



Building A GPU Mining Rig

Documenting the recycling of an old gaming PC into a GPU based mining rig suitable for mining ZenCash and other GPU mine-able cryptocurrencies.

I wish to give full acknowledgment to Vosk of the VoskCoin Youtube channel for inspiring me and giving many great tips that I have shamelessly appropriated.

<https://www.youtube.com/channel/UCT44w6854K62cSiwA1aiXfw>

<http://voskcoin.com>

Mistakes and omissions are my own and will be gladly corrected.

@Spencer on Discord

A promotional banner for Zencash with a dark, atmospheric background featuring a bridge and a city skyline. The text is centered and reads: "ZENCASH IS A SECURE PLATFORM FOR MONEY, MESSAGES, AND MEDIA".

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Materials List

A word on materials: with the current craziness in component pricing, I am not going provide pricing. For instance, the **EVGA SuperNOVA P2 850W 80 Plus Platinum Modular Power Supply** that I bought from **B&H Photo Video** for **\$139.00** is now out of stock there. On Newegg it is going for **\$630.77** + shipping. All major components was salvaged from hardware on hand. Incidental items were sourced as indicated. All links are informational. They have been shortened by goo.gl and are not affiliate links.

An old working PC with Windows 10 Home
Gigabyte GA-Z97MX-Gaming 5 Rev 1.0 Motherboard
LGA1150 socket
4 PCI-E slots
1 x M.2 PCI-E connector
Intel Core i7-4790K - This processor is ridiculously over-powered for a mining rig
Coolermaster CPU cooler
32 gigabytes of RAM - you only need 4 gigabytes - I will use the excess RAM on other projects
EVGA SuperNOVA P2 850W 80 Plus Platinum Modular Power Supply

GPUs

High prices and low availability are common at time of writing.

Gigabyte GTX 980 4 gigabytes RAM
Gigabyte GTX 1060 3 gigabytes RAM
MSI GTX 1050Ti 4 gigabytes RAM
ZOTAC GTX 1050 2 gigabytes RAM

Other items

Plastic Shelving Unit - I got mine from Ollies discount store for \$34

12 inch x 12 inch plywood - 5/8ths thick - found in garage

Zip ties

Ubit 6 Pack PCI-E Riser Express Cable 16X TO 1X

Always have an extra in case one goes bad

<https://goo.gl/wmTorW>

Electop 2 Pack 2 Pin SW PC Power Cable on/off Push Button

<https://goo.gl/xYrhfy>

JacobsParts PCI Express Power Splitter Cable 8-pin to 2x 6+2-pin (6-pin/8-pin)

<https://goo.gl/537z7V>

Very useful. Order several and keep extras on the shelf

Hot tip from Vosk

Heavy Duty Self Adhesive Furniture Felt Pads

<https://goo.gl/HDSTu9>

P3 International P4460 Kill A Watt EZ Electricity Usage Monitor

<https://goo.gl/VvLy5k>

Useful to determine power usage of various items around the house

Not heavy duty

Figure out your daily power consumption and then remove from mains receptacle

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Materials List (continued)

Heat Resistant Kapton Tape

Use to protect risers from shorts

Keep for future projects

<https://goo.gl/KeVZdp>

Black Nylon Round Spacers - OD 7mm, ID 3.2mm, Not Threaded, for M3 Screws, Plastic - (Pack of 100)

<https://goo.gl/vmQ1Ex>

Steel Sheet Metal Screw, Black Zinc Plated Finish, Pan Head, Phillips Drive (Pack of 100)

