

Desktop DAC vs. Onboard Sound

[Pete Matthews Jr](https://3nt.xyz/) – <https://3nt.xyz/> – © August 14, 2020

A digital-to-analog converter (DAC) converts sounds from digital format, usually from a computer, to the analog signals required for speakers. Onboard sound on a computer or smartphone has a DAC, as does a computer sound card. The most basic form of a DAC has a digital sound input, a power input, and analog audio output. The digital and power inputs are often provided by a single USB connection. A DAC could be as small as a thumb drive, with USB input and a 3.5mm audio output, such as the popular Dragonfly Black (\$99), Red (\$199) and Cobalt (\$299) by Audioquest. Most DACs have additional features.

My old speakers had a headphone jack. When they began to fail on my desktop computer, I found no acceptable replacements with a headphone jack. I began investigating DACs with speaker output, a headphone jack, and volume control, primarily for convenience.

An external DAC can provide a substantial improvement in sound quality, especially with lossless sources such as FLAC. For me, this was secondary, since I have the best available onboard sound and my music is all MP3s.

DAC Features

Price. DACs can go up to \$5,000, with sharply diminishing returns. I expect the quality of the sound from the DACs listed below to be at least as good as the onboard sound. Substantial improvements continue to be made in price and performance of DACs.

Driver-Free. Sound on Windows has come to age on Windows 10. However, it's complicated enough that adding a driver for an external DAC can cause problems. Fortunately, modern DACs should not need a driver. They can digital input from USB, and possibly from an optical source as well.

Input Select. Being able to select the input device can be an advantage, especially when there are more than two. When the choice is solely between USB and optical, input selection is less important. In most cases, you would not bother to connect an optical cable unless you intended it to take priority, which the DAC should do automatically.

Decent DACs with Outputs and Headphone AMP	Creative Sound Blaster X-Fi HD	Ifi Zen DAC	Soundavo HP-DAC1	Audioengine D1	No External DAC Realtek ALC1220-VB & Windows 10
Price	\$110	\$130	\$130	\$169	free
Shipping	Prime	Prime RT	Prime RT	Prime RT	N/A
Amazon Rating	3.8 (335)	4.5 (188)	4.7 (39)	4.4 (599)	
Driver-Free	-	★	★	★	
Power Switch	-	-	★	★	
Input Select	-	-	★	-	
RCA In	★	-	★	-	
USB In	★	★	★	★	
Optical In	★	-	★	★	
A/C Adapter	-	\$11	★	-	
Volume Knob	★	★	★	★	
HP Jack (mm)	6.3	6.3	6.3	3.5	3.5
HP Cuts Output	★	-	★	★	★
3.5 mm Out	-	-	-	-	★
RCA Out	★	★	★	★	-
Optical Out	★	-	★	-	★
Balanced Out	-	★	-	-	-

Optical In. Optical input may be higher quality than USB input. However, problems with optical can be hard to diagnose: is it in one of the devices, connectors, or the cable? If you do use optical, you will still need a power source, either USB or an A/C power adapter.

RCA In. An analog input could be converted to digital. The device will then operate as an ADC. A common analog device would be a turntable, and the output would usually be via USB to the computer. That's all you need, if the turntable contains a pre-amp. If not, the ADC must include a pre-amp, as raw turntable signals are not strong enough. (A USB turntable would have the pre-amp and ADC built-in, and could be connected directly to the computer.)

A/C Adapter. Powering the device by USB is convenient. However, additional power supplied by an A/C adapter may result in higher quality sound.

Headphone Jack. A headphone jack will connect to an internal amplifier. The larger quarter-inch (6.3 mm) jack is more convenient, since it also serves 3.5 mm plugs with a simple adapter that may come with the DAC.

Headphone Cuts Output. This is a required convenience, along with volume control. A mute button on a main speaker might suffice.

Optical Out. Speakers with a built-in DAC could take optical input from this external DAC, which would pass its digital input right out again. This would allow the DAC to intercept the input and send it out to headphones instead. I have not tried this.

With analog input, likely from a turntable, an optical output could be used to record on the computer. I have only used USB output for this purpose. (The USB connection is bi-directional.)

