Business white paper

Display Connectivity

Display connections and how they match your needs.

Sorting out your ports

Seeking out the right port

If you're looking to buy a new monitor but aren't sure what type of connectivity options you'll need, here are some questions to consider.

- Which devices do you want to plug into the monitor, and what types of ports do they use?
- Will you require demanding graphics, or use large data throughput?
- Do you want to have as few cables as possible running between your devices and the monitor?
- Are you looking for outstanding sound reproduction as well as picture quality from a single connection?

Many PCs, tablets, and smartphones are designed to deliver outstanding picture quality when they're connected to the right display and through the right ports. With the correct ports and cables you can make your business presentations, photos, media, and every-day computing look and perform best.

Understanding how the various connection ports on your devices work, and which connection is built to deliver the experience you want, will help you choose the optimal match in a display.

Choosing a connection largely depends on the needs of the user, whether they need the flexibility of a one-cable-connection through USB-C™, Thunderbolt™, or the all-digital standard DisplayPort™, HDMI, DVI or VGA connectivity options - each one has it's benefits. HP provides a broad selection of displays with multiple connectivity options to help you get more value and enjoyment from your digital devices.

To help simplify your choice of monitor, here is an overview of the most popular connectivity options available today, as well as some emerging standards.

Connection Types

USB-C™

USB-C™ is the latest single-cable connection between displays and PCs, phones, and tablets, capable of transmitting multiple data types over a single cable. Designed to be completely reversible there is no wrong way to plug the cable into the USB-C™ connector. Regardless which end of the cable you use, or which side of the cable is facing up - it always plugs in on the first try. It's a simple cable, easy to connect, and eliminates multiple cables between the display and the platform, lending new meaning to the term "Clean Desk Policy."

USB-C™, with USB 3.1

USB-C™, with USB 3.1 includes a digital video/audio connection (DispayPort™), a USB 2.0 and USB 3.0 or USB 3.1 data connection, and a power delivery connection that can provide up to 100w of power and multiple DC voltages.

USB-C™, with Thunderbolt 3

USB-C™, with Thunderbolt™ 3 includes a Thunderbolt™ 3 connection, a USB 2.0 connection, and a power delivery connection that can provide up to 100w of power and multiple DC voltages. Within the Thunderbolt™ connection, there is support for DisplayPort™ video/audio, and a high speed PCIe data connection.

From a display standpoint, the USB-C™ connection is the perfect connector. Both the display and the platform must have a USB-C™ connector that supports the multiple protocols that are transmitted across the wires. The USB-C™ technology eliminates the need to have a video cable or a USB upstream cable to enable and connect the display USB hub to the platform. If both the display and platform support power delivery, the display can power the platform device and charge the platform device battery, or in some cases, the platform, like a desktop PC, could power the display which will eliminate one power cable and power adapter. In the first versions of USB-C™ implementation, the display will power the platform or device (ultra small form factor desktop like HP Slice, notebooks, tablets, phones).

Thunderbolt™

Thunderbolt™ delivers high-speed data as well as high-quality video and audio. The underlying video and audio support is DisplayPort™ and the high speed data interface is PCIe. Each Thunderbolt™ port can support 6 daisy-chained devices, and the display should always be at the end of the chain, as such it is only necessary to use a Display with DisplayPort™, Mini DisplayPort™, or USB-C™ connections.


Thunderbolt

Thunderbolt™
Thunderbolt™, developed by Intel, is carried over the same connector as Mini DisplayPort™. It is capable of carrying data over PCIe in two directions at one time, using the full 10 gbps capacity in each direction, as well as carrying video over DisplayPort 1.1a.


Thunderbolt 2

Thunderbolt™ 2
Version 2 of Thunderbolt™, using the same connector and cable as the original Thunderbolt™, was designed to allow the full 20 gbps of data-transfer to be carried in both directions, allowing for 4K video support over the DisplayPort 1.2 protocol.

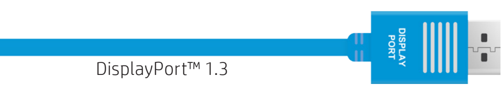

Thunderbolt 3, via USB-C

Thunderbolt™ 3
Version 3, an alternate mode of USB Type-C, uses a USB-C connector and doubles bandwidth to 40 gbps per channel over PCIe 3.0, allows video over DisplayPort™ 1.2, and includes HDMI 2.0 support as well.

DisplayPort™ & Mini DisplayPort™ (DP & mDP)
DisplayPort™ is an all-digital connectivity standard that not only carries audio and video, but also has the potential to handle a data signal from a USB device such as a webcam or PC mouse. Both protocols can be carried over the standard DisplayPort™ (DP) and Mini DisplayPort™ (mDP) connectors.

