

KRAMER CONNECTIONS™



DIGITAL

IS ON THE RISE

INSIDE THIS ISSUE:

The Challenges of Digital

Adventures with HDMI

The World of Wireless A/V

The Next Generation of Display Interfaces



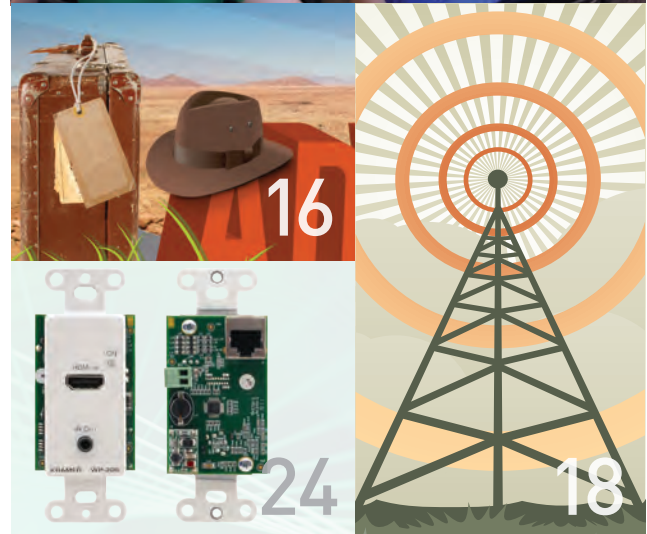
ISSUE 9

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WELCOME

From **Dave Bright**, President, Kramer Electronics

We are truly living in a digital age! It started over 25 years ago with the introduction of the compact disc and has turned into a full-blown revolution. Back then, all significant technological innovations originated in the professional electronics world and trickled into the consumer marketplace.

Now, everything has changed. There's no better example of this new order than the move from analog to digital display interfaces that began in 1999 and has gone on to completely transform television. Blu-ray optical discs, 1080p HD video, and 7.1 and 10.2 channel digital audio could not have existed without these new, high bitrate digital display interfaces.

You know these connectors - you've seen them on your new DVD or Blu-ray player and the back of your new flat screen TV. This new generation of 'intelligent' connections makes it possible for automatic configuration of picture geometry between signal source and display.

But there are also pitfalls in using digital display interfaces. What if the automatic picture set-up data isn't captured correctly, or is programmed incorrectly? What happens when copy-protected content is introduced into an AV installation with non-compliant displays and switches? How can you design a commercial AV system around consumer electronics products, and why would you even want to in the first place?

The fact is, more and more AV installations incorporate one or more pieces of consumer electronics gear. Like it or not, that means dealing with the high-definition multimedia interface (HDMI™), now adopted on millions of TVs, DVD and Blu-ray players, game consoles, digital cameras, and set-top boxes around the world.

And it also means preparing for and supporting the next wave of digital display, including DisplayPort™ for computers; multifunction display/audio/Ethernet/control connections such as HDBase™, and Thunderbolt™, a high-speed, hybrid data and display interface.

At Kramer Electronics, we've made a firm commitment to support and stay ahead of the digital transition. We're spending thousands of hours designing, testing, and refining new digital products to switch and route display signals—products that fully support display data exchange and copy protection while ensuring reliable, "smart" connections each and every time.

That commitment also means a new design philosophy: Modular, easily-customized frame-based products with field-swappable plug-in blades to handle the myriad of connectors and standards you're likely to come across. These new blade products will also include on-board scaling and full support for structured wiring and optical fiber, all in the interests of providing upgradable, future-proof solutions to AV professionals.

Kramer is also committed to education, developing a new series of "designing for digital" classes to help you get started and master this new world of digital signal switching.

Our technical support staff is up to speed on the latest interfacing challenges and stands ready to assist you with your design and specification requirements as you move past the 'analog sunset' into the new world of digital.

In that spirit, we've prepared this special supplement to guide you through the digital transition. Inside, you'll find many useful tutorials, Kramer product guides, and showcases, where you can read about real-world 'adventures' in digital signal interfacing and get a sneak peek at the next level of interfacing—wireless display connectivity and multifunction "do it all" display connections. Enjoy! ♦



"We're spending thousands of hours designing, testing, and refining new digital products to switch and route display signals—products that fully support display data exchange and copy protection while ensuring reliable, 'smart' connections each and every time."

THE CHALLENGES OF DIGITAL SIGNAL INTERFACING (AND KRAMER'S SOLUTIONS TO THEM)

The High Definition Multimedia Interface (HDMI), ubiquitous on a wide range of consumer televisions, Blu-ray and DVD players, and game consoles is now well-established in the professional audiovisual world.

This secure, high bandwidth connection has been adopted for projectors, LCD and plasma monitors, set-top receivers, digital cameras and camcorders, teleconferencing equipment, media players, and AV receivers. As a result, display interface manufacturers have introduced signal distribution and switching equipment to process HDMI just like any other analog or digital signal format.

But here's where things get tricky: HDMI was originally designed as a plug-and-play interface using a peer-to-peer connection. The concept was of a consumer Blu-ray player connecting directly to a flat screen LCD or plasma TV, and nothing more. At most, an in-between step would involve an AV receiver to extract multichannel audio while passing along the signal to a large display monitor or projector, using a 'repeater' connection.

for years with professional serial digital video and audio formats.

But HDMI proved to be different. In fact, early attempts at using expanded versions of HDMI peer-to-peer and repeater connections in pro AV distribution amplifiers and matrix switchers resulted in numerous dropped connections and reliability issues, creating many headaches and bad public relations for interface manufacturers!

Could HDMI ever be "tamed?" Could it be made to work reliably in a distributed signal environment? Good questions!

HOW DID WE GET HERE?

By now, you are probably wondering why HDMI is being used at all in commercial AV installations. Why not just stay with time-tested analog display connections, or at least move to a proven digital standard, like the high definition serial digital interface (HD-SDI)?

So where, exactly, did HDMI come from? It evolved from an earlier attempt at an intelligent, 100%-digital display connection you already know as DVI, or Digital Visual Interface.

DVI has been around 1999. It was first developed by the Digital Display Working Group (DDWG) and was intended to replace the 15-pin Video Graphics Array (VGA) analog display connector commonly found on desktop and notebook computers.

DVI allowed computers and video cards to communicate directly and automatically with compatible displays by using a protocol known as Extended Display Interface Data (EDID). EDID was added to the VGA standard in 1994 as a way to ensure that connected displays would be driven at optimal resolution and refresh rates, freeing up the user from tedious clock and phase adjustments.



Early attempts at using expanded versions of HDMI peer-to-peer and repeater connections in pro AV distribution amplifiers and matrix switchers, resulted in numerous dropped connections and reliability issues creating many headaches and bad public relations for interface manufacturers!

In the pro AV world, we have the reasonable expectation of distributing an HDMI source signal to two or more displays, or switching a matrix of video/audio sources and displays to suit our whims. That was an easy task with analog video formats, such as VGA and component video. And it's also been done

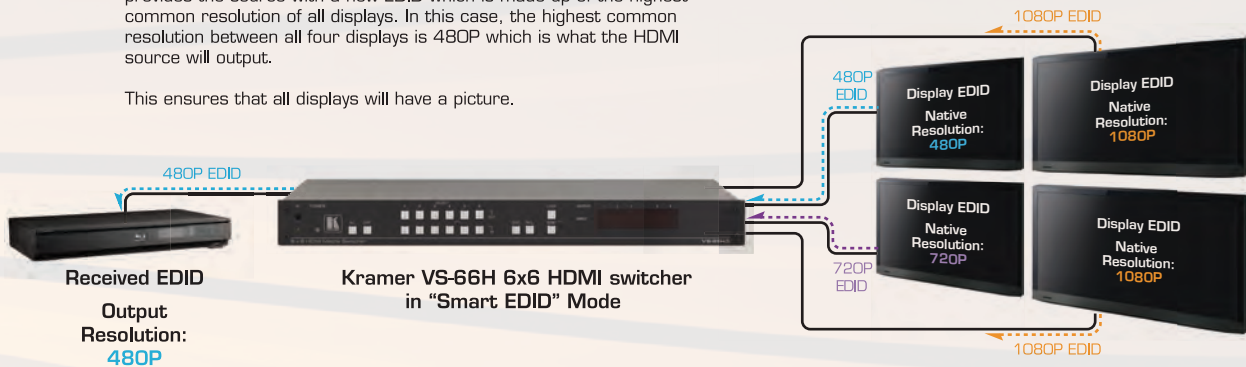
The answers to those questions are as follows: (a) Analog interfaces are quickly disappearing from consumer and professional AV equipment, and (b) HD-SDI is a digital data transport stream format, NOT a display connection. Like it or not, HDMI is here to stay (and so is its sibling, DisplayPort)!

Originally, DVI supported both "pure" digital connections to computer monitors (DVI-D) and hybrid analog/digital connections (DVI-I). However, the DVI-I connector also started to appear on some consumer electronics devices, such as terrestrial, cable, and satellite set-top receivers, DVD players, and HDTVs.

By using a 'smart EDID' polling and storage system, all connected displays are continuously optimized for the highest common resolution.

The HDMI matrix switch analyzes all connection EDID information and provides the source with a new EDID which is made up of the highest common resolution of all displays. In this case, the highest common resolution between all four displays is 480P which is what the HDMI source will output.

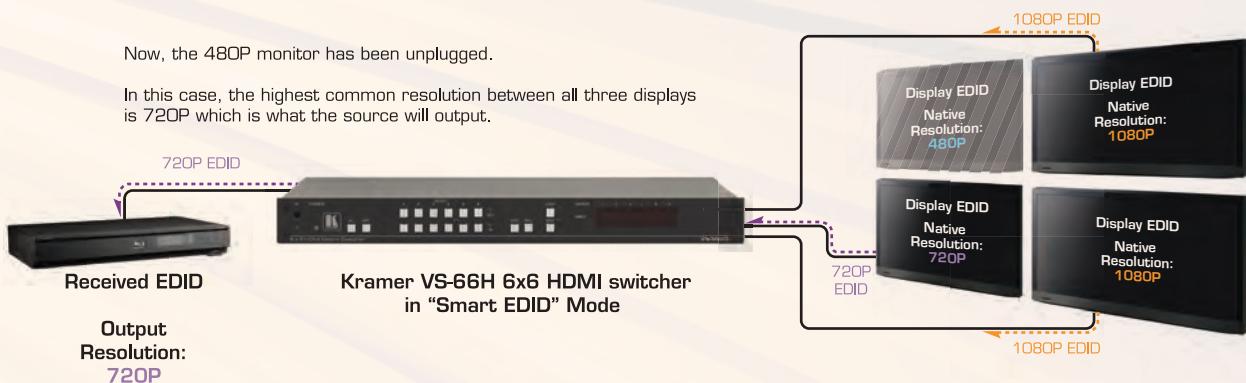
This ensures that all displays will have a picture.



