



Owner's Reference

Owner's Reference DirectStream DAC

Instructions for Use



PerfectWave DirectStream DAC

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Rev A



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Important Safety Instructions



Read these instructions
Heed all warnings
Follow all instructions



WARNING. TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS APPARATUS TO RAIN OR MOISTURE.

Clean only with a dry cloth. For the Piano Finish Top refer to the instructions on page 8 of the Quick Start Guide.

Do not place flammable material on top of or beneath the component.

All PS Audio components require adequate ventilation at all times during operation. Rack mounting is acceptable where appropriate.

Do not remove or bypass the ground pin on the end of the AC cord unless absolutely necessary to reduce hum from ground loops of connected equipment. This may cause RFI (radio frequency interference) to be induced into your playback setup. Removing or bypassing the ground pin on any electrical component is potentially dangerous and should be avoided for safety reasons. A polarized plug has two blades, one wider than the other. A grounding type plug has two blades and a third grounding prong. All PS products ship with a grounding type plug. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus. Unplug this apparatus during lightning storms or when unused for long periods of time.

When making connections to this or any other component, make sure all components are off. Turn off all systems' power before connecting the PS Audio component to any other component. Make sure all cable terminations are of the highest quality.

THERE ARE NO USER-SERVICEABLE PARTS INSIDE ANY PS AUDIO PRODUCT. REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL

Please contact your authorized dealer, distributor, or PS Audio if you have any questions not addressed in this reference manual.

This product is manufactured in the United States of America. PS Audio® is a registered trademark of PS Audio International Inc., and is restricted for use by PS Audio International, Inc., its subsidiaries, and authorized agents.



The exclamation point within a triangle is intended to tell the user that important operating and servicing instructions are in the papers with the appliance.



The lightning flash with arrowhead within a triangle is intended to tell the user that parts inside the product are a risk of electric shock to persons.





Introduction

Owner's Reference DirectStream DAC

Welcome

The PS Audio PerfectWave™ DirectStream Digital to Analog Converter (DAC) is a state-of-the-art DAC, preamplifier and media center. DirectStream accepts PCM as well as DSD Digital Audio data and converts it to high-performance analog audio that can be fed directly to a power amplifier or preamplifier.

DirectStream represents a major advancement in the art of recreating the musical event. Musical information that may have previously been hidden (or covered up by other DACs) in digital audio media ranging from CDs to high resolution downloads will be uncovered by DirectStream.

Subtle musical details and cues such as upper harmonics, decay, reverb and room reflections will no longer be masked by the conversion process from digital to analog. Your music will sound natural and you will be able to rediscover much of what you may have been missing in your digital audio library with the introduction of DirectStream into your system.

DirectStream Overview

DirectStream features a unique architecture inside. From its digital inputs to its passive output stage, DirectStream has been hand written, hand designed and personally voiced by its principal designer, Ted Smith, along with PS Audio CEO Paul McGowan and legendary loudspeaker designer and founder of Infinity Loudspeaker Systems, Arnie Nudell.

DirectStream is based on a FPGA (Field Programmable Gate Array) as its core processor and no off-the-shelf DAC chips are used in its design.

DirectStream is less sensitive to the vagaries of input source types and their level of jitter than most DACs made. Remarkably low jitter sensitivity is one of the hallmarks of this design and is accomplished by not using classic edge transition detection techniques used on the digital input data. Instead, a proprietary method of extremely fast sample-and-recognize technology is employed that reduces dependency on cables, jitter and the quality of the incoming data source.

Once the data from the selected digital audio source has been input to DirectStream it is upsampled to ten times the standard DSD rate of 2.8MHz before any processing takes place. After processing by DirectStream all input data is converted to double rate DSD (5.6MHz) and output through a passively filtered analog section consisting primarily of a high-quality audio output transformer. Elimination of the classic active analog output stage, with all its difficulties running at these high frequencies, have been implemented with a high quality passive audio transformer.

Why DSD?

DirectStream is entirely DSD based, even for PCM inputs. DSD was chosen as the core engine for this instrument for a number of compelling reasons:

- DSD is simple to convert to analog: just low pass filter it.
- DSD is inherently linear: it's hard to build a PCM DAC that always takes the same sized step in the output for any possible unit increment of the representative PCM voltage value. The best PCM technology for linearity is arguably a resistor ladder, then all steps are at least positive for a positive change in the input, but making resistors that are accurate to one part in 2^{16} is hard and to one part in 2^{20} very hard. DSD doesn't need anywhere near this level of component matching.
- DSD soft clips when overdriven, more like magnetic tape: signals which exceed the nominal full scale value only get slightly compressed if at all. With PCM you either have flat tops which induce extra energy at the squared off edges or, worse, you can have wrap around, which is very audible.
- All bits in a DSD stream have the same weight: a single bit error anywhere is barely measurable let alone audible. Some bits in PCM carry a lot of weight and would make a very loud pop if changed. PCM needs more error recovery to keep to a given signal to noise ratio (S/N) with a slightly corrupted digital signal.
- Ironically, most sanely priced PCM players actually use DAC chips that utilize a sigma-delta modulator (DSD) to get a DSD-like signal anyway. Similarly many (most) A/Ds are sigma-delta based. The typical PCM path is analog -> DSD -> PCM -> disc -> PCM -> DSD -> analog. The DSD path can skip the conversions to PCM. Those conversions can't be perfect and artifacts of the steep anti-aliasing filter or the reconstruction filter aren't considered benign by many.
- DirectStream handles the PCM conversion from AES/EBU, S/PDIF, TOSLINK, I²S and USB without recovering a clock, by simply watching for the edges and making decisions about what they mean in context. The result is that any jitter present on the input is lost entirely in the FPGA. There is no difference in TOSLINK or I²S because the output clock's rate only depends on the long term average rate of the inputs not on any edge or other local feature.



