

# CR6400 Family

Digital Compact Routers and Control Panels

## User's Guide

UG0078-02

2 Dec 2014



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## Change History

Rev.	Date	ECO	Description	Approved
1.0	09 Jul 14	19241	Initial Release.	D.Cox
1.1	03 Oct 14	19332	Added the use of remote panels to the CR6400 family which can now be used in general CRSC networks.	D.Cox
1.2	02 Dec 14	19357	New contacts.	D.Cox

## Notices

### **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.

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### **Software License Agreement and Warranty Information**

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

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## 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.

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## 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.
- To reduce the risk of electrical shock, plug each power supply cord into a separate branch circuit having a separate service ground.

# toc

## Table of Contents

<b>1 Preface .....</b>	<b>1</b>
Chapter Structure .....	1
The PDF Document .....	1
Terms, Conventions and Abbreviations .....	2
<b>2 Introduction .....</b>	<b>3</b>
Overview .....	3
Summary .....	3
Compact Router Background .....	4
General Compact Router Usage .....	4
Stand-Alone CR6400 Usage .....	5
Software .....	5
The Router .....	6
Control Card .....	7
Ports .....	8
Other Features .....	8
Crosspoint Card .....	9
I/O Cards .....	9
3Gig .....	9
AES .....	9
The Control Panel .....	10
Default Button Functions .....	10
Stand-Alone Definitions .....	11
Stand-Alone Button Color .....	12
Feature Summary .....	12
Router .....	12
Control Panel .....	12
Stand-Alone Mode .....	13
CRSC Mode .....	13
<b>3 Installation.....</b>	<b>15</b>
Package Contents .....	15
Design Considerations .....	16
Stand-Alone CR6400 Routers .....	16
Stand-Alone CR6400 Networks .....	16
CRSC Networks .....	16
NV9000 Networks .....	16
Rack Mount .....	17
Creating a Router Network .....	18
Stand-Alone Networks .....	19
Levels and IP Addresses in Stand-Alone Networks .....	19
Testing .....	20
Stand-Alone Router .....	20
Stand-Alone Network .....	21
Further Testing .....	21

<b>4</b>	<b>Configuration .....</b>	<b>23</b>
	Stand-Alone Routers .....	23
	Stand-Alone CR6400 Networks .....	25
	IP Addresses and Levels .....	25
	CRSC Networks .....	25
	Essential Information .....	25
	Terms .....	25
	Remote Panel Modes .....	26
	Salvos .....	27
	Paging .....	27
	Panel Types for CR6400 Routers .....	28
	IP Addresses in CRSC .....	28
	How to Add Routers to a Network .....	28
	How to Add Remote Panel Modules to a Network .....	29
	Configuring a Router in CRSC .....	29
	Active Subnet .....	29
	How to Update a Level .....	29
	How to Add a Level .....	30
	Configuring a Panel in CRSC .....	31
	Defining Destination Buttons .....	34
	Defining Level Buttons .....	35
	Defining Salvo Buttons .....	36
	Defining Source Buttons .....	37
	Unused Button Type .....	37
	Shortcuts .....	38
	NV9000 Networks .....	38
	Routers .....	38
	Panels .....	38
<b>5</b>	<b>Stand-Alone Operation .....</b>	<b>41</b>
	Summary .....	41
	Terminology .....	41
	For a Single Stand-Alone Router .....	41
	For a Stand-Alone Router Network .....	42
	Stand-Alone Router .....	42
	Startup .....	42
	Takes .....	43
	Example .....	43
	Locks .....	44
	Panel Lock .....	44
	Destination Lock .....	44
	Stand-Alone Network .....	45
	Startup .....	45
	Level Selection .....	45
	Takes .....	46
	Locks .....	47
	Panel Lock .....	47
	Destination Lock .....	47