RCA and 3.5mm Out. The quality of analog output may be slightly better from RCA than from 3.5 mm. Whichever you have, converting cables are readily available. Cable quality can make a difference.

Balanced Out. Most people in my situation do not need balanced outputs. While studio monitors have balanced XLR inputs, you can use two RCA to XLR cables (perhaps splitting a pair), one per speaker, to connect them up. (Avoid TRS balanced connectors, as I am told some vendors reverse the polarity.)

Other Features. Some DACs have internal batteries, a liability in a desktop context. Almost any combination of inputs and outputs are possible.

Creative Sound Blaster X-Fi HD

Creative took their internal sound card and moved it outboard. It has a microphone input and a phono pre-amp, features seldom found on a DAC. I bought the X-Fi in 2017 when my not-so-old internal version failed on my Windows 7 system. The X-Fi comes with a pile of not-so-useful software, including a required driver. I was able to use the X-Fi with my analog turntable on Windows 7 for a while, but it stopped working. When I built a new computer for Windows 10, I installed the X-Fi as well.

Products from Creative do not impress me much. I took the X-Fi out of service for a while, only too ready to blame it for multiple difficulties with sound on my new Windows 10 system. When the frequency of pops from the ADA885 speakers increased, I reinstalled the X-Fi, to use with headphones. Current X-Fi

software can be hard to locate on the Creative site; after trying older versions, I finally tripped over version 0024.

My ears ring all the time (tinnitus), although my brain usually tunes it out. It came on fierce while using the headphones on the X-Fi and it persisted afterward, so I stopped using the device. Unfortunately, I need to waste a little more space on the X-Fi:

The X-Fi software interferes intermittently with the Realtek sound on my motherboard. It turns out that removing the X-Fi software does not remove all components, and some of the remaining components can be problematic. I do not know the full extent of the problem but here is one:

RunDLL : Problem starting SBAVMON.DLL

This started popping up when I removed the X-Fi apps: Creative ASIO, Creative System Info, and USB SoundBlaster HD. Rebooting the system did not help – and sound then went haywire – a reverb effect apparently produced by having the sound come out twice, slightly offset. I was unable to find out where Windows was trying to start SBAVMON.SLL; here are some of the things I tried:

- Windows+R: regedit
Ctrl+F: look for SMAVMON. (None found, would have deleted them.)
- Windows+R: taskcmd.msc
In the task list, under Name, look for SBAVMON or related. (None.)
- Command Prompt: sfc /scannow (Found nothing.)
- Various iterations of installing the X-Fi software (which requires the device to be present) and rebooting got the Realtek sound working properly again. A glutton for punishment, I then disabled all the X-Fi crud, and the reverb returned.

Finally, I fixed the problem by removing the X-Fi software again, and then reinstalling the recommended Realtek driver for the current version of Windows 10 (see “No DAC” below). This solution persisted after a reboot.

ifi Zen DAC

The ifi Zen DAC is a fine low-end DAC. A reviewer said the Zen performs better after installing a free firmware update, and also using an optional external power supply. Along with the Zen, I ordered a good 5V3A power supply for \$11 on Amazon. One reviewer said ifi DACs tend to have a laid back sound, the opposite of the bright treble that bothers me.



The Zen came with a short USB cable, a short RCA cable, a 6.3 mm to 3.5 mm headphone adapter, and a “manual” on a small card (not shown). The A/C power adapter never left its box, and I did not get to update the firmware.

The cables were too short for my needs, but I did notice that the USB cable works only with USB-3 devices: it has an extra doo-hickey on top of the connector that slots into the port on the Zen. Because the computer has fewer resources for USB-3, and USB-2 high speed easily carries the sound data, a DAC should usually be connected to a USB-2 port. iFi might want the extra power that USB-3 could provide. I did my testing with a cable rated for USB-3, but without the doo-hickey (sorry to be so technical), connected to a USB-3 port.

First I tested the Zen with only headphones. When I first hooked it up, Windows Media Player whined about the missing X-Fi. Upon replay, it sent the output to the new Zen, and I heard it on my headphones. The Sound Settings on Windows recognized "Speakers (iFi (by AMR) HD USB Audio)" automatically. It's truly fine quality sound. The solid feel of the 12-sided, smooth-turning volume knob was particularly pleasing.