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The DSD engine is it's heart

The heart of DirectStream is the DSD engine itself. Regardless of input format, whether PCM or DSD, all data are upsampled to 30 bits running at 10 times the standard DSD rate and then back down again to double rate DSD for noise shaping.

The internal volume control keeps complete precision: every bit in the input affects the output of the DAC for any volume level. Except for the sigma-delta modulation process itself there is no rounding, dither or other trimming, not to 24 bits, not to 32 bits, not to 48 bits, but rather a full 50. The incoming PCM signal is 30 bits from the upsampling filter and the volume control is 20 bits wide so all 50 bits of the output are used throughout the sigma-delta conversion, requiring more than 50 bits of precision.

DSD only requires a nominal 20 bit signal to noise ratio, this design utilizes a minimum width of 24 bits with wide filter coefficients and 144dB S/N. Use of full precision everywhere and many guard bits in the IIR filters and the sigma-delta modulator help maintain our goal of perfecting the audio output.

Full headroom with room to spare

While some designs may run out of headroom or approach saturation levels, depending on the source material, the new design opts for an extra top bit everywhere in the digital path coupled with an extra 6 dB of head room in the analog path beyond the 6 dB of headroom that SACD uses. The top bit keeps PCM from saturating, even if that PCM was not properly bandwidth limited in the initial recording process.

The output of the DSD engine is fed directly into the output stage, based on high speed video amplifiers and a passive output transformer.

Transformer coupled outputs

Most output schemes for DSD modulators are active low pass filters, covering the required 120dB S/N ratio from 10Hz to 220MHz and have a number of design challenges and problems associated with even the best designs.

If the analog processing isn't linear and doesn't have a very wide bandwidth it will modulate the high frequency noise that's inherent in DSD back into the audio band. That modulation will not result in just low level noise. In practice it will be aliased back into the audible band with serious sonic consequences. To maintain low noise and linearity, the design incorporates both high speed symmetrical video amps and a passive output filter. The first challenge in such a design is the output switch that generates the final 1's and 0's of the modulator.

Clean switching

A very clean switch that hooks up the positive rail with a 1 and the negative rail with a 0 is essential. If it has too much resistance, if the resistance is different at the positive end than the negative end, if the resistance changes from time to time, ... the result will not be as clean as it needs to be. For 120dB S/N the switch resistance has to be quite consistent. Another design requirement is consistent and fast switching time.

If the switch is too slow it won't keep up with the 5.6MHz signal used in this instrument. If the switch doesn't react in consistent times it will introduce jitter. Use of traditional CMOS gates adds a lot of jitter as do cross-coupled totem-poled bipolar transistors. Instead, DirectStream relies on high speed differential video amps, which are essentially class A switches, have their outputs either near the top rail or near the bottom power supply rail (without ever saturating) and provide a very clean DSD switch.

For the all important low pass filtering requirements an active filter adds self noise even if it is effectively lowering incoming noise. A unique and effective solution to this problem is a passive filter. The design uses a carefully crafted high bandwidth audio transformer at the output of the instrument for both galvanic isolation from the outside world as well as low pass filtering.

DirectStream
hardware and
design choices

The theory of operation, the firmware and the complex algorithms needed to execute a design of this magnitude are daunting in their scale and scope. The actual hardware to run the instrument is, perhaps, easier to grasp although no less critical to the perfected performance.

Listed in this section are the highlights of the hardware, system's overview and design choices made to create an instrument of this caliber.

One master
clock

1. DirectStream runs from one master clock designed to subtend all possible combinations of sub-clocks, from 44.1, 88.2, 48, 96, etc in order to eliminate the need for multiple clocks that cause errors and problems associated when noise from the unused clock propagates to the desired clock.
2. All sample rates supported are synchronously upsampled to 10x the standard DSD sample rate and then back down to double rate DSD ($2 * 64 * 44.1\text{kHz}$). There's no need for other clocks to interpret the inputs, no matter what their sample rate, because of the instrument's single clock architecture.
3. The path from the single master clock to its retiming flip-flop path is designed as short as possible and isolated from all other clocking.
4. Connections between sections of the design have large impedances, not only lots of power supply isolation, but also, for example, 2k resistors in series with digital signals to slow down the edges and lessen any noise transfer.
5. Similarly we run I²C, SPI and other control signals as slowly as

they can possibly go without causing problems; we also control their transition times, thus limiting the amount of induced noise and jitter into the main digital processing area.

