Application Note

Compact Routers Ease the Digital Transition

Introduction

In 2006, Miranda's NVISION business unit introduced a line of compact routers and control panels — routers and panels having a very small form factor. The CR Series, as it became known, offers an affordable way for a facility to add digital routing to its signal management scheme. Simplicity and low cost were the design goals.

The only configurable item was a small 16-position rotary switch used to set a router's IP address.

The popularity of these products led customers to ask for more — additional formats, more versatility and additional configuration options. Although this deviated from the original concept of simplicity, Miranda answered the call for "more" with an unprecedented series of enhancements.

As a result, the CR Series now supports digital video, AES audio, analog video, analog audio, and machine control. More recently, Miranda added 3Gig compact routers. Versatility has been improved with the introduction of additional matrix sizes.

Finally — the subject of this application note — Miranda developed a feature-rich configuration tool that sets up all of your compact router equipment. This tool is known as CRSC (Compact Router System Configurator).

A Little Background

The CR Series Compact Router family includes 1RU and 2RU routers, control panels, and "remote panel modules." The series includes video and audio routers — digital and analog — in several formats, and machine control routers. The series includes 16×16, 16×4, 32×32, and 32×4 routers. The series includes 16×16, 16×4, 16×2, 32×32, 32×4, and 32×1 control panels.

Figure 1 shows a few of the CR Series products:

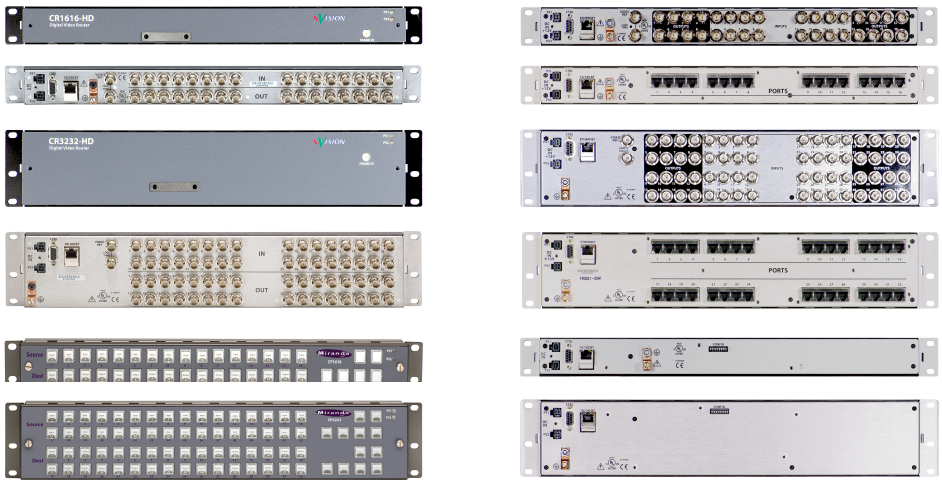

Figure 1. The Compact Router series

The routers and panels are very slim and lightweight, ranging from about 1″ deep to about 3″ deep.

With the exception of machine control routers, all the compact routers have n × m crosspoint matrices. An input can be routed to any or all of the outputs. The machine control routers (also called port routers) are

point-to-point routers. The connections are RS-422 and bidirectional, typically with commands in one direction and responses in the other direction.

Control panels in a system governed by CRSC install on the front of *remote panel modules* and provide direct control of the routers in the system. You can also mount a compact router series control panel on the front of a stand-alone router.

A “remote panel module” is a device on which to mount a control panel in a network of routers. A remotely mounted panel can control any router or all the routers in the network.

Routers and panels can be used stand-alone or in a network. Figure 2 compares a stand-alone router to a network of routers with remote panel modules:

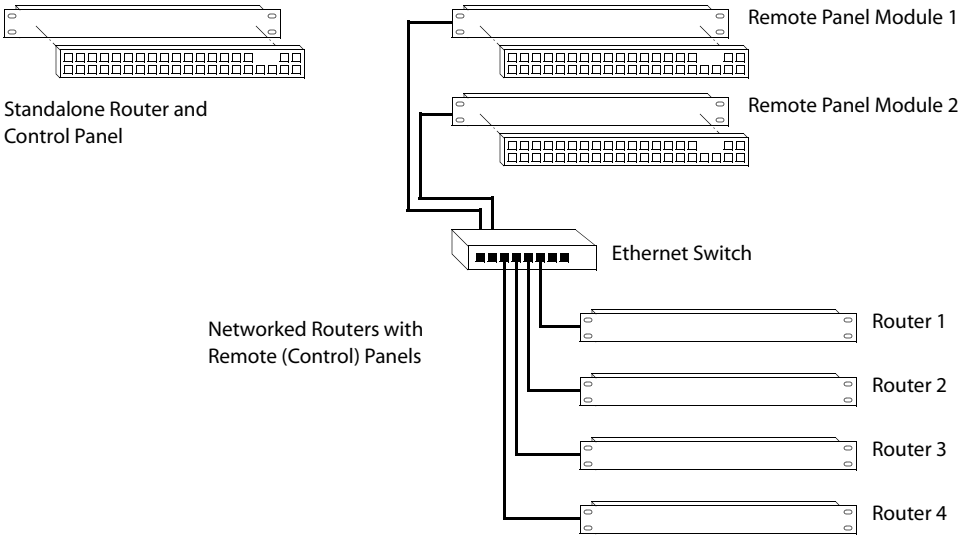

Figure 2. Standalone Router vs. a Network of Routers

CR Series routers can also be used with Miranda’s NV9000 Router Control System or NV915 Router Control System. These router control systems have features that extend the capabilities of the compact routers.

The Need for a Configuration Tool

The compact routers initially resembled the “bang box” or “10×1” [router] known to the broadcast and post production industries for years. Customers had a need for a small, inexpensive HD “10×1” and nothing was available to fill this void.

After the first shipments of these early CRs had begun, customers said “they work well, but…the monitoring station where HD-SDI needed to be routed suddenly must also be able to listen to a 5.1 surround mix” and “we would like to configure our 16×4 remote panel to have control over specific sources and destinations of our 32×32 router.” Features were added and consequently, how to configure the routers became a more complex subject. Some of the constraints imposed by its original “keep it simple” design now had to be rethought.

The newly released Compact Router System Configurator (CRSC) moves the product line into a truly new phase. Using CRSC, a network of compact routers can provide simple multi-level switching. You can program remote control panel buttons as needed. Operators can execute salvos. CRSC adds this functionality without increasing the cost of the base product. You can still buy a 16×4 HD compact router for small-scale routing needs, get the benefits of CRSC at no cost, and perhaps expand later.

Applications

With the final date for analog transmission now firmly set at February 17, 2009, implementing a digital core for your broadcast facility has become paramount. Whether you have purchased a new digital router or are planning to purchase one very soon, Miranda's compact routers can help.

Application 1

As a station in one of the top markets you had no choice but to install digital equipment early on. As a result, your digital core router cannot handle some of the newer digital formats. Your budget does not allow wholesale replacement of this router, but your operation is suffering. Adding a separate level using Miranda's compact routers is a low-cost and efficient way to resolve this problem.

Application 2

You have to start upgrading. After purchasing a new transmitter and antenna, not much money is left in the bank. Your plan has always been to migrate slowly, stretching the equipment you already own as far as you can. Some quality A/D conversion and a few decent up-converters will get you on-air with a digital signal. Your digital routing needs are modest.

The Miranda compact router line with up to 32 inputs and outputs per level can help. With CRSC, you get big system features to keep your operators happy.

Application 3

You do not have a broadcast or post-production facility, but still need to route video and audio signals. Applications of this kind include churches, conference centers, training rooms, and multi-monitor displays. The simplified user interface of the CR series makes it easy for guest speakers and other untrained users to understand system operation and confidently manage signal flow. Low cost and expandability mean your compact router system can keep up as your operation expands.

Application 4

Control rooms — for master control, post-production, or editing — usually support a wide range of activities and often require a compromise solution for each function. One common issue is monitor wall assignment. A CR series video router can be used as a pre-selector "ahead" of your monitor wall, where salvos "re-map" the monitors for these varying applications. The fact that compact routers use a standard NVISION serial protocols for their control ports and a UDP version of the NVISION Ethernet protocol for its network ports means they integrate with UMD systems easily.

Application 5

The compact router products have a very small form factor. They're ideal for monitor routing, news editing, ENG trucks or any application where powerful routing in a diminutive sized package is paramount. The ability to build up a simple network of CRs makes them ideal in applications where multiple levels need to be switched.