When the display with the lowest native resolution is disconnected, the matrix switcher automatically defaults to the next-highest resolution supported by all displays.

Now, the 480P monitor has been unplugged.

In this case, the highest common resolution between all three displays is 720P which is what the source will output.



DVI uses transition-minimized differential signaling (TMDS) and supports a maximum resolution of 1920x1080 pixels, refreshed @ 60 Hz, in a single-link implementation (165 MHz pixel clock), or 2048x1536 pixels, refreshed @ 60 Hz, in a dual-link implementation (330 MHz pixel clock). While it worked well, there never was any support for digital audio in the DVI specification.

THE NEXT STEP

As the transition to digital picked up speed in the late 1990s and HDTV broadcasts commenced, concerns were expressed that digital video content transmitted through DVI-D connections could be copied and distributed illegally. Those concerns led to the formation of the HDMI Consortium (Hitachi, Matsushita Electric Industrial (Panasonic), Philips,

Silicon Image, Sony, Thomson (RCA) and Toshiba).

This group developed the HDMI interface in 2002 as a more robust version of DVI, one that could also carry digital audio and metadata, and transport video at faster data rates. The High-bandwidth Digital Copy protection (HDCP) system, developed by Intel for DVI, would also be adopted.

Since the HDMI standard was first announced, it has undergone numerous revisions and updates, with the latest being version 1.4b (January 2012). V1.4 increases the maximum supported resolution to 4096x2160 pixels @24 Hz, and includes a 100 Mb/s Ethernet return channel, along with support for numerous 3D picture formats.

HDMI also carries up to eight channels of digital audio (linear pulse code modulation, 192 kHz); supports sRGB,

Deep Color, and xvYCC color spaces, high bitrate digital audio, and an audio return channel. There are five different versions of the HDMI connector, with Type A being the most widely implemented (19 pins, slide-on) and Type C finding increased use on portable consumer electronic devices such as digital "point and shoot" cameras.

AN UNWELCOME VISITOR?

HDMI snuck into the commercial AV market because of one product – the Blu-ray player. BD players can play back movies at full 1920x1080 resolution, using progressive scan and film (24 Hz) and video (60 Hz) frame rates. The problem is, with copy protection concerns, those modes were disabled through analog component video outputs at first.

Now, all Blu-ray players manufactured after December 2011 have dropped all analog video connections except for composite [480i] video. The only way to get HD content off a Blu-ray disc is to connect to the HDMI port, something that is also happening in the world of cable, satellite, and IPTV set-top receivers.

With HDMI now widely adopted by consumer electronics manufacturers, DVI is headed for the sunset. Intel and AMD both announced in 2010 that they would start phasing out support for both VGA and DVI-I interfaces this year, moving instead to DisplayPort and/or HDMI as computer manufacturers request.

SOUNDS GOOD (ON PAPER, THAT IS)

In the world of HDMI, there are two parts to a peer-to-peer connection – the “source” (DVD/BD player, set-top box, game console, desktop/notebook computer) and the “sink” (TV, monitor, projector). Should another device need to be connected between the two – such as AV receivers – an intermediary connection known as a “repeater” was employed to both extract and retransmit the HDMI signals to their ultimate destination.

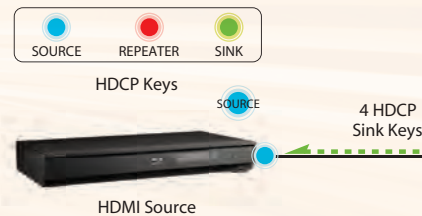
Exchanging EDID was a simple process. When plugged in or powered up, the connected “sink” (display) would immediately prompt an exchange of data with the source, sending information about the total number of pixels, normal refresh rate, and supported (standard) resolutions. In seconds, the source configured itself and transmitted back a compatible display signal and digital audio. Done, and done!

The next step is to exchange HDCP keys. Each HDCP-capable device has a set of forty 56-bit keys, which are exchanged repeatedly when a connec-

An HDMI matrix switcher that depends on repeaters is not reliable.

- (1) Repeaters pass HDCP keys back to the source for handshake
- (2) Source needs to decipher 4 HDCP keys instead of 1 to output an image
- (3) If one display is not HDCP-compliant, or if one HDCP key is corrupted, then source will not output content to any display

Problem: Many AV sources do not support repeater devices!



tion is made. Compromised keys will disable the connection, i.e. Blu-ray and DVD discs will not play if the players are presented with a compromised key or keys. In all, the exchange of EDID and HDCP took about five seconds before video was seen and audio was heard.

While this approach works well for the multi-source, single-sink world of consumers, it is not at all manageable in the pro AV market where the reverse condition is usually found—a single source driving multiple displays.

Designing a professional video display distribution system around a secure, all-digital connection like HDMI is generally inadvisable. And yet, it is being done by numerous companies, ostensibly to support formats such as Blu-ray and HDTV set-top receivers, but also to take advantage of the high-density connector and eliminate discrete connections for video, audio, and data.

The challenge is to connect two or more displays with different resolutions to a single HDMI source. Which EDID is to be supported? Are all displays HDCP-enabled? What if multiple sources are being connected to one or more displays? How can any computers connected through a HDMI matrix switch stay active when no active sink is detected?

Let's start with EDID.

STEP 1: THE EDID HANDSHAKE

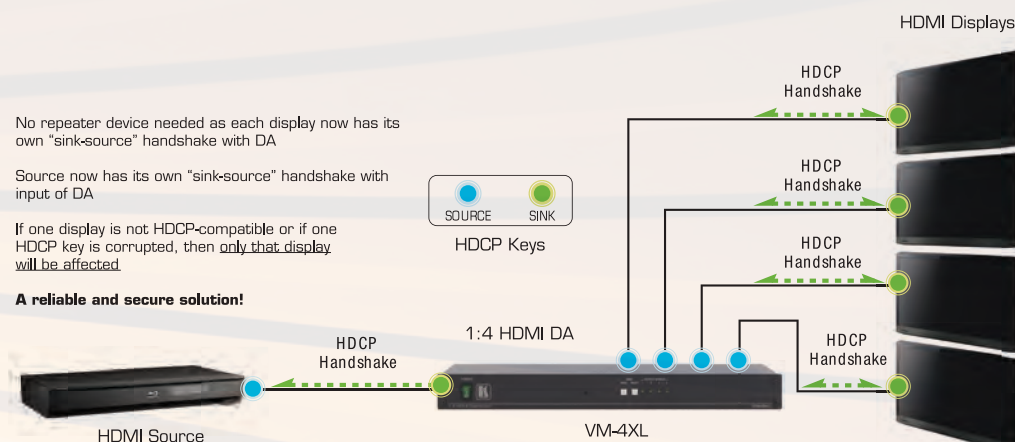
We can see from the earlier explanation of EDID that simply connecting and disconnecting different displays to an HDMI matrix switcher will likely result in (a) dropped connections, (b) long intervals waiting for EDID exchanges, or (c) no images at all.

Using the original model for HDMI connections, a repeater would be installed within an HDMI distribution amplifier to have the connected source communicate directly with the connected display. The problem? Repeaters do not work reliably for two or more connected displays, particularly if they have different native resolutions.

The Kramer solution—one which still takes full advantage of EDID—is to store EDID settings in memory for each display connected to the distribution amplifier. These settings are preserved in non-volatile memory, emulating a virtual display to ensure a connected PC or media player does not go into “sleep” mode when it is not the selected source.

This “smart” EDID design also analyzes all of the EDID information for each connected display and communicates the highest common display resolution to the video source. Here's an example: A 1x4 HDMI distribution amplifier might have two 1920x1080p displays, one 1280x720p display, and one 720x480 display connected. When

By using separate sinks in each input of the HDMI distribution amplifier, HDCP connections are maintained reliably while non-compliant displays are disabled.



all four displays are powered on and connected, the source is prompted to output 480p, as that is the highest common resolution for all displays.

Should the 480p display be disconnected from the matrix, Kramer's "smart" EDID analyzer automatically rescans the remaining connected displays and communicates 1280x720 as the highest common resolution to the source. If the 720p display is then switched out, the process happens again, and 1920x1080p is now communicated back to the source.

Storing multiple EDID sets in memory also speeds up the HDMI connection "handshake," which can take several seconds to execute. In short, Kramer's "smart" EDID management ensures that all connected sources remain active at all times and that every connected display will show an image, although the resolution may change as needed to accommodate all displays.

STEP 2: THE HDCP HANDSHAKE

Okay, now we've managed to send a video signal to all of our connected displays, one that is the best possible compromise based on EDID settings. But what if we want to play back a Blu-ray movie, or watch a premium video channel?

That means verifying that HDCP keys are present in each display. With the conventional approach, a repeater

within a distribution amplifier or matrix switch would pass display HDCP keys back to the source. Now the source needs to decipher a different set of keys for each connected display, and if any key is corrupted, no signal will pass to any connected display, even if the remaining displays are transmitting valid keys.

It's time for a more practical fix that respects the HDCP protocol, but still facilitates reliable connections to a matrix of displays.

This scenario is every AV systems integrator's worst nightmare and usually results in blank screens [plus phone calls from irate customers!]. The distribution amplifier or matrix switch cannot simply repeat the connection to each display: What happens if a non-compliant display is connected to the matrix? What if a non-compliant source is switched in?

It gets worse. Testing by an independent laboratory revealed that a vast majority of HDMI sources do not recognize HDMI repeaters correctly. More headaches!

Time for a more practical fix that respects the HDCP protocol, but still facilitates reliable connections to a matrix of displays. The Kramer solution is to make each input to a matrix switch or distribution amplifier a sink, providing a constant connection to the source (or sources).

Next, each output is now re-defined as a source, looking for a single, valid HDCP handshake with a single connected display.

Once keys are exchanged, copy-protected video from the actual source is passed through to that display. If any connected display is non-compliant, only that display will be cut off – all other connected, compliant displays will remain connected and display video.

If new displays are connected to each port on the matrix or DA, the secure connection is simply reestablished while EDID is exchanged. The beauty of this system is that copy protection is maintained at all times on all ports. The issue with repeaters is eliminated, and with it, the need for aspirin.

STEP 3: SMILES ALL AROUND

And that, in a nutshell, is how Kramer's HDMI distribution amplifiers and matrix switchers work. The goal is to make switching and distribution as smooth as it was with older analog formats while respecting copy protection and using EDID to the max.