6. Outputs of the FPGA use the slowest, lowest drive compatible with their function keeping noise as low as possible.
7. We use slower, older technology CMOS when we need CMOS. This choice lowers both noise and jitter potential.
8. We use balanced signals when practical, they not only lessen radiation and are less sensitive to radiation, but they lessen noise in the ground and power rails.
9. We use non-saturation logic so the exact transitions are more predictable. Coming out of saturation is a statistical process.
10. High rate signals (or signals with fast edges) are isolated from control signals and especially each other. If they have to be fast they are terminated appropriately to help address jitter.
11. Jitter is addressed everywhere in the design. Every component choice, every signal connection, every wire routed on the boards are all hand done to lower noise and pay attention to jitter.
12. 0.1% precision thin film low temperature coefficient resistors are incorporated everywhere in the audio path. 2% film caps in critical places and 5% film caps elsewhere in the audio path. By using 1/8W resistors or 1/4W resistors where others might use a 1/10W resistor the temperature coefficient of the resistors are lowered. For digital bypassing NPO/COG or at worst X7R MLCCs are used.
13. Low noise techniques are employed such as liberal use of low inductance capacitor bypassing with a self resonance frequency at the main clock rate to keep noise from ever getting into the voltage rails in the first place.
14. Digital filtering in general, and the upsampling and noise

Balanced design

Jitter is reduced throughout the design



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Digital filtering

shaping filters in the sigma-delta modulators in particular, offer many degrees of freedom for a filter designer. There isn't a mathematically perfect filter to use (they all have tradeoffs), so we've chosen the filters that sound best in our experience and in addition to that we run everything with as wide of an audio bandwidth as possible.

Double rate DSD

15. Although design choices might have been made to run everything at single rate DSD ($64 * 44100\text{Hz}$), it was decided instead to run at double rate DSD to have a wider audio band below the upsampling and noise shaping filters. Noise shaping is how a high rate sampled signal can have more accuracy in part of the spectrum than the 6dB / bit rule and it is understood that the quantizer in a sigma-delta modulator can hide a multitude of sins in the noise shaping filter. Our instrument still runs the noise shaping filter at full precision to get the cleanest DSD signal possible.
16. No shortcuts are ever taken in the Digital Signal Processing (DSP) section of the FPGA. Despite the fact that DSD is only nominally 20bit S/N, the design uses a minimum width of 24 bits throughout the device. Where needed, very expensive (in terms of math operations) filters with wide coefficients and 144dB S/N are employed along with many guard bits in the IIR filters and the sigma-delta modulator.
17. Every trace on the PC board is hand routed: even for the digital sections. No autorouting is employed so that each trace, each critical path is calculated and designed for lowest noise, jitter and isolation.

In Conclusion

The PerfectWave DirectStream DAC represents a significant departure in the design and execution of PS Audio's products. We believe this new instrument will help further our industry, music and the faithful reproduction of music around the world.



Getting Started

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Installation Considerations

LOCATION

A good location for DirectStream is in a cabinet or on a shelf at an easily accessible height. Care should be taken to keep it away from power amplifiers or large potentially hum inducing products. The IR (infrared) receiver for the remote is located to the left of the Touch Screen. A direct line of sight will help with DirectStream's IR sensor, which has been greatly improved from its predecessor, the PWD.

STACKING DIRECTSTREAM WITH A PERFECTWAVE MEMORY PLAYER (PWT)

DirectStream and the PWT were designed to stack on top of each other if they are not placed on separate shelves. To do this, remove the feet from the unit you wish to place on top of the stack. Carefully place the top unit so it rests on the bottom unit. You will note that the bottom of the corners of each PerfectWave piece is specially designed to mate with the top corners of another PerfectWave.

Digital Inputs Available

DIGITAL INPUTS

DirectStream offers multiple digital input choices including: The Network Bridge II, XLR (AES/EBU), RCA and Toslink (S/PDIF), USB as well as I²S. All inputs, including USB, are capable of accepting high-definition digital audio signals. The Toslink input is capable of 96kHz, 24 bit audio and all other inputs, including the USB, are capable of handling up to 192kHz 24 bit of PCM or DoP data. The I²S inputs can handle single and double rate DSD directly or DoP. Currently only the PS Audio NuWave Phono A/D Converter is capable of sending pure DSD over I²S.

DirectStream uses an HDMI cable to transfer I²S data. This data can only be used with another compatible component, such as the PerfectWave Memory Player, and will not work in other HDMI equipment as the I²S format incorporated does not comply with the HDMI standards. The HDMI connector and cable were chosen to carry the I²S signal because of their superior high-speed data transmission capabilities for multiple clocks and data lines. PS Audio publishes its I²S standard and it has been adopted by multiple other manufacturers as well.

DoP

DoP (DSD over PCM) is a standard allowing single rate DSD to travel over S/PDIF (the RCA, XLR and Network Bridge digital inputs are S/PDIF compatible) as well as over USB and I²S. It is not currently possible to send DSD directly over S/PDIF and the DSD files must first be converted to DoP standards to travel this route.

It is possible to send DSD files (without conversion to DoP) over DirectStream's I²S inputs as well as USB. Most programs, such as JRiver Media Center and Foobar 2000, will automatically convert DSD files to the DoP standards on the fly if the appropriate checkbox has been enabled. There are no sonic penalties for conversion to DoP as the raw DSD data is unaffected by the process.



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Unpacking and Connections

- Carefully unpack the unit. Your new DirectStream comes wrapped in a soft organic cotton bag to protect its beautiful finish. Use the included cotton gloves to remove the unit and place in the chosen location.
- The piano black top cover has a protective plastic film. Remove this film.
- Connect DirectStream to your digital sources using the appropriate connections.
- Connect the AC cable into the receptacle in back and plug the unit into your Power Plant or into the wall.

