, resistance and transistors, are very cheap, about £10.

4) Extra metal screws in various lengths, spirals and types.

5) Lots, lots, lots of coffee and patience...

1.5   Do It Yourself

DO IT YOURSELF

Now, if you feel ready and have got all the needed materials, you can start the building of your amiga tower. But to build, you have first to break apart...

Disassembling

Assembling

Power Supply

The Other Face

Making Bridges

Final Touches

1.6   Disassembling

Disassempling

First, open your new tower and observe it carefully. Watch what is included with (screws, metal faces for the rear to fit in different PCs motherboards, bases to hold the tower on the floor, plastic grid to hold the extention boards in place, cables for power and for front LEDs etc.). Remove the metal sides of the tower and unscrew the PSU from the rear face. Amiga's desktop PSU is 135W. Most towers have 200W (medium) or 250W (large) PSUs, so know you can fit any peripherals ever wanted without worry for room or power! Usually, the motherboard in most towers is fitted on the right side (the directions are always while front face of tower or amiga is towards you).

Then, you have to dismantle the desktop. Unplug all the cables (such as for monitor, printer, mouse etc.). Remove the cover (it has 2 screws in the upper rear corners). The interior of your amiga is lying in front of you. Remove your Zorro cards. Unplug all the PSU's cables towards peripherals or the motherboard (PSU is the large metal brick on the rear left). Remove all the peripherals such as CDROM drivers, ZIP drivers, floppy drives and hard disks. The hard disks bay is on the left of the PSU. It is formed by two metal corners. Left one is hold in place by 2 screws on a metal railway. The later connects the front face of the desktop metal case with the rear and has 2 screws, 1 on each edge (remove them and then the metal railway). The right corner is hold in place with another 2 screws mounted on the PSU. Between left corner and daughterboard (the later is a board that has the slots for Zorro boards and connects them to motherboard), there is a plastic corner to prevent short-circuits. Remove the HDs, unscrew and then remove PSU (2 screws in rear face).

The front plastic face is hold in place with 8 plastic arrows in 6 metal slots (2 left - 2 middle - 2 right). Press the arrows, one at a row, while you pull the plastic face in order to get the arrows out of the metal front and finally and the plastic face. From the front, 3 wires with connectors go to motherboard, for power - HD led and for keyboard lock. Remove them. Unscrew the exterior bay (it has place for a 5.25" and for two 3.5" drives. Remove the daughterboard (take care, it could be very hard if it is done for the first time). Remove the metal panel in the rear and left to the daughterboard which accepts the exterior outputs/inputs of the Zorro boards. It has a screw to its left face. Remove all the screws that hold the motherboard. Also, do not forget to unscrew the 2 sockets (one on the left and one right) of the serial port, where the screws of the serial cable mount on, else motherboard won't move. Now, you can remove motherboard from desktop - much dust on, isn't it! Underneath motherboard is a plastic sheet that prevents lower surface of motherboard to short-circuit with the desktop case. Well done, your amiga is now... apart for well!

1.7   Assempling

Assempling

Let's start building the tower! The descriptions and directions for the tower are given looking the left side of the tower. Front face is on our right and rear on left in order to look the mounted motherboard, which in most PCs towers is placed on the right side of the tower. Our first aim is to mount steadily motherboard in the tower. My tower had a metal surface with slots for PC's motherboard's screws. Some screws were in right place, some not. Use a drill with thin edge to make new holes, marked to match with amiga motherboard ones. Use screws for metal (aluminium) with thin edge, not flat to screw the motherboard on. DO NOT forget to place between motherboard and metal surface the plastic sheet you removed from desktop earlier. Also, do not place overpowered force to the screws, just to hold the motherboard well, not bending it from excessive force. My tower had on the rear face of the front a plastic grid like brick to hold the extra cards. Remove it. Place the metal surface with motherboard on the railway and slide it in, watching if contacts anywhere. Place the daughterboard with a full Zorro board (like PicassoIV) in motherboard (just touching each other, its does not needed to fit them in) and measure the distance between the right edge of the Zorro card and the rear surface of the tower's front face. Cut the plastic grid's height as above. PCs extention slots have same distance between them as amiga ones, so the plastic grid is suitable for holding your amiga Zorro boards parallel between them. It doesn't matter if you can't mount the grid on tower anymore, if your motherboard is on a railway like mine, screwing the railway will press and hold in place and the grid.