This innovative approach is a good example of how Kramer is not only staying current with digital interfaces, but looking to the future. It's also what has made possible the newest generation of Kramer frame- and blade-based digital switching products that can work with a wide range of interface standards, including DisplayPort. We'll cover that standard in more depth later in this supplement! ♦

KRAMER PRODUCTS

SERVE LOCAL HOUSTON CHURCH



The projectors had taken up much of the budget, but they still needed a cost-effective way to manage their video sources. Kramer had all the tools to help them create a quality system.

— Jason Staples, CTS, Account Manager at Industrial Audio/Video, Inc.

Every seat is the best seat in the house at Fellowship Bible Church in Pearland, TX. The congregation enjoys high resolution visuals, sings loud and clear from projected lyrics with sharp bright backgrounds, and experiences videos and events in high definition on three large screens around the sanctuary.

Each of the front 9 x 12-foot screens and the rear screen (for the Pastor and singers) can receive different images simultaneously. Two TVs provide additional monitor views for the band and singers. The audio/video system's flexibility is the result of Kramer Electronics switchers, scalars and scan converters. The Kramer equipment manages the video sources and converts the varied input signal resolutions to the same high quality video output. Those sources are then distributed throughout the church.

The Kramer products were recommended by Industrial Audio/Video, Inc., a local audio/video system integrator, when Fellowship Bible Church began its search for a high resolution system. "The existing system could not support higher resolutions, so we worked with the church team to create one that would," said Jason Staples, CTS, Account Manager at Industrial Audio/Video, Inc. "The projectors had taken up much of the budget, but they still

needed a cost-effective way to manage their video sources. Kramer had all the tools to help them create a quality system," Staples noted.

A Kramer VP-8X8 Computer Graphics Video Matrix Switcher manages the video sources, allowing multiple images to be directed to each screen. The church's sources often include multiple computers, a DVD player, video cameras and high definition TV. Housed in a rack in the central control room are two Kramer VP-420 digital scaler/format converters, four Kramer FC-32 DVI to Computer Graphics Video/HDTV format converters, two VP-409 digital scalars, and two VP-501XL Computer Graphics Video scan converters. These video products scale or convert video sources to the same resolution so that all video images projected on the giant screens are

sharp and crystal clear. The system also includes Kramer cables which ensure the signal maintains superior image quality.

In addition to audio and video for church services, Fellowship Bible Church also uses the system for youth and community programs, movie nights, and televised sporting events. According to Steve Wylie, the church volunteer who spearheaded the A/V installation, "Industrial Audio/Video, Inc. and Kramer worked with us to come up with a system that would fit both our technical and budgetary needs. We were thrilled at how much support we got from Kramer and the great product solution they offered."

From songs to sports, church attendees can be sure Kramer will serve their needs with high-resolution audio and video solutions. ♦



KRAMER PRODUCTS ROCK AT SCIENCE AND MATH LEARNING CENTER



Geology, biology, chemistry and math students at the University of New Mexico are working in classrooms and computer labs that bring lessons to life in high definition video. Thanks to a new 62,000-square-foot Science and Math Learning Center equipped with Kramer Electronics products, students and faculty can view various HD video sources, annotate over them and share work from their personal computers.

The Kramer VP-728 switcher/scaler is the heart of the video system in 14 new classrooms in the Learning Center. It switches images from the document camera, instructor PC, laptop, and HDMI input, scales them to the appropriate resolution and provides video to the projector and interactive annotation device. Some of the classrooms also include a DVD player. The model was recommended by Bridgers & Paxton Consulting Engineers, an Albuquerque-based technology, mechanical, electrical and plumbing consulting firm that specified the system in conjunction with the University's technical team and Van H. Gilbert Architect. The audio/video integrator was Albuquerque-based Advanced Presentation Systems.

"We recommended Kramer products for this job for several reasons," said Mark Odneal, Senior Technology Consultant at B&P. "Not only were the switcher/scalers HDCP compliant, they offered a number of different output resolutions, they scaled to both an HDMI and VGA output, included audio-embedding onto HDMI and

de-embedding from the HDMI input to the local stereo analog output." According to Odneal, the scaler/switcher's dual video outputs also provided the capability to annotate over any source. In addition, the

If the switchers are invisible to the user, it means they're doing their job. We've found the product to be seamless and the support from Kramer to be outstanding.

— Mark Odneal, Senior Technology Consultant at B&P

rack-friendly Kramer product fit within the teacher podium or cabinet in each classroom.

The room systems are operated through user-friendly interfaces. Advanced Presentation Systems trained

the faculty and staff on the front-end A/V system, made intuitive and seamless by the Kramer switcher/scalers behind the scenes. According to Tim Johnson, manager of Academic Technology Services at the University of New Mexico, "If the switchers are invisible to the user, it means they're doing their job. We've found the product to be seamless and the support from Kramer to be outstanding," he said.

In addition to the 14 classrooms and computer labs, the Learning Center's 300-seat lecture hall also includes a Kramer switcher/scaler. It controls video and audio components for large presentations, delivering the highest possible resolution from each source. Completed in late 2010, the University of New Mexico's Science and Math Learning Center houses the departments of Earth and Planetary Sciences, Biology, Mathematics and Statistics, Chemistry and Chemical Biology. The Kramer Electronics scaler/switchers rock with dazzling detail for all the Center's visual needs. ♦

ANY FORMAT. ANY WIRE.

ONE KRAMER CORE™



The Kramer Core offers a complete end-to-end solution for AV network needs for seamless high definition signal routing, switching, and long-distance distribution of HDMI, DVI, HDCP, Dual Link DVI, DisplayPort, and even VGA signals.

With Kramer Core products, you can mix many signal formats: HDMI, DVI, HDCP, dual link DVI or DisplayPort, using different infrastructures, whether Twisted Pair (DGKat™), Copper (local I/O) or Fiber.

At the heart of the Kramer Core solution stand truly modular, revolutionary products: the Multi-Format Modular Router family: VS-1616D, VS-3232D and VS-6464D with matching modular input and output modules for DVI, HDCP, HDMI, DGKat, Fiber and Dual Link DVI.

Other Kramer Core devices seamlessly and effortlessly connect to the router at the heart of the Core: DGKat Transmitters and Receivers, DGKat

Step-in Transmitters (for boardroom applications), Fiber Transmitters and Receivers and Video Scalers.

Kramer's 30+ years at the forefront of the industry enable us to understand and develop products to suit your professional needs with the highest-performance products in the market.

We have more than 1,000 products in our line, designed and engineered for the highest durability, reliability and efficiency. We are constantly introducing new products and we monitor technological advancements constantly. Our long warranties are well known in the industry.

KRAMER CORE PRODUCTS PROVIDE THE BEST BENEFITS

EXPAND EASILY

The Multi-Format Modular Router family is the heart of the Kramer Core solution. The VS-1616D is expandable in groups of 2 inputs and/or 2 outputs, up to 16x16. The VS-3232D expands in groups of 4 inputs and/or 4 outputs, up to 32x32 and our VS-6464D expands in groups of 8 inputs and/or 8 outputs, up to 64x64*.

- *Dual-Link DVI modules have half the inputs/outputs of the other modules.*



TRANSPARENT ANALOG SUPPORT

When using the new DGKat™ series of transmitters, analog computer graphics signals are converted to DGKat signals – Kramer’s renowned HDMI over Twisted Pair technology. This is an exceptional feature, allowing easy integration between analog and digital AV sources simultaneously.

FLEXIBLE CONVERSION

Copper, Fiber or Twisted Pair—all can be used at the same time, according to input/output module selection. The matrix receives digital signals from compatible Kramer transmitters, automatically converts between available cable infrastructure options and sends the signals to compatible Kramer receivers. The Kramer Core™ solution is the ultimate in versatility!

DYNAMIC PORTPROCESSING™ TECHNOLOGY

The Dynamic Port Processing is a unique mechanism that has the capability of changing the output signal for HDMI devices in color space, color depth—audio capabilities for any display—based on its EDID—individually. Whenever a new display is connected, this mechanism generates the highest quality output signal to the connected display.

TAILORED APPLICATIONS AND SERVICES

No matter how complex, what size, or the environment of your installation, the Kramer Core solution has the functionality you are looking for.

KRAMER CORE MODULAR FRAMES

VS-1616D/ VS-3232D /VS-6464D

2x2 to 16x16/ 4x4 to 32x32/ 8x8 to 64x64 Modular Multi-Format Digital Matrix Switchers

The VS-1616D, VS-3232D, and VS-6464D are high-performance matrix switcher chassis for DVI & HDMI signals. These units are modular and populated based upon needs. The chassis includes a power supply, control module and a test

module that can monitor and test any input and output in the matrix.

EACH MODEL FEATURES:

- Kramer Core—FLEXIBLE INFRASTRUCTURE CONVERSION! Copper, Fiber or Twisted Pair—all can be used at the same time, according to input/output module selection. The matrix receives digital signals from compatible Kramer transmitters, automatically converts between available infrastructure options and sends the signals to compatible Kramer receivers. Kramer Core solution is the ultimate in versatility!
- Max. Data Rate - 3.2Gbps per graphics channel.
- HDTV Compatible.
- HDCP Compliant - With DVI (HDCP), HDMI & DGKat modules.
- DGKat Signal Integration - Kramer’s unique technology for converting TMDS as well as control and communication to signals that run over twisted pair cables.
- Kramer Equalization & re-Klocking™ Technology - Rebuilds the digital signal to travel longer distances.
- Modular & Easily Configurable Platform—Input or output module types can be mixed and added in increments of 2 from 2x2 up to 16x16 (VS-1616D); increments of 4 from 4x4 up to 32x32 (VS-3232D); increments of 8 from 8x8 up to 64x64 (VS-6464D).
- I-EDIDPro™ Kramer Intelligent EDID Processing™ - Intelligent EDID handling & processing algorithm ensures Plug and Play operation for DVI and HDMI systems.
- Available Modules - DVI, DVI (HDCP), DVI (Dual Link), HDMI, LC Optical & DGKat Twisted Pair (available 2nd quarter 2012).
- Flexible Control Options - Front panel, IR remote, RS-232 (K-Router™ Windows®-based software is included), Ethernet.
- Front Panel Lockout.
- Take Button - Executes multiple switches all at once.
- Worldwide Power Supply - 100-240V AC.
- Memory Locations - Stores multiple

switches as presets to be recalled and executed when needed.

- Test Pattern Module - With 4 output resolutions.
- Standard 19" Rack Mount Size - 4U (VS-1616D), 6U (VS-3232D), 10U (VS-6464D). Rack “ears” included.

THE KRAMER PROSCALE™ FAMILY



VP-728/ VP-729 /VP-730/ VP-731 9-Input ProScale Digital Scaler/Switchers

The Kramer ProScale family of digital scaler/switchers are designed to make the installations of today as easy as possible. Display devices today need to accept a wide range of signal formats and resolution and they are becoming more and more prevalent in the boardroom, home, and indeed everywhere a screen is used. Kramer scalers smoothly switch and scale the output of various video sources such as DVD players, satellite decoders, VHS players, document cameras, computers, and videoconferencing systems to the native resolution of the display device.