The Vanatoo speakers that I was testing worked as expected, when I hooked them up. Then I plugged the headphones into the Zen again. The headphones played, but the speakers did not cut out. Grrrr! I asked iFi tech support about that and received this response two days later: "Both outputs will be active at the same time. With the Zen DAC you will have to unplug or power off

whichever connection." Somewhere, there may be somebody who wants it to work this way, but I cannot figure out why.

There are various ways to adapt to this deficiency, but I declined. The Zen went back into its box. Eventually, I returned it to Amazon (they gave me a free label for me to take it to a UPS store). See my 3-star Amazon review "Broken as Designed." The Zen Dac also lacks a power switch. Lots of other folks like this DAC, and I would if they fixed it.

Soundavo HP-DAC1

After investigation, I ordered the Soundavo HP-DAC1.



The HP-DAC1 was not recognized by Windows 10, when connected to the computer via USB, using my same USB-3 cable as for the Zen. After various experiments and reboots, the manual disclosed the instruction to plug it into a USB 2.0 port. I discovered four USB 2.0 ports tucked up under the lip of the computer backplane; I had been using a 3.0 port. Once I moved the cable to a 2.0 port, the DAC was recognized as "SPDIF Interface (HP-DAC1)" with the volume at 100%. I plugged in my headphones and adjusted the volume using the knob on the DAC to about 25% — great!

Here is an update of the 4-star review I wrote on Amazon:

Pros:

- A digital source can be connected to the USB port or via optical cable to the S/PDIF In port. The unit will convert digital to analog (DAC), sending the signal to the Line Out RCA jacks or to headphones.
- Only one output is active at a time; when anything is in the headphone jack, other outputs are inactive.
- The headphone jack is a flexible quarter inch, easily adapted to 3.5mm.
- The unit comes with an external power adapter.
- The Clip LED tells you when to use a REC.GAIN switch to reduce the signal strength.
- Use the Line In, USB or S/PDIF button to select the active input.
- Above the input buttons is the power button. This could be a good deal with my speakers, which will sleep with no input.

Cons:

- The Soundavo provided little or no sound improvement for me, with either new Audioengine A5+ speakers or with my Bose QC2 headphones from 2003. The QC2s probably cannot take advantage of the DAC, and maybe not the A5+ either. I play MP3s fairly quietly, and goose it a little occasionally.
- The plated plastic volume knob on the HP-DAC1 is OK, but it flexes the shaft it turns.
- It's kind of big and ugly: it's sizeable with all those features, and painted a silver that looks beige in my setting. Most of my other gear is black.
- The HP-DAC1 occasionally triggers "Not enough USB Controller Resources" errors in Windows 10. Given that my only USB devices are a wireless keyboard/mouse adapter and a 4-port USB-3 hub with a powered-off scanner connected, this was frustrating. I think the HP-DAC1 consumes a great many USB "endpoints" with all those potential connections. Things seem to get worse when you use the various input and power buttons, or do a bunch of disconnecting and reconnecting while testing or troubleshooting.

Noteworthy:

- An analog source can be connected via RCA connectors to Line In. The unit will convert analog to digital (ADC) to either the S/PDIF Out or USB port – or send output to the headphone jack. (It is not clear whether S/PDIF or USB output would have priority with analog input.) The instructions say the volume must be controlled at the source. I did not test the ADC features and doubt I would use them.
- This is a USB-2 (high speed) device and it will not work on a USB-3 port. That is sensible, because USB-3 ports have fewer endpoints.
- It is not clear whether digital input can be sent to S/PDIF out. This configuration would be an advantage with speakers that take digital input, offering the option to divert the sound to headphones.

The audio system with the HP-DAC1 felt like it had “too many moving parts.” It produces very good sound and has very good features; but it triggers USB issues, has a flimsy volume control, is ugly with all my black gear, and is fairly large as well.

The HP-DAC1 went back into its box. Amazon promised free returns. It turns out another company sent it, apparently a Soundavo distributor. I had to tell them I was entitled to free returns; then they sent me a USPS label.