<https://goo.gl/JGX5YG>

Tools Needed

Awl or Ice Pick

Phillips Screw Driver



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Prepare Your Plywood

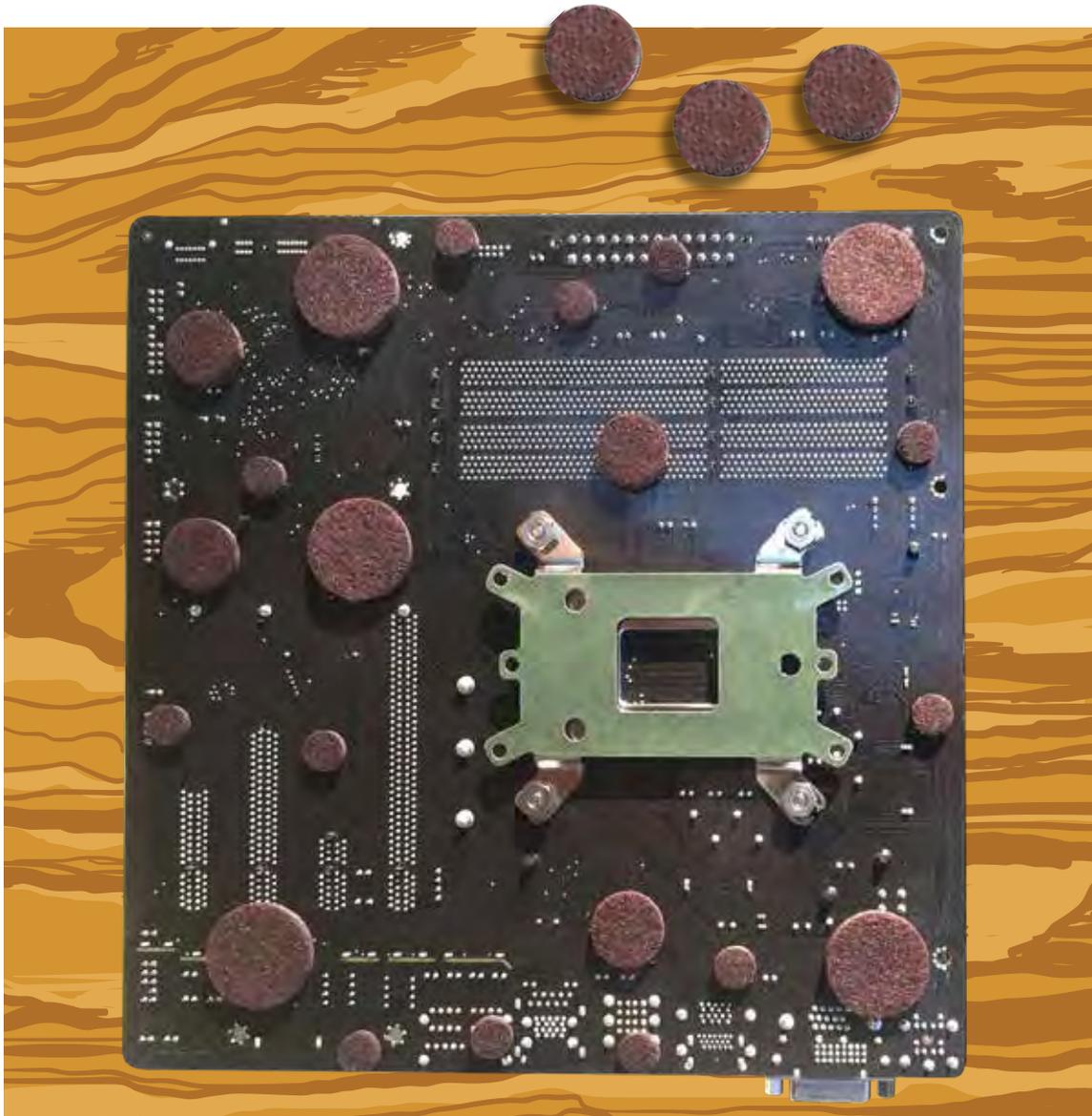


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Preparing Your Motherboard - 1

As my motherboard was salvaged from a working PC, the CPU, CPU Cooler, and RAM were already installed. If you need help with installation of these items, Youtube.com has lots of instructional videos.

Rather than use standoffs, I am using adhesive-backed felt pads to add support to the underside of the motherboard and raise it from the plywood.



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Preparing Your Motherboard- 2

Place your motherboard with the input/output edge slightly overlapping the front edge of your plywood. This will allow you to mount GPUs directly into the PCI-E slots of your motherboard without interference, if you do not wish to use powered risers. 5/8ths plywood gives plenty of height.



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Preparing Your Motherboard- 3

Notice the mounting holes on your motherboard. Yours may differ from mine.



Preparing Your Motherboard - 4

Use an awl or ice pick to mark the positions of the mounting screws.



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Preparing Your Motherboard - 5

Use electric drill with small drill bit to make pilot holes for the screws.



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Preparing Your Motherboard - 6

Insert a sheet metal screw into a round plastic washer for as many mounting holes as are required for your motherboard.

Screw each into the previously drilled pilot holes, securing the motherboard to the plywood. Do not bend the motherboard excessively. A snug fit is all that is required.