Register the Unit

PS Audio products come from the factory with a 3-year warranty. Please register your new DirectStream. Registration takes just a few minutes, helps us inform you about future upgrades, keeps track of your serial number and allows us to maintain the highest standards of product quality of any company.

To register your new unit, look on the back panel of DirectStream and note the serial number. Using any web browser, go to www.psaudio.com and click on Register Products. Once you have completed the registration process you can then go to the PS website and look at the My Registered Products page. The link to this page is located at the top right hand corner of the website once you are logged in. If you do not have web access you may register the unit via mail or phone. Notification of software upgrades to this product will be available only to registered owners via the web and email.

Connecting DirectStream

CONNECTING TO A DIGITAL SOURCE

There are four methods of connecting the digital inputs of DirectStream: Through the home network, S/PDIF, USB and I²S. The home network option requires the addition of the optional PS Audio Network Bridge II be installed. S/PDIF is a serial digital interface available as an optical source (TOSlink), coaxial source (RCA) or balanced source (AES/EBU XLR). Connect to your digital sources with any of these three cable types.

USB is the preferred method of connection for a direct-to-computer connection and DirectStream is capable of processing up to 192kHz 24 bit PCM data as well as both single and double rate DSD converted to DoP. Connect DirectStream to your computer using a well regarded USB cable and make sure to set the output of your computer to the higher 192kHz 24 bit standard. Once connected, your computer should automatically install DirectStream as a new device if you have a Mac. If you have a Windows operating system you may need to download the appropriate driver from our website and install it on your computer. The driver for DirectStream is the same as that used with the PWD and NuWave DSD.

If the device is not recognized or you are unable to obtain output through DirectStream it is possible there is a driver conflict on your computer. Please see the Troubleshooting section for further assistance on playback issues via USB.



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I²S Input

I²S is available through several manufacturers as well PS Audio equipment such as the PerfectWave Transport and the NuWave Phono A/D Converter. I²S is a parallel data connection with separate clocks and data and transferred via an HDMI cable. I²S will typically provide a slightly better performance standard than any serial data stream such as S/PDIF or AES/EBU.

USB

You can connect one or all seven inputs at the same time. For instance, you can connect the USB input to your computer and the coax input to your CD player. Then you can simply choose which one to listen to from the front panel touch screen or the remote. If you are using USB, make sure both the computer and DirectStream are connected and powered up. USB also requires a driver to operate properly. Mac computers running OSX have the driver built in. Windows based computers require the PS Audio driver to be installed. Download the driver from our website; it is the same driver used in the PWD. DirectStream will show up under Device Manager as PS Audio PerfectWave DSD, under a heading PS Audio USB 2.0 Audio Devices.

Connecting the Output

CONNECTING DIRECTSTREAM'S OUTPUT

DirectStream is designed to drive a power amplifier directly, or as another input on a preamplifier. The outputs of DirectStream are high-performance, high current outputs that can drive long lengths of interconnect cable without degradation.

DirectStream has two types of analog outputs, balanced XLR or single ended RCA. **We do not recommend using both outputs at the same time.** Be aware that most amplifiers and preamplifiers will produce 6dB higher level with the balanced outputs relative to the single ended outputs. If you are using both outputs be advised they will be at different levels. Our preference for connection to a power amplifier or preamplifier is through the balanced XLR outputs of DirectStream.

If There's a Gain Mismatch

If DirectStream has a gain mismatch with your power amplifier, you can use the balanced outputs and achieve 6dB more gain or choose the single ended RCA outputs for lower gain. DirectStream also has two output levels available to users. Go to the setup menu on the front panel touch screen to select the best output level.

RCA or single ended inputs will be the typical inputs as many preamplifiers, surround processors receivers, integrated amplifiers and power amplifiers have only this standard type of input.

Plug either the RCA or the XLR outputs of DirectStream into a line level input on the preamp, integrated, amplifier or subwoofer. Do NOT plug the output of DirectStream into a

phono or equalized input of any type.

Once everything has been connected, use a high quality AC cable to power DirectStream. DACs in particular are quite sensitive to AC power and produce a bit of line noise themselves. Make sure you have a high quality shielded power cable to power DirectStream, and a Power Plant if possible.

PS Audio produces an entire line of high quality shielded power cables that are generally accepted as being some of the best in the industry. Whatever you choose, make sure it honors the music.

Control and Operation

Turn the AC power switch in the rear of DirectStream to the ON position. The power switch is located just above the AC inlet.

As soon as the switch is activated the front panel touch screen will display the initializing screen. This screen shows when DirectStream's internal "engine" is being loaded with the firmware that runs DirectStream.

After the initializing screen, you will see the main screen of DirectStream.

Front Panel Standby Button

The front panel PS logo button, located on the upper left hand corner of the unit, is the Ready/Operation Mode control for DirectStream. This control has two modes: Ready Mode and Operational Mode. Ready Mode (Standby) is designed to keep power on to critical internal circuitry including power supply capacitors, thermally sensitive semiconductors and integrated circuits.

Press this front panel button to activate the Ready Mode or to place DirectStream in Operational Mode. When pressed to activate the Ready Mode, the display as well as the outputs are turned off, but all the unit's critical internal circuitry remains active.