**6 CRSC Network Operation ..... 49**

- Summary ..... 49
  - Terminology ..... 49
  - Panel Operation ..... 50
- Control Panel Buttons ..... 50
  - Button Types ..... 52
  - Panel Modes ..... 52
  - Red Buttons ..... 53
  - Button Order ..... 53
    - Spatial Ordering ..... 53
    - Temporal Ordering ..... 54
  - Button Illumination ..... 54
    - Source Button Colors ..... 54
    - Destination Button Colors ..... 55
    - Level Button Illumination ..... 55
- Power Up and Reset ..... 55
  - Routers at Power-Up ..... 55
  - Remote Panel Modules at Power-Up ..... 56
- Choosing a Button Page ..... 56
  - What Paging Is ..... 56
  - Paging Button Types ..... 57
- Performing Takes ..... 59
  - Normal Takes ..... 59
    - Example — Normal Take in Standard Mode ..... 59
    - Example — Normal Take in Enhanced Mode ..... 60
  - Breakaway Takes ..... 60
    - Example — Breakaway in Standard Mode ..... 61
    - Example — Breakaway in Enhanced Mode without Hold — Variant 1 ..... 62
    - Example — Breakaway in Enhanced Mode without Hold — Variant 2 ..... 63
    - Example — Breakaway in Enhanced Mode with Hold ..... 64
  - Single-Destination Takes ..... 65
    - Example — Normal Take for CP6401 ..... 65
    - Example — Breakaway for CP6401 in Standard Mode ..... 65
    - Example — Breakaway for CP6401 in Enhanced Mode with Hold ..... 66
    - Example — Breakaway Take for CP3201 in Enhanced Mode without Hold ..... 67
- Performing Locks ..... 68
  - Panel Lock ..... 68
  - Destination Locks ..... 68
    - Simple Locks ..... 68
    - Complex Locks ..... 69
    - Single-Destination Locks and Unlocks ..... 69
- Executing Salvos ..... 70
- Performing Level Selection ..... 70
  - Level Selection in Standard Mode ..... 70
  - Button Order ..... 71
  - Level Selection in Enhanced Mode ..... 73

**7 Maintenance ..... 75**

- Prevention ..... 75
- Trouble-Shooting ..... 75
  - Power Supply LED Does Not Illuminate ..... 76
  - Noisy Transitions ..... 76
  - Router Functioning Improperly ..... 76
  - Network Failure ..... 76

<b>8</b>	<b>Technical Details .....</b>	<b>77</b>
	Power Specifications .....	77
	Reference Specifications .....	78
	Physical Specifications .....	80
	Environmental Specifications.....	81
	Connectors .....	81
	Serial Connector .....	81
	Video Specifications.....	82
	Audio Specifications .....	83
	Drawings .....	83
	Defaults .....	88
	Default Router State.....	88
	Initial Control Panel State.....	88
<b>9</b>	<b>Misc. Topics .....</b>	<b>89</b>
	Power Cord Retention for the PS0012 Power Supply.....	89
	<b>Glossary .....</b>	<b>91</b>
	<b>Index .....</b>	<b>93</b>
	<b>Contact Us .....</b>	<b>99</b>

# 1

## Preface

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

### Topics

<a href="#">Chapter Structure</a> .....	1
<a href="#">The PDF Document</a> .....	1
<a href="#">Terms, Conventions and Abbreviations</a> .....	2

## Chapter Structure

The following chapters provide detailed instructions for all aspects of the CR6400 family of compact routers and control panels:

- 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 CR6400.
- Chapter 3, [Installation](#), provides installation and connection instructions.
- Chapter 4, [Configuration](#), provides configuration instructions.
- Chapter 5, [Stand-Alone Operation](#), provides operating instructions.
- Chapter 7, [Maintenance](#), provides maintenance and trouble-shooting instructions.
- Chapter 8, [Technical Details](#), provides electrical, video, audio, mechanical, and environmental specifications, product drawings, and default settings.
- Chapter 9, [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.

## 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 ▲ 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 CP6464 control panel.
- The term "router" refers to any of the CR6400 compact routers, with or without its control panel. If a distinction is required, it will be made.
- 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.
- The term "frame" refers to any CR6400 router.
- "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 term "3Gig" describes devices capable of operating at 2.97 Gb/s or 2.966 Gb/s<sup>1</sup>.
- 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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1. 2.97 / 1.001

# 2 Introduction

Chapter 2 provides a functional description of the CR6400 routers and the CP6464 control panel.