Getting Started with CRSC

Installing CRSC is simply a matter of inserting the software CD in your computer and following the on-screen instructions. The CRSC application will soon be platform independent. It is designed to run under nearly any operating system: Windows, Mac, Linux, etc. Extensive online help is available to guide you through the setup and configuration process.

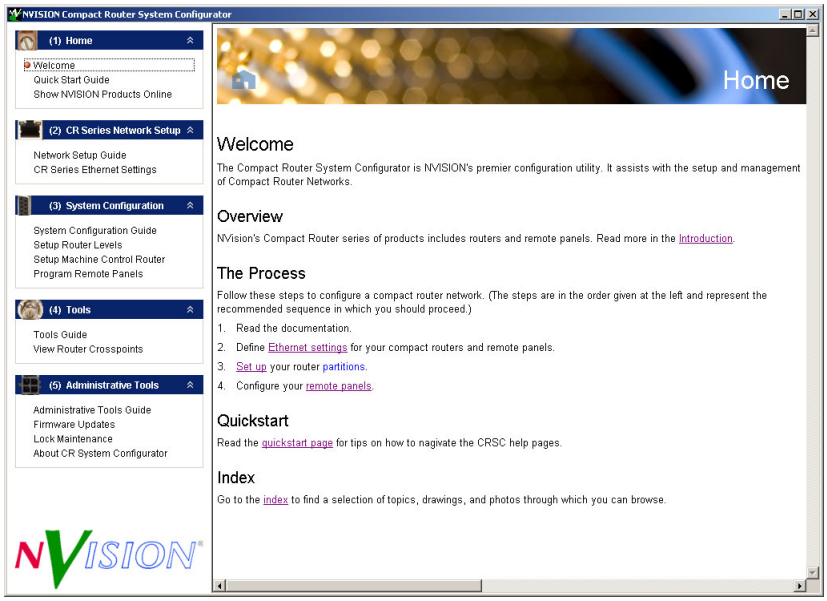

Figure 3. The CRSC home page

CRSC automatically discovers all devices on your compact router network. Network initialization is nearly automatic. All you have to do is set individual IP addresses using the small rotary switch at the front of each router and remote panel module. CRSC displays the physical settings you've made and allows you to make changes.

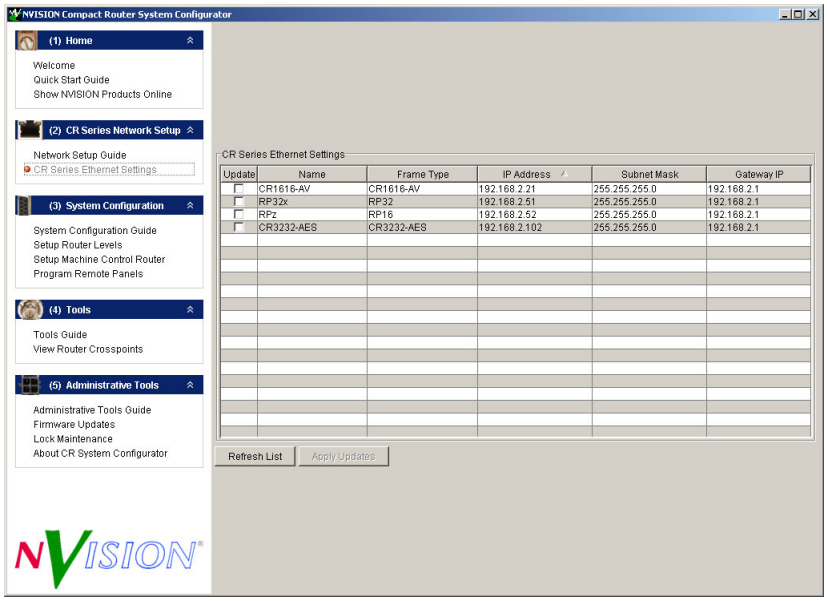

Figure 4. The CRSC Ethernet Settings page

Before you start to use CRSC to configure your compact router network, think about how you want your overall routing system to function. What signals need to switch together? How are video signals linked with their audio channels? What naming convention will make sense to operations personnel? How many control panels are needed? Where will they be located? What will each control panel's primary function be?