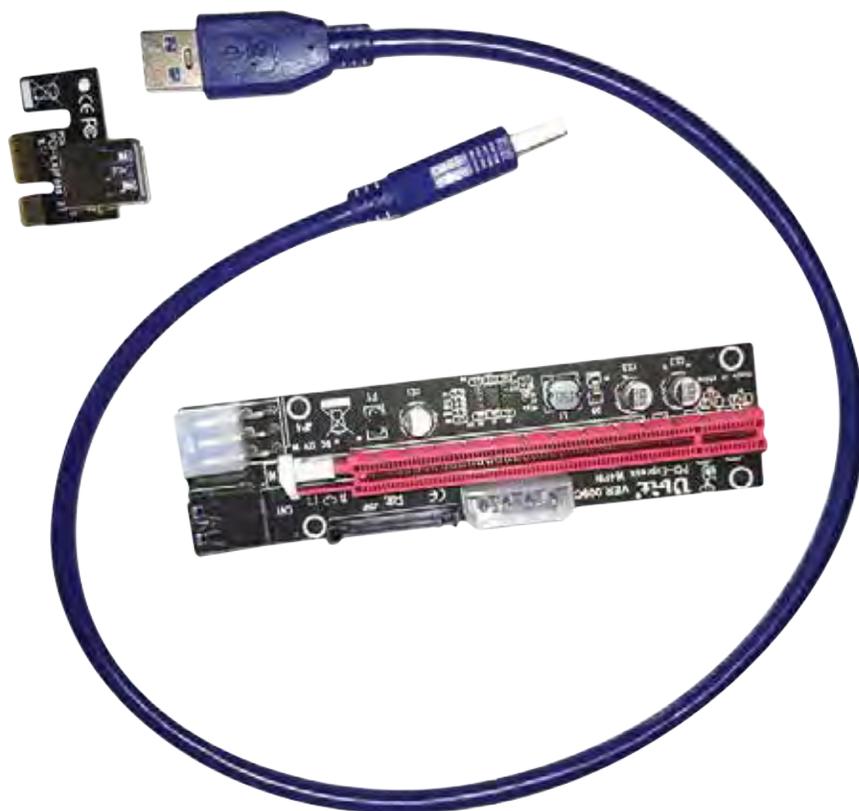
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Preparing The Powered Risers

I will not be mounting my GPUs into the PCI-E slots on my motherboard because I have 4 GPUs and one of the PCI-E slots would be unavailable due to the spacing of the slots on this motherboard. Instead, I will use powered PCI-E risers which move the PCI-E slot to a location determined by the length of the blue USB cable. The USB cable will provide the path for data between the GPU and the motherboard.

Cryptocurrency mining is computationally intensive, but large amounts of data are not moved so the USB cable is ample for the purpose.

Find the following parts from your powered riser kits. You will need one set for each GPU.