The ProScale family of products digitally reprocesses the signal to correct mastering and other errors, and regenerates the video at a higher (or lower) line and pixel rate format, providing native resolution video for LCD, DLP, LCoS, LED and plasma displays. The Kramer ProScale range is specifically designed to improve video quality by reducing artifacts such as block, chroma and mosquito noise. They are true multi-standard video to RGBHV/YPbPr scalers that convert video, s-Video, component video, VGA through WUXGA, and DVI-D/HDMI and HDTV signals.

The Kramer 7 Series ProScale models are 9-input scaler/switchers for analog and digital video, stereo, and S/PDIF audio signals. They scale any composite video, s-Video (Y/C), component video (YUV), HDMI, computer graphics video up or down to a selectable graphics or HDTV output resolution and output them via HDMI and 15-pin HD computer graphics video outputs. The units provide glitch-free switching between sources through FTB™ (fade-thru-black) switching technology. All models can be controlled via front panel buttons, through RS-232

serial commands or via the supplied Ethernet port. There is also an iPhone® app available.

PROSCALE DIGITAL SCALER/ SWITCHERS IN ACTION

When the Indianapolis Public School System (IPS) wanted to standardize the audio/video technology throughout its schools, it had specific requirements: consistent, high-resolution video in every classroom, a uniform system, and simple, intuitive controls. Teachers should be able to seamlessly integrate

the technology into their lessons and be confident in the presentation quality – not have to learn a new protocol in every room and wonder whether the video would be crisp and sharp.

According to ESCO Executive Vice President Gary Dunn, ESCO recommended a Kramer Electronics ProScale presentation scaler/switcher in each classroom to achieve the required consistent video resolution no matter the source. Every classroom has its own system that connects the teacher's computer, a student computer, docu-

THE KRAMER TOOLS™ FAMILY

THE ORIGINAL PRO AV TOOLS

Kramer TOOLS are extremely compact product solutions ideal for solving basic signal management problems; each product is manufactured to the highest standards. Here are a few of our most popular models.



▶ PT-101HxL - HDMI Repeater

Ideal for pushing the distance of standard HDMI cabling, the PT-101HxL uses re-Klocking™ and equalization to repair and rebuild HDMI signals. This could be a great trouble-shooting tool for images that have reached a maximum transition distance resulting in sparkles, or images that cut in and out.

▶ FC-113 - HDMI to 3G HD-SDI Format Converter

In an SDI environment, cameras and other production equipment rule as sources. Adding a computer into this environment is difficult because most computers do not come equipped with expensive graphics cards with SDI outputs. The FC-113 allows you to take a computer or any HDMI source and convert to SDI, while retaining embedded audio. Depending on the input resolution, the FC-113 will output SDI, HD-SDI or 3G HD-SDI.



▶ FC-46xL - HDMI Audio De-embedder

Since HDMI as a format dictates that audio is embedded in the video stream, a device is needed to retrieve the audio information; the FC-46xL is the ideal solution. The unit de-embeds audio from the HDMI input or from the HDMI output Audio Return channel to S/PDIF, TOSLINK® and analog audio outputs simultaneously. This device is becoming more and more popular because as video moves toward digital, audio remains analog in most applications; this device is the bridge between the two.

ment camera and DVR to the scaler/switcher. An extra input is available for an iPod or MP3 player. Each room features a video projector and sound system. The system can be operated directly from the Kramer scaler/switcher, on which all sources are clearly marked, or from a controller that allows laptop computer operation.

"IPS needed a centralized form of scaling and switching, and the Kramer product was easy and user-friendly," Dunn said. "As IPS expanded the system to more schools, we developed a partnership with Kramer. They worked closely with us to be sure we had the right product and the right quantities to meet the schools' needs."

The project started with a ProScale switcher featuring a DVI connector for the document camera. When IPS requested

a high-resolution input, Kramer recommended the step-up VP-730, featuring four VGA inputs and expansion capability with a total of nine inputs.

"Product reliability has been fabulous," Dunn said. "We've installed over 1,000 units of the scaler/switcher in this application and have had little to no glitches."

Each classroom system has its own IP address so that it can be monitored by the school system's IT staff. It also can receive local TV channels and those originating from IPS. The systems are installed in all of the district's middle and high school buildings. Elementary schools are in the process of installation. "We think the system has met the needs of IPS," Dunn said. "It provides every classroom with high-resolution, consistent video in a user-friendly package." ♦



▶ VA-1VGA - Computer Graphics Video EDID Emulator

Housed in an ultra-compact Pico TOOLS enclosure, the VA-1VGA is a VGA pass-through box with EDID storage on its input. Using a capture button, EDID from any display device can be copied onto the input of the VA-1VGA to be read by the connected PC. This product should be used when connecting to a display via a medium that does not pass EDID, such as a 5-BNC cable, VGA of Twisted Pair, or going through switchers and interfaces. With the complexity of EDID in today's digital systems, this device is a necessity in almost every installation.

▶ PT-571/PT-572+ - HDMI over Twisted Pair Transmitter/Receiver



With the limited distance capability of HDMI, one inexpensive way to extend the distance of HDMI is to send

it over a twisted pair cable. Part of our shielded *DGKat series™, the PT-571 and PT-572+ are twisted pair transmitters and receivers for HDMI signals. The transmitter and receiver have a system range of up to 295ft (90m) at 1080i/720p @ 60Hz, or up to 230ft (70m) at 1080p @ 60Hz on shielded BC-DGKat623 cable or plenum BCP-DGKat724 cable. They also feature Kramer's Power Connect™ System where a single connection to the transmitter or the receiver powers the other end.



▶ SID-X1 - 4-Input Multi-Format Video over DGKat Twisted Pair Transmitter & Step-In Module

In a world transitioning from Analog to Digital, you can never be sure what connector will be on a laptop; the SID-X1 provides all the potential options to let the user decide. The SID-X1 provides HDMI, DVI, DisplayPort and VGA inputs along with a shared analog audio input. The SID-X1 converts any of one of the selected inputs to HDMI and sends it over *DGKat twisted pair. This product can switch inputs via an "Input Select" button or it will automatically switch when it senses a live input.



*Kramer's DGKat signal integration which is a unique technology for converting TMDS (Transition-Minimized Differential Signaling), as well as control and communication to signals that run over twisted pair cables. Kramer strongly recommends the use of our high quality DGKat shielded twisted pair cables to ensure optimum performance.

HDBASET

A NEW MULTIMEDIA + ETHERNET INTERFACE FOR PRO AV

The world of “connected” consumer electronics devices continues to grow and evolve at dizzying speeds. It is abundantly clear that interoperability between conventional media hardware (TVs and monitors, AV receivers, set-top boxes, and DVD/Blu-ray players) and non-traditional devices (smart phones, tablet and notebook computers, and gaming consoles) is not just desirable; it is a must in this day and age.

To that end, manufacturers have been exploring and proposing a host of wired and wireless connectivity “solutions” that provide seamless operation with low latency and automatic configuration. One approach is to employ conventional structured wiring as the backbone of a whole-house or whole-office media and control system, providing video, audio, remote control, serial control, Ethernet access, and data exchange simultaneously.

This new architecture is known as HDBaseT™, and was originally developed by Valens Semiconductor.

and audio based on the High Definition Multimedia Interface (HDMI) connectivity standard, it should be of equal interest to commercial audiovisual systems integrators.

The commercial AV market is already using structured wire for a multitude of non-Ethernet applications, so the infrastructure to support HDBaseT is already in place in many cases. Kramer Electronics began shipping products with HDBaseT technology in 2011, with initial offerings consisting of transmitter-receiver sets.

STRUCTURED WIRE BACKBONES

It is now common practice to transport video, audio, and control signals over short to medium distances using structured wire as an alternative to more costly, lossy and complex wire pulls of coaxial cable, plenum wire, and other Class 2 wiring types. Structured wire has also proven to be an economical alternative to optical fiber in professional installations.

As well as early Cat5/6 interfaces worked, they were limited in their ability to transport anything beyond a single channel of video and audio, plus control signals. The ability to add both bi-directional Ethernet and serial data communications remained elusive until Valens



Semiconductor developed a proprietary solution-on-chip (SOC) to handle these additional signals.

The solution Valens introduced in 2010 differentiates between high-resolution digital component video, multi-channel digital audio, bi-directional 100BaseT Ethernet, and RS-232 and infrared control, and multiplexes all of these data streams across four unshielded twisted pairs.

HOW IT WORKS

HDBaseT is primarily an uncompressed asymmetric data transmission system. Each of the signals carried through the system first are encoded into packets with a custom protocol that preserves the packet order in a “real time” transmission format.

These packets are then transmitted as a pulse amplitude modulation (PAM) signal. Pulse-amplitude modulation is widely used in baseband transmission of digital data, using the differences in amplitude between bursts of packets to

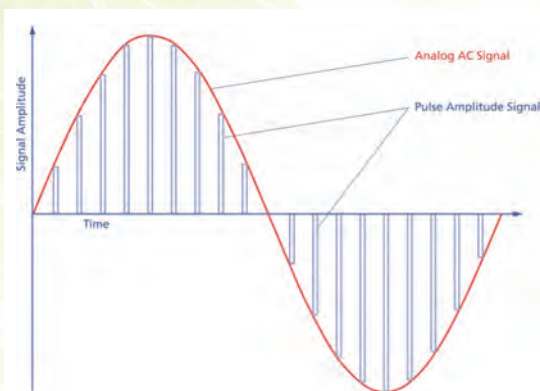


Figure 1 - Illustration of PAM signal concept.

Although HDBaseT was originally developed for residential applications to transport uncompressed digital video

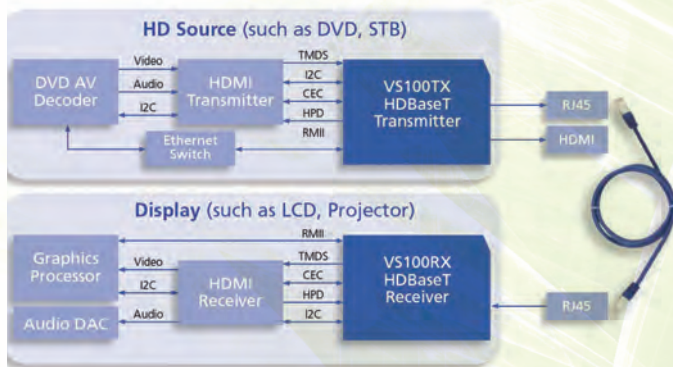


Figure 2 - HDBaseT functional block diagram.
(Courtesy of Valens Semiconductor)

differentiate video, audio, and control information. Demodulation is performed by detecting the amplitude level of the carrier during each symbol period, and symbol periods are evenly spaced.