Having some answers in mind to these questions will make the configuration process easier. Of course, one of the benefits of a utility like CRSC is that it is easy to try different things until you find the right solution.

Preliminary Steps

After you launch CRSC, click 'CR Series Ethernet Settings' on the left. CRSC automatically searches your network(s) for CR Series devices and display a list of what it finds. Use this page to make sure that all of your connected routers and remote panel modules appear in this list. Before proceeding, you should identify and resolve any connection problems. Click the 'Refresh List' button to perform the automatic discovery process again.

The 'CR Series Ethernet Settings' page is flexible and offers many network options, including the ability to name the products.

Setting Up and Managing Routers

Rarely are devices connected to a routing system of just one format or type. A typical route can involve video, several channels of audio, and even machine control. One of CRSC's most powerful tools defines router *levels*:

These are some examples of where levels are useful:

- You are routing both SD and HD signals in the same compact router. You want to ensure that an SD source is never routed to an HD destination and vise versa.
- Component video routing where (Y, Pr, Pb) signals must all be switched together using just one compact router.
- Multi-channel audio routing using just a single compact router.

Viewing the 'Setup Router Levels' page for the first time, you'll notice that CRSC has automatically created a set of default levels as determined by the routers you have connected to your system.

You can change this easily. You can add and delete levels, defining the start and end limits for input and outputs and a few other parameters.

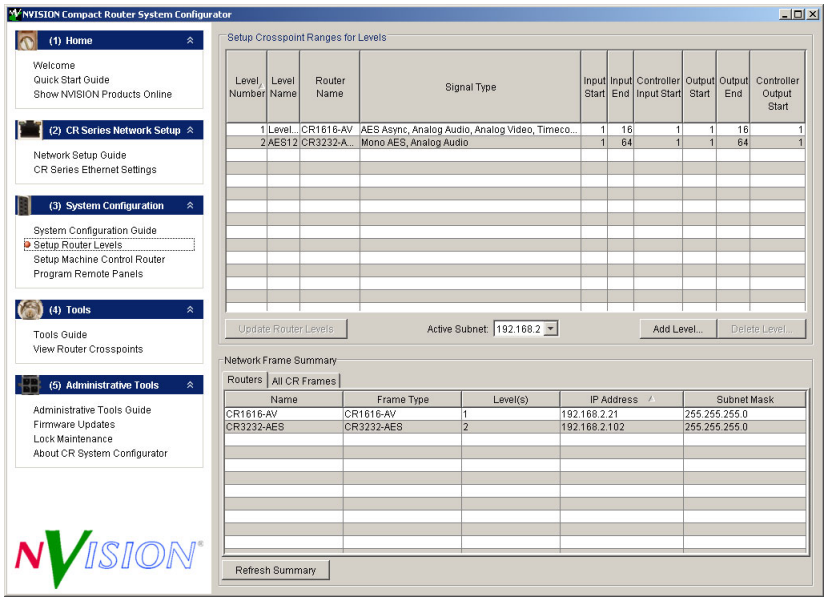

Figure 5. The CRSC 'Setup Router Levels' page

If a machine control router (or port router) is part of your compact router network, you can use the 'Setup Machine Control Router' page to view and modify its settings.

Unlike traditional video and audio routers that provide a "one input to many outputs" fan out function, a machine control router supports only point-to-point routes. This is because of the nature of control signals where, typically, two devices such as a VTR and an editor communicating.

Control messages sent from the editor to the VTR would generally create havoc if they were sent to other devices. Similarly, status messages coming back would confuse the editor if they originated from multiple devices.

Unlike video or audio signals, machine control signals are bidirectional. There are control messages in one direction and status messages in the other. One device is the *controlling* device and the other device (the VTR in the preceding example) is the *controlled* device.

When you create a route in a machine control router, it automatically sets the destination as the controlling device and the source as the controlled device. It helps to visualize the destination (the editor) as "acquiring" the source (the VTR).

The default setting in the machine control router page is that a router port is *dynamic*. What this means is that the router will make the port a controlling port or a controlled port according to what the *other* port in the router is: controlled or controlling. Internally, the port router swaps the Tx and Rx functions on the RJ-45 port connectors:

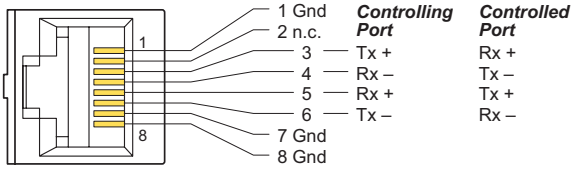

Figure 6. Internal Dynamic Port Operation

Dynamic mode works well for most applications. Other modes are available.

