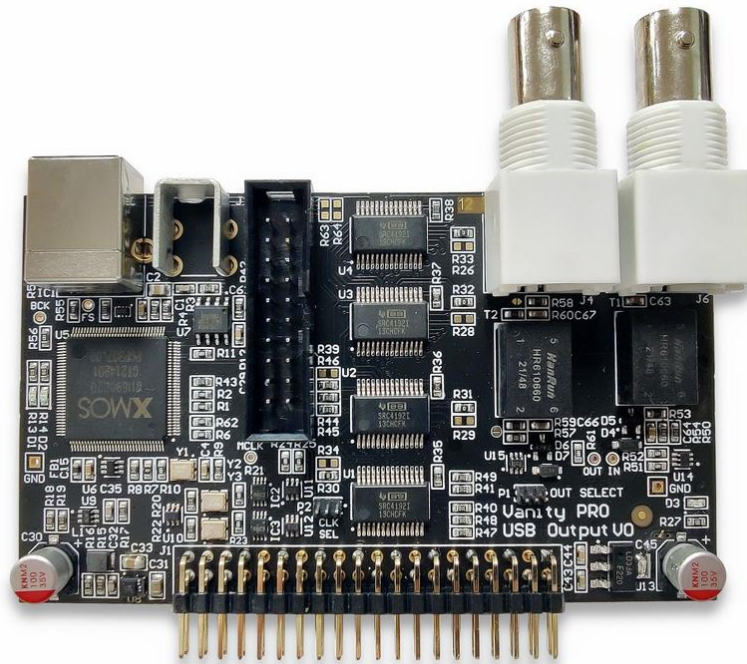




Vanity^{PRO} USB Output Module



1 Introduction

One of the many great features of the Vanity^{PRO} is the interchangeable output module with various configurations of output connectors. One of the latest additions to the collection of output modules is the USB Output Module.

This module greatly expands the connectivity and functionality of the Vanity^{PRO} and allows the user to send HDMI multichannel audio to a PC via USB for scenarios where the PC runs multichannel audio processing such as room correction, digital speaker crossover or similar.

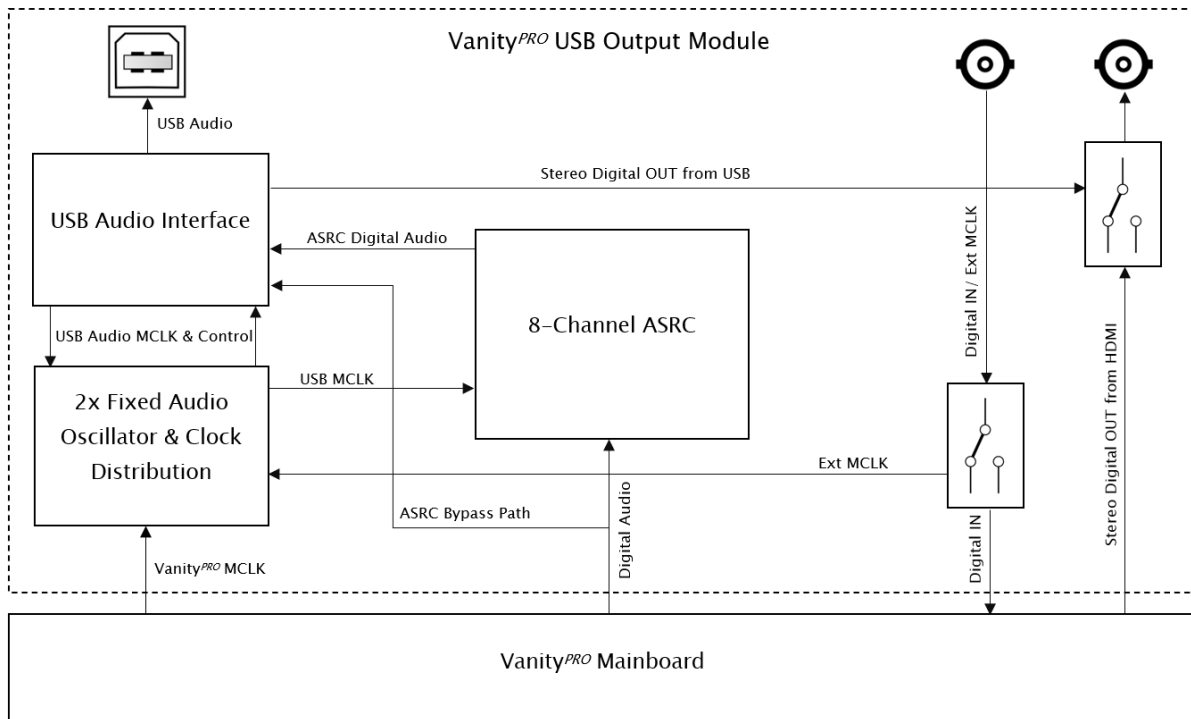
The module is equipped with a USB-B connector, a multichannel USB Audio Device controller and two BNC connectors. One BNC is for 2-channel digital audio output and one for 2-channel digital audio input or clock input for external clock synchronization. To overcome the issue of USB Audio protocol, when the USB device cannot inform the USB host about the incoming sampling frequency, the USB Output module employs 8-channel asynchronous resampling. This allows the USB host to run a session at fixed sampling frequency. The asynchronous resampling stage also has a bypass function for cases when bit accurate audio transmission is required. This scenario includes DoP playback and recording.