## Topics

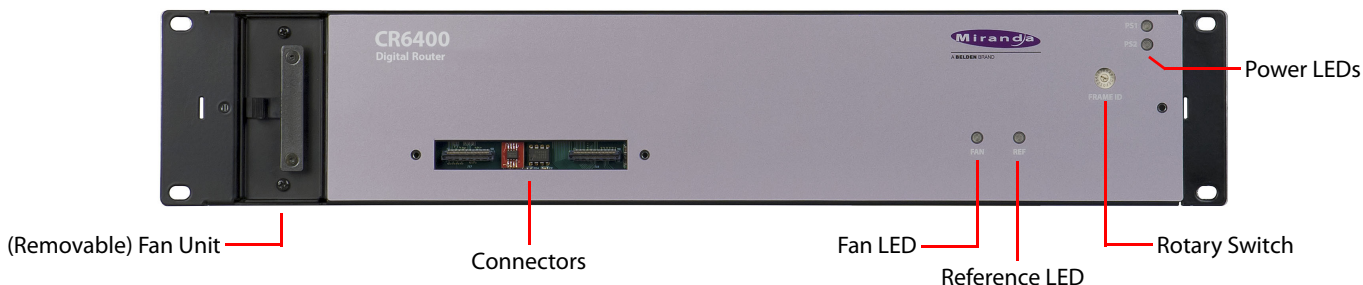
<a href="#">Overview</a> .....	3
<a href="#">The Router</a> .....	6
<a href="#">I/O Cards</a> .....	9
<a href="#">The Control Panel</a> .....	10
<a href="#">Feature Summary</a> .....	12

## Overview

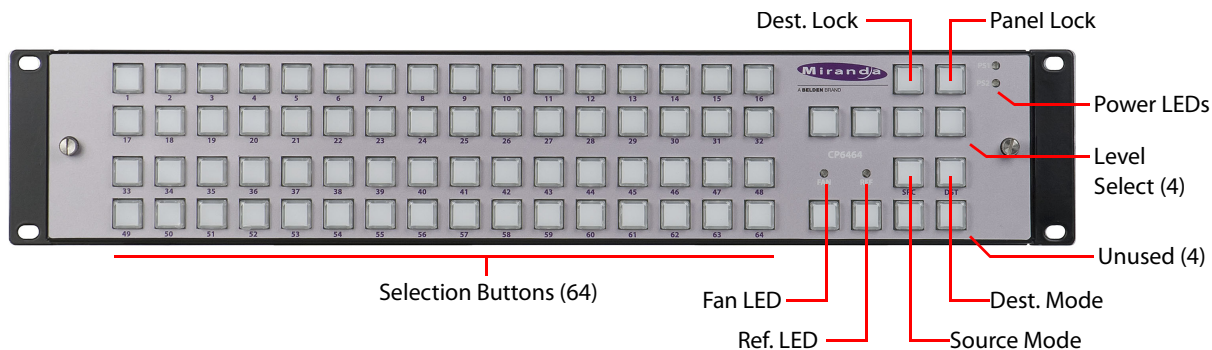
### Summary

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

The CR6400 routers are 2RU routers, are about 10 inches deep.



A thin 2RU control panel — the CP6464 — can mount directly on the front of the router as shown here:



The control panel has an array of 64 function buttons at the left and 12 function buttons at the right. The panel's default button functions are identified here.

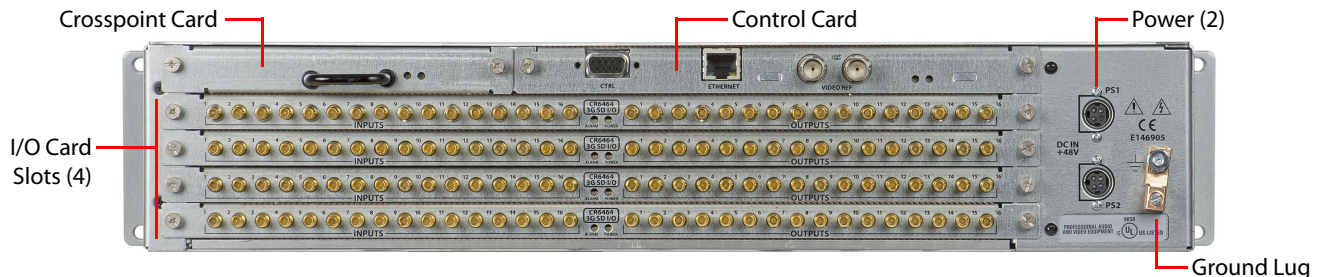
The default functions include:

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

In the default function set, four of the buttons are unused.