Among the dearth of comparative reviews on the HP-DAC1, I found this 5-star review on Amazon:

★★★★★ **The best sleeper DAC you've never heard of**

By Keqing Song on June 15, 2020

Since I've been working from home since February, I decided that it's time to upgrade my office audio system. I use music streaming services to play music from my Macbook Pro through an **Audioengine D1** and that was good enough for me for awhile, that is until recently I decided to get this **Soundavo HP-DAC1** and boy am I glad I got it. It's incredible. Night and day different in detail, clarity, bass delivery, and soundstage.

I got this for a few reasons:

1. I wanted a DAC with a headphone amp that takes 1/4" plugs instead of just a 3.5mm. Check! It powers my AKG K712 Pro well, being plenty loud setting the volume knob at just a little over halfway.
2. I wanted to be able to manage my headphone volume independently from the speaker volume (variable vs line output) since my speakers are powered by a Yamaha A-S501 integrated amplifier and has it's own volume control. The Optical Out option allows me to do just that, and it's awesome.

The Soundavo checks both of these boxes, and it delivers so. Much. More. I was blown away the moment I got it all hooked up and started listening to familiar music. The first song came on and I immediately noticed the improved bass response, which made me go turn down the subwoofer's volume! Don't get me wrong, it's the exactly opposite of boomy. it's tight, defined, and extends deep. Soundstage is fantastic.

At this price point, I don't think you'll find a better DAC that is as feature rich and good sound as the HP-DAC1. Soundavo seems like to be a fairly young company, but man this product is incredible, and I think as more people find out about it and become aware, this thing is gonna sell. High recommended. Stop reading and buy it already.

Audioengine D1

The Audioengine D1 has limited features and has been around for years. It requires USB for power, which could limit the sound quality. The sound can come in via USB or optical. It's small, neat and matches Audioengine gear.

The Audioengine D1 had been my fallback choice. That HP-DAC1 review convinced me not to bother testing the D1.

No DAC

During all my various tests, I discovered that Windows finally has acceptable sound handling for my case. When I plug my headphone cable into the jack on the front of my system unit, Windows asks me if I just plugged in my headphones. I say yes, and Windows instantly cuts the speakers, sending the sound to the headphones. When I unplug the headphones, sound immediately returns to the speakers. I can control the headphone volume in the system tray – Windows remembers separate settings for each device. I don't need to teach my wife how to use that, since I will be the only headphone user. We control the speaker volume on the speakers.

So far, this configuration is friendlier to use than the HP-DAC1. Windows 10 does take some configuring, however.

Realtek Sound Driver. My motherboard is a Gigabyte X570 Aorus Pro WiFi. Onboard sound appears to be the best available, Realtek ALC1220-VB. It requires downloading (from Gigabyte) the audio driver specific to the current version of Windows 10, 1903 for me. The posted driver version, also indicated in the file name, is 8688 for Win10 1903. The actual driver installed is 8703, a concealed upgrade. The correct driver is crucial, when using the analog Line Out or Line In jack on the mobo. It should be unimportant when using digital output via USB (or optical, I am told), which bypasses sound processing on the mobo.

Headphone Use. When I first plugged the headphones into their jack and clicked OK to activate them, sound came blasting from the headphones. I changed the level for the headphone device in the system tray down from 100% to 7% to solve the immediate problem.

Different tracks or applications may require volume adjustments. To provide better adjustability, I changed the master system volume to 67%, which may have been the original default. That seems to have reset the default for all devices, so I again reduced the headphone default in the system tray, but this time to 12%. The master volume remained at 67%; it is multiplicative with device settings.

