HDMI – Why?

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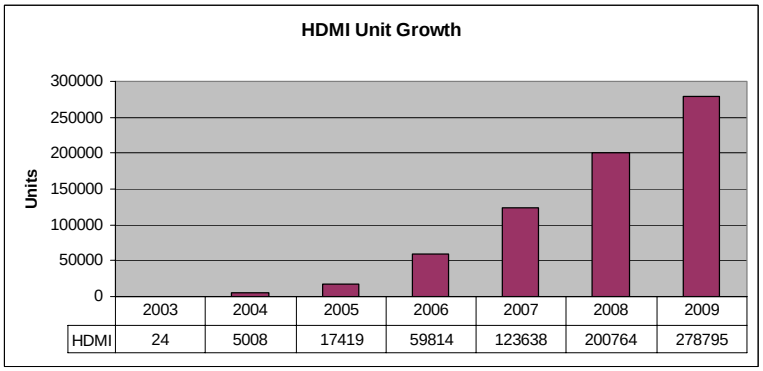
We are at the beginning of the greatest change in video and computer display signal distribution since the computer was invented 50 years ago. What Digital Television (DTV) and the DVD™ did for the broadcast and video industries, HDMI™ is doing for the display industry. The High-Definition Multimedia Interface (HDMI) is an evolution of the DVI standard from Silicon Image. It includes High-bandwidth Digital Content Protection (HDCP™), digital audio and control in one cable and is backwards compatible.

HDMI is a digital signal distribution standard covering the electronic and mechanical specifications and licensing and is under the auspices of HDMI Licensing, LLC. It is approved by both the FCC and content providers as the digital distribution technology. The number of adopters of the HDMI standard increased 60% after the most recent Consumer Electronics Show in January.



Source: In-Stat/MDR, 12/05

HDMI solves many of the challenges with analog signal distribution technologies such as composite, s-video, component, RGB, and CAT5 derivations of those signals. Unlike Serial Digital, MPEG, or FireWire™ technologies the signal is not compressed. Because of the inherent losses in Digital-to-Analog (DA) and Analog-to-Digital (AD) conversion, the benefits of HDMI are greatest with pixeled displays using such technologies as DLP, Plasma, LCD, and ILA. The images are improved for many reasons including compression/encoding errors, no DA or AD conversions, elimination of ground loops, and exact pixel-to-pixel mapping from source to display.

Images to be displayed come from one of three sources, a video camera, a film scanner or a computer. All are produced using the primary colors; red, green and blue. To reduce storage and bandwidth transmission requirements these signals have been encoded (analog) and/or compressed (digitally) since we started seeing color television. Every time an analog signal is converted from RGB to composite, S-Video, or component and back, there is a visible loss of quality. Digital Compression (such as MPEG compression) also causes a visible loss of quality. Errors in the conversion process between Analog and Digital are also prone to visible errors.

Pixel mapping errors and scalers also result in a loss of resolution. Source and display should be set at the same resolution. If the pixels generated by source don't align exactly with the pixels in the display, the pixel's data is averaged between two adjacent pixels, dropping the resolution by half. Analog signals don't have pixel timing information and are subject to mis-adjustment and drift over time. This is more noticeable with computer sources than with video sources. Only a digital source such as HDMI offers the stability of one-to-one pixel mapping. Scaling has a similar effect as does the use of electronic keystone correction.

Digital signals are less subject to interference from outside the system. "Hum Bars" (wide horizontal bars which slowly roll through a picture) which are caused by grounding problems are non-existent. Cross-talk (ghosting) doesn't occur. You may still see these effects if the original material was created in an analog environment, but they aren't being caused by your system!

DVI and HDMI signals are compatible. That is to say that a simple cable is all you to use the DVI digital output from your PC on your HDMI display. If you are going from an HDMI source to a DVI display, the DVI connector does not have the ability to transmit audio or control so don't expect the audio to work!

Some of the objections to using HDMI have to do with cable length and field termination of cables. Consequently cable length from Liberty Wire is now limited to 115 feet (35 meters) without electronic repeaters for recent HDMI sources and displays. The connectors must be installed in a controlled environment. For longer runs, or where the cables must terminated in the field, fiber optic repeaters are available to extend the length to several hundred feet. Due to the bandwidth requirements for HDTV, Liberty does not recommend the use of Category cable to transmit HDMI signals. HDMI recommends that all electronics use external power (wall warts) – not the 5 volts available on the HDMI cable.

