Haswell compatibility with Corsair PSU

A�report recently published over at the VR-Zone�discussing the new 4th generation Intel Core processors, code-named "Haswell", and their ability to go into a lower power sleep state than any previous processor has caused some concern about PSU compatability with the new processor.

When an Intel Core (i3, i5, i7) processor is idle, it goes into a sleep state that requires less power than when the CPU is active. Since the motherboard voltage regulation modules that provide power to the CPU gets their power from the power supply's +12V rail, these sleep states can dramatically reduce the load on the power supply's +12V rail.

According to Intel's presentation at IDF, the new Haswell processors enter a sleep state called C7 that can drop processor power usage as low as 0.05A. Even if the sleeping CPU is the only load on the +12V rail, most power supplies can handle a load this low. The potential problem comes up when there is still a substantial load on the power supply's non-primary rails (the +3.3V and +5V). If the load on these non-primary rails are above a certain threshold (which varies by PSU), the +12V can go out of spec (voltages greater than +12.6V). If the +12V is out of spec when the motherboard comes out of the sleep state, the PSU's protection may prevent the PSU from running and will cause the power supply to "latch off". This will require the user to cycle the power on their power supply using the power switch on the back of the unit.

While we are still working with Intel on the details of the testing methodology they use to check PSUs for Haswell compatibility, it is already known that a power supply that uses DC to DC for the non-primary rails (the +3.3V and +5V) will not have an issue with the new low power sleep states. This is because a DC to DC buck converter is used to convert +12V to +3.3V and +5V. This means that no matter what load the CPU puts on the power supply, there will always be a load on the +12V because the +12V is required to provide power to +3.3V and +5V.

Corsair utilizes this DC to DC technology in most of their power supplies. Starting with the CX750 and CX750M and moving all of the way through the GS Series, TX and TX-M Series, the HX Series, both the AX Series Gold and AX Series Platinum, and the new AXi Series. So whatever your budget, if you choose Intel's new Haswell processor and wish to utilize the new, low power C7 sleep state, Corsair has a power supply for you.

PSU Series	**Model**	**Haswell Compatibility**	**Comment**
	AX1200i	Yes	100% Compatible with Haswell CPUs
AXi	AX860i	Yes	100% Compatible with Haswell CPUs
	AX760i	Yes	100% Compatible with Haswell CPUs
	AX1200	Yes	100% Compatible with Haswell CPUs
AX (Gold and Platinum)	AX860	Yes	100% Compatible with Haswell CPUs
	AX850	Yes	100% Compatible with Haswell CPUs

	AX760	Yes	100% Compatible with Haswell CPUs
	AX750	Yes	100% Compatible with Haswell CPUs
	AX650	Yes	100% Compatible with Haswell CPUs
HX (Silver, Gold and HX1000)	HX1050	Yes	100% Compatible with Haswell CPUs
	HX1000	Yes	100% Compatible with Haswell CPUs
	HX850	Yes	100% Compatible with Haswell CPUs
	HX750	Yes	100% Compatible with Haswell CPUs
	HX650	Yes	100% Compatible with Haswell CPUs
HX (Legacy)	HX620	TBD	Likely compatible ? currently validating
	HX520	TBD	Likely compatible ? currently validating
TX-M (All Versions)	TX850M	Yes	100% Compatible with Haswell CPUs
	TX750M	Yes	100% Compatible with Haswell CPUs
	TX650M	Yes	100% Compatible with Haswell CPUs
TX (All Versions)	TX850	Yes	100% Compatible with Haswell CPUs
	TX750	Yes	100% Compatible with Haswell CPUs
	TX650	Yes	100% Compatible with Haswell CPUs
GS (V2)	GS800	Yes	100% Compatible with Haswell CPUs
	GS700	Yes	100% Compatible with Haswell CPUs
	GS600	Yes	100% Compatible with Haswell CPUs
GS (Legacy V1)	GS800	TBD	Likely compatible ? currently validating
	GS700	TBD	Likely compatible ? currently validating
	GS600	TBD	Likely compatible ? currently validating
	GS500	TBD	Likely compatible ? currently validating
CX-M	CX750M	Yes	100% Compatible with Haswell CPUs
	CX600M	TBD	Likely compatible ? currently validating
	CX500M	TBD	Likely compatible ? currently validating

	CX430M	TBD	Likely compatible ? currently validating
CX	CX750	Yes	100% Compatible with Haswell CPUs
	CX600	TBD	Likely compatible ? currently validating
	CX500	TBD	Likely compatible ? currently validating
	CX430	TBD	Likely compatible ? currently validating
VX (Legacy)	VX450	TBD	Likely compatible ? currently validating
	VX550	TBD	Likely compatible ? currently validating
VS	VS650	TBD	Likely compatible ? currently validating
	VS550	TBD	Likely compatible ? currently validating
	VS450	TBD	Likely compatible ? currently validating
	VS350	TBD	Likely compatible ? currently validating

As we work with Intel over their Haswell testing methodology and discuss with motherboard manufacturers about the different ways they may address potential compatibility problems with power supplies, we will keep you updated right here on this blog.

