Extron Electronics:
Looking Back at 20 Years in the A/V Industry

In my early years as the West Coast regional manager for Inflight Services, the US distributor for the Barco video projector, displaying the IBM PC was an issue. Although there was an interface installed on the rear of the early projectors to couple and convert the IBM PC CGA 16-color TTL video output signal for display, it only allowed the display of eight colors. In addition, the interface was mounted in the projector at the ceiling and required a long cable run from the PC to the projector interface. The CGA video output, a TTL level signal, introduced noise in the picture when it was run more than 10 to 12 feet. It also did not allow the local PC monitor to display at the same time. Running the cable parallel to the projector for monitor display only increased the noise. Thus, the need was born for the RGB 101 series of interfaces that solved all these issues. Placing the interface at the computer allows the local monitor to display at the same time as the projected image, providing a full 16 colors.

Recently, we introduced our new IP Link™ line of Ethernet control interfaces that, in my opinion, are as important a milestone for Extron as the first interface products. The core technology developed for these interfaces has the potential to revolutionize the way products operate within systems.

Product development and customer support have been my first loves at Extron. For the last 20 years, my focus has been providing you, the best dealers and consultants in the A/V industry, with the best products and backing them up with the best Service, Support, and Solutions.

Thank you and this industry so much for giving me the opportunity of a lifetime.

Andrew C. Edwards, President
Extron Electronics

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20th Anniversary Extron 1983-2003

- RGB 101 BNC-4
- Extron Stanton manufacturing and sales office opens (800 square feet)
- First bulk cable introduced – BNC-4
- First cable adapter introduced – SY 25
- RGB Systems, Inc. dba Extron Electronics, is incorporated

Extron Bulks up its Cable
Extron’s 20th Anniversary

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RGB 101
BNC-4
Addressing the Need

Projecting graphic images from desktop computers onto large screens became an industry desire and Extron’s primary reason for existence. The impact of projecting computer video was, and continues to be, enormous. This new ability to share computer information with a large audience in one or more rooms created a ground swell that impacted specific industries, such as education and live entertainment. In a few years, corporate industries began installing professional presentation facilities; among the many projects are boardrooms, conference rooms, auditoriums, classrooms and electronic training facilities. Interest in computer graphics projection eventually extended into the realm of command and control centers as well as video post production facilities. Contemporary applications like videoconferencing and personal home theater continue to fuel the need. Both present applications and those to come demonstrate the need to enhance the ability to integrate and install projection equipment, which includes professional distribution products. The SW 2A analog switcher, with only two inputs and one output, provided high resolution analog RGB and sync signals without undue signal loading or impedance problems. With 50 MHz video bandwidth, the ADA 3 featured one RGB and sync input and three isolated RGB and sync outputs.

The First Products

The RGB 100 series interfaces converted IBM’s non-standard CGA graphics card TTL signal to an analog video format compatible with existing projectors and large direct-view monitors. Extron’s RGB 100 enabled a full 16 color presentation, including gray and brown, on a large screen television or monitor display. This new interface technology enhanced image readability via the Horizontal Sync Delay feature. Horizontal sync delay allows image shifting, or centering, which accounts for the non-standard sync timing that exists throughout the computer graphics industry. The “looped output,” which allows simultaneous operation of the computer’s local monitor, provided a key advantage. Although now retired, the RGB 100 interface fundamental features and benefits are a mainstay of our current interface products. Today, many additional interface features solve unique problems presented by non-standard computer video.

Soon after Extron established signal interface compatibility, users asked for the ability to switch multiple sources to one display. Further, our customers desired equipment which distributed signals to more than one display. In those early days, most available switcher products were limited to standard definition, or television, video format. By 1986, we launched our first switcher and distribution amplifier, which marked our initial foray into signal distribution products. The SW 2A analog switcher, with only two inputs and one output, provided high resolution analog RGB and sync to video monitors and projection systems having analog level RGB inputs. That same year, the ADA 3 Analog Distribution Amplifier debuted. The modest ADA 3 distributed analog level RGB and sync signals without undue signal loading or impedance problems. With 50 MHz video bandwidth, the ADA 3 featured one RGB and sync input and three isolated RGB and sync outputs.

Extron and IBM

The year 1987 marked the launch of a breakthrough product, the RGB 109. It was the first VGA interface on the market. IBM selected Extron’s RGB 109, developed under a mutual non-disclosure agreement, for use with its new PS/2 and PS/1 computers, which scanned at 31.5 KHz. IBM needed the RGB 109 immediately to support rollout of those new products worldwide. Timely delivery ensured that the IBM sales team and our dealers obtained this new interface to support product sales. This new interface provided wide analog bandwidth and simultaneous local monitor viewing. Since the IBM PS/2 VGA supported many different image resolutions, the RGB 109 supported and tracked the auto-switching modes of the system while maintaining correct horizontal and vertical picture positioning. Separate red, green, blue, and composite sync outputs facilitated display via large screen projectors or monitors. Many of the picture enhancement features of the original RGB 109 are still found today in the current RGB 109xi.

The RGB products remain the first of our system “glue” products to support large-screen imaging. By 1988, development began on the RGB 202, the first high-end universal interface designed to operate with nearly all computers and graphics cards. Later, the RGB 202xi became our first interface to include audio capabilities, and the RGB 300 introduced the first interface product having RS-232 remote control. Throughout the years, several other interface models, whether dedicated or universal type interfaces, evolved with a myriad of features including peaking, video test signal generation, boost and level control, horizontal and vertical image centering, and architectural configuration capabilities. Each Extron model introduction furthers interfacing to a new
level in step with the growth of computer imaging capabilities.

As the IBM PC progressed in capability, several VGA graphics formats became commonplace in the AV industry. Our customers wanted a simple, portable solution that would allow for signal distribution to more than one display. In 1988, we delivered the industry's first low-cost computer-video distribution amplifier: the Extron P/2 DA2. As an analog device, the P/2 DA2 buffered computer graphics signals for use with early, overhead-style LCD panels having direct VGA inputs. The user could display an image via two separate outputs: the monitor and the primary display. With Extron's VGA extension cables, the P/2 DA2 outputs could be extended up to 150 feet.