The Operator Interface—Control Panels

Although CR Series control panels are small, they are by no means limited. CRSC has rewritten the rule book, so to speak, on small router control. You can configure virtually every button on a control panel when it is mounted on a remote panel module. There are also standard button configurations available on the installation disk so you don't have to configure every button. Because they are configurable, they are flexible.

Figure 7. CR Series Control Panels (Mounted)

CRSC's 'Program Remote Panels' page displays a list of control panels in your network. To select a panel in your network, click the circular button in the 'Edit/Update' column of the list.

If you click 'Read Panel', CRSC displays a graphic representing the button configuration stored in the selected remote panel.

You can also create and save panel configurations off-line for future use.

Configuring a panel means (1) defining its button functions and (2) selecting panel operation modes.

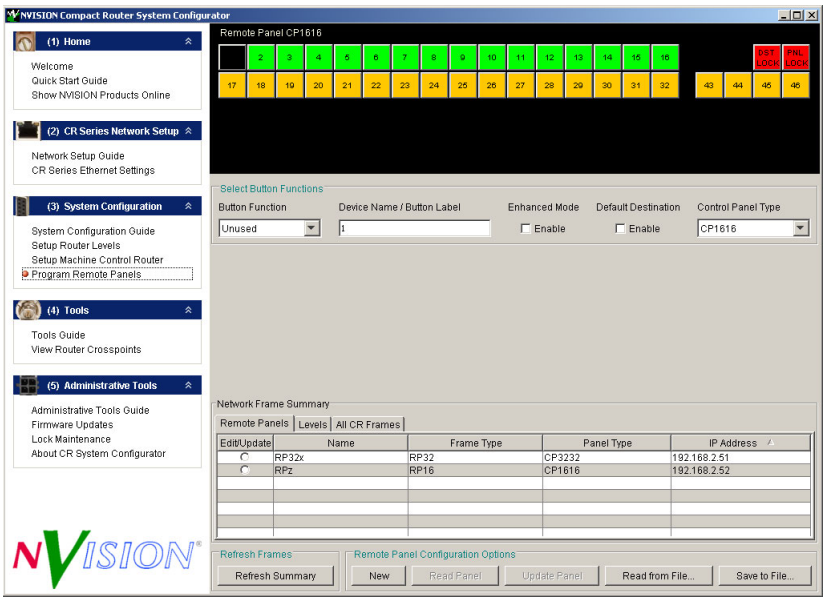

Figure 8. The CRSC 'Program Remote Panels' page

Button Definitions

Click any button to select it for editing. A pull-down list shows the available button function choices.

Sources and Destinations

If you define the button as a source or a destination, you'll want to enter a name in the 'Device Name/Button Label' box. This is not strictly necessary, but it will help you remember what the button represents. (It will become desirable, at some point, to create button legends to insert under the clear plastic button caps.)

A source or a destination device corresponds to one or more levels. You must specify those levels for the source or destination button. And you must specify an input port and an output port for each level. The levels will have previously been defined in the 'Setup Router Levels' page. The inputs and output ports that represent a source or destination will have been defined by the cabling at the back of the routers.

Enhanced panel mode affects the way operators use source and destination buttons. Besides making operation easier, enhanced mode also allows better utilization of the routers' input and output spaces. For example, consider a device that has only HD video and AES 1/2 digital audio in a compact router system that has four levels: HD video, SD video, AES 1/2 audio, and machine control.

In "standard" mode, all four levels would always switch (unless the operator deselects one or more levels). In any case, one or more of the ports on the un-needed levels would be wasted. Enhanced mode allows you to configure each source and destination using only the levels it needs, freeing ports for use elsewhere. Refer to *Panel Modes*, following, for more information on enhanced mode.

Salvos

A salvo is simply a list of "takes" that typically must be executed often. A salvo might, for example, switch a monitor wall to black at the end of a show, or route a set of tape machines to an edit bay.

When an operator presses a salvo button, the panel executes the takes in the list, in order.

