



Understanding HDMI: Cable Types, Pitfalls, and more

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Overview

HDMI 1.4, 2.1, standard, high speed, ultra-high-speed, how do you keep up with all these new changes and versions? Maybe you want your new HD home video setup to look amazing. Maybe, your new 4K gaming setup needs a new HDMI cable. This guide will teach you some of the basics of HDMI, the different connectors involved, and lastly, demonstrate the common pitfalls. By the end, you'll know exactly what you need to do to have that clear crisp quality and speed you were promised for your video, gaming, and other HDMI needs.

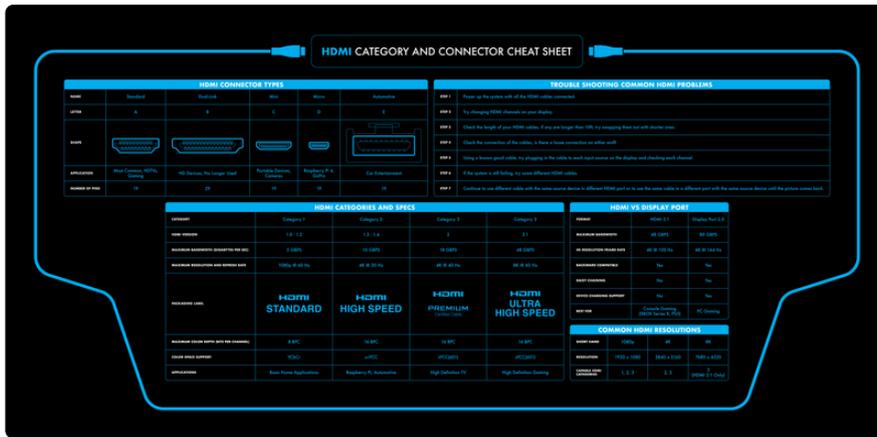


"HDMI" or [High-Definition Multimedia Interface \(https://adafru.it/Hbv\)](https://adafru.it/Hbv) is the global standard for digital video and audio transfer from a source device such as a computer or gaming console to a display such as a TV, monitor, or projector.

While HDMI has become the standard in audiovisual setups for gaming, home video, and more, it's also constantly being updated. How do you keep up with all the new standards and cable types? How do you know when you'll need an additional cable for audio? What happens when your screen is grainy or worse cuts in and out? HDMI in today's edge can sometimes be tricky but most of your confusion should be cleared up in this guide.

Confused and in a dash?

Do you need HDMI information quickly? **When in HDMI doubt, check this graphic out! (Click to enlarge)**



HDMI cables and hubs for purchase

These three items will meet most HDMI-related cable needs. Additionally, all of the following parts have the required HDMI specifications and certifications including implemented safeguards for protecting cables and ports.

The catch-all: This is a 1-meter HDMI 1.3 cable and will support most of your HDMI needs so long as you don't need [8K](https://adafru.it/-ff) resolution and an ultra-high-speed connection.



HDMI Cable - 1 meter

Connect two HDMI devices together with this basic HDMI cable. It has nice molded grips for easy installation, and is 1 meter long (about 3 feet). This is a HDMI 1.3... <https://www.adafruit.com/product/608>

High-end HDMI: This HDMI 2.1 cable is the most up-to-date HDMI cable of this writing and is designed for high-speed, high resolution 4K and [8K](https://adafru.it/-ff) video and gaming connections.

1 x 8K HDMI 2.1 Cable

48Gbps Certified Ultra High Speed 4K 120Hz 8K 60Hz

https://www.amazon.com.mx/Cable-48Gbps-Certificado-Ultra-Velocidad/dp/B09GXC46YH/ref=asc_df_B09GXC19MD/?tag=gledskshopmx-20&linkCode=df0&hvadid=54710

USB C support: Use this connector to transfer video from a computer with only USB-C ports to a display with HDMI ports.



[HDMI to USB-C Video Capture Adapter](https://www.adafruit.com/product/4910)
Discontinued - you can grab this HDMI
Input to USB 2.0 Video Capture
Adapter instead! Here's one of the...
<https://www.adafruit.com/product/4910>

A more in-depth explanation of resolution, speed, and cable types will come in the following pages. Skip to the section "Finding the Right Cable or Adapter for You" to read more on specific HDMI scenarios.

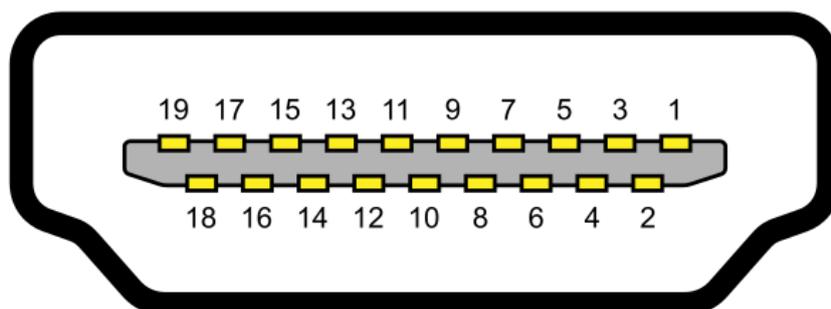
What is HDMI?

HDMI was created in 2002 as a way to bring audio and video into the digital age. As opposed to its predecessors VGA, RCA, and others that require a mess of multiple connections and wires, HDMI is a one-cable-for-all solution that transports both video and audio over one connection.

Here's the technical definition of HDMI from [Wikipedia \(https://adafru.it/Hbv\)](https://adafru.it/Hbv):

HDMI is a proprietary audio/video interface for transmitting uncompressed video data and compressed or uncompressed digital audio data from an HDMI-compliant source device, such as a display controller, to a compatible computer monitor, video projector, digital television, or digital audio device.

There are 5 connector types and the most common HDMI type is HDMI Type A with 19 pins.