" rowspan="1" width="112"> Yes 100% Compatible with Haswell CPUs GS600 Yes 100% Compatible with Haswell CPUs **GS**
(Legacy V1) GS800 TBD Likely compatible ? currently validating GS700 TBD Likely compatible ? currently validating GS600 TBD Likely compatible ? currently validating GS500 TBD Likely compatible ? currently validating **CX-M** CX750M Yes 100% Compatible with Haswell CPUs CX600M TBD Likely compatible ? currently validating CX500M TBD Likely compatible ? currently validating CX430M TBD Likely compatible ? currently validating **CX** CX750 Yes 100% Compatible with Haswell CPUs CX600 TBD Likely compatible ? currently validating CX500 TBD Likely compatible ? currently validating **Model Haswell Compatibility Comment AXi** AX1200i Yes 100% Compatible with Haswell CPUs AX860i Yes 100% Compatible with Haswell CPUs AX760i Yes 100% Compatible with Haswell CPUs

AX
(Gold and Platinum)

AX1200 Yes 100% Compatible with Haswell CPUs AX860 Yes 100% Compatible with Haswell CPUs AX850 Yes 100% Compatible with Haswell CPUs AX760 Yes 100% Compatible with Haswell CPUs AX750 Yes 100% Compatible with Haswell CPUs AX650 Yes 100% Compatible with Haswell CPUs **HX**
(Silver, Gold and HX1000) HX1050 Yes 100% Compatible with Haswell CPUs HX1000 Yes 100% Compatible with Haswell CPUs

My Corsair PSU FAN doesnt work

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The Hybrid Silent Fan Control only available from the following PSU models:

Corsair 1200AXi
Corsair 860AXi
Corsair 760AXi
Corsair 860AX
Corsair 760AX
Corsair 850AX
Corsair 750AX

Corsair 1050HX Gold
Corsair 850HX Gold
Corsair 750HX Gold
Corsair 650HX Gold

Corsair 850TXM
Corsair 750TXM
Corsair 650TXM
Corsair 850TX - CP-9020043
Corsair 750TX - CP-9020042
Corsair 650TX - CP-9020038

The Corsair Power Supply power supplies offer a unique fan control system, called Hybrid Silent Fan Control, which is part of the reason that they are so quiet. The 120mm cooling fan is enabled with three modes of operation. These modes are automated by the internal fan control circuitry and optimize both the thermal performance and fan lifespan, while minimizing audible noise.

I wanted to learn more about these modes and share the information with Corsair readers so I visited with Michael O?Connor, our Director of Power Supply Engineering Development. He explained that Hybrid Silent Fan Control offers three different modes of operation; Fanless Mode, Quiet Mode, and Cooling Mode. Each of the three modes is optimized to provide the most intelligent level of fan performance for any given load.

Fanless Mode means just that; the fan blades are completely stationary. There is no audible PSU noise in Fanless Mode, which is active when PSU output is below 20% of the rated DC output load. This completely silent mode is feasible due to the extremely high efficiency of these PSUs.

Quiet Mode runs the cooling fan at very low RPM, which results in extremely low level audible noise. The noise level is <16dBA, and is active when PSU output is between 20% and 50% of the rated DC output load.

In Cooling Mode, the fan speed and the associated airflow is adjusted to optimize thermal performance. This mode is based upon DC loading and ambient temperature conditions, resulting in the most effective and accurate cooling performance under heavier loading. Cooling Mode is active when the PSU output is above 50% of the rated DC output load.

With 90% efficiency at 50% load, the Corsair Professional Series Gold power supplies run quieter, generate minimal excess heat, and save you money every month. They push the state of the art for the reliable delivery of clean power under imperfect conditions. If you require mission-critical stability or you simply want one of the best power supplies available, Corsair Power Supplies are an ideal choice.

Why does a better power supply mean a better computing experience

So how does a better PSU equate to a better computing experience? Consider this: If your power supply isn't doing a good job of regulating voltage and filtering ripple, what is?

