

# CR Series

Compact Routers and Control Panels

## User's Guide

UG1600-13

30 Sep 2014



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## Change History

Rev.	Date	ECO	Description	Approved
1.0	03 Apr 06	—	Initial Release	—
1.1	14 Nov 06	12390	Added material regarding -AES routers, 32x32 routers, network operation, 16x4 router, and 16x4 and 16x2 control panels. Corrected a few problems.	D. Cox
1.2	04 Jan 07	12440	Added material regarding -AV routers, remote panel modules, CrConfig (software), and compact router networks. Created button legend templates.	D. Cox
1.3	12 Jul 07	13355	Added material regarding analog audio routers, machine control routers, and "3Gig" routers. Automation is now possible.	D. Cox
1.4	19 Nov 08	14426	References the CRSC software. Includes new CR Series products. Misc. corrections.	D. Cox
1.5	30 Mar 09	15703	Format change.	D. Cox
1.6	12 Oct 09	16114	Added new CR Series products, NV9000 support.	D. Cox
2.0	22 Mar 10	16912	Added CQX series.	D. Cox
2.1	04 May 10	16993	Added ± 3-line buffer.	D. Cox
2.2	18 Aug 10	17186	Short addition regarding 3-line buffer.	D. Cox
2.3	30 Mar 12	17286	Added 3Gig routers	D. Cox
2.4	15 Nov 13	19037	Improvements to CQX series.	D.Cox
3.0	28 May 14	19241	Added new CR6400 family products.	D.Cox
3.1	03 Oct 14	19332	Phase 2 of CR6400 products.	D.Cox

## **FC** FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## **CE** Declaration of Conformance (CE)

All of the equipment described in this manual has been designed to conform with the required safety and emissions standards of the European Community. Products tested and verified to meet these standards are marked as required by law with the CE mark.

When shipped into member countries of the European Community, this equipment is accompanied by authentic copies of original Declarations of Conformance on file in Grass Valley offices in Grass Valley, California USA.

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## Software License Agreement and Warranty Information

Contact Grass Valley for details on the software license agreement and product warranty.

## Important Safeguards and Notices

This section provides important safety guidelines for operators and service personnel. Specific warnings and cautions appear throughout the manual where they apply. Please read and follow this important information, especially those instructions related to the risk of electric shock or injury to persons.

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### WARNING

Any instructions in this manual that require opening the equipment cover or enclosure are for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any service other than that contained in the operating instructions unless you are qualified to do so.

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## Restriction on Hazardous Substances (RoHs)

Grass Valley is in compliance with EU Directive RoHS 2002/95/EC governing the restricted use of certain hazardous substances and materials in products and in our manufacturing processes.

Grass Valley has a substantial program in place for RoHS compliance that includes significant investment in our manufacturing process, and a migration of Grass Valley product electronic components and structural materials to RoHS compliance.

It is our objective to maintain compliance with all relevant environmental and product regulatory requirements. Detailed information on specific products or on the RoHS program at Grass Valley is available from Grass Valley Customer Support at

1-800-719-1900 (toll-free) or  
1-530-265-1000 (outside the U.S.).

## Symbols and Their Meanings



The lightning flash with arrowhead symbol within an equilateral triangle alerts the user to the presence of dangerous voltages within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle alerts the user to the presence of important operating and maintenance/service instructions.



The Ground symbol represents a protective grounding terminal. Such a terminal must be connected to earth ground prior to making any other connections to the equipment.



The fuse symbol indicates that the fuse referenced in the text must be replaced with one having the ratings indicated.



The presence of this symbol in or on Grass Valley equipment means that it has been designed, tested and certified as complying with applicable Underwriter's Laboratory (USA) regulations and recommendations.



The presence of this symbol in or on Grass Valley equipment means that it has been designed, tested and certified as essentially complying with all applicable European Union (CE) regulations and recommendations.

## General Warnings

A warning indicates a possible hazard to personnel which may cause injury or death. Observe the following general warnings when using or working on this equipment:

- Heed all warnings on the unit and in the operating instructions.
- Do not use this equipment in or near water.
- This equipment is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting the equipment inputs or outputs.
- Route power cords and other cables so they are not likely to be damaged.
- Disconnect power before cleaning the equipment. Do not use liquid or aerosol cleaners; use only a damp cloth.
- Dangerous voltages may exist at several points in this equipment. To avoid injury, do not touch exposed connections and components while power is on.

- 
- Do not wear rings or wristwatches when troubleshooting high current circuits such as the power supplies.
  - To avoid fire hazard, use only the specified fuse(s) with the correct type number, voltage and current ratings as referenced in the appropriate locations in the service instructions or on the equipment. Always refer fuse replacements to qualified service personnel.
  - To avoid explosion, do not operate this equipment in an explosive atmosphere.
  - Have qualified service personnel perform safety checks after any service.

## **General Cautions**

A caution indicates a possible hazard to equipment that could result in equipment damage. Observe the following cautions when operating or working on this equipment:

- When installing this equipment, do not attach the power cord to building surfaces.
- To prevent damage to equipment when replacing fuses, locate and correct the problem that caused the fuse to blow before re-applying power.
- Use only the specified replacement parts.
- Follow static precautions at all times when handling this equipment.
- This product should only be powered as described in the manual. To prevent equipment damage, select the proper line voltage on the power supply(ies) as described in the installation documentation.
- To prevent damage to the equipment, read the instructions in the equipment manual for proper input voltage range selection.
- Some products include a backup battery. There is a risk of explosion if the battery is replaced by a battery of an incorrect type. Dispose of batteries according to instructions.
- Products that have (1) no on/off switch and (2) use an external power supply must be installed in proximity to a main power outlet that is easily accessible.

# toc

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# 1

## Preface

Chapter 1 is a brief introduction to the User's Guide.

### Topics

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## Chapter Structure

The following chapters provide detailed instructions for all aspects of Compact Router operations:

- Chapter 1, [Preface](#), (this chapter) outlines easy ways to use this guide and provides a list of terms and conventions.
- Chapter 2, [Introduction](#), provides a functional description of the products.
- Chapter 3, [Installation](#), provides installation and connection instructions.
- Chapter 4, [Configuration](#), provides configuration instructions.
- Chapter 5, [Operating a Stand-Alone Router](#), provides operating instructions.
- Chapter 11, [Maintenance](#), provides maintenance and trouble-shooting instructions.
- Chapter 12, [Technical Details](#), provides electrical, video, audio, mechanical, and environmental specifications, product drawings, and default settings.
- Chapter 13, [Misc. Topics](#), presents a glossary, miscellaneous instructions and information, and a brief discussion of NV9000 router control systems.
- An [Index](#) and [Glossary](#) are also provided for your reference.

Please also refer to the *CR6400 Family User's Guide* for complete information regarding CR6400 products.

Please also refer to the *CRSC User's Guide* for complete information regarding CRSC.

## The PDF Document

This guide is provided in PDF format, allowing you to use Acrobat's "bookmarks" to navigate to any desired location. You can also easily print a hardcopy. Please note:

- Use the Table of Contents or the bookmarks page to jump to any desired section.
- Many hyperlinks are provided within the chapters.
- Use the Index to jump to specific topics within a chapter. Each page number in the index is a hyperlink.

- Use Acrobat's 'Go to Previous View' and 'Go to Next View' buttons to retrace your complete navigational path.
- Use the 'First Page', 'Previous Page', and 'Next Page', and 'Last Page' buttons to go to the first, previous, next, or last page within a PDF file.

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#### Note

To display the navigation buttons, right-click the Tool Bar area, and check 'Navigation'.

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- Use Acrobat's extensive search capabilities, such as the 'Find' tool and 'Search' tool to perform comprehensive searches as required.

## Terms, Conventions and Abbreviations

The following conventions are used throughout this guide:

- The symbol **p** denotes either an example or a special message.
- Entries written in **bold-face** or Capital Letters denote physical control panel buttons, GUI buttons, or menu items.

Click **Apply** to ...

Press the SRC 12 button ...

- Button names, menu names, and certain other names are enclosed in single quotation marks. Double quotation marks enclose informal or colloquial expressions.

The following terms and abbreviations are used throughout this guide:

- The term "control panel" refers to the CR Series *control* panels (such as the CP3232), and to NV96xx control panels.
- The term "router" refers to any CR Series compact router, with or without its control panel. If a distinction is required, it will be made.
- The term "remote panel module" refers to the CR Series RP16 and RP32. The legend on each of those products is "Remote Panel Module." The remote panel modules are also called *remote panel expansion kits* in the sales literature.
- The term "remote panel" refers to a control panel mounted on a remote panel module.
- The term "captive panel" refers to a control panel mounted on a router. They are not configurable and do not have the capabilities of remote panels, but are useful for some purposes.
- The term "frame" refers to any CR Series router or remote panel module.
- "High tally" means that a button is brightly illuminated.
- "Low tally" means that a button is illuminated at low intensity. Most buttons assume a low tally state until selected.
- The terms "machine control router" and "port router" have the same meaning.
- The term "3Gig" describes devices capable of operating at 2.97 Gb/s or 2.966 Gb/s<sup>1</sup> (and also at HD and SD rates).
- The term CRSC refers to configuration software, the Compact Router System Configurator.
- The term "CQX" represents the "clean and quiet" compact routers and panels.

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# 2 Introduction

Chapter 2 provides a functional description of the products.

## Topics

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## Overview

### Summary

CR Series products include 1RU and 2RU routers, control panels, and “remote panel modules.” The CR Series includes video and audio routers in several formats, and machine control routers.

These are the 1RU compact routers and matching control panels:

1RU Routers		Corresponding 1RU Control Panel	
CR0808-3Gig	8×8, “3Gig” digital video	CP0808	8×8, with 6 function buttons
CR0808-HD	8×8, high definition digital video		
CR0808-SD	8×8, standard definition digital video		
CR0808-AES	8×8, AES3id digital audio		
CR0808-HD-NR	8×8, HD video, non-reclocking		
CR0808-SD-NR	8×8, SD video, non-reclocking		
CR0808-AA	8×8, analog audio	CP1616	16×16, with 6 function buttons
CR0808-AV	8×8, analog video		
CR1616-3Gig	16×16, “3Gig” digital video		
CR1616-HD	16×16, high definition digital video		
CR1616-SD	16×16, standard definition digital video		
CR1616-AES	16×16, AES3id digital audio		
CR16-PR	16-port machine control		
CR1616-HD-NR	16×16, HD video, non-reclocking		
CR1616-SD-NR	16×16, SD video, non-reclocking		
CR1616-AA	16×16, analog audio		
CR1616-AV	16×16, analog video		

CR1604-3Gig CR1604-HD CR1604-SD CR1604-AES	16x4, "3Gig" digital video 16x4, high definition digital video 16x4, standard definition digital video 16x4, AES3id digital audio	CP1604 CP1602	16x4, with 6 function buttons 16x2, with 6 function buttons
CR1604-HD-NR CR1604-SD-NR	16x4, HD video, non-reclocking 16x4, SD video, non-reclocking		
CR1604-AA CR1604-AV	16x4, analog audio 16x4, analog video		
CR1602-3Gig-CQX CR1602-HD-CQX CR1602-SD-CQX	16x2, "3Gig" digital video 16x2, high definition digital video 16x2, standard definition digital video	CP1602-CQX	16 x (2 + 6), with 4 transition type buttons, 3 transition rate buttons, and 7 function buttons (5 undefined).

These are the 2RU compact routers and matching control panels:

2RU Routers		Corresponding 2RU Control Panel	
CR3232-3Gig CR3232-HD CR3232-SD CR3232-AES	32x32, "3Gig" digital video 32x32, high definition digital video 32x32, standard definition digital video 32x32, AES3id digital audio	CP3232	32x32, with 12 function buttons
CR32-PR	32-port machine control		
CR3232-HD-NR CR3232-SD-NR	32x32, HD video, non-reclocking 32x32, SD video, non-reclocking		
CR3232-AA CR3232-AV	32x32, analog audio 32x32, analog video		
CR3204-3Gig CR3204-HD CR3204-SD CR3204-AES	32x4, "3Gig" digital video 32x4, high definition digital video 32x4, standard definition digital video 32x4, AES3id digital audio	CP3204	32x4, with 12 function buttons
CR3204-HD-NR CR3204-SD-NR	32x4, HD video, non-reclocking 32x4, SD video, non-reclocking		
CR3204-AA CR3204-AV	32x4, analog audio 32x4, analog video		
CR6464-3Gig CR6464-AES	64x64 video router 64x64 AES3id router	CP6464	64x64, with 12 function buttons

The CP3201 (a 1RU panel) is special case not listed in the tables above: it controls 32 sources and 1 destination. It does not "correspond" to any router and is used only in a [CRSC Network](#). (See page 75.)

The CR6400 family products (the CR6464-3Gig, CR6464-AES, and the CP6464) are designed to work together but they do interoperate with other routers and panels in the CR Series.

These are the remote panel modules:

Remote Panel Modules		Corresponding Control Panel	
RP16	1RU	CP1616, CP1604, CP1602, CP3201	16x16, 16x4, 16x2, with 6 function buttons. (The CP3201 is a 1RU panel.)
RP32	2RU	CP3232, CP3204	32x32, 32x4 with 12 function buttons.



## Routers

The 16×16 routers can switch any of 16 inputs to any of 16 outputs and the 32×32 routers can switch any of 32 inputs to any of 32 outputs. The 8×8 routers switch 8 inputs to 8 outputs. The 16×4 routers switch 16 inputs to 4 outputs. The 32×4 routers switch 32 inputs to 4 outputs.

## Machine Control Routers

With the exception of the machine control routers (CR16-PR and CR32-PR), all the compact routers are X/Y routers having  $n \times m$  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. An input can be connected to at most one output. (The connections are RS-422 and bidirectional, typically with commands in one direction and responses in the other direction.)

## “Clean and Quiet” Routers

Each of the 3 “clean and quiet” (CQX) router models routes 16 inputs to 2 “clean and quiet” outputs or to 6 auxiliary (normal) outputs. For the clean and quiet outputs, the router performs smooth transitions. The transitions are governed by transition type and transition rate, selectable on the CP1602-CQX control panel. The CQX routers also provide 2 bypass inputs. The 2 clean and quiet outputs switch to the bypass inputs if the router loses power. There are no 2RU clean and quiet routers at present. The CQX routers also provide a GPIO connector, supporting 16 inputs and 4 outputs. The inputs each select one of the video inputs for CQ output 1 and the outputs signal alarms and status. See [GPIO Connections for CQX Digital Video Routers](#) on page 129 for details.

## CR6400 Routers

The CR6400 family is a unique subset of the Grass Valley's CR series of compact routers: the family's routers have a larger switching matrix (64×64) and modular construction. The family includes two routers and a control panel.

- CR6464-3Gig — a 2RU 64×64 video router
- CR6464-AES — a 2RU 64×64 AES router
- CP6464 — a 2RU 64×64 control panel

The CR6400 routers have removable control cards, removable crosspoint cards, and a removable fan tray. Because they are removable, they are field-serviceable.

Each router has 4 removable I/O cards. If a router is populated with one or more AES cards, it is considered a CR6464-AES. If a router is populated with one or more 3Gig cards, it is considered a CR6464-3Gig. If a router has no I/O cards, it is considered to be of “undefined” type.

The CR6400 family products work together may be mixed (on the same subnet) with other CR Series routers and panels.

## Control Panels

A CR Series control panel mounts on the front of a router or on the front of a remote panel module and provides direct visual and tactile control of the router or routers connected to the remote panel module. (You can install or uninstall one easily in a few seconds.) However, any of

the routers can also operate without a control panel, under network control or through automation.

The CP3201 is special case: it is a 1 RU panel that controls 32 sources and 1 destination. It does not mount on the front of a router and is used only in a [CRSC Network](#). (See page 75.)

The CP1602-CQX is also a special case: it is a 1RU control panel used in conjunction with any of the CQX routers. This panel has 16 source buttons, 2 “clean and quiet” destination buttons, 6 auxiliary destination buttons, 4 transition type buttons, 3 transition rate buttons, and 7 function buttons (5 undefined).

The CP6464 mounts on CR6400 routers and controls the CR6400 directly. The CP6464 can also mount on an RP32 (a 2RU remote panel module) and control a network of compact routers.

## Remote Panel Modules

A “remote panel module” is a device that sends control messages to a network of routers (and receives status messages from the routers in the network). A remote panel module receives take and lock commands from an attached control panel and must have a control panel attached to be useful. We say the module is “remote” because it and its control panel can be located apart from the routers (from a few inches to several hundred meters, subject to cable limitations).

There are two remote panel modules available:

- RP16 (1RU)
- RP32 (2RU)

A remote panel module can be configured to operate (with its mounted control panel) as either (1) a CRSC remote panel or (2) an NV9000 panel in a system controlled by an NV9000 router control system.

When it is set up for use as a CRSC panel, it is configured in CRSC. When it is set up for use as an NV9000 panel, it must be configured in NV9000-SE Utilities.

- ▲ CRSC is the Compact Router System Configurator. See [CRSC](#) on page 45 for information.
- ▲ Please also refer to the *NV9000-SE Utilities User's Guide*.

## Usage

There are several different ways to use compact routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A network of stand-alone routers, possibly with remote panels, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single stand-alone CQX router with a “captive” CQX control panel or with automation.
- A CQX router with a remote CQX control panel.
- ▲ A *captive* panel is one attached directly to a router. A *remote* panel is one mounted on a remote panel module.
- ▲ Automation (control of the routers through their serial ports) is left to the customer.

Routers and remote panel modules come from the factory ready for stand-alone operation. If they are to be used either in a CRSC network or in an NV9000 network, they must be configured for such use. Once configured, they must be reset if they are to work in stand-alone mode.

A remote panel module must be configured either for a CRSC network, an NV9000 network, or stand-alone mode. These configuration modes are not compatible.

### Stand-Alone Routers

Figure 2-1 compares a stand-alone router with a captive panel to a stand-alone router network with remote panel modules:

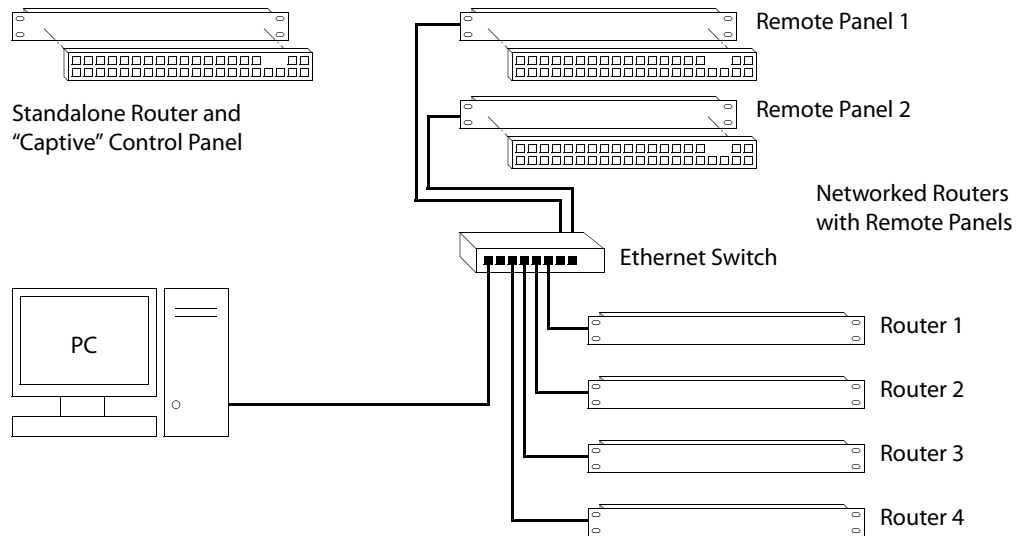


Fig. 2-1: Standalone Router vs. a Network of Routers

### CRSC Network

A CRSC network has the same topology as a stand-alone network (shown in Figure 2-1), except (1) the routers and remote panel modules have been configured under CRSC which provides a more elegant solution to system design.

CRSC networks *do* support the use of CR6400 routers and panels.

### NV9000 Network

An NV9000 network supports a larger number of routers. Commands issue from the remote panels to the NV9000 which then dispatches the instructions to the routers. The routers return status to the NV9000 which in turn relays the status to the remote panels.

▲ An NV9000 system can also receive commands from many other control panel types.

CR Series routers can be used with an NV9000 router control system. The NV9000 system extends the capabilities of the compact routers.

An NV9000 network is constructed and operated according to the requirements of the NV9000 router control system. Configuration and control of the routers is entirely within the scope of NV9000-SE Utilities, although you can use CRSC to designate the IP addresses of the compact routers. See [NV9000 Router Control Systems](#) (page 178) and [Compact Routers in an NV9000 System](#) (page 179).

Figure 2-2 shows a sample NV9000 network, one of several possible topologies:

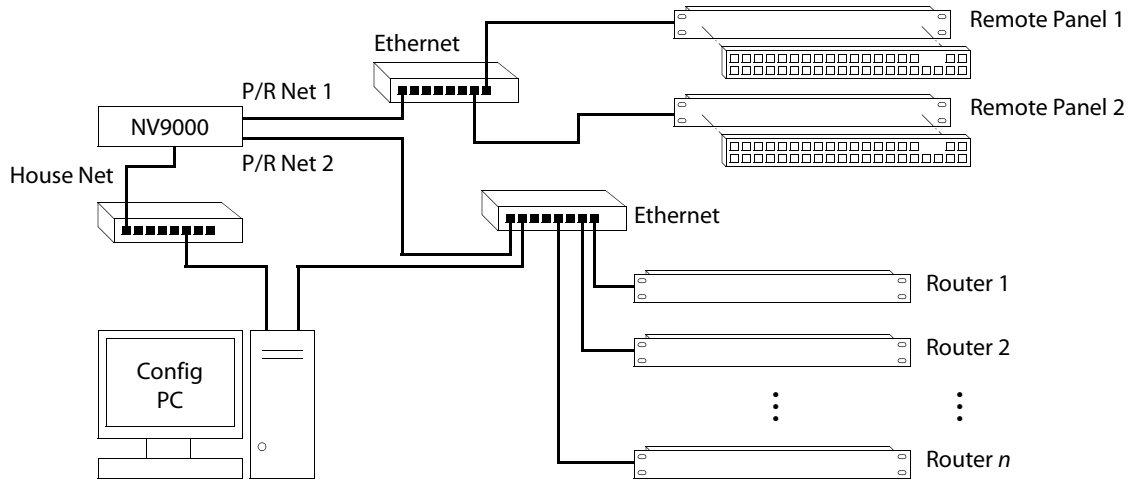


Fig. 2-2: NV9000 Network of Routers

### CQX Networks

Figure 2-3 shows the ways a “clean and quiet” router can be connected:

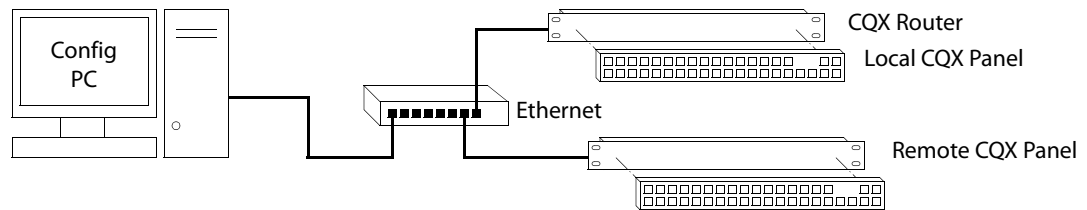


Fig. 2-3: CQX Network

At present, the CQX connections are limited. One CQX router with a local (or captive) CQX panel or a remote CQX panel (or both) can exist on any subnet. (You can have more than one subnet, however.)

At present there is little to configure other than the IP address of the router (and possibly the remote panel module).

### CR6400 Stand-Alone Networks

A CR6400 router can operate in stand-alone mode (also known as “default” mode) either as a single router or in a small network.

Figure 2-4 compares a stand-alone CR6400 router with a captive panel to a stand-alone router network with remote panel modules:

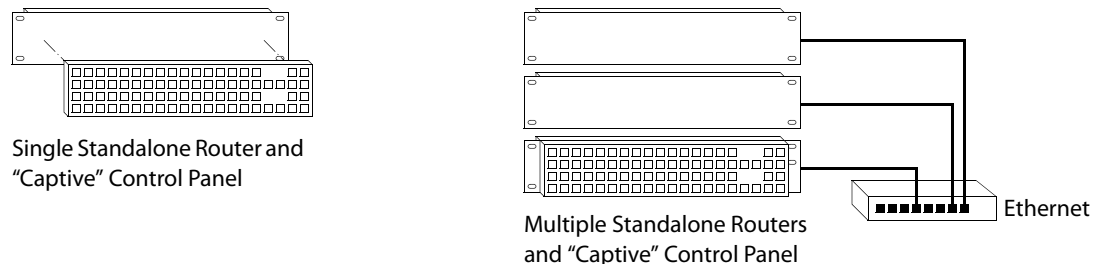


Fig. 2-4: CR6400 Usage

Up to 4 CR6400 routers may be controlled with a single CP6464.

## Software

CRSC (Compact Router System Configurator) is a configuration and monitoring tool for compact routers and remote panels. Refer to the *CRSC User's Guide* for details.

## Benefits

The CR Series Compact Routers offer these benefits:

- Grass Valley performance and quality.
- Very simple operation.
- Low cost.
- Small form factor.
- Easy migration to larger systems.

## The Routers

### CR6400 Routers

The CR6400 routers are 2RU and about 10" (254 mm) deep. The 2 models in the family are visually identical, except for the legend on the I/O cards (3Gig or AES) at the rear.

Figures 2-7 and 2-6 show front and rear views of the CR6400 routers.



Fig. 2-5: Front View of the CR6400 Digital Router

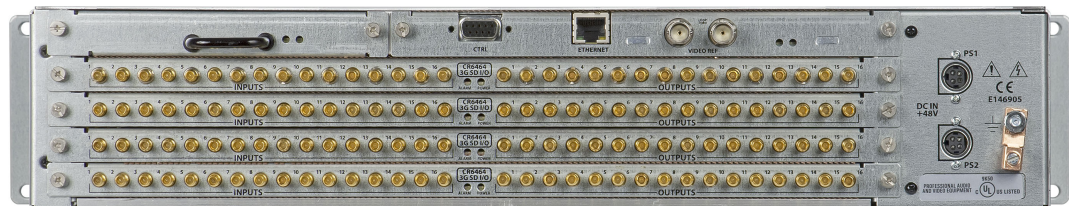


Fig. 2-6: Rear View of the CR6400 Router (CR6464-3Gig shown)

### Other CR Series Routers

The routers are slim (35–57 mm or 1.38"–2.25") and mechanically similar, differing principally in the number and type of connectors, and of course, in the signal type supported. The fronts of all the 1RU routers are the same except for their legends and the fronts of all the 2RU routers are the same except for their legends.

The 3Gig, HD, SD, AES, and analog video routers have BNC connectors. The analog audio routers have DB25 connectors (and fans). The machine control routers have RJ-45 connectors.



Figures 2-7 through 2-17 show front and rear views of the routers.



Fig. 2-7: Front View of the CR1616-SD Digital Video Router



Fig. 2-8: Rear View of the 16x16 3Gig, HD, SD, or AES Routers

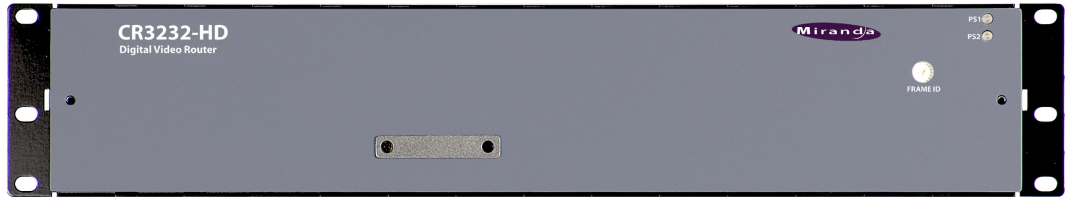


Fig. 2-9: Front View of the CR3232-HD Digital Video Router



Fig. 2-10: Rear View of the 32x32 3Gig, HD, SD, or AES Routers



Fig. 2-11: Rear View of the CR1616-AV Analog Video Router

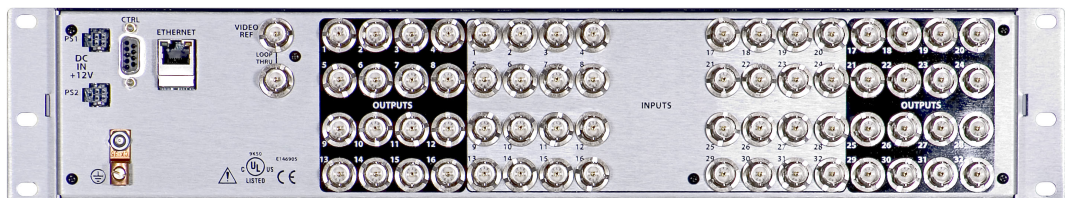


Fig. 2-12: Rear View of the CR3232-AV Analog Video Router



Fig. 2-13: Rear View of the CR1616-AA Analog Audio Router



Fig. 2-14: Rear View of the CR3232-AA Analog Audio Router



Fig. 2-15: Rear View of the CR16-PR Machine Control Router

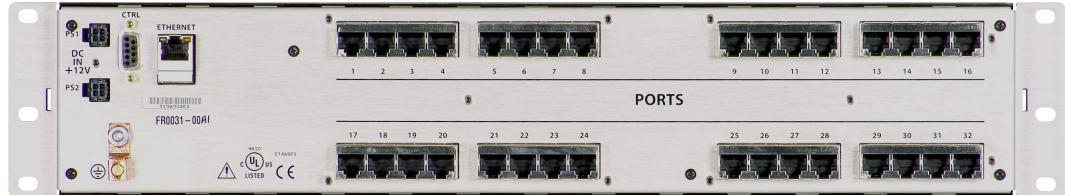


Fig. 2-16: Rear View of the CR32-PR Machine Control Router



Fig. 2-17: Rear View of the 16x2 CQX Routers (3Gig, HD, or SD)

Some routers (e.g., the CR3204-AA or the CR0808-3Gig) have fewer input or output connectors than shown here.

All compact routers save their state in non-volatile memory. Thus, if a power loss occurs, a router can recover almost instantly. All compact routers require a few seconds to initialize.

All compact routers have an serial port (DE9, RS-422 or RS-485).

All compact routers, including CR6400 routers, but not machine control routers, accept these video reference rates:

Composite	HD Tri-level		
525i / 59.94 (NTSC)	720p / 23.98	1080i / 47.95	1080p / 23.98
	720p / 24	1080i / 48	1080p / 24
625i / 50 (PAL)	720p / 25	1080i / 50	1080p / 25
	720p / 29.97	1080i / 59.94	1080p / 29.97
	720p / 30	1080i / 60	1080p / 30
	720p / 50		1080p / 50
	720p / 59.94		1080p / 59.94
	720p / 60		1080p / 60

Machine control routers do not receive video reference signals.

## Digital Video Routers

(See [CQX Video Routers](#) on page 13 for a discussion of the CQX routers.)

(See [CR6400 Routers](#) on page 16 for a discussion of the CR6400 routers.)

Other digital video routers are discussed here.

The 1RU digital video routers have 16×16, 16×4, or 8×8 crosspoint matrices, depending on the model. The 2RU digital video routers have either 32×32 or 32×4 crosspoint matrices.

Figure 2-18 shows a simplified view of the digital video router:

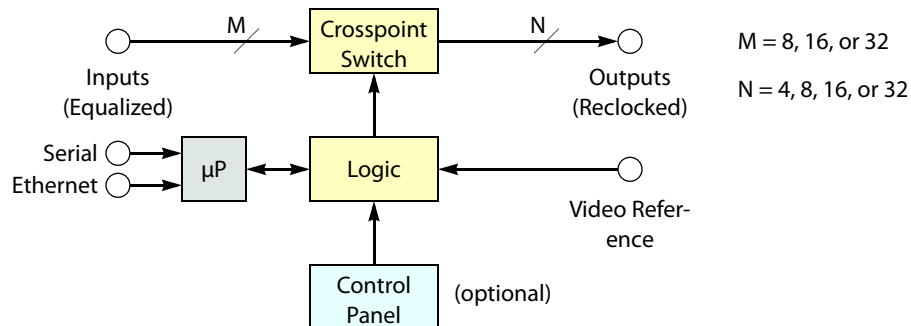


Fig. 2-18: Block Diagram of the Digital Video Router

The video routers perform input equalization and, except for the -NR models, perform reclocking of outputs. The -NR models do not perform reclocking. Router outputs are switched in sync with an external video reference if it is present.

All digital video routers accept bi-level or tri-level video references (sync) and switch according to SMPTE RP168-2002.

## 3Gig and HD Video Routers

All of the “3Gig” routers support 2.966Gb/s, and 2.97Gb/s video rates as well as a number of HD bit rates and formats. The 3Gig routers reclock at 270 Mb/s, 1.483Gb/s, 1.485 Gb/s, 2.966Gb/s, and 2.97Gb/s. The 3Gig routers bypass re-clocking for other rates. Video references must be nominally 800mV p-p and bi-level or tri-level in nature.

All of the “HD” routers are SWB (super wide band) routers: they support a wide range of SD and HD bit rates and formats, from 10Mbps to 1.5Gbps. With the exception of the -NR routers, the HD routers reclock at 143, 177, 270, 360, and 540Mb/s and 1.483 and 1.485 Gb/s and bypass re-clocking for other rates. Video references must be nominally 800mV p-p and bi-level or tri-level in nature. The HD routers support DVB-ASI signals.

## SD Video Routers

All of the “SD” routers support a wide range of SD serial data rates from 10Mb/s to 540MB/s. With the exception of the -NR routers, the SD routers reclock at 143, 177, 270, 360, and 540Mb/s. The SD routers support DVB-ASI signals.

## NR Video Routers

The HD and SD routers are available in non-reclocking models, such as the CR1616-HD-NR and CR3204-SD-NR. These models are less expensive than the models that have reclocking circuitry and work well with relatively noise-free signals. The reclocking models give better performance in noisy environments.



## Digital Video Formats

The digital video routers (other than CQX routers) perform video processing for these rates:

Video Format	Bit Rate	Remarks
1080p, 60 Hz	2.97 Gb/s	3Gig
1080p, 59.94 Hz	2.96 Gb/s	
1080p, 30 Hz	2.97 Gb/s	
1080p, 29.97 Hz	2.96 Gb/s	
1080p, 25 Hz	2.97 Gb/s	
1080p, 24 Hz	2.97 Gb/s	
1080p, 23.98 Hz	2.96 Gb/s	
1080i, 60 Hz	1.485 Gb/s	HD
1080i, 59.94 Hz	1.483 Gb/s	
1080i, 50 Hz	1.485 Gb/s	
1080psf, 30 Hz	1.485 Gb/s	
1080psf, 29.97 Hz	1.483 Gb/s	
1080psf, 24 Hz	1.485 Gb/s	
1080psf, 23.98 Hz	1.483 Gb/s	
720p, 60 Hz	1.485 Gb/s	
720p, 59.94 Hz	1.483 Gb/s	
720p, 50 Hz	1.485 Gb/s	
720p, 30 Hz	1.485 Gb/s	
720p, 29.97 Hz	1.483 Gb/s	
720p, 25 Hz	1.485 Gb/s	
720p, 24 Hz	1.485 Gb/s	
720p, 23.98 Hz	1.483 Gb/s	
625i, 50 Hz	270 Mb/s	SD
525i, 59.94 Hz	270 Mb/s	

The 3Gig routers can receive all rates listed for HD and SD. The HD routers can also receive video at SD rates.

## CQX Video Routers

These 1RU "clean and quiet" video routers switch 16 inputs to 2 "clean and quiet" outputs and 6 auxiliary outputs.

The CQX routers have two crosspoint matrices. The first crosspoint routes 16 normal inputs either to an internal mixer or to the second crosspoint matrix.

The mixer has 2 channels. Each channel mixes two inputs and produces an internal "clean" output. One of the inputs is the signal previously routed to that channel and the other input is the signal that *will be* routed to that channel. The mixer produces the transition between the previous input and the next input according to the transition type and transition rate currently selected (at a control panel) for the router.

For the SD and HD CQX routers, each input supports video plus 16 embedded audio channels. The mixer transitions both the video and the audio without artifacts.

The 3Gig router supports both level A and level B of the SMPTE 425M standard. The mixer transitions signals of level A, at 1080p, video and audio without artifacts. It handles level B—two 1080i signals in one stream—somewhat differently. It mixes the 16 audio channels of “link A” (from the two inputs) but passes the 16 audio channels of link B (from the two inputs) through to the output unmixed. “Link B” will undergo a cut transition with possible audio artifacts. Although audio for Link B is not processed and undergoes a cut transition, video for Link B is mixed according to the transition type and rate selected on the CQX control panel.

▲ The 3Gig routers do not accept level B’s 2×720p signals at present.

The second crosspoint matrix receives internal signals and produces the CQX outputs 1 and 2 and the 6 auxiliary outputs (which are normal outputs). A multiplexer selects either the clean output or the emergency bypass input. The emergency bypass input is selected only when power fails. (The multiplexer is controlled by a relay that switches to its relaxed position when power fails.)

The router has 16 normal input BNCs, 2 bypass input BNCs, 2 CQX output BNCs, and 6 aux output BNCs.

Figure 2-19 shows a simplified view of the CQX digital video router:

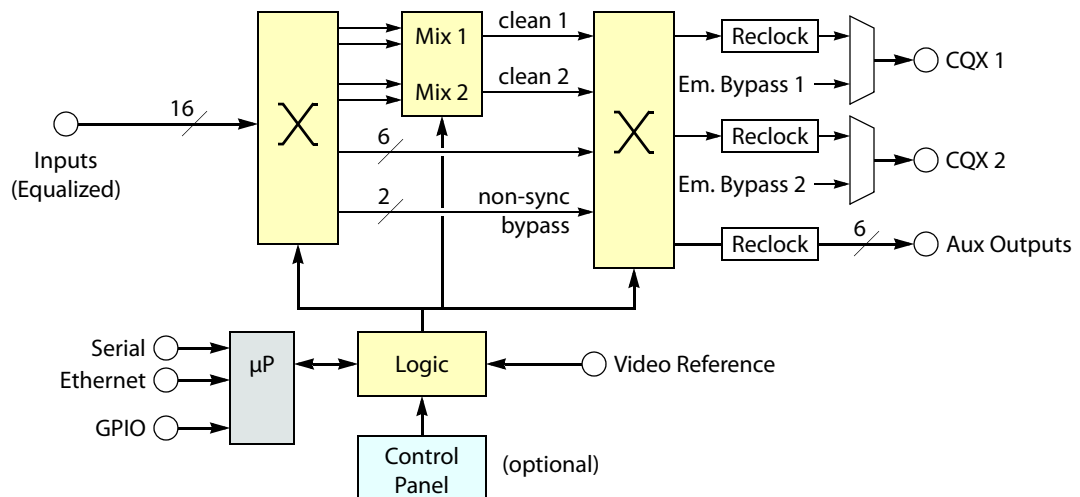


Fig. 2-19: Block Diagram of the CQX Digital Video Router

The video routers perform input equalization and perform reclocking of outputs. Router outputs are switched in sync with an external video reference if it is present. The video reference also provides sync for embedded audio.

All CQX video routers accept bi-level or tri-level video references (sync) and switch according to SMPTE RP168-2002.

The CQX video routers also provide a bypass path for non-synchronous input signals. If the two sources chosen for a clean and quiet switch are not of the same format, are off-rate, are not at the same frame rate as the video reference, or do not meet the timing window ( $\pm 3$  lines), the video processor enters non-sync bypass mode where the source signal bypasses the video processor and goes straight to the outputs. Thus, the clean and quiet output behaves like an aux output in which there is no video or audio processing—with no transition processing. Switches

still occur at the specified switchpoint for the video reference, but they will not be “clean and quiet.”

However, if there is no video reference present, the CQX does the cut to the new source as soon as it receives the command from the control panel and does not wait for the switchpoint.

Where one or both of the sources is off-rate or at a frame rate different from that of the video reference, the output will bypass the video processor.

If a clean and quiet output is in a non-sync state but conditions change so that a clean switch is possible, the processor waits for one frame of video before switching to processed video to ensure that the processed video has enough time to pass through the video processing path.

The CQX video routers have a removable fan unit. The fan unit is not visible when a CQX panel is mounted on the router.

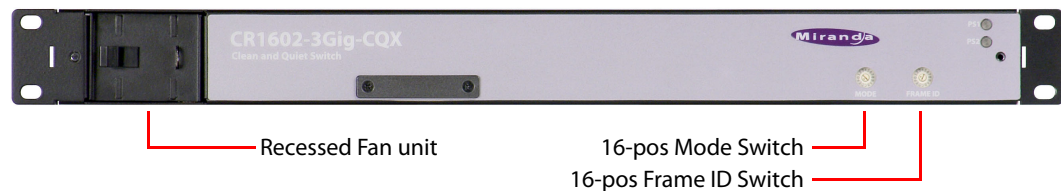


Fig. 2-20: Front View of the CQX Video Router

Customers should have no reason to remove the fan unit.

The CQX video routers have a “mode” switch in addition to the 16-position frame ID switch. Both are 16-position rotary switches that turn with a small screwdriver. The “mode” switch configures the video format of the router. See [CQX Routers](#) on page 81 for details.

Set the rotary switch to a position in the range 0–9, A, B, C, or D, according to this table:

Setting	Format	Setting	Format	
0	1080i, 59.94 or 60 1080p, 29.97 or 30 1080psf, 29.97 or 30	6	1080p, 59.94 or 60	<i>Switch positions 6 and 7 correspond to video according to SMPTE 425 level A.</i>
1	1080i, 50 1080p, 25 1080psf, 25	7	1080p, 50	
2	525i, 59.94	8	2 × 1080i, 59.94 or 60	<i>Switch positions 8 and 9 correspond to video according to SMPTE 425 level B.</i>
3	625i, 50	9	2 × 1080i, 50	
4	720p, 59.94 or 60	A	720p, 29.97 or 30	
5	720p, 50	B	720p, 25	
		C	720p, 23.98 or 24	
		D	1080p, 23.98 or 24, 1080psf, 23.98 or 24	
		E	<i>reserved</i>	
		F	<i>reserved</i>	

The default is 1080i, 59.94 Hz (switch setting 0). Positions E and F are not valid positions.

Where a switch setting supports multiple formats, the format is governed by the video reference applied to the router and must be compatible with that reference format.

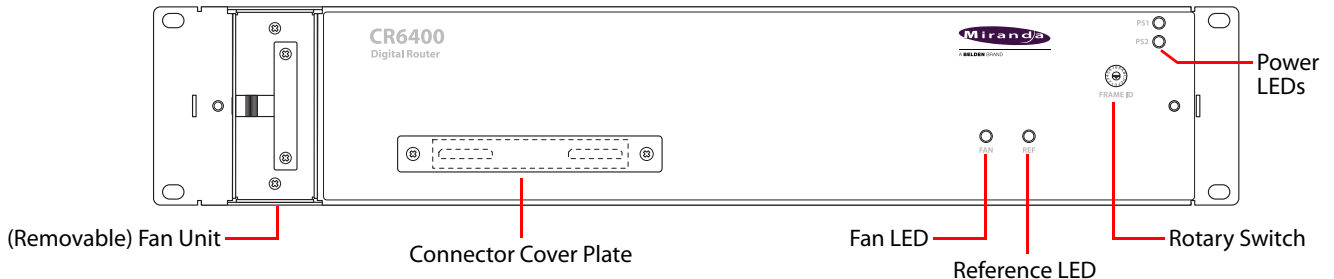
The CQX routers enter non-sync bypass mode for signals at other rates.

- ▲ When a control panel is mounted on a router or remote panel module, it conceals the rotary switch. You must remove the control panel when you are setting the rotary switch.
- ▲ Every time you make a switch change, power-cycle the router or remote panel module.

## CR6400 Routers

**Note:** the *CR6400 Family Users Guide* offers complete detail.

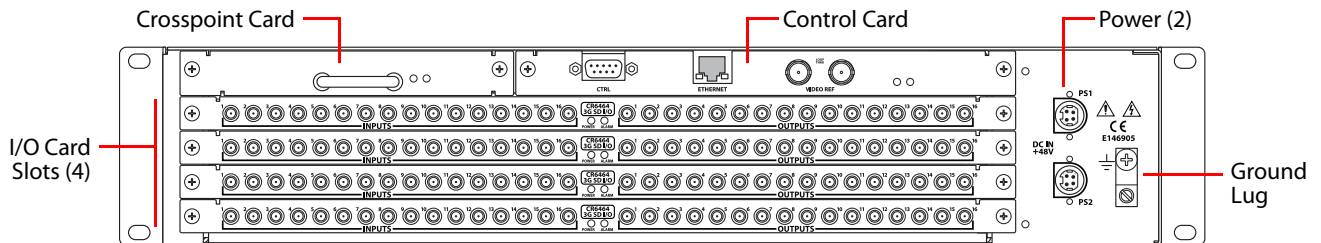
The CR Series routers are 2RU routers. They are about 10" deep to accommodate removable I/O cards. This is a front view of the router:



The CR6464-3Gig and the CR6464-AES routers have the same features at the front. The two routers are distinguished, at the rear, by the labeling on their I/O cards.

The router's fan module is removable through the front of the router.

At the rear, the CR Series routers have 4 slots for removable I/O cards, and slots for a crosspoint card and a control card (also called a CPU card).



Each I/O card has 32 ports. There are 16 input ports on the left (as you face the rear of the router) and 16 outputs on the right. The connectors for both the 3Gig card and the AES card are DIN 1.0/2.3 connectors (which we usually call "coax" connectors).

The port numbering at the rear of the CR6400 routers is simple:

Input																Output															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

It is 1–64, top-to-bottom, on the left for inputs and 1–64, top-to-bottom, on the right for outputs.

At this revision, the router must contain only 3Gig cards or only AES cards. It may contain from 1 to 4 cards. If the router is populated with 3Gig cards, the router is considered a CR6464-3Gig and switches video. If the router is populated with AES cards, the router is considered a CR6464-AES and switches audio. A router having no cards is considered to be of "undefined" type.

Figure 2-18 shows a simplified block diagram of a CR Series router:

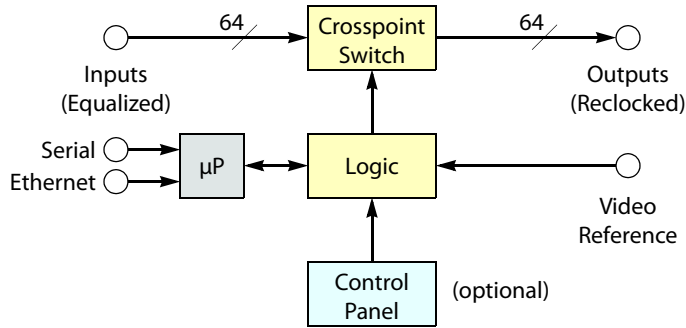


Fig. 2-21: Block Diagram of the CR Series

### Analog Video Routers

The 1RU analog video routers have 16×16, 16×4, or 8×8 crosspoints. The 2RU analog video routers have either 32×32 or 32×4 crosspoints.

Figure 2-22 shows a simplified view of an analog video router:

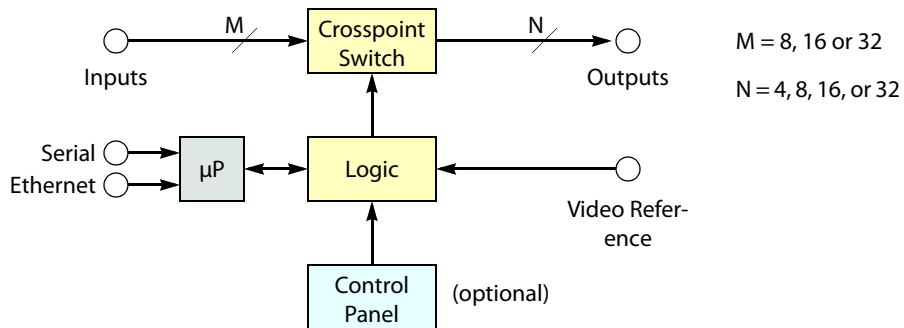


Fig. 2-22: Block Diagram of the Analog Video Router

The analog video routers switch NTSC (525i) or PAL (625i) video signals. The router outputs are switched in sync with an external video reference if it is present.

## Digital Audio Routers

(See [CR6400 Routers](#) on page 16 for a discussion of the CR6400 family's AES router. This section does not apply to the CR6400 family.)

Other digital audio routers are discussed here.

The 1RU AES routers have 16×16, 16×4, or 8×8 crosspoints. The 2RU AES routers have either 32×32 or 32×4 (stereo) crosspoints.

Figure 2-23 is a simplified view of an AES router:

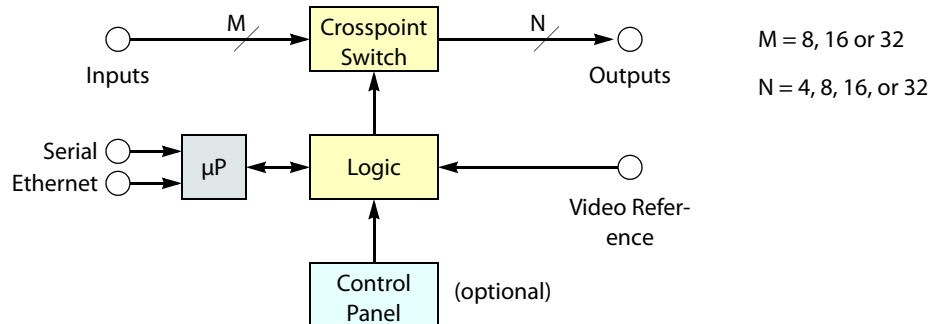


Fig. 2-23: Block Diagram of the AES Router

If a video reference is present, the router is considered “synchronous” and regenerates output at 48kHz (nominally). The routers also perform a certain amount of signal processing if the input is synchronous. If a video reference is not present, the router is asynchronous and passes input signals straight through without any processing.

In synchronous mode, the router can perform mono routing, in which case, the maximum number of signals is  $2N$ , that is 8, 16, 32, or 64. In asynchronous mode, the router processes AES stereo pairs.

The “AES” routers switch AES3id audio. The AES routers switch in sync with a video reference if one is present.

The two AES modes have different functional characteristics:

- Synchronous mode.

This mode is intended for 48kHz input. However, the router accepts input from 32kHz to 192kHz. The router produces AES3id output at 48kHz using *adds* and *drops*,<sup>1</sup> as required. If the input itself is locked to the video reference, no adds or drops occur.

The 16×16 router supports either 16×16 stereo switching or 32×32 mono channel switching (when controlled by an external control system). The 32×32 router supports either 32×32 stereo switching or 64×64 mono channel switching (when controlled by an external control system). Refer to [AES Routers](#) on page 181 for more information.

1. When the source and output AES streams are not in sync, AES samples arrive at a rate different from the rate at which they leave the router. **Add:** when the source is slower than the output, router software occasionally inserts an extra copy of the most recent sample in the output stream until the source and output are back in sync. **Drop:** when the source is faster than the output, software occasionally does not send the sample(s) to the output until the source and output are back in sync again. Adds and drops are performed on a minute scale, never in large blocks, keeping perceptible distortions to a minimum.

- ▲ A control panel **cannot** and **does not** perform mono switching. It is only in external software (CRSC, NV9000, or third-party software) that you can do that and then only when the router is in synchronous mode (i.e., has a video reference).

- Asynchronous mode.

The router passes the input stream (32kHz–192kHz) transparently to the output with no audio processing. The output is the same as the input and the output rate is the same as the input rate.

Because the router does no audio processing, it performs *stereo* switching only.

AES routers power up in asynchronous mode. If a video reference is present, the router immediately switches to synchronous mode. If no video reference is present, the router stays in asynchronous mode.

If a video reference is applied at any time after power-up, the router immediately switches from asynchronous to synchronous mode.

---

**IMPORTANT**

When the router is in synchronous mode, and video reference is lost, the router waits 15 minutes (a “grace” period) before reverting to asynchronous mode. If you need to switch from synchronous mode to asynchronous mode in less than 15 minutes, you can cycle power to the router with the video reference disconnected.

---

### Analog Audio Routers

The 1RU analog audio routers have 16×16, 16×4, or 8×8 crosspoints. The 2RU analog audio routers have either 32×32 or 32×4 (stereo) crosspoints. Figure 2-22 shows a simplified view of the analog video router:

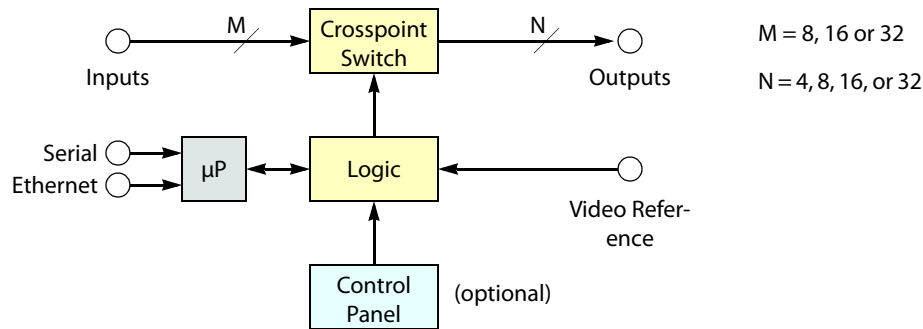


Fig. 2-24: Block Diagram of the Analog Audio Router

The analog audio routers switch analog audio signals. Router outputs are switched in sync with an external video reference if the reference is present and are switched asynchronously if no reference is present.

The analog audio router passes input signals transparently to the output with no audio processing or adjustments.

- ▲ Although the analog audio routers signals are stereo, the connectors are labeled as if the signals were mono. A 16×16 router shows inputs and outputs numbered 1–32. A 32×32 router shows inputs and outputs numbered 1–64. An 8×8 router shows inputs and outputs numbered 1–16.

## Machine Control Routers

The machine control routers do not have X/Y crosspoints *per se*, but allow point-to-point connections. One input may connect to (at most) one output.