When the panel is configured in CRSC (Compact Router System Configurator), all the buttons of the panel are configurable and support salvos, which are not available in the default function set.

At the rear, unlike other compact routers, the CR6400 has 4 slots for removable (serviceable) I/O cards, and slots for a crosspoint card and a control card.



Because all the cards are removable, they are field-replaceable. The CR6400 routers also have a removable fan unit, accessible through the front of the router.

The router, when it contains one or more 3Gig cards, is considered a *CR6464-3Gig* router and it switches video. The router, when it contains one or more AES cards, is considered a *CR6464-AES* router and it switches AES audio.

Without any I/O cards installed, the router is considered “undefined.”

At this release, the matrix size is fixed at 64×64. Each I/O card provides 16 inputs and 16 outputs.

## Compact Router Background

The CR series includes 1RU and 2RU compact routers, compact control panels, and “remote panel modules.”

The 1RU routers have switching matrices up to 16×16 and the 2RU routers (other than the CR6400 routers) have switching matrices up to 32×32.

The CR series includes many different routers that switch different signal formats: SDI (3Gig, HD, SD), AES, analog audio, and analog video. The CR series also includes machine control routers.

The CR series includes 3 “clean and quiet” (CQX) routers and a CQX control panel.

Please refer to the *Compact Router User’s Guide* for a complete list of the other compact routers and panels, and a description of each.

## General Compact Router Usage

There are several different ways to use compact routers in general:

- As a single stand-alone router with a “captive” control panel or with automation.
- In a network of stand-alone routers, with one or more captive panels, and with or without automation.
- In a CRSC network of routers and remote panels, with or without automation. Here, the panels and routers (including CR6400 routers and panels) are configured using CRSC.

- In a network of routers under an NV9000 router control system.
- ▲ A *captive* panel is one attached directly to a router. A *remote* panel is one mounted on a remote panel module.
- ▲ Automation is left to the customer and is not addressed in this document.

## Stand-Alone CR6400 Usage

The CR6400 family routers can also be used in the following ways:

- As a single stand-alone CR6400 router with a “captive” control panel or with automation.
- In a network of stand-alone CR6400 routers, possibly with captive panels, and with or without automation.

Compact routers and remote panel modules come from the factory ready for *stand-alone* operation. They must be configured in CRSC if they are to be used either in a CRSC network or in an NV9000 network. Once configured, they must be reset to their factory default state to operate in stand-alone mode.

A remote panel module must be configured to operate (1) in a CRSC network or (2) in an NV9000 network. The two configuration modes are mutually exclusive.

The CR6400 routers, in their factory default state, operate in stand-alone mode (also known as “default” mode) either as a single router or in a small network. They do not require configuration to operate in stand-alone mode.

Figure 2-1 compares a stand-alone CR6400 with a captive panel to a stand-alone CR6400 network with a captive panel:

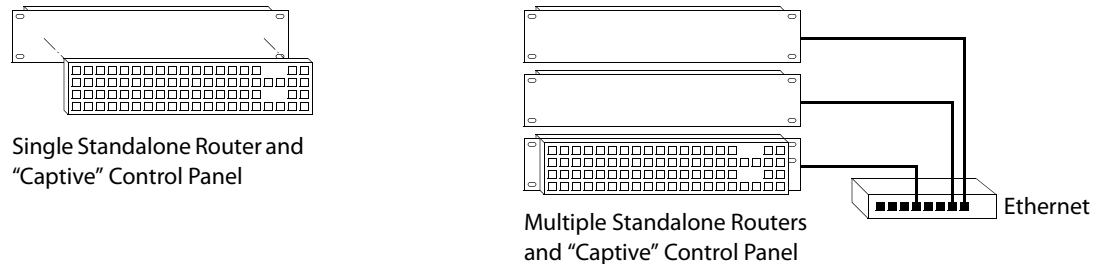


Fig. 2-1: Standalone CR6400s

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

When configured in CRSC, the CR6400 routers and remote panel modules can operate in CRSC network mode or NV9000 network mode. See [CRSC Networks](#) on page 25 and Chapter 6, [CRSC Network Operation](#) (page 49).