The BNC output is provided for monitoring purposes. Front/Stereo channels from the HDMI or USB subsystem can be routed to the BNC output in S/PDIF format and connected to a downstream DAC.

The BNC input can take in standard 2-channel digital audio in S/PDIF format and route it to the digital receiver shared with HDMI ARC.

2 Block Diagram

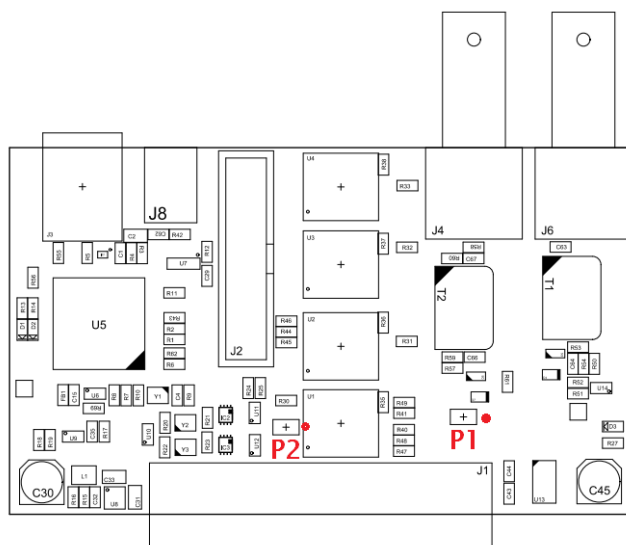
The principal block diagram of the USB Output Module with all main signal and clock paths and routing options is shown below.



3 Installation options

Before plugging the board into the Vanity^{PRO}, make sure the jumpers on headers P1 and P2 are set as desired. P1 selects the source for BNC output and P2 selects the clock source. Pin #1 of both headers is marked with a dot. Jumper headers are 1.27mm pitch and jumpers for both headers are provided.

Location of P1 and P2 headers with pin #1 indication is show on the right.



P1 Options (OUT SELECT)

- Pins #1 + #2 shorted, the BNC outputs Front Stereo pair from the HDMI audio subsystem (default).
- Pins #2 + #3 shorted, the BNC outputs Front Stereo pair from the USB audio subsystem.

P2 Options (CLK SELECT)

- Pins #1 + #2 shorted, the clock used is externally supplied clock from BNC input.
- Pins #2 + #3 shorted, the clock used is internally generated clock (default) and BNC input can be used for digital audio in.

Install the output module into the Vanity^{PRO} and secure the back plate with two screws.

4 Connections

The multichannel USB audio port can be connected directly to a PC with a USB port. The PC should be reasonably fast since it needs to be able to receive and process up to 8 channels at 192kHz and 24 bits. The S/PDIF input can be used to connect a device with S/PDIF output, such as a CD player or similar. The S/PDIF output can be used to connect a DAC for monitoring of the front stereo channels while recording or processed stereo audio coming from the PC via USB interface.

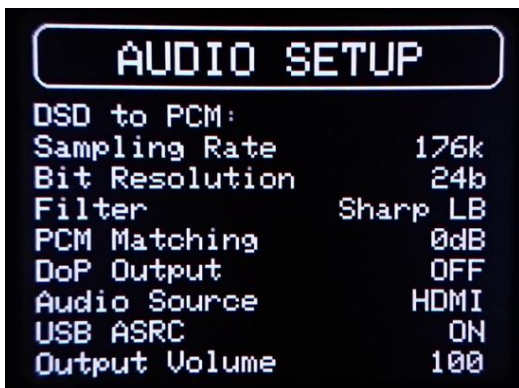


Typical signal connections of the Vanity^{PRO} with the USB Output Module

5 Vanity^{PRO} Settings

There are two dedicated settings of the USB Output Module which can be controlled from the Vanity^{PRO} user interface, and which are very important for correct operation. One of the settings controls the ASRC bypass function and influences the overall workflow of the USB audio transmission and session configuration. With ASRC enabled, the USB audio session can be operated at fixed sampling rate of user's choice. ASRC is applied to all PCM sampling rates, including DSD converted to PCM by the Vanity^{PRO}. It is important to note that the audio data subjected to ASRC is resampled and no longer bit accurate. The other setting selects the audio source between HDMI and the auxiliary digital audio input.