The 1RU machine control router has 16 bidirectional serial ports (RJ-45). The 2RU machine control router has 32. Figure 2-22 shows a simplified view of the machine control router:

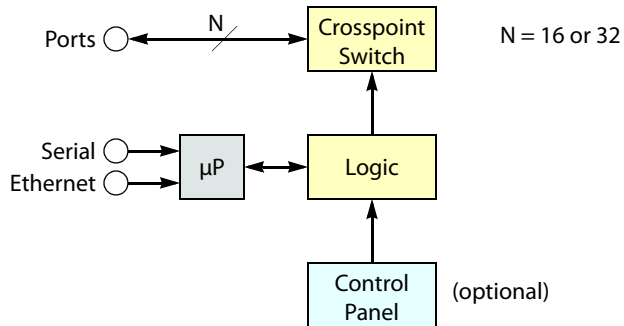


Fig. 2-25: Block Diagram of the Machine Control Router

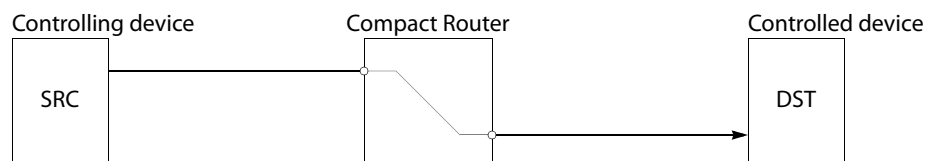
Machine routers channel serial data, typically commands in one direction and responses in the other direction. Because the connections are bidirectional, a port is both an input and an output.

The machine control routers are defined as “data reverse” routers. Each port can be configured as dynamic, master, slave, controlling, or controlled. CRSC is a requirement for configuring the ports.

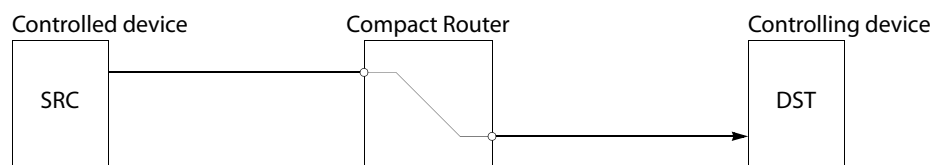
The machine control routers support serial communication up to 1 Mb/s.

## Background Information

A device can be considered a “controlled” device or a “controlling” device.



Above, the source device is a controlling device. A destination can also be the controlling device:



A controlling device sends commands to a controlled device. The controlled device passes responses (such as status) back to the controlling device. A source device can be a controlling device or a controlled device. A destination device can be a controlling device or a controlled device.

▲ Some external devices must be placed in “remote” mode to work with a port router.

A *controlling* port is one connected to a *controlling* device.

A *controlled* port is one connected to a *controlled* device.



The compact machine control routers operate in “data reverse” mode. This means that in any connection, the destination device is the controlling device by default. The default can be overridden by port type.

The 5 port types are variations of “controlled” or “controlling”:

Controlling	Master	Dynamic
Controlled	Slave	

### Controlling or Controlled

These port settings fix the direction of the router port to “controlling” or “controlled.” The port’s connection for Tx and Rx—made during configuration—is static and does not change during operation.

### Dynamic

A dynamic port can be a controlling or controlled port depending on whether it is connected to a master port or slave port. The port’s configuration is dynamic and can change during operation.

Dynamic ports are typically assigned to VTRs.

### Master or Slave

Any dynamic port connected to a “master” port will be changed to a *controlled* port. A “slave” port is the opposite of a “master” port: any dynamic port connected to a slave port will be changed to a *controlling* port.

The compact router applies logic to the port direction setting when a master port is connected to a dynamic port. In this case, the machine at the dynamic port is always controlled and the machine at the master port is always *controlling*.

### Configuration

Configuring the ports of a machine control router requires CRSC.

## The Control Panels

Control panels are optional if you have an automation system or a control system.

### 1RU Panels

The CP1616 control panel has 38 buttons:



Fig. 2-26: Front view of the CP1616 Control Panel

The CP1604 control panel resembles the CP1616, but it has 4 buttons in the lower row on the left, instead of 16. The CP1602 has 2 buttons in the lower row on the left.

The CP0808 has 2 rows of 8 buttons at the far left.

In stand-alone systems, a CP1616 has 16 source selection buttons, 16 destination selection buttons, the 2 lock buttons shown, and 4 level selection buttons (as shown).

In a CRSC system, all buttons except the lock buttons (shown) are configurable. In an NV9000 system, all buttons are configurable, including the lock buttons.

▲ You can mount a 1RU panel on any 1RU router or remote panel module.

The CP3201 is a 1RU panel that resembles the CP1616, but it has 32 source buttons (in 2 rows of 16) and no destination buttons. The CP3201 cannot be used as a captive panel. Its design requires a CRSC or NV9000 network.

## CQX Panel

The CP1602-CQX is also a 1RU control panel that has 38 buttons:

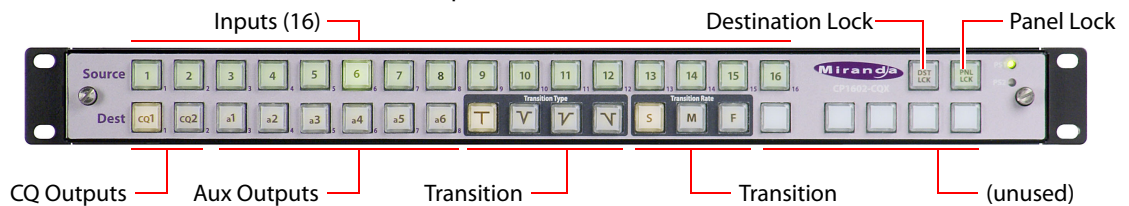


Fig. 2-27: Front view of the CP1602-CQX Control Panel

The CP1602-CQX control panel has 16 source buttons, 2 CQX destination buttons, 6 auxiliary destination buttons, 4 transition type buttons, 3 transition rate buttons, and 7 function buttons. Of the function buttons, 5 are presently disabled, reserved for future use, and two are active. The active buttons are 'Destination Lock' and 'Panel Lock'.

## 2RU Panels

### CP6464

The CP6464 control panel can be mounted on a CR6400 router and it will control that router directly. It can also be mounted on a 2RU remote panel module and control the routers in a CRSC network.

This is the CP6464:



Fig. 2-28: Front view of the CP6464 Control Panel

A CP6464 has an array of 64 general function buttons at the left and 12 general function buttons at the right.

There are two lock buttons (at the top right):

- Panel Lock. Protects the state of the entire panel.
- Destination Lock. Protects one or more destinations.

When the CP6464 is mounted on a CR6400 router operating in stand-alone mode, the general function buttons have fixed and predefined functions:



The 'SRC' button (at the right) places the panel in source mode, and the operator may select a source from the array of 64 selection buttons. Similarly, the 'DST' button (also at the right) places the panel in destination mode, and the operator may select a destination from the 64 selection buttons.

When the panel is mounted on a 2RU remote panel module, controlling the routers in a CRSC network, the assignment of functions to the buttons is completely configurable. (And in a CRSC network, the buttons must have been configured if the panel is to function at all.)

▲ Buttons are not labeled at the factory. If you want button legends, you must create your own. See [Button Legends](#) on page 74.

A panel's buttons have color: green, amber, or red. Green *usually* means source and amber *usually* means destination. Red is usually a warning of some kind. For instance, the buttons for locked destinations appear red.

Buttons go high-tally (bright) when selected (pressed) and remain low-tally (dim) when they are not selected. The function buttons vary in color.

- Unused function buttons are not illuminated.
- The panel lock button, normally low-tally green, goes high tally red when the panel is locked.
- The destination lock button, normally amber, goes high tally red when the currently selected destination is locked. When a destination is locked, the destination button goes high tally red as a warning if you press it. The button color of locked destinations varies with the type of system.

### Other 2RU Panels

The CP3232 control panel has 76 buttons:



Fig. 2-29: Front view of the CP3232 Control Panel

The CP3204 control panel resembles the CP3232, but it has 4 buttons in the lower section on the left, instead of 32.

In stand-alone systems, a CP3232 has 32 source selection buttons, 32 destination selection buttons, the 2 lock buttons shown, and 4 level selection buttons (as shown).

In a CRSC system, all buttons except the lock buttons (shown) are configurable. In an NV9000 system, all buttons are configurable, including the lock buttons.

▲ You can mount a 2RU panel on any 2RU router or remote panel module.

Except under NV9000 control, all control panels have two lock buttons (at the top right):

- Panel Lock. Protects the state of the entire panel.
- Destination Lock. Protects one or more destinations.

▲ Buttons are not labeled at the factory. If you want button legends, you must create your own. See [Button Legends](#) on page 74.

A panel's buttons have color: green, amber, red. In a CRSC system, the colors green and amber have no particular meaning. In a CRSC system, the labels 'Source' and 'Dest' that you see on the panel front also have no particular meaning. Any button, regardless of color or position—except for the lock buttons—can be a source, a destination, or have any assignable function.

In stand-alone systems, green means source and amber means destination and the labels 'Source' and 'Dest' do have meaning. The group of buttons labeled 'Source' are (green) source buttons and the group of buttons labeled 'Dest' are (amber) destination buttons.

In CRSC or NV9000 systems, the color of the button means little.

Buttons go high-tally (bright) when selected (pressed) and remain low-tally (dim) when they are not selected.

For all but machine control routers, source buttons represent inputs and destination buttons represent outputs. For machine control routers, a port is both an input and an output. Source button  $n$  and destination button  $n$  both represent port  $n$ .

The function buttons vary in color.

- Unused function buttons are not illuminated.
- The panel lock button, normally low-tally green, goes high tally red when the panel is locked.
- The destination lock button, normally amber, goes high tally red when the currently selected destination is locked. When a destination is locked, the destination button goes high tally red as a warning if you press it. The button color of locked destinations varies with the type of system.

Operating a control panel is usually very simple. See Chapter 5, [Operating a Stand-Alone Router](#) on page 85.

## The Remote Panel Modules

Like the routers, the remote panel modules are slim (35 mm or 1.38"). Except that they have no I/O connectors and no video reference connectors, remote panel modules are virtually the same size and shape as the routers.

Figures 2-30 through 2-33 show front and rear views of the remote panel modules:

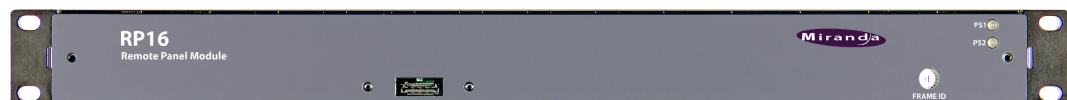


Fig. 2-30: Front View of the RP16 Remote Panel Module



Fig. 2-31: Rear View of the RP16 Remote Panel Module

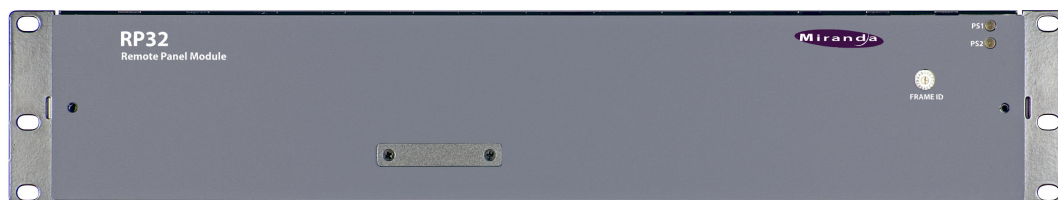


Fig. 2-32: Front View of the RP32 Remote Panel Module



Fig. 2-33: Rear View of the RP32 Remote Panel Module

A remote panel module must have a CR Series control panel attached to be usable. The remote panel module can be set up for operation under CRSC or NV9000.

Under CRSC, when you execute operations on the attached control panel, the remote panel module sends commands to the network of routers and receives status messages from the routers. The attached control panel shows router status on its buttons.

Under NV9000, when you execute operations on the attached control panel, the remote panel module sends commands to the NV9000 and receives status messages from the NV9000 which communicates with the routers. The attached control panel shows router status on its buttons.

A stand-alone network allows up to 16 remote panel modules, up to 4 routers, and up to 4 levels.

A CRSC network allows up to 16 remote panel modules, up to 4 routers, up to 8 levels, and enhanced capabilities.

An NV9000 network allows an indefinite number of remote panels, routers, and levels. The limitations are the number of IP addresses in your network and of course the throughput of the network.

A network requires one or more customer-supplied Ethernet switches.

## Features

### Routers

All CR Series compact routers have the following features and characteristics:

- Two power connections for redundancy. The routers have 2 indicator LEDs, one for each power supply.
- One Ethernet port, supporting network operation.
- One copper grounding terminal.

- One 16-position rotary switch used for network installations. (This switch is hidden if a control panel is mounted on the router.)  
See [Creating a Router Network](#), on page 54, for information regarding connections in a compact router network. See [Network Connection](#), on page 179, for information regarding connections under an NV9000 router control system.
- Quick and easy control panel mounting.
- Non-volatile memory. Routes are preserved if power is shut off.
- One RS-485 (or RS-422) port, supporting third-party automation or control systems.

The CR Series *analog audio* routers have DB25 input and output connectors.

The CR Series *machine control* routers have RJ-45 port connectors.

The CR6400 routers have DIN 1.0/2.3 I/O connectors. We usually call these “coax” connectors.

All other compact routers have BNC inputs and outputs (75Ω).

All but the machine control routers have one pair of video reference connectors (BNC, 75Ω, loop-through, non-terminating).

### 1RU Routers

Figures 2-34 through 2-45 show the 1RU router features.

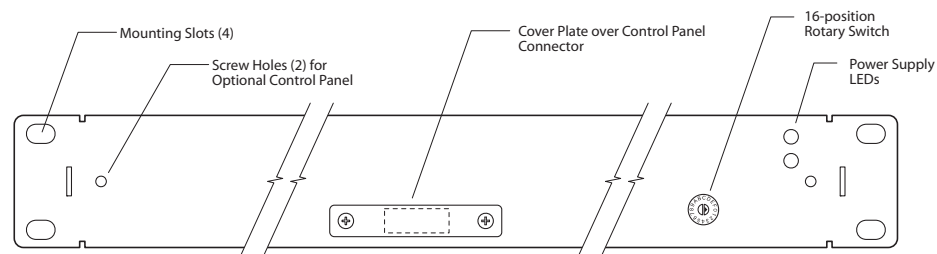


Fig. 2-34: Front View, 1RU Router

### 3Gig, HD, SD, and AES Routers

The 16×16 3Gig, HD, SD, and AES routers are characterized by a row of 16 inputs (BNC) and a row of 16 outputs (also BNC). The 16×4 3Gig, HD, SD, and AES routers are similar to the 16×16 routers, but they have 4 outputs instead of 16. Figure 2-35 shows a rear view of the 16×16 router.

Figure 2-36 shows a rear view of the 16×4 router.

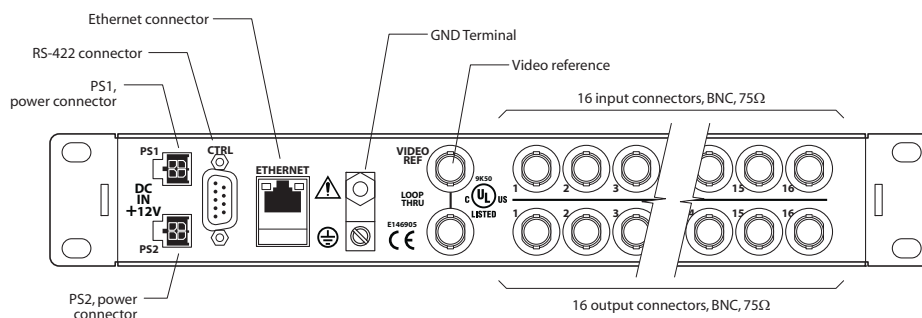


Fig. 2-35: Rear View, 1RU Router (3Gig, HD, SD, or AES)



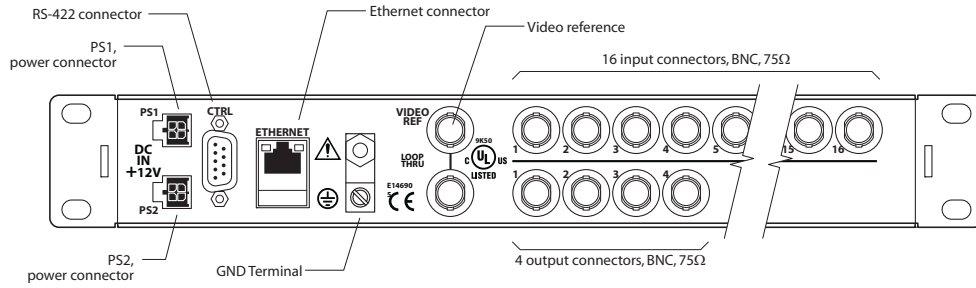


Fig. 2-36: Rear View, 16x4 Digital Router (3Gig, HD, SD, or AES)

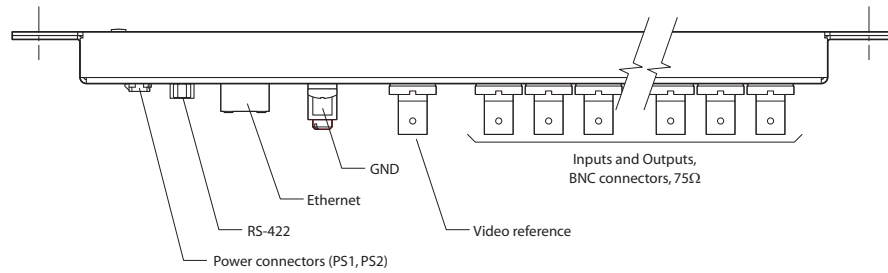


Fig. 2-37: Top View, 1RU 3Gig, HD, SD, AES, or Analog Video Router

Figures 2-38 and 2-39 shows a rear and top view of the 8x8 routers.

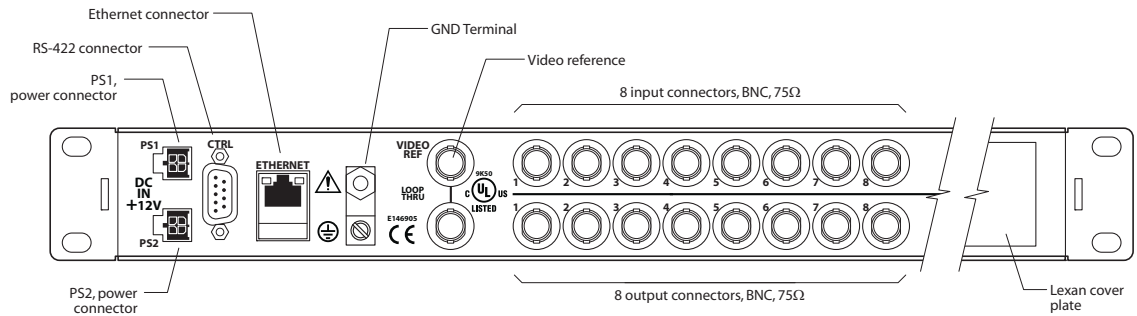


Fig. 2-38: Rear View, 8x8 Digital Router (3Gig, HD, SD, or AES)

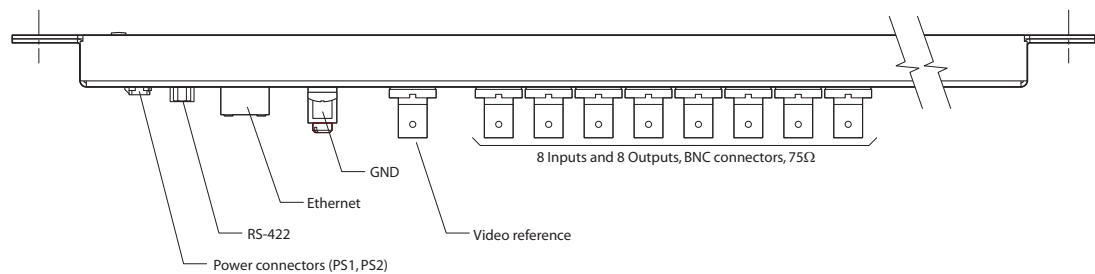


Fig. 2-39: Top View, 8x8 3Gig, HD, SD, AES, or Analog Video Router

### Analog Video Router

The 1RU *analog* video router is mechanically similar to other 8×8, 16×16, or 16×4 routers with BNC connectors except that the input and output BNCs have a different organization.

For the 16×16 analog video router, the inputs and outputs occur in blocks of 8:

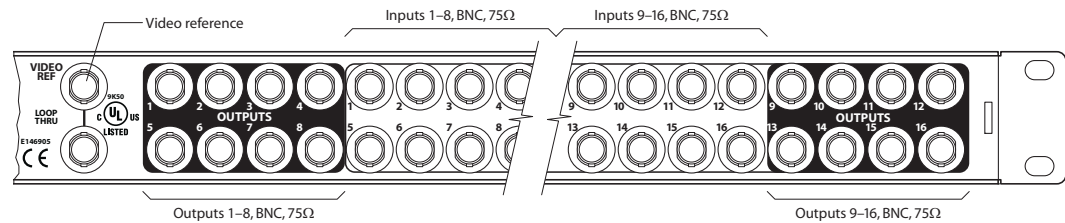


Fig. 2-40: Rear View, 16×16 Analog Video Router

For the 16×4 router, the 16 inputs and 4 outputs are arranged as for the digital video routers:

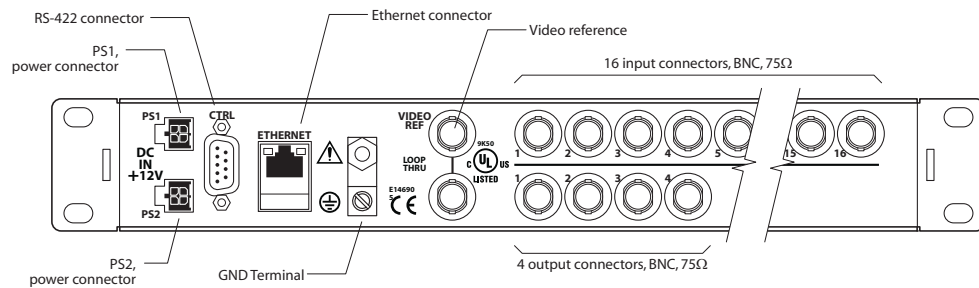


Fig. 2-41: Rear View, 16×4 Analog Video Router

For the 8×8 analog video router, the inputs and outputs also occur in blocks of 8:

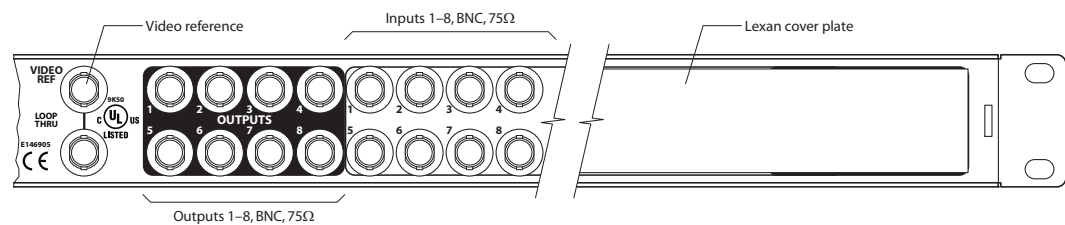


Fig. 2-42: Rear View, 8×8 Analog Video Router

### Analog Audio Router

The 1RU *analog audio* router is slightly deeper (57 mm) than any of the other 16×16 routers. Its inputs and outputs use DB25 connectors:

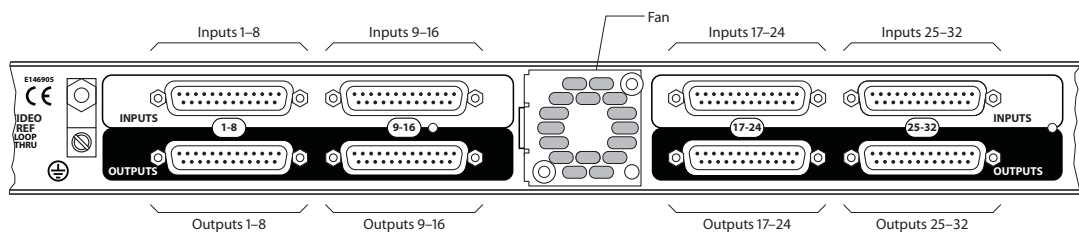


Fig. 2-43: Rear View, 16×16 Analog Audio Router



The 16x4 analog audio router has 4 output (pairs):

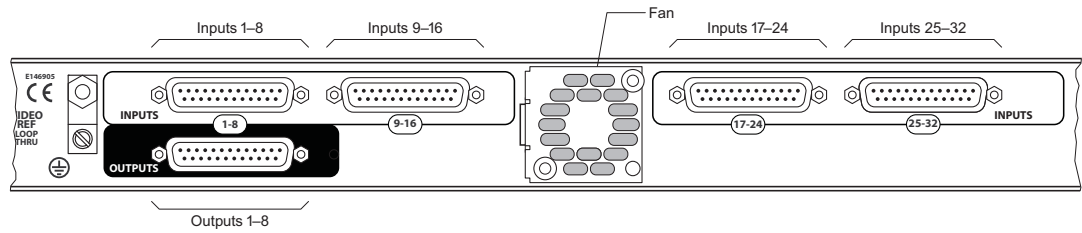


Fig. 2-44: Rear View, 16x4 Analog Audio Router

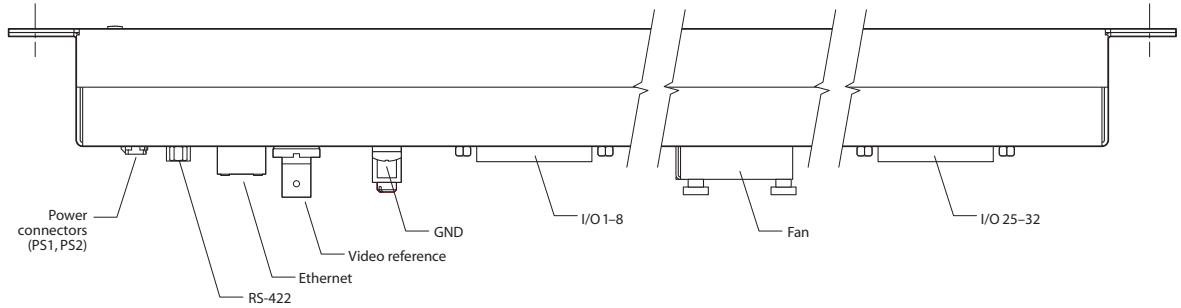


Fig. 2-45: Top View, 1RU Analog Audio Router

The 4 input connectors provide inputs 1–8, 9–16, 17–24, and 25–32, respectively, and are labelled that way on the rear of the router. Inputs are treated as 16 stereo pairs.

The same is true for the outputs.

The 8x8 analog audio router has 8 input (pairs) and 8 output (pairs).

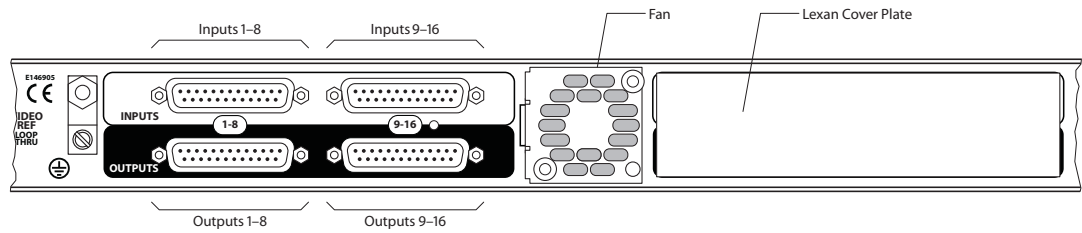
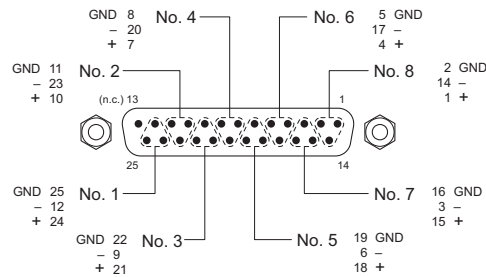


Fig. 2-46: Rear View, 8x8 Analog Audio Router

Analog inputs are at the top; analog outputs are at the bottom (in the dark regions). Each DB25 connector supports 8 inputs (or outputs) which are 4 input (or output) pairs:



I/O Connections	
Number	Stereo Designation
1	1L
2	1R
3	2L
4	2R
5	3L
6	3R
7	4L
8	4R

The analog audio routers also have a small fan.

### Machine Control Router

The 1RU *machine control* router has 16 RJ-45 ports.

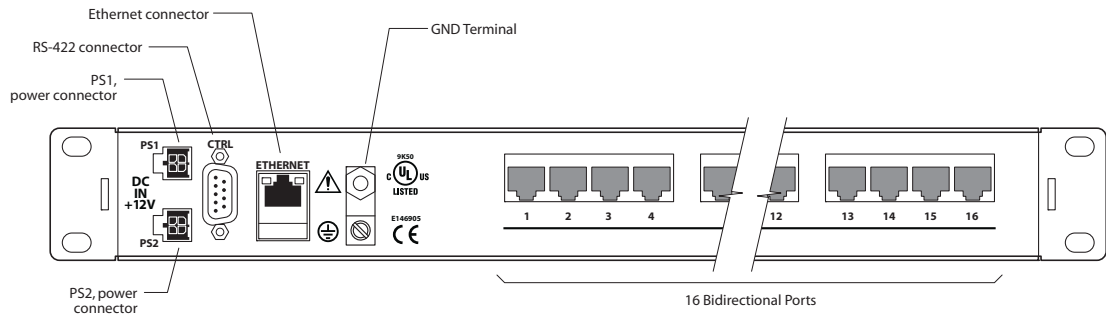


Fig. 2-47: Rear View, 16-Port Machine Control Router

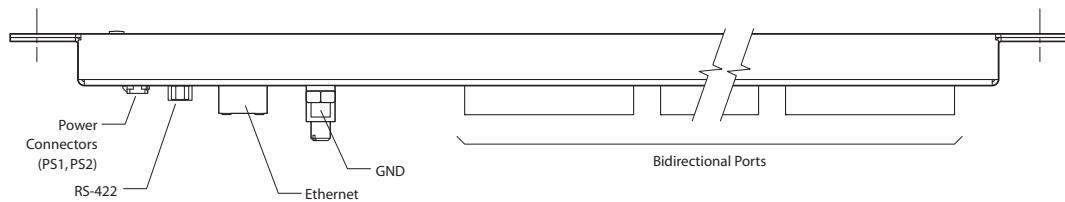
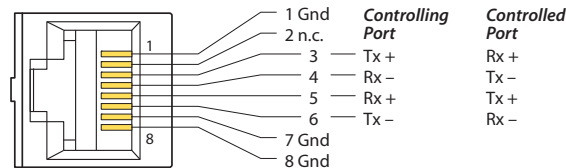


Fig. 2-48: Top View, 16-Port Machine Control Router

All ports are serial, RS-422, operating at up to 1 MB/s. The interface is RJ-45. Each port has the following pinout:



A port can be configured as “controlling” or “controlled” or variants (dynamic, master, slave). That is, the definition of the port can be reversed (Tx becomes Rx and vice versa) either during configuration or during operation.

Refer to the [CRSC User’s Guide](#) for port configuration information.

Refer to [Cabling](#) on page 181 for additional information.

### CQX Routers

There are 316x2 CQX router models: 3Gig, HD, and SD. In addition to power, serial, and Ethernet connectors, these 1RU routers each have a row of 18 inputs (BNC), a row of 8 outputs (also BNC), and a GPIO connector (DB25):

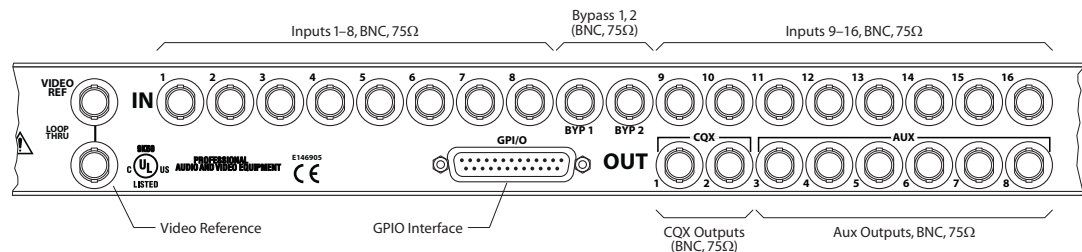


Fig. 2-49: Rear View, 1RU CQX Router (3Gig, HD, or SD)

There are 16 normal inputs, 2 emergency bypass inputs, 2 CQX outputs, and 6 aux outputs. The bypass inputs are switched to the CQX output in the event of a power loss. (The bypass relays switch when power is removed.)

The GPIO connector supports 16 TTL-level inputs and 4 high-power outputs. All are optically isolated. See [GPIO Connections for CQX Digital Video Routers](#) on page 129.

## 2RU Routers

### CR6400 Routers

The CR6400 routers (the CR6464-3Gig and the CR6464-AES) are of modular construction. They have removable control cards, crosspoint cards, and fan modules. They have 4 I/O card slots into which I/O cards can be inserted. Presently there are two card types: 3Gig and AES. If a router is populated with one or more AES card, it is considered a CR6464-AES; if it is populated with one or more 3Gig (video) cards, it is considered a CR6464-3Gig.

Figures 2-50 and 2-51 show the CR6400 router features.

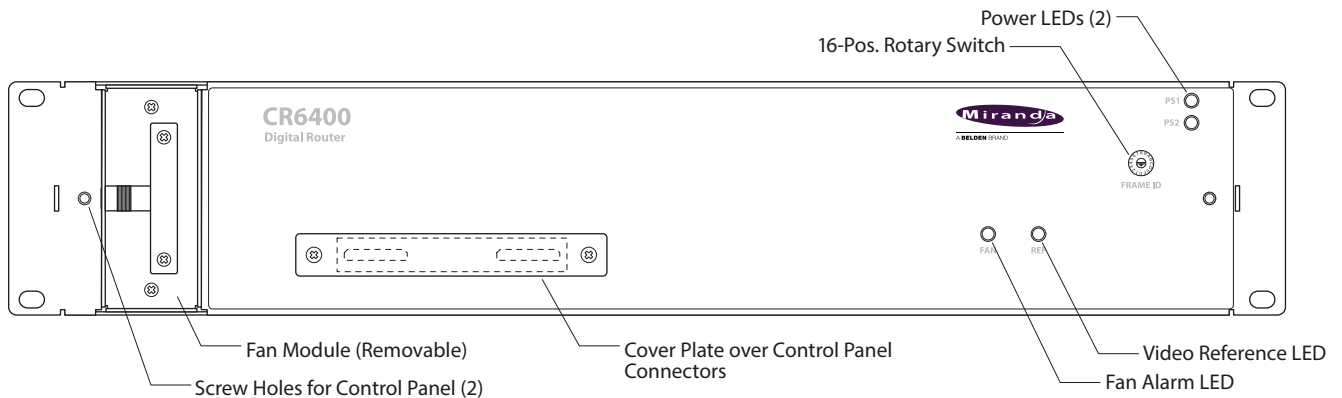


Fig. 2-50: Front View, CR6400 Router

Visible at the rear of the CR6400 routers are the (removable) crosspoint card, control card, and 4 removable I/O cards. The control card provides an RJ45 Ethernet connector, an RS-485 serial connector, and loop-through video reference connectors.

Each I/O card has 32 DIN 1.0/2.3 ("coax") connectors. The 16 at the left are inputs; the 16 at the right are outputs. Thus the router has a total of 64 inputs at the left and 64 outputs at the right. Two I/O card types exist presently: an AES card and a 3Gig card. I/O cards must not be mixed in a router frame.

The router frame has also two power supply connectors and a ground lug. Figure 2-51 shows a rear view of a CR6400 digital router.

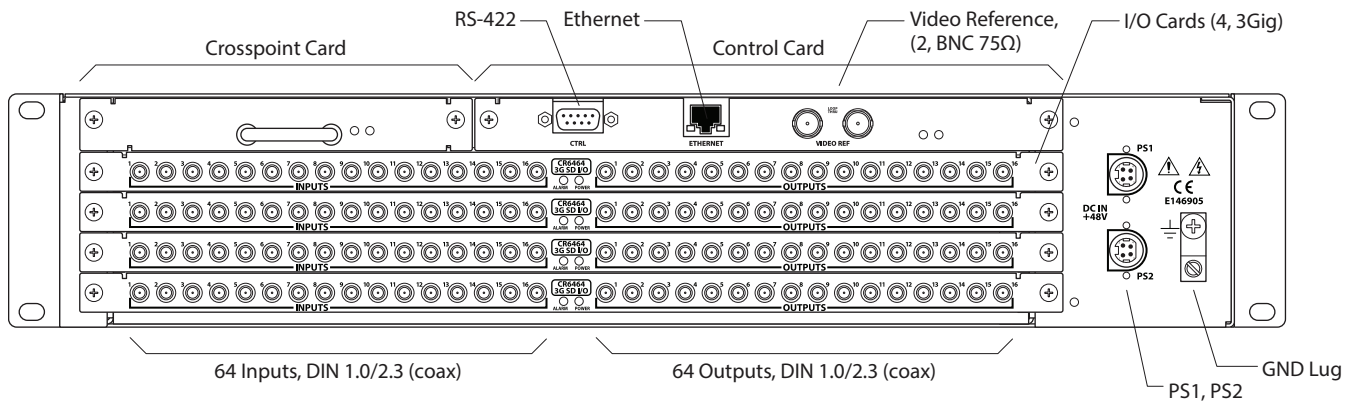


Fig. 2-51: Rear View, CR6400 Router (CR6464-3Gig Shown)

- ▲ **Caution:** unless otherwise instructed by a Grass Valley technician, do not remove the control card or crosspoint card from the router frame.

### Other 2RU Routers

Figures 2-52 through 2-59 show the 2RU router features.

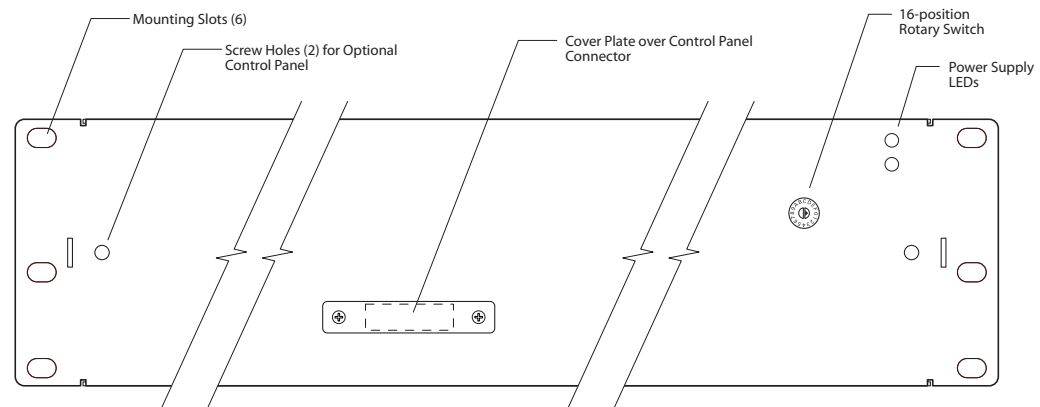


Fig. 2-52: Front View, 2RU Router

### 3Gig, HD, SD, and AES Routers

The 32×32 3Gig, HD, SD, or AES routers are characterized by 2 rows of 16 inputs and 2 rows of 16 outputs. The 32×4 routers are similar to the 32×32 routers, but they have only 4 outputs. Figure 2-53 shows a rear view of a 32×32 digital router.

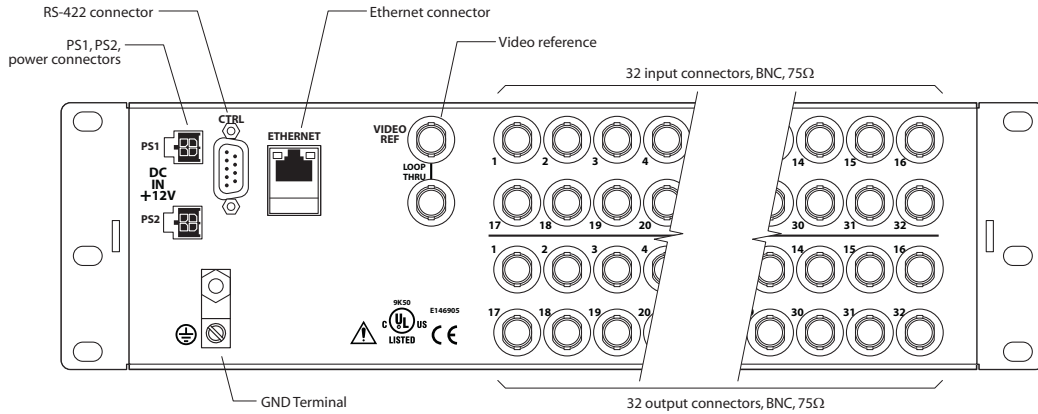


Fig. 2-53: Rear View, 32×32 3Gig, HD, SD, or AES Router

Figure 2-54 shows a rear view of the 32×4 router.

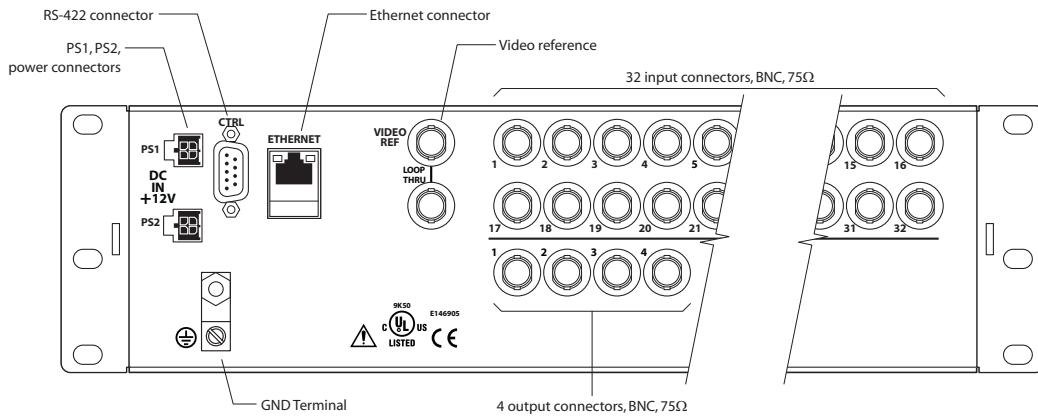


Fig. 2-54: Top View, 32×4 3Gig, HD, SD, AES, or Analog Video Router

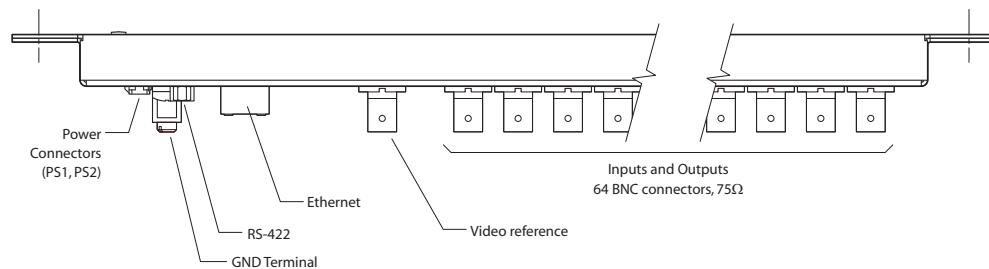


Fig. 2-55: Top View, 2RU 3Gig, HD, SD, AES, or Analog Video Router

### Analog Video Router

The 2RU *analog video router* is mechanically similar to other 32x32 routers with BNC connectors except that the input and output BNCs are grouped in blocks of 16:

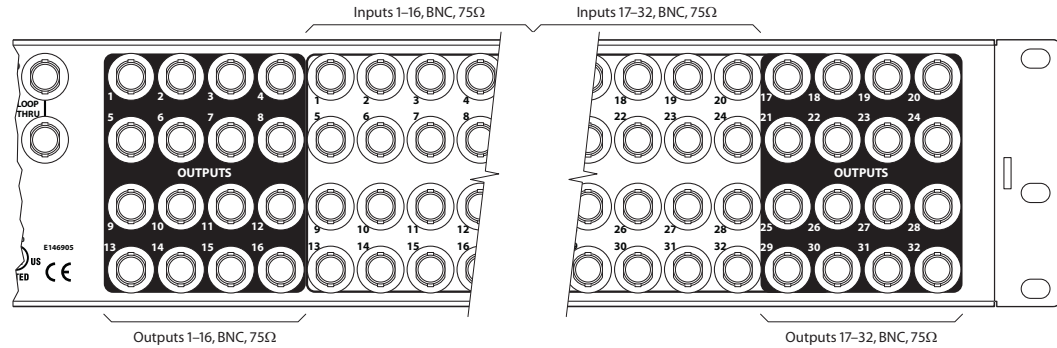


Fig. 2-56: Rear View, 32x32 Analog Video Router

The 32x4 analog video router has 4 outputs:

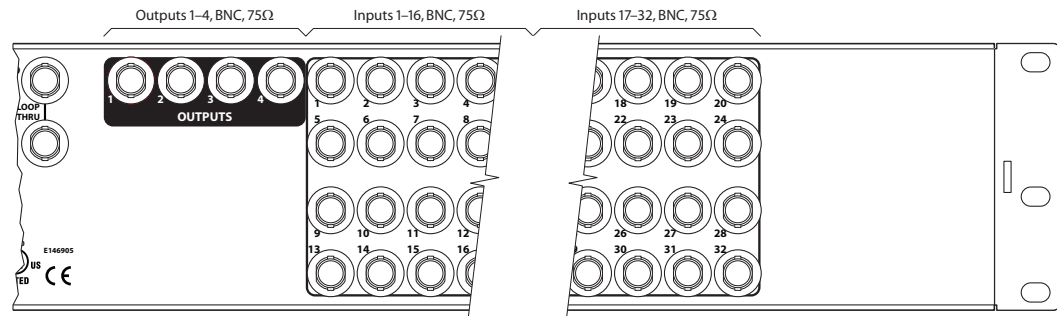


Fig. 2-57: Rear View, 32x4 Analog Video Router

### Analog Audio Router

The 2RU *analog audio router* is slightly deeper (57 mm) than any of the other 32x32 routers. Its inputs and outputs use DB25 connectors:

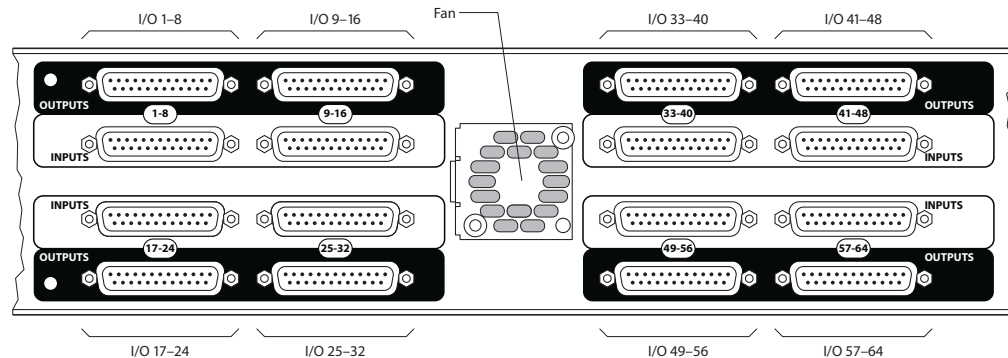


Fig. 2-58: Rear View, 32x32 Analog Audio Router

The 32x4 analog audio router has 4 output (pairs):

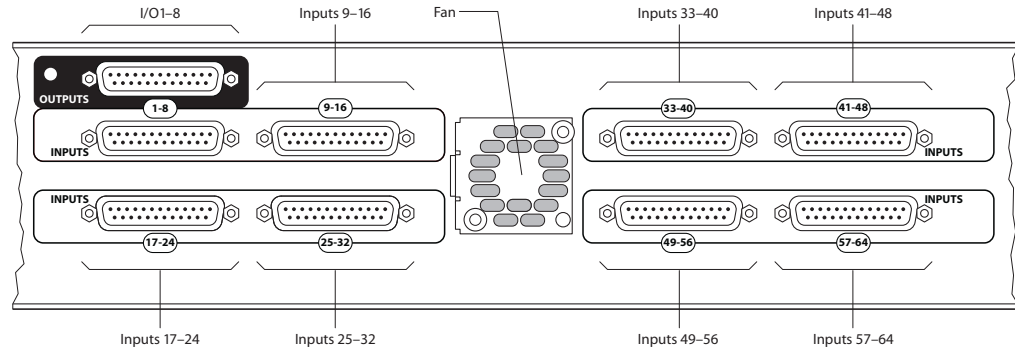


Fig. 2-59: Rear View, 32x4 Analog Audio Router

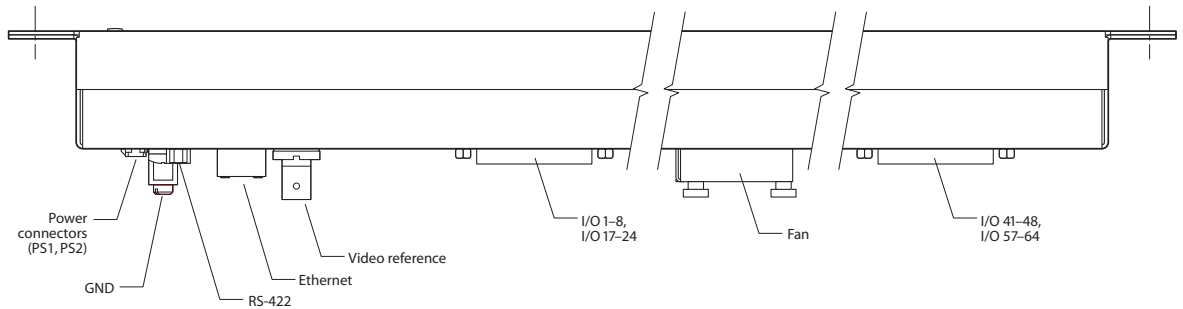
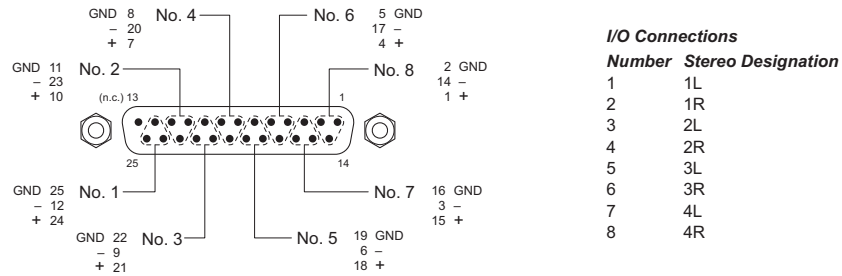


Fig. 2-60: Top View, 2RU Analog Audio Router

Analog inputs are in the middle; analog outputs are at the top and bottom (in the dark regions). Each DB25 connector supports 8 inputs (or outputs):



I/O Connections	
Number	Stereo Designation
1	1L
2	1R
3	2L
4	2R
5	3L
6	3R
7	4L
8	4R

The 8 input connectors provide inputs 1-8, 9-16, 17-24, 25-32, 33-40, 41-48, 49-56, and 57-64, respectively, and are labelled that way on the rear of the router. Inputs are treated as 32 stereo pairs.

The same is true for the outputs.

The 2RU analog audio router also has a small fan.

## Machine Control Router

The 2RU *machine control* router has 32 RJ-45 connectors.

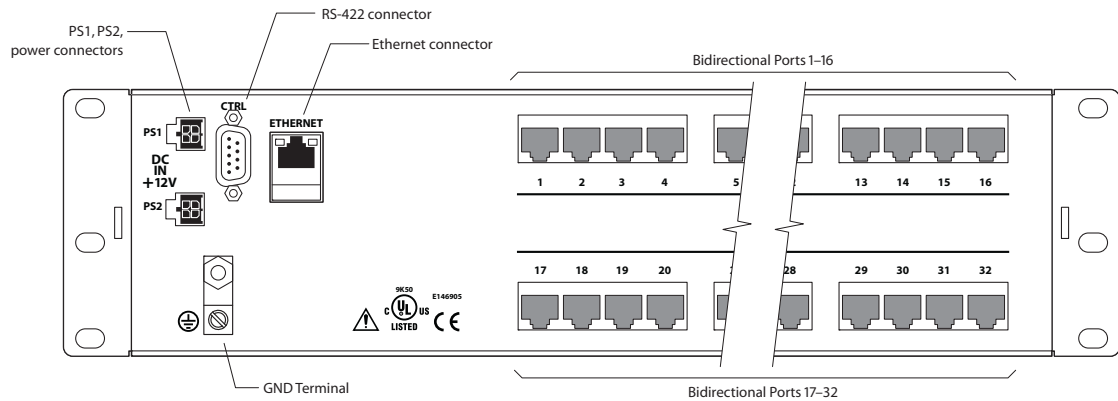


Fig. 2-61: Rear View, 32-Port Machine Control Router

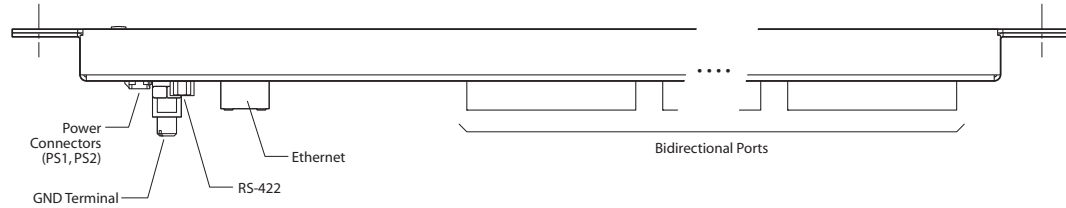
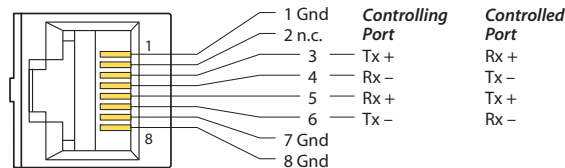


Fig. 2-62: Top View, 32-Port Machine Control Router

All ports are serial, RS-422, operating at up to 1 Mb/s. The interface is RJ-45. Each port has the following pinout:



A port can be configured as “controlling” or “controlled” or variants (dynamic, master, slave). That is, the definition of the port can be reversed (Tx becomes Rx and vice versa) either during configuration or during operation.

Refer to the [CRSC User’s Guide](#) for port configuration information.

Refer to [Cabling](#) on page 181 for configuration information.

## Control Panels

The behavior of control panels in stand-alone systems is very different from the behavior of control panels in CRSC systems. That is because CRSC remote panel operation is configurable and stand-alone panels are not configurable.