As the concept of interfacing became more common, we realized that our dealers and consultants needed an entirely different kind of product aid: an instructional guide to interfacing. It could be said that we grew up together in this industry. Before you, our customer, could select an interface, it was paramount that you and your customers understand why their installations required that type of product. Internally, we soon realized the importance of ongoing education. As our groups developed new products, implementation into the marketplace mandated education on those products. This was, and still is, our motivation and inspiration: to educate customers and help them make informed design and purchasing decisions. This early insight led to the Handbook of Computer Interfacing, the industry's first technical textbook, launched at the 1989 InfoComm in Dallas, TX.

The System 8/10 switcher debuted in 1991. While not the first multi-format switcher from Extron (the Model 8/10 switcher launched at InfoComm in 1987 provided routing for various RGBS formats or NTSC), the System 8 was the industry's first switcher to include universal projector control via bidirectional communication. Projector control eliminated any memory issues when switching between high and low resolution sources. The System 8/10 quickly became a staple in the industry. With Extron's array of internal projector control routines, these System Switchers were configurable to nearly any data projector. More than a decade later, the System 8 Plus and its sibling, the System 10 Plus, are still popular products in large-scale installations.

**Impacting the AV Industry**

By 1992, an entirely new product was introduced for the sole purpose of facilitating projector set-up before the computer arrives. Assisting field engineers and bench technicians, the VTG 50 and VTG 100 became the industry's first portable, high bandwidth video test generators. Previously, project installations were hampered since there was no convenient method for projector set up and display without a signal source present — laptops were not in common use. Using a video test generator, field engineers and technicians can reproduce an SGI line rate, for example, match it to the SGI computer, and align, set up, and test the projector before the hardware is onsite. Up to 85 scan formats are included with current models for reproduction with the most popular PC and computer system video signals.

The following year, two other significant products launched: the Emotia scan converter and the first wide bandwidth matrix switcher, the Matrix 200. Customer demand for better quality scan converters prompted the development of the Emotia real-time digital VGA and Macintosh scan converter. This product supported video recording of VGA PC and Macintosh computer imagery as well as its display on LCD video projectors and standard televisions. The Matrix 200, providing a standard-breaking 250 MHz video bandwidth, offered the highest RGB video performance at that time — other matrix switchers were limited to 100 MHz when high resolution workstations required more bandwidth. The Matrix 200 shipped in three sizes, 4x4, 8x4, and 8x8, and could be expanded externally up to 32x32.

The CrossPoint Series of wideband matrix switchers launched a new era in switching in 1996. These economical models were the first fixed I/O configuration matrix that provided out-of-box use — no complex configuration required. The first models offered a minimum of 16 memory presets and switched s-video and composite video for easy use with any large screen projector and monitor. The CrossPoint matrix switchers are still used in master control suites for power and telecom companies, training centers, military rooms, and schools.

Although in the mid-’90s, high resolution projectors and displays were common, many video sources still used only half the resolution of the projector. To obtain better quality images that matched the projector’s output, Extron introduced its first scaler, the Andora, in 1997. The Andora scaled VGA or video up to a standard VGA or Super VGA rate for display. Its applications included large-screen projection, desktop multimedia, and LCD panels.

**More Bandwidth Requires Higher Performance Products**

As the number and variety of computer signal sources increased, so did requests for more...
products supporting large-scale integrations with multiple locations. In addition, room system design projects jumped to new heights. Our development teams continued to improve the flexibility and variety of features in our products. And, more product categories emerged to meet the expanding needs of AV dealers and consultants.

Some of these improvements became reality in 1998, when more landmark products were introduced: the Matrix 6400, System 5cr System Switcher, and the VSC Series of video scan converters.

The Matrix 6400 is a continuation of the matrix line, and offers customizable and modular switching of RGBHV, RGBS, RGsB, component, S-video, and composite video, and two-channel stereo audio. But its capacity sets it apart from other models: the Matrix 6400 routes signals from 64 sources to 64 destinations, at the same time. Large applications become second nature, due to the large LCD window on the front panel, which greatly simplifies setup and operation by allowing settings and operational functions to be easily viewed and altered. And, using a feature called “rooming”, each Matrix 6400 switcher can be programmed to group multiple outputs to specific “rooms”, allowing them to have their own presets. This enables a new line of flexibility and control in routing signals.

### Products for Small Environments

The System 5cr, introduced in 1998, provided an economical solution for input switching, room control and audio control in small AV installations, such as classrooms, conference rooms, work environments, and boardrooms that use LCD, DLP, or plasma display devices. By providing projector control, room control, and universal compatibility with display devices as well as audio capabilities, the System 5cr performs functions that would normally require up to four different products. It features the same capabilities as the System 8 and System 10 switchers (including bidirectional communication with the projector), but on a reduced scale for smaller installations.

As videoconferencing grew in demand, our engineering team developed video scan converters to convert computer-video signals into a signal compatible with video conference codecs. The VSC 50, introduced in 1998, converted computer images as high as 832 x 624. The VSC 50 featured VGA/SVGA and Mac input/loop-through connectors and composite and S-video (NTSC/PAL) outputs. Either Mac or VGA connectors could be used as an input or a local monitor output. Now retired, these and many other features are included within our current line of high resolution scan converters.

### Improving Aesthetics

With the boom in corporate and other high profile installations in the late 1990s, the need for technology to be discretely hidden and customized became clear. Architectural Adapter Plates (AAPs) — part of our Architectural Series — provide pass-through connections and control modules. By blending into the environment, AAPs offer connectivity to a wealth of professional AV equipment while maintaining a streamlined, professional appearance in boardrooms, training facilities, and command and control centers. Today, there are hundreds of Extron AAPs available, in a variety of connector and control combinations.

The year 2001 marked the introduction of another architectural product, the Hideaway Surface Access series. Along with the AAPs’ inquisitive access to AV controls, the HSA series also provides access to computer-video interfaces. The HSA product design supports easy mounting into virtually any table to hide cables, connectors, and power cords. The availability of all architectural products allows AV professionals to incorporate AV systems during new building design, while providing aesthetic options to their customers.

That year also marked the growth of twisted pair technologies. Twisted pair technology had been around since the 1970s, when twisted pair transmitters and receivers were introduced into the AV industry to save time and money in long distance cable runs. They were used primarily for point-to-point transmission of signals from one source to one destination.

As twisted pair technology gained acceptance in the video world, we developed more high-end products to handle the challenge of sending RGBHV and digital stereo audio signals over UTP, or Category 5, cable. These transmitters and receivers, such as the Extron TP T and TP R Series, offer point-to-point transmission of high resolution video over distances up to 1,000 feet and included image enhancement features. It became a perfect combination: twisted pair technology and interfacing.