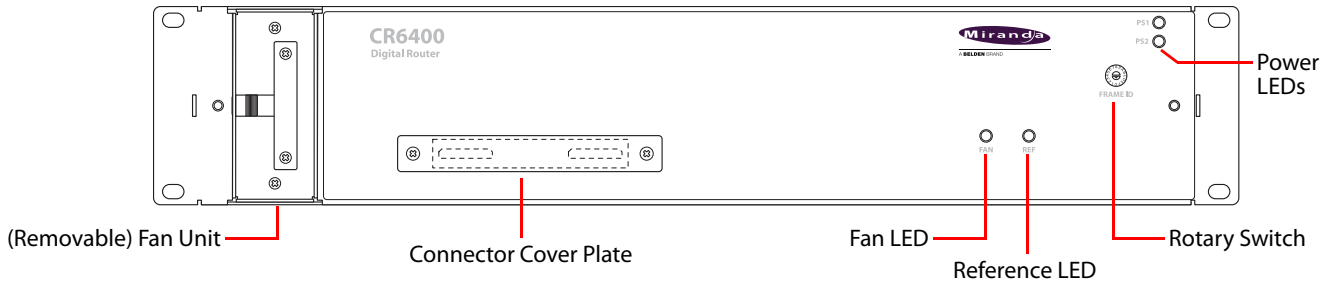
## Software

CRSC (Compact Router System Configurator) is a configuration and monitoring tool for compact routers and remote panel modules.

CRSC is also an essential tool for performing firmware updates for all CR Series products.

## The Router

The CR6400 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.

You can mount a CP6464 control panel on the front of the router. The router has a connector that mates to the panel. If a panel is not attached to the router, a small metal plate covers the connector opening.

At the right side of the front of the router is a 16-position rotary switch. The positions are labeled 0–F in hex (equivalent to 0–15 in decimal). Turning this switch to different positions on different routers (1) assigns "levels" to the routers, and (2) determines the IP addresses of the routers in a network of routers.

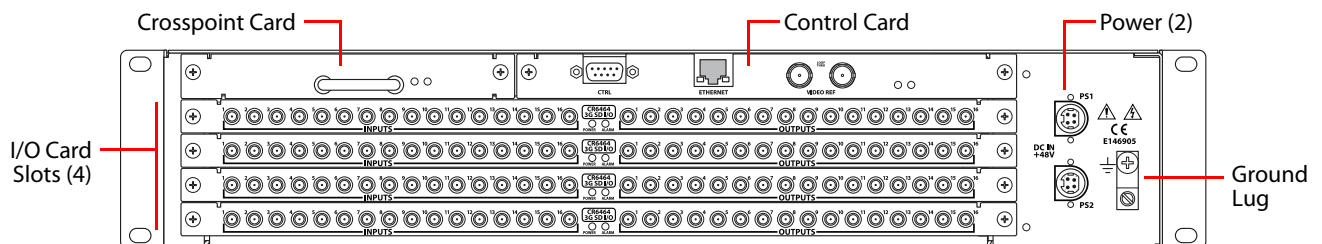
- ▲ Powering up the router with the rotary switch set at its 0 position causes the router to be reset to its factory defaults. (You should not use the router in your system with its switch at the 0 position.)

Two power LEDs give the status of the router's two power supplies. The LEDs will be illuminated if the power supplies are functioning properly.

The fan LED shows red if a problem exists in the fan module and green otherwise. The fan module has two fans. If one fails, the fan LED turns on. The other fan can provide enough air movement to cool the router.

The reference LED shows green when the router is receiving a good video reference signal and red when it is not.

At the rear, the CR6400 routers have 4 slots for removable I/O cards, and slots for a crosspoint card and a control card (also called a CPU card).



The control card has several connectors and 2 LEDs: an alarm LED and a power LED. The crosspoint card has no external connectors, but does have an alarm LED and a power LED.

See [Control Card](#) and [Crosspoint Card](#), following.



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 I/O cards are not configurable in any way, apart from their presence or absence in the router. The crosspoint card is not configurable and the control card is not configurable.

At this revision, the router must contain only 3Gig cards or only AES cards. It contains 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 frame having no cards is considered of "undefined" type.