Sound Playback Configuration. To bring up Sound Settings, click on the “Type here to search” box and type Sound. When Sound Settings becomes the top entry, press Enter. This can also be reached by:

Start > Settings > System > Sound

Down the page, click the link to **Sound Control Panel**. Another way to get here is via this arcanity: Windows+R > control mmsys.cpl,,0

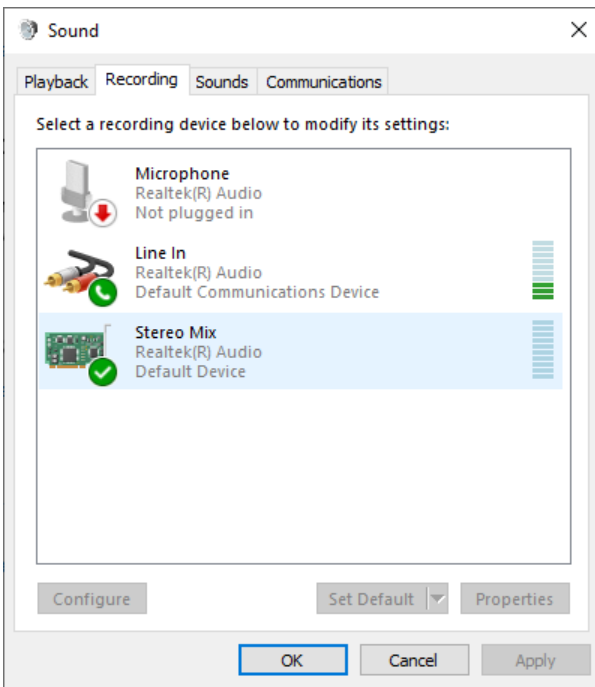
The Playback tab will be presented with all your possible output devices. I like to disable devices I do not plan to use, such as my HDMI monitor and graphics card, which have no sound. I also make sure any devices I will use are, at worst, “Not plugged in.” Here are the potentially useful playback devices on my system:

Jack	Device	Windows 10 Name
Line Out	Speakers	Speakers (Realtek(R) Audio)
Front HP	Headphones	Realtek HD Audio 2nd output
Optical	Speakers	Realtek Digital Output

Sound Recording Configuration (Turntable). Next to the Playback tab is the Recording tab. I record from my turntable connected to Line In with Wave Corrector; Audacity is also popular for this. *All three* of these Windows 10 devices are employed:

Jack	Device	Windows 10 Name
-	-	Microphone
Line In	Turntable	Line In
-	-	Stereo Mix

If you won't be recording sound, skip the following three subtopics.



Activate Devices. If this is what you see on the Recording tab, skip to the next subtopic.

If Stereo Mix is not the Default Device, right click on it, and make it so.

Then if Line In is not the Default Communication Device, reboot the system!

That should make it so. If not, see if you can make it so by right-clicking on it.

Change Line In Properties. To hear what you are recording, enable it:

Right-click on Line In > Properties > Listen > Listen to this device

Then *disable* enhancements on the Advanced tab (not sure this is necessary):

Advanced > Enable audio enhancements

Adjust the volume levels, which you may wish to do later, as well:

Levels > drag the slider (I changed from 47 to 67 as I test)

Enable the Microphone – Security Software.

Start > Settings > Privacy > Microphone > turn on: Allow apps to access your microphone

This action triggered an alert from Bitdefender, my security software. I opened up the Bitdefender “Microphone Monitor,” subtitled “Applications that access your microphone will appear here.” I clicked “+Add a new application to the list,” browsed to and added Audacity, which I only use for testing:

C:\Program Files (x86)\Audacity\audacity.exe

Next, I browsed to and added Wave Corrector, my editing software (now free):

C:\Programn Files (x86)\WaveCor\WaveCor.exe

If a record is playing on the turntable, you should be able to hear it, whether or not you are recording. If not, reboot and test again.

Mono Sound. In the course of all this, I discovered how to change the output to monoaural. This would be the tool to use, to test the relative strength of the channels or to help adjust speaker locations:

Start > Settings > System > Sound > Ease of Access audio settings > Turn on mono audio

Conclusion

Upcoming articles will review the desktop speakers and subwoofer that I tested. I have committed to Swans D1090 powered speakers. The superb sound from these speakers might benefit from a DAC, but I had returned both the Zen and the HP-DAC1 by the time I received the D1090 speakers.

For the time being, I'll be using the onboard sound, but I may go for a DAC in the future – maybe the ifi Zen DAC, if they fix the design flaw. My Bose QC2 headphones won't last forever, so I might want a DAC for the replacement. Even if the Soundavo were black, it has too many features that I do not need – features that actually cause problems.