### New Control Options

When our technical staff became involved in an installation at a private high school, we discovered control options for classroom elements were limited. No product existed that could easily control all the elements in a small classroom: projector, computer display, VCR, and DVD player — or at least be easy enough for a teacher or student to operate it. Our solution to this need is the Extron MediaLink System. This family of easy-to-use and inexpensive products inte-
grates and controls AV equipment in any small, one-projector classroom, boardroom, or auditorium. The MLC 206 MediaLink Controller acts as an extended remote control panel, and mounts on a wall, podium, or lectern. The MLS 306 and MLS 506 MediaLink Series Switchers consist of five different switchers that may be used in conjunction with the MLC 206, or as standalone switchers. This series proves especially useful for schools. Teachers and administrators continually hail its ease of use and low cost.

The Extron VersaTools line brought new flexibility to small-scale installations. These compact, economical AV switches and distribution amplifiers are designed for every day use in environments such as boardrooms, training facilities, home theaters, and rental and staging environments. Flexible mounting options are available due to its durable, quarter rack width enclosure. The VersaTools line marked an entry into a less specialized market in 2002.

In early 2003, we announced the IPL T S2 Ethernet Control Interface, the first comprehensive network-enabling product made specifically for the AV industry. It merges the capabilities of AV with information technology, providing the ability to remotely control, monitor, and troubleshoot AV products via Ethernet. Its included IP Link™ technology, developed by Extron, includes a Web server that permits continuous communication with the product, and alerts a technician to product failure or theft. It also provides additional benefits such as the ability to monitor equipment use, schedule rooms, labs, and other facilities based on availability, type of equipment, and instructor or presenter needs.

The IPL T S2 is already having a great impact on large institutions, in which the monitoring of equipment was previously limited to the number of staff technicians and their ability to travel across sprawling facilities to check, update, and repair AV equipment — and respond to distress calls due to equipment failure or theft. It also provides additional benefits such as the ability to monitor equipment use, schedule rooms, labs, and other facilities based on availability, type of equipment, and instructor or presenter needs.

The Next 20 Years

The full impact of IP Link technology will become more evident as we release new products designed to enable communication with more types of products — even those not typically assigned to the AV industry — to be controlled and monitored. The monitoring and control of rooms, systems, and displays will continue to influence our development of new products.

In the AV industry, change in technology occurs at a moderate pace. The next greatest challenge is the complete integration of AV products tied to the network — the convergence of AV and IT — suggesting a need for new technologies to exist with the old.

The Extron Team will continue to meet the needs of AV professionals by ever expanding our product flexibility, features, and categories. From the first computer-video interface to Ethernet control interfaces, we have continuously introduced products that meet the needs of the AV industry. In the years to come, we promise YOU, our dealers and consultants, that Extron will continue its lead in new, innovative products that help make your designs and installations successful.
Montréal's Urban Passenger Exhibit Travels Over Extron’s Twisted Pair Technology

Pointe-à-Callière, the Montréal Museum of Archaeology and History, opened its doors in 1992. Since that time, it has gained international acclaim for not only preserving and exhibiting the archaeological and historical heritage of one of Canada’s most cosmopolitan cities, but also for its many programs steeped in conservation, research, outreach, and education. In addition to a number of permanent exhibitions, the museum is also the site of temporary exhibitions and cultural activities.

Unique Techniques

One of the city’s most popular events surrounding the museum is the Montréal High Lights Festival, an annual mid-winter exhibition of light spectaculars, live performances, and culinary delights. Several free activities are also staged in and around the city for visitors to explore and engage in. This year, the festival added a unique, interactive experience called Urban Passenger to the program.

Conceptualized by Avec, a group of architects and designers, and positioned as a “real happening” outside the museum and in Old Montréal, Urban Passenger featured real-time images of ordinary townsfolk projected on the side of the Conveyor Pier Tower, a 165-foot structure in Montréal’s Old Port.

For Yannick Provencher, Technical Director of AV Services for Duocom Canada Ltd., and his staff, Urban Passenger provided an excellent opportunity to harness the power of twisted pair technology.

Lights, Camera, and 1,000 Feet

The Urban Passenger exhibition proved to be a real technical challenge. It began with a makeshift orange booth located just outside the museum. Within the booth, lighting fixtures were placed to hold the two high resolution, analog cameras vertically positioned on a pipe. The subjects were primarily random individuals passing by the booth. The top camera would capture the upper half of a person, from the top of their head to their waist, and the bottom camera would capture the lower half, from their waist to their feet. The goal was to combine the two shots into one image and display them onto the side of the tower.

The two composite signals from the cameras were fed into two eight-inch preview monitors — the top half on one screen, the bottom half on the other screen. From there, the signals were input to an Extron TP T 15HD AV, a twisted pair interface and composite video and audio transmitter. Utilizing the configurable female 15-pin HD input connector and female RCA connector, the composite signals were sent down CAT 5 unshielded twisted pair (UTP) cable, something Provencher was initially hesitant to use because he was unfamiliar with what it could do, especially in such cold winter conditions. However, when
he realized that the composite signals had to travel 1,000 feet (304.8 meters), CAT 5 UTP cable seemed like a logical choice. “The cable needed to go over three streets and under two railroad tracks to a boat where our projection booth was,” Provencher said. “Extron showed us that CAT 5 was reliable for the job.”

Originally developed by the computer industry for transmitting digital data over computer networks, CAT 5 twisted pair cabling is a fraction of the size of coaxial cable, as well as being much lighter, more flexible, and less expensive. Termination of the twisted pair cable with RJ-45 connectors is simple, quick, and economical. Aside from the advantages it offers carrying high resolution analog video signals over long distance runs, twisted pair is also useful when there is limited space for cables, and/or the installation is difficult or temporary.

The Extron family of twisted pair transmitters and receivers are designed to integrate twisted pair cabling into analog AV systems. Built with Extron’s exclusive, proprietary technology, long distance transmissions up to 1,000 feet are easily achieved. Provencher was astonished with the results on the Urban Passenger exhibition. “Everybody was very surprised with the quality of the picture,” he said. “A thousand feet is a very long distance. It’s rare we are able to project images that far, especially outside.”