When you create a salvo button, the panel configuration page displays a list where you enter the takes the salvo will execute. Note that a salvo entry is a (level, input, output) triple.

Levels

You can define buttons that enable or disable specific router levels. Under normal circumstances, this allows the operator to have level-by-level control when performing a take.

Level buttons allow the operator to change the level selection and in many cases to perform breakaway takes.

Panel Modes

The compact router panels have 2 modes of operation, standard and enhanced. When a panel is in standard mode, whether mounted on a remote panel module or a router, it operates as panels have since inception. When a panel is operates in enhanced mode, mounted to a remote panel module, the panel offers simplified control of device levels and an improved ability to show status at a glance.

Enhanced mode has been added to improve system level functioning and to simplify complex, multi-level operations. In enhanced mode, when a destination is selected, all sources and the associated levels routed to that destination become apparent on the control panel. The levels can then be toggled if the operator wishes to perform a breakaway. For example, if the operator has broken audio channels away from video, the control panel conveys this information to the operator using button LED color schemes.

Another control panel option is “Hold” vs. “No Hold.” This choice refers to the way the level buttons operate. Using the ‘Hold’ option is useful if you are constantly doing breakaways and would like to maintain the levels selection beyond a single take. The ‘No Hold’ option always returns status of all levels assigned to the selected destination after a take occurs or when you are simply getting status of your system destination by destination.

Other Topics

If you wish to configure panels “off-line,” choose the panel type you want to configure, proceed with the configuration, and then save the configuration in a file in your PC’s file system. You can retrieve and modify many configurations this way, and upload retrieved configurations to actual panels at any time.

Every panel has 2 lock buttons. A destination lock button protects selected destinations. A panel lock button prevents takes, salvos, and locks from being made at the panel itself.

For single-destination panels like the CP3201, configuring the single destination is done in CRSC. When you select the CP3201 control panel type for configuration, a phantom button representing the default destination appears. The phantom button should be configured for the appropriate destination that you would like the panel to control. This panel is a “button-per-source” panel meaning that each time you press a source button, a take occurs. This panel is useful in monitoring, QC, and other kinds of applications.

Some Examples to Whet Your Appetite

At the beginning of this application note, we presented 5 typical compact router applications. Here, we suggest how CRSC can provide solutions in those applications.

Application 1

In this scenario, the need to get a digital signal on air quickly meant early adoption of core routing technology. As a result, the core router does not presently meet all of the facility requirements.

In addition to SD and HD signals, a 19.39 Mb/s DVB-ASI signal must be routed as well as some 1080p equipment in the graphics department. A CR1616-3Gig or CR3232-3Gig router will easily handle all formats simultaneously. Because an external control system is already in place, using CRSC to edit the Ethernet settings to put the compact router on a subnet that the control system can access makes integration a simple one- or two-step process.

Similarly, CRSC could partition the compact router if the host control system does not support physical partitioning. Add source and destination device mnemonics to your existing control system configuration, with some panel updating, and you are done.