If you wish to conserve energy consumed by DirectStream it will be necessary to use the rear panel power switch. Using this rear panel switch will remove power from critical components and in order to gain maximum performance levels you will need



Standby or Operate

to turn DirectStream's power on at least 3 hours before use.

Should DirectStream need to be rebooted, use the rear panel power switch to power cycle the instrument. It's best to wait 30 seconds before powering back on.

Input Selection

SELECT THE INPUT

The first step is to select the input you wish to play. The input select is on the touch screen. Touch the input selected which is the visible input icon already displayed. The input selection list appears. Scroll through the list and touch the input you wish to play. The screen reverts back to the main screen and the selected input is displayed.

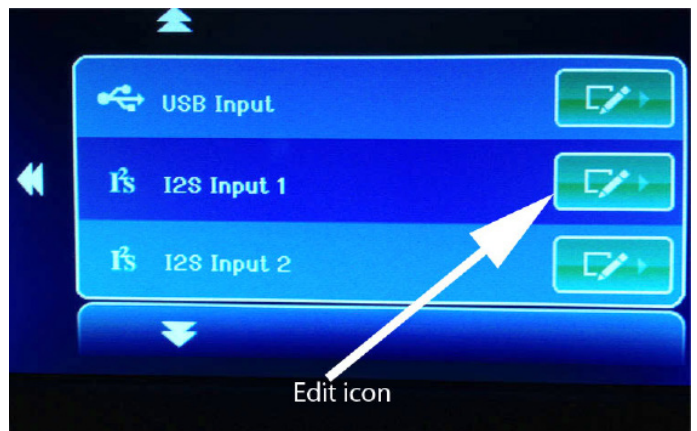


Each input has a lock light associated with it. The lock light has two states: connected (green) and not connected (red). This lock light indicator is located in the upper right hand corner of the input icon. Some transports will not appear connected until you start to play the transport.

Input Naming

INPUT NAMING

For greater convenience it is possible to assign a custom name to each input such as PerfectWave Memory Player, Apple TV, etc. To name each input, touch the input icon from the main screen. The input list appears. Touch the small edit icon of the input you wish to name and the edit screen appears. Type in the name of the product and touch "SUBMIT". If you wish to return to the default input name, go to the second keyboard screen (accessed by pressing the numeric key labeled 123/!) and touch "Restore Default".



DirectStream upsamples every input and file type to 10X DSD rate before processing. It is not possible to select the upsample rate for modification and therefore no sample rate choices are available on DirectStream's touch screen.

Unlike many DACs, including DirectStream's predecessor, no filter options are available.

Filter and Sample Rate Selections

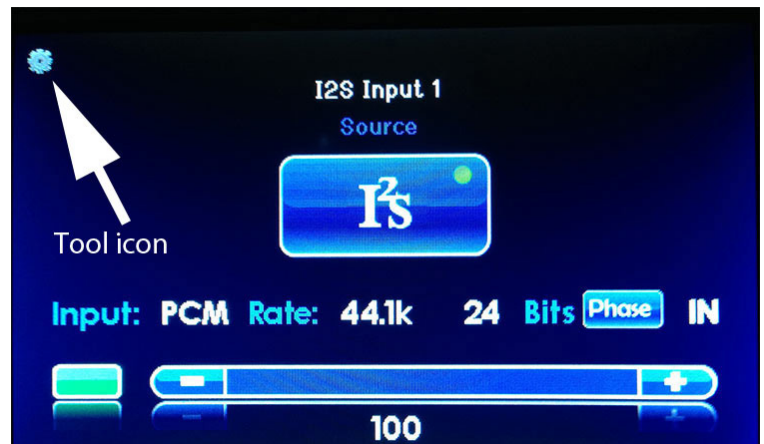
DirectStream has two output levels, High and Low. In the standard output mode, DirectStream will provide adequate output level to directly feed a power amplifier without use of a preamplifier. If the power amplifier, or preamplifier, is overly sensitive or you need to reduce the output level of DirectStream for any reason, you can activate the output attenuator to reach a lower level. There should be no sonic penalty for doing so.

Adjusting the Output Level

To turn on/off the output attenuator, press the filter button on the remote. Or, go to the setup screen which is accessible by touching the small tool icon at the top of the default screen.

Screen Brightness

The unit's screen brightness can be adjusted in the setup menu. The display can be turned off by pressing the button labeled "DIM" located at bottom right of the remote. When you are in the DIM mode, the screen will come back on when you touch it or press a remote key. To turn the DIM feature off, press "ON." You can also adjust brightness in the setup menu.



DirectStream can become far more than a high-performance stereo DAC. An optional Network Bridge II can be added that connects DirectStream to any home network. The Bridge II allows playback from a source not directly connected to DirectStream using a UPnP protocol and separately available controller and server, such as a NAS.

The Network Bridge Option

The Network Bridge II incorporates the exact same Digital Lens™ technology found in the PWT – without the input to the Lens being from a connected source. Instead, the input to the internal Lens of the Bridge II is over a network: addressable through an Ethernet connection. Music stored on a hard drive or even an Internet radio service are all accessible via this Network Bridge II. Once installed, the Bridge II will be accessed as another input.



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There will be no quality or performance issues on the Bridge II for the same reason as the PWT: the built in Digital Lens and output asynchronous clocks of both devices ensure bit-perfect performance.