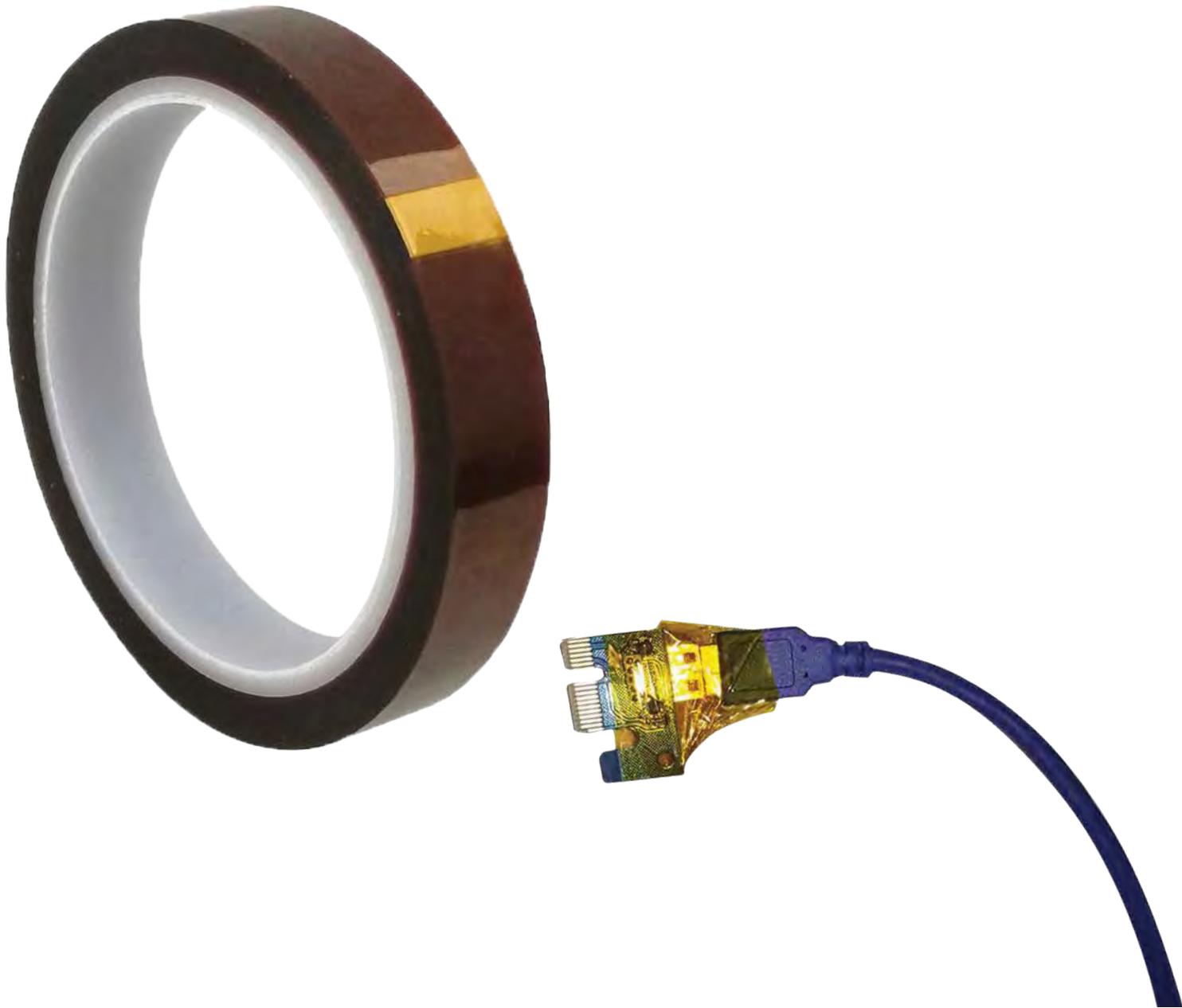


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Preparing The Powered Risers

Insert one end of the blue USB cable into the small daughter card that came with the powered riser kit. Then use the heat-resistant tape to secure the USB cable to the daughter card. Be sure to cover all the solder points on the card. This will prevent any chance of electrical shorting from an exposed solder point.

Repeat as necessary.



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Preparing The VGA Cables

In my case, I had two GPU cards that only took power from the PCI-E slot. Since I am using powered risers to move the GPUs away from the motherboard, I must provide for the power that would otherwise have been delivered by the motherboard.

I will use a JacobsParts PCI Express Power Splitter Cable to attach to an 8 pin VGA cable.



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Preparing The VGA Cables

This is what the assembled cable(s) looks like. Note that for the powered risers we only need 6 pins for each riser.