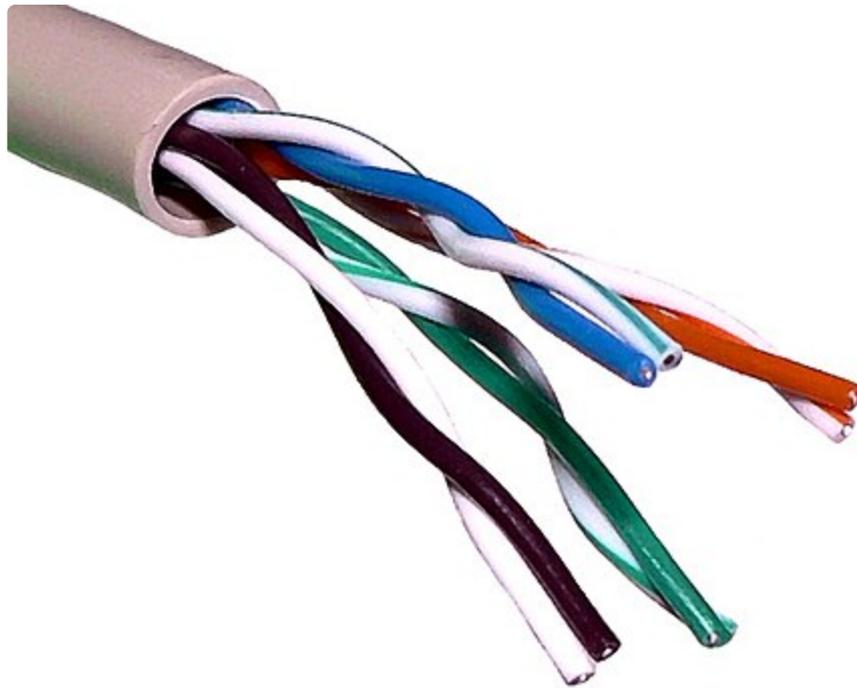
[History of HDMI \(https://adafru.it/Hbv\)](https://adafru.it/Hbv) - A TimeLine

Here's a condensed history of HDMI from an obscure new technology in 2002 to its adoption by billions of consumers in less than a decade.

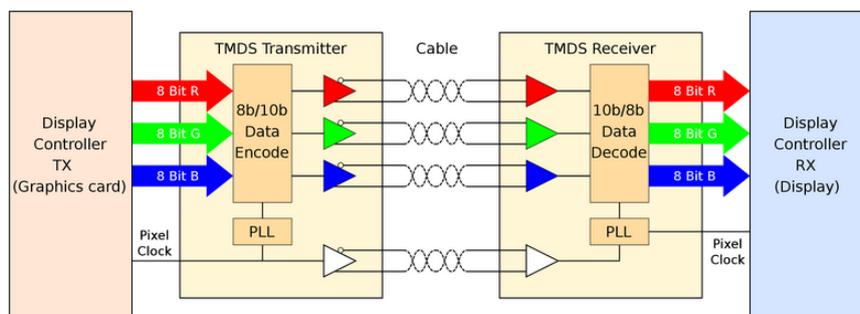
- April 16, 2002 - The HDMI founders began development on HDMI 1.0 with the goal of creating an AV connector that was backward-compatible with [DVI \(https://adafru.it/-fg\)](https://adafru.it/-fg) (Digital Visual Interface). HDMI was also created as a way to transport both video and audio over a single cable. DVI was the standard at the time and only transported visual info.
- HDMI was designed in December 2002 by the founders [Hitachi \(https://adafru.it/-fh\)](https://adafru.it/-fh), [Panasonic \(https://adafru.it/-fi\)](https://adafru.it/-fi), [Philips \(https://adafru.it/xbg\)](https://adafru.it/xbg), [Silicon Image \(https://adafru.it/-fj\)](https://adafru.it/-fj), [Sony \(https://adafru.it/-fk\)](https://adafru.it/-fk), [Thomson \(https://adafru.it/-fl\)](https://adafru.it/-fl), and [Toshiba \(https://adafru.it/-fm\)](https://adafru.it/-fm). HDMI 1.0 had the support of motion picture producers [Fox \(https://adafru.it/-fn\)](https://adafru.it/-fn), [Universal \(https://adafru.it/-fo\)](https://adafru.it/-fo), [Warner Bros. \(https://adafru.it/-fp\)](https://adafru.it/-fp) and [Disney \(https://adafru.it/-fq\)](https://adafru.it/-fq), along with system operators [DirecTV \(https://adafru.it/-fr\)](https://adafru.it/-fr), [EchoStar \(https://adafru.it/-fs\)](https://adafru.it/-fs) ([Dish Network \(https://adafru.it/-ft\)](https://adafru.it/-ft)) and [CableLabs \(https://adafru.it/-fu\)](https://adafru.it/-fu).
- 2004 - HDMI started to appear in consumer electronics.
- 2011 - The [HDMI Forum \(https://adafru.it/-fv\)](https://adafru.it/-fv) is established by the HDMI founders to create an open organization so that interested companies can participate in the development of the HDMI specification. All future development of the HDMI specification take place in the HDMI Forum and are built upon the HDMI 1.4b specification. Also on the same day, HDMI Licensing, LLC announced that there were over 1,100 HDMI adopters and that over 2 billion HDMI-enabled products had shipped since the launch of the HDMI standard.
- 2021 - Over 10 billion HDMI devices have been sold.

How does HDMI work?

[HDMI \(https://adafru.it/-fw\)](https://adafru.it/-fw) functions through a technology called [transition-minimized differential signaling \(TDMS\). \(https://adafru.it/ZZe\)](https://adafru.it/ZZe) TDMS is a method of transferring data like audio and video from one location to another. As information travels down the cable from one device to another, TDMS is able to protect the information from degradation.