**From the Bridge to the Tower**

The projection booth was actually an enclosed bridge of a large merchant boat, docked directly in front of the Conveyor Pier Tower. Because the water surface was frozen, the boat was a relatively stationary and level platform for the projectors. The two CAT 5 cables carrying the composite signals were run up to the bridge and input to an Extron TP R BNC AV RGB/video Twisted Pair receiver. The composite signals were then routed from the receiver to an Extron AVDA 6 MX DUAL, continued on page 8
which combines two one input, six output distribution amplifiers into one enclosure. The composite signals were split into two sets—the upper half of the person was input into one set while the lower half of the person was input into the other.

Output one was fed into two more eight-inch preview monitors, replicating the same images from the two cameras. Outputs two and three were fed to two sets of double-stacked LCD projectors (four total). Each projector featured 5200 ANSI lumens and native XGA resolutions. Due to the long projection throw (more than 200 feet), and the extreme size of the projected image (more than 120 feet high), two projectors were overlaid for each half of the image. The total distance between the source cameras and the projected image on the side of the tower was well over 1,200 feet.

Come and See the Show

The Urban Passenger images projected onto the Conveyor Pier Tower could be seen from many of the other attractions of the festival. Commencing at 6:30 each evening for 10 consecutive days, participants would line up at the camera booth, awaiting their chance to be photographed. Although no audio signals were integrated into the system, a distinctive soundtrack called the Port Symphonies accompanied the images during the first two days of the event. Orchestrated by composer, video artist, and musical explorer Sandro Forte, the music was interpreted from the horns of ships in the Port of Montréal. Altogether, the sights of Urban Passenger and sounds of the Port Symphonies were meant to convey the feelings of a traveler arriving in Montréal via the St. Lawrence river. From a technical perspective, it was a long and successful journey. “I’ve worked with Extron products for 12 years,” said Provencher. “For this job, they provided us with a solution that exceeded all of our expectations.”

For more information on Duocom Canada Ltd., please visit http://www.duocom.ca.
Recently introduced and now shipping, the DLA-SX21 projector from JVC delivers ultra high quality imaging with 1.5 million pixels. It is ideal for applications such as simulators, 3D engineering, architectural visualization, CAD, conferences, boardrooms, ad hoc meetings in corporations and universities, and upscale home theaters. The DLA-SX21 features a new optical engine based on JVC’s D-ILA technology that offers a native resolution of 1400 x 788 in 16:9 mode, and a high contrast ratio of 800:1. It has a suggested USD list price of $10,995.

The NEC GT6000 projector offers several customization options to fit the needs of most any application. It features a dual lamp configuration for variable light output and lamp life, a full line of lenses (optional), integrated networking via an RJ-45 jack or wired/wireless PC card for manageability, and input flexibility. It also offers a native SXGA+ (1400 x 1050) resolution and light output up to 6000 ANSI lumens for the most precise high resolution displays. It has a suggested USD list price of $18,995.
Extron Bulks Up its Cable

Since 1985, with the introduction of multi-conductor mini-HR (high resolution) coax cable, Extron has been an innovator in specialty high performance cables for the A/V industry. During that time, we have become a major manufacturer of hundreds of specialty cables. Now, Extron is taking the next step with the introduction of the industry’s most commonly used cable types.

In recent years, Extron has introduced RGB and special purpose cable products like our famous BNC-4/5/6 Mini HR Cable, which utilizes miniature high resolution coax cable for applications using RGB signals, such as routing computer-video signals via interfaces, switchers, or distribution amplifiers to projectors or monitors. Often, we were the first to offer that strange new adapter for the latest model of computer to hit the market. Or, we were the only company willing to commit to that unbelievable deadline for custom cables.

Most of these products work hand-in-hand with our extensive powered product line. While we continue to offer these and other specialty cables, Extron is rolling out 18 new, predominantly general purpose cables. These are some of the most commonly used cables A/V professionals rely on for system integration.

Coax Cable

Coax cable generally has 75 ohm impedance and is used in video applications, test equipment, and RF distribution. It requires a more complex design and is usually more expensive than twisted pair cable; however, coax cable provides excellent performance and shielding characteristics. The frequency and resolution of a signal along with distance are very important factors in determining which grade of coax cable should be used. Due to the crimp style of cable termination (connectorization) used with these cables, they are easy to terminate in field applications, and provide consistent and dependable connections.

The first new coax cable from Extron is the RG59/HR-1 High Resolution Cable. This is a single conductor cable designed for a wide range of analog video systems and digital SDI/HDSDI applications. Available in plenum and non-plenum versions, RG59 type cable is a workhorse of the A/V industry, making it one of the most popular coax cables on the market. It is constructed with a 20 gauge, solid copper conductor that is double shielded with a foil shield for 100% shield coverage and a tinned copper braid shield with 95% shield coverage. A foil shielding is effective in preventing EMI (electro-magnetic interference), while a tinned copper shield is an effective way to repel RFI (radio frequency interference). With both, the cable is protected from characteristic intrusions of outside interference while ensuring optimum reliability.

Steadfast and durable for everyday use, the RG59 /HR-1 Cable can transmit signals over long cable runs up to 1,000 feet (304.8 m). Typically used in many types of video applications, its 75 ohm impedance and a low attenuation (loss) level of -2.3dB over 100 feet make Extron RG59/HR-1 suitable for transmitting analog video signals with positive results. The plenum rated version also makes this cable advantageous for applications where National Electric Code (CMP) cable needs to be installed, such as in open air spaces where running conduit can be expensive.

The Extron RG6/SHR Super High Resolution Cable offers the best available video performance. Next to RG59, this type of cable is one of the more commonly used coax cables, able to handle the highest resolution signals with the lowest losses. RG6/SHR cable is ideal for the most critical applications and the longest cable runs, including high scan rate analog and demanding digital SDI/HDSDI applications.

Signal loss, seen as an image’s loss of brightness and sharpness or data errors in digital systems, is possible when cable runs travel over long distances. Signals that run at higher frequencies are especially vulnerable to loss over long distance cable runs. The Extron RG6/SHR
The Extron Speaker Cable is a two conductor cable available in three different gauges—14, 16, and 18 AWG—to meet attenuation and power requirements for an extensive array of audio applications. The 14 and 16 gauge cables offer a higher conductor strand count than comparable cables in their class, providing more flexibility and easy installation. Like most of Extron’s other cable, this cable is available in plenum and non-plenum versions.