The computer power supply essentially converts AC to DC. Older or more basic computer power supplies convert AC to multiple DC voltages (+12V, +5V, +3.3V) at the same time. Newer, more advanced power supplies, convert AC to +12VDC, while smaller DC to DC power supplies within the power supply's housing convert the +12V to lesser used +3.3V and +5V. The latter is more efficient because lesser used voltages are not converted unless they're required and converting DC to DC itself is more efficient than converting AC to DC as it requires fewer and smaller components.

After that voltage is converted, it's filtered with inductors and capacitors.

On the secondary side of this HX1050, we see a very large inductor and a handful of different sized capacitors.

So now we have two critical things to look at when looking at the output of this power supply: How well is the output voltage regulated and does this power output have minimal ripple?

I just used two words you hear a lot when people talk about computer power supplies: Regulation and ripple.

Computer power supplies use a "switching" technology to convert the AC to DC. And while the rectifier is switching on and off, it's producing DC that pulses in rhythm with whatever frequency the AC input is (60 Hz, for example, is your typical North American AC frequency) regardless of the frequency the rectifier is switching at. This is called noise. First, the voltage goes through an inductor, or a choke. This smooths out the waveform and lowers the frequency of the noise. Then you have your capacitors. Capacitors store electrical charges and can then output an electrical charge without the noise. If the voltage going into a capacitor raises or lowers with the switching frequency, the charge of the capacitor raises or lowers. This change in the capacitor's charge is much slower than the frequency of the switched power that's charging the capacitor. While this is how it filters the noise, this also creates ripple (small peaks and valleys in the DC output voltage). This is when larger capacitors, or capacitors in series, can help, because the slower the change between the lowest and highest voltages, the more stable the output voltage and ripple is reduced. But the engineers designing these power supplies have to be careful. If you use too many capacitors, too large of a capacitor or even too large of an inductor, you reduce your power supply's efficiency. Every part of a circuit that power goes through has some loss of power and the capacitors dissipate that filtered noise as heat, and that heat is lost power!

This is a screenshot of an oscilloscope measuring ripple on a power supply that does not do a very good job of filtering.

When a power supply does a better job of filtering ripple, it will look like this on an oscilloscope.

Regulation is how well a power supply responds to load changes. Say the power supply is putting out +12VDC with a 2A load. Let's say that load increases to 5A, 10A.. or even 15A. Just as I explained with the CPU voltage regulators, Ohm's law comes into play. As current increases, resistance increases. As resistance increases, voltages drop. A quality power supply should be able to compensate for this. Usually the monitoring is done internally by a "supervisor IC". The supervisor IC can tell the PWM (pulse width modulation) controller that it needs the rectifier to switch at a different frequency to adjust the output voltage accordingly. Sometimes, a "sense wire" senses the drop in voltage at the load and communicates this back to the IC. This gives the IC a little bit of a head start in telling the PWM controller to compensate. "Digital power supplies" like the Corsair AXi Series PSUs use a digital signal processor to monitor voltages and tell the rectifier directly to switch at different frequencies. Since the monitoring and control is all digital, the compensation is handled much quicker (more on how digital power supplies work can be found here.)

So how does a better PSU equate to a better computing experience? Consider this: If your power supply isn't doing a good job of regulating voltage and filtering ripple, what is?

While computer power supplies output multiple DC voltages (+12V, +3.3V and +5V) these are not all of the voltages a computer requires to run.

Take the CPU, for example. CPUs used to operate on voltages derived directly from the power supply. Originally, +5VDC. Eventually, this voltage was reduced to +3.3VDC. In an effort to make CPUs more and more power efficient, voltage continued to drop and voltage regulators on the motherboard were required to take either +3.3VDC or +5VDC from the power supply and reduce these voltages to even lower voltages. Naturally, one would think that converting one voltage to another would be more efficient if the before and after voltages were closer together. But as CPU's became faster, they required more power, but at lower voltages. The CPUs themselves were more efficient, but not the process of converting that power. More power (watts) at lower voltages require more current. Higher current, without increasing wire and trace gauge, increases resistance. Resistance then decreases voltage and creates heat, which is counterproductive to the reason CPU core voltages were being lowered in the first place! The solution was the ATX12V standard. A 4-pin power connector that delivers +12VDC, which was then upgraded to an 8-pin power connector that could deliver even more current, was added to the power supply. With the increase of voltage to the CPU's VRMs (Voltage Regulation Modules), less current is required to deliver power to the motherboard. Of course, with this greater delta in voltages (between the +12VDC and the CPU's core voltage), more robust voltage regulation on the motherboard is required.

This motherboard uses heatsinks to passively cool components of the voltage regulation circuit.