SYSTEM PERFORMANCE

The video packet bit error rate (BER) for HDBaseT is at least 10^{-9} , which is the same as that for the HDMI standard. For audio and control packets, the BER is 10^{-15} . It is worth emphasizing again that the video and audio signals travel uncompressed over HDBaseT, just as they would over conventional HDMI connections.

Video and audio clock pulse equalization and restoration is also part of the HDBaseT process. The Valens design incorporates additional, robust digital signal processing and filtering to minimize crosstalk between different data types and maintain high signal-to-noise ratios at the receiving end. HDBaseT is also “symmetric” in that it provides a return path for 100 megabits per second (Mb/s) Ethernet data.

FEATURES AND ADVANTAGES

The primary advantage of HDBaseT is that it can carry all the signals found in a typical presentation space through conventional category 5 structured wiring. At present, no other structured wiring system can carry bi-directional Ethernet and USB alongside video, audio, and serial command data.

upgrade existing presentation facilities that already incorporate structured wire AV interfaces, making it a strong candidate for retrofits or facilities upgrades.

Note, however, that HDBaseT is not compatible with conventional Ethernet routing equipment, and that all components in an HDBaseT system must use separate, dedicated structured wiring interconnects. (Existing Ethernet connections can be interfaced through HDBaseT TX units or switchers.)

A competing multimedia + Ethernet structured wire interface—DiVA, or Digital Interactive Interface for Video and Audio—does not use category 5 UTP cable and instead employs proprietary Category 6 structured wire with specialized connectors. DiVA was designed from the ground up to function as a structured wire alternative to HDMI. As such, it claims a much higher maximum bit rate (3.4 Gb/s), but is more susceptible to interference and is not suitable for long cable runs.

In contrast, HDBaseT uses a much lower clock frequency of 250 MHz for higher reliability. In fact, HDBaseT has been tested to even longer cable lengths for lower-resolution signals with slower

refresh rates. And the architecture can support up to four separate streams of 2 Gb/s each, which is sufficient for 1920x1080 interlaced video with a 29.97 Hz refresh rate.

The only limitation is distance and the quality of the category 5 wire selected. Note that the wire does not have to be shielded—conventional unshielded, twisted-pair wiring is adequate.

HDBaseT can also

SUMMARY

Kramer Electronics is expanding the range of HDBaseT products in its line, starting with paired transmit-receive AV extenders that can replace conventional structured wire transceiver products. The HDBaseT architecture will also be incorporated into selected models of matrix switchers and distribution amplifiers, with each separate output connection capable of delivering 100 watts of DC power to connected displays.

HDBaseT is a future-proof architecture, robust enough to transport DisplayPort signals. To date, several DisplayPort interfaces have been prototyped with success. Although DisplayPort is not currently supported directly in the Valens chipset, DP-sourced video and audio can travel through an HDBaseT network after conversion to the HDMI format through an appropriate adapter. The DisplayPort part of Intel's new Thunderbolt hybrid display/data interface is also compatible with HDBaseT, also through an adapter to HDMI. ♦

Note: HDBaseT is a trademarked logo of the HDBaseT Alliance.



Figure 3 - Kramer's new TP-528T transmitter and TP-528R receiver incorporate HDBaseT technology.



WELCOME TO KRAMER'S ADVENTURES WITH HDMI!

Need help interfacing HDMI signals? Join the experienced guides at Kramer as we grab our maps, compass, and Cat5 bullwhips, and head on an expedition to seek out those challenges, meet 'em head-on – and solve them!

Now, let's open the mailbag!

HDMI PUZZLER

Ten years ago, the “next big thing” was HDTV, which offered more resolution and larger, wider screens than regular television.

Now, we're starting to hear about “4K television.” The 4K format is already being used to shoot, edit, and finish movies.

So, here's the Puzzler question for this issue:

How much more picture resolution does 4K offer than 1080p HDTV?

- a) Twice as much
- b) Three times as much
- c) Four times as much
- d) Six times as much

See answer at bottom of next page



I have an LCD projector with Wide XGA (1280x800) picture resolution. However, I am unable to connect my laptop to that projector at 1280x800 through the projector's HDMI or DVI inputs. What I usually wind up with is a small image with black bars all around. How can I drive the projector at full resolution?



The problem here is the “disconnect” between the projector's display resolution and what standard and non-standard input resolutions it actually supports. Chances are the manufacturer opted to put these widescreen LCD chips into the projector because they support both the legacy XGA (1024x768) computer standard and widescreen video signals like 1280x720 and 1920x1080.

If you read the projector's Extended Display Identification Data (EDID), using a program such as Monitor Asset Manager [freeware, www.entechtaiwan.com], you may be surprised to see that there is NO support for 1280x800 computer or scaler signals on that particular projector. However, the projector will support 720p and 1080i, and maybe even 1080p HDTV sources!

This has been a common problem with earlier models (pre-2009) of WXGA projectors. However, we are starting to see more of these models that will actually support 1280x800 input signals from PCs and notebooks. You will either have to upgrade to a new projector, or change the output resolution of your PC or notebook to 1280x720 to fill (or nearly fill) the widescreen projected image.



I have a brand-new notebook computer. The LCD screen has 1366x768 pixel resolution. But I can't get this notebook to match to a WXGA (1280x800) projector, and it won't work with some LCD TVs we use at our facility. What's the solution?



Once again, there is a distinction between the actual display resolution of the projectors and the TVs, and the computer you want to connect to them. Chances are, the notebook computer can output either 1280x800 or 1280x720 resolution to all three displays successfully.

If you don't see a full 16:9 widescreen image, or the image you do see is cropped or stretched the wrong way, then go into your “Graphics Properties” menu on the laptop and manually change the output to either 1280x800 or 1280x720. Also try 1360x768 as the output resolution: this is a VESA standard and many actually work, and you'll come closer to filling the width of the image. (What's six pixels between friends?)

It should be noted that many older models of LCD TVs actually have 1366x768 pixel resolution, but do not support that signal coming from a computer – only 1280x720 or 1920x1080, which are both video standard resolutions.

Answer: c) Four times as much



THE WORLD OF

WIRELESS AV

A key component of the transition to digital is wireless connectivity. In its most common implementation, that means 802.11 WiFi connections between computers and the Internet, streaming emails, documents, audio, and even video inside and across networks.

There are other ways to go wireless with products such as cordless mice and keyboards, wireless presenter controls, and cordless ear buds, headphones, and microphones. Believe it or not, it's also possible to make wireless connections between AV receivers and speakers, computers and monitors, or between Blu-ray™ players and TVs!

All of these wireless connection systems exist for different reasons. Many of their protocols are unique, and several of them can co-exist in the same environment. Which system you choose to implement depends on the range of communication and the amount of data you need to move within a given time period.

Reality check: In general, wireless connectivity should be limited to applications where short-term, temporary connections into an AV system are needed. Dedicated AV systems with fixed equipment should always be hard-wired as a best practice.

Even so, there are increasing numbers of portable media player and computing devices finding their way into classrooms, conference rooms, and other presentation spaces—and wireless is tailor-made for those applications.

Some of these connectivity standards are already well-known to you (WiFi, Bluetooth™) while others aren't as familiar (ZigBee, UWB, WHDI). In this article, we'll take a quick tour of the most common wireless connectivity standards to see how they work.

HIGH BANDWIDTH WIRELESS

These products let you make wireless HDMI and DisplayPort connections from computers, optical disc layers, and set-top boxes to TVs, display monitors, and projectors. This is a “young” category—many products were shown as prototypes the past few years that are only now coming to market.

WHDI: The Wireless High Definition Interface system was invented by semiconductor manufacturer Amimon, and has been adopted by Samsung, HP, Asus, Lenovo, LG, and Sony, among others. WHDI operates in the 5 GHz radio band and supports the full HDMI specification, carrying 10.2 gigabits per second (Gb/s) of 1080p video, multi-channel audio, and data over distances of 30 feet and more.

WHDI employs a unique video modem process that transmits 720p HD video in a 20 MHz wide channel and 1080p video in a 40 MHz channel, both with extremely low latency. WHDI can also transport DisplayPort, VGA, and even HD-SDI signals! The standard is not based on WiFi (802.11) protocols and as a result provides a more reliable connection than WiFi.

WIRELESS HD

The Wireless HD system works much the same way as WHDI, except that it operates in the millimeter-wave radio band (60 GHz). This makes for an extremely small transmitter – about ¼ the size of a postage stamp – that can be built-in to tablets, smart phones, and even digital cameras.

Wireless HD also supports the full HDMI specification (10.2 Gb/s video/audio/data) over distances of 30 feet or more. Because it operates at such a high frequency, there may be limitations in operation over anything but line-of-sight paths. However, it is less likely to be interfered with as there is little or no activity in the 60 GHz band at present.

In 2011, Silicon Image—the inventor of HDMI—acquired the assets and patents of SiBEAM, who developed Wireless HD. This acquisition is expected to drive the development and release of more Wireless HD products. Currently, the standard is supported by Toshiba, LG, Samsung, Philips, Intel, and Panasonic, among others.

WiFi: There are already several WiFi-based wireless display connectivity products on the market. While these connectivity kits for the home are affordable and easy to install, the signals they carry ride alongside conventional 802.11 Internet traffic, which can cause the signal to take “hits” and drop out from time to time.

That's because the wireless display signals are sharing bandwidth with other traffic, including streaming video and other high-bandwidth applications. In periods of low Internet activity, the signals are quite robust and can operate at similar distances as wireless access points.

UWB: Ultra Wideband is a unique method of using extremely wide, low-power RF channels to transmit data over very short distances. Range is limited by design to a few feet as a result, but

UWB-equipped computers and media players can transmit HDMI and DisplayPort signals quite reliably.

A more compelling application for UWB is wireless KVM (keyboard, video, and mouse) connections. A computer monitor equipped with UWB would automatically power on in the presence of a UWB signal, and then make connections to create a wireless docking station. WB also supports wireless USB 2.0 and 3.0 for data exchange. UWB can co-exist with Wireless HD, and depending on the configuration, alongside WHDI.

LOW BANDWIDTH WIRELESS

A number of systems exist for short-range, low bitrate “bursty” connections. The best-known of these is Bluetooth™ (802.15.1), which has a maximum data rate of 1 megabit per second (Mb/s) and is used primarily to connect earphones, headphones, and microphones to smart phones. It can also maintain a connection to a GPS, or be used to remotely control everything from appliances to garage door openers.