Do not place motherboard in tower yet. My tower has 3 exterior 3.5" bays. One of them is useless, because amiga's floppy drive is not a half height one, but full height. So, I mounted desktop's HDs bay in the tower, making an interior 3.5" bay for 2 half height hard disks! In my tower, the front of exterior bays is covered with metal pre-catted in such way, so if you want to place a drive in the bay, just waggle the cover back and forth to remove it. Bending this parallelogram piece of 5.25" near to one of its end, we have a corner. Drill a hole in the middle of the desktop's HD bay corner and screw the two corners together. Mount the upper side of the T shaped bay to the unused upper exterior bay of tower using screws and metal clips like ones that car speakers have. The same with other side. So, now you have an interior hard disk bay hanging from the tower's exterior bays. My A4000 has 68030 and its CPU daughterboard is very slim. If you have an accelerator board, its increased height may be preventing to place the extra interior bay. Also, keep the lower plastic face of the desktop, which is shorter than a half height one and place it over the amiga's floppy drive on the tower's exterior bay (full height and this shorter plastic face equals with two half height) in order to fully close tower's front face.

1.8   Power Supply

Power Supply

Now, its time to adjust the PSU supply to amiga's motherboard. Cut the edge of desktop's PSU with some wire (10cm) left on. If you find the male connector of PSU, you can override this step, but whatever electronics shop I searched I couldn't find the right one. 6 pin male connectors with 2 rows and 3 columns exists, but are not exactly same with amiga's one and you can't plug them to motherboard's female slot. Desktop's PSU cable colors are the following:

Orange: +12V (3)

Red: -12V (2)

Brown: +5V (PG) (1)

Yellow: +5V (4)

Blue: Ground (5 and 6)

Also, in this directory, there is a Drawstudio project of the following image: "Amiga2towerPSU.dsdr". Look at Photos & Schematics chapter Image (1) to understand. Yellow cable is fatter than others, because transfers more power to motherboard. Cut the edge of tower's PSU (it's not needed to leave any cable on the connector). AT PSU cable colors equals with the following:

Orange: +5V (PG)

Red: +5V (there are 4 red cables)

Black: Ground (there are 4 black cables)

Blue: -12V

White: -5V (not needed - cover it - not short-circuit anywhere)

Yellow: +12V

It is recommended to use a voltage meter to verify the above voltage of the AT tower PSU and of amiga's desktop one. Just connect them to AV socket, turn them on and meter voltages using as ground the case of PSU. Watch out, DO NOT TOUCH any naked cables!!! Join the amiga's desktop PSU connector's cables with AT tower PSU's ones using cable joining clips. Use the following guide (assuming that your desktop and tower cables match in color with mine):

Desktop Connector <----- AT PSU

Orange (+12V) Yellow

Red (-12V) Blue

Brown (+5V PG) Orange

Yellow (+5V) Red (all 4 together using wider clip)

Blue (GRD) Black (2 black on each blue using wider clips

Double check the above connections. Any mistake and kiss your amiga good-bye for ever!!! Peripherals do not have any problem with power supply, just connect tower PSU's connectors instead, they are the same as desktop's ones. Also, make two 9pin DB extentions, about 20cm long for mouse and joystick ports (male 9pin DB connector to female 9pin DB connector with 20cm 9wire cable between them, using soldering iron, watch out not to cross wires ex. pin 1 of male goes to 1 of female, 2 to 2, 3 to 3 etc.). Now, you can screw PSU back in tower.

1.9 The Other Face

The Other Face

Its time to make the rear face of tower. When you bought the tower, with it was provided a number of different rear metal faces in order to fit with the great variety of rear connectors of PC's motherboards. Find which of them fits more to amiga's motherboard. It is not needed to exact match. Cut what prevents the bigger part to fit and adjust from other rear faces catted parts to cover the whole rear face. Use some sticking tape for small parts, the main aim is to prevent dust going in tower. The rear of my desktop was in two parts, one bigger forming outer perimeter of rear face, having place for extention boards connectors and one smaller forming the center and having place for motherboard's connectors. PC's have their extention boards vertical towards their motherboard, so the slots in the rear face are vertical too. Amiga ones are parallel, so you have to cut the above slots in rear face (not in their full extention, but measuring the desktop's rear metal face for extention boards and fitting it to the catted opening - it isn't needed to screw it on the rear face, it can be mounted on the motherboard - daughterboard - Zorro board complex as it was in desktop too). Do not forget to mount the mouse and joystick ports extentions you made earlier to the proper rear face sockets using screws. Also, plug the 2 screws you removed from serial interface, in order to unmount motherboard from desktop, back.

1.10   Making Bridges

Making Bridges

An important issue is to stabilize daughterboard in tower. Place and screw the metal surface with motherboard on, with daughterboard fitted in tower. Do not forget to place on the inner side of the front face the plastic grid that holds Zorro boards parallel to motherboard and between them. Mount on tower the rear face of it you previously made. Use the same metal railway that stabilized daughter board in desktop. Screw the two edges of railway in inner surfaces of rear and front tower face, using, if needed, metal corners made as for the interior hard disks bay. Make sure that the whole construction is stable enough and that no short-circuits are possible or no one screw left free in tower or no one metal part is going to fall easily. Do not forget to connect mouse and joystick ports extentions from rear face to motherboard.

