

## What is HDMI?

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HDMI IS THE GLOBAL STANDARD FOR CONNECTING HIGH-DEFINITION CONSUMER ELECTRONICS AND PC PRODUCTS. IT'S THE UNCOMPRESSED, ALL-DIGITAL INTERFACE THAT DELIVERS BOTH DAZZLING QUALITY AND UNMATCHED EASE OF USE.

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### The HDMI Advantage

When you connect with HDMI technology, you're getting the utmost in simplicity, performance, and system intelligence.

#### Simplicity

- HDMI transmits all types of audio and video through a single digital link.
- HDMI makes it easy to install or upgrade to an all-digital home entertainment system.
- HDMI makes it simple to hook up other devices to your home theater system. HDMI is the interface for convergence of PC and consumer electronics devices.

#### Performance

- All-digital. No conversion or compression needed
- Enormous bandwidth capacity – up to 10.2 gigabits per second resulting in
  - Better looking movies
  - Faster gaming
  - Richer audio
- Ready for future emerging technologies. HDMI is an evolving standard: Products implementing new versions of the HDMI specification will continue to be fully backward compatible with earlier HDMI products.

## Intelligence

- HDMI is a "smart" two-way connection that allows devices to communicate and interact with each other to dramatically improve your home theater experience.
- Devices connected with HDMI have the ability to scan each other's capabilities and automatically configure certain settings.
- Consumer Electronics Control (CEC) is another intelligent HDMI feature set that provides for integrated, "one-touch" commands across multiple linked components. When enabled by the manufacturer, CEC allows system-wide behaviors like one-touch play or one-touch record, where pressing a single button on a remote launches a series of coordinated commands.

## Misconceptions

The most common misconception that people have about HDMI is that, because the signal is digital and that "digital is perfect" the signal either works or it doesn't. This is not the case.

Whether the signal is sent via an optical cable, digital coax, or HDMI cable all of these digital signals can be distorted or changed and that distortion is called jitter. A digital signal stream is made up of ones and zeros or on and off pulses. The timing of the on and off pulses is critical. Jitter is timing errors. The materials used and physical variations in the HDMI cables cause jitter. As the amounts of information being sent down the cable increase and the capabilities of the cable are taxed – jitter increases.

More expensive HDMI electronics use some type of error correction to reduce jitter and they work pretty effectively until the capabilities of the error correction programs are overwhelmed. This is similar to running multiple programs on a computer eventually causing the computer to lock up.

One of the important elements of an HDMI cable is the thickness of the conductors, which allows the signal to go further. The type of dielectric (insulating material), the amount of shielding, the consistency of the construction (the number of twists in the conductors per inch and their positioning in the cable relative to each other) as well as the quality of the conductor metal all effect the way the cables perform. Some of the better cables actually use silver plating over the copper conductors. Silver is the best conductor metal and its use results in a cable that produces less jitter.

In shorter cables (source to processor or receiver) this benefit is especially noticeable in the way these cable "sound" – cleaner, smoother, more dynamic and fuller with better bass than with other HDMI cables.

### Cable Construction

All HDMI cables create some jitter since none are perfect. The construction of the cables has to be extremely uniform over the entire length in order to maintain the correct characteristics or impedance. This includes the geometry (in HDMI, twists per inch) and the way the connector is terminated. Every conductor must be the same distance apart and length -within .082". You want to look for cables that are:

- Certified HDMI LLC and High Speed® HDMI cables.
- Simplay Certified - an arm of Silicon Image that tests and ensures product's performance. (Note: Simplay only certifies cables up to 4m.)
- Utilizing higher quality materials: Silver-plated copper, skin-foam-skin dielectric, triple shielding and die cast metal connectors all contribute to delivering a better signal by decreasing noise and distortion, which means, less jitter.
- Built with a connector that is made to the very highest tolerance so the it will not fall out of the HDMI receptacle.
- Rigorous test procedure to ensure quality.

### Why Bravo AV recommends Tributaries Cable

Tributaries cables are:

- Built with better materials to reduce jitter. The materials in Tributaries HDMI cables are improved in the higher Series. Materials like silver-plated copper, skin-foam-skin dielectric and triple shielding.
- HDMI LLC, High Speed® HDMI and Simplay certified.
- Every cable is tested to pass 1080p.
- The die cast connectors in the Series 7 and Series 9 fit more snug than most cables
- Precision metal connectors that stay plugged in and deliver a better signal by decreasing noise and distortion.

## A Closer Look Inside an HDMI Cable

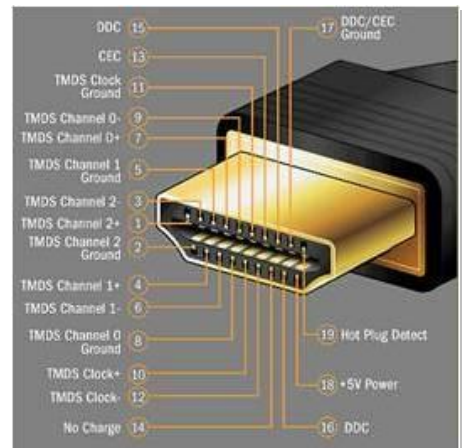
The HDMI interface has an extremely large frequency response. It can carry a tremendous amount of data at very high speeds. That is why cable quality is so important.