An HDMI cable is composed of four shielded [twisted pairs](https://adafru.it/-fx) plus seven separate conductors. As the information is transmitted, one of the twisted pairs of cables carries the signal itself while the other carries the inverse copy of the signal that is in transmission. The difference between these signals is measured as it arrives at the receiving device and this difference is then used to account for signal loss. High-quality audio and video is the result!



HDMI uses three physically separate communication channels, which are the DDC (data display channel), TMDS, and the optional CEC (Consumer Electronics Control). HDMI 1.4 added ARC (audio return channel) and HEC (HDMI Ethernet channel).

HDMI Applications

HDMI can be used in a number of applications including but not limited to:

- Gaming
- Home TV, theatre, and Blu Ray

- Computer monitor
- Raspberry Pi monitor
- Automotive entertainment
- Digital cameras and cam corders

Skip to the section "Finding the right HDMI Cable for You" to see the specifics of cable recommendations for these different applications.

What Can HDMI do?

HDMI 2.1 is the most up-to-date version of HDMI at the time of this writing. I will cover the different versions of HDMI in the next section. Here are the benefits and specs of using HDMI 2.1:

- Supports 8K resolution at 60 frames per second
- Supports 4K resolution at 120 frames per second
- Up to 48 GBPS ([Gigabytes per second \(https://adafru.it/Hbs\)](https://adafru.it/Hbs))
- Great for daisy-chaining (connecting multiple monitors)

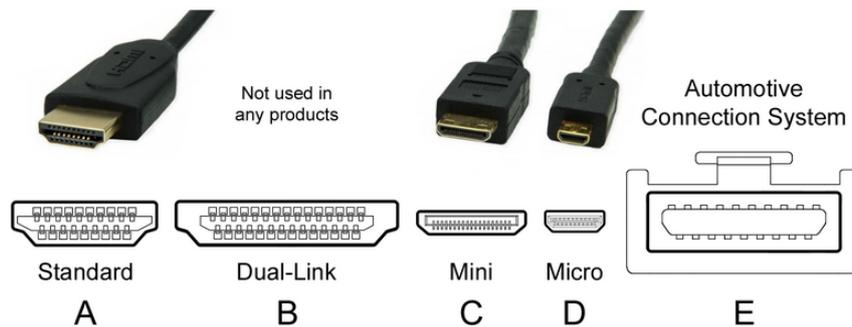
Of course, not all devices are compatible with HDMI 2.1 but I will talk about what that means for you and what cables will work best for your setup in the coming pages.

Cable Types and Differences

All HDMI cables are not made equal. In this section, I'll cover the differences in HDMI cables including:

- Connector shapes / types
- Cable versions and associated data speeds and resolutions
- How to identify a cable type based on packaging labels

Connector Types



There are five HDMI connector types.

- **Type A** is known as "Standard" and is the most common. It has 19 pins.
- **Type B** is called "Dual-Link" and is not used in many modern products. In the past it was used with high-resolution devices due to it having 29 pins however as of August 2021, it has not yet been used with any products.
- **Type C** is known as HDMI Mini and is used to connect to portable devices like digital cameras and camcorders. It has 19 pins like that of the HDMI Standard connector.
- **Type D** is "micro" and is often used with Raspberry Pi 4, and GoPros, amongst other devices like portable monitors. It has 19 pins as well.
- Lastly, **Type E** is used for connecting a video output device to an automotive entertainment system or display. It's almost identical to type A however it has a locking tab to keep the cable from vibrating loose as well as to help prevent moisture and dirt from interfering with the signals.

HDMI versions and associated speeds

There have been numerous upgrades to the HDMI standard since its inception in 2002 with HDMI 1.0. Check out the full list of all the HDMI versions of the past below:

- 1.0 (2002)
- 1.1 (2004)
- 1.2 (2005)
- 1.2a (2005)
- 1.3 (2006)
- 1.3a (2006)
- 1.4 (2009)
- 1.4a (2010)

- 1.4b (2011)
- 2.0 (2013)
- 2.0a (2015)
- 2.0b (2016)
- 2.1 (2017)

Most modern devices use HDMI 1.3, 1.4, 2.0, and 2.1.

HDMI Versions and Categories

Any time you buy a new cable, the packaging will indicate which type of HDMI cable it is with one of the below labels. If you already own a cable, the cable itself should have the type specified but not always. Below are the different HDMI cable types determined by the logo seen on the packaging of the cable [from the HDMI Forum](https://adafru.it/-fy). (<https://adafru.it/-fy>) What mainly separates each version and category are the differences in [bandwidth](https://adafru.it/-fz) (<https://adafru.it/-fz>) (in [Gigabytes Per second](https://adafru.it/Hbs) (<https://adafru.it/Hbs>)), [display resolution](https://adafru.it/-fA) (<https://adafru.it/-fA>) (in pixels), and [refresh rate](https://adafru.it/FkE) (<https://adafru.it/FkE>) (in Hertz). These topics are covered in more detail further down this page.



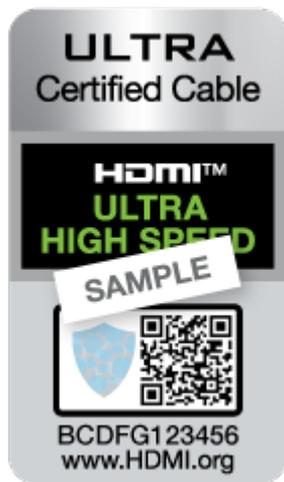
- **"Standard" or Category 1** - Designed to handle most home applications and tested to transmit 1080i/720p video. Most of these cables have been replaced by the High-Speed HDMI Cables but there are still some in the marketplace and consumers should note while fine for some uses, they don't support the later resolutions, refresh rates, and bandwidth requirements.
 - Associated HDMI versions: 1.0, 1.1, 1.2
 - Max bandwidth: ~5 GBPS
 - Max resolution: 1080p (1920 x 1080) @ 60 Hz