1.11   Final Touches

Final Touches

We are almost there! Some cables for tower's LEDs exit from the inner side of front face. We need only two of them, marked with HD and PWR letters on their connector edge (for hard disk and power led obviously). Connect them to the previously motherboard's front, to connectors marked on motherboard with HD and PWR. Each connector has 3 pins, use upper (right) 2 and make sure cable's connector marking letters are to the right, looking the front face of tower. The keyboard and mouse lock is not used anymore, I think it is not great protection, anyone who can opens the desktop's or tower's case can override it.

Place all the drives (CDROMs, ZIPs, HDs, floppies) in tower's bays and mount your Zorro cards in. If the construction you made is not as stable as desktop's one (the most probable), be careful with the force you put on daughterboard! Connect all the power cables from PSU to motherboard and peripherals, all the data cables from motherboard to peripherals and whatever other cables as you had and in the desktop. The inner of your new amiga tower is ready! Screw the right metal side of tower, but leave the left side open for any case some tunnings are needed.

DOUBLE CHECK ALL YOUR STEPS AND MOVEMENTS!!! Before power is on, make sure your amiga won't blow off. Check again and again for any minor problems, such as screws left free in tower, possible short-circuits, wrong power connector construction, even it is stupid or the possibility is very small or is just in your mind. Plug all the exterior peripherals (monitor, modem, printer, mouse, keyboard etc.) and power cable. If you are sure, switch your new amiga tower on and check everything is working right. Congratulations, your new A4000 is born!!! If any problem occurs, check Troubleshooting section. Also, a mouse cable extention is possibly needed, because desktop was closer than tower which stands on floor. You can make one or buy a ready made from almost any computer shop.

1.12   Photos & Schematics

PHOTOS & SCHEMATICS

The following images are from the tower I made with my good old A4000 desktop. There are from various views and stages of constructions, from interior and exterior. Also, there are photos of materials and tools needed to make this tower a reality. Next to image number is the image's filename in the directory. Also, they were designed for gfx card users in mind (large resolutions, true color etc.). For AGA users, the 2MB chip memory limit may prevent them. My advise: go buy a gfx card if you do not have one yet!

Image (1) "Amiga2towerPSU.iff"

It is a schematic of amiga's motherboard power supply connector, looking it from above, with its pins numbered.

Image (2) "AT_FrontOpen.jpeg"

The tower's front face with its exterior bays cover down ready to roll.

Image (3) "AT_HDcaseReady2fit.jpeg"

The D.I.Y. internal HD case ready to fit under the 3,5" exterior bays.

Image (4) AT_LeftSideOpen.jpeg + AT_LeftSideOpenZoom.jpeg

They are images from left side of finished tower (distant and zoomed).

Image (5) "AT_MBReady2fit.jpeg"

Motherboard mounted on its plate, ready to roll on the railway.

Image (6) "AT_MessyRoom.jpeg"

Well, be prepared to mess up your space to warp speed 10!

Image (7) "AT_Rear.jpeg"

Finished tower's rear face.

Image (8) "AT_RightSideOpen.jpeg"

The right face of finished tower.

Image (9) "AT_ToolsGood2Have.jpeg"

Small details that will make your life easier...

Image (10) "AT_ToolsNeeded.jpeg"

The absolutely minimum of tools for this project.

1.13 Troubleshooting

TROUBLESHOOTING

In this section there are problems you may have and solutions I have found to them, with possible causes. Before reading the following, make sure you constructed tower well, did not forget anything important and double checked the whole procedure.

1) Problem:

I have more than 4MB fast ram in 4MB SIMMs on motherboard and workbench shows that exist only 4MB of them. Or I have more than 1MB fast ram in 1MB SIMMs on motherboard and workbench shows only 1MB of them.

Reason:

Your PSU does not have +5V PG (Power Good) supply or you made wrong and used simple +5V supply to pin 1 of motherboard power connector.

Solution:

Check you made the right connections from AT PSU to motherboard. If you aren't sure that your PSU has +5V PG, remove PSU from tower and open its case. On the PSU's motherboard, next to each cable is written its voltage and PG has... what else, +5V PG written next to it. Also, if you have 4MB SIMMs make sure that the jumper which selects the capacity of SIMMs is in right position (consult A4000 User's Guide if you don't know).

2) Problem:

Caps Lock led is blinking after power up and keyboard doesn't work.