DisplayPort™ 1.2a

DisplayPort™ 1.2a
DisplayPort™ 1.2a can transmit data at up to 21.6 gbps (nearly doubling the DP 1.1 standard of 10.8 gbps), making it a great option for computer users who need to move large audio and video files between devices. Current leading edge 4K monitors rely on this standard to support their high video bandwidth, large conference room displays will appreciate the high-definition picture quality, ultra-fast graphics refresh rate, and vivid color palette. Version 1.2a also added support for Multi-Stream Transport (MST), so one cable from the PC can be used to connect up to four compatible MST monitors together (often refferred to as 'daisy-chaining'). An additional feature named Adaptive-synch is also included that supports the newer variable refresh monitors valued by gamers for their fast playback support.



DisplayPort™ 1.3

DisplayPort™ 1.3
Released in September 2014, DisplayPort™ 1.3 primarily provides support for 4K, 5K, and expected 8K displays (with some performance limitations) and is fully backwards compatible from a cable and connector standpoint. The standard promises to increase the data transmit bandwidth from 21.6 to 32.4 gbps (a 50% increase from the previous version). The additional bandwidth will also enable 4K displays to be driven at 60Hz over a single connection. The additional bandwidth will allow the simultaneous use of two 4K displays over MST, and allow future displays to drive colors with higher bit depths, such as 30bits and 36bit color.


DisplayPort™ 1.4, via USB-C™


DisplayPort™ 1.4, via USB-C™

DisplayPort™ 1.4
The newest DisplayPort™ standard (DP1.4) was released in March 2016. Improvements include the ability of 4K and 8K displays to use the new USB-C connector at the higher video and data bandwidth needed for these resolutions. This new standard will primarily benefit 4K, 5K, and 8K displays while HDR (high dynmaic range) future standards are also promised bandwidth with the new DP1.4 standard. All three resolutions will support 60Hz refresh rates, and 4K resolutions can even drive "deep color" modes up to 120Hz. The additional "Expanded Audio Transport" feature in DP1.4 will allow for future inclusion of all known audio formats. This new standard level is expected to benefit the fast growing automotive and digital television markets with their increasingly demanding display requirements.

HDMI & mini-HDMI
High-Definition Multimedia Interface (HDMI) is an all-digital connection standard that can carry a video signal and several digital audio channels on one cable and is widely used on commercial displays and PCs, as well as connected devices (such as blu-ray players and projectors). Many newer PCs, tablets, and smartphones also feature mini-HDMI ports (which offer the same connectivity features as the full-sized version).

HDMI can deliver a smooth, sharp picture and crisp sound with almost no signal loss. HDMI systems will also automatically convert a picture into its most appropriate aspect ratio, such as 16:9 or 4:3. Thanks to its versatility and compact size, a mini-HDMI port works well on handheld devices. Plus, the simplicity of sending audio and video through a single port means fewer tangled cables snaking between your devices and monitors.

HDMI 1.4

HDMI 1.4

HDMI version 1.4 was released May 2009, and its primary benefit was improved bandwidth to support 4Kx2K @30Hz, 100 Mbit/s Ethernet support, a new micro HDMI connector and maximum 3D resolution of 1920x1080 @24Hz over a single link.

HDMI 2.0

HDMI 2.0

HDMI Version 2.0 was released September 2013, and allows 4K resolution at 60Hz over the previous versions 30Hz. Optional features include Rec 2020 color space support, up to 4 audio streams, and a number of spec improvements to 3D (4Kx2K @24Hz), audio and video performance.

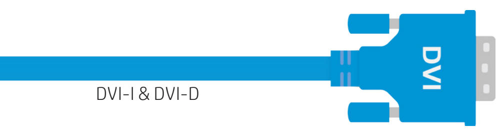
HDMI 2.0a

HDMI 2.0a

Introduced in April 2015, the new standard provides support for HDR.

DVI

DVI (Digital Visual Interface), released in 1999, was the first connection to support a digital signal. Compared to today's standard the ports are fairly large for thin, compact PC products such as notebooks and tablets. Also designed to only carry a video signal this standard is gradually being replaced by smaller and more versatile digital port designs that can support video, sound, and data on one connection.



DVI-I & DVI-D

DVI-I

DVI-I improves on VGA in two important ways. First, it supports HDCP safeguards. Second, PCs and monitors equipped with a DVI-integrated (DVI-I) port can handle both digital and analog video signals through one connection with no conversion or loss of quality.

DVI-D

The DVI-D interface is a digital only signal, and began to modernize the signal sent to displays.

VGA

VGA

One of the most familiar video connection ports is the legacy VGA (Video Graphics Array) which supplies an analog—rather than digital—signal from device to monitor. Released in 1986, VGA connectors are inexpensive to manufacture and provide sufficient picture quality for basic computing and image viewing. However, the rise of digital content is quickly making analog inputs obsolete.

In order to display digital content on-screen through a VGA connection, the signal has to be converted to analog and then back to digital, which can reduce picture quality. That's a challenge for consumers who want to experience the latest technology has to offer, however VGA monitors are still a reliable option for business users who mainly view non-digital content using a desktop PC or video projector.

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