With the new "Haswell" CPU coming from Intel, we'll start to see voltage regulation on the CPU itself. This will reduce power current on the pins that move power from the motherboard's traces to the CPU core and therefore reduce the pin-count required to deliver that power. This will also allow the CPU to dynamically scale the voltage of the CPU more efficiently than ever before. The voltage regulators in Haswell are certainly no slouch when it comes to efficiently converting voltages, but this still does not completely replace the motherboard's duty of converting, and filtering, the +12V from the power supply to a lower voltage as Haswell has an input voltage of 2.4VDC.

The same is true with your graphics cards. GPUs really are just small CPUs. Heck, in some cases with GPUs running as fast as 1GHz, they're more powerful than some CPUs! PCIe power connectors coming off of the power supply deliver +12V to the graphics card where voltage regulators drop the voltage down to what the GPU needs.

Two PCIe power connectors deliver +12V to this graphics card's PSU, but the GPU doesn't use +12V. It has to convert it to a lower voltage first.

The ATX specification says that the power supply is allowed to output voltage with regulation and ripple within a certain tolerance. The ripple can be as much as 1% and still be within specification. That means you can have as much as ±120mV of ripple on the +12V. Your voltage regulation can be as much as ± 5%. That means you +12VDC can be as high as +12.6V or as low as +11.4V and it is still within ATX specification. Likewise, your motherboard or graphics card's voltage regulator would have a similar tolerance for input voltage. In other words, if you have a VRM that is made to convert +12VSC to +2.4VDC, that VRM should be able to take in voltages as high as +12.6VDC or as low as +11.4VDC and still be effectively able to product +2.4VDC. The VRM has an added tolerance for slew rate. Slew rate is essentially the rate at which voltages change from one to another. If voltage drops from +12VDC to +11.99VDC within a microsecond, your slew rate is 10mV/µs. To help maintain these tolerances, your motherboard, graphics cards and other components also has some inductors and capacitors to filter voltages between the power supply and the VRM.

So, if everything is within specification, there's no problem, right?

Well, not so much. You see, as these components regulate voltage, and the harder they have to work to do so, they get hot. This heat is not only wasted energy, but also shortens the life of the components. And while voltage regulator's MOSFETs are often passively cooled with heatsinks (at least they are on high-end motherboards), capacitors are not. And if the MOSFETs are not passively cooled or there are fewer of them (which would be a VRM with "less phases"), then they will have to work harder to regulate voltage and run even hotter. Heat isn't good for a computer's components, so any way we can address the problem is a plus. Another problem with proper voltage regulation and filtering is that they take up space on a PCB. Like I said with the power supply: If you want to have less ripple, you need to have a larger or more capacitors. The same is true with voltage regulation circuits on motherboards and graphics cards. And the same is true with the MOSFETs too. You can have more phases for cleaner power, but if the MOSFETs aren't capable of more current, the extra phases will not do you any good. But higher power MOSFETs, more phases, larger and more capacitors all take up space. We don't always have enough space on a motherboard or graphics card to give up as real estate for near-perfect on-board voltage regulation.

And then there are the effects of ripple on overclocking. While your VRMs may be able to regulate voltages well, they won't be able to get rid of every bit of ripple and that gets passed right through to your CPU or GPU. Those of you that overclock know that you typically have to increase the CPU or GPUs Vcore voltage. This is because, as the transistors in the processing unit cycle, the regulators can't switch on and off at the higher speed required to keep the transistor energized at the required voltage. Increasing the voltage actually gives the CPU more than it needs, but allows the regulators to give the CPU what it needs more quickly than when it needs it. The unfortunate by-product of this is heat (everything keeps coming back to heat, doesn't it?). If you have any ripple in that Vcore voltage, it's going to prevent the VRMs from delivering exactly whatever voltage is needed when the CPU's transistors are operating at whatever clock speed you're trying to operate them at. The solution for this problem is to operate the CPU with an even higher Vcore voltage than what is actually needed. The downside of this is... wait for it.... higher CPU temperatures.

So, to summarize, a better power supply actually gives you longer motherboard and graphics card life, better overclocking and even longer life of your CPU and GPU. It's a win-win situation!

PSU Paper Clip Test

Testing our power supply without the use of your motherboard is generally pretty simple. Below we will show you how to test all our PSU's.