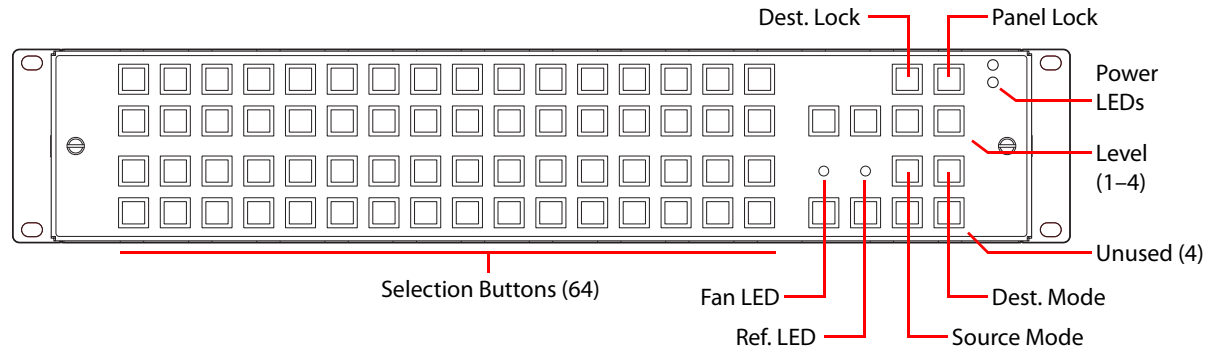
A “captive” panel in a CRSC network is a stand-alone panel and therefore behaves unlike the remote panels in the CRSC network.



## CP6464

The CP6464 can mount on a CR6400 router operating in stand-alone mode and control that router directly. The CP6464 can also be mounted on a remote panel module and control the routers in a CRSC network or an NV9000 network.

When the CP6464 is coupled with a router in stand-alone mode, its button functions are fixed and predetermined, as depicted here:

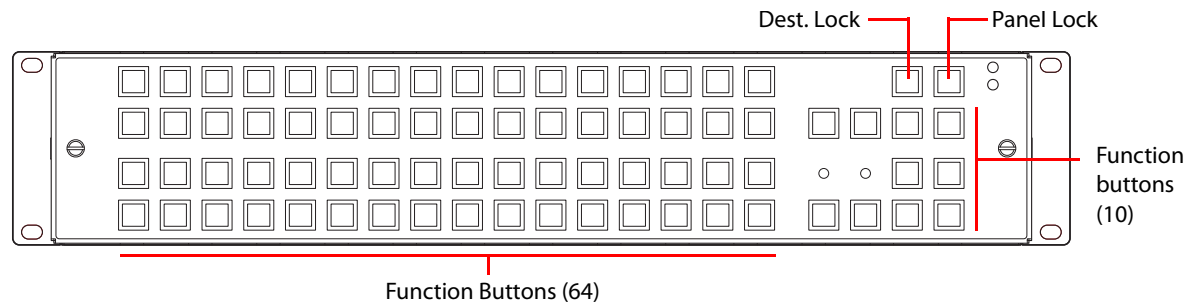


The control panel has an array of 64 selection buttons at the left and 12 function buttons at the right. Function buttons include:

Panel lock	Destination Lock	Level 1–Level 4
Source Mode	Destination Mode	

Four of the function buttons are unused (i.e., reserved for future use).

When the CP6464 is used in a CRSC network, the buttons are completely configurable (except for the lock buttons at the top right):



In fact, the buttons must be configured if the panel is to be operable.

Refer to the *CR6400 Family Users Guide* for panel operating instructions.

### The CP6464 on a Stand-Alone Router

Mounted on a single stand-alone CR6400 router, the CP6464 has the following characteristics:

- The meaning of buttons is fixed and the mapping of buttons to I/O connectors is fixed:

For AES routers:

SRC button *N* corresponds to stereo input *N*.  
DST button *N* corresponds to stereo output *N*.

For 3Gig routers:

SRC button *N* corresponds to video input *N*.  
DST button *N* corresponds to video output *N*.

- Selection buttons are illuminated in green (high- or low-tally) in source mode (i.e., when the source mode button is pressed. Selection buttons are illuminated in amber (high- or low-tally) in destination mode (i.e., when the destination mode button is pressed).
- Function buttons:  
The 4 buttons (immediately below the lock buttons) select levels 1 to 4, level 1 being on the left. Other function buttons are reserved for future use. (The level indicated on the panel is determined by the rotary switch position of the router on which the panel is mounted).

### The CP6464 in Stand-Alone Network

In a stand-alone CR6400 network, the CP6464 has the following characteristics:

- The meaning of buttons is fixed and the mapping of buttons to I/O connectors is fixed:  
In source mode, selection button  $N$  corresponds to source  $N$ . Source  $N$  comprises all inputs  $N$  on all the routers in the CR6400 network.  
In destination mode, selection button  $N$  corresponds to destination  $N$ . Destination  $N$  comprises all outputs  $N$  on all the routers in the CR6400 network.
- Selection buttons are illuminated in green (high- or low-tally) in source mode (i.e., when the source mode button is pressed. Selection buttons are illuminated in amber (high- or low-tally) in destination mode (i.e., when the destination mode button is pressed).
- Function buttons:  
The 4 buttons (immediately below the lock buttons) select levels 1 to 4, level 1 being on the left. Other function buttons are reserved for future use. (The levels are determined by the rotary switch positions of the routers in the network.)

### Other CR Series Panels

#### Stand-Alone Router Characteristics

In a single stand-alone router, control panels have the following characteristics:

- The meaning of buttons is fixed and the mapping of buttons to I/O connectors is fixed:

For machine control routers:

SRC button  $n$  corresponds to port  $n$ .

DST button  $n$  corresponds to port  $n$ .

For AES routers:

SRC button  $n$  corresponds to stereo input  $n$  or to mono inputs  $(2n-1, 2n)$ .

DST button  $n$  corresponds to stereo output  $n$  or to mono outputs  $(2n-1, 2n)$ .

For analog audio routers:

The connections (8 for each DB25) are labeled on the router. The 16×16 router has 32 inputs and 32 outputs. The 32×32 router has 64 inputs and 64 outputs. To determine which stereo pair  $n$  corresponds to connection  $m$ , use the following formula.

$$n = (m + 1) / 2 \quad [\text{integer division}]$$

If  $m$  is odd, it is the left channel. If  $m$  is even, it is the right channel.

SRC button  $n$  corresponds to stereo input  $n$ .

DST button  $n$  corresponds to stereo output  $n$ .

For all other routers:

SRC button  $n$  corresponds to input  $n$ .

DST button  $n$  corresponds to output  $n$ .

- Source buttons are illuminated in green (high- or low-tally) and labeled 'Source'. Destination buttons are illuminated in amber (high- or low-tally) and labeled 'Dest'.
- Function buttons:  
The 4 buttons (immediately below the lock buttons) select levels 1 to 4, in that order. Other function buttons are reserved for future use.

### Stand-Alone Network Characteristics

In a stand-alone router network, control panels have the following characteristics:

- The meaning of buttons is fixed and the mapping of buttons to I/O connectors is fixed:  
SRC button  $N$  corresponds to source  $N$ . Source  $N$  comprises inputs  $N$  on all routers in the stand-alone network.  
DST button  $N$  corresponds to destination  $N$ . Destination  $N$  comprises outputs  $N$  on all routers in the stand-alone network.
- Source buttons are illuminated in green (high- or low-tally) and labeled 'Source'. Destination buttons are illuminated in amber (high- or low-tally) and labeled 'Dest'.
- Function buttons:  
The 4 buttons (immediately below the lock buttons) select levels 1 to 4, in that order. Other function buttons are reserved for future use.

### Characteristics of Panels in CRSC Systems

In a CRSC system, control panels have the following characteristics:

- The meaning of buttons is configurable. The mapping of buttons to I/O connectors is configurable. Any button except the two lock buttons can be configured as source, destination, level selection, or salvo button.
- That a button is green or amber has no particular meaning. The labels 'Source' and 'Dest' and the numbers identifying the buttons have no particular meaning, although you can use the numbers to guide your hand to the button you want to press.  
Under CRSC, source buttons and level buttons can turn red to indicate breakaway.

### Characteristics Common to Both Systems

Control panels have the following *common* characteristics:

- Each button has a clear plastic cap that can be easily removed to accommodate customer-defined button legends.
- Panel Lock, Destination Lock buttons (at the top right).  
The Panel Lock button is normally low-tally green. It turns bright red when the panel is locked.  
The Destination Lock button is normally low-tally amber. It turns bright red when a selected destination is locked (unless none of the destination's levels are selected).
- Two LEDs indicate whether the power supplies of the router or remote panel module on which the control panel is mounted are connected and functioning.

- A control panel mounts easily and quickly on a router (or remote panel module) enclosure with two knurled screws and an electrical connector. Connectors for the 1RU panels have 40 pins; connectors for the 2RU panels have 60 pins.
  - ▲ It is not possible to connect a 1RU panel to a 2RU router or remote panel module, or vice versa.

### 1RU Control Panels

The CP1616 control panel can connect to, and control, any of the 16x16 routers. It can also connect to an RP16 remote panel module and control a network of mixed compact routers. Figures 2-63 and 2-64 show the 16x16 control panel features as used in a stand-alone system:

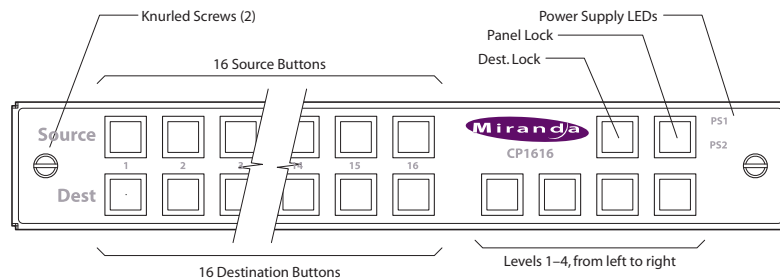


Fig. 2-63: Front View, CP1616

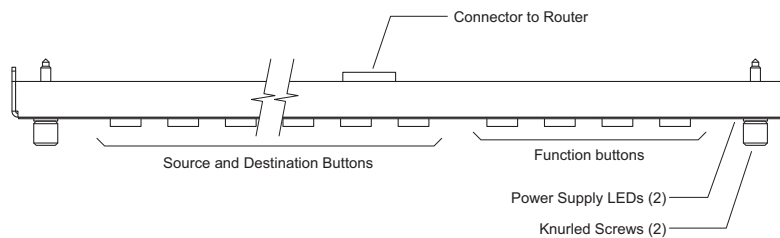


Fig. 2-64: Top View, CP1616

In CRSC systems, the buttons are all configurable except the lock buttons. In NV9000 systems, all the buttons are configurable.

The CP1604 or the CP1602 control panel can connect to, and control, a 1RU router and can also connect to an RP16 remote panel module and control a network of mixed compact routers. Figures 2-65 and 2-66 show the 16x4 and 16x2 control panel features:

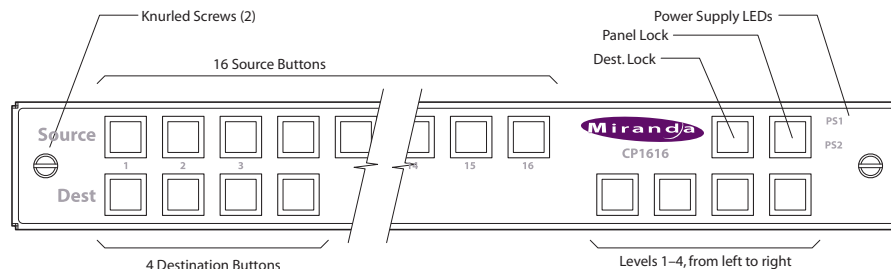


Fig. 2-65: Front View, CP1604

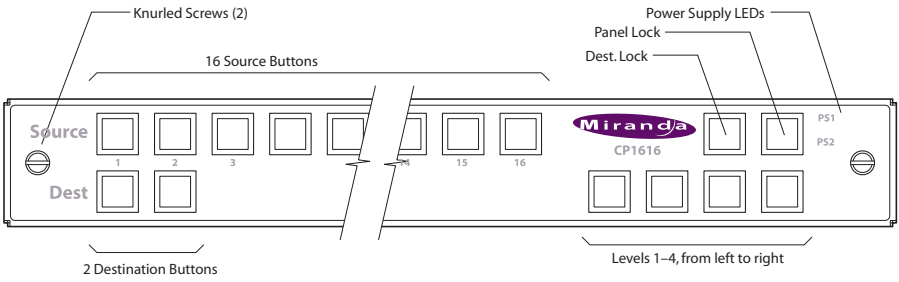


Fig. 2-66: Front View, CP1602

Here too, the illustrations show the fixed meaning of the buttons when the panel is used in a stand-alone system.

The CP0808 control panel can connect to any 1RU router. It was designed for 8x8 routers:

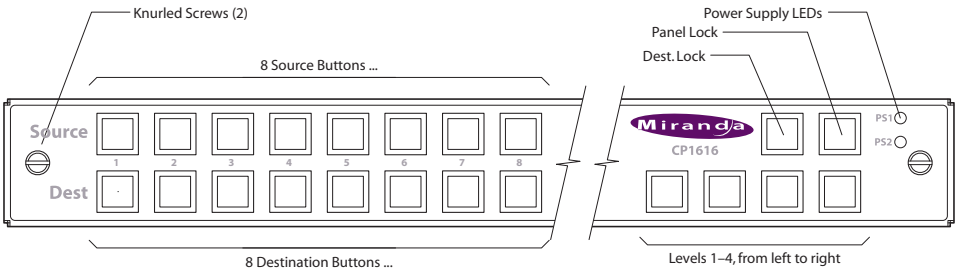


Fig. 2-67: Front View, CP0808

The CP3201 is a 1RU panel that resembles the CP1616 except that most of its buttons are green. In a stand-alone network or NV9000 network, the CP3201 has 32 source buttons and no destination buttons. In a CRSC network, the buttons are configurable. The CP3201 is not supported in stand-alone mode.

The CP1602-CQX is different. See [CQX Control Panel](#), following.

**CQX Control Panel**

The CP1602-CQX control panel is also a 1RU panel. It can connect to, and control, any of the CQX routers. It can also connect to an RP16 remote panel module and control any of the CQX routers.

- ▲ Although it can connect to any 1RU compact router, the CP1602-CQX can control only a CQX router. When placed on a remote panel module, it can control only one CQX router. It must not be deployed in a network of other routers.
- ▲ When the CP1602-CQX is placed on a remote panel module, its transition buttons have no effect on the CQX router. \

Figure 2-68 shows the CP1602-CQX features:

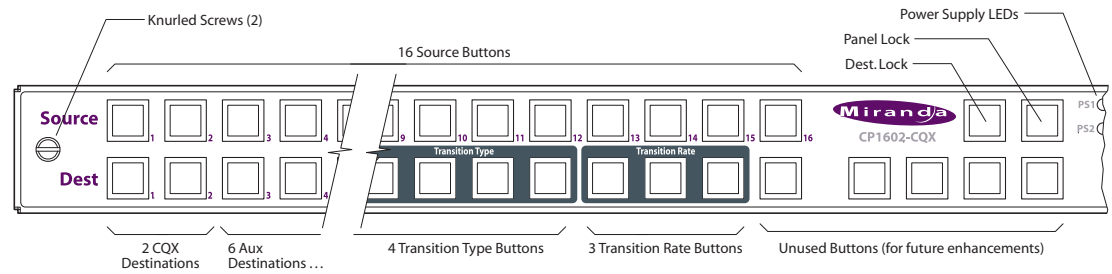


Fig. 2-68: Front View, CP1602-CQX

## 2RU Control Panel

### CP6464

The CP6464 control panel can connect to, and control, any of the CR6400 routers. The CP6464 operates only with CR6400 routers. At present, the CP6464 and the CR6400 routers operate only in stand-alone mode, either singly or in a small network.

Figures 2-69 and 2-70 show the CP6464 control panel features as used in a stand-alone system:

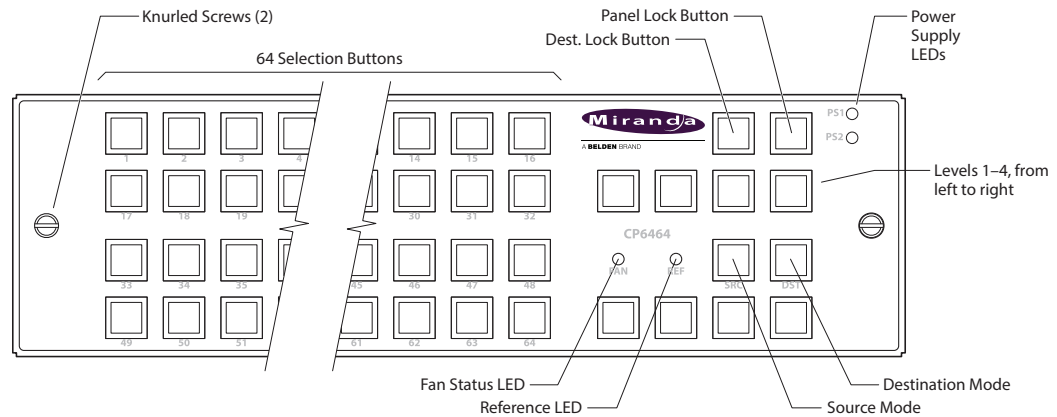


Fig. 2-69: Front View of the CP6464

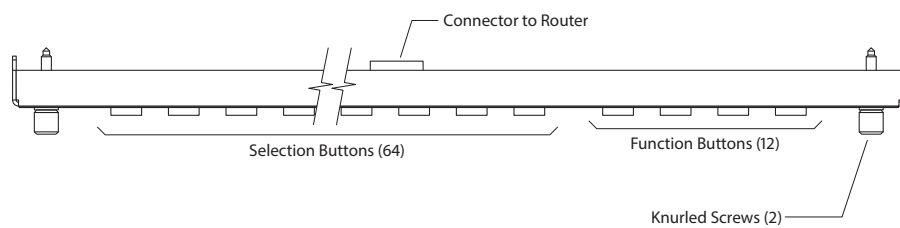


Fig. 2-70: Top View of the CP6464

The 64 selection buttons function as source buttons when the source mode button ('SRC') is pressed and function as destination buttons when the destination mode button ('DST') is pressed.

### Other 2RU Panels

The CP3232 control panel can connect to, and control, any of the 32x32 compact routers. It can also connect to an RP32 remote panel module and control a network of mixed compact routers. Figures 2-71 and 2-72 show the 32x32 control panel features as used in a stand-alone system:

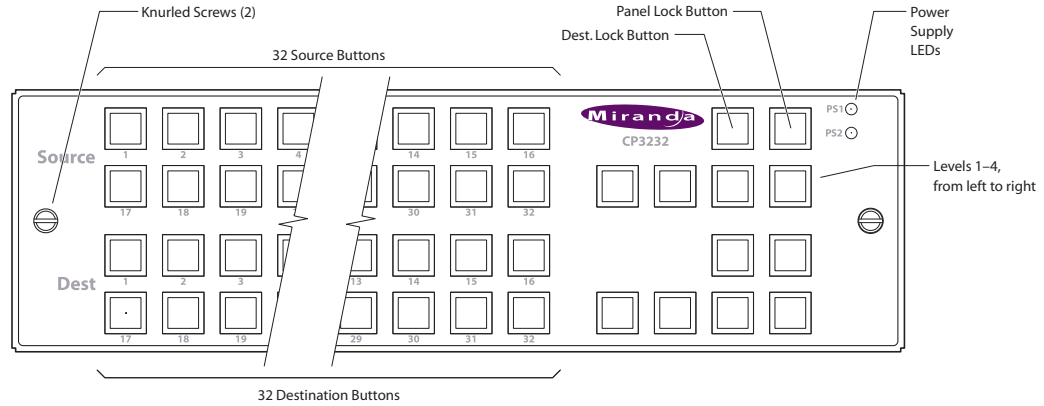


Fig. 2-71: Front View of the CP3232

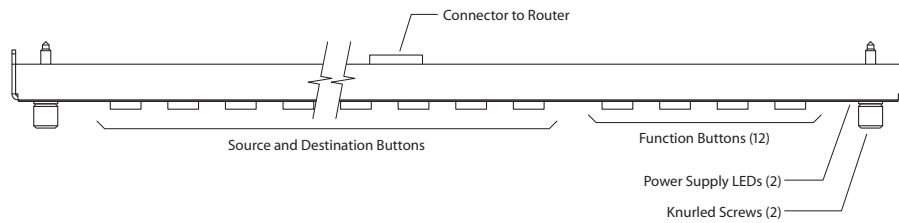


Fig. 2-72: Top View of the CP3232

In CRSC systems, the buttons are all configurable except the lock buttons.

The CP3204 control panel can connect to, and controls, a 2RU router and can also connect to an RP32 remote panel module and control a network of mixed compact routers. Figure 2-73 shows the 32x4 control panel features as used in a stand-alone system:

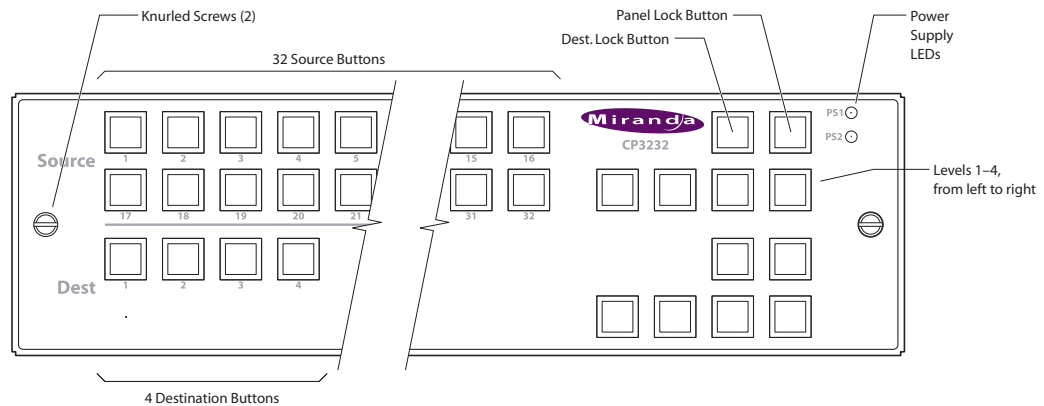


Fig. 2-73: Front View, CP3204

## Remote Panel Modules

The remote panel modules have the following features and characteristics:

- Two power connections for redundancy. The remote panel modules have 2 indicator LEDs, one for each power supply.
- One RS-422 port.
- One Ethernet port, supporting network operation.
- One copper grounding terminal.
- One 16-position rotary switch used for network installations. (This switch is hidden if a control panel is mounted on the router.)

See [Creating a Router Network](#), on page 54, for information regarding connections in a compact router network. See [Network Connection](#), on page 179, for information regarding connections under an NV9000 router control system.

- A control panel mounts easily and quickly on the remote panel module with two knurled screws and a 40- or 60-pin connector.
- Non-volatile memory.

### 1RU Remote Panel Module

The RP16 remote panel module—coupled with a 1RU panel—can be used to control a network of mixed compact routers. Figures 2-74 through 2-76 show its features:

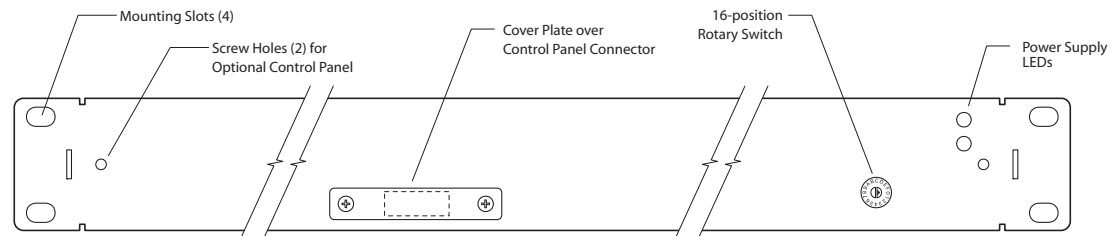


Fig. 2-74: Front View, RP16

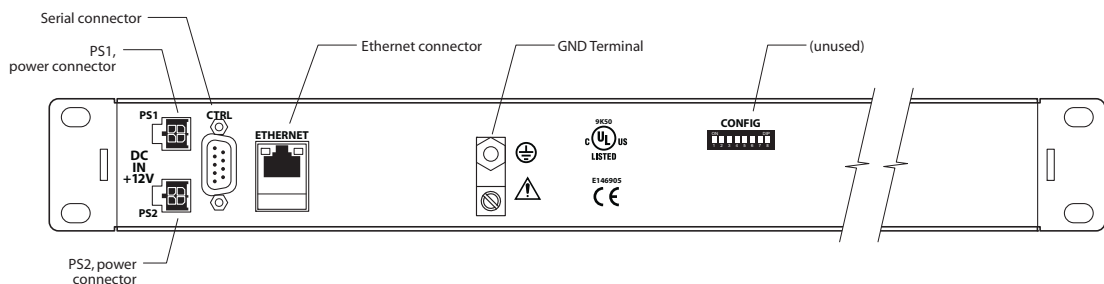


Fig. 2-75: Rear View, RP16

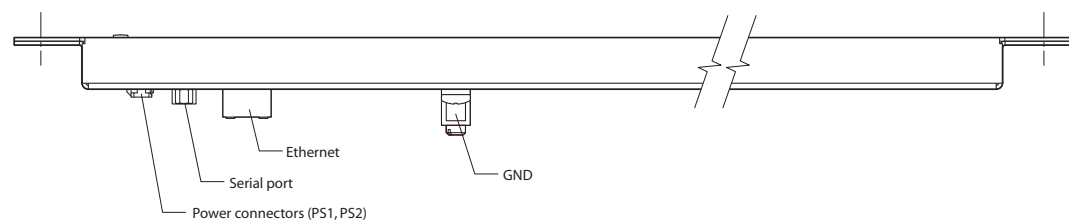


Fig. 2-76: Top View, RP16



### 2RU Remote Panel Module

The RP32 remote panel module—coupled with a 2RU panel—can be used to control a network of mixed compact routers. Figures 2-77 through 2-79 show its features:

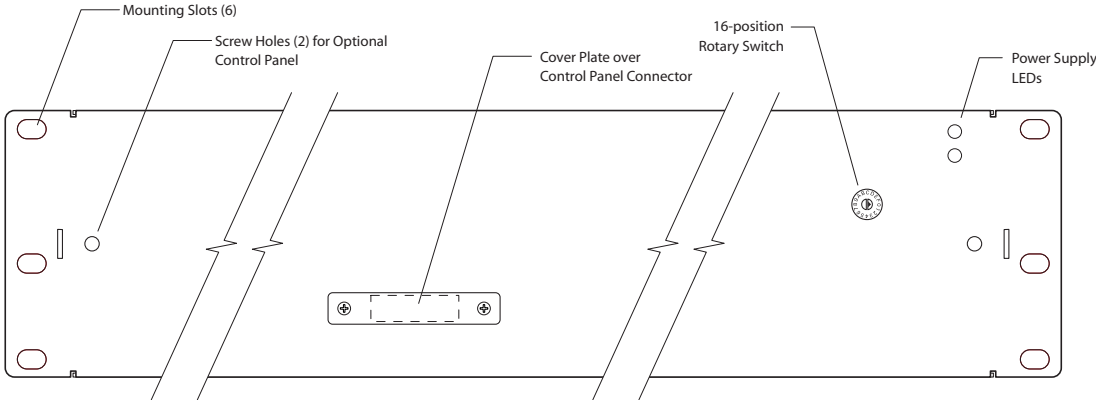


Fig. 2-77: Front View, RP32

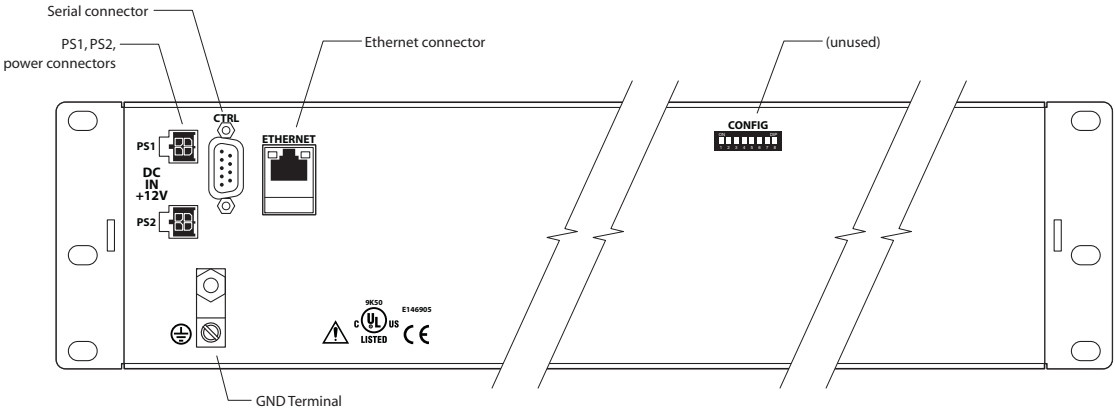


Fig. 2-78: Rear View, RP32

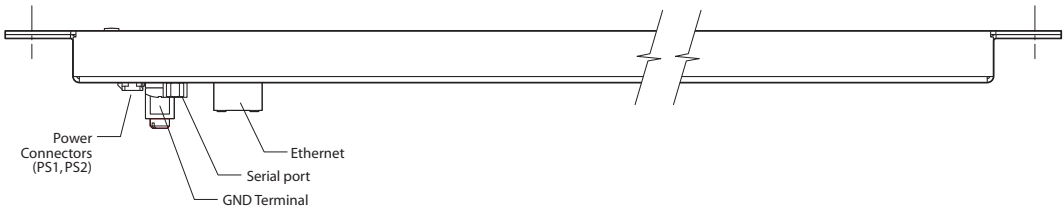


Fig. 2-79: Top View, RP32

### CRSC

CRSC (Compact Router System Configurator) is configuration software that runs on your PC. A compact router network developed using CRSC offers many benefits:

- Configurable panels with a choice of operating modes.
- Flexible networking.
- Router partitions (levels).
- Configuring the ports of a machine control router.
- Maintenance and monitoring.

CRSC is a Java application, available on the software and documentation CD (SB0033). It takes less than a minute to install and is easy to use. See the *CRSC User's Guide* for details.

CRSC might require that your older routers and remote panel modules be updated with firmware compatible with CRSC. This should present no problem to you other than the few minutes it takes.

You can use CRSC to initialize your remote panel module(s) for use with a NV9000 network and to restore those remote panel module(s) to use under CRSC.

You can use CRSC to configure CR6400 routers and panels as you would any other router or panel. However, if you want a CR6400 router to remain in stand-alone (or default) mode, do **not** assign a level that router. Doing so places the router in "CRSC" mode and it will not function properly in stand-alone mode until you perform a reset of the router to its default state.

# 3 Installation

Chapter 3 provides a functional description of the products.

## Topics

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<a href="#">Installing Software</a> .....	53
<a href="#">Creating a Router Network</a> .....	54
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## Package Contents

If you have ordered CR Series products from Grass Valley, you should inspect the shipping container for damage. If you find any container damage, unpack and inspect the contents. If the contents are damaged, notify the carrier immediately.

As you unpack the shipping container, look for the packing slip and compare it against the contents to verify that you received everything as ordered. If anything is missing (or if you find equipment damage unrelated to shipping), please contact Grass Valley.

Depending on your order, the CR Series items that can ship include:

- One or more routers.
- One or more control panels.
- One or more remote panel modules.
- One or more power supplies, with straps that secure the AC power cords to the power supplies.
- User's guides (this document in particular), CRSC software and firmware, and button legend templates in different formats, on a CD.
- A quick-start guide (hard copy).

The package does not contain network cables, video cables, BNC terminators, mounting screws, or grounding wire. You do not need to take any special precautions regarding ESD.

This document does not address the shipment or installation of any other equipment or software that can be used in conjunction with Compact Routers (including any system controllers, NV96xx control panels, EC9700 GUI, EC9710 GUI, and configuration programs such as UniConfig, MRC, or NV9000-SE Utilities).

## Design Considerations

By the time you are ready to install your equipment and software, you (or someone in your organization) will have already made most of the system design decisions. In fact, the design decisions will have been made before the equipment is ordered. The following is a review of the concepts.

There are several ways to use compact routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A network of stand-alone routers, possibly with remote panels, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels. Here, the panels and routers are configured (and optionally monitored) using CRSC.
- A network of routers under an NV9000 router control system.
- A standalone CQX (clean and quiet) router with either a captive (local) CQX control panel or a remote CQX panel.

### Stand-Alone Router

The most basic compact router system is a single stand-alone router with an attached (or “captive”) control panel. A stand-alone router will work reliably and operation is extremely simple.

The single router can switch signals of its own type — HD, SD, AES, etc. — and supports one or more signal types and rates. Operation of the router through an automation system is possible.

### Stand-Alone Network

A stand-alone network will include 1–4 routers and optionally one or more control panels. A stand-alone network supports up to 16 remote panels. Panels are optional only if there is a control system that can perform takes and locks.

If an automation system is in use, the network might not require any panels at all.

Each router in the network is considered a *level*. The levels range from 1 to 4. The routers can be switched either independently or simultaneously for multi-level takes.

- ▲ If you have 32×32 routers in your network, you will require a 32×32 control panel to handle all 32 inputs and outputs.

### CRSC Network

A CRSC network will include 1–4 routers and at least one remote panel.

A CRSC network is highly configurable. Control panels are almost completely configurable. Each router in the network can be partitioned. Up to 8 “levels” (generally corresponding to signal types) can be switched in a CRSC network.

A CRSC network supports the concept of sources and destination. A source is a specific combination of input ports on one or more levels. A destination is a specific combination of output ports on one or more levels.

Because sources and destinations are not tied to specific inputs and outputs, a CRSC network more effectively utilizes the router ports. You can do more with less.

A CRSC network supports salvos.

A CP3201 can be used in a CRSC network (because sources and destinations are not tied to specific inputs and outputs).

CRSC supports advanced Ethernet connections (e.g., gateway connections).

## CQX Routers

At present, a CQX router must operate by itself with a CQX control panel (or automation). Do not place a CQX router on a subnet with other routers. You can have more than one subnet dedicated to CQX routers, however.

The CQX panel can be local (mounted on a CQX router) or it can be remote (mounted on a remote panel module). The remote CQX panel then must be connected to the CQX router by an Ethernet switch.

As product development continues, we expect the networking capabilities of CQX routers and panels to expand.

## CR6400 Routers

CR6400 routers operate—in stand-alone mode—only with other CR6400 routers and CP6464 panels. They must not be on the same subnet as CR Series routers of other types.

In a CRSC network, however, CR6400 routers can interoperate with any other CR Series routers and panels. The CP6464 panels can be configured and used in the same way as other panels in the network.

CR6400 routers and panels can be used in NV9000 networks in the same way as other CR Series routers and panels.

## Router Control Systems

A router control system can switch video and audio (and other signal types) elegantly and in fact offers a number of other features and services not available in the CR Series routers alone.

An NV9000 system also supports a number of additional hardware and software control panels. Thus, in a system under NV9000 control, CR Series control panels are optional.

Remote panel modules require a specific setup step to work under NV9000. With that setup they act as NV9000 panels and are configured using NV9000-SE Utilities. Other NV9000 panels can also be used to control compact routers.

## Rack Mount

### CR6400 Routers

The CR6400 routers are designed to mount in a 19" rack. Rack-mounting is not a requirement, but we assume a 19" rack for the sake of simplicity.

Follow these steps to install a CR6400 router:

- 1 Set the position of the 16-position rotary switch on the front of the router. (It is not on the control panel. If the control panel is mounted on the router, you must detach the control panel from the router to access the rotary switch.)

If you have a single CR6400 router, set the switch to any *non-zero* position.

If you have more than one CR6400 router, their rotary switches must be set to positions in the range 1–4. The switch positions for the routers must all be different.

Use a small slotted screwdriver to turn the rotary switch.
- 2 If the router is to have a CP6464 control panel, place the panel on the front of the router, mating the electrical connector on the panel to the electrical connector on the router. The fit requires only minimal force. Tighten the knurled screws that secure the control panel to the router. Tabs at the ends of the control panel fit in slots in the face of the router, helping you align the panel to the router.

You may design, fabricate, and install a control panel's button legends (clear inserts that fit under the clear plastic button caps) at any time.
- 3 Mount, and secure, the router assembly in the rack.

The CR6400 router's mounting holes on each side are spaced 3" (76 mm) vertically and allow approximately 1/8" (3 mm) of play horizontally.

Position the router so that its mounting holes are aligned with the holes in the rack. Use 4 rack-mounting screws to secure the router to the rack.
- 4 If you are using the router on a network, connect an Ethernet cable (RJ-45) from the network switch to the Ethernet port of the router.

See [Creating a Router Network](#), on page 54.
- 5 Optionally, connect your video reference.

SDI signals require a reference to perform switches in accordance with SMPTE RP168.

The router has two video reference BNC connectors. You can connect the reference source to either one. If you have more than one router, you can "daisy chain" the output of one reference connector to the input of another. The output of the last connector in the series should be terminated with a 75 $\Omega$  BNC terminator.
- 6 Optionally connect the ground lug to earth ground. Use copper wire from 14 to 6 AWG. Grounding decisions are left to you or your facilities manager. Failure to connect the ground will not affect normal operation, but connecting the ground will protect you and your equipment in a power anomaly such as a lightning strike.
- 7 Connect one or both power supplies.

The external power supply's cable connector has 4 pins.

  - ▲ The enclosing ring of the cable connector is connected to ground. Be very careful not to short the power pins (+48V) to the ring. It is easy to do.
  - ▲ Always disconnect the power supply from AC power before connecting the power supply to the router. Then reconnect AC power to the power supply.

See [Trouble-Shooting](#) on page 115 if either of the power LEDs on the front of the router (or control panel) fails to light.
- 8 Connect input devices and output devices. The exact connections are, of course, determined by the requirements of your system.

The AES and 3Gig cards have DIN 1.0/2.3 connectors. Depending on the devices you are connecting to your router, you might need to obtain BNC-to-DIN adapter cables.

## Other Routers

Whether stand-alone, used in a network, or used in a router control system, the CR Series routers and remote panel modules are designed to mount in a 19" rack. This is not a requirement, but we assume a 19" rack for the sake of simplicity.

Follow these steps to install a CR Series device:

- 1 Set the position of the 16-position rotary switch on the front of the router or remote panel module. (It is not on the control panel. If the control panel is mounted on the router, you must detach the control panel from the router to see the switch.)

If you have a stand-alone router, set the switch to any *non-zero* position.

If you have a stand-alone router network, refer to [Levels and IP Addresses in Stand-Alone Networks](#), on page 56 for information on how the rotary switch is used.

If you have a CRSC router network, refer to the *CRSC User's Guide* for information on how the rotary switch is used.

If you are using the router in a control system, refer to [Network Connection](#) on page 179 for information on how the rotary switch is used.

Use a small screwdriver to turn the rotary switch.

- ▲ In a network, all devices must have unique IP addresses. An IP address is determined (at least initially) by the rotary switch at the front of the device. The rotary switches for routers must (at least initially) be distinct. The rotary switches for remote panel modules must (at least initially) be distinct. However, a remote panel module may have the same switch setting as a router. Their address spaces are separate by default.

- 2 If the router is to have a control panel, place the control panel on the front of the router, mating the electrical connector on the panel to the electrical connector on the router. The fit requires only minimal force. Tighten the knurled screws that secure the control panel to the router.

- ▲ A 2RU panel does not work with, or even fit on, a 1RU router and vice versa. Do not try to connect a control panel to the wrong type of router or remote panel module.

You may install a control panel's button legends at any time. See [Button Legends](#) on page 74.

- 3 Mount, and secure, the router assembly in the rack.

For the 1RU routers (or assemblies), the mounting holes are spaced 1.25" (31 mm) vertically and allow approximately 1/8" (3 mm) of movement horizontally.

For the 2RU routers (or assemblies), the 3 mounting holes on each side are spaced 1.25" (31 mm) and 1.75" (44 mm) (3", 76 mm, overall) vertically and allow approximately 1/8" (3 mm) of play horizontally.

- ▲ Because the routers are short and thin, you might not have enough space to reach behind the router and make connections. In that case, leave this step until last.

- 4 If you are using the router on a network, connect an Ethernet cable (RJ-45) from the network switch to the Ethernet port of the router.

See [Creating a Router Network](#), on page 54, for information about Compact Router networks.

See [Network Connection](#), on page 179, for information about router control systems.

5 If you intend to use the router in an automation system or under a third-party control system, connect the 9-pin serial port to a serial port of your system. Contact Grass Valley for information about the serial protocol.

6 Optionally, connect your video reference.

AES routers require a video reference to operate in synchronous mode. SDI routers require a reference to perform switches in accordance with SMPTE RP168.

Each router (except the machine control routers) has two video reference BNC connectors. You can connect the reference source to either one. If you have more than one router, you can “daisy chain” the output of one reference connector to the input of another. The output of the last connector in the series should be terminated with a 75W BNC terminator.

7 Optionally connect the ground lug to ground. Use copper wire from 14 to 6 AWG. Grounding decisions are left to you or your facilities manager. Failure to connect the ground will not affect normal operation, but connecting the ground will protect you and your equipment in a power anomaly such as a lightning strike.

8 Connect one or both power supplies. First connect the 4-pin connector to PS1 or PS2 on the rear of the router. The connectors are keyed and snap into place. There is only one way they fit. Do not force them. Then connect the power supply to AC power.



The second power connection is for redundancy only (protection against failure) and is not a requirement for operation.

See [Trouble-Shooting](#) on page 115 if the power LED on the front of the router (or control panel) fails to light.

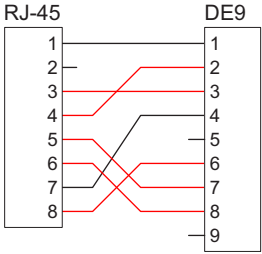
9 Connect input devices and output devices. No particular order or combination is required. However, if the router is controlled by a Grass Valley router control system, the configuration you create for your system controller will have to match the devices you connect.

Many I/O connections use standard 75W BNC connectors. Use Belden 1694A or equivalent cable, up to 100m for 3Gig video (80m for 3Gig CQX routers), up to 150m for HD video or up to 400m for SD video.

Analog audio connectors are DB25. You can obtain DB25 breakout cables from Grass Valley or build your own. (The Grass Valley part number is WC0053.)



Machine control ports (RJ-45) could take ordinary Ethernet cable. However, it is probable that you will need to connect devices that have DE9 connectors. A DE9 to RJ-45 cable is required: This is the RJ-45 to DE9 mapping for RS-422:



This cable wiring is applicable whether the port is a controlling port or controlled port. See the *CRSC User's Guide* for information about port configuration.

## Installing Software

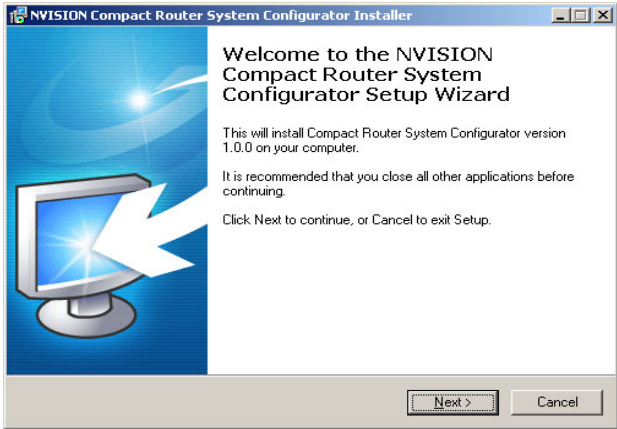
The CRSC software is optional. CRSC *is* required if you want to have a CRSC network. (You can also use it to change the IP addresses of routers in a CR6400 network an NV9000 network.)

- ▲ CRConfig is obsolete and no longer available.
- ▲ We recommend that you install CRSC first before creating a network. That way you will have a way to view the status of your network as you build it.
- ▲ CRSC comes with a compact router firmware file that you should upload to all your routers and remote panels (if you intend to have a CRSC network.)

## Installing CRSC

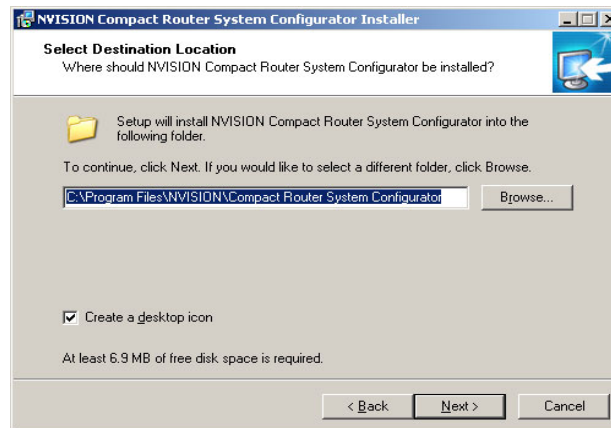
CRSC, its user's guide (and this user's guide) are available through the Grass Valley website.

Double-click the installer icon to install CRSC:

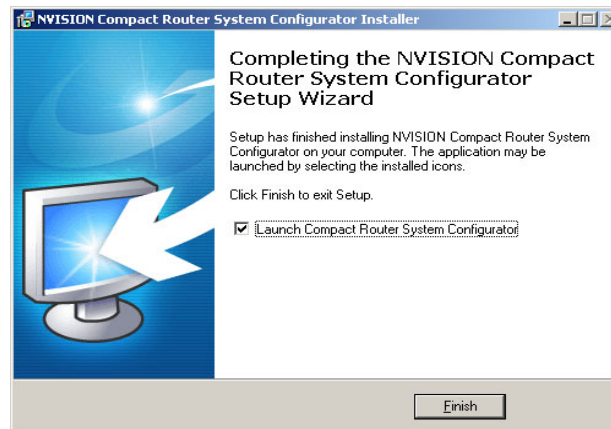


Click 'Next' in this window and other windows to advance through the installation process. Click 'Back' to retrace your steps and change the installation. Click 'Cancel' at any time to stop the installation. (The installation takes less than a minute.)

Step 2 asks you to designate a folder in which to install the software:



Click 'Next'. Step through the remaining screens, clicking next to proceed. When the installation has completed, the installer displays a completion message:



Click 'Finish' to exit from the installer and return to the 'CR Series' window of the CD window. The installer creates a desktop icon and a Start menu entry. The default location for the application is:

```
C:\Program Files\NVision\Compact Router System Configurator\CrConfigurator.jar
```

The Start menu entry is:

```
Start > Programs > NVision > Compact Router System Configurator
```

Finally, launch CRSC to verify that it executes. You must create a router network before you can put CRSC to use. Your configuration PC must be on that network. The next section, [Creating a Router Network](#), tells you how to set up the network.

## Creating a Router Network

There are two main reasons to create a router network:

- To perform multi-level operations (takes and locks).
- To operate individual routers or network of routers remotely (e.g., from a separate room).

## Network Considerations

Compact routers (and remote panel modules) were designed to use 10/100BaseT networks, occasionally auto-negotiating to 10BaseT.

Modern 100/1000BaseT switches (such as those offered by Cisco) will stop sending router traffic when a compact router goes to 10BaseT.

Such auto-negotiating tends to occur where CAT 5 runs exceed 25 meters.

Our recommendation for network equipment is this: use a 10/100BaseT unmanaged switch for your compact router network. These switches should reliably support CAT 5 to 100 meters or better.

The CR6400 routers are immune to this problem, having parts of more recent design.

## CR6400 Stand-Alone Networks

A stand-alone CR6400 network comprises the following items:

- From 1 to 4 CR6400 routers.
- A CP6464 panel.
- An Ethernet switch capable of 100MB/s operation with enough ports to accommodate your routers.

Figure 3-1 shows a sample network of routers:

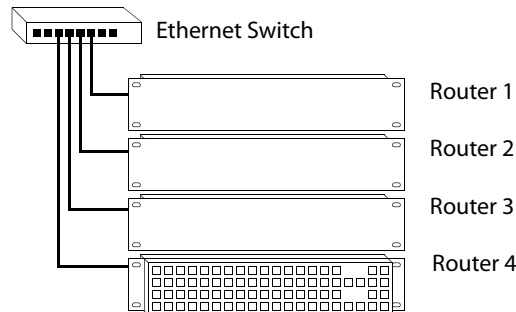


Fig. 3-1: Network of Routers

The panel can switch signals on the 4 routers simultaneously, resulting in multi-level takes. Each router is considered a level. The panel operator selects levels using the level buttons on the panel. Takes occur only on selected levels. (However, if no levels are selected, the result is as if all levels are selected.)

- ▲ CR6400 routers used in CRSC networks (or NV9000 networks) have different characteristics. See [CRSC Networks](#) on page 57 or [NV9000 Networks](#) on page 60 for more information.

## Levels and IP Addresses in CR6400 Stand-Alone Networks

Each CR6400 router in the network is considered equivalent to a level. Each router requires an IP address. Use the 16-position rotary switch on the front of a router to set its IP address and corresponding level:

Level = switch value (1–4).

**address** = switch value + 100.

The IP address is 192.168.2.**address**.

Thus, subnet addresses for routers range from 101 to 104 and correspond to the router levels. The numbers on the rotary switch are in hexadecimal: 0–F. Do **not** use 0.

## Stand-Alone Networks for Other CR Series Routers

A router network comprises the following items:

- From 1 to 15 remote panel modules (with attached control panels).
- From 1 to 4 compact routers. You can mix routers of any size and type according to your requirements. Keep in mind that a 16×16 remote panel module **cannot** control inputs or outputs numbered 17 and higher.
- Optionally, one or more PCs (running Windows XP) on which you have installed CRSC.
- An Ethernet switch (or hub) capable of 100MB/s operation with enough ports to accommodate your routers, remote panel modules, and PCs.

Figure 3-2 shows a sample network of routers with remote panel modules:

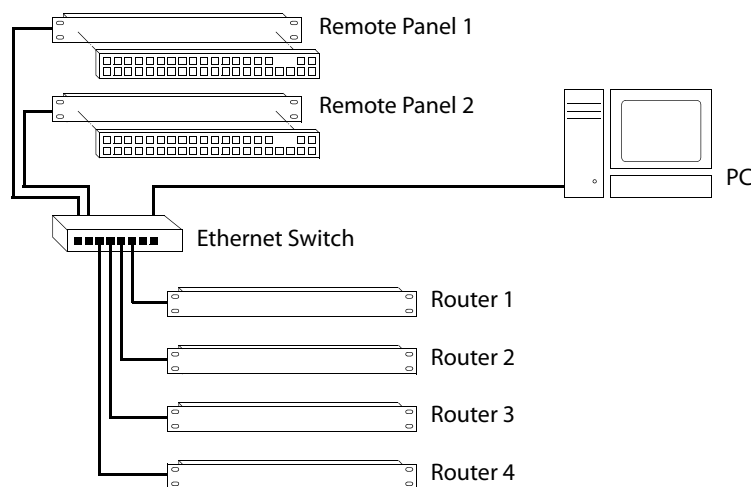


Fig. 3-2: Network of Routers

It is permissible to have a control panel on any router, if that is what you want. Those routers can be switched both locally and remotely.

## Levels and IP Addresses in Stand-Alone Networks

Each router in the network is considered a level. Each router and remote panel module requires an IP address. Use the 16-position rotary switch on the front of a router to set its IP address and level. Use the rotary switch on the front of a remote panel module to set its IP address.

For routers,

Level = switch value (1–4).

**address** = switch value + 100.

The IP address is 192.168.2.**address**.

Thus, subnet addresses for routers range from 101 to 104 and correspond to the router levels.

For remote panel modules,

**address** = switch value + 50.

The IP address is 192.168.2.**address**.

Thus, subnet addresses for remote panel modules range from 51 to 65.

The numbers on the rotary switch are in hexadecimal: 0–F. Do **not** use 0.

You must assign an IP address to the PC that runs CRSC, if you intend to use it. See [Setting Up Your Configuration PC](#) on page 62.

## CRSC Networks

A CRSC network comprises the following items:

- From 1 to 16 remote panel modules (with attached control panels, including CP6464s).
- From 1 to 4 compact routers (including CR6400 routers). You can mix routers of any size and type according to your requirements. A router can be partitioned. Each partition is a level. There can be up to 8 levels. Panels in a CRSC network are highly configurable and do not have some of the constraints that panels in a stand-alone network have.
- Optionally, one or more PCs (running Windows XP, Vista, or Windows 7) on which you have installed CRSC.
- An Ethernet switch (or hub) capable of 100MB/s operation with enough ports to accommodate your routers, remote panel modules, and PCs.

You can have multiple CRSC networks. CRSC can detect multiple networks if your configuration PC has the network connections to do so. CRSC can work with only one network at a time and that is called the “active subnet.”

Figure 3-2 shows a sample network of routers with remote panel modules:

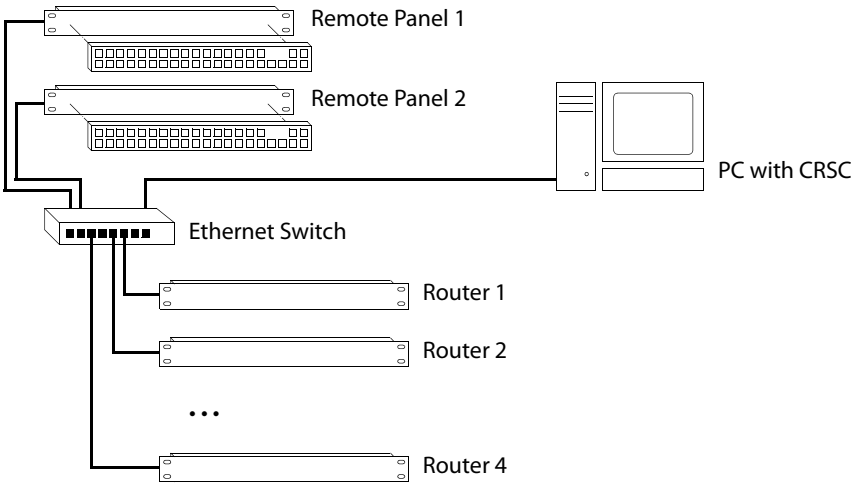


Fig. 3-3: Network of Routers

Although captive panels (those mounted on routers) are permissible, these panels do not have the capabilities of remote panels. Captive panels operate in stand-alone mode, controlling only the router on which they are mounted, and are extraneous to the CRSC network.

## Levels and IP Addresses in CRSC Networks

(Refer to the *CRSC User's Guide* for complete detail.)

Each router in the network is considered a level. Each router and remote panel module requires an IP address. Use the 16-position rotary switch on the front of a router to set its IP address and level. Use the rotary switch on the front of a remote panel module to set its IP address.

For routers,

Level = switch value.

**address** = switch value + 100.

The *default* IP address is 192.168.2.**address**.

Thus, by default, the subnet addresses for routers range from 101 to 115.

For remote panel modules,

**address** = switch value + 50.

The *default* IP address is 192.168.2.**address**.

Thus, subnet addresses for remote panel modules range from 51 to 65.

The numbers on the rotary switch are in hexadecimal: 0–F. Do **not** use 0.

CRSC allows you to change the IP address of any router or remote panel module. CRSC supports router partitioning. A partition is also called a level. You can have 8 levels in a CRSC network. The level numbers can be in the range [1–250] and must be unique. In other words, CRSC allows you to override the defaults obtained from the rotary switch settings.