- **High-Speed or Category 2** - Designed and tested to support video resolutions of 1080p and more, including display technologies such as 4K UHD, 3D, and Deep Colour. This is a recommended cable if you are using any of these technologies or connecting your 1080p display to a 1080p content source e.g. a Blu-ray Disc player. These cables will be distinguished with a "High Speed" label on the packaging
 - Associated HDMI versions: 1.3, 1.4
 - Max bandwidth: ~10 GBPS
 - Max resolution: 4K (3840 x 2160) @ 30 Hz



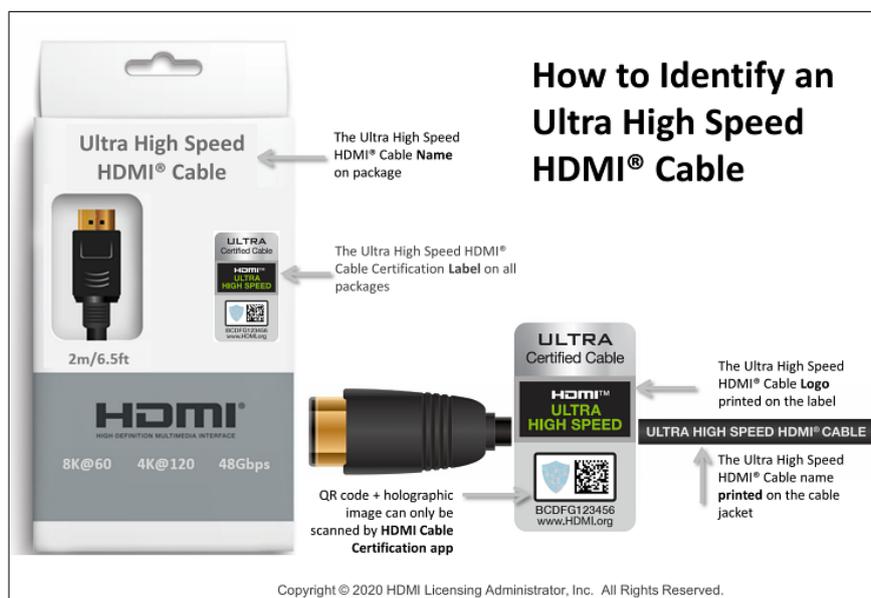
- **Premium High-Speed HDMI or Category 3** - Special certification designations for High-Speed HDMI Cables that have been designed/certified for reliable performance for 4K and UltraHD. This includes advanced features such as HDR, 4K60, expanded color spaces including 4:4:4 chroma sampling and BT.2020. They have low EMI and identify them by the HDMI Licensing Administrator's Premium HDMI Cable Certification Label for authentication verification.
 - Associated HDMI versions: 2.0
 - Max bandwidth: 18 GBPS
 - Max resolution: 4K (3840 x 2160) @ 60 Hz



- **Ultra High-Speed (also Category 3)** - This is the cable with the highest resolution and bandwidth (at the time of this writing). It can reach up to an 8K resolution with 48 GBPS. The Ultra-High Speed cable is often used in console and PC gaming as it provides the best quality at the highest bandwidth possible.
 - Associated HDMI versions: 2.1
 - Max bandwidth: 48 GBPS
 - Max resolution: 8K (7680 x 4320) @ 60 Hz

Each category also has a separate Ethernet-enabled option. This option has become less important as WiFi speeds have increased.

Certifications to look for when purchasing cables



Only products featuring this official anti-counterfeit label have been certified as part of the Premium HDMI Cable Program. Each certified product label will feature a unique QR code & holographic fingerprint which can be scanned and verified using the HDMI smartphone app.

Are HDMI cables backward compatible?

Yes. Ultra High-Speed HDMI cables are backward compatible with older HDMI devices, and older cables are compatible with new HDMI 2.1 devices, though the full 48 Gbit/s bandwidth is only supported with the new cables.

What is Resolution? What is 4K?

The [display resolution](https://adafru.it/-fA) (https://adafru.it/-fA) or display modes of a [digital television](https://adafru.it/-fB) (https://adafru.it/-fB), [computer monitor](https://adafru.it/-fC) (https://adafru.it/-fC) or [display device](https://adafru.it/-fD) (https://adafru.it/-fD) is the number of distinct [pixels](https://adafru.it/-fE) (https://adafru.it/-fE) in each dimension that can be displayed.

HDMI resolutions:

- High Definition
 - 720p (1280 × 720 pixels) HDMI 1.0 and up
 - 1080p (1920 × 1080) HDMI 1.0 and up
- Ultra High Definition (UHD)
 - 4K UHD (3840 × 2160) HDMI 1.3 and up
 - 8K UHD (7680 × 4320) HDMI 2.1

What is Refresh Rate?

A **refresh rate** is the number of times a new image is shown on a screen (such as a [television](https://adafru.it/-fF) (https://adafru.it/-fF) or [computer monitor](https://adafru.it/-fG) (https://adafru.it/-fG)) per second. It is measured in [hertz](https://adafru.it/-fH) (https://adafru.it/-fH) (Hz), which is a measurement of frequency. This means that a screen with a refresh rate of 60 Hz will show 60 images per second.

Bandwidth or Bit Rate

This is the number of [bits](https://adafru.it/uep) (0s and 1s) that are conveyed or processed per unit of time. The bit rate is expressed in the unit **bit per second**.

For example, here are the max HDMI Bit Rates and Refresh rates at 4K resolution (for the versions that can support it). Notice how the bandwidth and refresh rate increase as the versions and categories move up when the resolution stays the same.

- Category 2: HDMI 1.3 & 1.4 - High Speed @ 4K
 - data rate: 10 GBPS
 - refresh rate: 30 Hz
- Category 3: HDMI 2.0 - Premium High Speed @ 4K
 - data rate: 18 GBPS
 - refresh rate: 60 Hz
- Category 3: HDMI 2.1 - Ultra-High-Speed @ 4K
 - data rate: 48 GBPS
 - refresh rate: 120 Hz

Color Space and Depth

One bonus specification that is often included in HDMI version information is color capabilities. This includes color "space" and "depth".

