



WHITEPAPER

HDMI 2.1 WITH XBOX SERIES X & PLAYSTATION 5



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The next generation of video game consoles is already upon us - Sony's PlayStation 5 (PS5) and Microsoft's Xbox Series X (XSX) are now live.

These consoles are some of the first consumer electronics that feature a HDMI 2.1 chipset. So, what does that mean for retrofit and new installations?

In order to fully utilize these consoles, it is crucial to understand the difference between HDMI specifications and standards. The PS4 Pro and Xbox One X are HDMI 2.0 devices, meaning their outputs support a maximum bandwidth of 18Gbps, translating to a 4K 60Hz 4:2:2 12bit or 4K60Hz 4:4:4 8bit signal. When distributing these consoles through a matrix switch, extender, or AVoverIP system, it is necessary for the distribution system to support 18Gbps content, otherwise the customer will be stuck with a sub-par system that cannot achieve maximum fidelity.

This same concept holds true for both the PS5 and XSX. To achieve maximum fidelity, the distribution technology must be capable of handling HDMI 2.1, which supports up to 48Gbps. But, upon their respective launches, the PS5 and XSX do not output a full 48Gbps. The PS5 is limited to 32Gbps, while the XSX is limited to 40Gbps.

The XSX can output maximum resolutions of:
4K 120Hz 4:4:4/RGB 10bit = 40Gbps

The PS5 can output maximum resolutions of:

- 4K 120Hz 4:2:2 10bit = 32Gbps
- 4K 60Hz RGB 12bit = 32Gbps

These video output formats usher in a new era of video fidelity. With this increased bandwidth available in HDMI 2.1, we are now able to experience video games, movies, and other media

on an entirely new level by taking better advantage of the increased color and contrast that HDR can offer.

HDMI 2.1 uses a new technology called Fixed Rate Link (FRL). This differs from the HDMI 2.0 standard, which is a TMDS transmission. It is important to note that when setting up the XSX, HDMI 2.1 FRL only activates when you output 4K 120Hz. Using a 4K 60Hz configuration defaults back to the HDMI 2.0 TMDS method and is then held to the 18Gbps bandwidth ceiling. The PS5 operates differently in that it will use HDMI 2.1 FRL even at 60Hz, as long as the connected display uses an HDMI 2.1 chipset. If the PS5 is connected to an HDMI 2.0 display, it is then limited to 18Gbps.

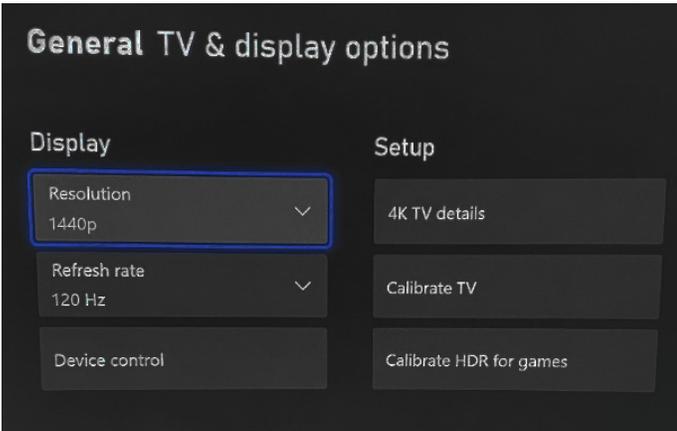
Additional HDMI 2.1 features, such as Auto Low Latency Mode (ALLM) and Variable Refresh Rate (VRR), are supported on the XSX. When the console reads a display's EDID, it will find whether the display is capable of ALLM or VRR and if so, these options can then be enabled on the XSX. When ALLM is enabled the console can automatically trigger a display to enter Game Mode. Game Mode offers reduced post processing by the display, which in return will reduce input latency, making it a better experience for online competitive gaming.

VRR allows the display to actively adjust its refresh rate based on framerate of the content it is receiving. This is critical in gaming, as many times games will fluctuate their framerate based on the intensity of the scene and the ability of the GPU to process information. Without VRR, when game framerates fluctuate, "screen-tearing" will occur. This appears on the display as out of sync frames with visible horizontal lines (see image below). With VRR enabled, screen-tearing can be easily avoided.



Currently, many WyreStorm products already support ALLM and VRR. You do not need an XSX to take advantage of these features as it is also supported on the last generation Xbox One X. For example, our pure HDMI and MXV Series of 18Gbps HDBaseT switchers will allow ALLM and VRR metadata to pass from the display to the source.