You must also assign an IP address to the PC that runs CRSC, if you intend to use it. See [Setting Up Your Configuration PC](#), following.

## I/O connections

Depends on your hardware and how you configure the routers and panels. Configuration depends on your hardware and your I/O connections. In other words, there is a cyclic dependency among the system design issues. At some point during the design process, you must define your I/O connections in CRSC.

## CQX Networks

At present, a CQX router must operate by itself with a CQX control panel (or automation). Do not place a CQX router on a subnet with other routers. You can have more than one subnet dedicated to CQX routers, however.

Figure 3-4 shows the ways a “clean and quiet” router can be connected:

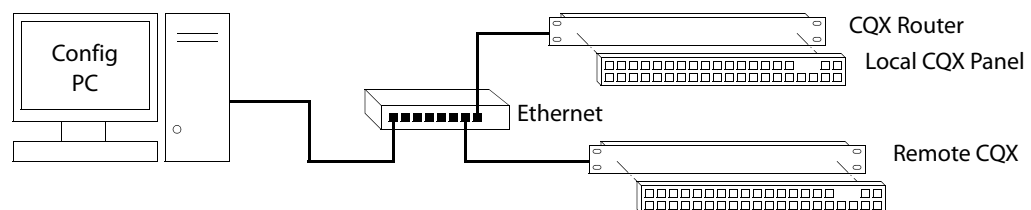


Fig. 3-4: CQX Network

The CQX panel can be local (mounted on a CQX router) or it can be remote (mounted on a remote panel module). The remote CQX panel then must be connected to the CQX router by an Ethernet switch. It is possible to use both a captive panel and a remote panel.

Unlike other compact routers, the CQX routers have two rotary switches. You must set both switches to an appropriate value.

## Mode Rotary Switch

The 16-position 'Mode' rotary switch configures the router's video format. Set the rotary switch to a position in the range 0–9, A, B, C, or D, according to this table:

Setting	Format	Setting	Format	
0	1080i, 59.94 or 60 1080p, 29.97 or 30 1080psf, 29.97 or 30	6	1080p, 59.94 or 60	<i>Switch positions 6 and 7 correspond to video according to SMPTE 425 level A.</i>
		7	1080p, 50	
		8	2 × 1080i, 59.94 or 60	<i>Switch positions 8 and 9 correspond to video according to SMPTE 425 level B.</i>
1	1080i, 50 1080p, 25 1080psf, 25	9	2 × 1080i, 50	
		A	720p, 29.97 or 30	
		B	720p, 25	
2	525i, 59.94	C	720p, 23.98 or 24	
3	625i, 50	D	1080p, 23.98 or 24, 1080psf, 23.98 or 24	
4	720p, 59.94 or 60	E	<i>reserved</i>	
5	720p, 50	F	<i>reserved</i>	

The default is 1080i, 59.94 Hz (switch setting 0). Positions E and F are not valid positions.

Where a switch setting supports multiple formats, the format is governed by the video reference applied to the router and must be compatible with that reference format.

- ▲ Every time you make a switch change, power-cycle the router.

## Frame ID Rotary Switch

You must set up the IP addresses for the router (and a remote panel, if you have one). First, use the rotary switch on the router (and remote panel module) to set an initial IP address:

For a CQX router,

**address** = switch value + 200.

The *default* IP address is 192.168.2.**address**.

Thus, **address** ranges from 201 to 215. *However, use only a switch setting in the range 1–4 (addresses 201 to 204).*

For remote panel modules,

**address** = switch value + 50.

The *default* IP address is 192.168.2.**address**.

Here, **address** ranges from 51 to 65.

The numbers on the rotary switch are in hexadecimal: 0–F. Do **not** use 0 because 0 causes the router or remote panel module to be reset.

After you perform the setup using the rotary switches, you can use CRSC to change the IP addresses from the defaults.

- ▲ Every time you make a switch change, power-cycle the router or remote panel module.

## NV9000 Networks

An NV9000 network<sup>1</sup> has connectivity that differs from a CRSC network. The chief difference is the presence of the system controller(s):

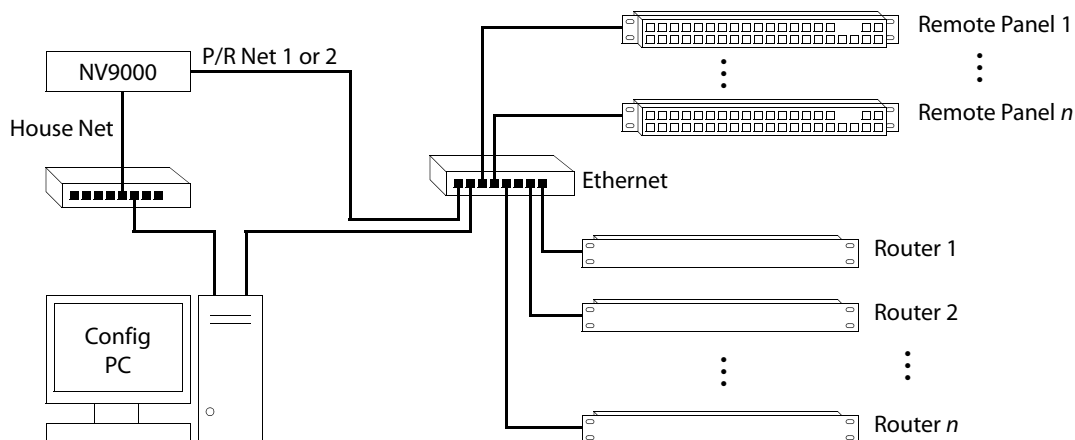


Fig. 3-5: NV9000 Network of Routers

The NV9000 is the center of activity and the remote panel modules do no significant processing whereas in a CRSC network, the remote panel modules do all the processing and there is no NV9000.

- ▲ You will use CRSC to set up a remote panel module for operation in the NV9000 network and to define the partitions of the routers used in the NV9000 network. NV9000-SE Utilities is the configuration software for the system and for any remote panels used by the system.

The NV9000 network comprises the following items:

- An indefinite number of remote panel modules (with attached control panels).  
Panels in an NV9000 network are configurable and **must be** configured in NV9000-SE Utilities. Most of the features and concerns of panel configuration in a CRSC network are **not** present in panel configurations in an NV9000 network.
- An indefinite number of compact routers. You can mix routers of any size and type according to your requirements. A router can be partitioned. Each partition is a (physical) level. There can be up to 8 levels. The physical levels (i.e., partitions) must be configured the same way in NV9000-SE Utilities as you have configured them in CRSC.  
When defining the routers in the NV9000 configuration, specify 'NV Compact Router Ethernet' as the protocol.
- Optionally, one or more PCs (running Windows XP, Vista, or Windows 7) on which you have installed CRSC and NV9000-SE Utilities.
- One or more Ethernet switch (or hub) capable of 100MB/s operation with enough ports to accommodate your routers, remote panel modules, PCs, and other NV9000 components.  
The NV960 system controller has 2 panel/router network ports by default. The NV920 has 3 general-purpose network ports.

1. An NV9000 network that includes compact routers is one that operates under NV9000 software. The NV9000 system will have at least one NV960, NV920, (or older NV915) system controller and a number of different control panels, many of which are not CR Series panels.



## Levels and IP Addresses in NV9000 Networks

(Please refer to the *CRSC User's Guide* for complete configuration details.)

Levels and IP addresses are configured for NV9000 networks as they are for CRSC networks. However, levels must *also* be configured in NV9000-SE Utilities. The NV9000-SE Utilities configuration must match levels you define in CRSC. If the configurations are not identical, your routers will probably not switch the correct signals.

Remote panel modules must also be configured in NV9000-SE Utilities.

There are 3 parts to installing an NV9000 network.

- Initial setup of routers, levels, and remote panel modules in CRSC.
- Configuration of routers, levels, and panels in NV9000-SE Utilities.
- Cabling of the control connections and cabling of the I/O.

The initial setup in CRSC turns off the factory defaults in the routers and remote panel modules. After that initial setup, they are ready to be deployed in your NV9000 network.

### In CRSC

At the beginning of the initial setup, each router requires a unique IP address and each remote panel module requires a unique address. Use the 16-position rotary switch on the front of a router to set its IP address and level. Use the rotary switch on the front of a remote panel module to set its IP address.

For routers,

Level = switch value.

**address** = switch value + 100.

The *default* IP address is 192.168.2.**address**.

Thus, by default, the subnet addresses for routers range from 101 to 115. Initially, each router in the network has one level. You can define new levels, up to a total of 8.

For remote panel modules,

**address** = switch value + 50.

The *default* IP address is 192.168.2.**address**.

Thus, subnet addresses for remote panel modules range from 51 to 65.

The numbers on the rotary switch are in hexadecimal: 0–F. Do **not** use 0.

CRSC allows you to change the IP address of any router or remote panel module. The NV9000 will almost certainly require it. You will define the IP addresses in CRSC and reference them in the NV9000 configuration.

Change the IP addresses of your devices in CRSC's 'CR Series Ethernet Settings' page. Do not forget to click 'Apply Updates'.

CRSC supports router partitioning. A partition is also called a level. You can define 8 levels in CRSC. The level numbers can be in the range [1–250] and must be unique. Your level definitions will depend on your system design. You can change your level assignments at any time. Do not forget to click 'Update Router Levels'.

For remote panels to function properly in an NV9000 network, you must set them up for use as "dumb panels." In CRSC's 'Setup NV9000 Remote Panels' page, for each remote panel module,

check 'Enable NV9000 Mode'. We recommend that you check 'Use DHCP. . .' also. Do not forget to click 'Update Remote Panel'.

The NV9000 normally uses DHCP to assign IP addresses to its panels. If you do not configure your remote panel modules for DHCP, you would then have to configure your NV9000 system not to use DHCP and that is not feasible.

#### In NV9000-SE Utilities

You must create a definition for each router you have in your system. In this guide, we are interested only in compact routers, but your system certainly may include other routers.

You must create a configuration for each remote panel in your system. Your system may also include NV96xx panels.

The levels you define for the routers in NV9000-SE Utilities must match the levels defined in CRSC. You must specify the same number of levels, the same level numbers, and the levels must be of the same size. NV9000-SE Utilities also allows you to define "level sets." You must have at least one level set. A suitable level set might be one that includes all levels.

Once panels and routers are defined in NV9000-SE Utilities, you must enumerate the inputs and outputs (i.e., map sources to router partitions and input connector numbers and map destinations to router partitions and output connector numbers.) You can do this in the 'Devices' page or using the 'Add Device' or 'Add Multiple Devices' tools.

Further, you can define system salvos in NV9000-SE Utilities and assign them to panel buttons. Salvos are a topic outside the scope of this guide. Refer to the *NV9000-SE Utilities User's Guide*.

Also refer to the [NV9000 Network Example](#) on page 171.

▲ Note that AES setup in NV9000-SE Utilities is unusual. Exercise care: you must use the odd channel numbers to represent the I/O pairs at the rear of your compact router(s).

You must also assign an IP address to the configuration PC. Your PC might have to appear on the NV9000's house net (or the NV915's "Config" net) and on the panel/router network. See [Setting Up Your Configuration PC](#), following.

#### I/O connections

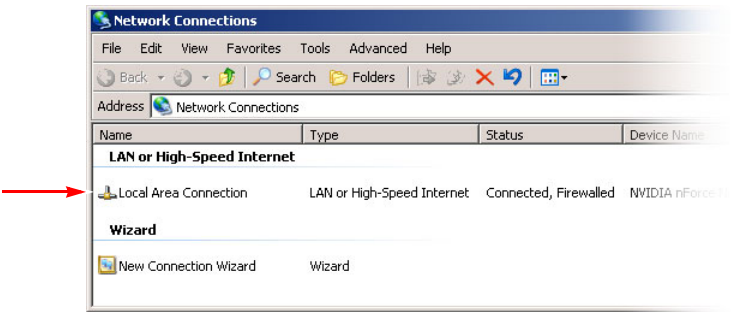
Your I/O connections depend on your hardware and how you configure the routers and panels. Configuration depends on your hardware and your I/O connections. In other words, there is a cyclic dependency among the system design issues. At some point during the design process, you must define your I/O connections in NV9000-SE Utilities.

Refer to the [NV9000 Network Example](#) on page 171.

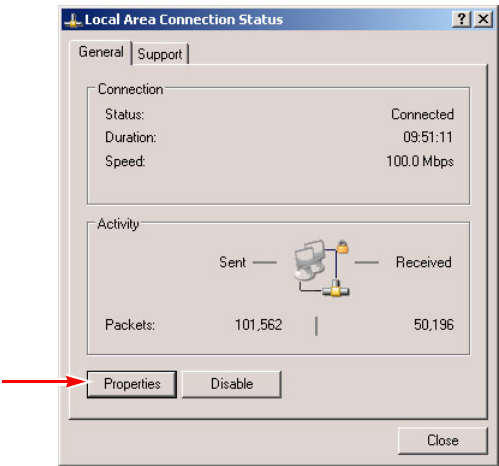
## Setting Up Your Configuration PC

Your configuration PC must be assigned an IP address on the same subnet as one of your compact router networks. The factory default subnet is 192.168.2.xxx. It is expected that you will use a subnet appropriate for your system. Follow these steps to configure your PC's address:

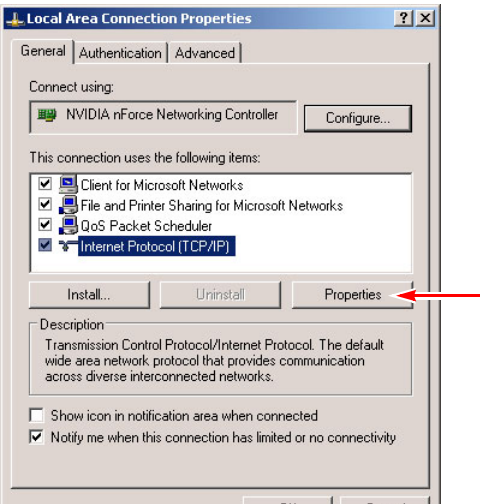
1 Launch 'Settings>Network Connections' from you PC's Start menu. The following window appears:



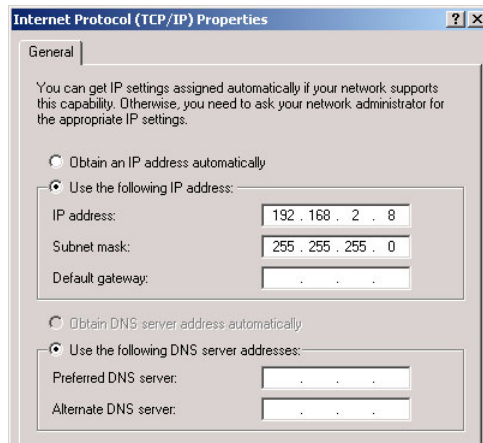
2 Double-click 'Local Area Connection'. Then, choose the 'General' tab and click 'Properties'.



3 Select 'Internet Protocol (TCP/IP)'. Click 'Properties' again:



- 4 Select 'Use the following IP address' and enter the IP address for your PC. Use the default subnet mask.



The IP address must be on the same subnet as (one of) your compact router network(s). We recommend that you choose an IP subnet address that is not in the range 100–115 or 50–65. Those ranges are used as defaults.

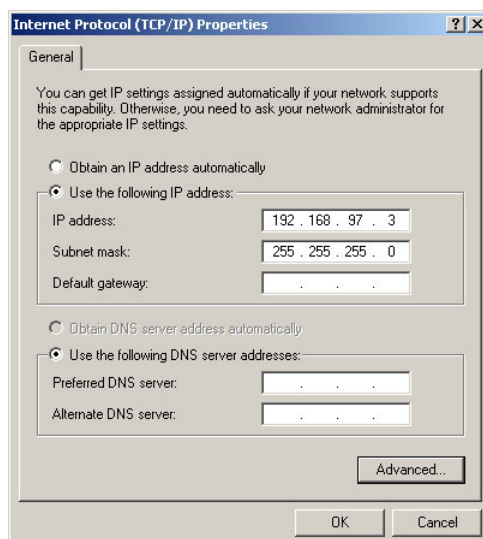
- 5 Click OK to finish.

## Multiple Subnets

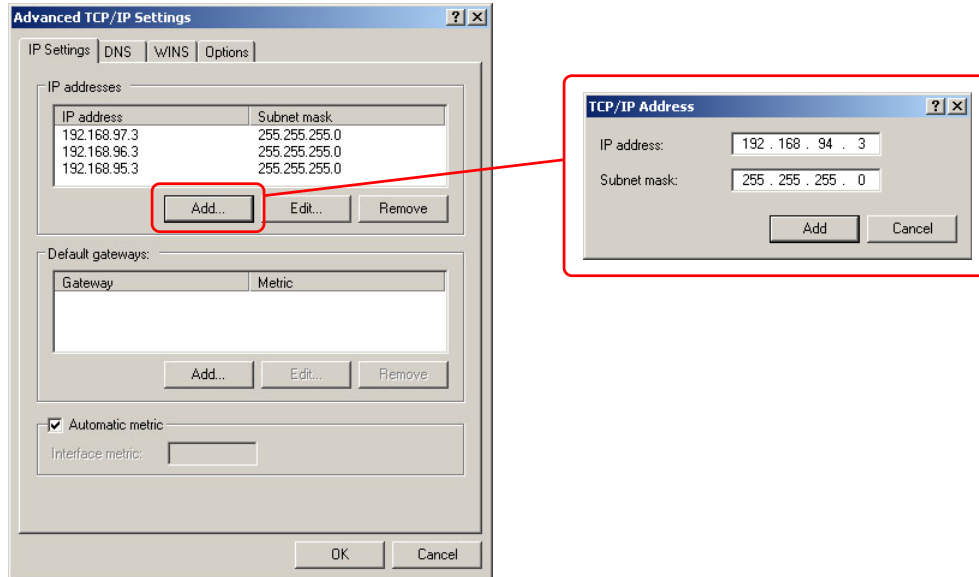
If you have multiple subnets in your compact router system, you will probably have to add those subnets to your PC's network configuration. Doing this is especially important for CQX routers.

Follow these guidelines:

- 1 Starting from step 4 in the preceding procedure, click the 'Advanced' button:



2 Click the 'Add' button and enter an IP address for your PC on each of the subnets:



3 After adding IP addresses for your subnets, click OK.

## Power-Up

Apply power to each router, each remote panel module, and the Ethernet switch if you have a network. The network should initialize and stabilize in a few seconds.

If you have CRSC connected, you can perform a quick check to see whether your network is operating. In CRSC, click 'CR Series Ethernet Settings' at the top left. In the Ethernet settings page, click 'Refresh List'. All your routers and remote panel modules should appear in the list of CR Series devices.

If you have a CRSC network that has already been configured, the network will require a few more seconds to perform its "discovery" especially if it is a complex network.

If you have a CRSC network and have yet to perform any configuration, follow the steps described in the *CRSC User's Guide*.

If your system fails in any way, refer to [Trouble-Shooting](#), on page 115, or [Testing](#), next.

## Testing

### Stand-Alone Routers (including CR6400 Routers)

A stand-alone router is one that is not connected to a network and (presumably) has a captive panel mounted on the front.

The router's rotary switch must be set to a value in the range [1–4].

- ▲ The panel will power up in the locked state. The 'Panel Lock' button will be red. Just press the red button to clear the lock.

- 1 Ensure that the router has power. Either or both of the power indicator LEDs should be on. If that is not the case, then check the power indicator LED of the router's power supply and check the connectors of the power supply's cables. Replace the power supply if it is defective.  
You might want to use the power supply strap to help the line cable secure. See [Power Cord Retention for the PS0001 and PS0012 Power Supplies](#) on page 185.
- 2 Examine the captive panel. Are all the source and destination buttons illuminated? Most will be illuminated at a low level.
- 3 Perform one or more takes using the panel. (Press a destination button followed by a source button.)  
You do not need to connect any devices to a router to see whether the router switches. Button status on the control panel reflects the router's state. However, connected devices will give you visual and auditory feedback regarding the quality of the switched signals.
- 4 Perform a panel lock. Press the panel lock button and it should turn red. (When the panel is locked, other buttons are disabled.)
- 5 Perform a destination lock. Press a destination then press the 'Destination Lock' button. Both buttons should turn red. Press the 'Destination Lock' button again. Both buttons should revert to amber.
- 6 Exactly one of the level selection buttons should be bright. (There are 4 buttons, corresponding to the level you selected with the rotary switch.)

If the router and panel pass all of these simple tests, it is likely to be working properly. You can now proceed with I/O connections and more exhaustive and detailed testing that is dependent only your installation.

Report any failures to Grass Valley customer service.

## CR6400 Stand-Alone Networks

A stand-alone CR6400 network comprises 1–4 CR6400 routers, one or more captive CP6464 panels, and an Ethernet switch. If you have an automation system, the panels are not strictly required, but are helpful for testing.

- 1 Ensure that each router has a unique rotary switch setting in the range 1–4. The switch position determines the router's level.
- 2 Connect and power-up your Ethernet switch. Verify that the switch is operating and that all ports are communicating. You should see both green and amber communication lights at the Ethernet connectors of the routers.
- 3 Your panel should power up with its panel lock button high-tally red. Press the panel lock button to turn panel lock off. The panel's buttons should become illuminated and operable.
- 4 If you have set the rotary switches of your routers correctly, one or more of the level buttons should be illuminated. Level button 1 (the left-most level button) corresponds to the router whose rotary switch was set to 1. Level button 2 corresponds to the router whose rotary switch was set to 2, and so on.

Report and correct any failures before proceeding.

## General Stand-Alone Networks

A stand-alone network comprises 1–4 routers, one or more control panels, and an Ethernet switch. If you have an automation system, the panels are not strictly required, but are helpful for testing.

(A stand-alone can include CR6400 routers and panels as well as routers and panels of other types.)

The network can include captive and remote panels. It should include a PC on which you can run CRSC. (CRSC, although not used with a stand-alone network, can provide a better view of stand-alone routers and panels and can be used for firmware updates.)

▲ If you are using devices that were previously used in a CRSC network, you must restore them to their factory-default states. To do that, turn the rotary switches to position 0 and cycle power. Then turn the rotary switches to different non-zero positions and proceed to make network connections.

- 1 First ensure that all your routers and remote panels have power and are functioning.
- 2 Ensure that each router has a unique rotary switch setting in the range 1–4. The switch position determines the router's level.
- 3 Ensure that each remote panel module has a unique rotary switch setting in the range 1–15. (The letters A–F on the rotary switch represent the values 10–15.)
- 4 Connect and power-up your Ethernet switch. Use CAT5 Ethernet cable or better. Verify that the switch is operating and that all ports are communicating. You should see both green and amber communication lights at the Ethernet connectors of the routers and remote panel modules.
- 5 If your panels are mounted, they should power up with their panel lock button high-tally red and all source and destination buttons illuminated (low-tally). Turn panel lock off if you wish to operate a panel.
- 6 Level buttons should be high-tally for each level in the network. Each source and each destination button should be illuminated—and high tally when selected.

Report and correct any failures before proceeding.

### Further Testing

Perform a few multi-level takes and locks. See Chapter 5, [Operating a Stand-Alone Router](#), for instructions.

Report failures to Grass Valley customer service.

## CRSC Network

A CRSC network comprises one or more routers (up to 8 levels), one or more remote panels, and an Ethernet switch. If you have an automation or control system, the panels are not strictly required, but are helpful for testing.

The network should not include captive panels. It must include a PC on which you can run CRSC. (CRSC is a requirement for creating a CRSC network.)

- 1 First ensure that all your routers and remote panels have power and are functioning.
- 2 Connect and power-up your Ethernet switch. Use CAT5 Ethernet cable or better. Verify that the switch is operating and that all ports are communicating. You should see both green and

amber communication lights at the Ethernet connectors of the routers and remote panel modules.

- 3 Follow the steps for initial setup as described in the CRSC User's Guide. This ensures that all routers and remote panel modules on your network are properly connected.

To confirm that you have done this, choose the 'CR Series Ethernet Settings' page and examine the list of devices. All devices in your network should be present in the list with the IP addresses that you have chosen.

- 4 In CRSC, choose the 'Firmware Update' page and upload current firmware to all routers and remote panel modules. It takes about 2–3 minutes per device.

Report and correct any failures before proceeding.

### Simple Testing with CRSC

Because CRSC requires at least some configuration of your routers and panels and because CRSC networks involve a considerable amount of design, it is not possible to present a definite procedure for testing your network. You may consider the following points to be guidelines.

- 1 Examine your router levels carefully in the 'Set Up Router Levels' page.

Ensure that there are 8 or fewer levels on a subnet and that the partition types and partition ranges reflect your design goals.

It is easy to forget that adding a router adds a level. If you already have 8 levels and add a router, CRSC allows it and you now have 9 levels. One level must be deleted. (You cannot simply delete the level created by the router you just added. You must remove the router from the network.)

Make sure that the added router's level number is correct for your design.

- 2 Ensure that any AES router has video reference if it is required and that the partition type is chosen appropriately.

You can test the operation of an AES router—or any router—in the 'View Crosspoint' page.

- 3 Ensure that any machine control router partition is set to 'machine control reverse'. Other partition types are allowed, but not yet implemented.

- 4 Panel configuration is fairly easy but can become complex if your system is complex. Be aware of the differences between panel operating modes.

### Further Testing

Perform a few multi-level takes and locks. See the *CRSC User's Guide* for more information.

Report failures to Grass Valley customer service.

### CQX Routers

A CQX system is restricted: one CQX router and one captive CQX panel and optionally a remote CQX panel. If you have an automation system, the panel is not strictly required, but helpful for testing. Your CQX router and panel may be on a network that includes a PC on which you can run CRSC.

- 1 First ensure that your router and panel have power and are functioning.
- 2 Ensure that the router and remote panel module (if you have one) have non-zero rotary switch settings for the frame ID.



- 3 Ensure that the router has the 'Mode' rotary switch set for the correct video rate. See [Mode Rotary Switch](#) on page 82 for details.
- 4 (Optionally) connect your video reference at this time. It takes about 10 seconds for the router to lock to the reference. You can wait until you have I/Os connected before connecting a video reference. You will not be able to perform any useful tests until the reference and at least some I/Os are connected.
- 5 If you have a network, connect and power-up your Ethernet switch. Use CAT5 Ethernet cable or better. Verify that the switch is operating and that all ports are communicating. You should see both green and amber communication lights at the Ethernet connectors of the router (and remote panel module).
- 6 Your panel should power up with its panel lock button high-tally red and all source and destination buttons illuminated (low-tally). Turn panel lock off.

### Basic Functions

Assuming a CQX panel is connected to the CQX router:

- 1 Press one or more destination buttons. Do the buttons change state (go high- or low-tally)?
- 2 Press one or more transition type buttons. Do the buttons change state (go high- or low-tally)?  
(You must have pressed one of the two CQ outputs for the transition type and rate buttons to be enabled.)
- 3 Press one or more transition rate buttons. Do the buttons change state (go high- or low-tally)?
- 4 Press one of the 2 CQ outputs, then press a source button other than the source that was already selected. Does a transition occur according to the transition type and rate you have selected? (You will need a monitor connected to the CQX outputs for this test.)  
A clean and quiet transition occurs only if the video input formats match the 'Mode' switch setting and a valid video reference is connected.
- 5 Choose a different transition rate or type, then repeat step 4. Does a transition occur according to the transition type and rate you have selected? (You will need a monitor connected to the CQX outputs for this test too.)
- 6 Press one of the 6 auxiliary outputs, then press a source button other than the source that was already selected. Does a transition occur (without any transition effects)?

Report and correct any failures before proceeding.

### Bypass Functions

This test does not assume that a CQX panel is connected to the CQX router. It does assume that a monitor is connected to one or both of the 2 CQX outputs.

- 1 Ensure that a video source is connected to the 'Bypass 1' BNC.
- 2 Route a video source to the 'CQX 1' output.
- 3 Remove power from the CQX router. The monitor should switch to the source from the bypass input.
- 4 Repeat steps 1–3 for CQX 2 and 'Bypass 2'.

Report and correct any failures before proceeding.

## GPIO Functions

Each of the 16 GP inputs switch a corresponding video input to CQ output 1. The 4 GP outputs signal alarms and status. See [GPIO Connections for CQX Digital Video Routers](#) on page 129 for details.

## Using CRSC for Testing

You can use CRSC to view the CQX crosspoint. CRSC presents a 16×8 crosspoint matrix that you can use to perform takes directly and to view takes and locks performed at a CQX panel.

You can also use CRSC to perform (destination) lock maintenance.

## NV9000 Network

An NV9000 network includes one or more compact routers (up to 8 router partitions, or *levels*), one or more remote panels acting as NV9000 panels, and an Ethernet switch for each panel/router network and possibly an Ethernet switch for the house net or config net to which you configuration PC is connected. The NV9000 network might include large routers and NV96xx control panels and other equipment, but that equipment is not the concern of this guide.

The NV9000 network centers around a system controller (i.e., an NV960, NV920, or NV915). The NV9000 network might also include automation.

The network allows captive panels but does not include them (although they do show the status of the routers on which they are mounted).

Use these guidelines to test your network:

- 1 First ensure that all your routers and remote panels have power and are functioning.
- 2 Verify that the Ethernet switch is operating and that all ports are communicating. You should see both green and amber communication lights at the Ethernet connectors of the routers and remote panel modules.
- 3 Follow the steps for initial setup as described in the *CRSC User's Guide*. This ensures that all routers and remote panel modules on your network are properly connected.  
To confirm that you have done this, choose the 'CR Series Ethernet Settings' page in CRSC and examine the list of devices. All devices in your network should be present in the list with the IP addresses that you have chosen.  
You can perform similar tests in the 'System' pane (and pages) of NV9000-SE Utilities.
- 4 If necessary, choose the 'Firmware Update' page in CRSC and upload current firmware to all routers and remote panel modules. It takes about 2–3 minutes per device.

Report and correct any failures before proceeding.

## Simple Testing with CRSC

NV9000 networks that use compact routers require some setup in CRSC. (Other NVISION series routers require some setup in UniConfig or MRC. It is the same idea.) The principal use of CRSC is (a) to assign IP addresses to all the routers and remote panel modules and (b) to specify the router partitions (a.k.a. levels). This use of CRSC in an NV9000 network is no different from the setup required by a CRSC network. A third function is to change all remote panel modules to NV9000 mode.

- 1 Examine your router levels carefully in the 'Set Up Router Levels' page.  
Ensure that there are 8 or fewer levels and that the partition types and partition ranges reflect your design goals.  
Make sure the level numbers are correct. You will entered much of this level information in NV9000-SE Utilities. The information in CRSC and NV9000-SE Utilities should match.
- 2 Ensure that any AES router has video reference if it is required and that the partition type is chosen appropriately.
- 3 Test the operation of any router in the 'View Crosspoint' page of CRSC.
- 4 Ensure that any machine control router partition is set to 'machine control reverse'. Other partition types are allowed, but not yet implemented.
- 5 Perform a few multi-level takes and locks. See the *CRSC User's Guide* for more information.

### Simple Testing under NV9000

- 1 Use the 'System' pages of NV9000-SE Utilities to examine, start, stop, or otherwise manage your NV9000 network.  
You will see the routers and panels of your network and their status in these pages.  
Verify that all your compact routers and remote panels are present and that their status is "good." You might have to correct IP addresses in CRSC or in NV9000-SE Utilities and possibly restart your NV9000 software.
- 2 Press a few panel buttons. Do they work? Chances are that if any button works, they all work (subject to the correctness of your configuration and the suitability of your network design).  
You can correct panel configuration errors at any time. You must re-transmit the configuration to the NV9000 when you do so.

Report failures to Grass Valley customer service.



# 4 Configuration

Chapter 4 provides configuration instructions for the CR Series products.

## Topics

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There are several general ways to use the CR Series Compact Routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A network of stand-alone routers, possibly with remote panels, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single CQX router with a captive CQX panel and optionally a remote CQX panel.

## Stand-Alone Routers

A stand-alone router has *very little* to configure. This is what you can control:

- The number of power sources: 1 or 2.
- The physical input and output connections.
- The video reference.

### The Number of Power Sources

You can connect one or two external power supplies. The second power supply provides redundancy protection if the first malfunctions.

Follow these steps to connect a power supply:

- 1 Plug the 4-pin connector on the power supply into the 4-pin connector (PS1 or PS2) on the router. There is only one way that it will fit. Do not force it.
- 2 Plug the AC cord into the other end of the power supply “brick” and then plug the AC plug into an AC power outlet. There is no on/off switch.

Note that this connection order is especially important for CR6400 routers because of the large DC voltage and current values applied to the router. (The two CR6400 routers have a different connector from other CR Series routers.)

### The Physical Inputs and Output Connections

Connect input devices and output devices to the router according to the requirements of your system and according to the connector types for the particular router(s) you have.

In a stand-alone router, there are no mappings, configurations, or special organization to consider. With certain exceptions, your devices connect directly to the connectors of your router. These are the exceptions:

- Machine control routers have RJ-45 connectors. If your devices have DE9 (or other) connectors, you will have to fabricate or acquire adaptor cables. See [Cabling](#) on page 181.
- The CR6400 routers have DIN 1.0/2.3 connectors. If your devices have BNC (or other) connectors, you will have to fabricate or acquire adaptor cables.
- ▲ Video cable length limits are standard: 400m for SD, 150m for HD, and 100m for 3Gig (80m for 3Gig CQX routers), for Belden 1694A (or equivalent) cable. Input equalization is automatically adjusted according to that cable type and cable length. Audio cable limits are about 100m.
- ▲ Grass Valley offers a breakout cable (WC0053) for DB25 connectors. The breakout cable provides 24 individual wires (plus, minus, and shielding connections for each of the 8 channels on the DB25 connector).

### External Video Reference

All routers except the machine control routers accept bi-level or tri-level video references and switch according to SMPTE RP168-2002. The machine control routers do not receive video reference.

Unless you want asynchronous mode with an AES router, use an external video reference. AES routers require a video reference to operate in synchronous mode.

Connect your video reference input to either video reference connector on the rear of the router. Use the other video reference connector to feed the reference signal to another device. Terminate the reference signal (or chain of reference signals) using a 75Ω terminator.

### The Rotary Switch

A single stand-alone router does not use its 16-position rotary switch setting (useful only in a network) but you should set it to a non-zero position in any case. (When the rotary switch is zero, the router reverts to its factory-default state at power-up.)

When a control panel is mounted on a router, it conceals the rotary switch. You must remove the control panel when you are setting the rotary switch.

- ▲ Every time you make a switch change, power-cycle the router or remote panel module.

### Button Legends

You can label the control panel buttons. Use a desktop publishing program to create your own button legends. The legends should be transparent and no larger than 0.40" × 0.40" (10mm square). A 3/8" (9.5mm) square insert will allow a little clearance. The clear plastic material used for overhead transparencies is suitable for printing legends.

To apply a label to a button, pull the clear plastic cap from the button, insert the label in the cap, and replace the cap. The caps come off easily. No tools are required. We recommend that you not use adhesive.

- ▲ Button legend templates (in Word,\* Illustrator,\* and Freehand\* formats) are available on the documentation and software disk (SB0033-17) you received with your CR Series product(s). Simply type (or draw) the legends you want and print the page on transparent film. Then cut apart the button legends and insert them under the clear plastic button caps.

## Stand-Alone Network

For each router, set up I/O, video reference, and power and ground connections as you would for stand-alone routers.

Similarly, for each remote panel module, set up power and ground connections. Attach a matching control panel to each. See [Stand-Alone Routers](#), the previous section, for information.

### IP Addresses and Levels

A stand-alone network allows up to 4 routers (levels 1–4) and up to 15 remote panel modules. Decide what signal types (HD, SD, AES, AV, etc.) you want on which levels and set the rotary switch position to configure the levels accordingly. For routers, the switch positions must be 1, 2, 3, or 4.

To configure the IP addresses of remote panel modules, set the rotary switch to a *non-zero* position. Each remote panel module is treated identically on the network, so the rotary switch positions are immaterial as long as they are all distinct.

If you are using CRSC, the PC(s) on which CRSC executes must be on the same subnet. Make sure that each PC's IP address is 192.168.2.xxx, where xxx is not the subnet address of any router or remote panel module. We suggest any address outside the ranges 101–104 and 51–65.

See [Levels and IP Addresses in Stand-Alone Networks](#), on page 56, for information on rotary switch settings and subnet addresses.

- ▲ You can use CRSC to perform a quick check to see whether your network is connected properly. Click 'Find CR Family Routers' to scan your network for CR Series routers and remote panel modules. Everything connected to your network should appear in CRSC's Devices list.

## CRSC Network

For each router, set up I/O, video reference, and power and ground connections as you would for stand-alone routers.

Similarly, for each remote panel module, set up power and ground connections. Attach a matching control panel to each.

### IP Addresses and Levels

A CRSC network allows up to 4 routers, 8 router levels and up to 16 remote panel modules. Decide what signal types (HD, SD, AES, AV, etc.) you want on which levels.

Rotary switches must be unique for routers initially. Then, use CRSC to assign IP addresses that do not depend on the rotary switches. Also use CRSC to assign level numbers that do not depend on the rotary switches.

Rotary switches must be unique for remote panel modules initially. Use CRSC to assign IP addresses that do not depend on the rotary switches.

See [Levels and IP Addresses in CRSC Networks](#), on page 57, for information on rotary switch settings and subnet addresses.

- ▲ You can use CRSC to perform a quick check to see whether your network is connected properly. Choose 'CR Series Ethernet Settings' to scan your network for CR Series routers and remote panel modules. All your devices should appear in the list on that configuration page.

Beyond these rudiments, CRSC network configuration is beyond the scope of this document and depends largely on your design goals. Read about in the *CRSC User's Guide*.

## NV9000 Networks

An NV9000 router control system can include compact routers and remote panel modules on its networks. The (active) system controller is the focus of the system. It controls everything according to operations performed at NV96xx panels and CR Series remote panels.

Your remote panel modules must be set up for NV9000 and subsequently configured in NV9000-SE Utilities. (They can be converted back to CRSC.) It is generally required to use CRSC to set up the initial IP addresses of the remote panel modules and routers and the levels within routers.

After the initial setup is done, use NV9000-SE Utilities to configure the routers and remote panel modules.

### Remote Panel Modules

Every remote panel module in an NV9000 network must be configured in CRSC to operate under NV9000. Use the 'Setup NV9000 Remote Panel' page:

NV9000 Remote Panel Settings

Enable NV9000 Mode

NV9000 Panel ID:

Use DHCP to acquire IP Address

Update Remote Panel

Network Frame Summary

Remote Panels | Levels | All CR Frames

Edit/Update	Name	Frame Type	Panel Type	Panel Mode	IP Address
	RP32	RP32	Unknown	Standard	192.168.97.51

Follow these steps:

- 1 Select the remote panel module (i.e., a frame) in the table in the lower part of the page.
- 2 Check the 'Enable NV9000 Mode' box.
- 3 Check the 'Use DHCP...' box if you want the NV9000 to use DHCP to assign an IP address to the remote panel. We strongly recommend that you check this box.
- 4 The default panel ID (an NV9000 feature) is derived from the lower 16 bits of the remote panel's IP address as defined in CRSC. You can change the panel ID. Note that panel IDs under NV9000 must be unique.



5 Click the 'Update Remote Panel' button to commit your changes.

If you want to revert a panel, uncheck the 'Enable NV9000 Mode' box and press 'Update Remote Panel'

▲ Regardless of the terminology you might see on the page, this page affects *remote panel modules* and not routers and not control panels.

## Router Configurations

NV9000-SE Utilities requires you to enumerate your compact routers. From the 'Routers' page, click 'Add Router'. In NV9000-SE Utilities, a compact router definitions require 'NV Compact Router Ethernet' protocol. (NV9000-SE Utilities sometimes calls this "NVEthernetProtocolCR.")

After you add the router, you may specify its IP address, physical levels, and other characteristics. This figure shows an typical router configuration. It is the AES router used in the [NV9000 Network Example](#) on page 171:

Router: AES3232-A

**Router Info**

Name: AES3232-A Protocol: NVEthernetProtocolCR

**Router Connection Info**

Primary Control Point

IP Addr: 192.168.97.102

**Physical Levels**

Name	#	Input Start	Input End	Output Start	Output End
AES3232-A_PL1	2	1	32	1	32
AES3232-A_PL2	3	33	64	33	64

Input Protect: In Server Input Lock: In Server Output Protect: In Router

Output Lock: In Router Shared Control: False

Signal Type: XY or Standard Number Virtual XPTs: 0

Chop Interval: 6 Virtual XPT Default Input: 1

Add Delete

Revert to Saved Save

The IP address and the physical levels you specify here must match the IP address and the levels you defined in CRSC. (CRSC allows up to 8 levels in total on a single subnet.)

Please refer to the CRSC User's Guide for details regarding level configuration.

Click 'Save' to capture your configuration.

## Virtual Levels

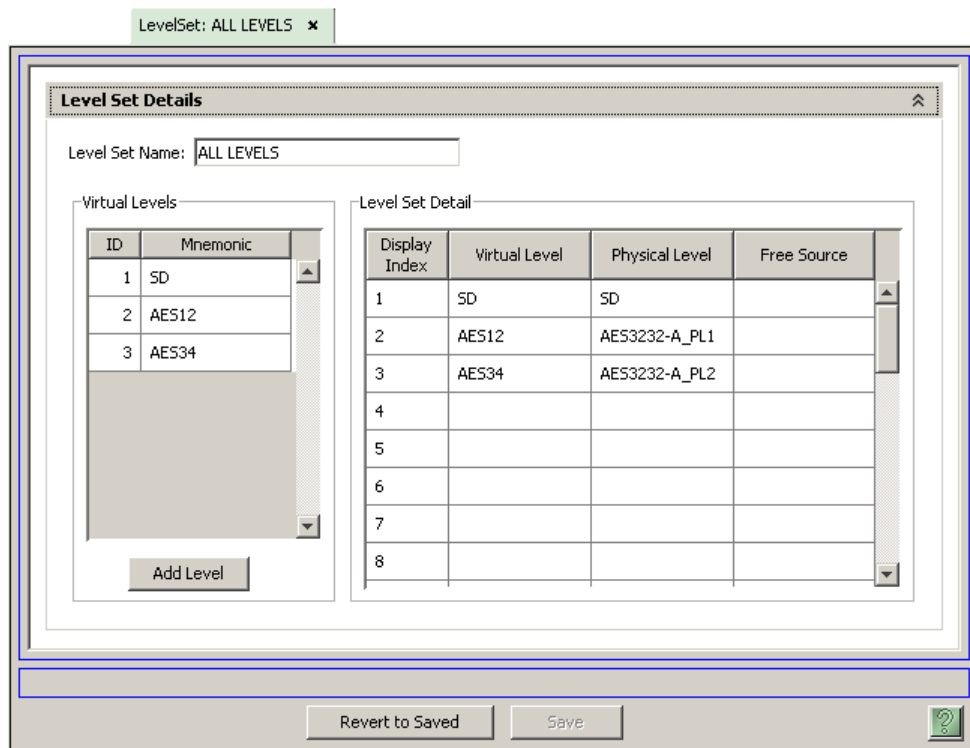
You must decide what signal types (HD, SD, AES, AV, etc.) you want on which levels.

An NV9000 network relies on CRSC to define Compact Router partitions (levels) as it relies on UniConfig or MRC to define the partitions of other NVISION series routers. If your system is to work properly, you must define *virtual levels* in NV9000-SE Utilities that match the levels defined in CRSC.

To do that, you must create at least one *level set*. It is often sufficient to define a single level set in NV9000-SE Utilities that includes all levels.

Go to the 'Level Sets' page and click 'Add Level'.

This level set matches the [NV9000 Network Example](#) on page 171:



In this example, the level set includes one SD level, and two AES levels. The physical levels were defined when you defined the routers.

Each virtual level is defined by some physical level. The virtual levels must match, in number and type, those you have defined in CRSC. Their names in NV9000-SE Utilities may differ. The example above matches these CRSC levels:

Level Number	Level Name	Router Name	Signal Type	Physical Input Start	Physical Input End	Controller Source Start	Physical Output Start	Physical Output End	Controller Destination Start
1	SD	CR1616-SD	SD Digital Video	1	16	1	1	16	1
2	AES12	CR3232-AES	Synchronous AES Mono	1	32	1	1	32	1
3	AES34	CR3232-AES	Synchronous AES Mono	33	64	1	33	64	1

Do not forget to click the 'Save' button.

(The rotary switches on compact routers are of concern only during initial setup in CRSC.)

(1) When a compact router's rotary switch is at position 0, it will reset to its factory default state at power up. That is useful at times, but once you have set up a router in CRSC, you want to avoid position 0.

(2) The rotary switch when it is non-zero defines the router's default level and its IP address. Once you have defined partitions for the router (and have redefined the router's IP address), the position of the rotary switch no longer matters.

NV9000 configuration, therefore, does **not** involve a compact router's rotary switch.

## I/O Connections

At some point you will have decided to what devices your routers' I/Os connect. Use the 'Devices' or 'Add Multiple Devices' in NV9000-SE Utilities to enumerate I/O connections.

Configuring I/Os in NV9000-SE Utilities is outside the scope of this guide. The page shown below is the result, in the [NV9000 Network Example](#) on page 171, of making I/O connections.

Device Phys Conns : ALL LEVELS x

Select Level Set for Query: ALL LEVELS v

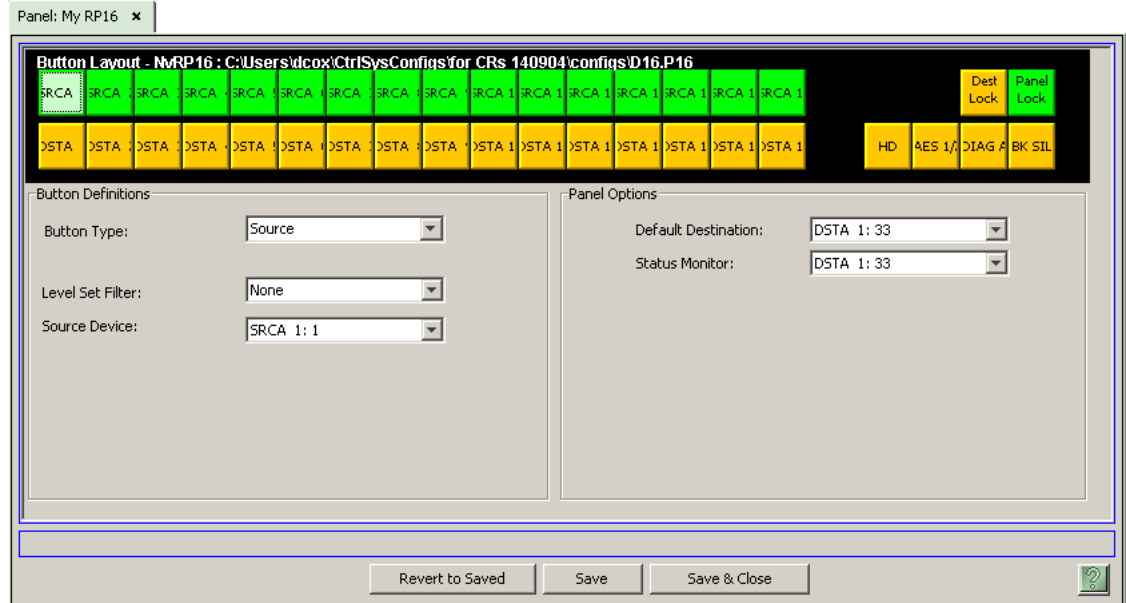
Device ID	Device	Device Des...	In			Out		
			SD	AE512	AE534	SD	AE512	AE534
1	INPUT 1		1	1	33			
2	INPUT 2		2	3	35			
3	INPUT 3		3	5	37			
4	INPUT 4		4	7	39			
5								
15	INPUT 15			29	61			
16	INPUT 16		16	31	63			
17	OUTPUT 1					1	1	33
18	OUTPUT 2					2	3	35
19	OUTPUT 3					3	5	37
20	OUTPUT 4					4	7	39
21	OUTPUT 5					5	9	41
22	OUTPUT 6					6	11	43
23	OUTPUT 7					7	13	45

Create Device    Revert to Saved    Save    Export    ?

## Panel Configurations

NV9000-SE Utilities allows you to configure RP16s and RP32s as panels.

This shows an RP16 configuration that matches the [NV9000 Network Example](#) on page 171:



## Button Functions

Except for the two lock buttons at the top right, any button on the panel can have one of these functions.

- Source

A source button represents a source *device* (which is generally a set of inputs in the NV9000 network. The devices do not necessarily have to be connected to compact routers.

During configuration, when you make a button a source button and it is selected, a drop-down menu of sources appears. The name of the source appears on the button in the configuration page.

- Destination

A destination button represents a destination *device* (which is generally a set of outputs in the NV9000 network. The devices do not necessarily have to be connected to compact routers.

During configuration, when you make a button a destination button and it is selected, a drop-down menu of destinations appears. The name of the destination appears on the button in the configuration page.

- Salvo

In the context of CR Series remote panels, a salvo is a *system salvo* (as opposed to a "local" salvo or any other kind). A system salvo is a sequence of NV9000 commands, such as Take, Lock, Release, or Pause, that executes when the salvo button is pressed. System salvos are stored in the system controller. You can define system salvos in NV9000-SE Utilities.

When you make a button a salvo button and it is selected, a drop-down menu of system salvos appears. The name of the salvo appears on the button in the configuration page.

▲ An NV9000 system salvo is not the same thing as a CRSC salvo.

- Previous Source

A 'Previous Source' button is like an "undo" button: when you press it, the connection to the source previously routed to a destination is restored.

- Undefined.

Some remote panel buttons can be left undefined. Such buttons do nothing and are unlit.

The two lock buttons under an NV9000 system are the same as for CR Series panels in any other situation: a destination lock button and a panel lock button.

A remote panel under an NV9000 network is not the same as a remote panel under a CRSC network.

## Special Functions

At the right side of the configuration page, there are two drop-down lists:

- Default destination.

The default destination is a destination to be selected when the panel powers up. That destination remains selected until an operator selects another destination at the panel.

Because of the default destination, the panel could conceivably function as a single-destination panel. Without a default destination, at least one destination button is required.

- Status monitor.

The status monitor is a destination device (such as a video monitor) on which the output(s) of the currently selected destination are replicated. When you select a different destination, the status monitor output reflects that change. When you select a different source for a destination, the status monitor output reflects that change also.

## References

Refer to [NV9000 Router Control Systems](#) on page 178 for more information about configuring an NV9000 system.

NV9000-SE Utilities is the configuration software used to configure a system controller. Please refer to the NV9000-SE Utilities online documentation or to the *NV9000-SE Utilities User's Guide*.

## CQX Routers

At present, a CQX router, like a stand-alone router, has *very little* to configure:

- The video format.
- The frame ID.
- The number of power sources: 1 or 2.
- The physical input and output connections.
- The video reference.

### Mode Rotary Switch

The 16-position 'Mode' rotary switch configures the router's video format. Set the rotary switch to a position in the range 0–9, A, B, C, or D, according to this table:

Setting	Format	Setting	Format	
0	1080i, 59.94 or 60 1080p, 29.97 or 30 1080psf, 29.97 or 30	6	1080p, 59.94 or 60	<i>Switch positions 6 and 7 correspond to video according to SMPTE 425 level A.</i>
1	1080i, 50 1080p, 25 1080psf, 25	7	1080p, 50	
2	525i, 59.94	8	2 × 1080i, 59.94 or 60	<i>Switch positions 8 and 9 correspond to video according to SMPTE 425 level B.</i>
3	625i, 50	9	2 × 1080i, 50	
4	720p, 59.94 or 60	A	720p, 29.97 or 30	
5	720p, 50	B	720p, 25	
		C	720p, 23.98 or 24	
		D	1080p, 23.98 or 24, 1080psf, 23.98 or 24	
		E	<i>reserved</i>	
		F	<i>reserved</i>	

The default is 1080i, 59.94 Hz (switch setting 0). Positions E and F are not valid positions.

Where a switch setting supports multiple formats, the format is governed by the video reference applied to the router and must be compatible with that reference format.

- ▲ When a control panel is mounted on a router or remote panel module, it conceals the rotary switch. You must remove the control panel when you are setting the rotary switch.
- ▲ Every time you make a switch change, power-cycle the router or remote panel module.

### Frame ID Rotary Switch

Set the router's 16-position 'Frame ID' rotary switch to a position from 1 to 4. Do not use position 0. (When the rotary switch is zero, the router reverts to its factory-default state at power-up.)

If you have a remote panel, set the remote panel module's 16-position rotary switch to a non-zero position. (When the rotary switch is zero, the remote panel module also reverts to its factory-default state at power-up.)

- ▲ When a control panel is mounted on a router or remote panel module, it conceals the rotary switch. You must remove the control panel when you are setting the rotary switch.
- ▲ Every time you make a switch change, power-cycle the router or remote panel module.

The rotary switch determines the IP address of the router or remote panel module. You can change the IP address(es) in CRSC.

### The Number of Power Sources

You can connect one or two external power supplies. The second power supply provides redundancy protection if the first malfunctions.

Follow these steps to connect a power supply:

- 1 Plug the 4-pin connector on the power supply into the 4-pin connector (PS1 or PS2) on the router. There is only one way that it will fit. Do not force it.
- 2 Plug the AC cord into the other end of the power supply "brick" and then plug the AC plug into an AC power outlet. There is no on/off switch.

### The Physical Inputs and Output Connections

Connect input devices and output devices to the router according to the requirements of your system and according to the connector types for the particular router(s) you have. Keep in mind that there are 16 normal video inputs, 2 bypass video inputs, 2 CQX outputs, and 6 auxiliary (normal) video outputs. All inputs and outputs use BNCs.

- ▲ Video cable length limits are standard: 400m for SD, 150m for HD, and 100m for 3Gig (80m for 3Gig CQX routers), for Belden 1694A (or equivalent) cable. Input equalization is automatically adjusted according to that cable type and cable length.

### External Video Reference

The CR1602-SD-CQX accepts composite (NTSC or PAL) reference. The other two CQX routers accept either composite or tri-level video reference. All switch according to SMPTE RP168-2002. Connect your video reference input to either video reference connector on the rear of the router. Terminate the reference signal (or chain of reference signals) using a 75W terminator on the other reference connector.

### Button Legends

The buttons are pre-labeled at the factory, but you can create labels of your own. Use a desktop publishing program to create your own button legends. The legends should be transparent and no larger than 0.40" x 0.40" (10mm square). A 3/8" (9.5mm) square insert will allow a little clearance. The clear plastic material used for overhead transparencies is suitable for printing legends. To apply a label to a button, pull the clear plastic cap from the button, insert the label in the cap, and replace the cap. The caps come off easily. No tools are required. We recommend that you not use adhesive.

