Version 0.2

General HDMI questions:

What is HDMI?

HDMI (High-Definition Multimedia Interface) is the first and only industry-supported, uncompressed, all-digital audio/video interface. HDMI provides an interface between any audio/video source, such as a set-top box, DVD player, or A/V receiver and an audio and/or video monitor, such as a digital television (DTV), over a single cable.

HDMI supports standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable. It transmits all ATSC HDTV standards and supports 8-channel digital audio, with bandwidth to spare to accommodate future enhancements and requirements.

What are the advantages of HDMI over existing analog interfaces such as composite, S-Video and component video? Ease-of-use: HDMI combines video and multi-channel audio into a single cable, eliminating the cost, complexity, and confusion of multiple cables currently used in A/V systems.

Quality: HDMI transfers uncompressed digital audio and video for the highest, crispest image quality.

All-Digital: HDMI ensures an all-digital rendering of video without the losses associated with analog interfaces and their unnecessary digital-to-analog conversions.

Low-cost: HDMI provides the quality and functionality of a digital interface while also supporting uncompressed video formats in a simple, cost-effective manner.

Audio: HDMI supports multiple audio formats, from standard stereo to multi-channel surround-sound.

Intelligence: HDMI supports two-way communication between the video source (such as a DVD player) and the DTV, enabling new functionality such as automatic configuration and one-button play.

What formats will HDMI support?

HDMI is high speed digital connection and will support resolutions of 480i, 480P, 720i, 720P, 1080i and in the future, 1080P.

What are HDMI 1.1, HDMI 1.2 and HDMI 1.3?

-The HDMI 1.0 specification was released in December 2002.
-The HDMI 1.1 specification was released in May 2004.
-The HDMI 1.2 specification was released in August of 2005.
-The HDMI 1.2a specification was released in December of 2005.

What has been added in the HDMI 1.2 specification?

The HDMI 1.2 specification also adds features and capabilities that increase HDMI's appeal for use in both the CE and PC industries. Specifically, the features and modifications for HDMI 1.2 include:

- Support for One Bit Audio format, such as SuperAudio CD's DSD (Direct Stream Digital)
- Changes to offer better support for current and future PCs with HDMI outputs, including:
- Availability of the widely-used HDMI Type A connector for PC sources and displays with full support for PC video formats
- Ability for PC sources to use their native RGB color-space while retaining the option to support the YCbCr CE color-space
- Requirement for HDMI 1.2 and later displays to support future low-voltage (i.e., AC-coupled) sources, such as those based on PCI Express I/O technology

What has been added in the HDMI 1.2a specification?

With the release of HDMI 1.2a, CEC features and command sets and CEC compliance tests are now fully specified. In addition, the Founders have created version 1.2a of the HDMI Compliance Test Specification (CTS), which includes a CEC Supplement. HDMI CTS 1.2a has been updated for technical consistency with HDMI Specification 1.2a as well as to the recently released HDMI Specification 1.2.

Significantly, CTS 1.2a contains additional cable and connector testing and Authorized Testing Center (ATC) submission requirements. Specifically, under CTS 1.2a, the Adopter shall submit for testing to the ATC any new HDMI cable whose length exceeds previously tested cables.

What will be added in HDMI 1.3 specification?

HDMI organization has not yet released the specification for HDMI 1.3.
HDMI interface will have the following new features under development:

- Higher speed: Though HDMI has more than twice the bandwidth needed to support all HDTV formats, HDMI will increase its single-link bandwidth to support the demands of future HD display devices, such as higher resolutions, deep color and high frame rates.

- Deep color: HDMI will support 30-bit, 36-bit and 48-bit color depths for stunning rendering of over one billion colors in unprecedented detail.

- Greater PC/CE convergence: HDMI will be enhanced for easier integration into low voltage, AC-coupled PC graphics controllers, cementing HDMI's position as the de facto standard digital multimedia interface enabling true convergence across PC and CE platforms. The HDMI Founders also support compatibility between HDMI and the Unified Display Interface (UDI), the HDMI-compatible digital video interface for PC displays announced recently by a group of leading PC technology makers.

- New mini connector: With small portable devices such as HD camcorders and still cameras demanding seamless HDTV connectivity, HDMI will offer a new, smaller form-factor connector option. Since HDMI offers the highest quality digital audio and video on a single connection, such devices will be also benefit from a reduced connector count.