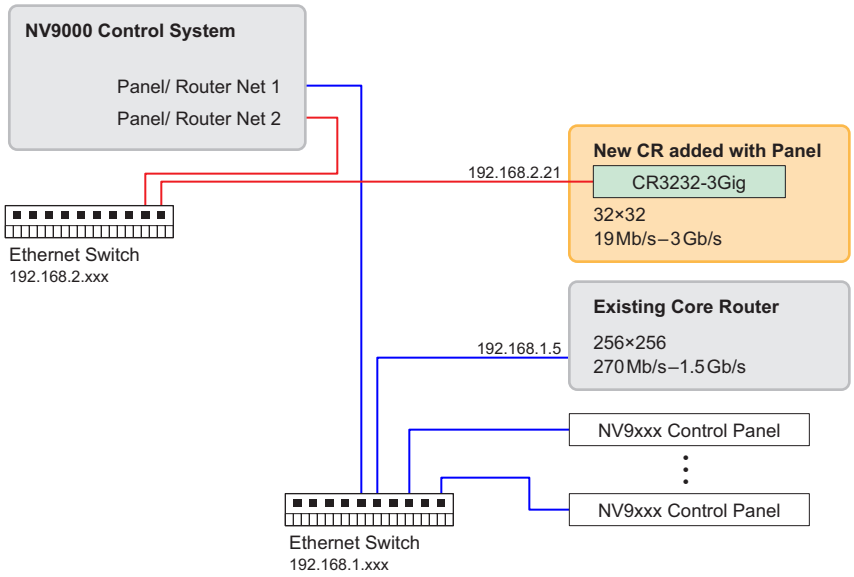

Figure 9. Application 1

Application 2

With your budget spent on a transmitter and an antenna, there is not much left to use for facility upgrades. Network HD programming, as well as some local content, must be switched to air. Using up-conversion to get your production room going means some modest digital routing must also be supported. After working up routing requirements, you find that you need a digital router in the range of 64×64, and three levels of 32×32 audio.

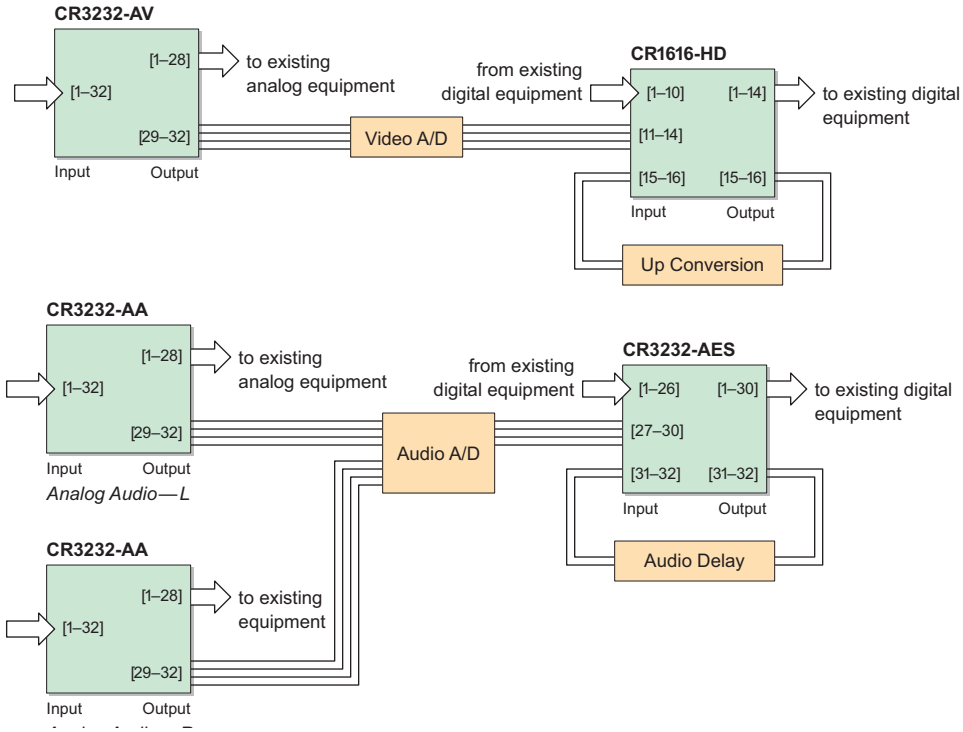

Figure 10. Application 2

Some analog video and audio routing is still required and your old analog core is too costly to maintain. An s NVISION series 128×128 frame populated 64×64 handles the digital video upgrade, and three CR3232-AES routers manage the audio. A CR3232-AV and CR3232-AA can support your existing analog needs. It ends up cheaper to buy these two CRs than just one year's maintenance costs on the old system.

Application 3

Moving audio/visual equipment back and forth on carts worked well enough when you had just a small number of clients, but now your facility is booked constantly and you need a way to increase efficiency and make better use of your A/V investment.

Using several CR3232-AV and CR3232-AA routers, you build a small core routing system, and connect all of your A/V gear to it. Each conference room is given access to half a dozen outputs from each router level and a local CP1616 panel for control. Salvos allow users to call up equipment profiles that route specific devices to projectors and monitors in each room.