- ▲ Button legend templates (in Word,® Illustrator,® and Freehand® formats) are available on the Compact Router documentation and software disk you received with your CR Series product(s). Simply type (or draw) the legends you want and print the page on transparent film. Then cut apart the button legends and insert them under the clear plastic button caps.





# 5 Operating a Stand-Alone Router

Chapter 5 provides operating instructions for single stand-alone CR Series routers (and panels).

For information regarding CQX routers, see Chapter 9, [Operating CQX Routers](#).

For information regarding CR6400 routers, see Chapter 10, [Operating CR6400 Routers](#).

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## Reminder

There are several ways to use the CR Series Compact Routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A single stand-alone CR6400 router with a “captive” control panel or with automation.
- A network of stand-alone routers (other than CR6400 routers), possibly with remote panels, possibly with captive panels, and with or without automation.
- A network of stand-alone CR6400 routers, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single CQX router with a captive CQX panel (and optional remote CQX panel).

See the *CRSC User's Guide* for detailed information about operating a CRSC network.

CR6400 stand-alone routers and networks are distinguished from other types of stand-alone routers and networks because the user interfaces are different. See Chapter 10, [Operating CR6400 Routers](#).

## Stand-Alone Router

A “stand-alone” router is one operated independently with an attached or “captive” CR Series control panel. (It is possible to control the router using an third-party automation or control system but this document does not address automation.)

## Operation

### Startup

To power up a router, connect the 4-pin connector the power supply to PS1 or PS2. Then plug the power supply into AC power outlet. If you have chosen to use two power supplies for redundancy, connect one to PS1 and the other to PS2.

At power-up, the router loads stored program code into its internal FPGA and restores its previous operational state. (The “state” includes the crosspoint map between inputs and outputs and which of the outputs are locked.)

▲ If a router’s rotary switch is set to the 0 position, the router reverts to the factory-default state, not its previous state.

At power-up, the router detects the presence or absence of a video reference signal. The AES routers start in asynchronous mode, but switch almost instantly to synchronous mode if a video reference is present.

At power-up, a control panel’s ‘Panel Lock’ button is on (red). You must turn Panel Lock off before you can use the panel.

At power-up, a control panel lights one of its level buttons, if the rotary switch of the router beneath it is set to a value in the range 1–4. If the rotary switch is set otherwise, the control panel does not light any level button. In any case, all level buttons are inoperable. For a stand-alone router, level selection is disabled.

### Takes

Except for the number of buttons, performing takes is identical on all control panels.<sup>1</sup> To perform a take, first press a DST button and then a SRC button. The take occurs immediately.

When you press the DST button, it becomes bright (becomes high-tally amber). The button for the source that corresponds to the selected DST also tallies high (green). When you press a SRC button, the old connection is lost, the old SRC button goes low tally, and the new SRC button goes high tally.

▲ Example: you want to route input 4 (VTR2) to output 5 (monitor). The monitor is presently connected to input 3 (VTR1).

- Press the DST 5 button. It goes high tally. SRC 3, the current source, does also.



- Press the SRC 4 (VTR2) button. The SRC 3 button goes low tally and the SRC 4 button goes high.



Pressing another DST button starts a new route.

---

1. A CP3201 cannot be used with a stand-alone router.

If a destination is locked, it will be low-tally red. If you press its button, it will go high-tally red. You cannot perform a take for a destination that is locked. See [Locks](#).

## Machine Control Takes

The method for performing a machine control take is the same as for any other compact router: first press a DST button and then a SRC button. However, for machine control routers, the intrinsic nature of the take is different and the effects on the control panel are different:

- 1 A machine control router is a point-to-point router whereas other compact routers are X/Y routers. In an X/Y router, a source can be routed to multiple destinations. In a machine control router, a new route breaks all previous connections to the source and all previous connections to the destination prior to making the new connection.
- 2 Port router connections are bidirectional. A port is both an input and an output. Thus, if you take SRC1 to DST6, SRC6 is also connected to DST1.

For dynamic ports, there is a difference between taking DST6/SRC 1 and taking DST1/SRC 6.

DST1/SRC 6     Port 1 is "controlling." Port 6 is "controlled."

DST6/SRC 1     Port 6 is "controlling." Port 1 is "controlled."

Thus, it is the destination that is "controlling." That is because compact machine control routers are "data reverse" or "machine control reverse."

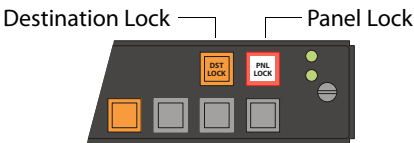
- 3 Internally, the router can change a dynamic port from controlled to controlling or vice versa.

See [Machine Control Routers](#) (page 20) for a description of port types.

- ▲ Machine control takes do not start, stop, rewind, or cue any machines, nor do they pre-roll or position any media.

## Locks

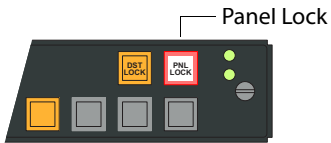
The 1RU panel has 6 function buttons. The 2RU panel has 12 function buttons. In all cases, two of the function buttons are locks, four are level buttons. Any other buttons are reserved for future use.



- ▲ Buttons are not labeled at the factory. You must create your own labels. See [Button Legends](#) on page 74.

### Panel Lock

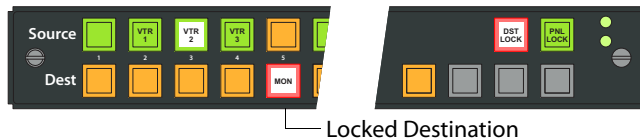
Pressing 'Panel Lock' disables the control panel. Only the 'Panel Lock' button remains enabled. Pressing it again re-enables the control panel.



When the control panel is locked, the lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The panel lock button is low tally green when the control panel is not locked.

### Destination Lock

Destination lock prevents selecting another source for the currently selected destination. To lock a destination, press the destination button, then press Destination Lock. This sample shows DST 5 locked to SRC 3:

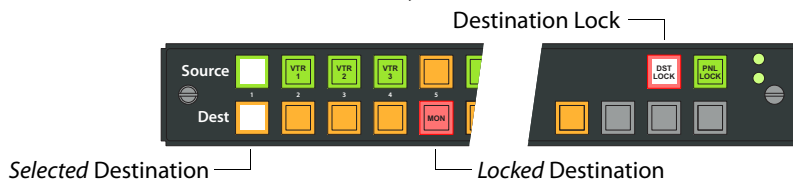


Locked Destination

The Destination Lock button immediately goes high tally red and the current source and destination are high tally, with the destination button red. Changes to that destination are disabled. If you subsequently press a destination button that is locked, the button goes high tally (red), its source goes high tally (green) and the Destination Lock button goes high tally, as this sample shows.

Changes to *other* destinations are, however, enabled, and specifically, you can route the source that feeds a locked destination to any number of other destinations.

After you select another (unlocked) destination, the locked destination goes low tally red. This illustration shows DST 1 selected and DST 5 locked. Because DST 1 is not locked, the Destination Lock button is low tally amber.



Selected Destination

Locked Destination

To unlock a destination, press the destination button and then press Destination Lock (again). The destination button reverts to amber and the Destination Lock button goes low tally. This illustration shows DST 5 selected and no longer locked:



# Operating a Stand-Alone Network



Chapter 6 provides operating instructions for a stand-alone network of CR Series routers (and panels).

For information regarding CQX routers, see Chapter 9, [Operating CQX Routers](#).

For information regarding CR6400 routers, see Chapter 10, [Operating CR6400 Routers](#).

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## Reminder

There are several ways to use the CR Series Compact Routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A single stand-alone CR6400 router with a “captive” control panel or with automation.
- A network of stand-alone routers (other than CR6400 routers), possibly with remote panels, possibly with captive panels, and with or without automation.
- A network of stand-alone CR6400 routers, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single CQX router with a captive CQX panel (and optional remote CQX panel).

See the *CRSC User's Guide* for detailed information about operating a CRSC network.

CR6400 stand-alone routers and panels are distinguished from other types of stand-alone routers and panels because the user interfaces are different. Nevertheless, CR6400 routers and panels *can* be mixed with CR Series routers and panels of other types in a stand-alone network with some limitations. For example, a CP3232 panel cannot address destinations 33–64 of a CR6464-3Gig.

For information on the operation of CR6400 routers and panels, see Chapter 10, [Operating CR6400 Routers](#). This chapter does not discuss the operation of CR6400 routers and panels.

## Stand-Alone Network

A stand-alone network includes 1–4 routers, possibly some remote panel modules (up to 15), and an Ethernet switch. A remote panel module, to be useful, must have a control panel<sup>1</sup> attached. (Automation is possible, but this document does not address automation.)

A PC running configuration software can optionally be connected to the network.

## Operation

### Startup

To power up a router or a remote panel module, connect the 4-pin connector the power supply to PS1 or PS2. Then plug the power supply into AC power outlet. If you have chosen to use two power supplies for redundancy, connect one to PS1 and the other to PS2.

At power-up, a router loads stored program code into its internal FPGA and restores its previous operational state. (The “state” includes the crosspoint map between inputs and outputs and which of the outputs are locked.)

At power-up, a router detects the presence or absence of a video reference signal. The AES routers switch to synchronous mode if a video reference is present.

At power-up, routers and remote panel modules “discover” the presence and state of the routers in the network.

- ▲ It might be convenient to connect all your CR Series power supplies to a power bus that you can switch on and off. A fully populated network requires 20 power supplies (or up to 40 if you are providing redundant power). Under normal operation, a fully populated network draws less than 3 A at 120 VAC.

At power-up, a control panel’s ‘Panel Lock’ button is on (red). You must turn Panel Lock off before you can use the panel. This is true whether the control panel is mounted on a router or a remote panel module.

At power-up, a control panel mounted on a remote panel module lights a subset of its level buttons, depending on the levels selected at each of the routers in the network. There are 4 situations to consider:

- 1 If there is one router (level in the range 1–4), one level button is illuminated but is inoperable because, with one level, level *selection* is not possible.
- 2 If there is no router whose level is in the range 1–4, no level button is illuminated and all are inoperable. The network routers are configured in error and inaccessible.
- 3 There are from 1 to 4 routers whose levels are distinct and in the range 1–4. The level buttons that correspond to the levels of the routers are illuminated and operable.
- 4 There are from 1 to 4 routers whose levels are **not** distinct in the range 1–4. The level buttons that correspond to the levels of the routers are illuminated and operable. However, the router network will misbehave in unpredictable ways.

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1. A CP3201 cannot be used in a stand-alone network.

## Level Selection

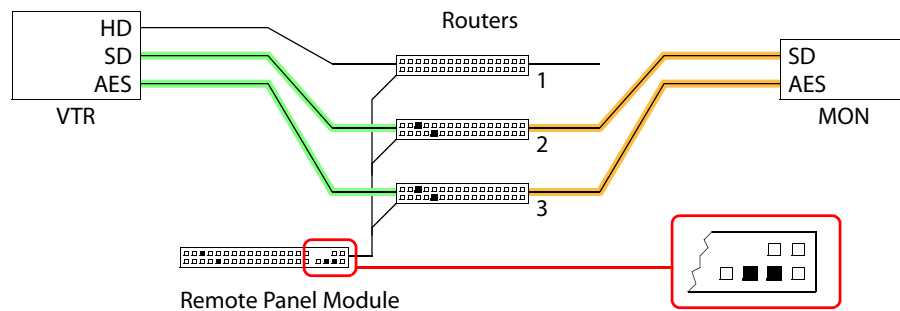
A video or audio device typically receives or transmits signals of several types. A VTR might handle HD, SD, AES, and machine control signals that need to be switched simultaneously. The different signal types are considered "levels" in a router network.

In a stand-alone compact router network, multiple levels can be taken to a destination simultaneously (in a single button press).

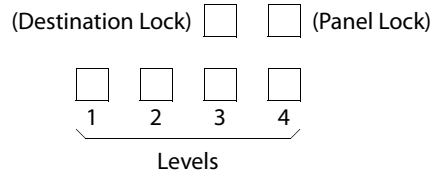
In a stand-alone compact router network, multiple levels of a destination can be locked simultaneously (again, in a single button press).

### Example

Two levels, SD and AES, are taken from the VTR to the monitor:



The four level buttons on a control panel correspond to the four router levels, with level 1 on the left and level 4 on the right.



A level button is lit in amber if a router at that level is present in the network. A level button is high-tally when the level is selected and low-tally when not.

### Exceptions

In most cases, the level buttons are toggles: press the level button to select the level, press the button again to deselect the level. However, there is an exception: when you have selected *all* the levels in your network, pressing any level button deselects the *other* levels and leaves the one you pressed selected.

Another exception is when you have only one router in your network. Pressing the level selection button has no effect. The single router is always selected.

### Takes

A network of routers is capable of multi-level takes. Multi-level takes are issued at a remote panel module. Local (single-level) takes can be issued through the crosspoint displayed in CRSC.

Follow these steps to perform a multi-level take:

- 1 Press the level buttons on a remote panel module to select the levels for the take. Be aware of the level selection exceptions, listed under [Exceptions](#) in the previous section. Selected levels show high-tally amber.
- 2 Press a destination button on the remote panel module to choose a destination.
- 3 Press a source button on the remote panel module to route the source to the chosen destination.

The take is complete. A routing switch occurs on each level you selected at the remote panel module. If you are monitoring the network with CRSC, you can view the results of the take in CRSC's crosspoint image.

### Machine Control Takes

Performing machine control takes is the same in a stand-alone network as for standalone routers. See [Machine Control Takes](#) (page 87).

However, in a network that includes machine control router(s), operators must be aware of the difference between machine control routers and other routers (video and audio).

Machine control routers are point-to-point and other routers are X/Y. Creating a point-to-point connection breaks any connections previously made to the source and to the destination. In a video or audio router, prior connections are not generally broken: you can route a source to multiple destinations.

In a network that includes machine control routers, you might wish to switch video and audio levels separately from machine control levels.

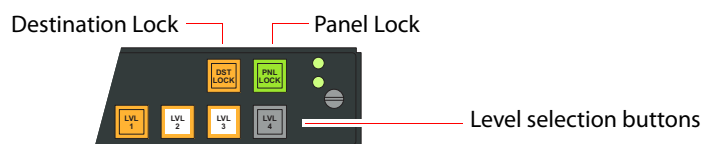
- ▲ Machine control takes do not start, stop, rewind, or cue machines, nor do they pre-roll or position any media.

### Locks

Performing locks in a network is almost the same as performing locks in a stand-alone system. However, please note:

- A panel lock performed at a remote panel module locks the remote panel module's control panel only.
- A destination lock performed at a remote panel module locks a destination on all *selected* levels. The lock state of a destination is not changed on *unselected* levels.  
If *all* the selected levels of a destination are locked, the destination button is red. If *some* of the selected levels of a destination are unlocked, the destination button is amber.
- A destination locked at one control panel (on a router or remote panel module) cannot be unlocked at another control panel.
  - ▲ Be sure to unlock any locks before removing a panel from a network!

As previously stated, two of the function buttons are locks and four are level buttons. (Any other function buttons are reserved for future use.)



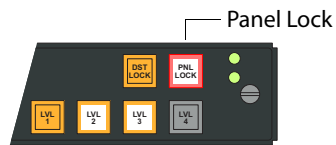


This illustration shows a system that has 3 levels (1–3), two of which are selected. Buttons for selected levels are high-tally. The button for (non-existent) level 4 is unlit.

- ▲ Buttons are not labeled at the factory. You must create your own labels. See [Button Legends](#) on page 74.

## Panel Lock

Pressing Panel Lock disables the control panel on the remote panel module where you press Panel Lock. Only the Panel Lock button remains enabled. Pressing it again re-enables the control panel.



When the control panel is locked, the Panel Lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The Panel Lock button is low tally green when the control panel is not locked.

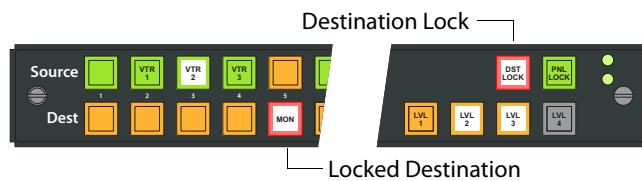
- ▲ Remember that a Panel Lock button locks *that panel only*. It does **not** lock a router, a remote panel module, other control panels, or the network.

## Destination Lock

Destination Lock prevents selecting another source for the currently selected destination. In a network, sources and destinations comprise one or more levels. When you lock a destination, it is locked on the levels you select.

To lock a destination, first press level buttons on a remote panel module (or local panel) to select the intended levels. These illustrations show a system that has 3 levels (1–3), two of which are selected. Buttons for selected levels are high-tally.

After selecting levels, press a destination button on the remote panel module, then press Destination Lock. This sample shows SRC 3 locked to DST 5 on levels 2 and 3, but not level 1:



The Destination Lock button immediately goes high tally red and the current source and destination go high tally, with the destination button red. Changes to that destination are disabled on all selected levels. If you subsequently press a destination button that is locked, the button goes high tally (red), its source goes high tally (green) and the Destination Lock button goes high tally, as this sample shows.

Changes to *other* destinations are, however, enabled, and specifically, you can route the source that feeds a locked destination to any number of other destinations.

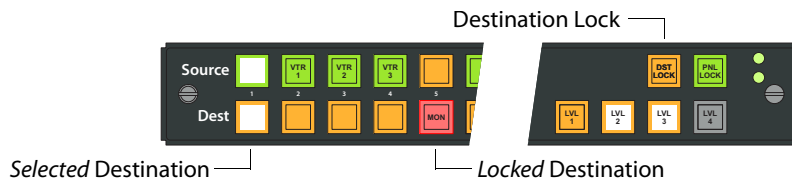
Changes to *unselected levels* for that destination remain enabled. In these examples, level 1 is unselected and therefore, you can route to device 5 on level 1.

## Operating a Stand-Alone Network

### Operation

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After you select another (unlocked) destination, the locked destination goes low tally red. This illustration shows DST 1 selected and DST 5 locked. Because DST 1 is not locked, the Destination Lock button is low tally amber.



To unlock a destination, press the destination button on the remote panel module and then press Destination Lock (again). The destination button reverts to amber and the Destination Lock button goes low tally. This illustration shows DST 5 selected and no longer locked:



A destination button on a remote panel module will be red (high-tally if selected, low tally if not) when *all* of its levels are locked and selected.

Selecting or deselecting a level does not affect the signals being routed on that level. Nor does pressing a destination button or either of the lock buttons. It is only when you press a source button (effecting a take) that the signals are changed.

# Operating a CRSC Network



Chapter 7 provides operating instructions for a CRSC network of CR Series routers (and panels).

For information regarding CQX routers, see Chapter 9, [Operating CQX Routers](#).

For information regarding CR6400 routers, see Chapter 10, [Operating CR6400 Routers](#).

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## Reminder

There are several ways to use the CR Series Compact Routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A single stand-alone CR6400 router with a “captive” control panel or with automation.
- A network of stand-alone routers (other than CR6400 routers), possibly with remote panels, possibly with captive panels, and with or without automation.
- A network of stand-alone CR6400 routers, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single CQX router with a captive CQX panel (and optional remote CQX panel).

Stand-alone networks of CR6400 routers and panels are distinguished from stand-alone networks composed of other types of routers and panels because their user interfaces are different.

However, in a *CRSC network*, CR6400 routers and panels can be freely mixed with CR Series routers and panels of other types, because all routers and panels are completely configurable and do not rely on “default” behaviors.

## CRSC Networks

Operation of a CRSC network can vary from very simple to very complex. There are many, many options and many factors to consider.

Refer to the *CRSC User’s Guide* for detailed information regarding options.



# 8

## Operating in an NV9000 Network

Chapter 8 provides operating instructions for NV9000 router control systems that use CR Series routers (and panels).

For information regarding CQX routers, see Chapter 9, [Operating CQX Routers](#).

For information regarding CR6400 routers, see Chapter 10, [Operating CR6400 Routers](#).

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### Reminder

There are several ways to use the CR Series Compact Routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A single stand-alone CR6400 router with a “captive” control panel or with automation.
- A network of stand-alone routers (other than CR6400 routers), possibly with remote panels, possibly with captive panels, and with or without automation.
- A network of stand-alone CR6400 routers, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single CQX router with a captive CQX panel (and optional remote CQX panel).

See the *CRSC User's Guide* for detailed information about operating a CRSC network.

Stand-alone networks of CR6400 routers and panels are distinguished from stand-alone networks composed of other types of routers and panels because their user interfaces are different.

However, in an *NV9000 network*, CR6400 routers and panels can be freely mixed with routers and panels of other types, CR Series or otherwise. All routers and panels are completely configurable and do not rely on the “default” behaviors of CR Series devices, but function according to the principles of the governing NV9000 system.

## NV9000 Networks

In an NV9000 router control system, it is the system controller that is the focal point of the system—the “clearing house” for all commands and responses. Remote panels are comparatively simple panels under NV9000. Their function set includes these buttons:

- Source

A source button represents a source *device* (which provides a set of inputs to the NV9000 network. The devices do not necessarily have to be connected to compact routers.

- Destination

A destination button represents a destination *device* (which comprises a set of outputs in the NV9000 network. The devices do not necessarily have to be connected to compact routers.

- Salvo

In the context of CR Series remote panels, a salvo is *system salvo* (as opposed to a “local” salvo or any other kind). A system salvo is a sequence of NV9000 commands, such as Take, Lock, Release, or Pause, that executes when the salvo button is pressed. System salvos are stored in the system controller. System salvos are defined in NV9000-SE Utilities.

▲ Note that NV9000 system salvos are not the same as CRSC salvos.

- Previous source

A ‘Previous Source’ button is like an “undo” button: when you press it, the connection(s) to the source(s) previously routed to a destination is restored.

- Undefined.

Some remote panel buttons can be left undefined. These buttons do nothing and are unlit.

A remote panel under an NV9000 network is not the same as a remote panel under a CRSC network.

A remote panel has two further considerations (during configuration):

- Default destination.

The default destination is a destination selected for the panel at power-up. That destination remains selected until an operator selects another destination at the panel.

- Status monitor.

The status monitor is a destination device (such as a video monitor) on which the output(s) of the currently selected destination are replicated. When you select a different destination, the status monitor output reflects that change. When you select a different source for a destination, the status monitor output reflects that change also.

## Modes

Because of the possibility of a default destination, a remote panel can function in two ways: as a  $m \times 1$  panel or as  $m \times n$  panel.

- Takes under an  $m \times n$  setup require an operator first to press a destination button, then a source button.
- Takes under an  $m \times 1$  (i.e., a single-destination) setup require an operator to press only a source button.

These are the minimum. Breakaway takes can involve much button pressing to select sources for different levels.

## References

Refer to [NV9000 Router Control Systems](#) on page 178 for information about using an NV9000 router control system.

Refer to whatever NV9000 documentation you can obtain for information about operating an NV9000 router system. The *NV9000-SE Utilities User's Guide* provides some background information about NV9000 router control system concepts, and has functional descriptions of most Grass Valley NV96xx control panels.





# 9 Operating CQX Routers

Chapter 9 provides operating instructions for CQX routers (and panels).

## Topics

<a href="#">Reminder</a> .....	101
<a href="#">CQX Routers</a> .....	101
<a href="#">Operation</a> .....	103

## Reminder

There are several ways to use the CR Series Compact Routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A single stand-alone CR6400 router with a “captive” control panel or with automation.
- A network of stand-alone routers (other than CR6400 routers), possibly with remote panels, possibly with captive panels, and with or without automation.
- A network of stand-alone CR6400 routers, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single CQX router with a captive CQX panel (and optional remote CQX panel).

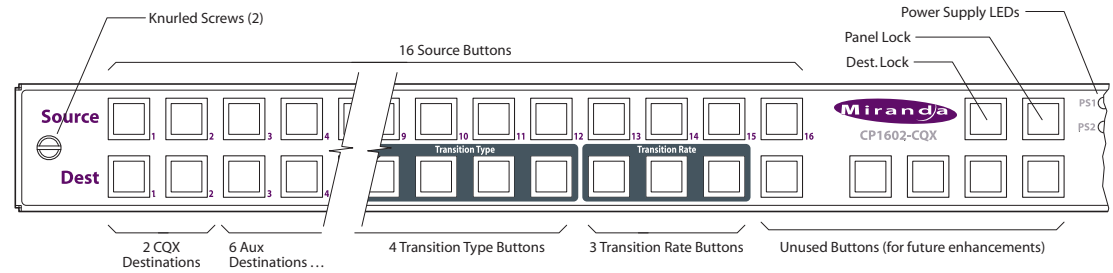
See the *CRSC User’s Guide* for detailed information about operating a CRSC network.

Note that CR6400 stand-alone routers and networks are distinguished from other types of stand-alone routers and networks because the user interfaces are different. See Chapter 10, [Operating CR6400 Routers](#).

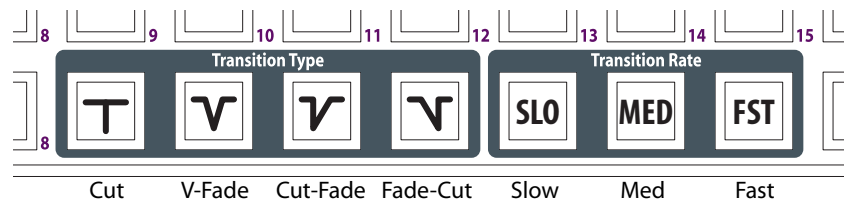
## CQX Routers

A “clean and quiet” (CQX) router is one that performs smooth transitions in both video and audio. There are 3 models supporting 3 video formats: 3Gig, HD, and SD.

The “clean and quiet” (CQX) control panel is used with the CQX router. It has 4 dedicated transition type buttons (cut, v-fade, cut-fade, and fade-cut) and 3 dedicated transition rate buttons (slow, medium, and fast).



The transition buttons appear in this ordering:

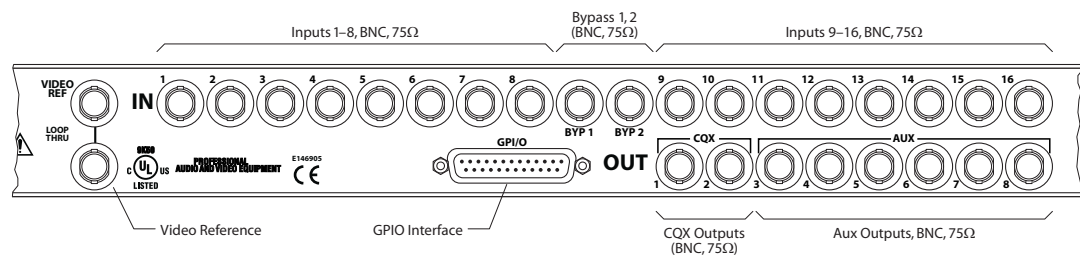


The panel is not configurable at present. (A slow transition is fixed at 3 seconds; medium, at 2 seconds; and fast, at 1 second. A cut transition is instantaneous for video; the audio ramps down over 3 frames and ramps back up over 3 frames. See [CQX Transition Rates](#) on page 169 for more detail.)

At present, the concept of levels does not apply to the CQX router.

The router can be used with a captive panel (mounted on the router) or a remote panel (mounted on a remote panel module and connected to the router through an Ethernet switch). (It is possible to control the router using a third-party automation system but this document does not address automation.)

The CQX router models each have 2 CQX outputs and 6 auxiliary outputs. The CQX outputs exhibit smooth transitions. The auxiliary outputs are “normal” outputs.



The CQX router models also have 2 bypass video inputs in addition to the 16 video inputs. The bypass inputs become active if the router loses power. The bypass relay switches when it loses power, causing the bypass video sources to be routed to the CQX outputs.

The CQX router models each have a GPIO connector (DB25) that supports 16 TTL-level inputs and 4 high-power outputs, all optically isolated. Each of the 16 GP inputs switches a corresponding video input to CQ output 1. The GP outputs represent status and alarms.

# Operation

## Startup

To power up a router, connect the 4-pin connector of the power supply to PS1 or PS2. Then plug the power supply into AC power outlet. If you have chosen to use two power supplies for redundancy, connect one to PS1 and the other to PS2.

At power-up, the router loads stored program code into its internal FPGA and restores its previous operational state. (The "state" includes the crosspoint map between inputs and outputs and which of the outputs are locked.)

- ▲ If a router's rotary switch is set to the 0 position, the router reverts to the factory-default state, not its previous state.

At power-up, the router detects the presence or absence of a video reference signal. It takes about 10 seconds to lock to the reference rate.

At power-up, a control panel's 'Panel Lock' button is on (red). You must turn panel lock off before you can use the panel.

Level selection is disabled because the concept of levels does not apply to CQX routers.

## Takes

Takes on a CQX panel involve transition type and rate when the destination selected is one of the 2 CQX destinations. Takes do not involve transition type and rate when the destination is one of the 6 auxiliary outputs.

To perform a CQX take, first press a CQX destination button. Then, optionally, choose a transition type and rate. Then, press a source button. The take occurs nearly immediately (about 5 frame periods later so that the video processor has time to lock to the new video source).

To perform an auxiliary take, simply press an aux destination button and then a source button. The take occurs immediately (without a transition effect).

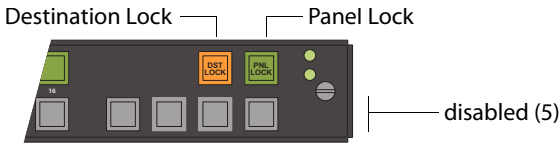
When you press a destination button, it tallies high (amber). The button for the source that corresponds to the selected destination also tallies high (green). When you press another source button, the old connection is lost (after the transition), the old source button goes low tally, and the new source button goes high tally.

Pressing another destination button starts a new route.

- ▲ If a destination is locked, it will be low-tally red. If you press its button, it will go high-tally red. You cannot perform a take for a destination that is locked. See [Locks](#), following.

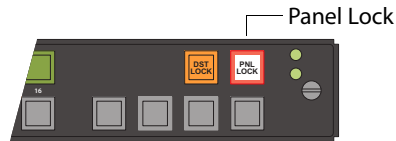
## Locks

The CQX panel has 7 function buttons. Only panel lock and destination lock are active. The other 5 buttons are disabled:



## Panel Lock

Pressing 'Panel Lock' disables the control panel. Only the panel lock button remains enabled. Pressing it again re-enables the control panel.

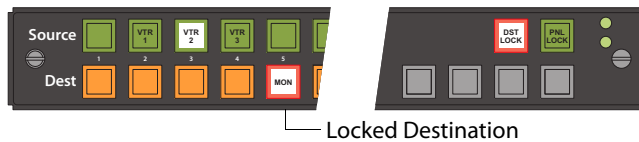


When the control panel is locked, the lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The panel lock button is low tally green when the control panel is not locked.

The 'Panel Lock' button also prevents takes controlled by the GP inputs. If this panel is a captive panel, the lock will also prevent takes from a remote panel.

## Destination Lock

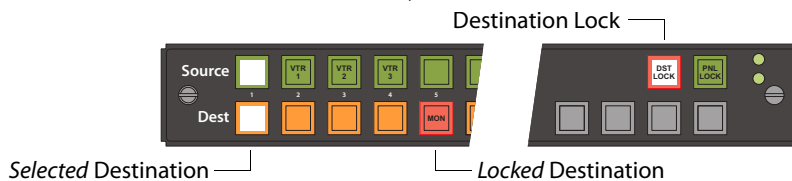
Destination lock prevents selecting another source for the currently selected destination. To lock a destination, press the destination button, then press Destination Lock. This sample shows DST 5 locked to SRC 3:



The destination lock button immediately goes high tally red and the current source and destination are high tally, with the destination button red. Changes to that destination are disabled. If you subsequently press a destination button that is locked, the button goes high tally (red), its source goes high tally (green) and the destination lock button goes high tally, as this sample shows.

Changes to *other* destinations are, however, enabled, and specifically, you can route the source that feeds a locked destination to any number of other destinations.

After you select another (unlocked) destination, the locked destination goes low tally red. This illustration shows DST 1 selected and DST 5 locked. Because DST 1 is not locked, the Destination Lock button is low tally amber.



To unlock a destination, press the destination button and then press Destination Lock (again). The destination button reverts to amber and the Destination Lock button goes low tally. This illustration shows DST 5 selected and no longer locked:



# 10

## Operating CR6400 Routers

Chapter 10 provides operating instructions for a single CR6400 router or a network of CR6400 products.

### Topics

<a href="#">Reminder</a> .....	105
<a href="#">CR6400 Terms</a> .....	105
<a href="#">Stand-Alone CR6400 Router</a> .....	106
<a href="#">Stand-Alone CR6400 Network</a> .....	109

### Reminder

There are several ways to use the CR Series Compact Routers:

- A single stand-alone router with a “captive” control panel or with automation.
- A single stand-alone CR6400 router with a “captive” control panel or with automation.
- A network of stand-alone routers (other than CR6400 routers), possibly with remote panels, possibly with captive panels, and with or without automation.
- A network of stand-alone CR6400 routers, possibly with captive panels, and with or without automation.
- A CRSC network of routers and remote panels with or without automation. Here, the panels and routers are configured using CRSC.
- A network of routers under an NV9000 router control system.
- A single CQX router with a captive CQX panel (and optional remote CQX panel).

See the *CRSC User’s Guide* for detailed information about operating a CRSC network.

CR6400 stand-alone routers and networks are distinguished from other types of stand-alone routers and networks because the user interfaces are different. See Chapter 10, [Operating CR6400 Routers](#).

### CR6400 Terms

This chapter describes two of the ways to use the CR6400 routers and the CP6464:

- A single stand-alone CR6400 router with a “captive” CP6464 control panel.
- A network of stand-alone CR6400 routers with a captive panel (or panels).

CR6400 routers and panels can also be used in CRSC networks and NV9000 networks. See Chapter 7, [Operating a CRSC Network](#), or Chapter 8, [Operating in an NV9000 Network](#) for information.

## Terminology

It is essential for the material that follows to define the terms “source” and “destination.”

In general, the terms source and destination refer to devices (e.g., VTRs, cameras, monitors) that can be connected to the I/O cards of the router. In discussions of routers, we usually think of sources and destinations only as the connectors to which a device is connected and we ignore the devices. (In fact, the router functions properly regardless of whether it is actually connected to any devices.)

A **port** is a single connector (DIN 1.0/2.3) on a router.

An input port, or just **input**, is one that receives a signal.

An output port, or just **output**, is one that sends a signal.

### For a Single CR6400 Router

1 A **source** is a one input at the rear of the CR Series router.

2 A **destination** is one output at the rear of the CR Series router.

A CR Series router has a 64×64 switching matrix and thus supports up to 64 inputs and 64 outputs.

### For a CR6400 Network

1 A **source** is set of **N** inputs on the routers in the network, where **N** is the number of routers. A source uses the same input on all **N** routers.

For example, source 12 comprises input 12 on router 1, input 12 on router 2, input 12 on router 3, and input 12 on router 4. (All available levels are included in the source.)

2 A **destination** is set of **N** outputs on the routers in the network, where **N** is the number of routers. A destination uses the same output on all **N** routers.

For example, destination 55 comprises output 55 on router 1, output 55 on router 2, output 55 on router 3, and output 55 on router 4. (All available levels are included in the destination.)

3 If the operator chooses source **J** and destination **K**, then input **J** is taken to output **K** on all enabled levels. (A level — i.e., a router — is enabled when a level button selects it.)

Breakaway can occur when you choose different levels for separate takes to the same destination. (Breakaway is an undefined concept for a single router.)

A CR Series network supports up to 64 sources, each of which can comprise up to 4 inputs, and supports 64 destinations, each of which can comprise up to 4 outputs.

## Stand-Alone CR6400 Router

A “stand-alone” router is one operated independently with an attached CP6464 control panel. (Automation is possible, but this document does not address automation.)

### Startup

To power up a router, connect the 4-pin connector the power supply to PS1 or PS2. Then plug the power supply into AC power outlet. If you have chosen to use two power supplies for redundancy, connect one to PS1 and the other to PS2.

At power-up, the router loads stored program code into its internal FPGA and restores its previous operational state. (The "state" includes the crosspoint map between inputs and outputs and which of the outputs are locked.)

- ▲ If a router's rotary switch is set to the 0 position, the router reverts to the factory-default state, not its previous state.

At power-up, the router detects the presence or absence of a video reference signal.

At power-up, a control panel's 'Panel Lock' button is on (red). You must turn Panel Lock off before you can use the panel.

At power-up, a control panel lights one of its level buttons, if the rotary switch of the router on which it is mounted is set to a value in the range 1–4. If the rotary switch is set otherwise, the control panel does not light any level button. In any case, all level buttons are inoperable because, for a single stand-alone CR Series, level selection is disabled.

### Takes

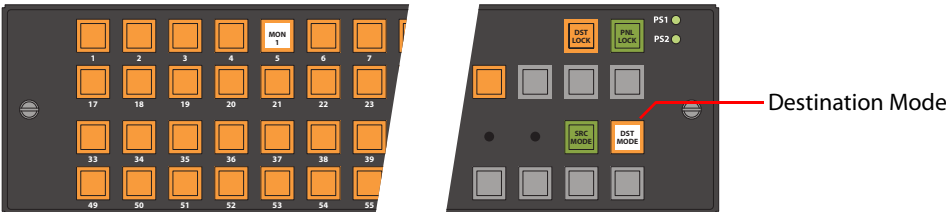
There are 4 very simple steps to perform a take (using a CP6464 panel):

- 1 Press the destination mode button. (The selection buttons turn amber, representing destinations.)
- 2 Press one of the selection buttons to select a destination. The destination's button goes high-tally. It will be red if the destination is locked and the take will not be allowed.)
- 3 Press the source mode button. (The selection buttons turn green, representing sources.)
- 4 Press one of the selection buttons to select a source. The source's button goes high-tally. The take is complete.

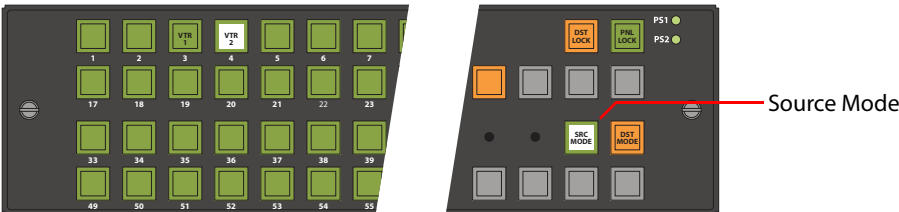
### Example

You want to route input 4 (VTR2) to output 5 (MON1). The monitor is presently connected to input 3 (VTR1).

- 1 Press the 'Destination Mode' button. The selection buttons turn amber. Then press selection button 5. It is labeled 'MON1' in this example. It goes high tally:



- 2 Press the 'Source Mode' button. The selection buttons turn green. Then press selection button 4. The button for input 3 goes low tally and selection button 4 (VTR2) goes high-tally.



3 The take is complete.

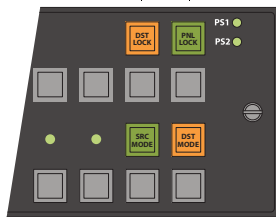
The panel remains in source mode until you again press 'Destination Mode'. If you forget to which destination you made the route, the destination will be high-tally when you press 'Destination Mode'.

- ▲ If a destination is locked, it will be low-tally red. If you press its button, it will go high-tally red. The panel remains in destination mode. You cannot perform a take for a destination that is locked. See [Locks](#).

## Locks

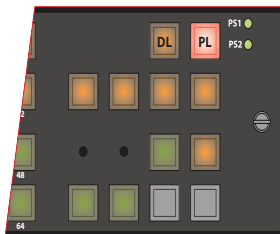
The CP6464 has 12 function buttons. Two of the function buttons are locks:

Destination Lock      Panel Lock



### Panel Lock

Pressing 'Panel Lock' disables the control panel. Only the Panel Lock button remains enabled. Pressing it again re-enables the control panel.



When the control panel is locked, the lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The panel lock button is low tally green when the control panel is not locked.

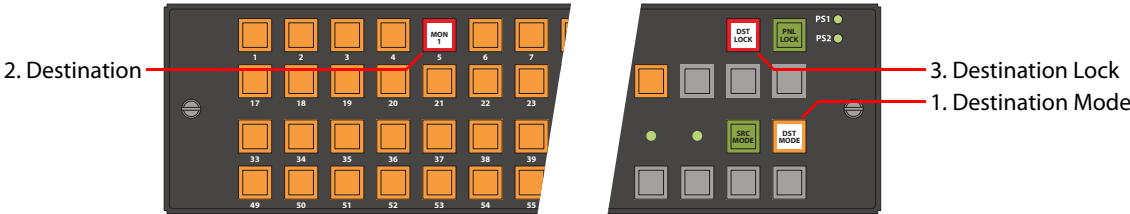
### Destination Lock

Destination lock prevents selecting another source for the currently selected destination. To lock a destination,

- 1 Press the 'Destination Mode' button.
- 2 press the desired selection button.
- 3 Press 'Destination Lock'.



This sample shows destination 5 locked:

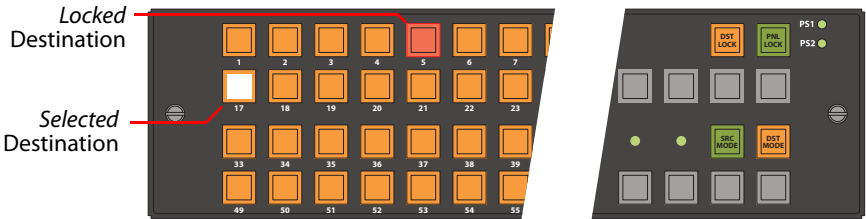


(Press 'Source Mode' to see the source that feeds the destination. The button for that source is high-tally.)

If you subsequently press a button for a destination that is locked, the button goes high tally (red), and the Destination Lock button goes high tally, as this example shows.

*Other* destinations remain unchanged, whether locked or unlocked, and specifically, you can route the source that feeds a locked destination to any number of other destinations.

When you select another (unlocked) destination, a locked destination goes low-tally red. This illustration shows destination 1 selected and destination 5 locked. Because the selected destination is not locked, the 'Destination Lock' button is not red, but low-tally amber.



To unlock a destination, press the selection button for the destination and then press Destination Lock (again). The selection button for the destination reverts to amber and the 'Destination Lock' button goes low-tally amber.

## Stand-Alone CR6400 Network

A stand-alone network includes 1–4 CR Series routers, one CP6464 panel, and an Ethernet switch.

### Startup

To power up a router or a remote panel module, connect the 4-pin connector the power supply to PS1 or PS2. Then plug the power supply into AC power outlet. If you have chosen to use two power supplies for redundancy, connect one to PS1 and the other to PS2.

At power-up, a router loads stored program code into its internal FPGA and restores its previous operational state. (The "state" includes the crosspoint map between inputs and outputs and which of the outputs are locked.)

At power-up, a router detects the presence or absence of a video reference signal.

At power-up, routers "discover" the presence and state of other routers in the network.

At power-up, a control panel's 'Panel Lock' button is on (red). You must turn 'Panel Lock' off before you can use the panel.

There must be from 1 to 4 routers whose levels are distinct and in the range 1–4. The level buttons on the panel that correspond to the levels of the routers are illuminated and operable. If the levels are not distinct, your network will not perform correctly.

## Level Selection

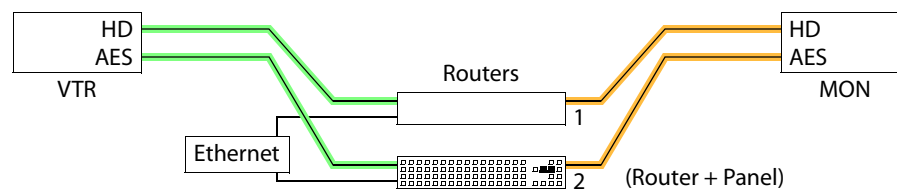
A video or audio device typically receives or transmits signals of several types. A VTR might handle HD, SD, AES, and machine control signals that need to be switched simultaneously. The different signal types are considered “levels” in a router network.

In a stand-alone CR Series network, multiple levels can be taken to a destination simultaneously (in a single button press).

In a stand-alone CR Series network, multiple levels of a destination can be locked simultaneously (again, in a single button press).

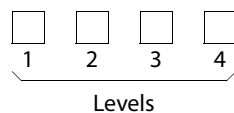
### Example

Two levels, HD and AES, are taken from the VTR to the monitor:



The four level buttons on a control panel correspond to the four router levels, with level 1 on the left and level 4 on the right.

(Destination Lock)  (Panel Lock)



A level button is illuminated (in amber) if a router at that level is present in the network. The button is dark if not.

A level button is high-tally when the level is selected and low-tally when not.

### Exceptions

In most cases, the level buttons are toggles: press the level button to select the level, press the button again to deselect the level. However, there is an exception: when you have selected *all* the levels in your network, pressing any level button deselects the *other* levels and leaves the one you pressed selected.

Another exception is when you have only one router in your network. Pressing the level selection button has no effect. The single router is always selected.

### Takes

A network of routers is capable of multi-level takes.

Follow these steps to perform a multi-level take:

- 1 Press the level buttons on a panel to select the levels for the take. Be aware of the level selection exceptions, listed under [Exceptions](#) above. The buttons for selected levels are high-tally.
- 2 Press 'Destination Mode'.
- 3 Select a destination.
- 4 Press 'Source Mode'.
- 5 Select a source.

The take is complete. A routing switch occurs on each level you selected at the remote panel module.

## Locks

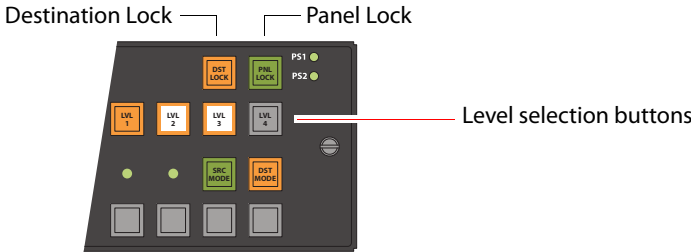
Performing locks in a network is almost the same as performing locks for a stand-alone CR Series. However, please note:

- Pressing 'Panel Lock' locks that panel and no other.
- A destination lock locks a destination on all *selected* levels. The lock state of a destination is not changed on *unselected* levels.

If *all* the selected levels of a destination are locked, the destination button is red. If *some* of the selected levels of a destination are unlocked, the destination button is amber.

- A destination locked at one control panel cannot be unlocked at another control panel.
  - ▲ Be sure to unlock any locks before removing a panel from a network!

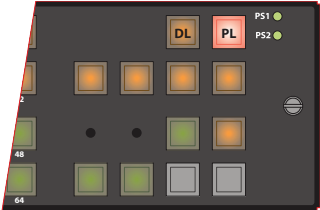
As previously stated, two of the function buttons are locks and four are level buttons. Two others are destination mode and source mode.



This illustration shows a system that has 3 levels (1–3), two of which are selected. Buttons for selected levels are high-tally. The button for (non-existent) level 4 is dark.

## Panel Lock

Pressing 'Panel Lock' disables the control panel on which you press 'Panel Lock'. Only the 'Panel Lock' button remains enabled. Pressing it again re-enables the control panel.



When the control panel is locked, the Panel Lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The 'Panel Lock' button is low tally green when the control panel is not locked.

- ▲ Remember that a 'Panel Lock' button locks *that panel only*. It does **not** lock any router, other control panels, or the network.

## Destination Lock

Destination lock prevents an operator from selecting another source for the currently selected destination. In a network, sources and destinations comprise one or more levels. When you lock a destination, it is locked *on the levels you select*. And when you unlock a destination, it is unlocked *on the levels you select*.

- ▲ To unlock the destination completely, you must select exactly the levels on which it was locked. But, after you lock a destination on levels, it is difficult to remember on which levels you have locked it.

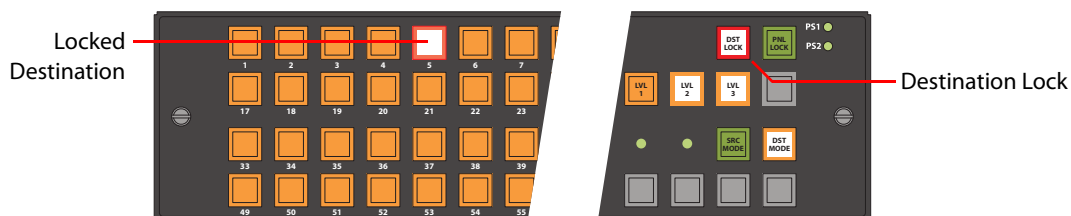
To lock a destination,

- 1 Press level buttons on a panel to select the intended levels.

The following illustrations show a system that has 3 levels (1–3), two of which are selected. Buttons for selected levels are high-tally.

- 2 Press 'Destination Mode'.
- 3 Press the selection button for the destination you want to lock.
- 4 Press 'Destination Lock'.

This sample shows destination 5 locked on levels 2 and 3, but not level 1:



When you press 'Destination Lock', immediately goes high-tally red and the selection button for the destination goes high tally red. Changes to that destination are disabled on all selected levels. If you subsequently press a destination button that is locked, the button goes high tally (red), and the Destination Lock button goes high tally, as this sample shows.

Changes to *other* destinations remain enabled and *other* destinations remain unchanged, whether locked or unlocked. Note that you can route the source that feeds a locked destination to any number of other destinations.

When you select another (unlocked) destination, a locked destination goes low-tally red. This illustration shows destination 1 selected and destination 5 locked. Because the selected destination is not locked, the 'Destination Lock' button is not red, but low-tally amber:



To *unlock* a destination,

- 1 Press level buttons on a panel to select the intended levels.
- 2 Press 'Destination Mode'.
- 3 Press the selection button for the destination you want to unlock.
- 4 Press 'Destination Lock'.

This will clear the lock on the locked levels you have selected and set the lock on unlocked levels you have selected.



# 11 Maintenance

Chapter 11 provides instructions regarding maintenance.

This document does not address maintenance of NV9000 equipment.

## Topics

<a href="#">Prevention</a> .....	115
<a href="#">Trouble-Shooting</a> .....	115

## Prevention

There are no user-serviceable parts in the compact routers, control panels, or remote panel modules. No CR Series product requires any physical maintenance. However, we recommend that you keep your devices free of dust, water, and contaminants, and ensure that cables are organized so that they do not short, kink, or break.

Check periodically that your power supplies are working, especially if you are using the second power connections for redundancy.

Occasionally, Grass Valley releases new versions of Compact Router software and firmware. If you order a new router and your existing routers have older software and firmware, the new and the old products might be incompatible. If you experience difficulties with new routers, contact Grass Valley to request software and firmware upgrades.

***Update all your network (CR Series) devices to the same firmware revision.***

If a router fails, you can perform certain simple diagnostics. Call Grass Valley if the problem cannot be solved easily.

## Trouble-Shooting

If a CR Series device (router, control panel, or remote panel module) malfunctions, first examine all input and output connections, all network connections, and all power connections. Verify that cables are secure at both ends and that they are not broken. Determine that video sources and destinations are on and functioning properly. Verify that the video reference is functioning.

If *everything else in your system* is functioning properly, the problem is at the device. Here are some problems that can occur:

- The LED corresponding to your power supply connection does not illuminate.
- Noisy transitions.
- The router gets power, but does not work properly or fails to “remember” its settings.

## Power Supply LED Does Not Illuminate

If the device is otherwise functioning properly, the problem is a faulty LED. (Call Grass Valley for service.) If the router is not functioning at all, take the following steps.

Determine whether the external power supply delivers power. (If you cannot do this, call Grass Valley.) If it does deliver power, try using the other PS connector. If neither connector works, the router is “dead.” If one PS connector works and the other doesn’t, the router is defective.

The CRPS1 power supplies from Grass Valley have an indicator lamp. If the indicator lamp is off, either the power supply is dead or the AC socket is defective or not connected. Try plugging the power supply into another socket that you know is working. If the power supply’s indicator light remains off, the power supply is dead. Otherwise, the AC socket was the problem.

## Noisy Transitions

Try using a video reference to align video (and audio) transitions with the sync in the video reference.

Verify that the video reference signal is appropriate for the router, well-formed, and terminated.

- ▲ If you use one of the composite analog signals (525 or 625) as a reference for an HD router, you will probably introduce switching transients. Because SMPTE specifies the switch point for HD as NTSC line 4, using an SD reference might cause the switch point to occur at the wrong place in the HD stream. You might see switching transients. (The SD switch point is specified as NTSC line 10.) Embedded audio will have a noticeable discontinuity.

## CQX Routers

The router will switch at the correct point for HD if its ‘Mode’ switch setting is an HD standard. See [Mode Rotary Switch](#) on page 82 for switch setting details.

For the auxiliary outputs, the video must be aligned to the reference to avoid noisy switches. For the CQ outputs, the video has only to be within  $\pm 3$  lines of the video reference.

- ▲ Because of processing delays, a video signal might not line up perfectly with a plant’s timing, i.e, its reference signal. Aux outputs ignore timing and switches according to the reference. The 2 CQ outputs, on the other hand, allows a certain amount of delay by accepting the video within  $\pm 3$  lines of the plant reference. The CQX determines how early or late the video stream is with respect to the video reference, then delays it so that the output video occurs 3 lines after the reference. Doing this allows it to process the video and to perform a clean switch.

If the video is outside the  $\pm 3$ -line window, the CQX does not process the video. Instead, it uses the non-sync bypass (**not** emergency bypass) to route the video, so that the switch behaves like an auxiliary output. As with auxiliary outputs, the bypass can result in glitches in the video and audio, because no processing is being done.

## Router Functioning Improperly

If the router gets power, but the router does not transmit signals properly or does not switch properly, the router has an indeterminate problem. Call Grass Valley.



- ▲ Level selection can be confusing: when all levels are selected, level buttons are not toggles. Pressing a level button in this situation *turns off all other levels* and leaves the one you selected on. This is by design. Do not think this is a malfunction.
- ▲ Occasionally, a button press will fail to make contact. Press the button firmly and straight in. If a button continues to fail, the control panel, router, or remote panel module might be broken or you might misunderstand something about the way the routers work.

If a router malfunctions, try resetting the router. Either set its rotary switch to 0 and cycle power or select the router in CRSC and click 'Reset Router'.

A control panel powers up in 'Panel Lock' state. The 'Panel Lock' button at the top right is bright red. Be sure to press 'Panel Lock' once (it turns low-tally green) so that the panel can operate.

## Network Failure

Determine whether the Ethernet switch has power. If it has power, check whether the switch is broken. A quick check is to see whether the switch's activity lights are on or active.

Check the amber and green lights on the Ethernet port on your router or remote panel module. These should be on and steady (not blinking).

Check your cables. They might be defective or of the wrong type. If your devices are very far apart, the cable might be too long.

Again, check power.

## CRSC Failures

CRSC failures are not likely to occur. But in rare instances, you may experience difficulties:

- 1 CRSC doesn't launch or misbehaves.