The importance of gauge size for speaker cable cannot be underestimated. The proper gauge size is determined by the length of the cable runs, as well as power and performance requirements. The more electrical current the A/V system draws and the longer the cable runs, the thicker the gauge size should be. Thicker gauge wires have less resistance to current flow (impedance) than thinner wires. Here’s a basic rule of thumb to follow: You can always use a thicker gauge cable than you actually need, but you shouldn’t use a thinner gauge cable than is recommended. Simply put, a thinner gauge cable will decrease the performance of the amplifier, the speakers, and the entire system.

Wrapping it up
Extron has also made some additions to one of its existing cable lines. The popular Extron Comm-Link Cable, a shielded twisted cable for carrying power and control communications, is now available in a non-plenum version. As with the plenum versions, this cable is offered in spools of 500 feet (152.4 m) and 1,000 feet (304.8 m).

Altogether, the introduction of these new cables is designed to help make Extron your source of cable solutions for A/V integration. After 20 years of being the “glue” that brings A/V systems together, it only makes sense that Extron’s experience and expertise are utilized to help make cables—commonly called “the weakest link” — that much stronger in the A/V system chain.

We’ve Added 18 New Audio, Video, and Control Cables!

Audio Cable
As more Extron products are incorporating audio capability, it only follows that we offer our own selection of audio cable to complement these enhancements. The Extron line of Audio/Control Cables are high performance solutions for transmission and distribution of audio and control signals in a variety of line level audio and control applications. These cables, consisting of eight varieties, are available in plenum and non-plenum jackets. Each cable includes a tinned copper drain wire on the inside of the foil shield, which is bonded to the jacket for easy stripping (this applies to single twisted pair cable only).

Cable for audio and control applications falls within the parameters of line level signals and is usually constructed of one or more pairs of stranded wires, or stranded twisted pairs. By using shielded, twisted pair cable, a more balanced signal path is possible that minimizes susceptibility to outside interference. Combining a shield with the twisted pair also improves unwanted signal rejection. Gauge size for line level audio and control applications is usually determined by transmission distance and termination hardware. Larger gauge cable has less DC resistance per unit length, so there is less signal loss over long distance paths. The Extron Audio/Control Cable is available in 20 or 22 gauge versions.
This year marks Extron’s 20th anniversary of manufacturing the “glue” that connects AV systems together. Since our beginning in 1983, we’ve listened carefully to feedback from dealers about the products they need most.

18 New Cables
This year, with 18 new bulk cable additions, that tradition continues. Thanks to some new additions, the Extron line of high quality cables now includes some of the most commonly used cables in the industry. We’ve added two new single conductor coax cables and, for the first time, audio/control and speaker cables.

In addition, we now offer a wide range of compression connectors and a single tool to terminate virtually all cable types. Our expanded cable and connector selection, combined with Extron’s industry leading service and support, means you can be confident in choosing Extron as the single source for all your cabling needs. Consider what Extron has to offer:

Available Stock
With our huge inventory, we’ll have your cable out the door and on its way to you — anywhere in the world — usually the same day you order it.

Shipping
We offer a wide range of shipping options to ensure your cable order arrives where you need it, when you need it. We will soon open a new cable distribution warehouse on the East Coast, shortening transit distance and time to provide faster ground-rate delivery at lower cost for our east coast customers.

Technical Support
Cable can be a surprisingly technical product. For complex applications, Extron Application Engineers can answer all your questions, and help you select the most appropriate cable for your application.

It has always been our goal to exceed our customer’s expectations. We’re confident that the latest additions to our cable lineup will help provide you with industry leading quality and performance at the most competitive prices. Now that you have the convenience of working with a single vendor — a vendor you can trust — rest assured, your next cabling problem has already been solved.
Selecting the Right Cable – Your Best A/V Investment

"If money were no object, this is what I would do.” Haven’t we all said this before? Or, haven’t others confronted us with the same rhetorical situation? It’s the classical search for the best choice. All of us want the best things or the best performance. Only time and/or money stand in the way.

In A/V system design, there are many trade-offs, some of them more difficult to justify than others. It’s the infrastructure of any project that tends to be the most expensive. Take a look at system wiring, for example. The cost of the wire and cable may, on the surface, be one of the least expensive individual components. Certainly, the selection of cable is often considered at the back-end of the project design and may be considered an area for cost savings. Those who see the larger picture realize that the total cost of installation with labor and long-term maintenance elevates the wiring infrastructure to a new level of concern. If you are the contractor who will support and service a project in future years, the stability and expandability of the wiring infrastructure should take on new dimension and importance.

Deciding on the correct cable for an application today is, in many cases, augmented (or even limited) by the devices to be interconnected. For example, the contemporary connection of network components dictates the use of CAT 5e type cable. Often, digital appliances have specific connectivity requirements that are straightforward. Only when the project design calls for a connection distance that challenges the norm do we find ourselves having to expand our awareness for a solution, a good solution.

Cable Crystal Ball

Consider the classical signal distribution question: “How far can I run this analog video signal on coax?” Often, we are asked how far a particular cable may be run for a specific signal type. There is no simple answer. Coaxial cable selection for analog video signal distribution is traditionally challenging. Analog signals degrade at a generally predictable rate during distribution; so the designer is faced with balancing tradeoffs involving cable type, distance, image quality, and economics. We know the signal will degrade. As if we had a crystal ball, we need to predict the maximum distance at which it will still be acceptable for a given cable type.

And, consider the contemporary signal distribution question: “How far can I run graphics on CAT 5 cable?” Though the video or graphics transmission format is really analog in current-day CAT 5 style distribution systems, these transmitter/receiver combinations share similarities with digital transmission schemes. That is, the losses on the cable become so significant that the receiver must possess amplification and cable equalization capability to make sense of the signal. Transmission distance for this type of system is totally dependent on those two functions. The better they are, the farther the signal may be successfully transmitted on a given cable type.

Digital transmission does not involve conveyance of the actual signal information like an analog transmission. Digital signals transfer long chains of numbers representing numeric samples of the original analog event. The receiving device must recognize those numbers and translate them into an analog re-creation that we perceive as the original. When the digital receiver encounters difficulty interpreting those transmitted numbers, the system fails. The ability to “read” and interpret the numbers is related to the amount of high frequency information present in the signal. The same physical loss factors within the cabling system that degrade high frequency content of analog signals also affect the high frequency content that supports reception of the number codes in a digital signal. Just as we perceive image sharpness and detail due to high frequency content, the digital receiver “looks” for the same so that signal edge transitions may be detected, which leads to proper numerical decoding.