- Lip Sync: CE devices are employing increasingly complex digital signal processing of high-resolution video and audio formats to enhance the clarity and detail of the content. As a result, synchronization of video and audio in user devices has become a greater challenge and could potentially require complex end-user adjustments. HDMI will incorporate features to enable this synchronization to be done automatically by the devices with greater accuracy.

- New compressed audio formats: In addition to HDMI's current ability to support high-bandwidth uncompressed digital audio and all currently-available compressed formats (such as Dolby Digital and DTS), HDMI will add additional support for new compressed digital audio formats Dolby TrueHD and DTS-HD.

Is HDMI 1.2a backwards compatible with 1.2, 1.1 and 1.0?

Yes, the latest HDMI specification is fully backwards compatible with previous versions.

Does HDMI provide a secure interface?

While no security system is one hundred percent secure, HDMI, when used in combination with HDCP, provides an audio/video interface that meets the security requirements of content providers and systems operators.

What is HDCP?

HDCP is an acronym for High-Bandwidth Digital Content Protection. HDCP is an encryption method developed by Intel in order to control unauthorized copying of digital media. The encryption is carried out in the HDMI transmitter found in the "source" (dvd player, set top box) and decryption is carried out by the HDMI receiver (the HDTV display). The public keys (Key Selection Vectors) for encryption are exchanged between the source and display over an I2C bus (pins 15 and 16).

Does HDMI accommodate long cable lengths?

Yes. HDMI technology has been designed to use standard copper cable construction at long lengths. In order to allow cable manufacturers to improve their products through the use of new technologies, HDMI specifies the required performance of a cable but does not specify a maximum cable length. Cable manufacturers are expected to sell reasonably priced copper cables at lengths of up to 15 meters.
The maximum cable length varies between cable brands. When an HDMI cable is too long you may see snow over the picture (pixels dropping out) or the picture is totally blank.

What is the HDMI Extender?

The HDMI Extender allows you to extend the length of HDMI cable used in your theatre system. It is especially useful in DLP projector systems where the source and projector are far apart. The unique circuitry automatically provides compensation for DVI, HDMI cables by equalization, buffering and de-jittering the TMDS signals which degrad over long cable runs. The HDMI Extender "cleans" up all signals to ensure error free transmission.

Technical questions about HDMI:

How does HDMI transport the digital video?

The video portion of HDMI is carried by 3 separate differential pairs. Each pair transports 1 of 3 uncompressed native digital R,G, B signals from source (dvd player, set top box) to the sink (HDTV display). A unique protocol, T.M.D.S.(transmission minimized differential signaling), is used to transport the digital data. Each pixel is represented by 24 bits (8 bits each for each of the primary colors). The T.M.D.S. protocol then "calculates" and stuffs 2 extra bits to the video data stream in order to create a digital stream with minimum transitions (lower EMI, lower interference) and also minimize long strings of '1' and '0' which can cause detection errors.

A fourth differential pair, called the TMDS clock provides the pixel clock for timing the data stream. The maximum TMDS single link pixel clock rate is 165 MHz.

How does HDMI transport audio?

The multi-channel audio is time multiplexed into the TMDS data streams. Audio is much lower data rate (192kbps) and the extra time is used to demux the audio signals.

Does HDMI support Dolby 5.1 audio and high-resolution audio formats?

Yes. From the start, HDMI was defined to carry 8-channels, of 192kHz, 24-bit uncompressed audio, which exceeds all current consumer media formats. In addition, HDMI can carry any flavor of compressed audio format such as Dolby or DTS. (Such compressed formats are the only multi-channel or high-resolution audio formats that can be carried across the older S/PDIF or AES/EBU interfaces.) Additionally, most existing HDMI sources can output any compressed stream, and the newer sources can output uncompressed 6-channel, 96kHz audio from a DVD-Audio disk. There are A/V receivers on the market that can accept and process the 6- or 8-channel audio from HDMI.

Does HDMI support SACD?

HDMI version 1.2 features support for One Bit Audio format, such as SuperAudio CD's DSD (Direct Stream Digital)

Does HDMI support 1080p/60Hz?