ASRC can be disabled when bit accurate audio data transmission is required. In this case the user must manually set the correct sampling rate on the PC side and match the sampling rate of the USB audio session to the sampling rate of the digital audio source – HDMI or S/PDIF input. This scenario is mandatory for DoP playback when the digital audio stream is regarded as a generic bitstream and must not be resampled. Similarly, if the user wants to pass through other types of bitstream (AC3 and similar) for decoding and processing in a PC, ASRC must be disabled. The ASRC setting can be found in the Audio Setup screen.



Audio Source: Selects the audio source between HDMI (default) and auxiliary SPDIF Input. With SPDIF input selected, the Vanity^{PRO} can be used as a USB audio interface with digital input.

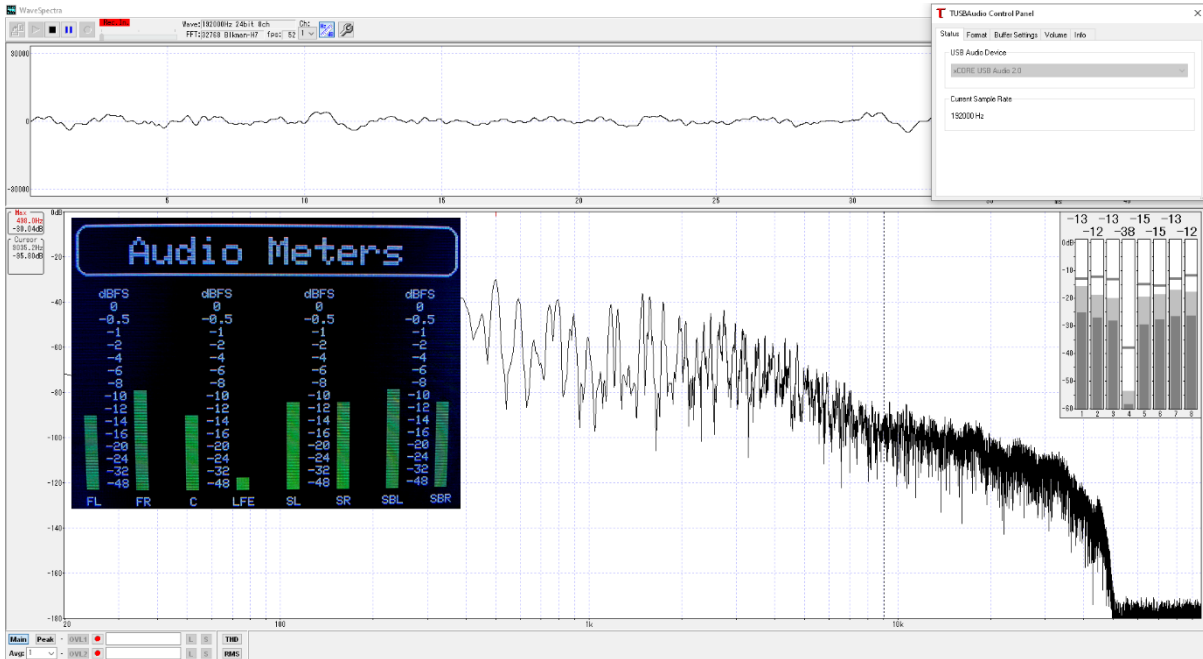
USB ASRC: Enables or disables the asynchronous resampling function on the USB Audio output module. This setting has no effect with any other output option.