ZigBee (802.15.4) is another popular protocol for short to mid-range (30-300 feet) wireless connectivity. It has an even lower bit rate than Bluetooth at 250 kilobits per second (Kb/s), but is suitable for connecting computer mice, keyboards, 3D glasses, and printers. Because of the low bit rate, ZigBee isn’t suitable for data exchange, but repetitive pulsed command strings for remote control are its forte.

Z-Wave is another short-range wireless application specifically designed for remote control or lights, thermostats, security systems, and even appliances. It can easily be embedded into smoke alarms, security sensors, remote controls, and thermostats. Z-Wave operates in the 900 MHz radio band.

All three of these low-bandwidth wireless protocols can operate alongside WHDI, Wireless HD, and WiFi-based wireless display connectivity systems.

CONCLUSION

When it comes to wireless AV, there’s more than one way to make the connection! Interest in wireless display systems is at an all-time high, particularly with the growing popularity of tablet computers, the new generation of super-thin ultrabook computers, and increasing use of smart phones to play back video, audio, and photographs.

At CES 2012, numerous manufacturers announced products with embedded wireless connections, and one company even showed the world’s first 4x1 wireless HDMI switch. InfoComm will offer a class on wireless AV connectivity this year, and you may even see a few products at the show that are ready to ship. Stay tuned! ♦



KRAMER SCORES HIGH MARKS IN EDUCATION



At Wisconsin's Gateway Technical College, the faculty and staff are confidently teaching with technology every day. It is integrated seamlessly into classroom presentations through the Kramer Electronics' SummitView System. Instructors use the system to control document cameras, PCs, and DVD players, with an option to project content from portable electronics devices and even cell phones. In addition, Gateway Technical College is able to give its 6,000 full-time equivalent students the advantages of distance learning by connecting campuses through videoconferencing using the SummitView system for room control.

SummitView has replaced a system that was complicated and confusing for our staff.

— Jeff Robshaw, CIO and Learning
Innovation Division Vice President,
Gateway Technical College

The college's CIO and Learning Innovation Division Vice President Jeff Robshaw says the technology is a welcome change on its campuses in Kenosha, Racine and Elkhorn and at its four Technology Centers in Burlington, Kenosha, Sturtevant and Pleasant Prairie. "SummitView has replaced a system that was complicated and confusing for our staff," Robshaw said. "There were a number of possible room configurations so instructors had the challenge of re-learning these systems every time they taught in a new location. Using SummitView provides a consistent experience for our staff and students."

The project's objective was to simplify and standardize room controls throughout the college's eight facilities. The solution needed to be portable, supportable and flexible. The SummitView system provided a complete installation kit including switcher/processor, controller, wall plates, audio amplifiers, speakers and CAT5 cabling. Gateway Technical College installed SummitView systems in over 70 rooms, along with video projectors for high resolution display. The electronics are managed through an easy-to-use remote control panel. The system controller itself is small enough to be placed above the projector, eliminating

any chance that students or faculty will attempt to reprogram it.

"The configuration is the same in every room, and our technicians have stopped getting calls to support these media rooms—everyone is impressed with the ease-of-use," Robshaw said.

Several "Delta" classrooms have been designed with videoconferencing systems connected to the SummitView. These distance learning rooms allow the college to combine participants on various

campuses for a class that may have low enrollment, thus preventing cancellation. They also allow more crowded classes to have satellite classrooms, eliminating the need to commute. Administrators are scheduling curriculum meetings in the rooms, as well, so they can use the technology first-hand.

"All the feedback from users and from our technical staff has been positive," said Robshaw. "The system is reliable, convenient and intuitive." ♦



KRAMER AND SIERRA VIDEO

KEEP BOWLING ENTERTAINMENT CENTER ROLLING



Visitors to a new entertainment center in the southwest are getting more than just a night at the bowling alley. They are enjoying heart-thumping music, stunning big-screen video and a captivating multi-media extravaganza that takes bowling to the next level.

The high-tech environment was created by Digital Commercial Systems, an audio/video design and installation company, using Kramer Electronics and Sierra Video products for the switching technology. "Kramer and Sierra Video provided a perfect balance of both price and performance," said Jeff Beall, owner of Digital Commercial Systems. "They are recognized as a reliable product and their switching technology and twisted pair product easily met our needs."

Each of the bowling lanes has projected high definition images. Many other displays throughout the large facility showcase video ranging from fast-mov-

ing music videos to static art images. A Sierra Video Pro XL RGBHV 32 x16 routing switcher manages 17 different video sources, which can be viewed on any of the displays. Several Kramer TP-121 twisted pair transmitters and TP-122 twisted pair receivers work together to convert computer graphics video and unbalanced stereo audio signals into a twisted pair signal for long distance distribution. Some Kramer VP-704xl video scan converters are also used in the system to down-convert computer graphic signals for display on the video monitors. The entire behind-the-scenes system was carefully designed

Kramer and Sierra Video provided a perfect balance of both price and performance. They are recognized as a reliable product and their switching technology and twisted pair product easily met our needs.

— Jeff Beall, owner of Digital Commercial Systems

to surround guests with the highest level multi-media quality possible.

Visitors can count on great entertainment enhanced by the latest digital image technology from Kramer Electronics and Sierra Video products. ♦



Note: DIGITAL Commercial Systems, based in Phoenix, AZ, provides award-winning consulting and design services to architects and building professionals for both commercial and residential low-voltage communications systems. DIGITAL provides the right mix of skilled staff, experienced leadership, and corporate infrastructure to reliably execute a broad range of technology integration projects. www.digitalcommercialsystems.com

KRAMER ACADEMY

The goal of the Kramer Academy is to provide relevant and topical training and education on key industry concepts, technologies and techniques that provide students with the comprehensive knowledge base necessary to succeed in the AV marketplace. The Kramer Academy provides technology training to the industry without a product focus, while the Engineering team at Kramer provides all product-specific training.



Malissa Dillman, CTS-D, CTS-I,
Training & Education Manager

The Kramer Academy is led by Malissa Dillman, CTS-D, CTS-I, Training & Education Manager. Malissa has over 12 years of extensive A/V experience within the industry and brings her diversified skills and experiences to the classroom. She has been active on several InfoComm Committees, including most recently being one of the first nine members of the Certification Committee.

Kramer Electronics offers an extensive curriculum of AV Technology classes to enhance your AV knowledge that leads to professional success. It is our aim to continue expand-

regional trade shows, via webinars or our own Kramer Road Shows being held across the country this year; we will bring the education and training that you need to stay current with the latest trends in technology. On-Demand classes are coming soon! No matter your learning style Kramer Academy hopes to be able to produce a class that fits into your schedule and desired format. The Kramer Academy also makes every effort to provide our classes around the country at various times throughout the year. As a result, we hear about the trends and concerns around the country and develop educational programs that meet the ever-changing needs of our client base.

*With classes in the Kramer Academy,
you not only Learn, you also Earn.*

ing Kramer Academy to include courses and literature on more and more topical subjects, adjusting ourselves to a constantly evolving technology. Kramer courses also offer learning credits with many industry certifications. With classes in the Kramer Academy, you not only Learn, you also Earn.

Kramer Academy believes that your time is valuable so we continue to strive to bring our educational offerings to our clients. Whether you invite us to your office for an afternoon of education, a lunch-and-learn,



Our new Kramer Road Show has been met with great success. In our travels we have heard numerous times that our clients would like to gain a better understanding of how to design and work with digital signals. The Kramer Road Show entitled "Designing in a Digital Age" attempts to provide our attendees with a full understanding of digital signals, how to design and avoid common mistakes with EDID, HDMI and HDCP. We end the day evaluating a variety of system designs and applying the knowledge gained throughout the course.

We hope to see you at a Kramer Academy event soon!



CLASS OFFERINGS

CTS EXAM PREP – INFOCOMM LICENSED 3-DAY COURSE COURSE CODE: CTS

Kramer Academy has licensed the content from InfoComm's acclaimed CTS Exam Prep class. This class provides a forum for people to explore the new exam format and to work collaboratively, guided by a facilitator, studying the topics provided in the exam content outline. This course is ideal for the learner who likes a hands-on, interactive learning environment. Let Kramer help you prepare to take your CTS Exam!

COURSE	CODE	CTS	CTS-I	CTS-D
Getting the Most from a Digital Display	KA1202	2	2	2
Introduction to Analog Audio	KA1204	2	2	2
Digital Video Signal Format Conversion	KA1205	2	2	2
AV IT: When Worlds Collide	KA1216	2	2	2
Digital AV: A Tutorial for the AV Professional	KA1224	2	2	2
Digital Display Signals: The Next Generation	KA1225	2	2	2
Working with Digital Video Signals in the Pro AV World	KA1231	4	4	4
Analog Sunset, Digital Sunrise: How to Handle Digital Signal Routing	KA1232	1	1	1
5 Tips to Generating Revenue By Avoiding Digital Pitfalls	KAT1233	2	2	2
AV Signals Gone Wireless	KA1240	2	2	2
Soup to Nuts of Digital Video	KA1241	2	2	2
Specialty Course Offerings:				
Designing in a Digital Age, 1-Day Workshop	KA1299	10	10	10
Challenges of Digital Signal Integration, 2-Day Workshop	KAT1299	5	5	5

Please visit our web site at www.kramerus.com and click on the Trainings tab for more information on the Kramer Academy. **Learn to Earn™!**

WHY BUY

KRAMER CABLES AND INSTALLER SOLUTIONS?



With so many unique and reliable products available, these are reasons Kramer Installer Solutions should be your first option.

Outstanding Quality Kramer Installer Solutions and cables go through rigorous testing in order to validate their quality. The quality of the materials utilized and the quality of workmanship employed ensure signal integrity, and provide the user with unparalleled performance.



ONLINE USER-FRIENDLY SELECTION OPTIONS

Eliminate guesswork by consulting Kramer's Suggested Cables tab. Kramer products are accompanied on our website by a Suggested Cables tab making the selection process convenient and uncomplicated.

Online Kramer Wall Plate and Kramer Room "Configurator" programs make it easy to choose the right wall plate and table mount solution for any space.



EXCELLENT VALUE

Purchasing installer solutions and cables from Kramer guarantees you value pricing for premium quality. To remain competitive, Kramer continually researches the market to ensure we offer unbeatable value.





TREMENDOUS SELECTION & ON-HAND INVENTORY

Kramer boasts an incredibly wide variety of installer solutions and cables, with most items in stock and ready for immediate delivery.



ADAPTABLE OPTIONS FOR WALL PLATES AND TABLE MOUNTED CABLE CONNECTION PRODUCTS

While ready-to-use out-of-the-box wall plates are typical in our industry, Kramer offers a different option to our customers as well. Kramer also offers products in this category that provide our customers with greater flexibility and the confidence of being future-proof. Our insert-based wall plates and table mount cable connection solutions allow the user the option of switching out an insert, instead of replacing an entire wall plate or table-mounted cable connection product as their needs grow over time.