Reason:

Keyboard connector doesn't make right contact with socket. Desktop was positioned 90 degrees differently from tower. After 3-4 years, gravity had effect on cable's shape and slot shape. Caps Lock led blinks once during power up, for about half second and then doesn't blink anymore. If it blinks once for 2-3 seconds and then starts to blink continuously, it means there is a keyboard (connection) problem.

Solution:

Switch amiga off. Bend the edge of keyboard's cable back and forth and try to plug it better in tower, maybe pressing it little up, down, left or right and then switch on. You will find a place that contact is good and keyboard powers up without problem. After 1-2 months, gravity will have effect and this problem want appear.

3) Problem:

You switch the tower on, but hard disk led doesn't light, monitor goes to power saving mode (its led from green to orange), screen is black, hard disk doesn't boot up and pressing the two mouse buttons during power up has no result.

Reason:

CPU daughterboard doesn't make good connection to motherboard. You forgot to place your CPU board to motherboard. Your CPU board is damaged. So, amiga acts like as when it has not CPU, simply does nothing! I have disassembled my amiga many times and as result the CPU slot has been loose, making right contact difficult. Also, gravity may had effect as previous problem.

Solution:

Check if you have placed CPU board. If yes, check if you placed it right and tight. Press CPU board to the end of the motherboard's slot or to one or other side in order to make better contact. Make sure it doesn't short-circuit with anything else. After some tries, you will find the right place.

4) Problem:

As above, but not even the power led is on.

Reason:

You forgot to connect PSU's supply to motherboard or you didn't even connect the tower to AV supply. Worse, you made the connections totally wrong and blew motherboard apart...

Solution:

Connect the above. Check motherboard's power supply.

5) Problem:

Amiga boots up right, but power led and/or hard disk led are off.

Reason:

You forgot to connect the LEDs to motherboard or you connected them wrong.

Solution:

Some cables for tower's LEDs exit from the inner side of front face. We need only two of them, marked with HD and PWR letters on their connector edge (for hard disk and power led obviously). Connect them to the previously motherboard's front, to connectors marked on motherboard with HD and PWR. Each connector has 3 pins, use upper (right) 2 and make sure cable's connector marking letters are to the right, looking the front face of tower. Also, read again the Final Touches part of Do It Yourself chapter.

6) Problem:

Mouse or joystick are not working at all or don't work properly.

Reason:

You forgot to connect mouse and joystick port extentions to motherboard or the cable you made is wrong, meaning that some of its pins short-circuit or you connected wrong pins together.

Solution:

Check if you have connected the extentions and if the construction is right. Also, read again the Power Supply part of Do It Yourself chapter.

7) Problem:

Some Zorro cards do not work properly or do not work at all. For example PicassoIV card in P96 native modes work properly, but when flicker fixer is trying to show amiga native modes, screen blurs with pixels going from left to right.

Reason:

Daughterboard is not fitted tight in motherboard or Zorro cards are not fitted tight in daughterboard. You forgot to place some of the above. Zorro cards are touching each other making short-circuits or they are too close and overheating.

Solution:

Make sure you have placed right daughterboard and Zorro cards, tight and all the way in, that you have placed the plastic grid on front edge and the metal one from desktop to the rear edge in order to secure right distances between the Zorro cards and between them and the motherboard.

1.14 Tower Logo

TOWER LOGO

Most tower cases have a small square area in front to place the sign of company that made the tower. So, if you have a printer, you can easily make your own. Measure the area's dimensions, draw your Amiga sign, print it, cut the paper to form the area in right dimensions and using paper glue, stick it on the tower. Your PCs owning friends will have the biggest surprise of their life!

My tower has a square area with dimensions 26mm x 26mm. The following image is an example of the logo I made. In the directory there are variations, where the background (the Boing Ball) remains same and changes the font of AMIGA word, in 300dpi and 600dpi. Print them as they are. Their dimentions are 30mm x 26mm (I left some white border around in order to cut it more easily).

Also, in this directory, there is a Drawstudio project of the Amiga Tower Logo: "AmigaLogo.dsdr".

Tower Logo Example

1.15 Notes and Thanks

NOTES AND THANKS

The processing of all those files was made with my A4000, using Ed for text and guide documents, FinalWriter Lite (from AF) and Wordworth 5. Most images were scanned from photos taken with an old Panasonic camera (no zoom capability, this is the reason why some photos are blurred). I used my brother's PC (what a nightmare...) with its Agfa scanner to pass them as TIFF files to my ZIP drive and then to my Amiga and processed with ImageFX v2.1. The rest images were made from me using Drawstudio v1.1.

I would like to thank my wife Katerina, because she had the patience to see her house in a wild condition and mess during the construction of this tower and for providing me endless cups of coffee...

Also, thank God that this project worked and did not blew my amiga apart during my various experiments...