[Color space](https://adafru.it/-fI) is the range of colors represented in an image. The two main color spaces used to represent digital video are [RGB](https://adafru.it/-fJ) and [YCbCr](https://adafru.it/-fK).

[Color Depth](https://adafru.it/-fL) is the number of bits used to represent the color of a single pixel and determines the amount of shading or gradation in the pixel. Color depth is expressed as BPC or Bits Per Channel.

Color Differences in HDMI Categories

Category 1

max color depth support: 8 BPC

color space support: [YCbCr \(https://adafru.it/-fK\)](https://adafru.it/-fK)

Category 2

max color depth support: 16 BPC "true color"

color space support: [xvYCC \(https://adafru.it/-fM\)](https://adafru.it/-fM)

Category 3

max color depth support: 16 BPC "true color"

color space support: [sYCC\(601\) \(https://adafru.it/-fN\)](https://adafru.it/-fN)

The original HDMI design provided support for 24-bit Color Depth (8 bits per color x 3 RGB colors). HDMI 1.3 introduced "True Color" which added support for 10, 12, and 16 BPC. The human eye can differentiate about 10 million different colors, and 24-bit color has roughly 17 million colors. Thus 24-bit color or 8BPC is more than sufficient.

Moving Ahead

Now that you know all the different HDMI categories and their specs, let's take a look at some different HDMI applications and when you'd need an Ultra-High-Speed cable as opposed to a High-Speed cable.

Finding the Right Cable or Adapter for You

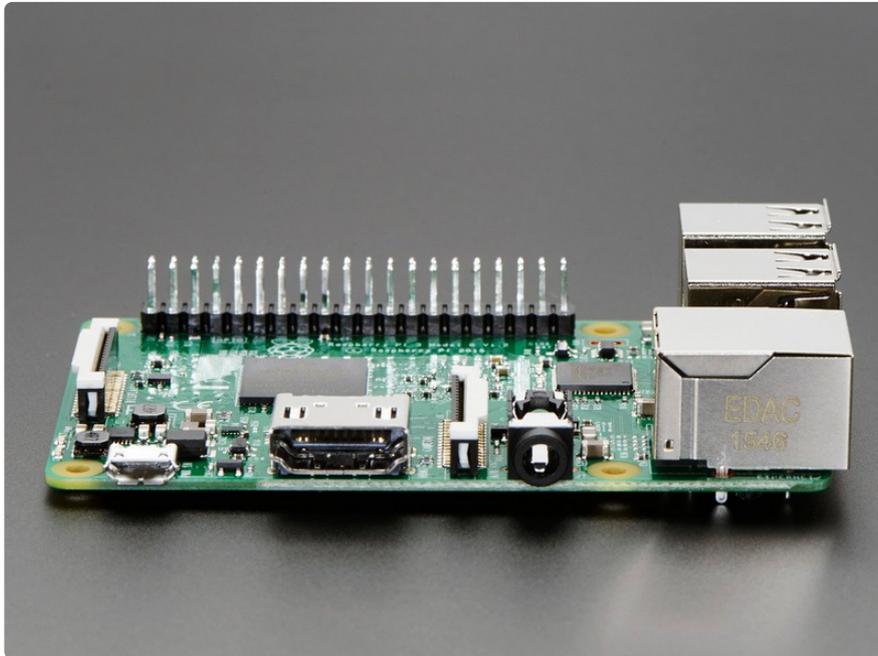
Are you creating the ultimate 4K video gaming setup? Have a new home theatre? Maybe you have a Raspberry Pi and would like to connect to a monitor? With so many different HDMI applications, knowing which cable is suitable for you can be difficult.

There are some expensive (\$50+) cables out there and they are almost always unnecessary. Here are some of the more common situations you might find yourself in, what to consider in a cable for each scenario, and how to avoid overspending. In general, you should first focus on the monitor, computer, media player, TV, etc. that you want then think about the best cable for your device. Said another way, first buy the device you want, then buy the cables based on the device.

Raspberry Pi

Depending on which Raspberry Pi you have you will need a different HDMI cable.

For Raspberry Pi 1, 2, and 3, you will need a standard HDMI to HDMI (<https://adafru.it/fO>) cable such as either of the two below. These Raspberry Pis have HDMI connector type-A ports.



Here's an HDMI 1.3 cable that will be suitable for your Raspberry Pi 1-3 needs.



HDMI Cable - 1 meter

Connect two HDMI devices together with this basic HDMI cable. It has nice molded grips for easy installation, and is 1 meter long (about 3 feet). This is a HDMI 1.3... <https://www.adafruit.com/product/608>

This HDMI 1.4 cable works great too if you'd like something shorter with high resolution and refresh rate capabilities.