6 Operation

6.1 Recording

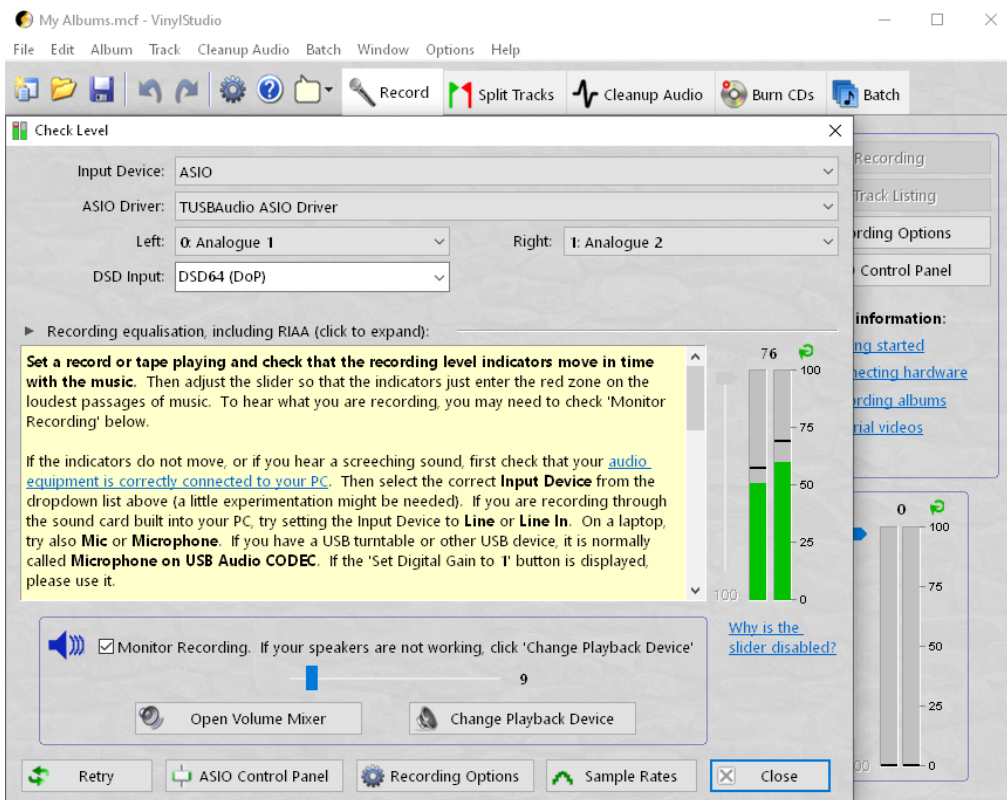
In the following paragraph, there are two examples of multichannel and stereo recording made using two different software tools. The first example is an 8-channel recording with Wavespectra (<https://gtkc.net/efu-mirror/soft/ws/ws.html>) audio analyzer and recorder. The signal source is a BD player playing an 8-channel BD audio at 96kHz. The ASRC on the USB Output module is enabled and the recording session in Wavespectra is set to 192kHz sampling rate. This way, the Vanity^{PRO} resamples all 8 channels from 96kHz to 192kHz.

This example is shown as a screenshot of the Wavespectra main screen below. There is also a photo of the audio meters of the Vanity^{PRO} included for comparison with the audio meters of the Wavespectra and a window of the USB audio driver showing the actual sampling rate. Please note that the scaling of the audio meters is different.



Recording example #1

The second example is a DoP recording and live playback with decoding using VinylStudio PRO (<https://www.alpinesoft.co.uk>). This tool, probably as the only one available, can perform live DoP decoding into PCM for live listening/monitoring and recording into native dff or dsf files. In this example, the BD player plays an SACD disc and the Vanity^{PRO} is set with DoP enabled and ASRC disabled (Audio Setup screen).



Recording example #2

When the VinylStudio is set to record DoP64, the sampling rate is automatically set to 176.4kHz. In the Check level screen, one can enable monitoring which converts DoP into PCM and routes the audio to selected playback device. The audio indicators show decoded audio levels rather than steady low levels of the DoP signal.

6.2 Playback

In addition to 8 input channels, the USB Output Module also features 2 output channels. These can be accessed by setting P1 jumper appropriately as described above. The 2 output channels can be used for monitoring audio processed in a PC or other purpose.

6.3 Synchronization

The BNC input can be used as synchronization input for USB master clock. The frequency required is determined by selected sampling rate of the USB audio recording session. It can be either 22.5792MHz for sampling rates 44.1kHz, 88.2kHz and 176.4kHz or 24.576MHz for sampling rates 48kHz, 96kHz and 192kHz. Such clock signal is commonly called Super-clock.

7 Specifications

USB Audio Interface

- USB Audio Class 2 controller based on XMOS XU216 MCU
- USB-B connector
- 8 IN and 2 OUT channel configuration
- Up to 192kHz and 24 bits LPCM in both directions
- 8-channel ASRC with any ratio of input and output sampling rates

Digital Audio Input and Output

- BNC connectors, 75Ω impedance
- Protocol: S/PDIF (IEC958 / EIAJ CP1201)
- 2 channels, up to 192kHz and 24bits
- Transformer isolated
- User configurable source for output between HDMI and USB
- User configurable input signal type between digital audio and super-clock
- Super-clock frequencies: 22.5792MHz or 24.576MHz