Selecting the right cable for digital or special analog transmissions, like video over twisted pair, follows a more regimented procedure. Usually, the manufacturer will recommend a particular style cable along with recommended transmission distances for the particular format of interest.

Cloudy Predictions

It should be clear by now that when we are concerned about cable selection, we are really concerned about passing the highest frequencies through the system. For simplicity, we’ll work with the classic situation of selecting coaxial cable for analog video signal distribution. Having a good grasp of the fundamentals here sets the stage of understanding for distribution of almost any signal format.

As cable run distance increases, so does high frequency loss in the analog signal. To review, the presence of high frequencies translates into fine image detail. Preservation of high frequency information is most important. However, as cable length increases, low frequency losses increase proportionally as well. Should you be concerned? Absolutely.

The combination of skin effect and dielectric loss affect the entire signal energy spectrum. The well-known rule of thumb recommending a system bandwidth of three times the fundamental signal rate is intended to focus on the high frequency loss problem. About 80% of the signal energy deriving transition rise and fall time is comprised of frequencies near DC onward through the fundamental, second, and third harmonics. System bandwidth equal to or greater than the third harmonic ensures adequate transmission of the majority of the spectral energy. But, while the third harmonic level drops in a

continued on page 14
long cable run due to dielectric loss effects, skin effect and DC resistance are attenuating signals below the fundamental. Overall, all spectral energy is decreasing. While the observer may, at some point, begin to notice loss of edge detail, the not-so-obvious effect is that low frequency smearing and streaking across the image become the most noticeable and objectionable quality issue. The smearing, or streaking, effect is a combination of increased signal rise time and lower energy in the fundamental and second harmonic as well. Compare a good signal, Figure 1, with the degraded signal, Figure 2.

Artificial Pixelligence
Perhaps in your experience with newer LCD and DLP projectors you have found that systems with performance bandwidth less than three times the fundamental frequency seem to perform good enough. So, why follow the three times rule? It is true that performance may be good enough, particularly if you (or the intended audience) cannot easily compare it to the original good enough, particularly if you (or the intended audience) cannot easily compare it to the original. The smearing, or streaking, effect is a combination of increased signal rise time and lower energy in the fundamental and second harmonic as well. Compare a good signal, Figure 1, with the degraded signal, Figure 2.

Figure 1: Original Pulse and Bar test signal.

Figure 2: Pulse and Bar degradation after a long cable run.

Loss Table Replaces Crystal Ball
Put aside the crystal ball for now and let’s work through an actual application. Suppose you have a design calling for transmission of RGBHV graphics at a resolution of 1024 x 768 at 60 Hz refresh for a 100 foot distance. The graphics card clock rate will be about 65 MHz for this resolution. Now, we take one half the clock rate (32.5 MHz), since this represents the highest viewable resolution. About 80% of the energy required to create sharp edge detail in the image extends from near DC through the third harmonic frequency: 3 x 32.5 = 97.5 MHz. Let’s round this 97.5 MHz value to 100 MHz, since most loss tables contain data at this frequency. Now, we can peruse the loss tables located within the published spec sheet of various coax types to determine the distance at which losses will mount to a noticeable level.

Look at Loss Table 1 for Cable Type A and note that the loss will be -5.4dB at 100 MHz for 100 feet of this type cable. This loss is approaching the -6dB value for a distance of 100 feet. Remember, at -3dB the signal power is down to one half the original value (this is where we typically spec system performance) and -6dB is one-half of that, or one-fourth of the original power. Scale the loss downward linearly if your design requirement is for a shorter distance. For example, at 50 feet, the loss in the same cable reduces to -2.7dB (just under -3dB).

Loss Table 1

For any coaxial cable, we can see from Figures 4 through 7 taken from an actual graphics monitor the typical image presentation encountered with increasing loss of the third harmonic energy. Compare the performance of Cable Type A with the -6dB images shown. Is that level of visual performance good enough for the application? The text image is from a Web page and the H pattern is from an Extron VTG 200. The scope waveform illustrates the same cable loss effect on a pulse and bar signal from a computer. The pulse and bar is an excellent test signal for this because the pulse height is highly dependent on third harmonic content, while the bar height remains mostly intact since it comprises not only the third harmonic (its rise time), but also lower frequency information; i.e., from near DC through the fundamental and second harmonic. As the pulse height drops, the bar’s rise time drops accordingly.

As signal loss increases, the brightness of the image is affected too. In the progressive images of the pulse and bar waveform, you will see that the top of the bar is decreasing in amplitude. The brightness change is in addition to the loss of
high frequency information, which makes the image appear fuzzy, and loss of low frequency response, which causes image smear. Pay particular attention to how slow the rise time of the signal becomes, as in the -9dB example, Figure 7. The shallow ramp effect at the leading edge of the bar portion of the waveform indicates that image smear will be present. This slope accounts for the difference in image brightness seen after black characters on a light background.

Compare the expected signal loss for Cable Type B in Loss Table 2. Note that at 100 MHz, the loss is a little less than -3dB (only -2.3dB). This cable is a better choice for our hypothetical application where the run distance is 100 feet. Again, you can scale the loss value against the distance to interpolate closely to the performance you might expect. One half the run distance will be one half the loss and, conversely, twice the distance will be twice the loss value. In any case, the loss with Cable Type B will be about one half that of Cable Type A in all applications.

### Loss Table 2

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</table>

The solution to the loss problem is to specify a cable that, at its -3dB point for the highest frequency of interest, will yield an image no worse than the -3dB image in Figure 5. Should you not be able to attain a loss budget of -3dB or less for a given cable type and distance, then select a lower loss cable. A lower loss cable will be a larger diameter cable or have a lower loss dielectric design.

When other factors such as cost or cable size become an issue, the alternative is to use an interface or other type of cable driver amplifier capable of adding level and pre-emphasis (peaking) to overcome some or all of the loss. This device is added at the head-end of the signal run to pre-emphasize the signal prior to entering the cable run. A typical amount of high frequency peaking available in most cable drivers of this type will be at least +3dB and may extend to as much as +12dB. If you are considering a design situation with a potential loss of 6dB, the cable interface/driver can potentially overcome a significant portion or all of the cable loss. At a minimum, you can see that the goal should be no more loss than -3dB for best results. Adjusting the level control provides the necessary gain to restore overall image brightness lost in the cable DC resistance, as shown in Figure 8.