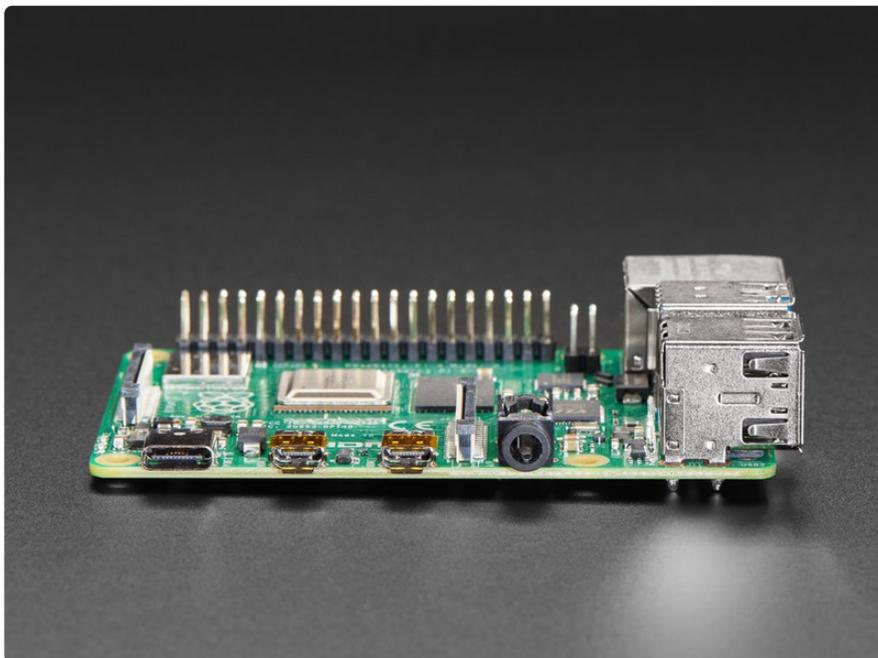


HDMI Flat Cable - 1 foot / 30cm long

Connect two HDMI devices together and save space with this basic flat HDMI 1.4 cable. It has nice molded grips for easy installation, and is 1 foot long (~30 cm). This cable is...

<https://www.adafruit.com/product/2197>

For Raspberry Pi 4, you will need an HDMI to Micro-HDMI cable.



The one below is an HDMI 1.3 cable and will be great for your Raspberry Pi 4.



Micro HDMI to HDMI Cable - 2 meter

Connect an HDMI device with a micro HDMI port to one with a regular size HDMI port together with this basic HDMI cable. It has nice molded grips for easy installation, and is 2 meter...

<https://www.adafruit.com/product/1322>

Here's the official Raspberry Pi 4 HDMI micro to HDMI cable from the Raspberry Pi store:

The official Raspberry Pi micro HDMI to HDMI (A/M) cable designed for the Raspberry Pi 4 computer

1 x Raspberry Pi 4 Micro HDMI to HDMI Cable

<https://www.raspberrypi.com/products/micro-hdmi-to-standard-hdmi-a-cable/>

The official Raspberry Pi micro HDMI to HDMI (A/M) cable designed for the Raspberry Pi 4 computer

Increasing the Resolution and Refresh Rate on a Pi

1080p (**1920x1080**) @**60Hz** is the max default resolution for a Raspberry Pi. This means that with an HDMI 1.3 or 1.4 cable, the Pi will automatically be set to 1080p at 60Hz.

If you want to change your Raspberry Pi's resolution to be even higher or configure the resolution settings check out [this guide here \(https://adafru.it/-fP\)](https://adafru.it/-fP). You have the option to go up to 4K (3840 x 2160) however you will need to change some settings to do this. HDMI 1.3 and 1.4 cables can handle this resolution at 10 GB/s and a refresh rate of 30Hz. If you are looking for a higher data and refresh rate consider an HDMI 2.0 or 2.1 cables. Please refer to our cheat sheet for the specs and cable you are looking to aim for.

Home Theatre, Blu Ray and HDTV set ups

Follow these steps for finding the right HDMI cable when planning your home theatre or TV setup:

Step 1: Measure the distance from your TV to the media player you'd like to connect.

Step 2: Buy a Category 2 "High-Speed Cable" for more simple setups or a Category 3 "Premium Certified High-Speed Cable" for more bandwidth and a higher refresh rate. Try to buy a cable that is no longer than 6 feet and definitely no longer than 10 feet. Read on to the next section about "Extenders" if you need a cable that is longer than 10 feet. This will ensure your cable is suitable for your home theatre setup.

You will know your cable is a Category 3 Premium Certified High-Speed cable because it will have the following on the packaging.



For 8K set ups, you will want an Ultra-High-Speed cable. Here is the label for Ultra-High-Speed HDMI cables.



The below Category 3 cable is suitable for most 4K HDTV setups.

1 x [Amazon Basics Premium-Certified Braided HDMI Cable](https://www.amazon.com/AmazonBasics-Premium-Certified-Braided-HDMI-Cable/dp/B08224HT83?tag=cnet-buy-button-20&ascsubtag=47328a870aed47ac99efba5d)

HDMI 2.0 (18Gpbs, 4K/60Hz) - 6 Feet

<https://www.amazon.com/AmazonBasics-Premium-Certified-Braided-HDMI-Cable/dp/B08224HT83?tag=cnet-buy-button-20&ascsubtag=47328a870aed47ac99efba5d>

Additionally, with Home Theatre and TV setups, it's important to get a cable that is not too long. As I'll cover later in this guide, HDMI cables that are too long can often lead

to blinking on the screen due to due to the weakened [DDC](https://adafru.it/-fQ) signal that [HDCP](https://adafru.it/-fR) requires.

Do you need a cable longer than 10 feet? Consider the below section on **Active** HDMI cables and extenders.

Extenders and Active HDMI Cables

An HDMI extender is a single device (or pair of devices) powered by an external power source or with the 5V DC from the HDMI source. You can buy special devices that connect and power multiple HDMI cables. Active HDMI cables use electronics within the cable to boost the signal and allow for HDMI cables of up to 30 meters (98 feet).

For more tips on home theatre setups check out [this article](https://adafru.it/-fS).

Ultra High Definition Gaming: Display Port vs HDMI

For any 4K gaming setup, your best options will be between HDMI 2.1 and [DisplayPort](https://adafru.it/Hby) 2.0. DisplayPort is a separate cable type and protocol from HDMI. Here are the [different specs](https://adafru.it/-fT) of each when making your decision of which type of cable to go with:

HDMI 2.1

- Bandwidth: 48 GBPS
- Resolution: 4K @ 120Hz
- Better for gaming consoles like Xbox Series X and PlayStation 5
- Backward compatible

DisplayPort 2.0

- Bandwidth: 80 GBPS
- Resolution: 4K @ 144Hz
- Device Charging support
- [Display daisy chaining](https://adafru.it/-fU)
- Better for PC gaming
- Backward compatible

The Bottom Line

Use HDMI 2.1 or 2.0 cables for connecting your TV with your gaming console. Be sure your TV supports the bandwidth you are looking for. Most gaming consoles cannot support Display Port 2.0.