The Bridge II slips right into the slot on the back of DirectStream and can be added in less than 30 seconds by the owner. Simply remove the rear cover plate, insert the Bridge II and you are done. Complete instructions are available with purchase of the Network Bridge II.

The front panel touch screen software will be updated at the same time as the Bridge II installation allowing full access to music stored on your computer.

These units operate from sophisticated software that is built in to the device, but upgradable by the user through the rear panel mounted SD card. To check for the current firmware version simply touch the tool icon on the front panel, located in the upper left hand corner of the touch screen.

Firmware Upgrades

Should a new operating system become available, it may be obtained by ordering a pre-programmed SD card directly from PS Audio, or downloaded to your own SD card for free from the PS Audio website. To install, place the SD card in the rear of DirectStream, gold pins facing up. The SD card slot is found directly below the Network Bridge slot. Then, follow these steps:

First, turn off the rear panel power switch. Wait for 10 seconds, then insert the SD card (upside down with the gold connector pins facing up). Turn the rear panel main power switch to the on position. The front panel Ready Light will begin blinking, signifying the new firmware is being installed.

DO NOT REMOVE THE POWER OR DO ANYTHING WHILE THE UPDATE PROCESS IS TAKING PLACE. BE PATIENT AND WAIT UNTIL THE LOGO LIGHT BLINKING IS DONE. Once the blinking has finished, keep the power to the unit on until it has fully initialized and is ready for operation again. Then remove the SD card.

Care and Cleaning

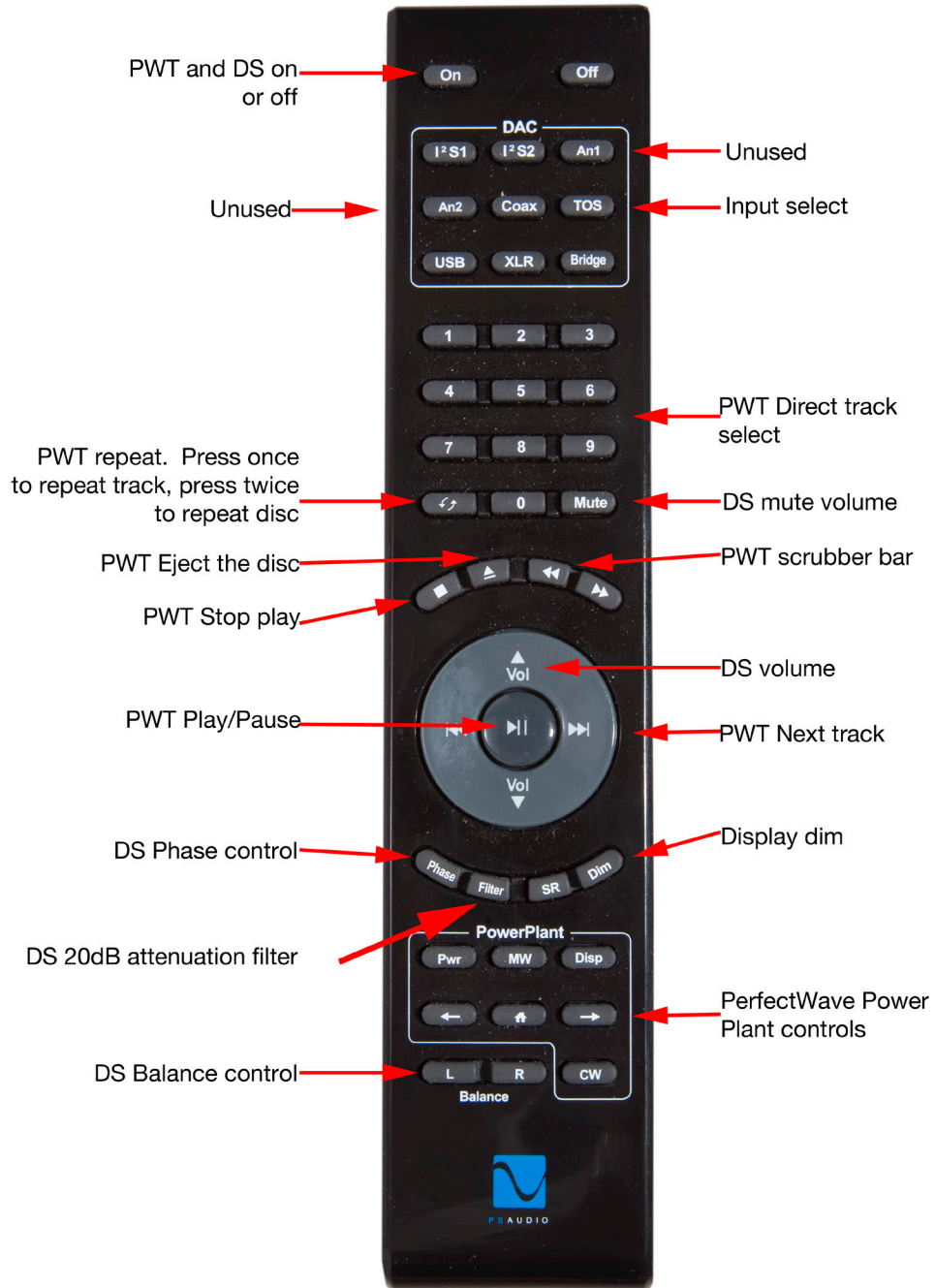
DirectStream does need some care and is appreciative of being fed proper AC power. A Power Plant is recommended for this task.