If your system crashed at any time, CRSC might have been damaged. Try reinstalling CRSC. The installation might be defective if CRSC fails immediately after installation.

- 2 CRSC does not detect some or all of the devices in your network.

It is possible that you configured the IP address of your PC incorrectly. Note that the PC must not use DNS or DHCP on the compact router network. Refer to [Levels and IP Addresses in CRSC Networks](#), on page 57, for more information.

Router or remote panel module software or firmware is out of date. Get updates from Grass Valley. Remove suspect devices one-by-one to see whether the network stabilizes. Rescan the network in CRSC each time you do so.

You have duplicated levels or IP addresses. Router behavior in this case is unpredictable. Unless you have assigned IP addresses to your routers and remote panel modules, remote panel modules must have distinct rotary switch settings (1–F) and routers must have distinct rotary switch settings.

It is possible that you have more than 8 routers or more than 16 remote panel modules. Results are not predictable if you do.

Please report all CRSC failures to Grass Valley.



# 12

## Technical Details

Chapter 12 provides electrical, video, audio, and mechanical specifications for the CR Series.

### Topics

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## Power Specifications

### CR Series Router and Remote Panel Module Power Specifications

Specification	Detail
DC power	External power supply: 12VDC $\pm$ 10%, 5A.
Power consumption	15 W nominal (8x8 3Gig, SWB, SD) 10 W nominal (8x8 3Gig, SWB, SD, non-reclocked) 15 W nominal (16x4 3Gig, SWB, SD) 10 W nominal (16x4 3Gig, SWB, SD, non-reclocked) 20 W nominal (16x16 3Gig, SWB, SD) 15 W nominal (16x16 3Gig, SWB, SD, non-reclocked) 25 W nominal (32x4 3Gig, SWB, SD) 20 W nominal (32x4 3Gig, SWB, SD, non-reclocked) 35 W nominal (32x32 3Gig, SWB, SD) 25 W nominal (32x32 3Gig, SWB, SD, non-reclocked) 5 W nominal (8x8AES) 5 W nominal (16x4 AES) 6 W nominal (16x16 AES) 10 W nominal (32x32 AES) 7 W nominal (8x8 analog video) 7 W nominal (16x4 analog video) 9 W nominal (16x16 analog video) 16 W nominal (32x32 analog video) 15 W nominal (8x8 analog audio) 15 W nominal (16x4 analog audio) 18 W nominal (16x16 analog audio) 40 W nominal (32x32 analog audio) 12 W nominal (16-port machine control) 22 W nominal (32-port machine control) 33 W nominal (16x2 CQX router) 77 W max (CR6464-3Gig router) 55 W max (CR6464-AES router)
Regulatory	UL listed and CE compliant.

### PS0001 Power Supply Specifications

Specification	Detail
AC power	90–264 VAC (127–300VDC), 47–447Hz. Inrush current < 50A at 230VAC, cold start, at 25°C, Input current < 2.0A rms at 115VAC; < 1.0A at 230VAC.
DC power	$\leq$ 60W, 12VDC, 5A (5.4A peak), Regulation $\pm$ 2%. Ripple $\leq$ 120mV.
Efficiency	Efficiency > 80% at full load typical, 115VAC.
Weight	1.06 lb (0.48 kg).
Regulatory	UL listed and CE compliant.

The power supply is a Grass Valley PS0001-00:

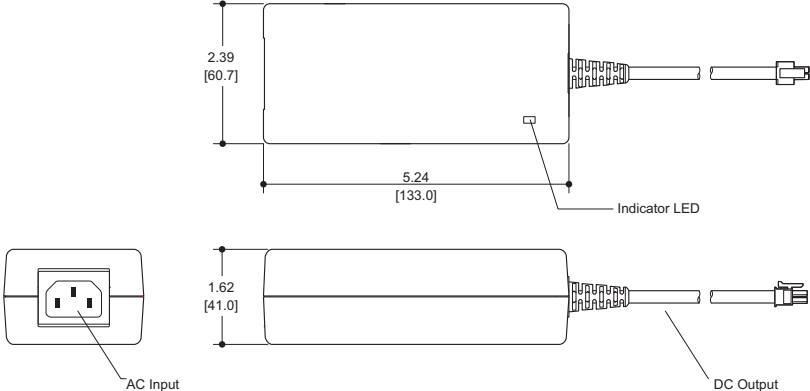


Fig. 12-1: The power output has Molex 4-pin plug.

See [Power Cord Retention for the PS0001 and PS0012 Power Supplies](#) on page 185.

**CR6400 Power Supply Specifications**

Specification	Detail
AC power	120–240 VAC, 50–60Hz, up to 2.0 A.
DC power	48 VDC, 160 W max, 3.34 A max
Ripple and Noise	≤ 240 mV p-p
Efficiency	Typically 94%
Weight	1.45 lb (0.66 kg).
Regulatory	UL listed and CE compliant.

The power supply is an Grass Valley part PS0012-00:

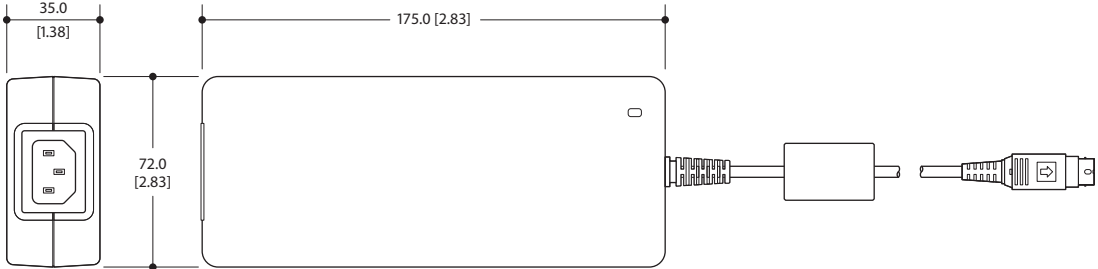
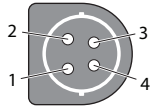


Fig. 12-2: Power Supply

Its power output has a 4-pin plug:



Pins 1 and 4 are +48V;  
Pins 2 and 3 are ground, nominally 0V. The metal ring is ground also.

The power supply's output is rated at 48 VDC, 160 W max, 3.34 A max.

Its input is rated for 120–240 VAC, 50–60 Hz, and 2.0 A.

See [Power Cord Retention for the PS0001 and PS0012 Power Supplies](#) on page 185.

## Reference Specifications

### CR Series Video Reference Specifications

Detail			
Connectors: 2 BNC (1 pair, loop-through), non-terminating, 75Ω characteristic impedance. All digital routers (HD, SD, AES) accept these video reference rates:			
Composite	HD Tri-level		
525i / 59.94 (NTSC)	720p / 23.98	1080i / 47.95	1080p / 23.98
	720p / 24	1080i / 48	1080p / 24
625i / 50 (PAL)	720p / 25	1080i / 50	1080p / 25
	720p / 29.97	1080i / 59.94	1080p / 29.97
	720p / 30	1080i / 60	1080p / 30
	720p / 50		1080p / 50
	720p / 59.94		1080p / 59.94
	720p / 60		1080p / 60
Input level range: 500 mV p-p to 2 V p-p			
Input return loss: > 40 dB, to 6 MHz			

Machine control routers do not have video reference connectors.

**Compatibility between Video Formats and Reference Rates**

Video Format	Comp		Tri-Level Sync																					
	NTSC (525i/59.94)	PAL (625i/50)	720p / 23.98	720p / 24	720p / 25	720p / 29.97	720p / 30	720p / 50	720p / 59.94	720p / 60	1080i / 47.95	1080i / 48	1080i / 50	1080i / 59.94	1080i / 60	1080p / 23.98	1080p / 24	1080p / 25	1080p / 29.97	1080p / 30	1080p / 50	1080p / 59.94	1080p / 60	
525i / 59.94	✓					✓								✓						✓				
625i / 50		✓			✓								✓						✓					
720p / 23.98			✓								✓					✓								
720p / 24				✓								✓					✓							
720p / 25		✓			✓								✓					✓						
720p / 29.97	✓					✓								✓					✓					
720p / 30							✓								✓					✓				
720p / 50		✓			✓			✓					✓					✓				✓		
720p / 59.94	✓					✓			✓					✓					✓				✓	
720p / 60							✓			✓					✓					✓				✓
1080psf / 23.98											✓													
1080psf / 24												✓												
1080psf / 29.97	✓													✓										
1080psf / 30															✓									
1080i / 50		✓			✓								✓					✓						
1080i / 59.94	✓					✓								✓					✓					
1080i / 60							✓								✓					✓				
1080p / 23.98			✓								✓					✓								
1080p / 24				✓								✓					✓							
1080p / 25		✓			✓								✓					✓						
1080p / 29.97	✓					✓								✓					✓					
1080p / 30							✓								✓					✓				
1080p / 50		✓			✓			✓					✓									✓		
1080p / 59.94	✓					✓			✓					✓					✓				✓	
1080p / 60							✓			✓					✓					✓				✓

## Physical Specifications

### CR Series Router Specifications for all CQX Compact Routers (3Gig, HD, and SD)

Specification	Detail
Dimensions	Height: 1.72" (43.7 mm), fits EIA 1 RU (1.75" or 44.5 mm), Width: 19.0" (482.6 mm).
Depth	9.50 ± 0.01" (241.3 mm), enclosure. 10.15" (257.8 mm) overall, including connectors, 10.97" (278.6 mm) overall, with control panel, including connectors.
Weight	1.7 lb (0.77 kg) without control panel.
Connectors	Power: 2 connectors, Molex 4-pin, keyed. Ethernet: 1 connector, 10/100BaseT, RJ-45 jack. RS-422: 1 connector, 9-pin D type, usage determined by software, SMPTE 207M. Video reference: 2 connectors, BNC, 75Ω. I/O: BNC, 75Ω. 26 connectors. GPIO: DB25 (16 inputs, 4 outputs) 40-pin, for optional control panel
Grounding terminal	Copper, accepts 14–6 AWG.

### CR6400 Router Specifications

Specification	Detail
Dimensions	Height: 3.47" (88.1 mm), fits EIA 2 RU (3.50" or 88.9 mm), Width: 19.0" (482.6 mm).
Depth	10.18 ± 0.01" (258.6 mm), enclosure. ≤ 10.75" (273.1 mm) from front of rack to extended ground screw
Weight	11.8 lb (5.35 kg) with no I/O cards, without control panel. 15.3 lb (6.94 kg) with 4 I/O cards, without control panel.
Connectors	Power: 2 connectors, unusual type. See the drawing under <a href="#">Power Specifications</a> on page 120. Ethernet: 1 connector, 10/100BaseT, RJ-45 jack. RS-422: 1 connector, 9-pin D type, usage determined by software, SMPTE 207M. Video reference: 2 connectors, BNC, 75Ω. Two 2×60 connectors for optional control panel.
Removable module	4 I/O card slots at rear 1 crosspoint card slot at rear 1 control card slot at rear 1 fan module removable at the front
I/O module types	SDI. AES
Grounding terminal	Copper, accepts 14–6 AWG.



### CR Series Router Specifications for All 3Gig, HD, SD, AES, and Analog Video Compact Routers (Other than the CR6400 Routers)

Specification	Detail
1RU dimensions	Height: 1.72" (43.7 mm), fits EIA 1 RU (1.75" or 44.5 mm), Width: 19.0" (482.6 mm).
2RU dimensions	Height: 3.47" (88.1 mm), fits EIA 2 RU (3.50" or 88.9 mm), Width: 19.0" (482.6 mm).
Depth	0.693 ± 0.01" (17.6 mm), enclosure. ≤ 1.29" (31.8 mm) from front of rack to extended ground screw, ≤ 1.41" (35.8 mm) overall, to extended ground screw, ≤ 2.23" (56.6 mm) overall, with control panel, to extended ground screw.
1RU weight	16×16: 1.7 lb (0.77 kg) without control panel. 16×4: 1.47 lb (0.67 kg) without control panel.
2RU weight	32×32: 3.23 lb (1.47 kg) without control panel. 32×4: 2.69 lb (1.22 kg) without control panel.
Connectors	Power: 2 connectors, Molex 4-pin, keyed. Ethernet: 1 connector, 10/100BaseT, RJ-45 jack. RS-422: 1 connector, 9-pin D type, usage determined by software, SMPTE 207M. Video reference: 2 connectors, BNC, 75Ω. I/O: BNC, 75Ω. 16×16 routers: 32 connectors, 32×32 routers: 64 connectors, 16×4 routers: 20 connectors, 32×4 routers: 36 connectors. 1RU: 40-pin, for optional control panel, 2RU: 60-pin, for optional control panel.
Grounding terminal	Copper, accepts 14–6 AWG.

### CR Series Analog Audio Router Specifications

Specification	Detail
1RU dimensions	Height: 1.72" (43.7 mm), fits EIA 1 RU (1.75" or 44.5 mm), Width: 19.0" (482.6 mm).
2RU dimensions	Height: 3.47" (88.1 mm), fits EIA 2 RU (3.50" or 88.9 mm), Width: 19.0" (482.6 mm).
Depth	1.55 ± 0.01" (39.4 mm), enclosure. ≤ 2.16" (54.9 mm) from front of rack to extended ground screw, ≤ 2.28" (57.9 mm) overall, to extended ground screw, ≤ 3.10" (78.7 mm) overall, with control panel, to extended ground screw.
1RU weight	16×16: 1.83 lb (0.830 kg) without control panel. 16×4: 1.71 lb (0.774 kg) without control panel.
2RU weight	32×32: 3.09 lb (1.402 kg) without control panel. 32×4: 3.00 lb (1.362 kg) without control panel.

Specification	Detail
Connectors	Power: 2 connectors, Molex 4-pin, keyed. Ethernet: 1 connector, 10/100BaseT, RJ-45 jack. RS-485: 1 connector, 9-pin D type, usage determined by software, SMPTE 207M. Video reference: 2 connectors, BNC, 75Ω. 1RU: 40-pin, for optional control panel, 2RU: 60-pin, for optional control panel.
I/O Connectors	CR1616-AA: 8 DB25s, each having 8 STPs (64 connections). CR3204-AA: 9 DB25s, each having 8 STPs (72 connections). CR3232-AA: 16 DB25s, each having 8 STPs (128 connections).
Grounding terminal	Copper, accepts 14–6 AWG.

### CR Series Machine Control Router Physical Specifications

Specification	Detail
1RU dimensions	Height: 1.72" (43.7mm), fits EIA 1 RU (1.75" or 44.5mm), Width: 19.0" (482.6mm).
2RU dimensions	Height: 3.47" (88.1mm), fits EIA 2 RU (3.50" or 88.9mm), Width: 19.0" (482.6mm).
Depth	0.693 ± 0.01" (17.6 mm), enclosure. ≤ 1.29" (31.8 mm) from front of rack to extended ground screw, ≤ 1.41" (35.8mm) overall, to extended ground screw, ≤ 2.23" (56.6mm) overall, with control panel, to extended ground screw.
1RU weight	1.31 lb (0.596 kg) without control panel.
2RU weight	2.21 lb (1.004 kg) without control panel.
Connectors	Power: 2 connectors, Molex 4-pin, keyed. Ethernet: 1 connector, 10/100BaseT, RJ-45 jack. Serial: 1 connector, 9-pin D type, RS-485/422, usage determined by software, SMPTE 207M. 1RU: 40-pin, for optional control panel, 2RU: 60-pin, for optional control panel.
I/O Connectors	CR16-PR: 16 RJ-45, 1 Mb/s. CR32-PR: 32 RJ-45, 1 Mb/s.
Grounding terminal	Copper, accepts 14–6 AWG.

### CR Series Control Panel Physical Specifications

Specification	Detail
1RU dimensions	Height: 1.66" (42.2mm), Width: 17.62" (447.5mm).
2RU dimensions	Height: 3.41" (86.6mm), Width: 17.62" (447.5mm).
Depth	0.50" (12.7mm) enclosure, 0.82" (20.8mm) overall.
1RU weight	16×16: 0.75 lb (0.34 kg), 16×4: 0.70 lb (0.32 kg), 16×2: 0.69 lb (0.31 kg).
2RU weight	32×32: 1.43 b (0.65 kg). 32×4: 1.31 lb (0.59 kg).
Connectors	1RU: 40-pin, to the Compact Router, 2RU: 60-pin, to the Compact Router.

### CR Series Remote Panel Module Physical Specifications

Specification	Detail
1RU dimensions	Height: 1.72" (43.7mm), fits EIA 1 RU (1.75" or 44.5mm), Width: 19.0" (482.6mm).
2RU dimensions	Height: 3.47" (88.1mm), fits EIA 2 RU (3.50" or 88.9mm), Width: 19.0" (482.6mm).
Depth	0.693±0.01" (17.6mm), enclosure. ≤ 1.29" (31.8mm) from front of rack to extended ground screw, ≤ 1.41" (35.8mm) overall, to extended ground screw, ≤ 2.23" (56.6mm) overall, with control panel, to extended ground screw.
1RU weight	1.06 lb (0.48 kg) without control panel.
2RU weight	1.83 lb (0.83 kg) without control panel.
Connectors	Power: 2 connectors, Molex 4-pin, keyed. Ethernet: 1 connector, 10/100BaseT, RJ-45 jack. RS-422: 1 connector, 9-pin D type, usage determined by software, SMPTE 207M. 1RU: 40-pin, for optional control panel, 2RU: 60-pin, for optional control panel.
Grounding terminal	Copper, accepts 14–6 AWG.

## Environmental Specifications

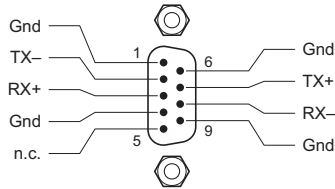
### CR Series Environmental Specifications

Specification	Detail
Operating temperature	0–40°C, ambient.
Relative humidity	0 to 90%, non-condensing.
Cooling	No fan required, except for the analog audio routers.

## Connectors

### Serial Connector

The serial connector for all CR Series Compact Routers (including the CR6400 family routers) has this pinout:



The connector is RS-485 and can be used as RS-422. It communicates at 38,400 Baud rate (no parity, 8 data bits and one stop bit).

All compact routers also support RS-485 multi-drop.

Compact routers communicate using a *subset* of NVSP (NVISION serial protocol). They accept any command and respond to the following commands:

0x01	Device Present
0x15	Extended Software Version Command
0x50	Take (without timestamp)
0x51	Destination Status
0x55	Lock Destination
0x58	Release Destination
0x59	Level Configuration
0x5D	Tally
0x5E	Salvo (without timestamp)
0x66	Destination LPR State
0x67	Machine Control Salvo Command
0x68	Expanded Tally Command
0x80	Error Response
0x81	Error Response to Sequenced Message

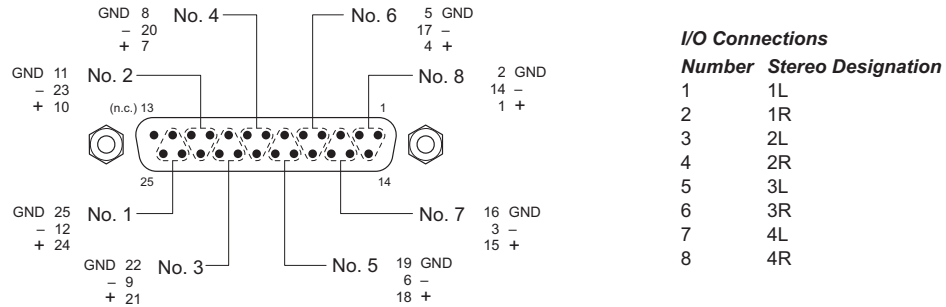
Customers who want to operate the router through its serial port using an automation system or an external control system may contact Grass Valley technical support for information and to obtain the NVSP protocol document (which is essential).

The serial port of remote panel modules is presently non-functional.

## DB25 Connectors

### Analog Audio Routers

The analog audio routers use DB25 connectors. Each connector supports 8 inputs (or outputs):



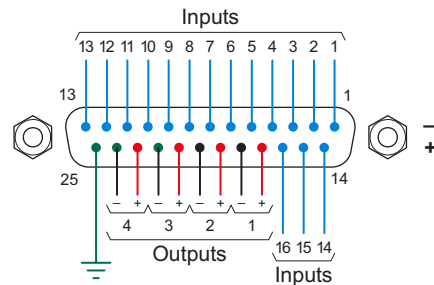
For 16×16 routers, the connectors provide inputs (or outputs) 1–8, 9–16, 17–24, and 25–32, respectively, and are labelled that way on the rear of the router. Inputs (and outputs) are treated as 16 stereo pairs.

For 32×32 routers, the connectors provide inputs (or outputs) 1–8, 9–16, 17–24, 25–32, 33–40, 41–48, 49–56, and 57–64, respectively, and are labelled that way on the rear of the router. Inputs (and outputs) are treated as 32 stereo pairs.

For 32×4 routers, the connectors provide inputs 1–8, 9–16, 17–24, 25–32, 33–40, 41–48, 49–56, and 57–64, respectively. The inputs and outputs are labelled accordingly. The inputs are treated as 32 stereo pairs. The single output connector provides outputs 1–8 (4 stereo pairs). The inputs and outputs are labelled accordingly.

### GPIO Connections for CQX Digital Video Routers

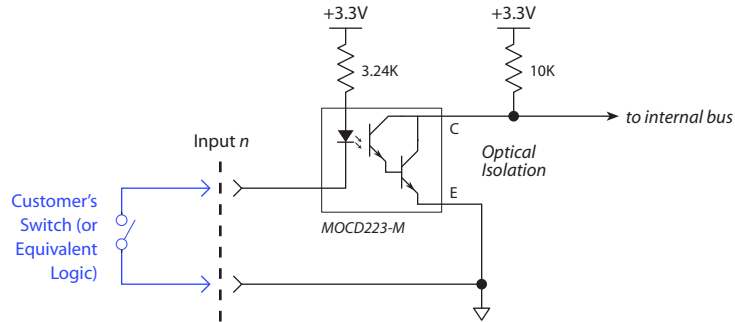
The CQX routers use DB25 connectors for GPIO (general-purpose I/O). The connector supports 16 inputs and 4 outputs:



The 16 inputs are in order on pins 1 through 16. The outputs are paired on pins 17–24. Pin 25 is ground.

## Inputs

Each input circuit has an individual signal connection, but all the inputs share a single ground connection:

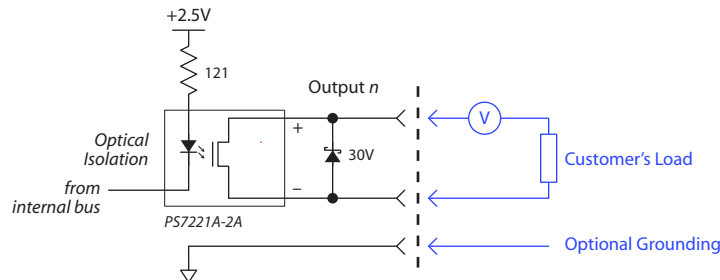


The input turns on (a positive-going pulse) when the signal is connected to ground (on the connector). The positive-going pulse on input  $N$  switches video input  $N$  to CQ output 1, where  $1 \leq N \leq 16$ .

The router firmware debounces the inputs and requires about 100 ms between the positive edges of pulses.

## Outputs

The output circuit requires an external voltage source:



The Schottky diode across the output limits applications to less than 30VDC.

The outputs represent alarm states.

- Output 1 (power supply).  
If you have connected two power supplies and one malfunctions or is disconnected, output 1 signals an alarm.
- Output 2 (video reference).  
If the router has no video reference or the video reference is disconnected, output 2 signals an alarm.
- Output 3 (fans).  
If any of the fans stop turning, output 3 signals an alarm.
- Output 4 (bypass).  
If the router has no power at all, output 4 signals an alarm. (This condition can occur if both power supplies fail or are disconnected or if main power fails.)

**A GP output turns off to signal an alarm condition. When the CQX router is running properly, all 4 GP outputs are on.**

## Video Specifications

### CR Series Digital Video Specifications<sup>1</sup>

Specification	Detail
3Gig	<p>Auto re-clocking: 270 Mb/s, and 1.483, 1.485, 2.966, and 2.970 Gb/s, or auto bypass. Pass-through: 10 Mb/s to 3.0 Gb/s</p> <p>Input &amp; output impedance: 75Ω</p> <p>&gt; 400 m, Belden 1694A or equivalent, 270 MB/s.</p> <p>&gt; 150 m, Belden 1694A or equivalent, near 1.5 GB/s.</p> <p>&gt; 100 m, Belden 1694A or equivalent, near 3.0 GB/s.</p> <p>&gt; 80 m, Belden 1694A or equivalent, near 3.0 GB/s for CQX routers.</p> <p>Input return loss: &gt; 15 dB, 5 MHz to 1.5 GHz.</p> <p>Output level: 800 mV pp ± 10%.</p> <p>Output offset: 0VDC ± 0.5V.</p> <p>Output rise/fall time: ≤ 135 ps.</p> <p>Output overshoot: ≤ 10% of amplitude.</p> <p>Output timing jitter: ≤ 0.2 UI p-p.</p> <p>Output alignment jitter: ≤ 0.3 UI at 100 kHz</p> <p>Output return loss: &gt; 10 dB, 1.5 GHz to 3.0 GHz.</p>
HD-SDI (SWB)	<p>Data rates: up to 1.5 Gbps, reclocking at 143, 177, 270, 360 &amp; 540 Mb/s and 1.483 &amp; 1.485 Gb/s rates, automatic bypass for other rates.</p> <p>Input &amp; output impedance: 75Ω</p> <p>Cable equalization: up to 150 m Belden 1694A or equivalent cable, at 1.483 Gb/s and 1.485 Gb/s, and 400 m at 143–540 Mb/s.</p> <p>Input return loss: ≥ 15 dB, 5 MHz to 1.5 GHz.</p> <p>Output level: 800 mV pp ± 10%.</p> <p>Output offset: 0VDC ± 0.5V.</p> <p>Output rise/fall time: ≤ 270 ps (20% to 80%).</p> <p>Output overshoot: ≤ 10% of amplitude.</p> <p>Output jitter: ≤ 0.2 UI p-p.</p> <p>Output return loss: ≥ 15 dB, 5 MHz to 1.5 GHz.</p>
SD-SDI	<p>Data rates: auto reclocking at 143, 177, 270, 360 &amp; 540 Mb/s and auto-automatic bypass for other rates.</p> <p>Input &amp; output impedance: 75Ω</p> <p>Cable equalization: up to 300 m Belden 1694A or equivalent cable.</p> <p>Input return loss: ≥ 15 dB, 5 to 540 MHz.</p> <p>Output level: 800 mV pp ± 10%.</p> <p>Output offset: 0VDC ± 0.5V.</p> <p>Output rise/fall time: 0.4 to 1.5 ns.</p> <p>Output overshoot: ≤ 10% of amplitude.</p> <p>Output jitter: ≤ 0.2 UI p-p.</p> <p>Output return loss: ≥ 15 dB, 5 MHz to 540 MHz.</p>

1. All compact SD, HD, and 3Gig video routers support DVB-ASI.

### CR Series Analog Video Specifications

Specification	Detail
Signal inputs (NTSC, PAL)	Input level: 1V p-p nominal. Input range: $\pm 2$ V. Input return loss: $< -45$ dB, DC to 6 MHz. Input CMRR: $> 60$ dB at 120 Hz.
Signal outputs (NTSC, PAL)	Output level: 1V p-p nominal. Output offset: DC offset $0\text{ V} \pm 30\text{ mV}$ , relative to back porch. Output return loss: $< -45$ dB, DC to 6 MHz. Output-to-output isolation: $> 90$ dB at subcarrier frequency.
Signal specifications	Insertion loss: $0\text{ dB} \pm 0.1\text{ dB}$ . Frequency response: $0\text{ dB} \pm 0.05\text{ dB}$ , DC to 6 MHz. Crosstalk: $< -65$ dB, at subcarrier frequency. Noise spectrum: $< -60$ dB (test signal: luminance ramp). Differential gain: $< 0.1\%$ at subcarrier frequency. Differential phase: $< 0.1^\circ$ at subcarrier frequency. Delay scatter: $< \pm 0.65^\circ$ at subcarrier, any input to any output. Tilt: $< 0.1\%$ . DC coupled system.
Video reference	Input level range: 500 mV p-p to 2 V p-p. Input return loss: $> -40$ dB, DC to 6 MHz.

## Audio Specifications

### CR Series Digital Audio (AES) Specifications

Specification	Detail
Signal inputs	Signal type: AES3id (2 "mono" channels per input). Sample rate: 32 kHz – 192 kHz. Input level: 1V p-p nominal into $75\ \Omega$ . Input range: 200 mV p-p to 3 V p-p into $75\ \Omega$ . Input return loss: $< -25$ dB, from 100 kHz to 6 MHz. Input connectors: BNC, $75\ \Omega$ .
Signal outputs	Signal type: AES3id (2 "mono" channels per input). Sample rate: async, 32 kHz – 192 kHz; sync, 48 kHz. Output level: $1\text{ V p-p} \pm 10\%$ into $75\ \Omega$ . Output offset: $0.0\text{ VDC} \pm 50\text{ mVDC}$ , AC coupled. Output rise/fall time: 4 ns – 8 ns. Output jitter: $< 1$ ns, in synchronous mode. Output return loss: $< -25$ dB, from 100 kHz to 6 MHz. Output-to-output isolation: $> 40$ dB, from 100 kHz to 6 MHz. Output connectors: BNC, $75\ \Omega$ .



**Compact Router Analog Audio Specifications.**

Specification	Detail
Signal inputs	Input level: Up to 24 dBu. Input impedance: > 20 kW. Input CMRR: > 75 dBu. Input connectors: DB25.
Signal outputs	Output level: Up to 24 dBu (unity gain). Input to output level variations: $\pm 1$ dB, nominal. Frequency response: $< \pm 0.05$ dB from 20 Hz to 100 kHz. Output impedance: 50 $\Omega$ , nominal. THD and noise: < 0.002%. Crosstalk: > 85 dB, worst case. SNR: > 100 dB, relative to +24 dBu (20 Hz to 20 kHz). Output connectors: DB25.

**Drawings**

The following drawings identify features and provide overall and critical dimensions. The drawings are grouped as follows:

- [1RU Routers, Control Panels, and Remote Panel Modules](#)
- [CQX Routers and Control Panel](#)
- [2RU Routers, Control Panels, and Remote Panel Modules](#)

*Please refer to the CR6400 Family User's Guide for drawings of the CR6400 family routers and panel.*

## 1RU Routers, Control Panels, and Remote Panel Modules

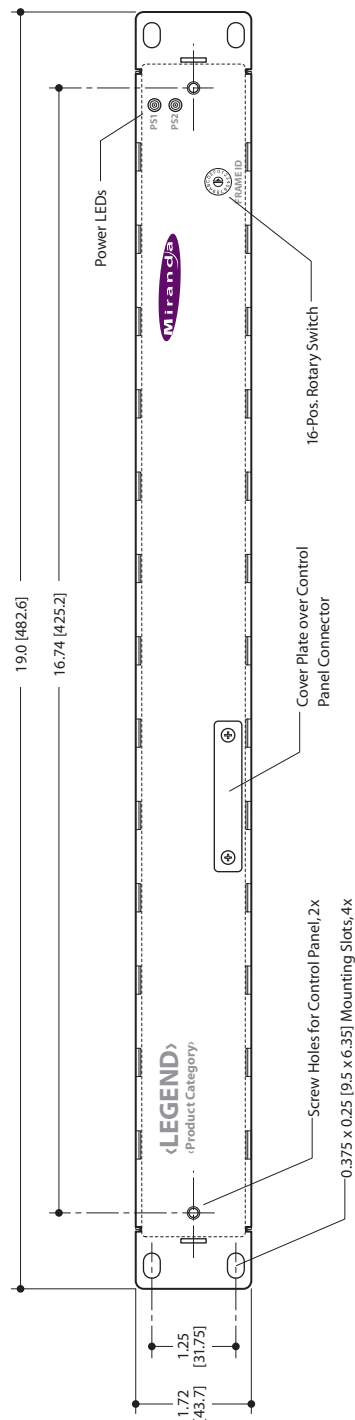


Fig. 12-3: Front View of the 1RU Routers

All the 1RU compact routers have the same features and dimensions at the front, except for the legends:

Legend	Product Category
CR1616-3Gig	Digital Video Router
CR1616-HD	Digital Video Router
CR1616-HD-NR	Digital Video Router
CR1616-SD	Digital Video Router
CR1616-SD-NR	Digital Video Router
CR1616-AES	Digital Audio Router
CR1616-AV	Analog Video Router
CR1616-AA	Analog Audio Router
CR1604-3Gig	Digital Video Router
CR1604-HD	Digital Video Router
CR1604-HD-NR	Digital Video Router
CR1604-SD	Digital Video Router
CR1604-SD-NR	Digital Video Router
CR1604-AES	Digital Audio Router
CR1604-AV	Analog Video Router
CR1604-AA	Analog Audio Router
CR0808-3Gig	Digital Video Router
CR0808-HD	Digital Video Router
CR0808-HD-NR	Digital Video Router
CR0808-SD	Digital Video Router
CR0808-SD-NR	Digital Video Router
CR0808-AES	Digital Audio Router
CR0808-AV	Analog Video Router
CR0808-AA	Analog Audio Router
CR16-PR	Machine Control Router



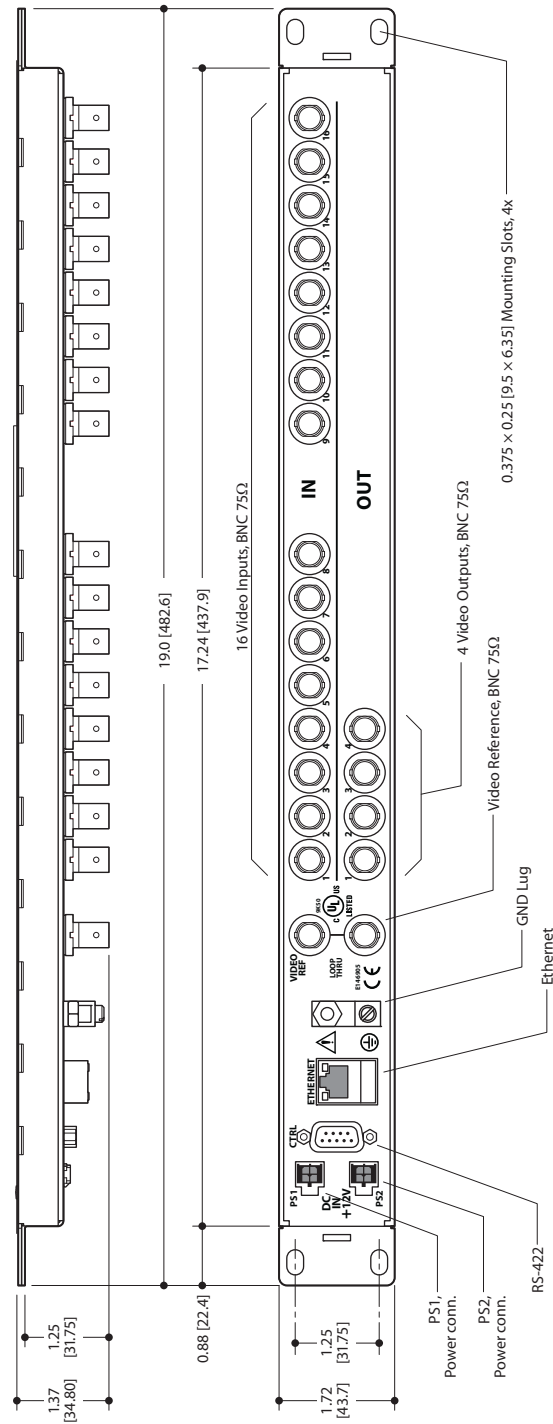


Fig. 12-5: Rear and Top Views of the 16x4 3Gig, HD, SD, AES, and AV Routers

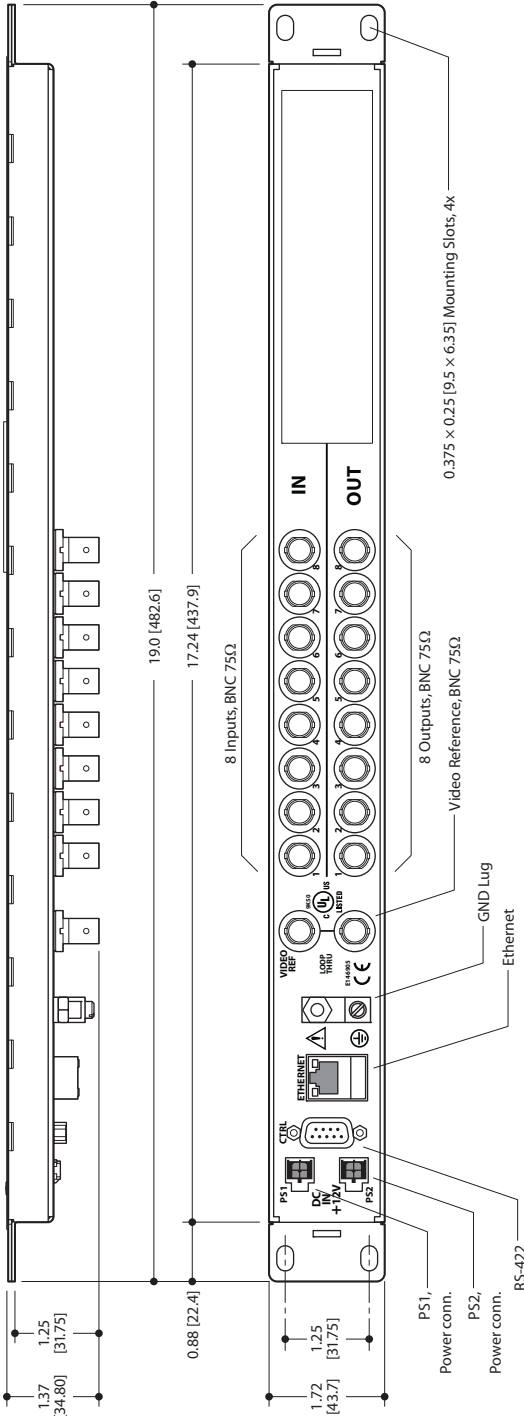


Fig. 12-6: Rear and Top Views of the 8x8 3Gig, HD, SD, AES, and AV Routers

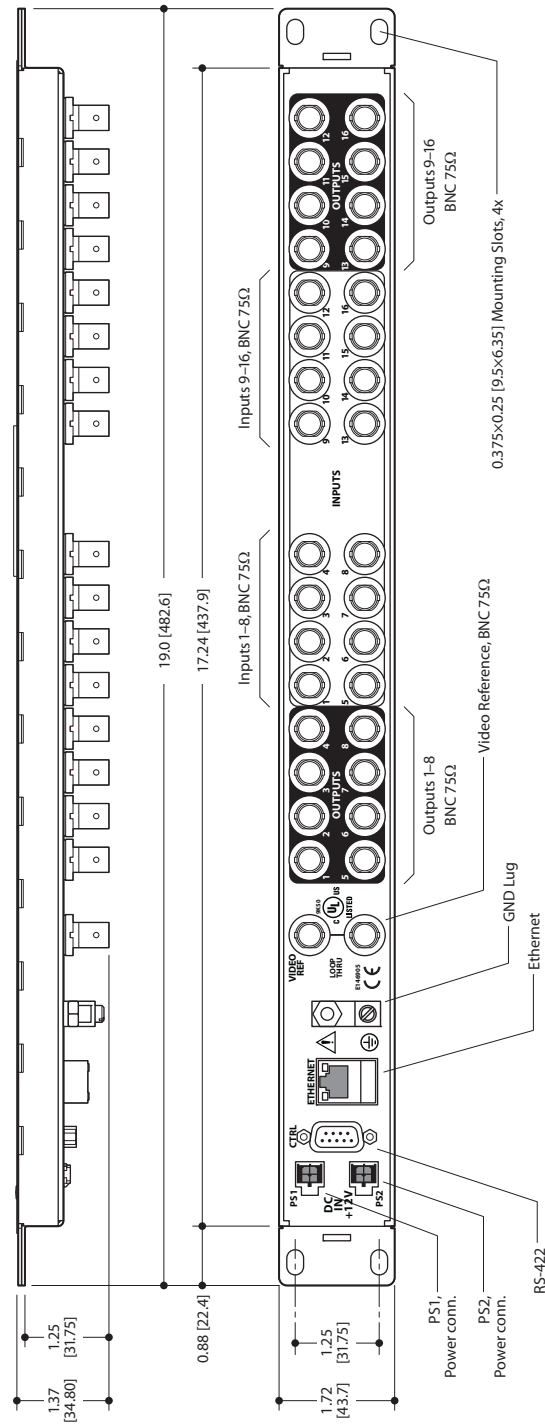


Fig. 12-7: Rear and Top Views of the CR1616-AV

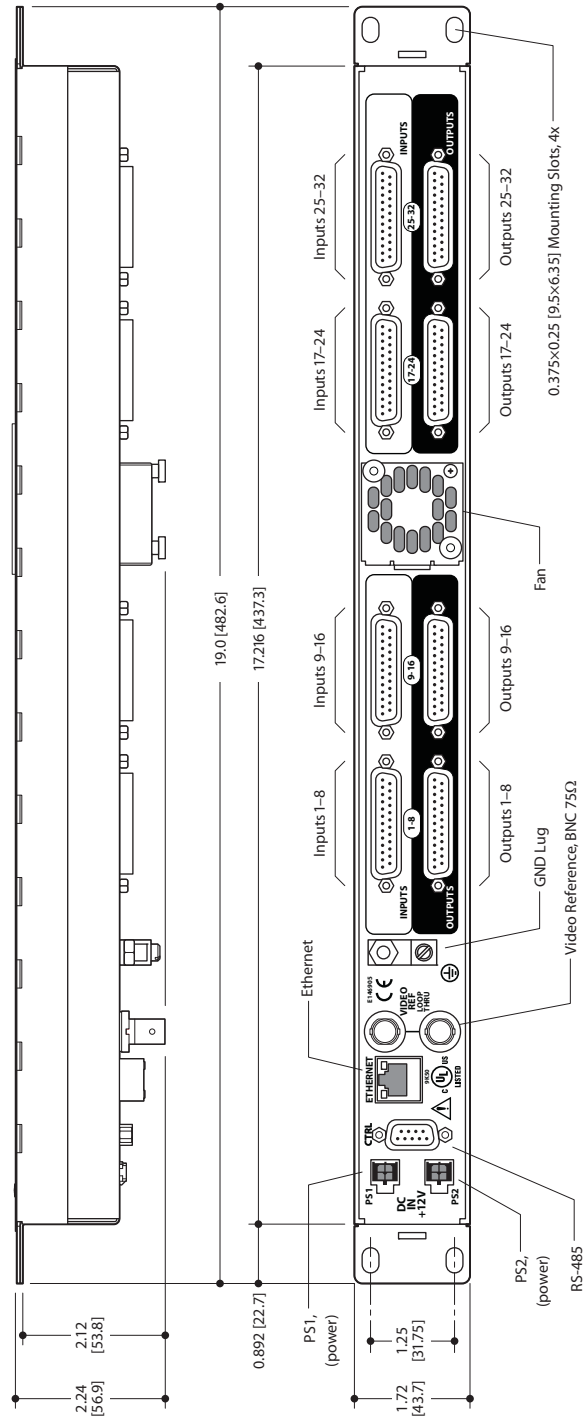


Fig. 12-8: Rear and Top Views of the CR1616-AA

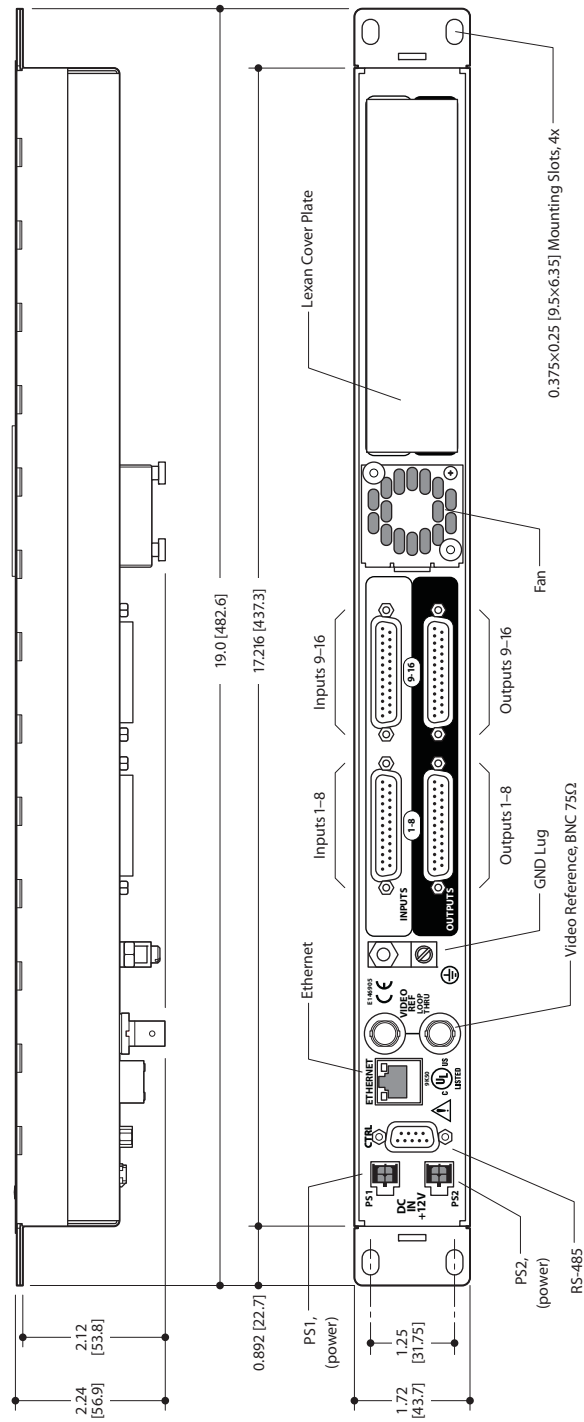


Fig. 12-9: Rear and Top Views of the CR0808-AA



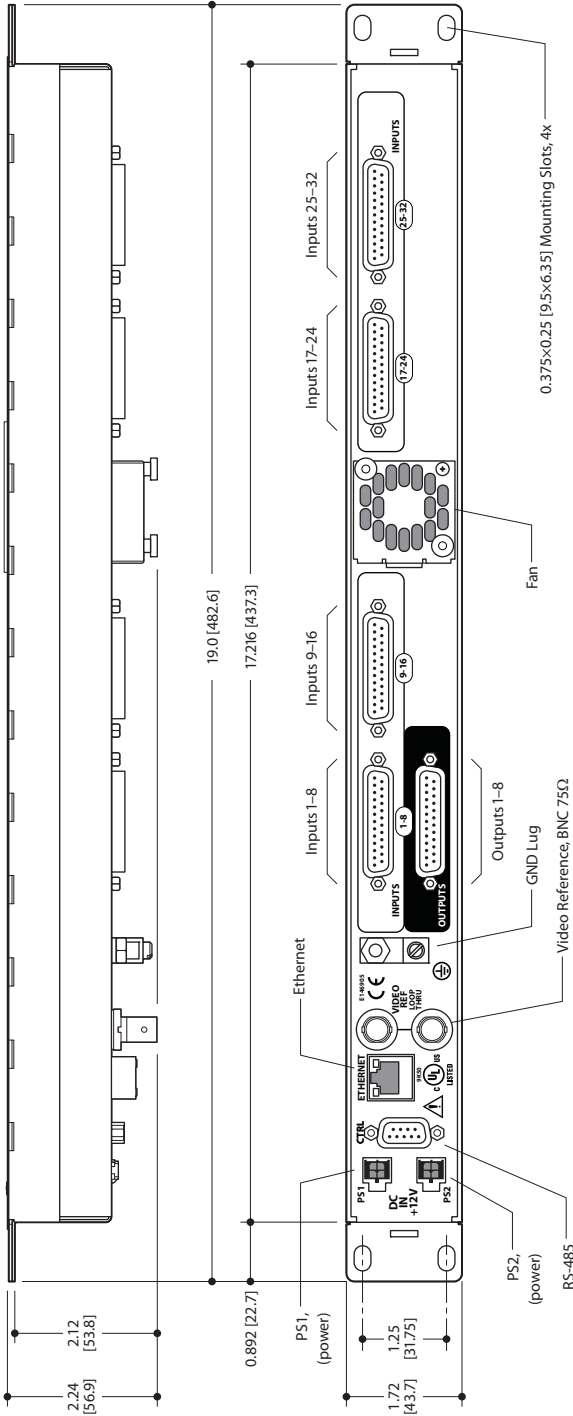


Fig. 12-10: Rear and Top Views of the CR1604-AA

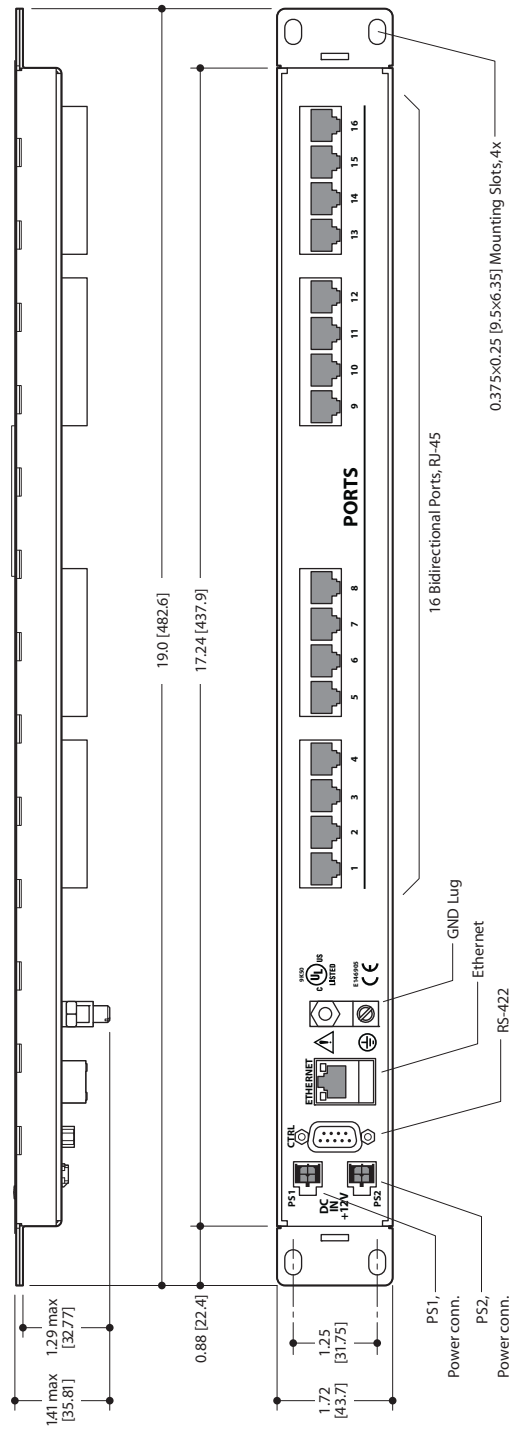


Fig. 12-11: Rear and Top Views of the CR16-PR

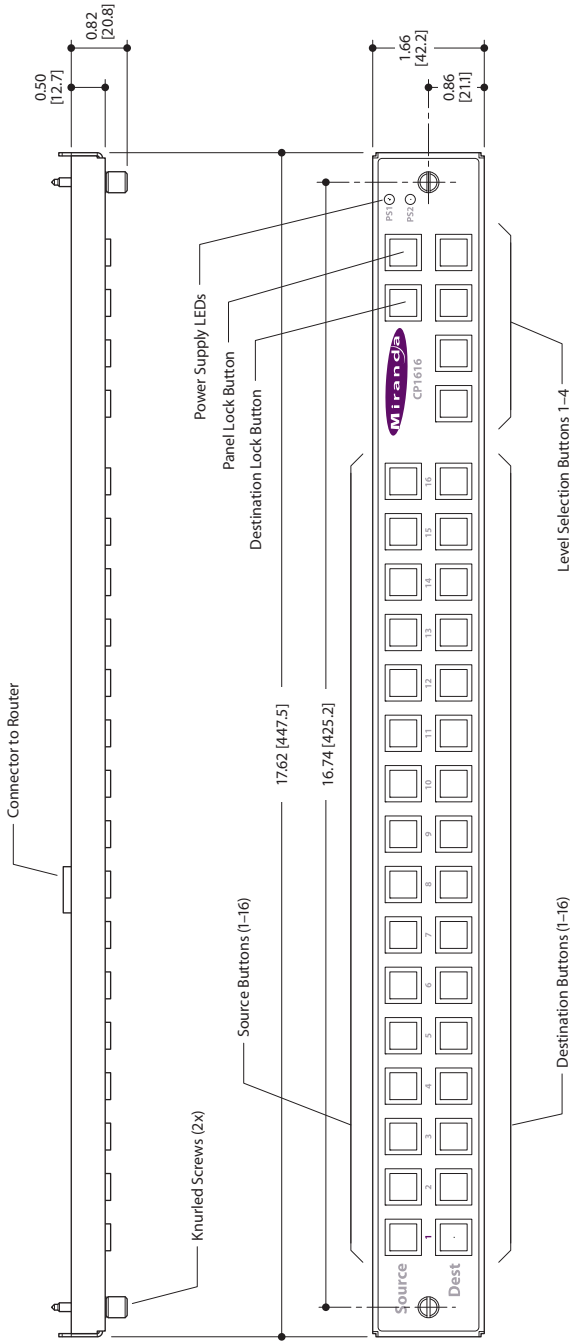


Fig. 12-12: Front and Top Views of the CP1616 Control Panel

Except for the lock buttons, the button designations do not apply when the panel is used in a CRSC system.

None of the button designations applies when the panel is used in an NV9000 system.