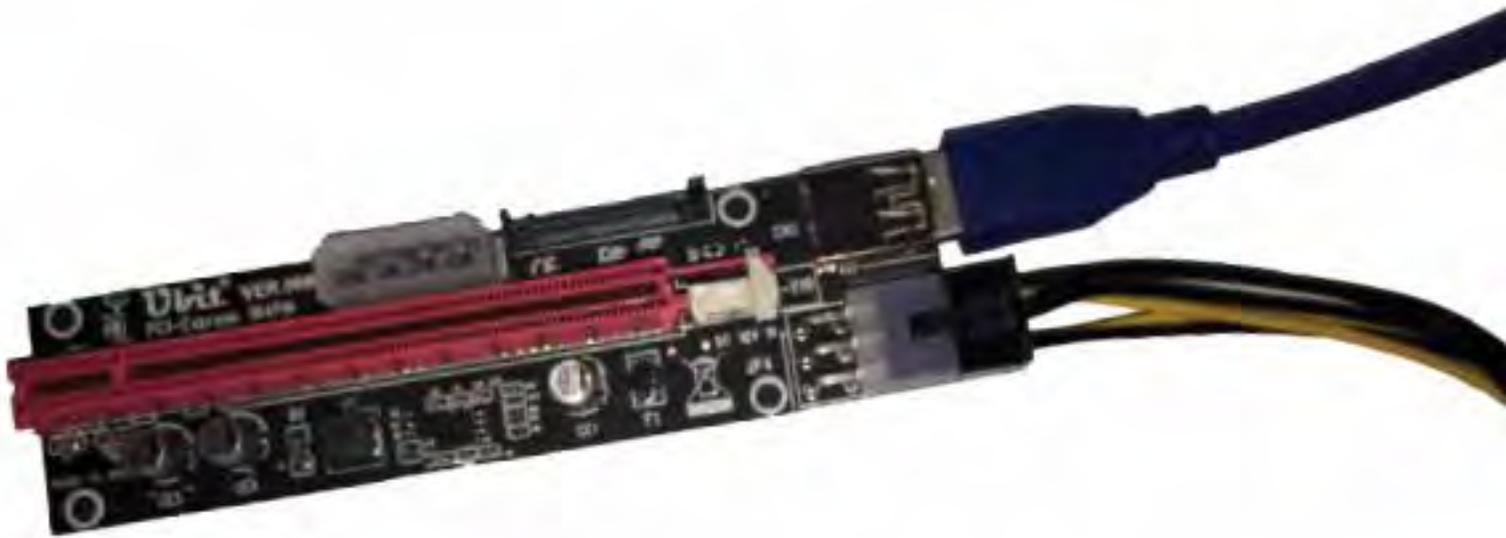


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Attach Power Cables To The Powered Risers

Connect 6 pin VGA power cables to the 6 pin Molex connector on each riser.

Insert the free end of a blue USB cable into the female USB connector on each riser. This cable carries data between the GPU and the motherboard. Mining is computationally intensive but not data intensive and the USB connection is sufficient.



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Attach The Powered Risers To The GPUs

There is a retaining fitting that must be opened to allow the edge connector of the GPU to enter the powered riser slot. Once the GPU is firmly inserted, slide the retaining fitting to the closed position.



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Attach Power Cables To The GPUs

In my example, two of my GPUs do not require any power except that provided by the powered riser. Here I want to make sure that I am using VGA 6 pin cables.

My GX 980 requires two 8 pin connectors. My GTX 1060 requires one. These are in addition to the powered risers.

Now I have to make a compromise. I use a Peripheral to Molex cable to provide power to one of the risers for the GTX 980. I do not recommend using SATA cables to provide power to risers.



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Hang The GPUs From The Shelving Rack

I allow my GPUs to hang vertically from the upper shelf. I use ZIP ties for this purpose.

Connect Power Cables

Connect the daughter cards to the slots on the motherboard. Make sure that you have attached the motherboard power cable and the CPU power cable.



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Connect Ethernet Cable To Your Router Or Switch

I do not recommend mining with WI-FI.

Setup Your BIOS

When you power on your mining rig (you did remember to attach the power switch, didn't you?) you will need to invoke the BIOS before your Operating System loads. For this motherboard, this is done by holding the DEL key while the computer starts up.

You will be presented with a series of menus that adjust settings regarding the operation of your computer. Set as many of these options as you are able to find.

set VTd INTEL VIRTUALIZATION to DISABLE.

set ONBOARD AUDIO/SOUND (AZALIA) to DISABLE.

set IEEE1394 to DISABLE.

set PCI-E SUBSYSTEM/LANES to x8/x4/x4

set PCI-E GENERATION to GEN2.

set CPU FREQUENCY SCALING to DISABLE.

set CPU PERFORMANCE MODE to ENABLE.

set AUTOMATIC RESTART AFTER POWER LOSS to ENABLE

Start Your Mining Rig / See that Windows Appears To Work

Connect the daughter cards to the slots on the motherboard. Make sure that you have attached the motherboard power cable and the CPU power cable.

Be prepared to troubleshoot, by shutting down and inserting a single GPU daughter card at a time until you are able to get Windows to start normally. This can be tricky and frustrating. Every combination of components is different and you may have to use trial and error. Don't give up.



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Wallets, Mining Software, Utilities, and Mining Pools

You need an wallet and address for your mined coins. I use the Arizen wallet available at:

<https://zensystem.io>

I use MSI Afterburner to tune the speed of the GPUs and underclock them.

<https://www.msi.com/page/afterburner>

I use GPU-Z to check on the status of individual GPUs.

<https://www.techpowerup.com/gpuz/>

I use Bminer as mining software.

<https://bminer.me>

Solo mining is not every exciting. I recommend that you use an anonymous mining pool to join forces with other miners and have the pool send your ZEN to your Arizen wallet.

You may want to have a mining account on your PC that opens automatically and have these 3 items run automatically.



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