Should minor scratches occur in your top cover, simply purchase any type of high quality automotive scratch removal polish such as Kit's Scratch Out or McGuire's products. Car finish polish and wax can both be used on this surface for a beautiful luster.

The top cover is a piano black painted surface over HDF (wood).

The front panel touch screen can be cleaned with Windex or similar glass cleaners. To clean, spray the cleaner on a soft lint free towel and carefully clean. Do not spray cleaner directly on the unit.

Remote Control





Troubleshooting

Owner's Reference DirectStream DAC

USB not
connecting

USB – DirectStream not recognized, or no sound via USB

To play music from your computer into the DirectStream via USB you must have a driver installed that communicates with the DirectStream. On a Mac computer with OS X Yosemite the drivers are already available and the unit should be automatically recognized. You can then go and choose the PS Audio USB driver to play to by going to System Preferences->Sound and select the PS Audio PerfectWave DSD. You can also go to Applications->Utilities->Audio Midi and select the driver as well as set the sample rate.

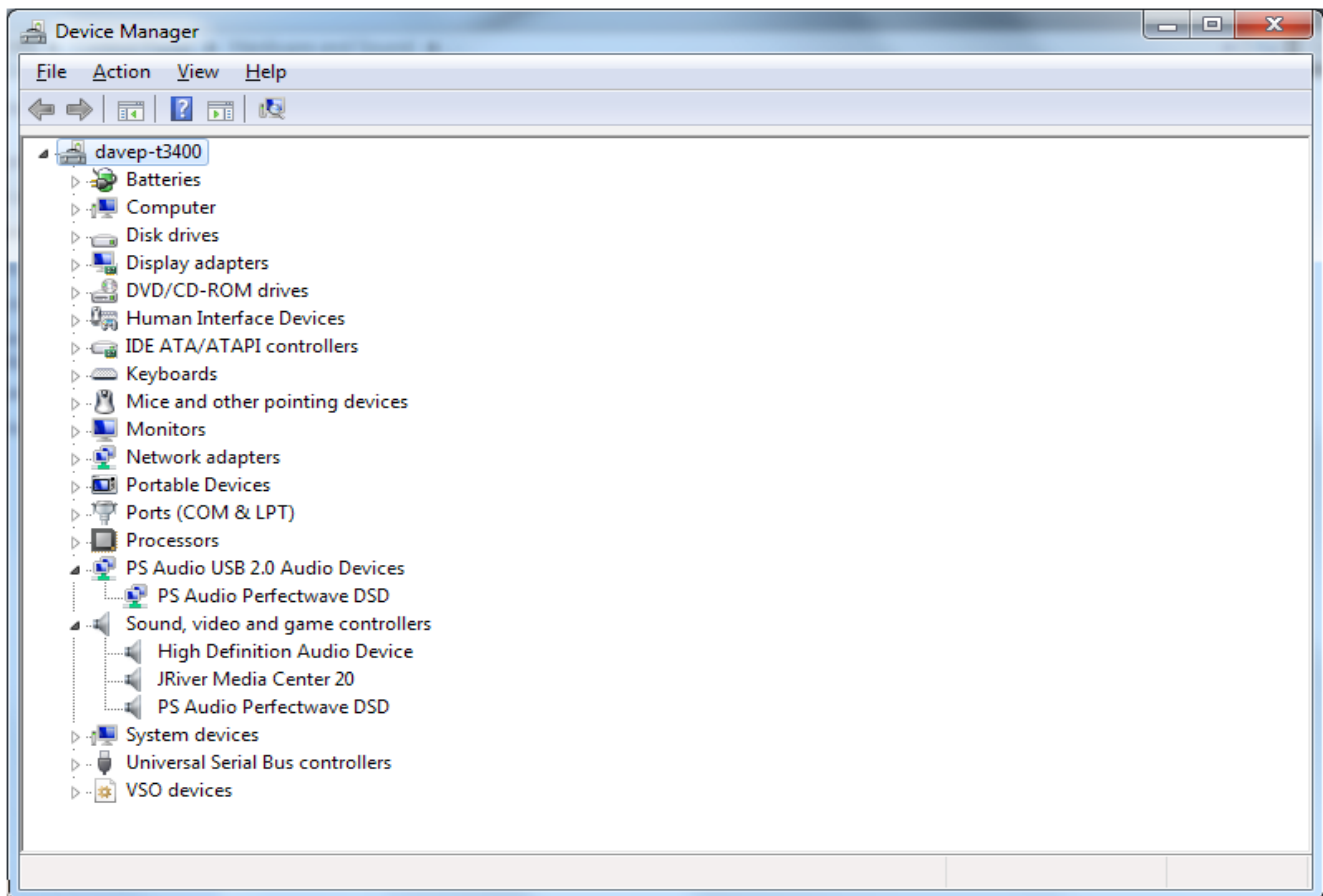
Currently Windows operating systems do not come with appropriate USB audio driver software installed. You will need to download the PS Audio USB driver from the PS Audio website.

You can also contact our support staff via email or phone or simply go to www.psaudio.com and click on the Downloads page for the download. You must then unzip the driver and install it on your Windows machine. Once installed, Windows will recognize the DirectStream and allow you to select it for playback from any program on your computer.

If you are unable to obtain sound via USB on a Windows based device it is most likely the result of a partial or incorrect driver installation.