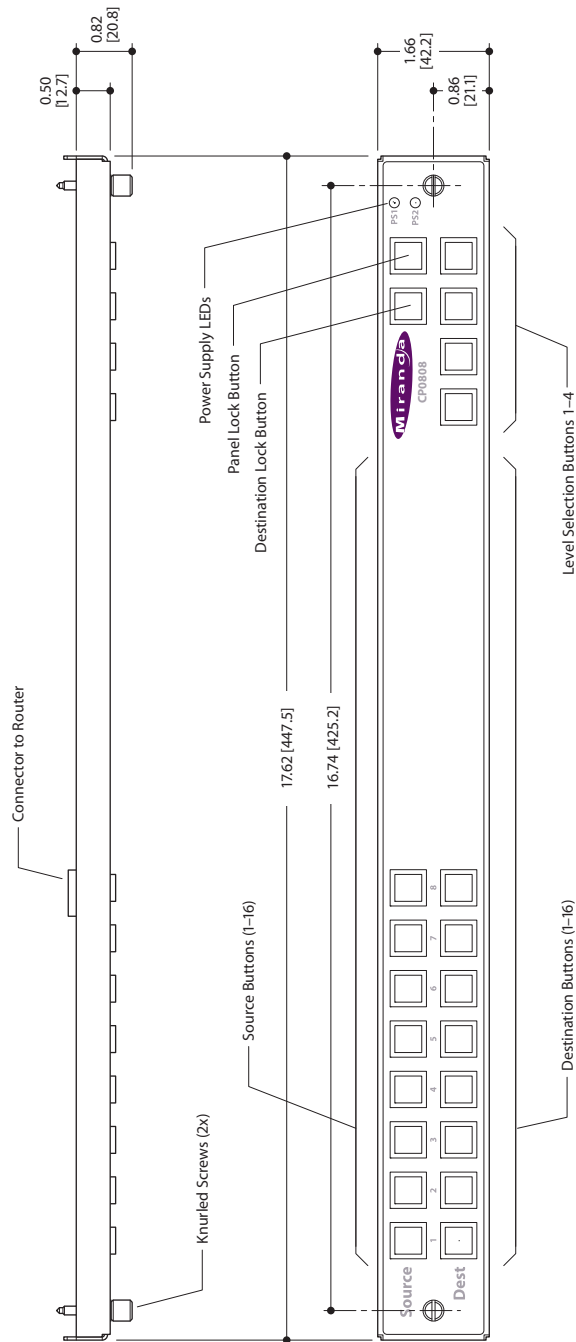


Fig. 12-13: Front and Top Views of the CP0808 Control Panel

Except for the lock buttons, the button designations do not apply when the panel is used in a CRSC system.

None of the button designations applies when the panel is used in an NV9000 system.

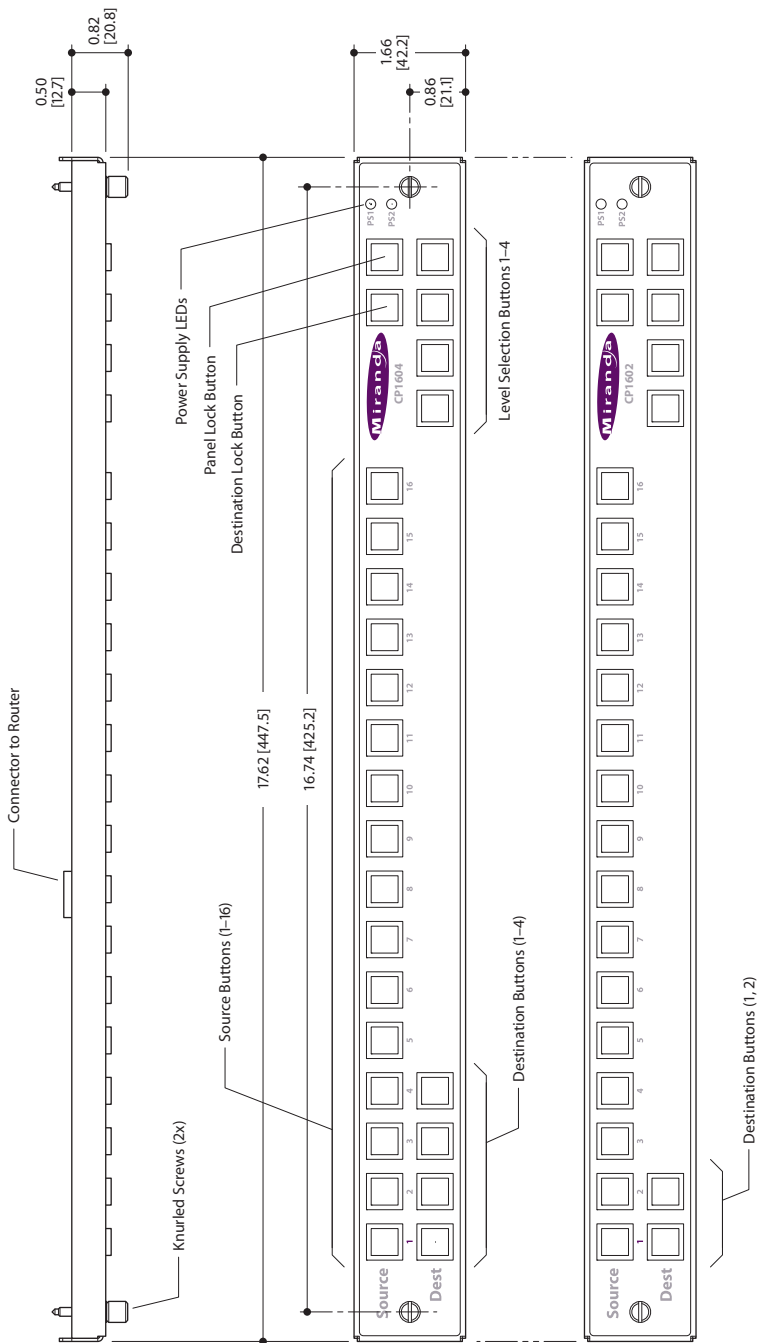


Fig. 12-14: Front and Top Views of the CP1604 and CP1602 Control Panels

Except for the lock buttons, the button designations do not apply when the panel is used in a CRSC system.

None of the button designations applies when the panel is used in an NV9000 system.

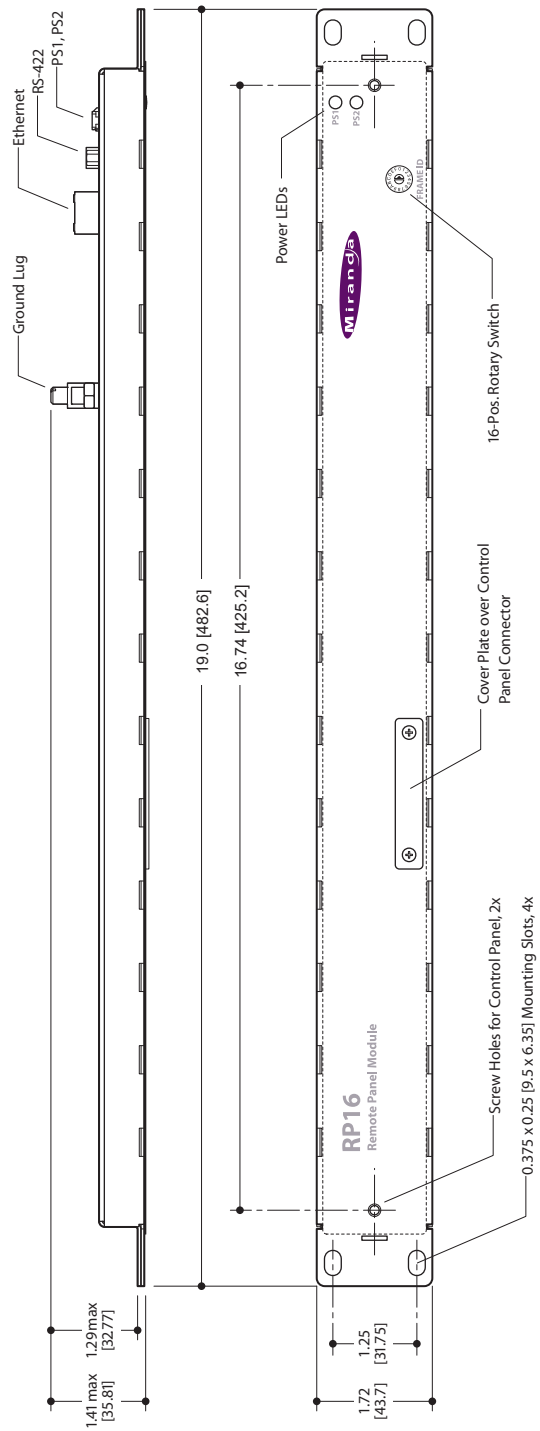


Fig. 12-15: Front and Top Views of the RP16 Remote Panel Module

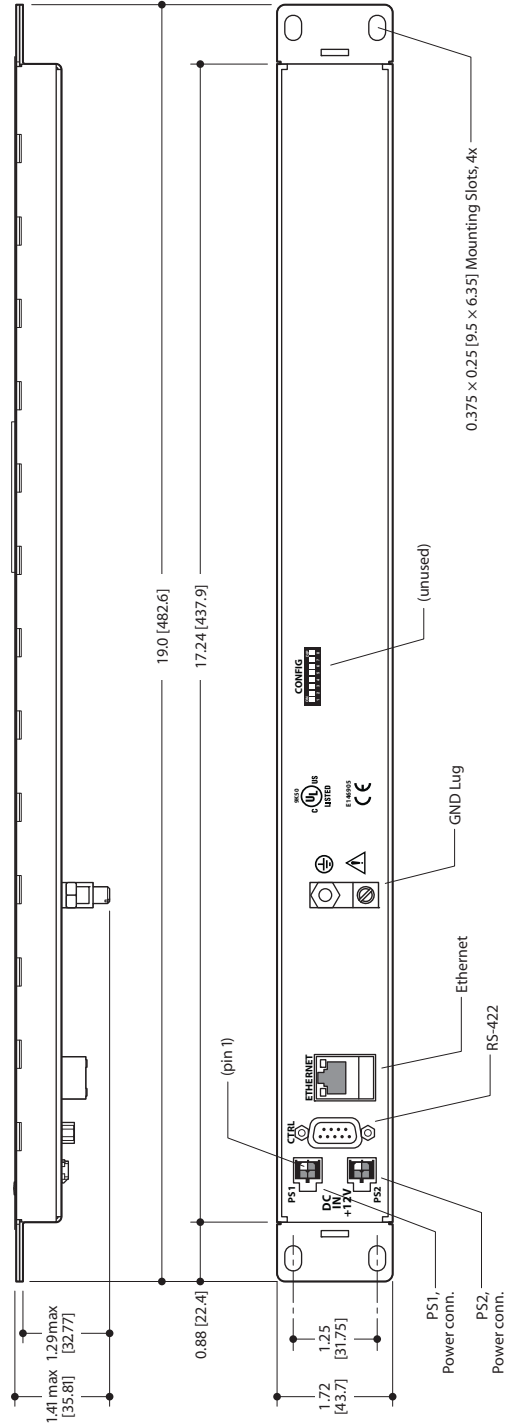


Fig. 12-16: Rear and Top Views of the RP16 Remote Panel Module

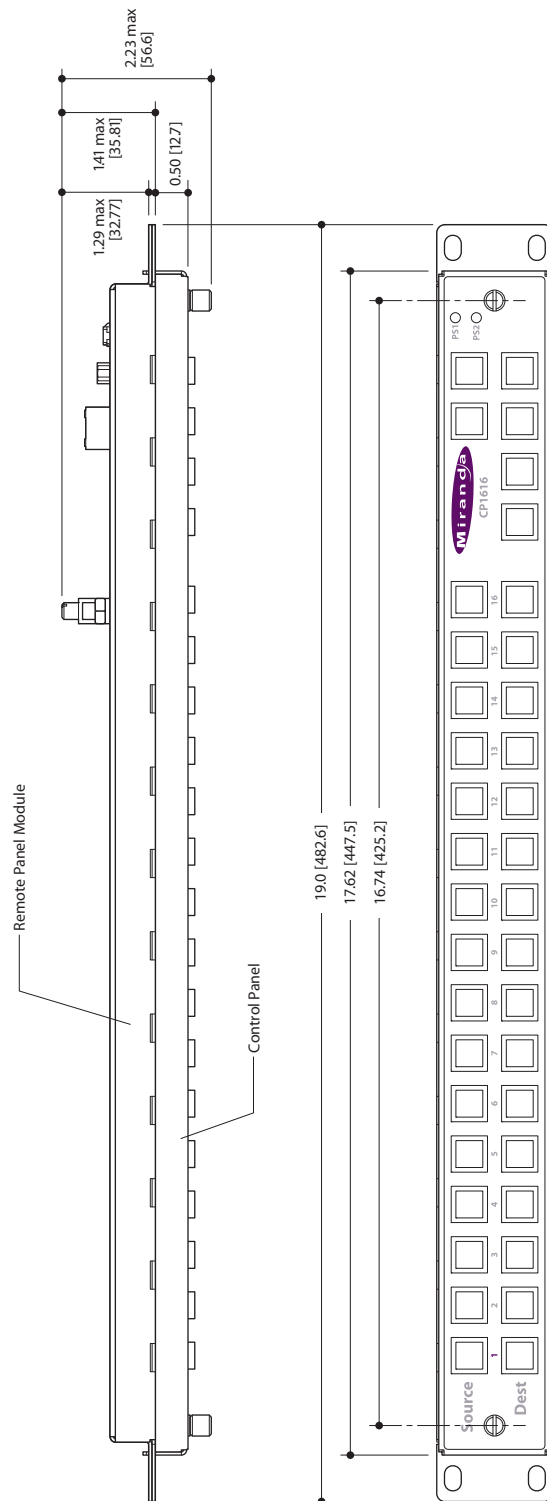


Fig. 12-17: Front and Top Views of an RP16 and Control Panel Assembly



## CQX Routers and Control Panel

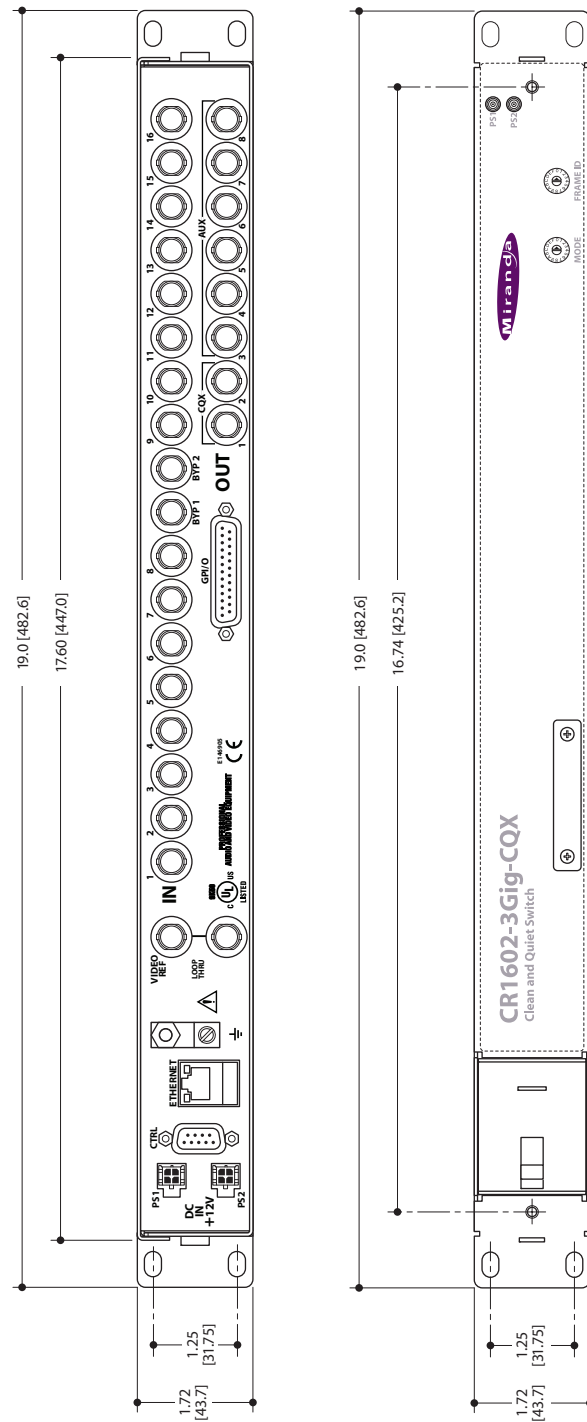


Fig. 12-18: Front and Rear Views of the CQX Routers

All CQX compact routers (1RU) have the same features and dimensions, except for the legends:

Legend:	Product Category
CR1602-3Gig-CQX	Clean and Quiet Router
CR1602-HD-CQX	Clean and Quiet Router
CR1602-SD-CQX	Clean and Quiet Router

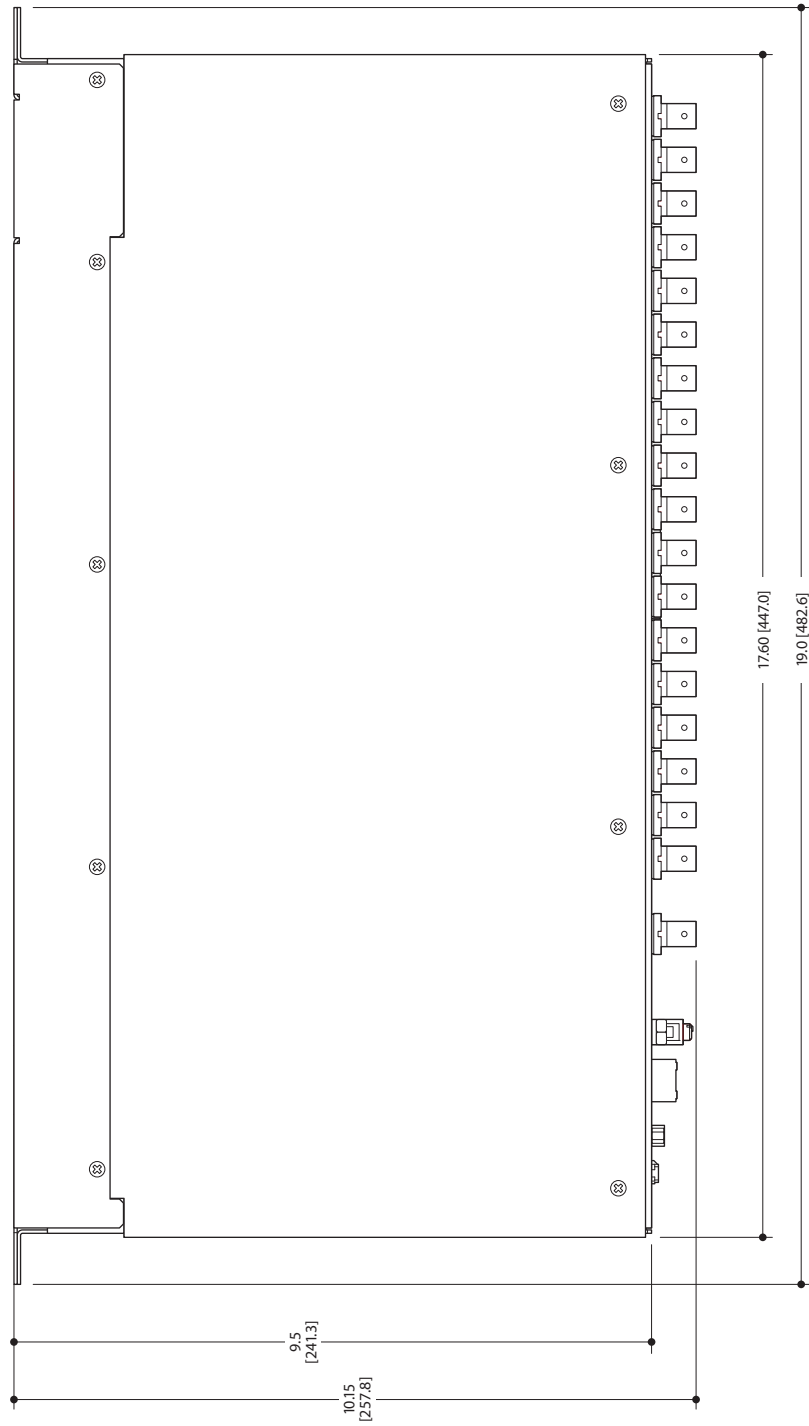


Fig. 12-19: Top View of the CQX Routers

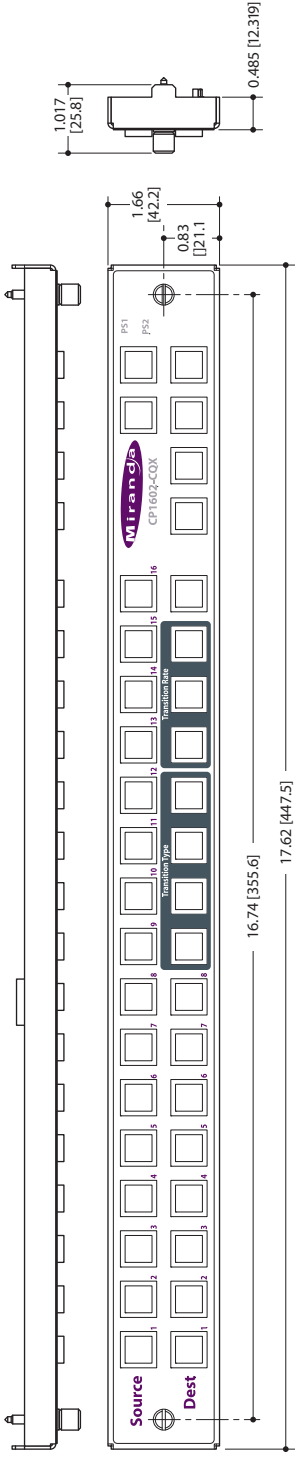


Fig. 12-20: Front and Top Views of the CQX Panel

## 2RU Routers, Control Panels, and Remote Panel Modules

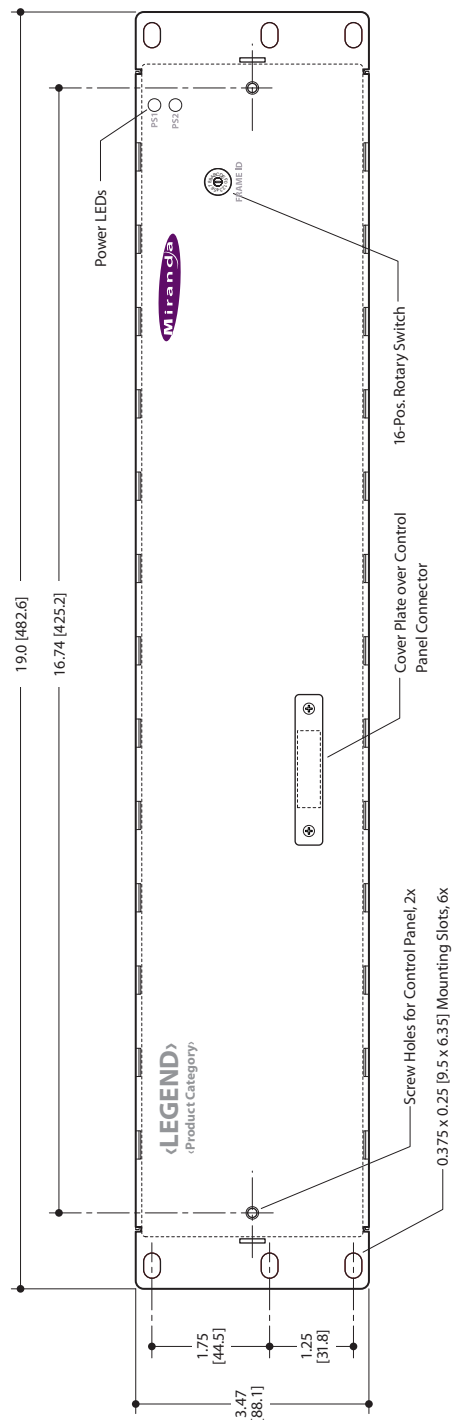


Fig. 12-21: Front View of the 2RU Routers

All the 2RU compact routers have the same features and dimensions at the front, except for the legends:

Legend:	Product Category
CR3204-3Gig	Digital Video Router
CR3232-3Gig	Digital Video Router
CR3204-HD	Digital Video Router
CR3204-HD-NR	Digital Video Router
CR3232-HD	Digital Video Router
CR3232-HD-NR	Digital Video Router
CR3204-SD	Digital Video Router
CR3204-SD-NR	Digital Video Router
CR3232-SD	Digital Video Router
CR3232-SD-NR	Digital Video Router
CR3204-AES	Digital Audio Router
CR3232-AES	Digital Audio Router
CR3204-AV	Analog Video Router
CR3232-AV	Analog Video Router
CR3204-AA	Analog Audio Router
CR3232-AA	Analog Audio Router
CR32-PR	Machine Control Routing Switcher

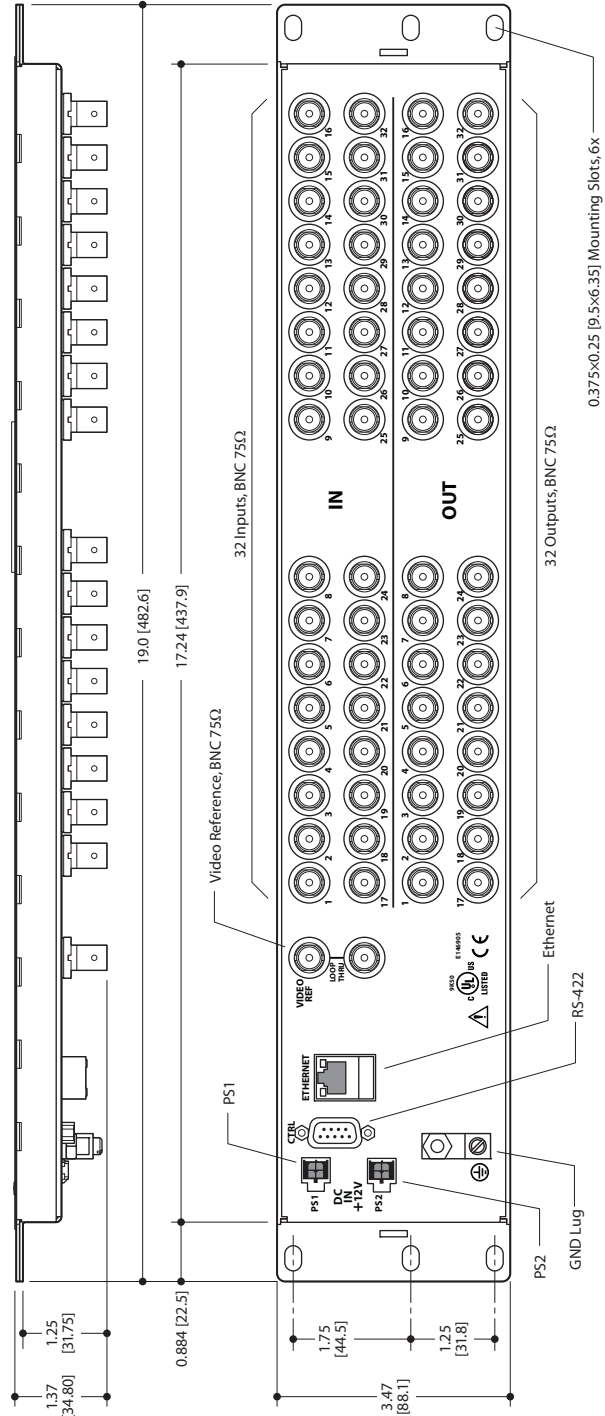


Fig. 12-22: Rear and Top Views of the 32x32 3Gig, HD, SD, and AES Routers

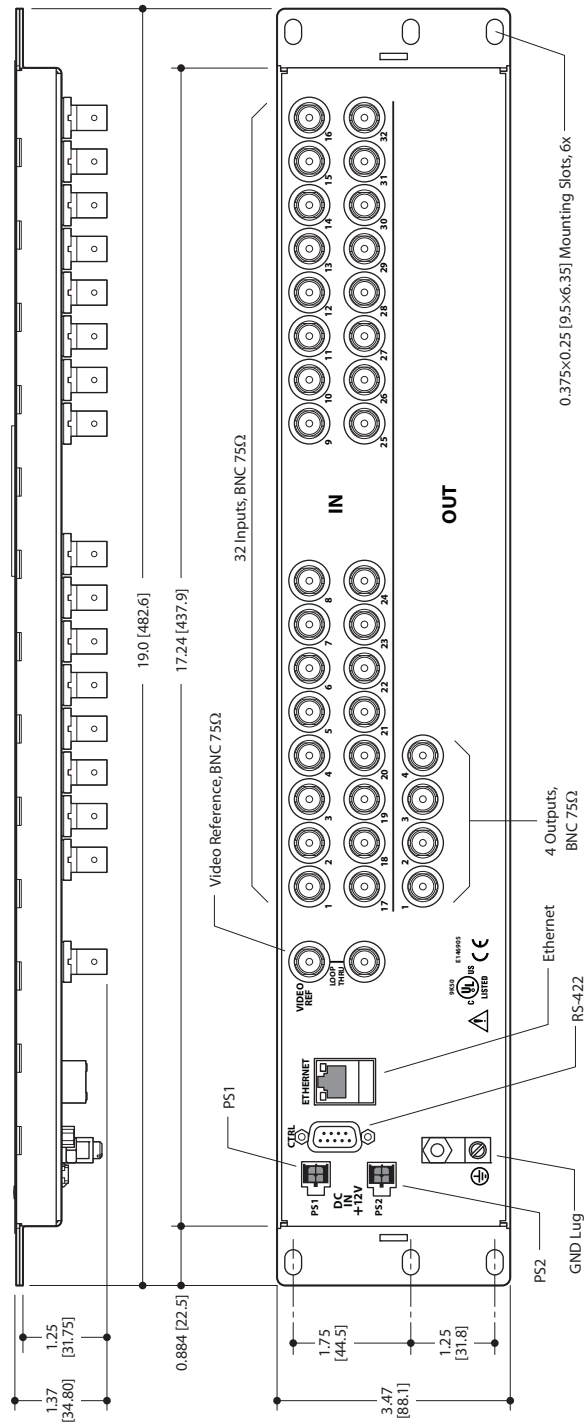


Fig. 12-23: Rear and Top Views of the 32x4 3Gig, HD, SD, and AES Routers

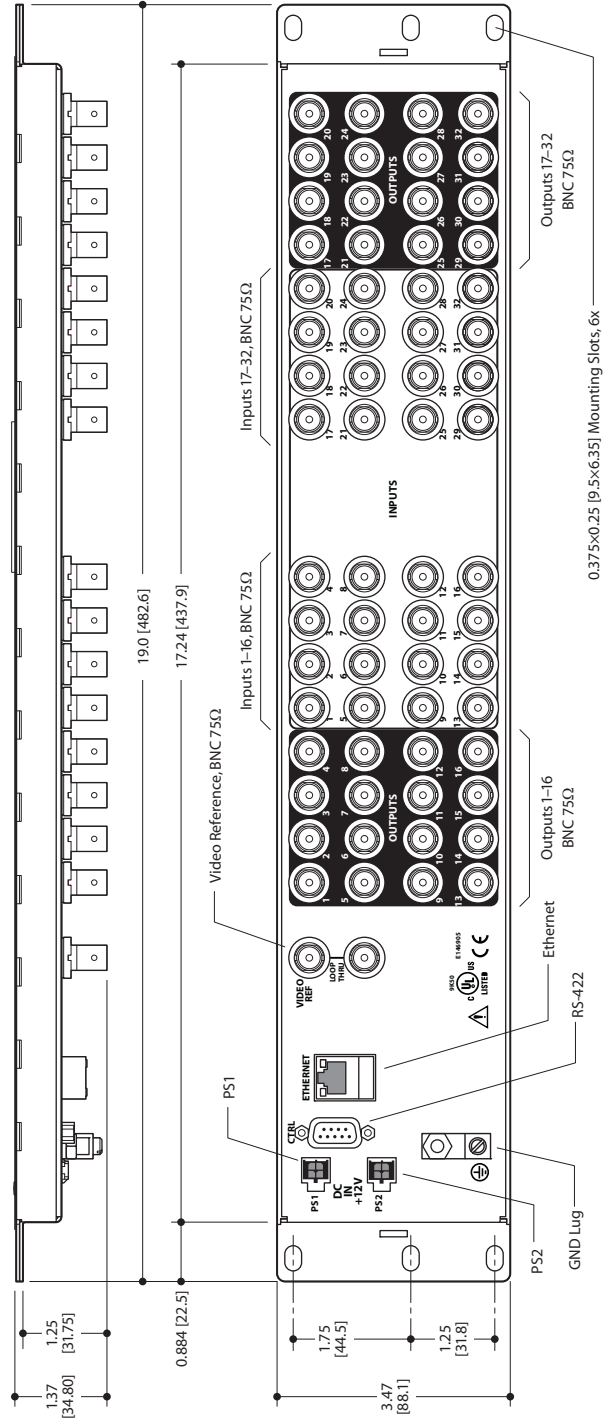


Fig. 12-24: Rear and Top Views of the CR3232-AV

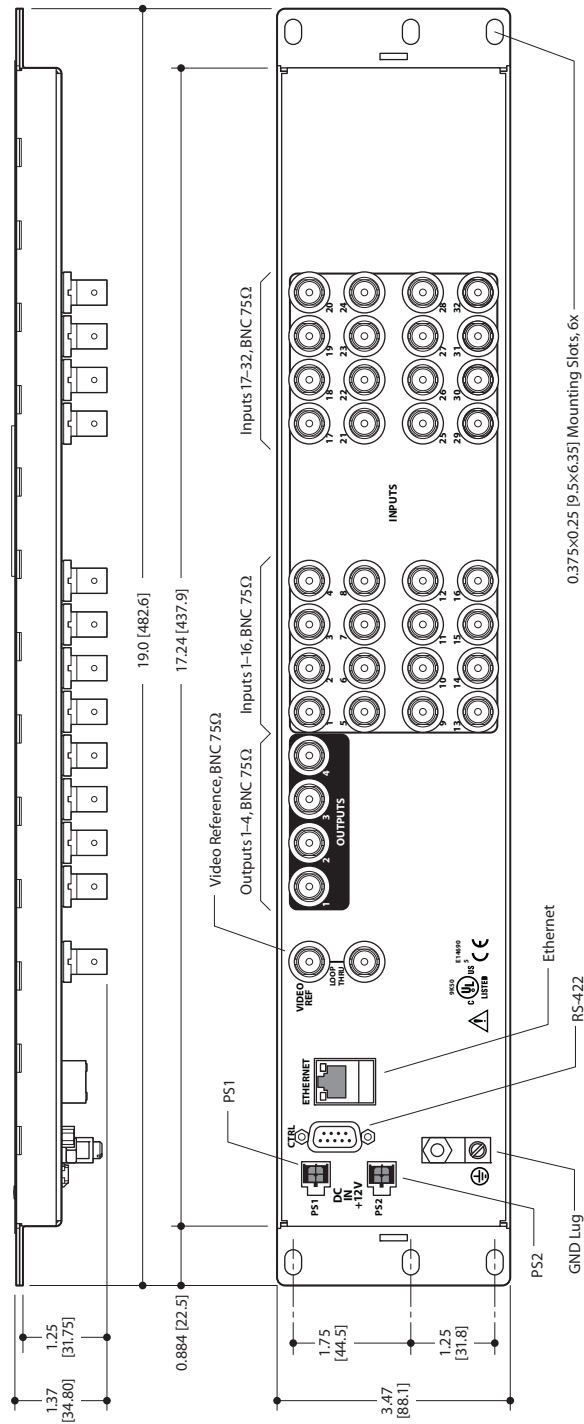


Fig. 12-25: Rear and Top Views of the CR3204-AV



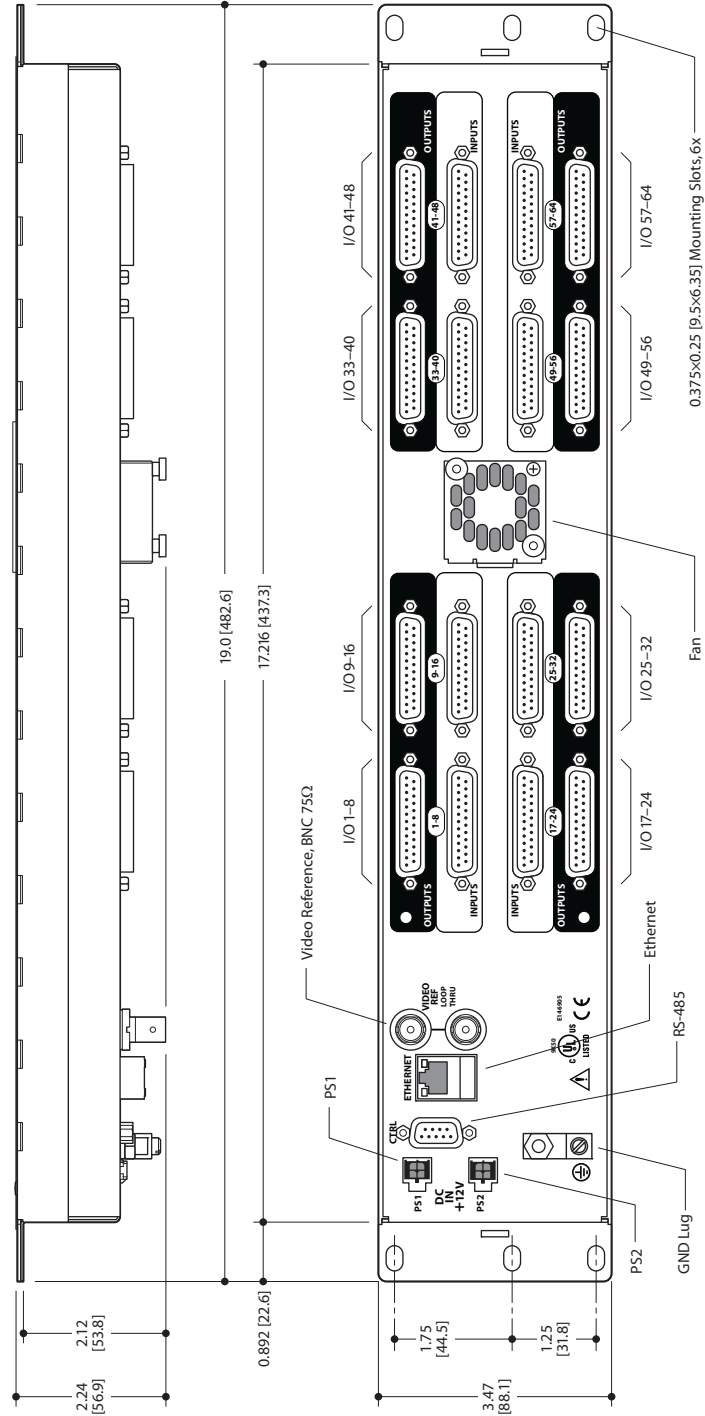


Fig. 12-26: Rear and Top Views of the CR3232-AA

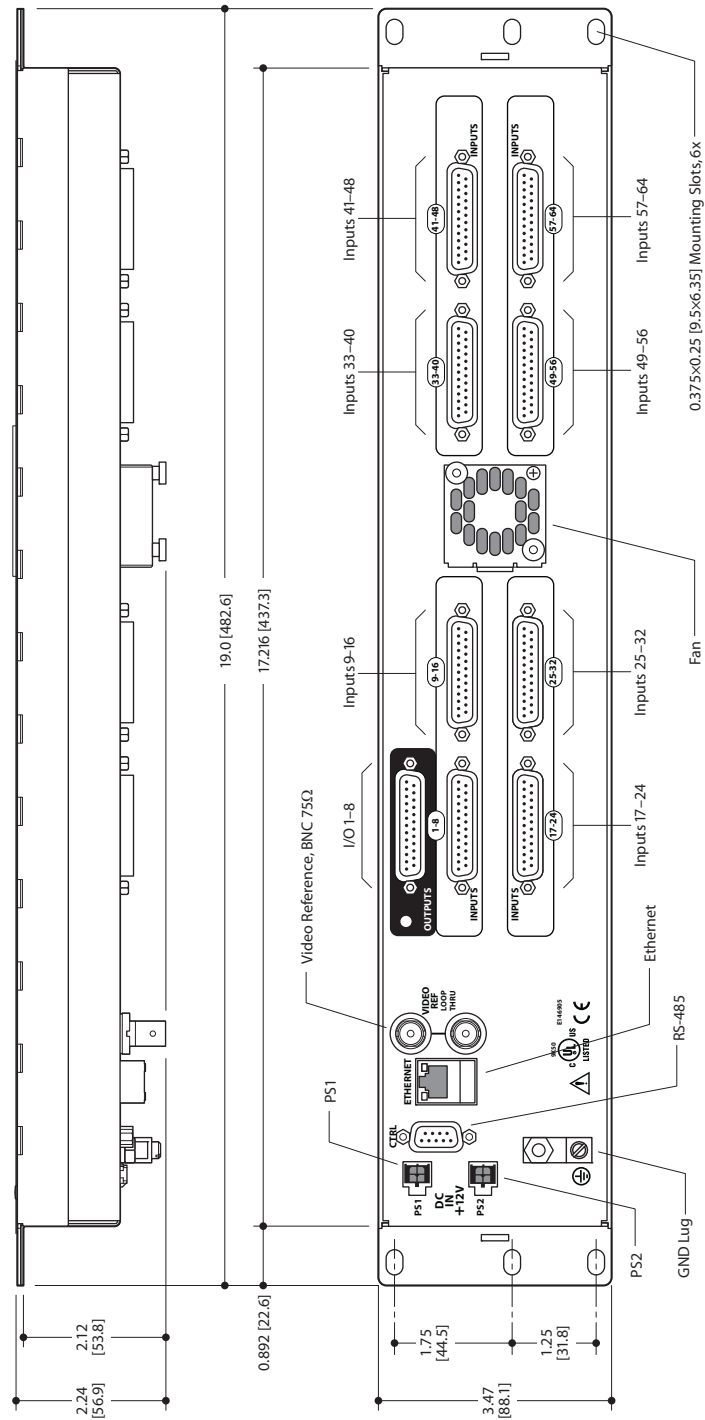


Fig. 12-27: Rear and Top Views of the CR3204-AA

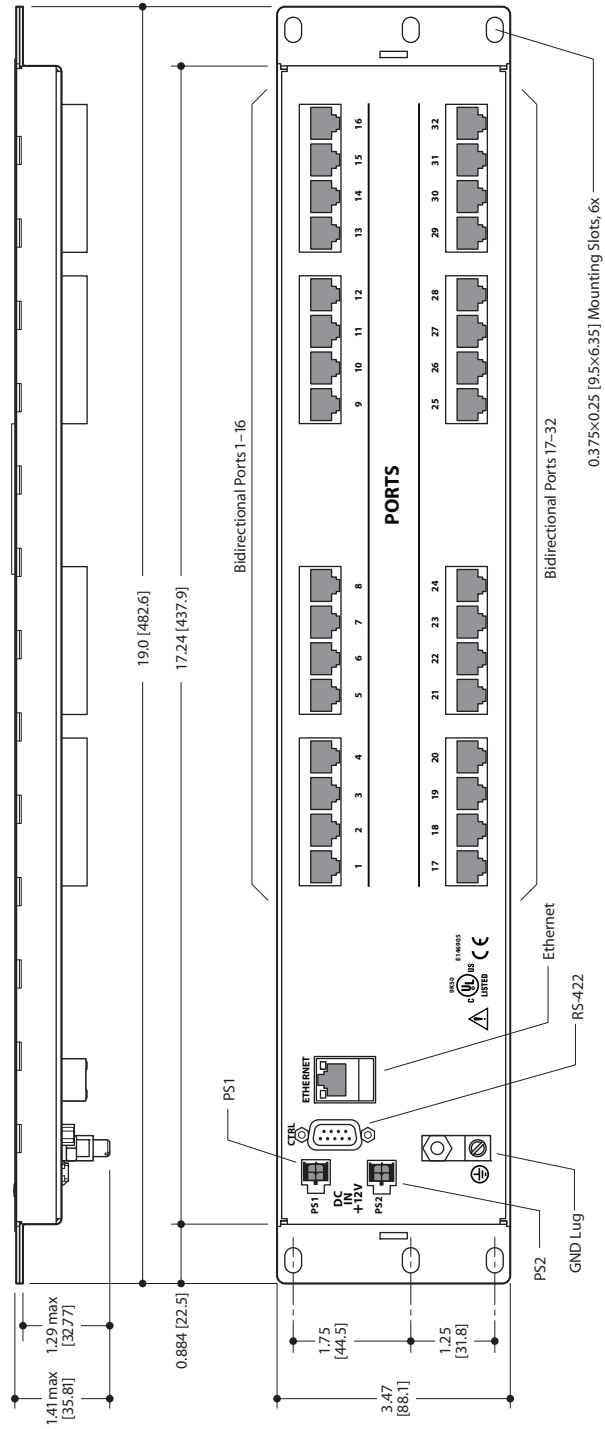


Fig. 12-28: Rear and Top Views of the CR32-PR

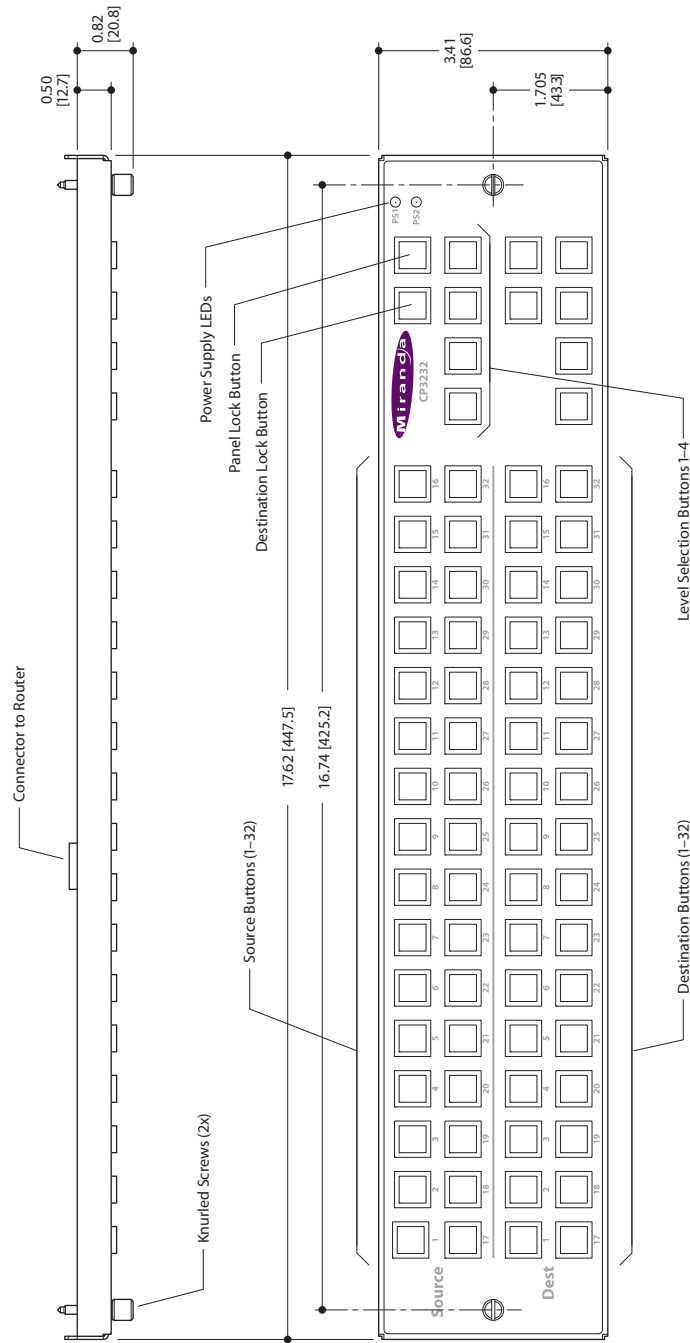


Fig. 12-29: Front and Top Views of the CP3232 Control Panel

Except for the lock buttons, the button designations do not apply when the panel is used in a CRSC system.

None of the button designations applies when the panel is used in an NV9000 system.

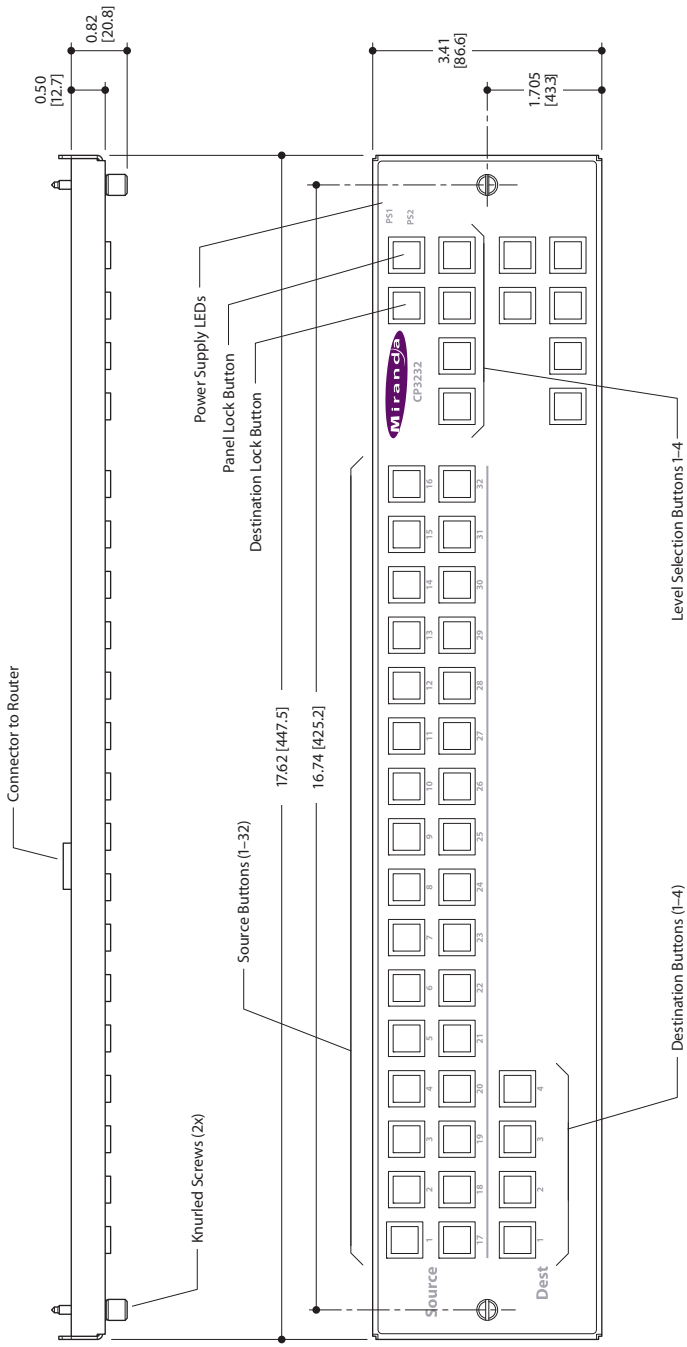


Fig. 12-30: Front and Top Views of the CP3204 Control Panel

Except for the lock buttons, the button designations do not apply when the panel is used in a CRSC system.

None of the button designations applies when the panel is used in an NV9000 system.