### The Right Cable, The Right Investment

Maintaining image quality and bandwidth through careful system design is challenging. Most discussion about system bandwidth traditionally accompanies the application of signal sources, distribution boxes and the displays to be used. This article is intended to focus attention on that most often left-for-last consideration: the cabling infrastructure.

In some cases, you may find that hedging the rule-of-thumb for system bandwidth can be bent to your advantage depending on factors introduced by specific display technologies. Ultimately, you and/or the client must decide if image quality is adequate based on the tradeoffs encountered. Remember, while displays come and go, your wiring infrastructure will have to support the application for some time to come. There is no time like the beginning of the project for making the right cabling design decision.
**Why Internet Protocol?**

It’s been several years in the making — the convergence of A/V technologies and information technologies — and we are just now starting to be heard and understood by our IT counterparts. IP has been the mainstay of the computer industry for high-speed communications for more than a decade. With the influx of sophisticated A/V technologies in the corporate, education, and consumer marketplace, the demand for both technologies has increased exponentially. Most manufacturers in our industry have realized the importance of Ethernet control for their products, and as a result, the manufacturers have rushed to implement this capability.

What are manufacturers doing with this new port on their products? Some provide a simple Telnet pass-through control via a PC-based application dedicated to their specific product. Others provide an embedded computer architecture and operating system to allow for sophisticated presentations without the need for an additional PC in the room. But the question begs to be asked: What are users really looking for manufacturers to provide in their products? The answer we’ve received has been curiously consistent: “Give me a Web-based control and monitoring application that unifies our equipment under a single common graphical user interface (GUI).”

So how does Extron fit into this puzzle? This same requirement also applies to all of our serially controlled equipment. We needed to make a product that would Web-enable our own products to answer this demand. After researching our solution further, we set the following minimum objectives:

- The ability to monitor key device status and send a customized e-mail when a service threshold is exceeded or the device is off line. This communication could be sent to security and/or service personnel to initiate a quick response to a critical problem.

- The ability to schedule devices, using a real time clock calendar, to control them at user-specified times.

Meeting these objectives meant that we needed to develop a solution that would not only enable our existing RS-232 controlled products, but also provide the same core features and functions in all future Extron products in which Ethernet control is needed. The solution we created, IP Link™ Technology, addresses all of these requirements and more. Extron has developed a series of Ethernet-to-Serial Interfaces using IP Link technology and categorized them as IP Tools™ to provide a uniform and consistent method of adding Ethernet control to our products. Extending this thought, as further discussion with end users, integrators, and manufacturers confirmed, our new interfaces could allow for the unification of all serially controlled devices to be managed using a single software application. For this, we developed our Web-based management and control application, the IP Link Global Viewer. The Global Viewer along with IP Link Technology provides all of this capability to Extron and third party devices. The Global Viewer can also work with any other Web-enabled device as long as the device can serve Web pages to a browser.
The Global Viewer uses the open-source, open-architecture philosophy of Web-based languages such as HTML, JavaScript, and XML, which allow for customization without additional knowledge of programming skills. Now, under a single Web-based operating environment, control for devices from diverse manufacturers can be unified, eliminating end-user purchases based on what their software will support. All manufacturers can benefit from this approach by including capabilities in their products that provide the monitoring and service functions our customers feel are valuable, such as tracking lamp usage, total life timer, filter replacement, etc.

Extron’s ground-up design approach for the IP Tools family of products is centered around A/V resource and device management over today’s widely available transport medium — the corporate network. Our focus on creating the most cost-effective, dynamic, and compact Ethernet-to-serial interfaces will continue to be driven by AV professionals and users of our products. We are answering this request by providing the same top-notch service and support you have come to expect over the years, including proactive driver development of many frequently used devices, so more of the work is done for you. Extron’s long-standing cooperative relationships with hundreds of manufacturers in our industry will ensure that we have the resources at our fingertips to deliver this and future robust solutions to the marketplace.

I look forward to bringing you new ideas and applications in the future. I plan to use this column to provide additional explanation on our solutions and related topics that are of general interest and related to IP connectivity.

Editor’s Note

The IP Link is a new column written by David Libman, Director of Software Product Development for Extron Electronics. This article is the first of several focusing on the implementation and impact of IP connectivity in A/V products. David joined Extron last year and oversees the growth of Extron’s Ethernet-based products, including the unification and standardization of software for simplified use.

David brings more than 12 years of industry experience to Extron, most recently as Director of Market Development for Synelec USA, a manufacturer of video walls and processors. Prior to Synelec USA, David worked for Crestron, a control systems manufacturer, for more than nine years in many different capacities, including Special Projects Manager, Manager of Systems Engineering, and National Sales Engineer.
Extron has expanded its IP Tools™ Series of compact Ethernet Control Interfaces with integral Web servers. The two new models are the IPL T S4 with four serial ports and the IPL T S6 with six serial ports. The IPL T S4 Ethernet-to-Serial Interface, with four serial ports on four 9-pin D-sub connectors, can control four independent RS-232, RS-422, or RS-485 serial devices. When configured for pass-through mode, the IPL T S4 can pass through commands from an existing control system and control two other attached devices. The IPL T S6, with a total of six serial ports, provides two 9-pin D-sub connectors and four captive screw serial connectors. It can control six independent RS-232, RS-422, or RS-485 serial devices.

All models in the IP Tools Series enable any A/V device to be controlled, monitored, and accessed from any computer connected to a Local Area Network (LAN), Wide Area Network (WAN), or the Internet. IP Tools give users the ability to remotely monitor and troubleshoot projectors, plasma displays, switchers, and other serially controlled products.

The IP Tools models are equipped with Extron’s exclusive IP Link™ technology, a high performance intelligent network solution specifically engineered to meet the needs of professional A/V environments. Multiple Ethernet-enabled A/V products can be managed and supported by a technician or administrator at any time from any computer with a Web browser.

IP Tools products use an integrated, high performance Web server with 1.25 MB of flash memory for storing HTML, JavaScript, Flash™ animation, and graphics files. Customizable Web pages can be created and stored using off-the-shelf software programs. Using the included Web-based software, users can access a variety of A/V products connected to a network to check activity and status. With e-mail notification, technical support administrators can receive failure and service messages through an e-mail enabled cell phone, PDA, pager, or computer.