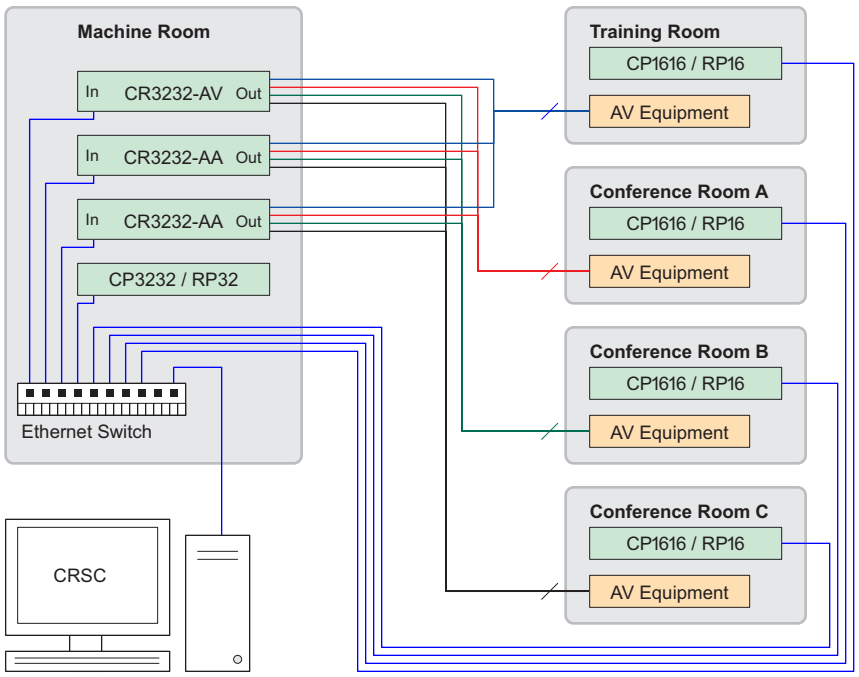

Figure 11. Application 3

A CP3232 set up as a master panel sets locks so that once a room is set up it cannot be changed, and allows you fix equipment allocation problems right from your office. The investment in routing lets you more fully utilize your equipment, allows your customers a high level of flexibility, and makes your facility one of the premier sites in your area.

Application 4

Any control room that must perform multiple differing functions will benefit from monitor wall reconfiguration. Source monitors, camera monitors, and studio monitors can be tailored to the specific job at hand. In most cases, one or two CR3232 routers of the appropriate format will get the job done.

One or two local compact router panels configured with salvos let operators set up monitoring quickly, while having the compact router also integrated with the facility's main control system permits engineering personnel to make changes on the fly. The CR Series uses a derivative of Miranda's NVISION Ethernet protocol (NVEP) and will communicate with most tally systems, providing UMD or IMD support.

Miranda has joined with Marshall Displays in a development effort that incorporates the Marshall IMD protocol into the NV9000 control system. Marshall multi-format LCDs and Miranda's CR Series routers, controlled through an NV9000 provide dynamic mnemonic update to the IMD system within the display.

Application 5

These are some ideas from customers who have used compact router products in other applications:

- ENG/Remote trucks

  A compact router is ideal as a small router to feed the backhaul link between an ENG truck and the studio. Deploying an HD compact router means that both HD and SD can be routed as needed. Having 16 destinations available allows a single router to support not only the backhaul signal but to perform internal routing for a small news edit bay, monitor feeds, camera tally, etc.

- Signal monitoring and QC

  Four compact router levels — one digital video level and three AES digital audio levels — provide a low-cost, highly flexible "video + 5.1 surround" QC station.

- Studio monitoring

  Large productions often require on-stage monitors to be switched during commercial breaks or during production. A compact router in the studio allows camera operators to switch monitoring as needed. The ability to lock to an external video reference means that "live" switches can be done with confidence. Other studio applications include studio audience monitors, floor monitoring, and camera tally.

- Audio control rooms

  Managing surround signals can be a headache if you to swap channels around or need only small islands of 5.1 channel audio support. Several levels of AES compact router (3 CRs running in "mono" mode) allow you to integrate multi-channel audio where needed with minimal cost and maximum flexibility. Using the new enhanced panel settings, you can set up a control panel to allow simple, easily managed sub-frame or mono routing, giving your audio operators unparalleled inter-channel routing options in an easy-to-understand form.

Conclusion

This application note has two purposes. First, to introduce the new Compact Router System Configurator (CRSC) and second, to provide some examples of where Miranda's CR Series products and CRSC can be used to solve some common routing problems.

Miranda hopes that the examples cited give you some idea of the flexibility these products can offer and some new avenues to explore when searching for routing solutions.