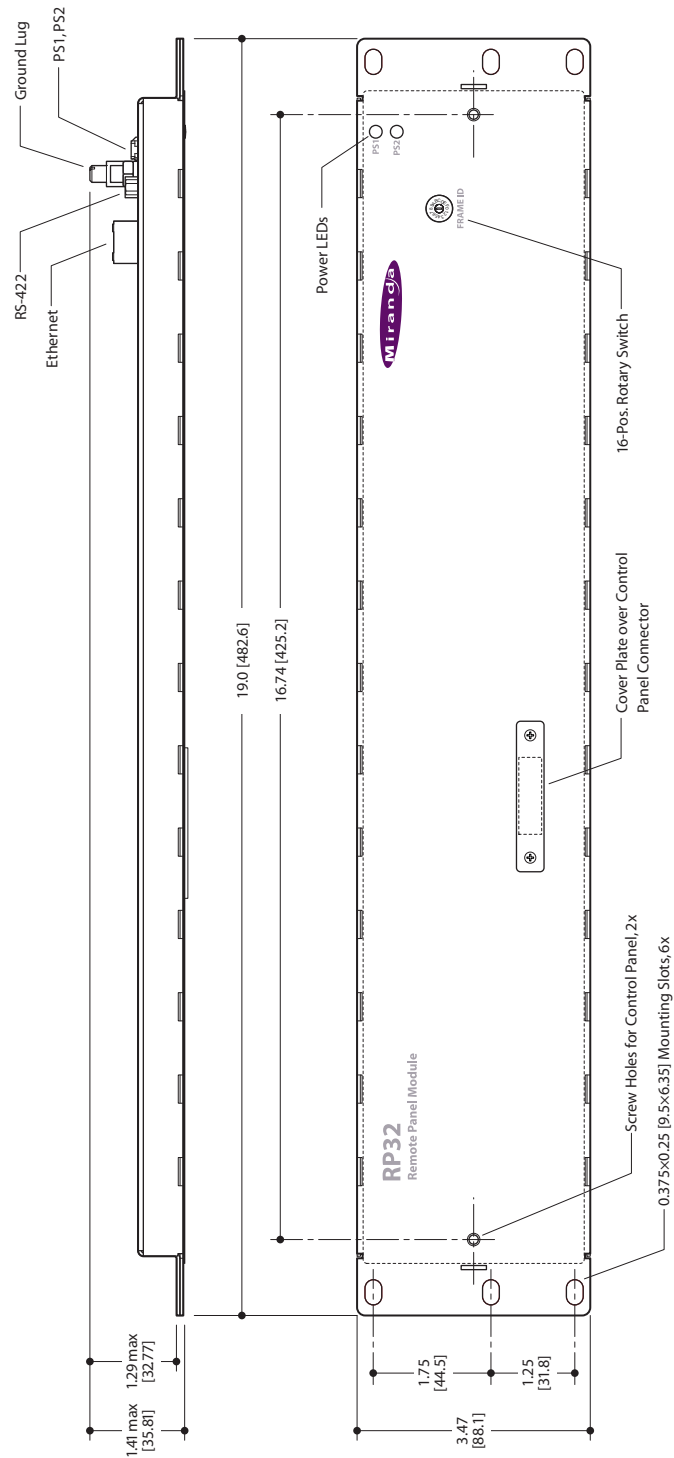


Fig. 12-31: Front and Top Views of the RP32 Remote Panel Module

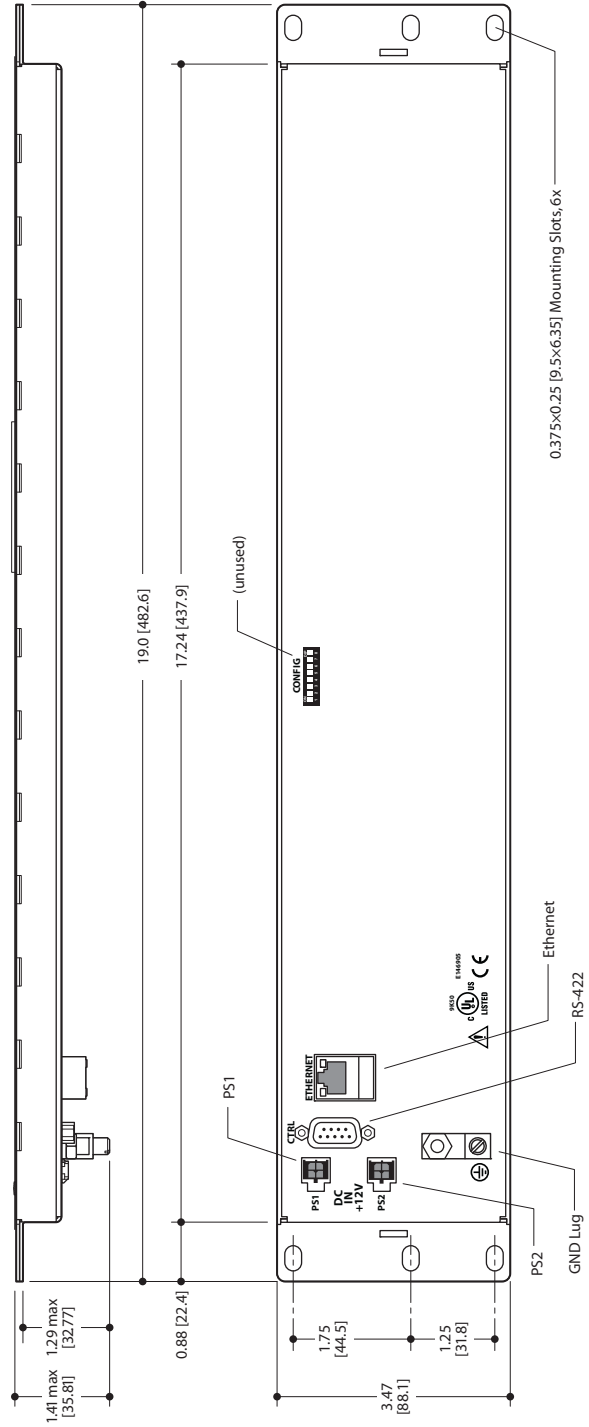


Fig. 12-32: Rear and Top Views of the RP32 Remote Panel Module

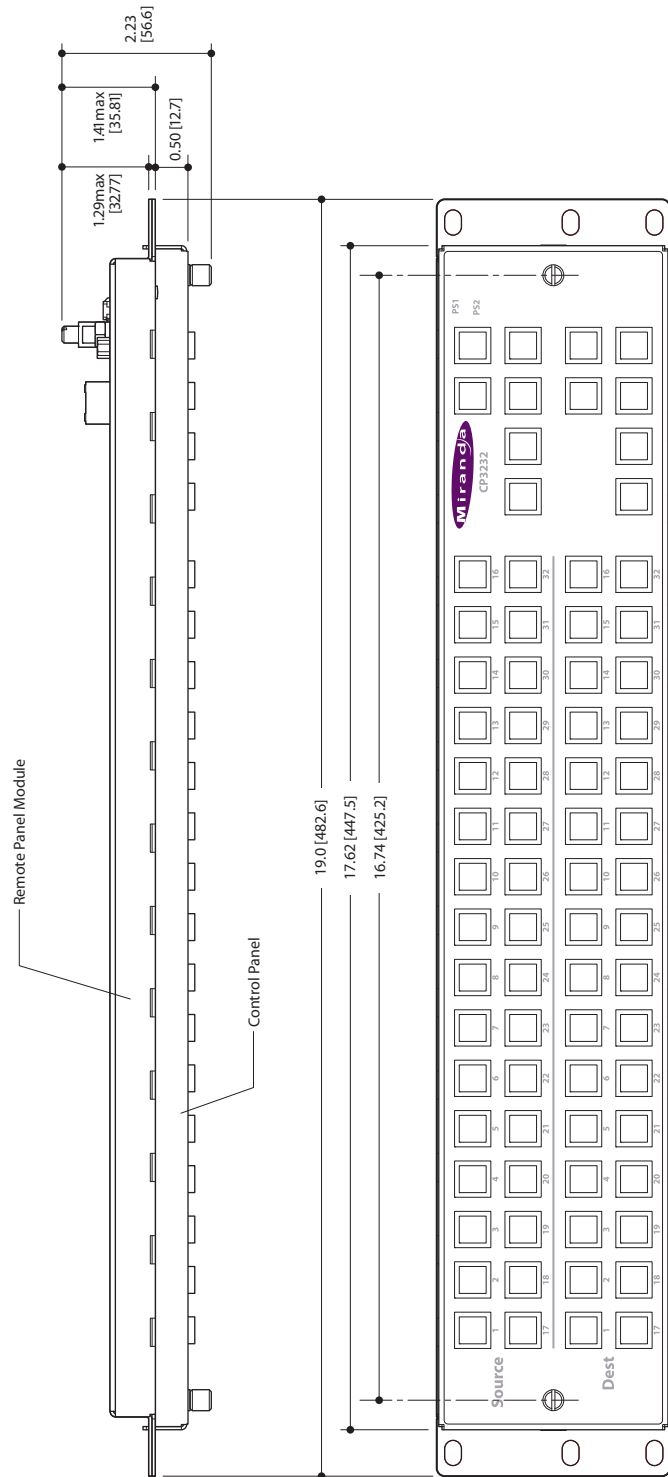


Fig. 12-33: Front and Top Views of an RP32 and Control Panel Assembly



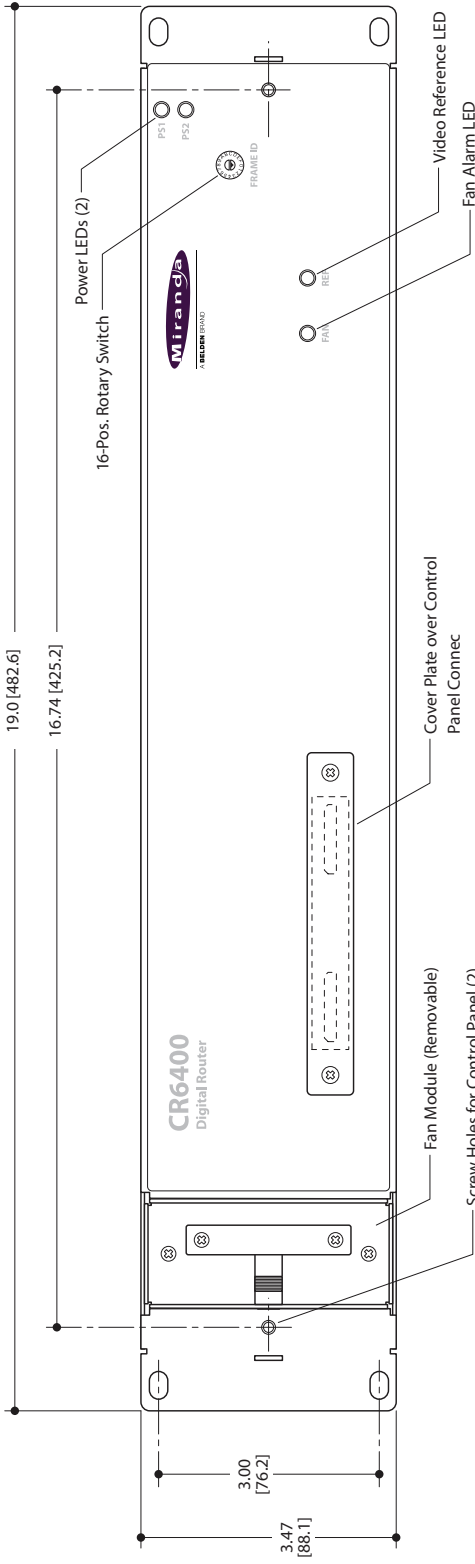


Fig. 12-34: Front View of the CR6400 Family Routers

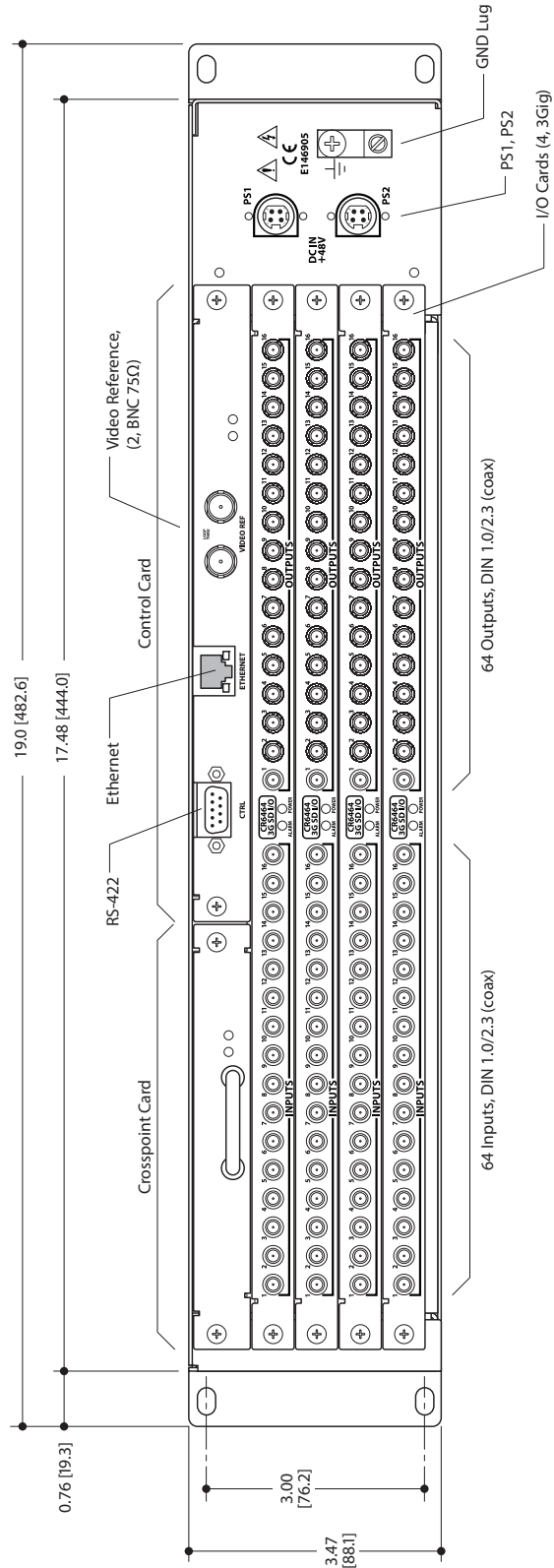


Fig. 12-35: Rear Views of the CR6464-3Gig Router

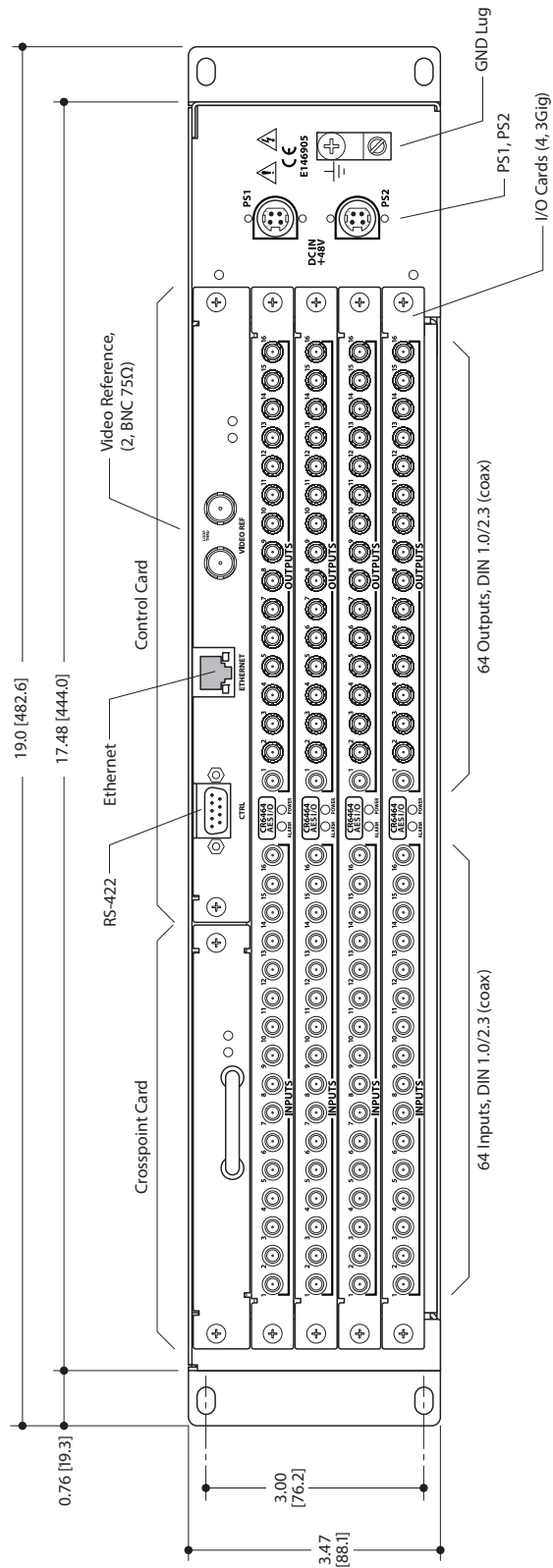


Fig. 12-36: Rear Views of the CR6464-AES Router

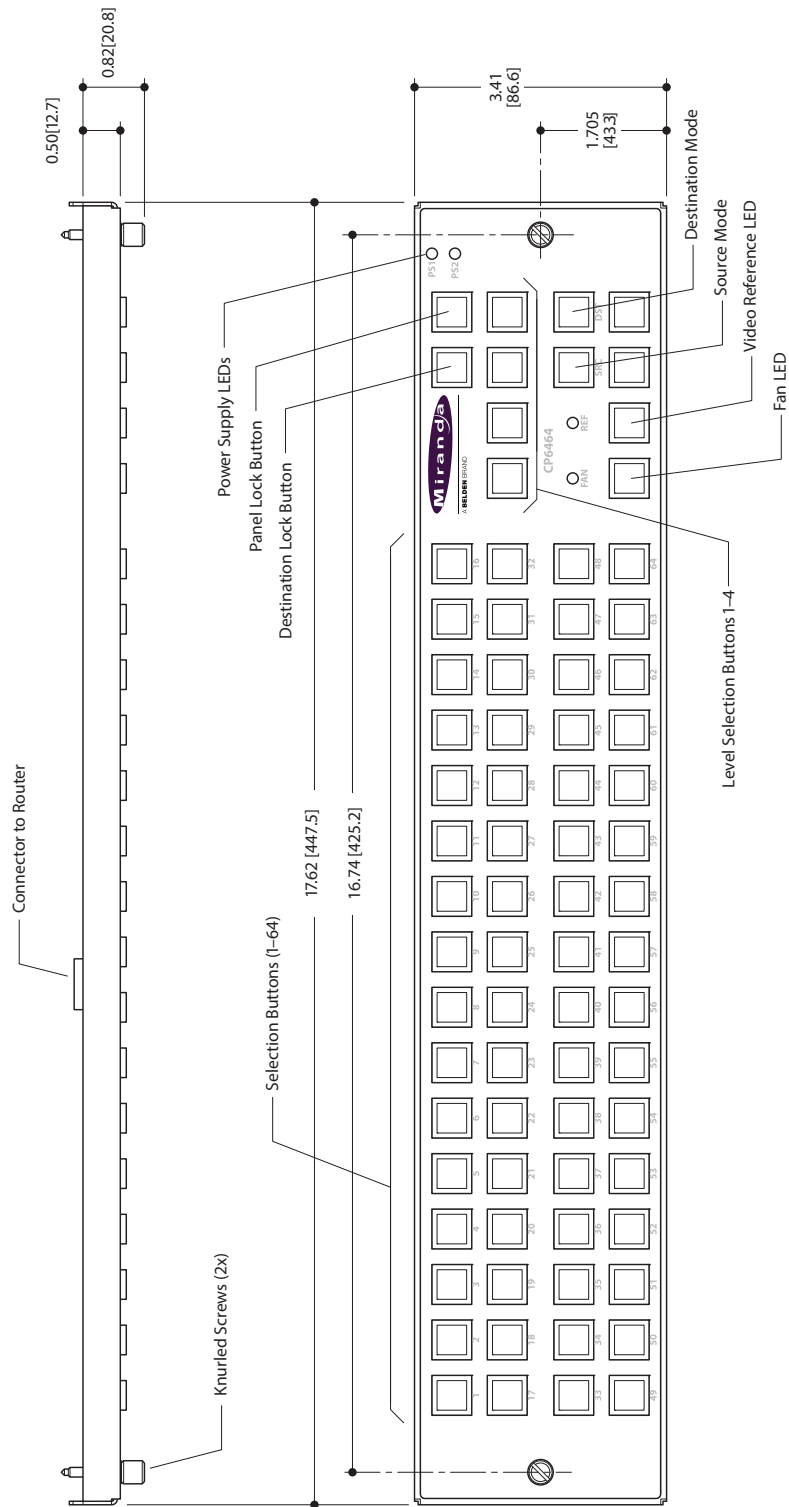


Fig. 12-37: Front and Top Views of the CP6464 Control Panel

## Defaults

### Default Router State

The factory-default state is to be in stand-alone mode.

The default routing state of a compact router is for input 1 to connect to output 1, input 2 to connect to output 2, and so on for all inputs and outputs. This is called a *diagonal* routing. (After you have made routing changes, the power-up state of the inputs and outputs is the state you last created.)

- ▲ If the router's rotary switch is at position 0, the router will reset to its factory-default state at power-up.

For machine control routers, a diagonal route means that the ports are tri-stated (disabled). The initial (and default) state of machine control ports is "dynamic" and diagonal.

### Default Remote Panel Module State

The factory-default state of a remote panel module is to be in stand-alone mode.

- ▲ If the remote panel module's rotary switch is at position 0, it will reset to its factory-default state at power-up.

### Initial Control Panel State

The initial control panel state at power up is "Panel Lock" with all levels selected. Before performing an operation on any control panel (remote or local) you must turn off its panel lock.

- ▲ Remember that a Panel Lock button locks *that panel*. It does **not** lock a router, a remote panel module, other control panels, or the network.

### Control Panel Configuration in NV9000-SE Utilities

The initial remote panel configuration (RP16 or RP32) is empty. It has no default destination and no status monitor output.

### CQX Transition Rates

The CQX routers support 3 transition rates: slow, medium, and fast. The actual rate is adjusted in the router to make the transition times of the different routers uniform:

Video Format	Transition Period (in Frames)		
	Slow	Medium	Fast
1080i, 59.94, NTSC	90	60	30
1080i, 50, PAL	75	50	25
720p, 50	150	100	50
720p, 60	180	120	60

Thus, slow is nominally 3 seconds, medium is 2 seconds, and fast is 1 second. At 59.94 Hz (or 29.97 Hz), of course, the transition periods are actually 1.001, 2.002, or 3.003 seconds.

Cut transitions do not involve a transition rate. The video transition of a cut is instantaneous. In a cut, however, the audio fades down over 3 frames and fades back up over 3 frames.

The nominal times for video fades with audio are expressed in seconds. The transition time for audio cuts is always 3 frames and the exact duration of a frame varies with the video rate. Note that 3 frames at progressive video rates (e.g., 720p) occur twice as fast as for interlaced video rates.

This table describes the transitions over a 2-second transition:

Transition	Description
Fade-fade	Video and audio ramp down over 1 second, then ramp up over 1 second, for a total of 2 seconds (nominal).
Fade-cut	Video and audio ramp down over 2 seconds, then video switches immediately and audio ramps up over 3 frames, for a total of 2 seconds plus 3 frames.
Cut-fade	Audio ramps down over 3 frames. Then video and audio ramp up over 2 seconds, for a total of 2 seconds plus 3 frames

Again, for a cut transition, audio ramps down over 3 frames, then ramps up over 3 frames, for a total of 6 frames. The video cut is instantaneous at the transition from the third frame to the fourth frame.

# 13

## Misc. Topics

Chapter 13 discusses several miscellaneous topics.

### Topics

<a href="#">NV9000 Network Example</a> .....	171
<a href="#">NV9000 Router Control Systems</a> .....	178
<a href="#">Compact Routers in an NV9000 System</a> .....	179
<a href="#">Cabling</a> .....	181
<a href="#">Ordering Information</a> .....	182
<a href="#">Power Cord Retention for the PS0001 and PS0012 Power Supplies</a> .....	185

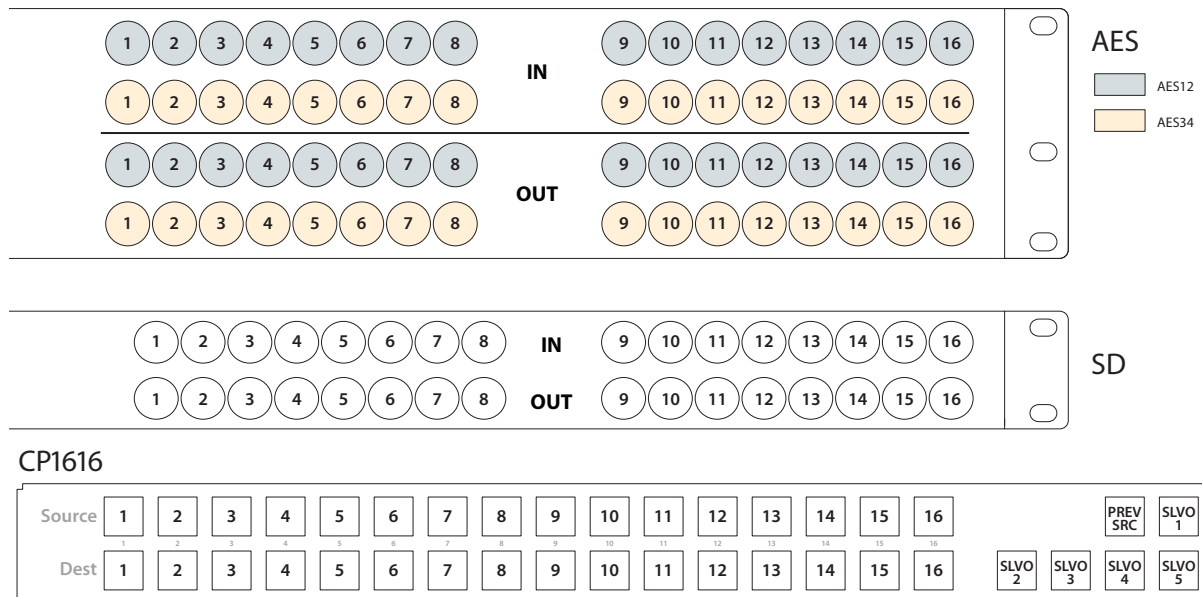
## NV9000 Network Example

This is a simple example. It uses a 16x16 SD router, a 32x32 AES router, and a CP1616 (remote panel) to route 16 sources having 3 levels (SD, AES1/2, and AES3/4) to 16 destination devices having the same levels. For the sake of simplicity, assume that all the source devices are identical and all the output devices (the destinations) are identical.

Any take will route all 3 levels from one of 16 sources to one of 16 destinations.

### Connectivity

This diagram shows the connections of the routers and the remote panel's button assignments:



The AES router, with 32 inputs and 32 outputs, allows two levels for 16 sources and two levels for 16 destinations. The SD router, of course, provides one level for 16 sources and 16 destinations. The panel is straightforward, having 16 source buttons and 16 destination buttons. Takes are simple: press a destination button then press a source button. The 'Previous Source' button allows you to undo a mistake.

There are 5 salvo buttons. In this example, the actual salvos are left undefined. You will use NV9000-SE Utilities to define salvos. It is not complex.

## Initial Setup

### Levels

This figure shows the initial level setup in CRSC:

Level Number	Level Name	Router Name	Signal Type	Physical Input Start	Physical Input End	Controller Source Start	Physical Output Start	Physical Output End	Controller Destination Start
1	SD	CR1616-SD	SD Digital Video	1	16	1	1	16	1
2	AES12	CR3232-AES	Synchronous AES Mono	1	32	1	1	32	1
3	AES34	CR3232-AES	Synchronous AES Mono	33	64	1	33	64	1

The levels are number 1, 2, and 3. The AES router defines 2 of the levels. Note how the inputs and outputs are partitioned at the right. (The 32x32 AES routers have 64 inputs and 64 outputs. The inputs occur in pairs on the input connectors. The outputs occur in pairs on the output connectors.)

▲ In NV9000-SE Utilities, you will represent the pairs by their odd-numbered inputs or outputs.

### Remote Panel

This figure shows the initial remote panel setup in CRSC:

NV9000 Remote Panel Settings

Enable NV9000 Mode

NV9000 Panel ID:

Use DHCP to acquire IP Address

---

Network Frame Summary

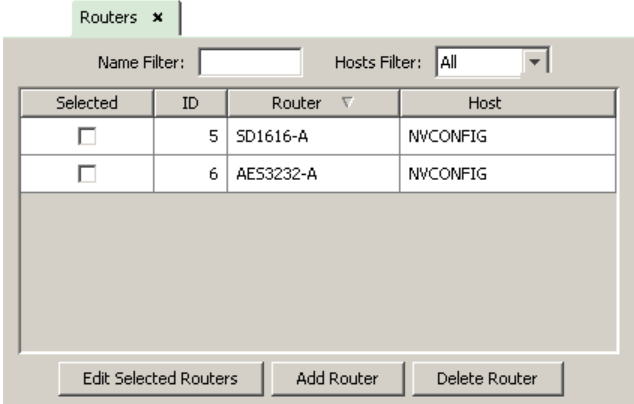
Remote Panels    Levels    All CR Frames

Edit/Update	Name	Frame Type	Panel Type	Panel Mode
○	RP16	RP16	Unknown	Standard

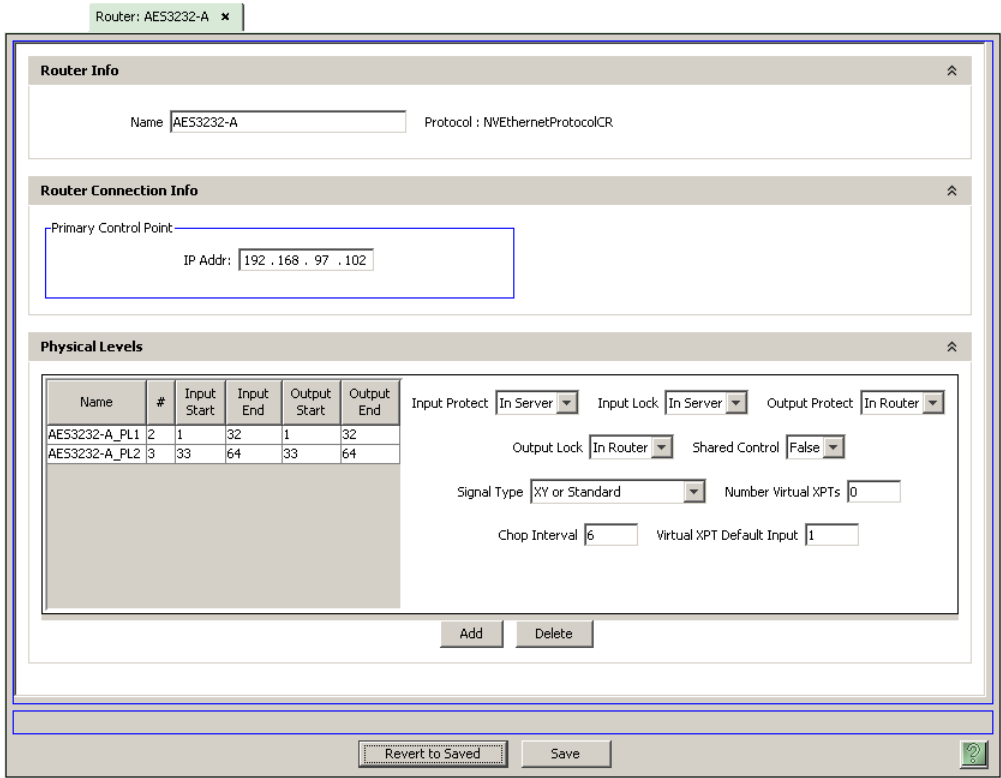


## Routers

This figure shows the 'Routers' page in NV9000-SE Utilities:



Two routers were defined. This configuration page defines the AES Router:



This configuration page defines the SD Router:

Router: SD1616-A x

### Router Info

Name:  Protocol: NVEthernetProtocolCR

### Router Connection Info

Primary Control Point:  
IP Addr:

### Physical Levels


Name	#	Input Start	Input End	Output Start	Output End
SD-A	1	1	16	1	16

Input Protect:  Input Lock:  Output Protect:

Output Lock:  Shared Control:

Signal Type:  Number Virtual XPTs:

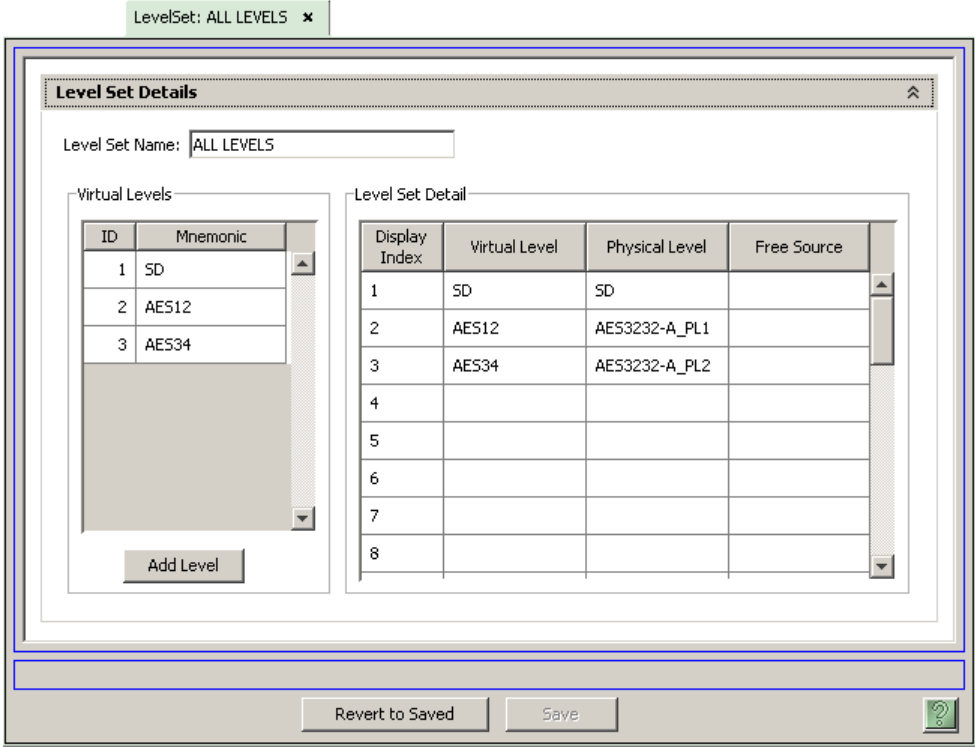
Chop Interval:  Virtual XPT Default Input:



The AES router defines two *physical* levels. The SD router defines one *physical* level.

## Levels

The simple example defines one level set "All Levels":



Note the correspondence between the virtual levels here and the levels defined in CRSC. Note also the mapping of the virtual levels to the physical levels of the routers.

## Devices

It is by creating "devices" that you enumerate the I/O connections of your routers. Each device you define is assigned to a level set. In this example, there is just one level set. In NV9000-SE Utilities, you have a choice for entering device data: you can use the 'Devices' configuration page, the 'Add Device' page (under the 'Tasks' pane) or the 'Add Multiple Devices' page (also under 'Tasks').

This figure illustrates the I/Os for one device:

The screenshot shows a web-based configuration interface for a device named 'INPUT 1'. The interface is titled 'Device: INPUT 1' and contains two main sections: 'Device Info for Device ID: 1' and 'Device Level Detail'. The 'Device Info' section includes fields for Name (INPUT 1), Description, Level Set (ALL LEVELS), Current Categories (INPUT), and a description box. The 'Device Level Detail' section contains a table with columns for Level, Input, and Output. The table lists three levels: SD, AES12, and AES34, with their respective input and output values. At the bottom of the interface are buttons for 'Revert to Saved' and 'Save', along with a help icon.

Level	Input	Output
SD	1	
AES12	1	
AES34	33	

The device illustrated is named “input 1.” In this example, the other devices are named “input *m*” or “output *n*.” In your system, of course, you may name the devices as you like.

As a general rule, you assign numbers in the ‘Input’ column to input devices and numbers in the ‘Output’ column to output devices.

The numbers for inputs and outputs are subject to the ranges you listed for the partitions (physical levels) you defined in the definition of the routers.

In the case of the AES34 level, the range of inputs is 33–64 (in pairs). Thus, the first input is 33.

However, for AES routers, inputs always occur in pairs on the connectors. The first connector for the AES34 level carries inputs 33 and 34. That pair is represented by its odd input, 33.

Other input pairs follow the same pattern.

- ▲ Although analog audio inputs and outputs are paired, you use the pair number in NV9000-SE Utilities, not the input number. For example, you refer to input pair (17,18) as input 9.

The following table is the result of device entry for this example:

Device Phys Conns : ALL LEVELS ✕

Select Level Set for Query: ALL LEVELS ▾

Device ID	Device	Device Des...	In			Out		
			SD	AES12	AES34	SD	AES12	AES34
1	INPUT 1		1	1	33			
2	INPUT 2		2	3	35			
3	INPUT 3		3	5	37			
4	INPUT 4		4	7	39			
5	INPUT 5		5	9	41			
6	INPUT 6		6	11	43			
7	INPUT 7		7	13	45			
8	INPUT 8		8	15	47			
9	INPUT 9		9	17	49			
10	INPUT 10		10	19	51			
11	INPUT 11		11	21	53			
12	INPUT 12		12	23	55			
13	INPUT 13		13	25	57			
14	INPUT 14		14	27	59			
15	INPUT 15		15	29	61			
16	INPUT 16		16	31	63			
17	OUTPUT 1					1	1	33
18	OUTPUT 2					2	3	35
19	OUTPUT 3					3	5	37
20	OUTPUT 4					4	7	39
21	OUTPUT 5					5	9	41
22	OUTPUT 6					6	11	43
23	OUTPUT 7					7	13	45

Create Device    Revert to Saved    Save    Export    ?

Note that the input and output pairs are represented by the odd-numbered member of the pair.

### Panel

This figure shows the panel configuration for the simple example:

Panel: My RP16 ✕

Button Layout - MyRP16 : C:\Users\lcox\CtrlSysConfigs\for CRs 140904\configs\D16.P16

SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	SRCA	Dest Lock	Panel Lock			
DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	DSTA	HD	AES 1/2	DIAG #	BK SIL

Button Definitions

Button Type: Source ▾

Level Set Filter: None ▾

Source Device: SRCA 1: 1 ▾

Panel Options

Default Destination: DSTA 1: 33 ▾

Status Monitor: DSTA 1: 33 ▾

The names of your inputs and outputs appear as the button legends here in the configuration page. The names of your salvos appear here as the button legends. These names do *not* automatically appear on the actual remote panel. (If the panel is to have button legends, you can create physical button legend inserts using graphics and text.)

## NV9000 Router Control Systems

The name of Grass Valley's NVISION router control system is *NV9000*. There are 2 system controllers<sup>1</sup> in the NV9000 family: the NV960 and the NV920. Each of the system controllers is a host to the NV9000 router control software. The NV9000 software supports many different types of routers and control panels.

The NV9000 system offer features and services not available in the CR Series routers alone.

### NV9000

NV9000 systems can be ordered in different configurations, characterized in part by the number of Ethernet and serial ports available. In any case, an NV9000 system includes:

- A system controller
- Control panels or GUIs
- Routers

The system controller software fields commands (button presses) at the control panels, interprets them, issues instructions to all the routers in the network, obtains status from the routers, and relays the status back to the control panels as visual feedback for the operator.

### Configuration Database

The NV9000 control system uses a standard, SQL-compliant database management system in which to create configuration databases. System administrators may develop their own tools to import and export data.

The NV9000 software that executes in NV960 and NV920 system controllers is configured using NV9000-SE Utilities.

### Lock, Protect, and Release

In a router control system, both source and destination devices can be locked or protected. Lock and protect options include:

- Locks and protects made in the system controller.
- Locks and protects made in the router.
- Locks and protects disabled.

In a router control system, the default setting for each of the destination lock and destination protect configuration settings is "in the system controller." The default setting for each of the source lock and source protect configuration settings is "None."

NV9000 locks and protects can apply to sources and destinations connected to compact routers. However, operators cannot perform locks or protects at a CR Series remote panel.

You must configure the compact router locks as "in system." The NV9000 **does not** recognize any locks made locally.

CR Series control panels do not show status for locks made in the NV9000 system. NV96xx panels **do** show the status of locks made in the NV9000 system.

---

1. Some NV915s might still exist at installations in the field.

## Compact Routers in an NV9000 System

Installing one or more Compact Routers on an NV9000 network requires Ethernet connections, a system configuration generated by NV9000-SE Utilities and uploaded to the system controller, and one or more control panels, either NV96xx panels or CR Series remote panels.

Figure 13-1 shows a typical NV9000 router control system as it applies to Compact Routers:

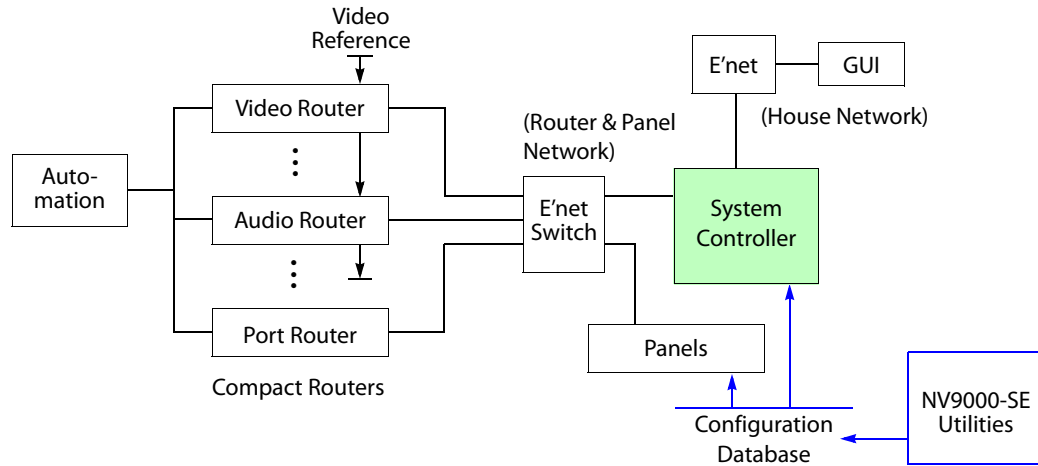


Fig. 13-1: NV9000 Router Control System Schema

The choice of routers and number of routers, of course, depends on your requirements. An NV96xx control panel is not strictly required, but strongly recommended.

- ▲ You must use CRSC to perform the initial setup of routers and remote panels for an NV9000 network.

## Network Connection

Use CAT5 Ethernet cable and follow these simple steps:

- 1 Connect your Ethernet switch to the "Router and Panel Network" port of the NV9000 host computer.
- 2 Connect each router to the Ethernet switch.  
You must assign a unique IP address to each router and designate at least one physical level (partition) for each router.
- 3 Connect your remote panel(s) to the Ethernet switch.  
You must either assign a unique IP address to each remote panel or specify that the panel is to be identified by DHCP.

Refer to the *NV9000-SE Utilities User's Guide* or its on-line help for detailed information.

Following are important points about compact routers in an NV9000 system.

## Configuration Differences

Under an NV9000 control system, the compact routers and remote panels are slightly different:

- Level sets.

NV9000-SE Utilities uses level sets to define virtual levels and physical levels. Under CRSC or in standalone situations, compact routers do not have the concept of a level set or virtual level. Under CRSC, the idea of physical levels is informal.

NV9000-SE Utilities uses “devices” sets to define inputs and outputs. CRSC defines inputs and outputs in its panel configurations.

In stand-alone systems, inputs and outputs are not “defined” at all, but simply connected.

- DHCP.

Under NV9000, panels may be identified by DHCP. The NV9000 does this at startup. A CRSC network does not have DHCP. Stand-alone configurations not using CRSC rely on the rotary switch positions to designation IP addresses and levels.

- Locks and Protects.

Under NV9000, remote panels have no locks or protects. Under CRSC, remote panels may have destination locks (and panel locks). In standalone configurations, panels may have destination locks (and panel locks).

## Operational Differences

Under an NV9000 control system, CR Series router and panels operate differently from the way they operate in CRSC systems (or stand-alone systems):

- Takes

Under NV9000, takes are very simple. Press a destination button, optionally select levels, and press a source button. If the remote panel is configured with a default destination, it is sufficient just to press a source button.

Under CRSC, takes are very complex, involving button colors, level selection and the order of level selection, destination locks, and so forth.

- Other panels and other routers.

Your NV9000 system might have NV96xx panels and other routers in addition to CR Series equipment. Certain other panels have features not available to CR Series remote panels. For example, most panels support the selection of devices by category and suffix (or category and index). Most NV96xx panels support locks, protects, and force release. CR Series panels do not have these features.

With other routers, the number of sources and destinations you can control can far exceed the number of devices connected to CR Series routers.

- Asynchronous notification

Under automation or an external control system, CR Series products support the asynchronous notification feature of Grass Valley’s NVISION serial protocol.



## AES Routers

Under an NV9000 control system, AES compact routers perform stereo switching only, regardless of how they are configured.

- ▲ Note that, during configuration, the AES inputs and outputs must be numbered as if they were paired mono channels. See [Devices](#) on page 175 for configuration information.

## Loss of Reference

Let N be the nominal size of the router, 16 or 32.

If an AES router transitions from synchronous mode to asynchronous, it re-writes the  $2N \times 2N$  matrix as an  $N \times N$  matrix and the  $2N \times 2N$  route table is lost. That is one of the reasons for the 15-minute delay before such a transition.

When the AES router re-writes the matrix, it attempts to preserve as much of the  $2N \times 2N$  information as possible. Thus,

- If an output pair has a “left” signal from input N in its “left” channel, the output pair becomes N-left, N-right.
- If an output pair has a “left” signal from input N in its “right” channel, the output pair becomes N-left, N-right.
- If an output pair has no “left” signal at all, the router chooses the input number (N) from its output’s “left” channel, and the output pair becomes N-left, N-right.

This method has been described as “right follows left.”

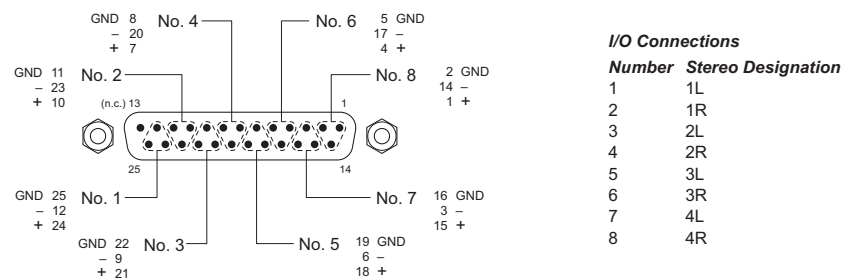
- ▲ This behavior would be important to engineers only when loss of reference occurs. It has no bearing on normal operation.

## Cabling

### Analog Audio Routers

Grass Valley offers a breakout cable for DB25 connectors of analog audio routers. The part number is WC0053.

Each DB25 connector supports 8 inputs (or outputs):



For  $16 \times 16$  routers, the connectors provide inputs (or outputs) 1–8, 9–16, 17–24, and 25–32, respectively, and are labelled that way on the rear of the router. Inputs (and outputs) are treated as 16 stereo pairs.

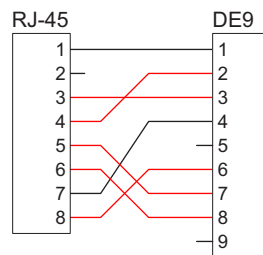
For  $32 \times 32$  routers, the connectors provide inputs (or outputs) 1–8, 9–16, 17–24, 25–32, 33–40, 41–48, 49–56, and 57–64, respectively, and are labelled that way on the rear of the router. Inputs (and outputs) are treated as 32 stereo pairs.

For 32x4 routers, the connectors provide inputs 1–8, 9–16, 17–24, 25–32, 33–40, 41–48, 49–56, and 57–64, respectively. The inputs and outputs are labelled accordingly. The inputs are treated as 32 stereo pairs. The single output connector provides outputs 1–8 (4 stereo pairs). The inputs and outputs are labelled accordingly.

## Machine Control Routers

Many VTRs and other devices provide a DE9 connector for machine control. The machine control routers have RJ-45 connectors. Customers will need RJ45-to-DE9 cables (or some other means of connecting to DE9 ports).

This is the RJ-45 to DE9 mapping for RS-422:



This cable wiring is applicable whether the port is a controlling port or controlled port.

## Ordering Information

These are the 1RU CR Series components:

CRPS1	12V power supply, 4-pin Molex connector, with cord, and cord retention strap.
CR1616-3Gig	16x16 "3Gig" Digital Video Router.
CR1616-HD	16x16 High-Definition Digital Video Router.
CR1616-HD-NR	16x16 High-Definition Digital Video Router, Non-Reclocking.
CR1616-SD	16x16 Standard-Definition Digital Video Router.
CR1616-SD-NR	16x16 Standard-Definition Digital Video Router, Non-Reclocking.
CR1616-AES	16x16 AES Digital Audio Router.
CR1616-AV	16x16 Analog Video Router.
CR1616-AA	16x16 Analog Audio Router.
CR1604-3Gig	16x4 "3Gig" Digital Video Router.
CR1604-HD	16x4 High-Definition Digital Video Router.
CR1604-HD-NR	16x4 High-Definition Digital Video Router, Non-Reclocking.
CR1604-SD	16x4 Standard-Definition Digital Video Router.
CR1604-SD-NR	16x4 Standard-Definition Digital Video Router, Non-Reclocking.
CR1604-AV	16x4 Analog Video Router.
CR1604-AA	16x4 Analog Audio Router.
CR1602-3Gig-CQX	16x2 "3Gig" Clean and Quiet Digital Video Router.
CR1602-HD-CQX	16x2 High-Definition Clean and Quiet Digital Video Router.

CR1602-SD-CQX	16x2 Standard-Definition Clean and Quiet Digital Video Router.
CR0808-3Gig	8x8 "3Gig" Digital Video Router.
CR0808-HD	8x8 High-Definition Digital Video Router.
CR0808-HD-NR	8x8 High-Definition Digital Video Router, Non-Reclocking.
CR0808-SD	8x8 Standard-Definition Digital Video Router.
CR0808-SD-NR	8x8 Standard-Definition Digital Video Router, Non-Reclocking.
CR0808-AV	8x8 Analog Video Router.
CR0808-AA	8x8 Analog Audio Router.
CR16-PR	16-Port Machine Control Router.
CP1602-CQX	16x2 Clean and Quiet Control Panel.
CP1616	16x16 Control Panel.
CP1604	16x4 Control Panel.
CP1602	16x2 Control Panel.
CP0808	8x8 Control Panel.
CP3201	32x1 Control Panel. (This is a 1RU panel!)
RP16	16x16 Remote Panel Module (requires a control panel to function).

These are the 2RU CR Series components:

CR3204-3Gig	32x4 "3Gig" Digital Video Router.
CR3204-HD	32x4 High-Definition Digital Video Router.
CR3204-HD-NR	32x4 High-Definition Digital Video Router, Non-Reclocking.
CR3204-SD	32x4 Standard-Definition Digital Video Router
CR3204-SD-NR	32x4 Standard-Definition Digital Video Router, Non-Reclocking.
CR3204-AES	32x4 AES Digital Audio Router
CR3204-AV	32x4 Analog Video Router
CR3204-AA	32x4 Analog Audio Router
CR3232-3Gig	32x32 "3Gig" Digital Video Router.
CR3232-HD	32x32 High-Definition Digital Video Router.
CR3232-HD-NR	32x32 High-Definition Digital Video Router, Non-Reclocking.
CR3232-SD	32x32 Standard-Definition Digital Video Router.
CR3232-SD-NR	32x32 Standard-Definition Digital Video Router, Non-Reclocking.
CR3232-AES	32x32 AES Digital Audio Router.
CR3232-AV	32x32 Analog Video Router.
CR3232-AA	32x32 Analog Audio Router.
CR32-PR	32-Port Machine Control Router.
CP3204	32x4 Control Panel.
CP3232	32x32 Control Panel.
CR6464-3Gig	64x64 "3Gig" Digital Video Router.
CR6464-AES	64x64 AES Digital Audio Router

Misc. Topics  
Ordering Information

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CP6464	64×64 Control Panel.
RP32	32×32 Remote Panel Module (requires a control panel to function).

These are other associated components:

SB0033-xx	CR Series software and documentation CD.
SV0904-01	CRSC (Compact Router System Configurator installer).
IG0002-00	Button legend template (Word document).
IG0003-00	Button legend template (Illustrator document).
IG0004-00	Button legend template (Freehand document).
WC0053-xx	DB25 breakout cable.

## Power Cord Retention for the PS0001 and PS0012 Power Supplies

Use the supplied retention strap to keep the AC power cord firmly connected to the power supply. Follow these steps to use the strap:

- 1 Firmly insert the AC power cord into the power supply. Examine the last figure in this section to see how the strap should be applied.
- 2 Placed the Velcro retention strap, fuzzy side up, on top of the power supply with the buckle loop approximately 1 inch from the AC input side and the remaining strap around the cord end and down:



- 3 Holding the buckle in place, lift the strap up and around the cord end so the strap overlaps itself:



- 4 Holding the buckle loop in place, route the strap around the back of the supply diagonally across so that it sticks out on the left below the output cord:



- 5 Continue the strap around toward the buckle loop and through the loop. Cinch the strap tightly. While keeping tension, place the 2 inch strap end (with Velcro loops) down on the fuzzy part to complete the process:



- 6 Examine the strap though its path around the cord and power supply. Be sure that no slack exists and that it is tight the full length of the strap. If necessary, adjust and cinch it more tightly.

## Misc. Topics

Power Cord Retention for the PS0001 and PS0012 Power Supplies

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# G

## Glossary

<b>AES/EBU</b>	(Audio Engineering Society/European Broadcasting Union). AES and EBU are standards organizations.
<b>AES3, AES3id</b>	<p>AES/EBU formulated this professional serial interface in 1992. The standard typically transmits PCM and Dolby Digital 5.1, but is not tied to any particular sampling rate or any particular audio format.</p> <p>Grass Valley's compact AES routers support AES3id and provide 75Ω BNC connectors. AES3id is specified for 75Ω coaxial cable up to 1000 meters.</p>
<b>Asynchronous</b>	As it applies to the compact AES routers, "asynchronous" means switched without a video reference signal. In asynchronous mode, the AES router passes the input to the output unmodified.
<b>Breakaway</b>	A route where signals are taken from different sources. A breakaway might, for example, take video from one source and audio from another source.
<b>CQX</b>	An abbreviation for "clean and quiet."
<b>Device</b>	A device is a grouping of input and output ports that define a logical entity. (The logical entity does not have to be a real entity.) For example, a system might have 3 levels: video, AES, and time code. A hypothetical device in this system is Camera 1, which consists of video on input port 1 of the video router, AES on input port 5 of the AES router, and time code on input port 8 of the time code router. (You can use an analog audio router to router time-code signals.)
<b>DVB-ASI</b>	(Digital Video Broadcast — Asynchronous Signal Interface) A transmission scheme for MPEG-2 payloads at up to 270 Mbps. It was developed for transmission over long distances subject to high noise levels.
<b>High-tally</b>	Bright, in reference to a lamp or LED.
<b>Hold</b>	During a breakaway take, the level selections remain unchanged. ('No Hold' means that levels are selected anew at the next source or next destination.
<b>Input/output</b>	Inputs and outputs are the physical connections on the back of the router. The term "input port" is used interchangeably with "input" and the term "output port" is used interchangeably with "output."
<b>IP address</b>	A 32-bit number that identifies a device on an Ethernet LAN. The address is commonly expressed as a series of 4 numbers separated by periods. Each of the 4 numbers represents 8 of the 32 bits.
<b>Level</b>	In a compact router system, a (physical) level is the same thing as a router partition. (The partition can be the entire router.)
<b>Lock</b>	A "destination lock" protects a destination from being switched to a different source. A "panel lock" prevents accidental changes at a panel.
<b>Low-tally</b>	Dim, in reference to a lamp or LED.
<b>Operator</b>	The term operator refers to control panel users as opposed to system configurers or system administrators. An operator is responsible for making the routes.

<b>Port</b>	In general, a port is a physical connection on a router. For compact machine control routers, a port is a bidirectional serial connector. A machine control router is also called a <i>port router</i> .
<b>Remote Panel Module</b>	<p>A CR Series product that sends take and lock messages to routers in a CR Series network. The remote panel module receives commands from an attached CR Series control panel. The remote panel module receives status messages from the routers in the network, and in turn, illuminates its control panel buttons according to the status messages.</p> <p>The remote panel module is also a place to mount a control panel.</p>
<b>Primary level</b>	A destination's primary level is the first level in the list of levels assigned to the destination.
<b>Salvo</b>	<p>(1) A salvo is a stored sequence of simple takes that can be executed at a control panel.</p> <p>(2) A salvo can also mean a "snapshot" of a router crosspoint matrix in the context of the 'View Router Crosspoints' page of CRSC.</p>
<b>Source/ Destination</b>	<p>The term "source device" is used interchangeably with "source" and the term "destination device" is used interchangeably with "destination." A source is a device that is connected to one or more input ports. A destination is a device that is connected to one or more output ports. An example of such a device would be a monitor.</p> <p>A device can be both a source and destination. An example of such a device is a VTR.</p>
<b>Subnet mask</b>	A 32-bit number that distinguishes the common part of an IP address from the unique part. For two IP addresses 192.168.2.10 and 192.168.2.30, the common parts are 192.168.2 and the unique parts are 10 and 30 respectively. The common part has 24 bits. The subnet mask in this example is 255.255.255.0.
<b>SWB</b>	(Super Wide Band). A term originated by Grass Valley's NVISION business group that refers to the ability of a router to pass a wide range of digital bit rates and formats. Grass Valley's SWB supports data rates from 10Mbps to about 1.5 Gbps. The HD-SDI routers reclock at 143, 177, 270, 360, and 540MB/s and 1.483 and 1.485 Gb/s. The HD routers bypass re-clocking for non-video rates.
<b>Synchronous</b>	As it applies to the AES routers, "synchronous" means switched in relation to the sync obtained from a video reference signal. The AES routers perform certain functions when in "synchronous" mode, namely (1) outputting an AES stream at 48kHz, and (2) switching mono channels.
<b>Take</b>	A take is a route. The panel operator "takes" a source (to a destination).
<b>3Gig</b>	The term "3Gig" describes Grass Valley devices capable of operating at 2.97 Gb/s or 2.966 Gb/s <sup>1</sup> and lower rates. (They reclock at 2.97 Gb/s, 2.966 Gb/s, 270 MB/s, 1.483 Gb/s, <sup>1</sup> and 1.485 Gb/s).

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1. 2.97 / 1.001; 1.485 / 1.001



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