Yes, every version of the HDMI standard supports 1080p/60Hz. However, as discussed below, this is not a requirement, and manufacturers may choose to only implement 1080i, for example. For some types of devices (e.g. DVD players), this has not historically resulted in a reduction in quality as there has been relatively little true 1080p/60Hz content available, and 1080i can deliver all of the visual information available from the source.

What is the data rate of a single link HDMI connection?

The maximum pixel clock rate is 165MHz and each of the 3 TMDS video streams carries 10 bits. Therefore the aggregate data rate is 3 x 10 x 165MHz = 4.96Gbps.

How many pins are included in the HDMI connector?

There are 19 individual pins in the HDMI connector. There are 3 pairs of TMDS signals which carry all the digital audio and video signals.

Compatibility questions about HDMI:

What is the connection order for HDMI?

The connection order can be a key issue as to whether or not the HDMI signals will pass through the system. For best results the receiver should be turned on first, then the source device(s) and then the display. The reason for this has to do with getting the equipment to handshake properly for the HDCP protocol.

It is also recommended to plug and unplug HDMI cables only when the units are plugged to AC power. In addition to this it is also recommended to have other cables connected between devices before connecting any HDMI devices. These precaution tips will reduce the typical ground loop issues between devices which can easily damage HDMI chips.

Why won't the set top box pass video signal through my receiver with an HDMI connection?

A set top receiver connected to an A/V receiver via HDMI may have trouble passing video signals through the A/V receiver even though a direct connection to the display seems to work fine. This has to do with the HDMI HDCP protocol being sent and received and the authentication process. This is not a fault of the receiver. Recently set top box manufacturers have become aware of this issue. It has been found that the U-code information appears to be the problem which is part of Annex A of the repeater conformity specifications of the HDMI protocol. Some set top receiver manufacturers have already implemented firmware changes to their units while others are in the process of updating their units. If a set top receiver being used is having problems passing HDMI video signal through an A/V receiver, contact the manufacturer of the set top receiver to see if an update is available.

What can I do if the HDMI video will not pass through my receiver?

The first thing is to check firmware upgrades for all HDMI devices in the system. If this does not help you may want to utilize analog video to HDMI conversion feature found on Controller. Also see the question "What is the connection order for HDMI?" above.

Is HDMI compatible with DVI?

Yes, HDMI is fully backward-compatible with DVI using the CEA-861 profile for DTVs. HDMI DTVs will display video received from existing DVI-equipped

products, and DVI-equipped TVs will display video from HDMI sources. A separate audio cable will be needed to carry the digital audio.

Will current HD TVs and set-top boxes using DVI-HDTV be compatible with HDMI devices?

Yes. Currently there are TVs with DVI-HDTV inputs available from a wide variety of manufacturers. These devices will be compatible with future HDMI-equipped products.

What is the backward compatibility of different HDMI versions?

All new versions of HDMI are backwards compatible with all previous versions of HDMI; we have no plans to add any new functions that will break this backwards compatibility. This is very important for us. Each new version of the specification describes one or more new optional features, but all of the functions of the previous version are still supported in the new versions of the HDMI specification.

What is so called "repeater" issue with some HDMI devices?

There are some cable TV boxes are not working correctly when used in conjunction with an A/V receiver (but will typically function correctly when connected directly to a TV/monitor). This is caused by an error in the way these devices implement HDCP (HDCP is a content protection system that is nearly always implemented in HDMI). Specifically, some of those boxes do not support "HDCP Repeaters" such as an A/V Receiver or switch. This is not an HDMI-specific problem (as we have seen the same problem in DVI outputs as well). This may be a problem in the initial versions of these products, and in some cases there is new firmware available that fixes this issue in HDMI.

Which television models support 480i resolution over HDMI?

Some of the HDMI capable television and projector are not supporting 480i resolution with HDMI interface. This can be a problem when analog video is converted to HDMI without any scaling or de-interlacing like NHT Controller. The same issue is also with Controller On Screen Display (On Screen Display) which 480i resolution and some television are not capable of handling that over HDMI.

The following models are confirmed to work with 480i HDMI signals:

Sharp Aquos LC376u
Sharp LC45GD7u

Mitsubishi WD62527
Mitsubishi PD4265
Panasonic TH42PD50u
Sony KFDE42A10

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