### IPL T S4
- **Part Number:** 60-544-03
- **List Price:** $625.00
- **URL:** [www.extron.com/iplts4](http://www.extron.com/iplts4)

### IPL T S6
- **Part Number:** 60-544-04
- **List Price:** $695.00
- **URL:** [www.extron.com/iplts6](http://www.extron.com/iplts6)

*Prices listed in US Dollars, valid for US sales only.*

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The RGB 580xi CCS AAP and the RGB 580xi CCSI AAP are double space, universal, computer-video interface Architectural Adapter Plates (AAPS) that work with the Extron RGB 580xi interface to give users discreet, remote access to interface connections and controls. The CCS model provides horizontal shift control, and the CCSI model provides input select and horizontal shift control. Both AAPS fit conveniently into a Cable Cubby enclosure, which mounts in a tabletop or other flat surface. The RGB 580xi interface is compatible with VGA-UXGA, Mac, Sun, SGI, and other computer-video signals. It is available with two cable assembly lengths (9 foot and 12 foot / 2.74 meters and 3.66 meters).

### RGB 580xi CCS AAP 9’, Black
- **Part Number:** 70-254-02
- **List Price:** $190.00
- **URL:** [www.extron.com/rgb580xiccsaap](http://www.extron.com/rgb580xiccsaap)

### RGB 580xi CCS AAP 12’, Black
- **Part Number:** 70-255-02
- **List Price:** $200.00
- **URL:** [www.extron.com/rgb580xiccsiaap](http://www.extron.com/rgb580xiccsiaap)

### RGB 580xi CCSI AAP 9’, Black
- **Part Number:** 70-256-02
- **List Price:** $195.00
- **URL:** [www.extron.com/rgb580xiccsiap](http://www.extron.com/rgb580xiccsiap)

### RGB 580xi CCSI AAP 12’, Black
- **Part Number:** 70-257-02
- **List Price:** $205.00
- **URL:** [www.extron.com/rgb580xiccsiap](http://www.extron.com/rgb580xiccsiap)

*Prices listed in US Dollars, valid for US sales only.*
The Extron RCP 2000 Remote Control Panel enables control of input selection, transition effects and duration, and picture control of the ISS 108, ISS 408, and SGS 408 from a remote location. The RCP 2000 can be placed on a table away from the equipment rack for convenient operation by a switcher operator. With IP Link™ Ethernet compatibility, the RCP 2000 can make one switch while being updated for another. The ISS switchers can be controlled simultaneously by the RCP 2000 and through RS-232, offering the user additional control flexibility. The RCP 2000 can also send commands simultaneously from its RJ-45 and RS-232 ports to support the ISS and SGS switchers. The RCP 2000 is equipped with a T-bar for manual control of dissolve speeds, as well as a gooseneck lamp for low-light environments.

Extron introduces 18 new cables to its existing line of bulk cable products. These new cables complete Extron’s lineup of the most common cables A/V integrators use in system integration. The lineup includes: two high resolution RG59 cables; a super high resolution RG6 plenum-rated cable; several audio/control cables; and three gauges of speaker cables.

The RG59/HR-1 and RG59/HR-1 Plenum are single conductor, 20 gauge, coaxial cables available in non-plenum and plenum versions. The RG6/SHR-1 Plenum is a single conductor, 18 gauge, plenum-rated coaxial cable with an NEC CL2P rating for use in plenum environments. Both of these cables are ideal for a wide range of AV systems and digital SD/HDSI applications.

The new Audio/Control Cables include several shielded twisted pair configurations for line level audio and control applications. The Speaker Cable is a twisted pair cable available in three different gauges to meet attenuation and power requirements for an extensive array of audio applications. The 14 and 16 gauge cables offer a higher conductor strand count than comparable cables in their class, providing more flexibility and ease of installation.

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*Prices listed in US Dollars, valid for US sales only.
**Extron Carousel**

David Crepeau, Systems Integration Manager for Adtech Systems in Wayland, MA, built the Extron Carousel using a motor assembly from a Mercedes-Benz power antenna. With a built-in gear box, the motor powers the carousel to rotate at 5 RPM. The horses move vertically up and down to music, six times per revolution. In the center, David used a six-inch PVC pipe covered with metallic contact paper, which houses 4 D cell batteries. Several Extron Tweekers support the tent. The coup de grâce, however, is the Extron S3 logo printed on the tent. David re-created the logo on a computer, printed it in reverse on iron-on transfer paper, then ironed it onto the tent. “Extron makes doing business fun,” says David, “so what better way to show appreciation than to build something fun?”

Send us a photograph and brief explanation of how you use the Tweeker. If we publish it in a future issue of ExtroNews, we’ll give you a free VTG 300.

Please send entries along with contact information to: Extron Tweeker Contest, 1230 South Lewis St., Anaheim, CA 92805.
Or e-mail a high resolution photo and explanation to tweeker@extron.com

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**Extron Institute**

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<tr>
<td>Aug. 14-15</td>
<td>Singapore</td>
</tr>
<tr>
<td>Aug. 18-22</td>
<td>Washington, DC</td>
</tr>
<tr>
<td>Sept. 1-2</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Sept. 8-9</td>
<td>The Netherlands</td>
</tr>
<tr>
<td>Sept. 11-12</td>
<td>Anaheim, CA</td>
</tr>
<tr>
<td>Sept. 22-26</td>
<td>Chicago, IL</td>
</tr>
<tr>
<td>Oct. 6-7</td>
<td>The Netherlands</td>
</tr>
<tr>
<td>Oct. 20-21</td>
<td>Anaheim, CA</td>
</tr>
<tr>
<td>Oct. 27-30</td>
<td>Philadelphia, PA</td>
</tr>
</tbody>
</table>

**Tradeshows**

<table>
<thead>
<tr>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 5-7</td>
<td>CEDIA</td>
</tr>
<tr>
<td>Oct. 1-2</td>
<td>Rocky Mountain Film &amp; Video</td>
</tr>
<tr>
<td>Oct. 22-24</td>
<td>NSBA</td>
</tr>
<tr>
<td>Oct. 21-23</td>
<td>SATIS</td>
</tr>
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<td>Oct. 29-31</td>
<td>InfoComm Asia</td>
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<tr>
<td>Nov. 4-7</td>
<td>Broadcast (International Show)</td>
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</tbody>
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**Extron Carousel**

Carousel

Tweeker Use #67

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