Since this is a digital signal, the signal is either works or it fails completely. As the cable length is extended the image is perfect. As you near the failure point, you will see a few streaks going across the screen. A couple feet longer and the image will go away. Because of the higher voltage requirements of the audio signals on the HDMI cable, it is usually the first part of the signal to be lost. The image will still be visible, but you won't hear anything.

The other failure mode of HDMI systems is the HDCP handshake. The source, the display and all electronics in between must be HDCP compliant. Traditionally computer and computer displays are not HDCP compliant, although that is changing. If the handshake is not satisfactory, either the display will show a low resolution image, or a blue/blank screen. This varies from manufacturer to manufacturer.

The latest revision of HDMI is 1.3. Although not required for current broadcast, production, or content distribution technologies such as DTV, HD-DVD™ or Blu-Ray™, and incapable of being used by most displays, to "future proof" the standard, 1.3 includes (from www.HDMI.org):

- Higher speed: HDMI 1.3 increases its single-link bandwidth to 340 MHz (10.2 Gbps) to support the future demands, such as higher resolutions, and high frame rates.
- Deep Color™: HDMI 1.3 supports 30-bit, 36-bit and 48-bit (RGB or YCbCr) color depths, up from the 24-bit depths in previous versions.
- Broader color space: HDMI 1.3 adds support for "xvYCC" color standard.
- New mini connector: With small portable devices such as HD camcorders and still cameras.
- Lip Sync: HDMI 1.3 incorporates automatic audio synching capabilities that allows devices to perform this synchronization automatically.

For more information about HDMI refer to the HDMI website which has several excellent tutorials at www.hdmi.org. For more information about HDCP refer to the Digital Content Protection, LLC, website at www.digital-cp.com. Contact Liberty Wire and Cable at www.libertycable.com.

HDMI 1.3 has two subcategories, 1 and 2. Category 1 supports all the typical resolutions and color depths currently in use or anticipated in the near future. Most products that are HDMI 1.3 approved fall under this category. Category 2 is primarily for specialty computer display applications such as active 3D stereo displays, very high resolution and very high color depths. There is no advantage in using these cables for 1080i or 1080p applications. In reality, the lengths that these cables can be run successfully are very short.

Liberty has a complete line of cables and electronics for the commercial or residential installer.

Connector shape and signal data from HDMI Specifications:

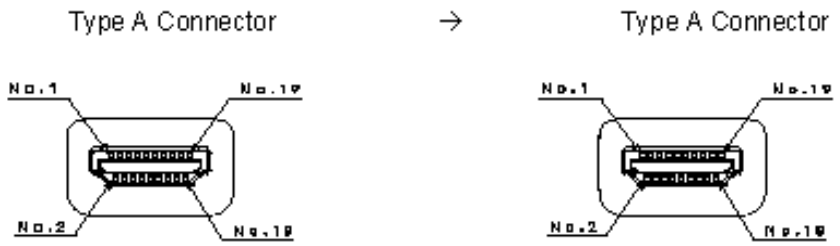


Table 4-8 Type A-to-Type A Cable Wire Assignment

Type A pin	*Signal Name*	*Wire*	*Type A pin*
1	*TMDS Data2+*	*A*	*1*
2	*TMDS Data2 Shield*	*B*	*2*
3	*TMDS Data2–*	*A*	*3*
4	*TMDS Data1+*	*A*	*4*
5	*TMDS Data1 Shield*	*B*	*5*
6	*TMDS Data1–*	*A*	*6*
7	*TMDS Data0+*	*A*	*7*
8	*TMDS Data0 Shield*	*B*	*8*
9	*TMDS Data0–*	*A*	*9*
10	*TMDS Clock+*	*A*	*10*
11	*TMDS Clock Shield*	*B*	*11*
12	*TMDS Clock–*	*A*	*12*
13	*CEC*	*C*	*13*
14	*Reserved (in cable but N.C. on device)*	*C*	*14*
15	*SCL*	*C*	*15*
16	*SDA*	*C*	*16*
17	*DDC/CEC Ground*	*D*	*17*
18	*+5V Power*	*5V*	*18*
19	*Hot Plug Detect*	*C*	*19*