COMPETITIVE AND ACCOMMODATING CABLE PROGRAMS

Accurate Cross-Referencing & Quoting Program

Not currently purchasing your installer solutions and cables from Kramer? We want you to know the value of our products because we know that when you do, you will want to buy Kramer products! Provide a list of the installer solutions and/or cables you currently buy and Kramer will match them up with Kramer model numbers and in turn show you how we can save you money for your efforts.



UNBEATABLE CUSTOMER SERVICE

Need special packaging? Kramer can bundle installer solutions and cables together and/or create a custom part number. This saves time and ensures the proper products always make it to the job site.



FREIGHT ALLOWANCE PROGRAM

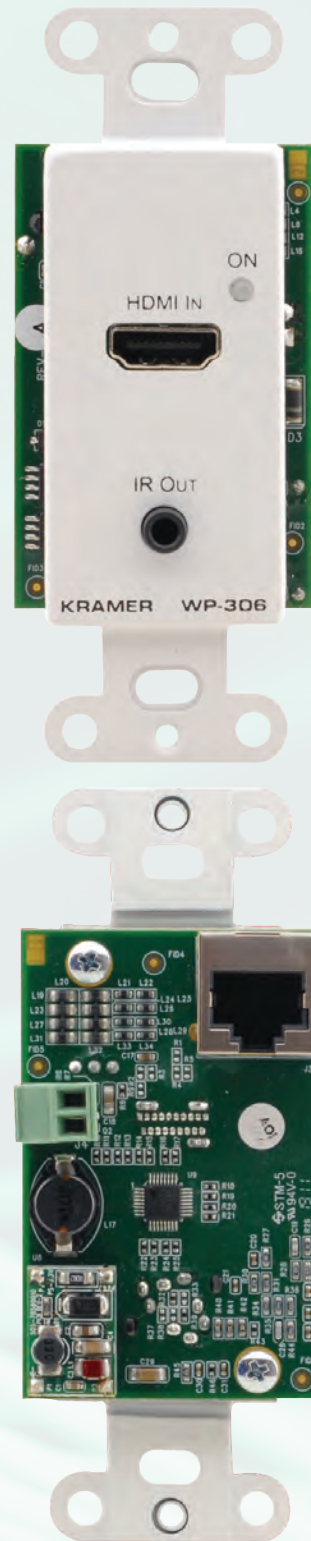
Cables can be heavy, especially bulk cable. Kramer can extend a freight discount or allowance against a UPS ground shipment for any authorized Kramer dealer/integrator. Quantity, weight, and destination are all taken into account when participating in this program.



KRAMER PEOPLE AND KRAMER PRODUCTS MAKE THE DIFFERENCE

Purchasing Kramer Installer Solution Products ensures quality, value, flexibility, and reliability. Also included in every purchase is Kramer's unbeatable customer service and seven-year warranty on Kramer Installer Solutions and cables.

For complete product information on Kramer's Installer Solutions and cables, as well as all Kramer and Sierra Video products, please contact your Kramer sales representative or visit us at www.kramerus.com.



THE NEXT GENERATION OF DISPLAY INTERFACES: DISPLAYPORT



In an earlier article, we referenced another digital display interface known as DisplayPort. You may not have heard of it, but DisplayPort is another way to connect computers, monitors, tablets, and portable media devices digitally.

Even though HDMI had a five-year head start, support for DisplayPort is growing rapidly.

Unlike HDMI, which was largely developed by one company, DisplayPort is a 'consensus' standard, evolving over several years from technical specifications developed and refined by members of the Video Electronics Standards Association (VESA).

RING IN THE NEW

VESA's goal was to replace the 20-year-old Video Graphics Array (VGA) analog display interface with a high-speed, multifunction display connection that took full advantage of EDID while adding new functions. DisplayPort, which made its debut in 2007, is also intended to replace the DVI interface, which has not been updated in years.

The DisplayPort architecture uses four scalable "lanes" to pass display data. Each lane has a maximum data rate of 4.32 gigabits per second (Gb/s), and the four lanes can be combined to achieve a maximum data rate of 17.2 Gb/s – fast enough to drive a display with 4K resolution (3840 x 2160 pixels) at a 120 Hz refresh rate, using 10 bits per color! Contrast that with HDMI's maximum data rate of 10.2 Gb/s.

The developers of DisplayPort were thinking long-term when they announced six different implementations of the standard, including an embedded version that allows direct drive of flat panel displays, and a wireless version. There are also full-sized, "mini," and portable DisplayPort connectors. What's more, a new "mini" mobile version of DisplayPort made its debut at the

2012 International Consumer Electronics Show. Like HDMI, DisplayPort carries multiple channels of digital audio. Unlike HDMI, the DisplayPort interface also carries phantom power (3.3 volts @ 500 mA), offers native support for optical fiber connections, and includes an auxiliary data return channel. (The latest versions of HDMI and DisplayPort both support symmetrical Ethernet as well.) The presence of phantom power is why you can easily find DisplayPort-to-HDMI adapters, but not the opposite.

While HDMI uses transition-minimized differential signaling (TMDS), DisplayPort employs a packet system to send data from source to display. EDID is fully supported, as is the high-bandwidth digital copy protection (HDCP) key system. That means you can play back Blu-ray discs just as easily from a laptop equipped with DisplayPort as you can with HDMI.

THE NEXT STEPS

Even though HDMI had a five-year head start, support for DisplayPort is growing rapidly. At the time of this writing, most major computer manufacturers had announced they will provide DisplayPort interfaces on their next generation of notebooks and tablet computers. The same holds true for video graphics card manufacturers (except nVidia, which hasn't decided yet). One reason is the lack of royalties for DisplayPort, which makes it more attractive than HDMI.

Microprocessor and motherboard manufacturers are agnostic. Both Intel

and AMD announced in 2010 that they would start phasing out the VGA connector this year, leaving it up to their customers to decide whether they wanted to support HDMI, DisplayPort, or both going forward.

A new development may make DisplayPort even more attractive to computer manufacturers. In January of 2011, Intel unveiled Thunderbolt, a combination Mini DisplayPort / PCI Express interface that can stream data at rates up to 10 GB/s. The Intel and Apple implementation of Thunderbolt combines PCI Express and DisplayPort data packets, allowing both to be carried over the same cable at the same time.

A single Thunderbolt port supports hubs as well as a daisy chain of up to seven Thunderbolt devices, and a maximum of two of these devices may be high-resolution displays using the DisplayPort interface. While Thunderbolt is unlikely to show up on professional display monitors and projectors, it most certainly will appear on desktop, mobile, and notebook computers used in a production environment.

What's the significance of this development? Now, computing devices are heading towards a single, multifunction connector that carries everything – video, audio, metadata, Ethernet, control signals, and high-speed data. That in turn makes it easier to design lighter, thinner, and more powerful computers, such as the Ultrabooks shown at CES 2012 and the next generation of tablet computers. ♦

KRAMER HDMI SWITCHING SYSTEM DAZZLES HOLLYWOOD CROWD



Set it and forget it...it works! Attendees at the Hollywood Post Alliance® Technology Retreat in California witnessed first-hand the ease of a fully HDMI-based presentation system. During a panel discussion about next-generation projector technologies the newest “lamp-free” projectors and a successful “hot” switching of multiple laptop presentations were highlighted for an audience of more than 500 people. Six presenters and two moderators connected a variety of MACs and PCs “on the fly” at the podium, displaying presentations on two 16-foot projection screens.



According to AV technology consultant Pete Putman, who co-moderated the discussion, he decided to show an example of the new hybrid projection technology instead of just talking about it. To build the system, he chose a Kramer Electronics VP-728ProScale™

them, recognizing and reformatting the signal and establishing the right resolution,” he said.

High-level executives from TV networks, movie studios, post-production houses and corporate production departments enjoyed a seamless dem-

nized the signal resolution and cropped the picture beautifully. We proved the ‘set it and forget it’ mentality.”

Normally, a big-screen presentation in a large ballroom or auditorium would use DVI or VGA signal distribution at the podium with the signal running back to a master control system and to a preview monitor prior to being shown on the projection screen. Putman said that even though his system used the more complex HDMI digital interface standard for switching and distribution, it worked because the VP-728 recognized every signal from every computer, regardless of maker and operating system. He noted, “It didn’t matter what presenters brought in the door. The VP-728 figured it out.” ♦

We had no idea what sources the presenters would have, but we knew the Kramer VP-728 would be able to handle them, recognizing and reformatting the signal and establishing the right resolution.

— Pete Putman, co-moderator, Hollywood Post Alliance Technology Retreat

Digital Scaler/Switcher that would manage all of the anticipated input signals. He showcased two 3500-lumen XGA light-emitting diode projectors, which letterboxed the displays to a 16 x 9 image. “We had no idea what sources the presenters would have, but we knew the VP-728 would be able to handle



onstration. Each speaker interfaced his or her notebook computer to the VP-728 switcher through HDMI and DisplayPort/HDMI adapters. The switcher converted all signals to 1280 x 720 HDMI output for display on the projectors. The switcher was connected to a Kramer VM-4HxL 4x1 HDMI distribution amplifier by a 25-foot Kramer HDMI cable, which in turn was connected to each of the projectors by a pair of 50-foot Kramer HDMI cables. The system used the switcher’s analog audio connections to connect to the ballroom’s audio system.

“The transitions were quick, and there wasn’t as much as a hiccup with the system,” Putman said. “The switcher recog-



JUST FOR FUN FACTS

SAID ABOUT SEPTEMBER

- September comes from the Latin word, "septem," which means seven.
- Except December, no month ends on the same day of the week as September, in any year.
- On September 17, 1787, the Constitution of the United States was signed.
- September 14, 1814, Francis Scott Key wrote "The Star-Spangled Banner" during the attack on Fort McHenry.
- On September 17th, both Citizenship Day and

Turkey Talk

- Abraham Lincoln chose the last Thursday in November for Thanksgiving. Approximately 90% of American homes eat turkey on Thanksgiving; that's more than 45 million turkeys each year (over 675 million pounds according to the U.S. Department of Agriculture)!
- Scientists have found fossils suggesting that turkeys roamed North America 10 million years ago!



They fly to their roosts around sunset, and fly to the ground at first light to feed all day.

PRESIDENTS' DAY PRECEDENTS

Presidents' Day is a day when Americans honor the legacies of the U.S. presidents. Congress declared February 22, George Washington's birthday, a federal holiday in the 19th century. Presidents' Day has become a day to honor not only Washington, as well as the lives and accomplishments of all presidents.

Did you know?