You may have also experienced a pop-up window asking you to provide the correct driver. In any of these cases the remedy is quite simple. Remove the device and force Windows to reinstall the driver and the device.

DirectStream will show up under device manager as "PS Audio PerfectWave DSD" It should show up under a heading "PS Audio USB 2.0 Audio Devices", this is the USB2.0 driver. The entry under "Sound video and game controllers" is the USB1.0 fallback driver.



Too much gain

DirectStream has enough output gain to directly drive most power amplifiers without a preamplifier. DirectStream's volume control is a no-loss design and may be used at any setting from 1 to 100 without fear of resolution loss.

However, if there is too much gain when you connect directly to a preamplifier or power amplifier, it is possible to select a lower output gain setting. To do so, go to the setup touch screen on DirectStream and choose the lower output option (see the Quick Start guide). You can also turn the output attenuator on or off by pressing the Filter button on DirectStream's remote control.



Warranty

Owner's Reference DirectStream DAC

Limited Three Year Warranty

Registering

Should I Register My Product?

- Registering your product validates the warranty start date.
- If you do not register your product within 30 days of service, a copy of your purchase receipt from an authorized PS Audio dealer may be used as a proof of purchase to establish the warranty start date.
- If no proof of purchase from an authorized PS Audio dealer or registration is provided, the production date of the product will be used to determine the warranty start date.
- Registration can be completed online, by phone, by mail, or by email.
- You may wish to sign up for PS Audio's monthly newsletters, specials, product updates, and/or Paul's Daily Posts.

Coverage

What Does this Warranty Cover?

This warranty covers defects in material and workmanship for products purchased from PS Audio or its authorized dealers and agents.

What Will PS Audio Do to Correct the Problem?

In the event your product fails your sole remedy under this limited warranty shall be to return the product to PS Audio. The product will be repaired without charge for parts or labor, replaced, or the purchase price refunded through the original point of purchase, at the option of PS Audio.

What is the Period of Coverage?

This limited warranty is in effect for 3 years from the date the unit was first purchased from PS Audio or its dealers and agents.

Shipping

Who Pays for Shipping?

You are responsible to pay for the safe and proper shipment of the warranted product to PS Audio.



Warranty

Owner's Reference DirectStream DAC

Not Covered

What Does this Warranty Not Cover?

This warranty does not cover damage due to:

- Accidents, carelessness, improper transportation, misuse, neglect, or abuse
- Failure to follow the operating instructions that are provided by PS Audio in the owner's manuals (available for download at psaudio.com)
- Use in any manner inconsistent with PS Audio's operating instructions (available for download at psaudio.com)
- Lack of routine maintenance
- Connection to an improper voltage supply
- Alterations or modifications to the unit
- Improper or unauthorized repair, including repairs not authorized by PS Audio.
- Fire, lightning, flood, "acts of God," or other contingencies beyond the control of PS Audio
- Products purchased through an unauthorized source (if you have questions as to whether or not a dealer is authorized, please contact customer support at psaudio.com)
- Products with a factory-applied serial number that has in any way been altered, defaced, or removed

Limitations

Limitations on PS Audio's Obligations Under this Warranty

- In no event will PS Audio's liability to you exceed the original purchase price of the unit.
- This warranty does not cover the cost of custom installation, customer instruction, setup adjustments, or signal reception problems.
- This warranty does not cover consequential and incidental damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.
- In the event your warranted product cannot be repaired, PS Audio will replace or refund the unit. We reserve the right to replace any out-of-stock, discontinued, or limited edition products with a comparable product. Discontinued products may not be available for warranty replacement.

Warranty Transfer

How Can the Warranty be Transferred?

This warranty is for the benefit of the original purchaser of the product. The warranty may be transferred to a subsequent purchaser during the 3 year warranty period. To do this, you must contact PS Audio directly to set up transfer of registration.



If you require service in North America

How Do I Get Warranty Service?

For service assistance, or for help with the operation of a product or just for information, please contact PS Audio customer support.

Obtain an RMA number

Warranty Service Within the US

- You must first obtain a Return Merchandise Authorization Number (RMA#) to receive warranty service and prior to returning any item. Contact PS Audio to receive an RMA#.
- You must put the RMA# on all returns. If it is not clearly marked, PS Audio will return the package back to you, freight collect.
- You should include a description of the problem, along with the RMA# inside the packaging.
- Original packaging should be used for the safe transit of your PS Audio unit. If you do not have the original packing, PS Audio can sell and ship to you replacement packaging.
- You are responsible for the cost of shipping the product to PS Audio. You should insure the product for its full retail cost in the event it gets lost or damaged in transit. PS Audio is not responsible for damage incurred in products sent to us.
- Shipping your product in non-PS Audio packaging may void this warranty. PS Audio reserves the right to charge you for new factory packaging to return your product after a repair.

Use original packing

State law

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

If you are outside the US

PS Audio has authorized distribution in many countries of the world. In each country, the authorized importing distributor has accepted the responsibility for warranty of products sold by that distributor. Warranty service should be obtained where the product was purchased.

Changes to Our Products

PS Audio reserves the right to modify the design of any product without obligation to purchasers of previously manufactured products and to change the prices or specifications of any products without notice or obligation to any person.



Service

Owner's Reference DirectStream DAC

Your Serial
Number

Your Purchase
Information

Date of Purchase