Use DisplayPort 2.0 for PC gaming, especially if you are looking for high-resolution support like 8K and a bandwidth of 48 GPBS or higher. Make sure your monitor supports DisplayPort 2.0.

Computer Monitors and UBC

If your computer supports USB C, save yourself the trouble and get a monitor that supports USB C. It will reduce your cable clutter as you only need one USB C cable for display, audio, and power plus no adapters are needed. For more info on USB C and cable types, check out our Guide to USB below.

**Guide: Understanding USB Type C:
Cable Types, Pitfalls and More.**

<https://adafru.it/-fV>

If your computer and or monitor do not support USB C, DisplayPort 2.0 is the next best option due to the daisy-chaining, and device charging capabilities it provides.

HDMI to Lightning (Apple)

You can display your iPhone, iPad or iPod to a projector, TV or monitor with an HDMI to lightning cable adapter. This adapter supports up to 1080p resolution.



1 x [Apple Lightning Digital AV Adapter](https://www.apple.com/shop/product/MD826AM/A/lightning-digital-av-adapter#:~:text=The%20Lightning%20Digital%20AV%20Adapter)

Supports up to 1080p resolution

<https://www.apple.com/shop/product/MD826AM/A/lightning-digital-av-adapter#:~:text=The%20Lightning%20Digital%20AV%20Adapter>

Automotive HDMI Ports

Some cars now have HDMI ports where you can plug in a video device to display on your car's navigation screen. This feature typically only works when the car is stationary for safety reasons. Due to most car screens being small, a high-speed HDMI cable such as version 1.3 or 1.4 will be more than adequate as a high resolution and bandwidth are not necessary for a small screen.

Why would you want this feature? The below video shows a Honda transformed into a gaming den. Additionally, you could use your car as a mobile entertainment center! Just be careful to not drive distracted.

Other Cables / Adapters and Scenarios:



For displaying older PC laptops and computers: VGA and DVI to HDMI

Many older computers still use [DVI](https://adafru.it/-fg) and [VGA](https://adafru.it/-fW). To display these devices on a monitor, projector, or other display that has an HDMI input you will need an HDMI to DVI or VGA adapter **and** an audio cable such as the one below.

When looking for an HDMI to DVI or VGA adapter, consider that you will need an additional audio cable, such as a 3.5mm stereo cable, to transmit the audio from the source as the DVI or VGA cable cannot transport audio.



HDMI to VGA Video Adapter and 3.5mm Male/Male Stereo Cable

If you have a computer or tablet or device with HDMI output but you want to connect it to a projector, monitor or display with VGA input, you have come to the right place! This nifty...

<https://www.adafruit.com/product/1151>

Wireless HDMI Transmitters

With all the mess that HDMI cables can cause, a wireless solution could be a game-changer for your home entertainment center. How does a wireless HDMI transmitter work? Unlike [Apple's Airplay](https://adafru.it/-fX) which requires WiFi, wireless HDMI works via transmitting at microwave frequencies. This technology works similarly to

Bluetooth. As such, this signal can be easily obstructed. Additionally, this solution is not recommended for gaming or situations where high bandwidth is needed. The technology is still developing and many products still have serious latency. Read more about wireless HDMI solutions [here \(https://adafru.it/-fY\)](https://adafru.it/-fY).

HDMI for Legacy TVs and Gaming Consoles.

Do you have a display, TV, or some other older device that isn't compatible with your HDMI devices? Additionally, you may have an older gaming console like a Game Cube which you may want to display on your HDMI device. The below adapter will allow you to convert from RCA to HDMI.



[HDMI to RCA Audio and NTSC or PAL Video Adapter](https://www.adafruit.com/product/3365)

Do you have a display, television, projector or some other older device that isn't compatible with your HDMI devices? Here's an adapter that will allow you to convert HDMI...

<https://www.adafruit.com/product/3365>

Now that you have the HDMI cable of your wildest dreams, it's time to talk about the most common issues and pitfalls with HDMI cables, sources and displays.

Troubleshooting Common HDMI Issues

Whenever looking at any issues with an HDMI setup, the problem could lie with the HDMI cable, the video source, or the display. First to take a look at the most probable culprit, the HDMI cable.

Signs of a Faulty HDMI Cable

[This article \(https://adafru.it/-fZ\)](https://adafru.it/-fZ) does a great job at demonstrating common HDMI cable problems and I will reference its great wisdom for you to get the best takeaways.

Problem: [Blackouts \(https://adafru.it/-fZ\)](https://adafru.it/-fZ)

An image that goes black can often be the result of a bum HDMI cable. This could show up as no image at all being seen on the screen or as frequent “blackouts” where the screen goes completely black and then comes back again.

Problem: "Sparkles"

One of the most common issues with a faulty HDMI cable is “sparkles” or flickering dots that are usually white. This might look like shooting stars or white noise, and may show up as subtle interference or be much more of a nuisance.

Problem: Grainy Image

An image that looks fuzzy or grainy (like an extreme version of the “sparkles” mentioned above) may also be caused by a bad cable. Colors may look desaturated and the image may appear solarized, overexposed, or washed out.

Solution 1: Swap out the cable

The easiest way to identify a bad cable is to simply swap it out when you first notice an issue. If you keep a few spare HDMI 2.1 cables around, you’ll cover both older HDMI 1.3 and 2.0 devices (the cables are backward compatible) as well as current and upcoming devices that push more pixels at higher frame rates.

Solution 2: Replace the cable with a shorter one

As mentioned earlier, cables longer than 10 feet tend to be faulty due to HDMI cables not having any power. Try a shorter one and see if that does the trick.