- All of the U.S. presidents except George Washington lived in the White House; it wasn't completed until after Washington left office.
- Thomas Jefferson, the 3rd President, had two pet bears. He kept the bears in a cage on the White House lawn and occasionally went on walks with them. Other strange presidential pets include: alligator (John Quincy Adams), elephant (James Buchanan), and zebra (Teddy Roosevelt).
- John Quincy Adams, the 6th President, regularly skinny-dipped in The Potomac! He also wore the same hat every day for ten years.

CAN OF CORN

In baseball, the phrase "Can of Corn" refers to a high, easy-to-catch, fly ball hit into the outfield. The phrase is said to have originated in the 19th century and relates to an old-time grocer's method of getting canned goods down from a high shelf. Using a stick with a hook on the end, a grocer could tip a can so that it would fall for an easy catch into his apron. A can of corn was considered the easiest "catch," as corn was the best-selling vegetable in stores and was heavily stocked.

Constitution Day are observed in the United States.

- September 19th is International Talk Like a Pirate Day. Arrrrrgh Matey!!



- The best time to see a turkey is on a warm clear day or in light rain. But did you know that they can drown if they look up when it is raining?
- Most wild turkeys are found in hardwood forests with grassy areas. Turkeys spend the night in trees.



- Ulysses S. Grant, the 18th President, was given a \$20 speeding ticket for riding his horse too fast down Washington Street!

- William Howard Taft, the 27th President, was a stately fellow weighing in at over 300 lbs. Due to his size, he unfortunately became stuck in one of the White House bathtubs (bathtubs were much smaller then).



- Herbert Hoover, the 31st President, moved his family to China before taking office, and he and his wife learned to speak Mandarin Chinese fluently. They would speak the language around the White House to prevent others from understanding them.
- While in the Navy, Richard Nixon, the 37th President, noticed that his friends were winning money in poker games. He was taught how to play and within only a few months, Nixon had won around \$6,000 in poker games, which he used to fund his first congressional campaign.
- Warren Harding, the 29th President really liked to gamble. In one poker game, he bet the White House china collection and lost it all in one hand.



THE LOW-DOWN ON ST. PATRICK

- St. Patrick's Day is observed on March 17, the feast day of St. Patrick, known as the patron saint of Ireland.
- In Ireland on St. Patrick's Day, people traditionally wear a small bunch of shamrocks on their jackets or caps. Children wear orange, white and green badges, and women and girls wear green ribbons in their hair.



SHINE ON HARVEST MOON

- "Shine On, Harvest Moon" is the name of a popular early-1900s song.
- The Harvest Moon is the first full moon closest to the autumnal equinox. During Harvest Moon the retardation (later rising each night) of the moon is at a minimum. On several nights in succession, the moonrise is at nearly the same time and there is full moonlight almost from sunset to sunrise, if the sky is unclouded. Since this usually happens at the peak of harvest, farmers could work late into the night by the light of the moon; hence the name, Harvest Moon.
- This year's Full Harvest Moon falls on September 12th and the best viewing of the Harvest Moon will be the evenings of 9/11 through 9/13. So, be sure to check outside around dusk for a Harvest Moon if the sky is clear.



- Dublin, the capital of Ireland, has a huge St. Patrick's Day festival from March 15-19. In Chicago, the Chicago River is dyed green with a special dye that only lasts a few hours. There has been a St. Patrick's Day parade in Boston, Massachusetts since 1737. Montreal is home to Canada's longest running St. Patrick's Day parade, which began in 1824.

St. Patrick

- St. Patrick was born in 385 AD somewhere along the west coast of Britain.
- At age 16, he was captured and sold into slavery to a sheep farmer. He escaped when he was 22 and spent the next 12 years in a monastery. In his 30s he returned to Ireland as a Christian missionary.
- He died at Saul in 461 AD and is buried at Downpatrick.

About the Irish

- The Irish flag is green, white and orange. The green symbolizes the people of the south and orange, the people of the north. White represents the peace that brings them together as a nation.



- 34 million Americans have Irish ancestry, according to the 2003 US Census. That's almost nine times the population of Ireland, consisting of 4.1 million people.
- There are some American towns that have "Irish" names: Mount Gay-Shamrock, West Virginia; Shamrock Lakes, Indiana; Shamrock, Oklahoma; Shamrock, Texas; Dublin, California and Dublin, Ohio.
- The color green is also commonly associated with Ireland, also known as "the Emerald Isle."
- The name "lephrechaun" could be from the Irish Gaelic word "leipreachan," which means "a kind of aqueous sprite." Or, it could be from "leath bhrogan," which means "shoemaker."

Clovers

- According to the Guinness Book of World Records, the highest number of leaves found on a clover is 14!
- It is estimated that there are about 10,000 regular three-leaf clovers for every lucky four-leaf clover.
- Legend says that each leaf of the clover means something: the first is for hope, the second for faith, the third for love and the fourth for luck.

For more of Kramer's Just for Fun Facts, visit www.kramerus.com.

KRAMER PROFILES

Mike Lewis- VP Installer Solutions



Mike Lewis has a long history of association with Kramer Electronics. Mike spent 15 years at Comprehensive Video Supply in New Jersey selling cables and Kramer Products, and then spent the next 6 years selling cables for CompuCable before joining Kramer as Regional Sales Manager of the western region in 2003. For 4 years, Mike was consistently one of Kramer's top performers in regional sales before being promoted to National Accounts

Manager. Currently as Kramer's VP of Installer Solutions, Mike continually creates awareness for the Kramer installer solutions category. He looks for opportunities to grow the business with key accounts and for new products to stay abreast with the latest trends in the industry.

"The most rewarding part of my job has to be customer satisfaction. The greatest complement after satisfying a customer is retaining their loyalty and business for years to come. I have several customers who continue to show their support by returning to Kramer time and time again."

Mike Lewis grew up in Rockland County, New York. He attended Clarkstown South High School in New York

"The most rewarding part of my job has to be customer satisfaction. The greatest compliment after satisfying a customer is retaining their loyalty and business for years to come. I have several customers who continue to show their support by returning to Kramer time and time again."

and graduated from Rockland Community College with an Associate's Degree in Business Management. He currently resides in Wake County, North Carolina with his wife Shelia, two daughters, Paige and Taryn, and two granddaughters, Jade and Jordyn. Taryn recently joined Kramer Electronics where she works alongside Mike as an assistant sales manager. Mike leads a very active lifestyle enjoying basketball, bike riding, and boxing. He is an avid reader and his favorite author is James Patterson.

Chris Kopin- VP Technology



Prior to joining Kramer Electronics in 2001, Chris Kopin had been running his own business since high school. Chris sold and repaired audio devices for the first fourteen years in business, and spent the next ten years designing and installing sophisticated AV systems for dentist offices.

Chris began to incorporate Kramer products into his installations, and after becoming one of Kramer USA's first and biggest customers, he was eventually offered a position at Kramer. Almost 11 years later, as Kramer's VP of Technology, Chris focuses and studies technical trends and issues, and is in constant communication with Kramer Headquarters in Israel.

"Being an integral part of the growth of the Kramer US organization and having the ability to teach people about developing technical concepts and processes are the most rewarding parts of my job."

Chris was born and raised in New Jersey, graduated from Scotch-Plains Fanwood High School, and currently resides in Branchburg, NJ with his wife Robyn. Their son Tom Kopin, is an Electrical Engineering Graduate of the Stevens Institute of Technology in Hoboken, and prominent engineer at Kramer Electronics for the last four years. Their daughter Michele Kopin is Store Manager at Abercrombie & Fitch in Memphis, Tennessee. Chris is also an accomplished wood worker and loves auto racing.

"Being an integral part of the growth of the Kramer US organization, and having the ability to teach people about developing technical concepts and processes are the most rewarding parts of my job."

KRAMER TESTIMONIALS

"We researched the various head-end hardware and Kramer and Sierra kept popping up. Everyone we talked to gave those products a great recommendation, and the company was able to meet our tight time frame."

—Dan Salimbene, Arcadia New Media Services

"The Kramer products simplify the process. They allowed a flexible trailer to route signals and create a patch-panel that has close to infinite possibilities. All we do is turn them on and they work."

—Brandon Utech, National Institute of Land Management and Training (NILMT) Director of Technology at Kansas State

"We chose the Kramer product for its flexibility, adjustability, and technology. The transmitter/receivers are a robust combination that can handle the retail atmosphere. The product would also be installed by hundreds of different technicians across the country, so the learning curve needed to be short. Any technical issues were handled quickly by the Kramer staff. I was comfortable knowing they would resolve anything reliably and efficiently."

—Tim Johnson, manager of Strategic Innovation and Prototypes at AT&T Services, Consumer IT division

"The whole project has really revitalized the community, especially with the younger generation. The Kramer technology has attracted younger people, and their ability to work with it is allowing us to capture storm stories and document Greensburg's recovery."

—Janet West, President of the Board of Directors of Kiowa County

"We wanted to have a secure place for local government representatives and emergency management personnel to come and share information and make decisions for the community during a crisis. The space also needed to be multi-purpose to support use on a regular day. The system is easy to use because of the controller. The Kramer and Sierra Video products are great equipment at a great price."

—Elvis Wilson, Robertson County 911 System director

"We chose the Kramer switcher because of its range of inputs, its scaling solution, reliability and ease-of-use. Our faculty is confident operating the systems because they can use the switcher intuitively, the systems are the same in every room, and they work every time."

—Joseph Kalinowski, Director of IT Systems and Security at Clark University

Any Format. Any Wire. One Kramer Core™.



DVI



Dual Link DVI



HDMI



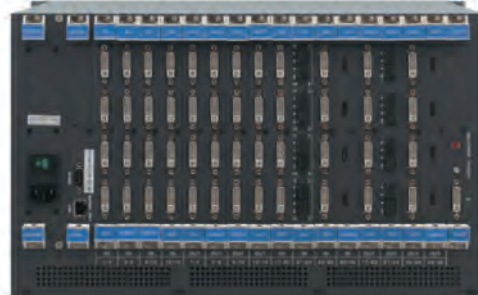
Fiber 4LC



Single Fiber



DGKat™



KRAMER CORE™ PRODUCTS ARE AT THE VERY HEART OF ANY AV SYSTEM DESIGN.

Our new line of modular digital routers is your perfect core solution, offering the most flexible infrastructure conversion, depending on your choice of input/output modules. The routers receive digital/analog signals from compatible Kramer core transmitters, automatically convert them, and send appropriate signals to compatible receivers.



Copper, Fiber or Twisted Pair - all can be used at the same time with Kramer's core solution. Kramer's new modular routers are available in a 16x16, 32x32 or a 64x64 frame.

*Picture showing 32x32 frame with cards supporting four channels



Visit Kramer Electronics in Booth #N1240 at InfoComm 2012, June 13-15, in Las Vegas, NV

For further product information, visit www.kramerus.com • Toll-Free: 888-275-6311 • E-mail: info@kramerus.com

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