To start off you will need the following:

1. Corsair power supply
2. Power cord
3. ATX 20-24 pin PSU connector and 4 Pin Peripheral Connector
4. Paperclip
5. One or more case fans
6. 2/3 pin case fan connector to Molex adapter if needed

Step 1: (Step for AX/HX series only)

Connect both the 20-24 pin (AX Series) and the 4-pin Molex (AX/HX series) connector to the PSU. Make sure to use the cables provided with power supply. Note that on many of our PSUs, these cables are permanently connected.

Step 2:

Attach the case fan to the Molex connector. If you're case fan only has a 2/3 pin connector, use a 2/3 pin case fan connector to Molex adapter. The PSU does have a built in fan, but depending on the series, it might not spin without a certain amount of load or reaches a certain temperature. See picture below

Step 3:

Bend the Paper clip into a u-shape.

Step 4:

Use the paper clip to connect it to the 20/24 pin connecter. Usually the wires are color coded (one green wire and mutiplie black wires), but with our AX version they are all black. To bridge the correct pins face the cable the exact same way shown in the picture below. Locate the pin which is indicated in Green (your green wire) and yellow (your black wire) on the picture below and bridge the two using the paperclip. One way to help make sure you have the correct pins, locate the missing pin on the 20/24 connector (boxed in blue) as it should be on the same row with the bridged pins (all our PSU series have a missing pin).

Final Step:

Make sure the switch on the back of the PSU is set to (O) before plugging each side of the power cable to the power supply and the wall outlet. Once the power cord is plugged into both the wall and power supply, make sure to check if all connections are good. Once complete, turn the switch on the back of the power supply to (I) and see if the case fan spins. If so, the PSU is functional!

Corsair Power Supply FAQ

1) WATCH: How does the fan work on my AX series PSU?

The Professional Series Gold AX series PSUs have thermally controlled fans which will vary the fan speed depending on both the loading and temperature of the PSU. Check out the video below for a specific explanation: Link

2) WATCH: How do I connect the 24-pin connector on my AX Series PSU?

The 24-pin ATX connector for the AX series PSUs have a split connector that plugs into the AX series PSU. The single 24-pin connector is the end that will connect directly to your motherboard. See below for a video explanation: Link

3) How long are the cables on my Corsair PSU?
You can download a PDF file containing all of the cable lengths of Corsairs PSUs in the following link: Download Here

4) What is the difference between the HX1000 and the HX1050?

The HX1050 is the updated version of our popular HX1000 PSU. In addition to a slightly different look, we have moved to a single 12v rail design, and we have also been able to increase efficiency to 80 Plus Silver compliance to match our other HX series PSUs.

5) What is the difference between the old TX series PSUs and the new V2 version?

Efficiency has been improved from standard 80 Plus, to 80 Plus Bronze with the V2 versions. Also, the V2 PSUs are now ErP compliant. The only other main difference is that the product labeling and packaging have been revised.

6) BIOS or software detects voltage readings for one of the rails on my PSU being too high/low, is there something wrong?

BIOS and software readings are never 100% accurate and they can fluctuate. The only way to measure the rails accurately would be to use a digital multi-meter.

ATX spec also indicates that as long as the voltage stays within 5% of the rating for the rail then the PSU is within spec. For instance on the 12v rail this would equate to 11.4v-12.6v.

7) Why doesn?t my Corsair power supply start up when I plug it into the wall and flip the switch?

In order to start up, the power supply requires two things. A load (a device connected to it requiring power) and a signal. The switch on the back of the PSU simply tells the power supply to go into standby mode and await a signal from the motherboard to actually turn on.

8) My Machine doesn?t start up when I hit the power button, is the PSU faulty?

Disconnect everything from your PSU except for one single fan that should be connected directly to one of the Molex connectors. Then, get a small piece of wire, paper clip, or suitable object and short the green pin and a black pin on the 24-pin connector on the power supply. The voltage present is a very low signaling voltage so no worries of being shocked. Your PSUs fan should spin along with the fan you have connected to it. If this is the case, your PSU may not be receiving the power on signal from your motherboard and you should consider other causes of the problem you?re having.

9) Which Corsair PSUs will be able to power my rig?

We suggest using our PSU finder tool to answer this question. You can find it by clicking here.

The PSU finder results are accurate estimates which would correlate to Corsair Power Supplies ONLY. We cannot guarantee that a non-Corsair unit of similar wattage rating would be equivalent.

10) How can I get replacement cables for my modular Corsair PSU?

Please set up a case in Corsair Customer Portal, and let us know which PSU you have and which cables you need.

11) WATCH: Where?s the 4-pin EPS/ATX 12v connector that I need for my motherboard?

Our power supplies ship with an 8-pin connector that splits in half. Use half of this connector for the 4-pin EPS/ATX 12v connector on your motherboard: Link