There are 5 shielded twisted pairs each with a drain. In addition, there are four more conductors inside this cable:

**TMDS-** Three of the shielded twisted pairs are reserved for three high speed data channels carrying video, audio and control. Developed by Silicon Image, TMDS stands for Transition Minimized Differential Signaling. TMDS is a way to transmit huge amounts of data over a twisted pair, up to 3.4Gbps per pair (10.2Gbps total). Because of the large amount of information being sent, crosstalk can occur between the twisted pairs. TMDS uses an advanced coding algorithm that maximizes bandwidth by reducing crosstalk and data interference between channels. Each twisted pair is color coded to carry the corresponding signal (red for red, green for green and blue for blue).

**Clock Channel-** The clock channel, carried on another shielded twisted pair, enables reliable data processing. Simply put the clock ensures the TMDS signals arrive at exactly the same time. In order for the clock channel to ensure the signals arrive at the same time, the Clock and TMDS conductors all have to be the same length and distance apart from one another within .082”.

**DDC-** The last shielded twisted pair is for the Display Data Channel (DDC) which provides 2-way communication system intelligence. This is also where the Extended Display Identification (EDID) channel and High-Bandwidth Digital Copy Protections (HDCP) keys are transmitted. The EDID is like a genetic code for electronics. It contains the manufacturer's name, product type, video resolutions, audio type capabilities and other information. The EDID can be read through the DDC channel by all the components in the system. This HDMI feature allows the source to send the best signal available for this display unit. The HDCP is the digital handshake for HDMI electronics. Their keys have to be validated every 2 seconds.



**CEC-** the Consumer Electronic Control (CEC) uses only one conductor. The CEC is the control part of the cable. It is a bi-directional control that allows something called 1-touch play. This occurs when a trigger sends a series of intelligent commands to multiple devices in a system. A few examples of 1-touch play are: system standby, one touch record, and tuner control. The CEC is found in all HDMI cables, but its implementation is optional on some devices.

**Hot Plug Detect-** Another signal conductor inside HDMI is the Hot Plug Detect which is attached to the only recessed pin on the connector. The Hot Plug Detect enables the components to detect when an HDMI cable is attached, detached, or when an HDMI input is switched. Once “hot”, the source turns on the 5v supply.

**5v Supply-** The 5 volt supply provides low current power for the purpose of reading the EDID ROM inside the display. If the voltage drops under 4.7v, there will not be enough power to boot up the interface (e.g. HDCP, which means no picture).

**Ethernet and Audio Return Channel-** The HDMI 1.4 spec adds Ethernet over the HDMI cable and Audio Return Channel (ARC). To take advantage of these new features, two new cables will be added: 1) Standard Speed HDMI with Ethernet, and 2) High Speed HDMI with Ethernet.

Current HDMI cables, Standard Speed and High Speed HDMI, can be used with all versions of HDMI, even HDMI 1.4. However, a separate Ethernet cable will have to be run in order to carry that signal. All Tributaries cables are High Speed HDMI cables. Look for Tributaries to announce the availability of High Speed HDMI with Ethernet in the coming months.

**Note:** Current HDMI cables are capable of carrying the ARC.

### Tributaries Cable Construction

Tributaries make four levels of cables to accommodate a wide range of performance expectations but even our least expensive Series 3 HDMI cables are certified as 1.3b High Speed compliant. For those who want better performance Tributaries makes three step-up models. Regardless of the model range, all of our HDMI cables are designed to perform consistently and reliably. The manufacturing techniques we employ drastically reduce the chance of cold solder connections and the plugs we use are of a tighter tolerance than the norm reducing the chances of the cables falling out.

All cable signal conductors create distortion ... better metals are used in an effort to reduce the amount of distortion. The silver plated OFHC copper conductors used in the series 7 and 9 HDMI cables create significantly less distortion (jitter) than the conductors used in lesser cables.

All dielectrics create some noise and with digital audio cables - less noise ultimately means less jitter. The state-of-the-art skin-foam-skin dielectric helps to maintain the correct impedance over the length of the cable while creating less noise. Maintaining the proper impedance and reducing the noise created by the cable itself reduce cable induced timing errors – jitter.

A shield on a cable is an antenna that gives noise a path to ground. Two shields are used on the Series 7 and 9 HDMI cables. The OFHC copper shield provides 90% coverage (Series 7) and 95% coverage (Series 9). In addition, both models utilize an aluminum/Mylar foil shield that provides 100% coverage.

The benefits to this extensive shielding are twofold. First, the small, delicate signals traveling on the conductors are protected from external noise that would cause jitter. In addition, the shields also keep the ultra high frequency HDMI signals from radiating into the room and adversely affecting the performance of the AV equipment.

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### Article Sources

Tributaries Cable - [www.tributariescable.com](http://www.tributariescable.com)

HDMI - [www.HDMI.org](http://www.HDMI.org)

Simplay Labs - [www.simplaylabs.com](http://www.simplaylabs.com)