Solution 3: HDMI 2.1 Devices may need new cables

HDMI 2.1 debuted on the Xbox Series X, PlayStation 5, and NVIDIA 30-Series graphics cards in 2020. Many TVs and monitors now support the standard and its associated suite of features, including variable refresh rate (VRR) and auto low latency mode (ALLM).

If you’re buying a new set of HDMI 2.1 cables, you can use the HDMI Licensing Administrator’s own smartphone app to verify that your cable is genuine.

“Premium” HDMI cables that cost exorbitant amounts of money are often not worth it. There is no image quality to be gained and a cheap cable will do just fine, provided it meets the 48 Gbps bandwidth requirement.

While a functioning lower quality HDMI cable will still work with your device you will be limited with your quality and bandwidth options.

Digging deeper: what's going on inside?

The majority of issues in HDMI cable fails are with I2C, the serial protocol used on the DDC line for EDID and HDCP.

[Jeff Boccaccio \(https://adafru.it/-f-\)](https://adafru.it/-f-), the owner of a Florida-based company DPL Labs runs the Digital Performance Level program, intended to help manufacturers, retailers, and customers test and rate HDMI products.

In regards to HDMI cable fails, Jeff says "I2C is slow but very susceptible to stray capacitance issues from connectors, cables, or anything the electrical bus is connected to. If capacitance gets to a critical point, it slows the signal 'rise time' needed for proper communication. You can have all the high-speed data bandwidth in the world, but without DDC, you're dead in the water."

How to Troubleshoot HDMI-to-DVI/VGA or DVI/VGA-to-HDMI Connection Problems

The most common problem with HDMI to DVI / VGA connections is the loss of audio. Remember VGA and DVI cables do not carry audio signals so without a separate 3.1mm auxiliary cable from the video device, the audio signal will be lost.

When the Receiver or TV settings may be to blame

Do you use a receiver, soundbar, or splitter for controlling multiple HDMI devices? Try removing the "middle man" device from the HDMI pipeline. Plug your cable directly from your video source to your display to see if the cable is truly at fault.

[This article \(https://adafru.it/-ga\)](https://adafru.it/-ga) does a great job at walking you through potential issues with your receiver or intermediary device and how to troubleshoot.

How to troubleshoot HDMI issues

The best way to troubleshoot HDMI issues is by the process of elimination. You want to isolate the issue to determine if the problem lies with the video source, the HDMI cable, the display, or something in between.

1. Power up the system with all the HDMI cables connected.

2. Try changing HDMI channels on your display.
 3. Check the length of your HDMI cables, if any are longer than 10 feet, try swapping them out with shorter ones.
 4. Check the connection of the cables, is there a loose connection on either end?
 5. Using a known good cable, try plugging in the cable to each input source on the display and checking each channel.
 6. If the system is still failing, try some different HDMI cables.
 7. Continue to use a different cable with the same source device in a different HDMI port or to use the same cable in a different port with the same source device until the picture comes back.
-

Takeaways

There are lots of caveats and specifics to digest from this guide. Here are some of the top takeaways to help you distill this info.

1. Check the packaging for HDMI type markings

To find the category or type of HDMI cable you are looking for, take a look at the packaging before purchasing the cable. The packaging of the cable should have the certification you are looking for. If the box does not have any certification or marking, it's probably best to leave it alone.

2. Don't buy overly expensive cables

Even if you're looking for an HDMI 2.1 cable you do not need to spend more than ~\$10-\$15. Cables more expensive than this are generally not worth it.

3. Buy your video sources and displays before buying your cables

HDMI cables should be the last part of our journey when considering any home entertainment setup. Once you have the equipment you want, use the specs on that equipment to determine what cables you need.

4. Don't use cables that are over 10 feet (unless they are active)

HDMI cables are not designed to work over longer distances than 10 feet due to their lack of power source. If you need a cable longer than 10 feet, use an active (powered) cable or an extender (covered in Finding the Right Cable or Adapter for You section)

5. If the screen is going black or has any irregularities in the picture, try swapping the cable out

HDMI cables can often fail due to wear and tear.

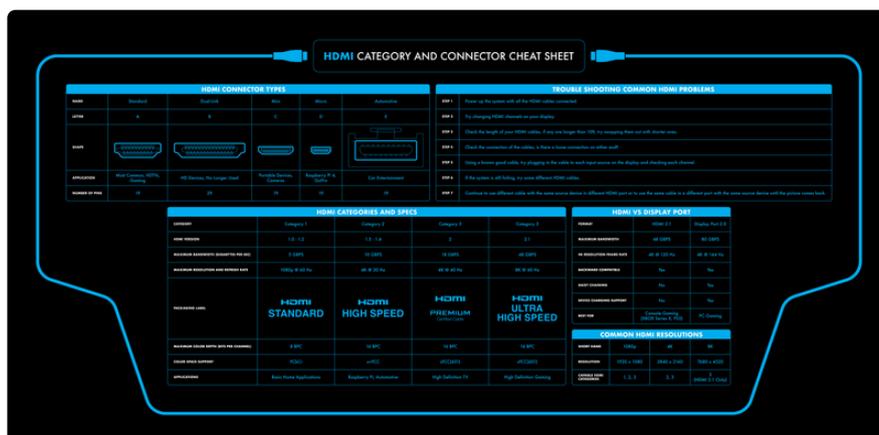
6. HDMI cables are backward compatible

HDMI cables whether 2.1 or 1.3 will work with any device. See the caveat below.

7. HDMI cables are like water spouts

If you use an HDMI 2.1 cable with a TV that only has 1080p capacity, it will still work but you won't be able to access the fidelity that the cable can provide. To access the 4K power of the HDMI 2.1 cable, you need both a video device and a display that are compatible.

8. When in doubt check this HDMI graphic out!



That is everything you could possibly want to know about HDMI cables. Huzzah!