What does all of this mean for installation of a PS5 or XSX into an existing HDMI 2.0 infrastructure? To put simply, the PS5 and XSX will be limited to the same experience as the PS4 Pro or Xbox One X. One feature to note on the XSX is its ability to output 120Hz at 1080p and 1440p (QHD). This is a good alternative if the customer does not have a 4K 120Hz HDMI 2.1 display. Since both 1080p & 1440p 120Hz fall within the HDMI 2.0 spec, you can still achieve high framerate output just at a lower resolution.



But what if the customer wants a 4K 120Hz experience? Well, there are few options on the market as of November

2020. The first is to ensure the display has an HDMI 2.1 chipset and can support 4K 120Hz. Most of the big-name manufacturers like LG, Samsung and Sony have options readily available.

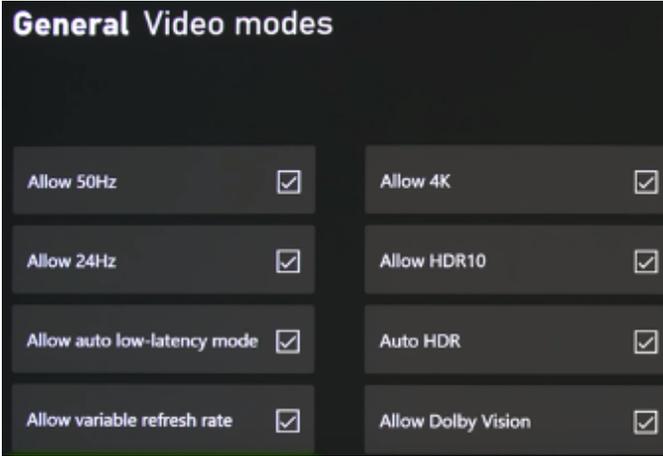
Second, you will need to ensure the HDMI cable complies with the 2.1 specification. At WyreStorm, we have our CAB-HAOC-FRL active optical HDMI cables that are rated to pass 48Gbps up to 15 meters (~50ft). Large scale distribution of 4K 120Hz content is slim as of now, but rest assured that WyreStorm is already developing 4K 120Hz and 8K 60Hz switchers and splitters.

Pre-Launch, both the PS5 and XSX highlighted their ability to support 8K UltraHD. Recently, both Sony and Microsoft confirmed that 8K support is currently disabled on both consoles as of their November 2020 launches. It is yet to be seen what they may allow in the future as 8K content becomes more prominent.

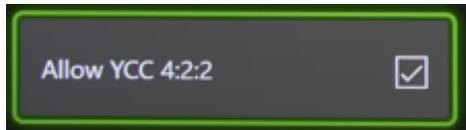
QUICK TIPS TO BEST TAKE ADVANTAGE OF HDMI 2.1 FEATURES ON NEXT GEN CONSOLES

XBOX SERIES X

On the XSX, navigate to the Settings menu and choose General > TV & Display Options > Video Modes. You will then see the options to enable both ALLM and VRR, along with many other settings such as enabling HDR and Dolby Vision support.



The XSX also features an option to enable YCC 4:2:2. This option is primarily important when connecting the console to an HDMI 2.0 infrastructure. By enabling YCC 4:2:2, the Xbox will convert 4K 60Hz 4:4:4 10bit content to 4:2:2 instead of 4:2:0, giving you better image quality.

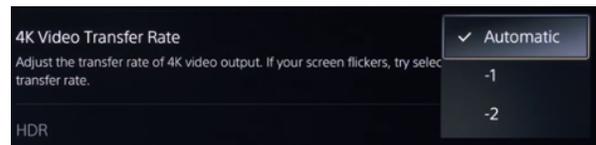


PLAYSTATION 5

The PS5 can be a bit tricky when enabling 120Hz. Unlike XSX which is very clear about configuring the refresh rate, PS5 has a secondary menu option that allows you to set the preference for game modes between "Performance" or "Resolution." It may be required in some situations to manually change this to "Performance" mode for the game to support 120Hz.



The PS5 has a similar function to the XSX YCC 4:2:2 checkbox. If you navigate to Settings > Screen and Video, you will see an option for "4K Video Transfer Rate." Adjusting this setting will affect the chroma subsampling of the PS5's output. "-1" is equal to 4:2:2 8bit and "-2" is equal to 4:2:0 12bit. Typically, you can leave this option on "Automatic," but it may help encourage a video handshake if you are experiencing issues.



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