Figure 2-2 shows a simplified block diagram of a CR6400 router:

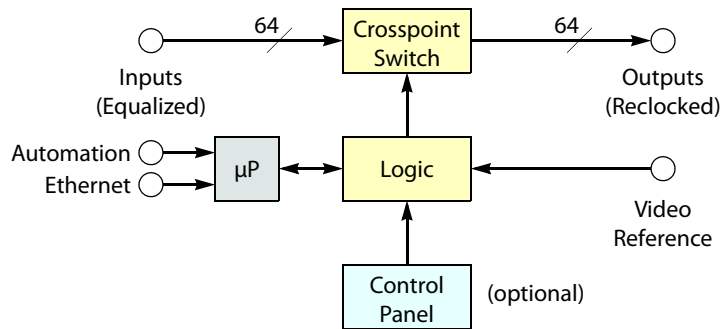
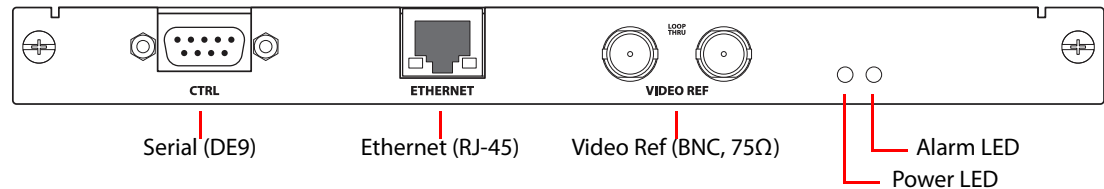


Fig. 2-2: Block Diagram of the CR6400

## Control Card

The control card (also called the CPU card) is the heart of the router:



These are its functions:

- Receive button presses made at the panel and send status (button illumination) to the panel.
- Implement the "architecture" of the router.
- Receive reference video.
- Maintain buffer for video timing with respect to the video reference.
- Execute switches (with respect to the video reference) and perform locks and unlocks.
- Read the rotary switch at startup.
- Communicate with an automation or control system
- Communicate with other CR6400 family routers over Ethernet.

## Ports

The control card has several ports:

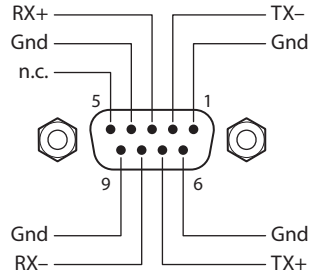
[Serial Port](#)

[Ethernet Port](#)

[Video Reference](#)

### Serial Port

The serial port uses a DE9 connector, and supports RS-422 or RS-485 protocol. This is the pinout of the port:



The serial port allows access to an automation system that uses NVISION serial protocol.

### Ethernet Port

The Ethernet port has an RJ-45 connector. The CR6400 routers communicate with other CR6400 routers through this port. It is also through the Ethernet port that CRSC (on your PC) communicates with the router.

The protocol is UDP as for all compact routers.

### Video Reference

The video reference ports (2 BNCs) provide loop-through, where you connect your video reference to either video reference connector and use the other video reference connector to feed the reference signal to another device. The reference signal must be terminated using a 75Ω terminator.

The CR6400 accepts 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

### Other Features

The power LED is green when the control card has good power, and red if power is faulty.

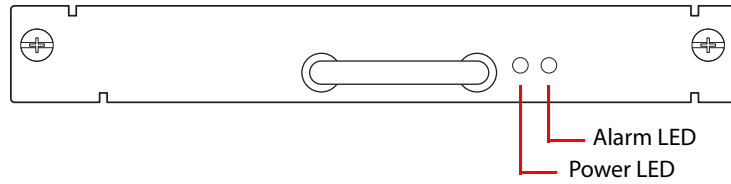
The alarm LED is red when an alarm condition exists (such as the absence of a video reference).

The alarm LED is green otherwise.

(Of course, both LEDs are off when there is no power.)

## Crosspoint Card

The crosspoint (XPT) card contains the switching matrix:



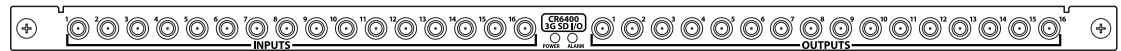
There are no connectors on the XPT card, but it does have an alarm LED and a power LED. The power LED is green when the control card has good power and red if power is faulty. The alarm LED is red when an alarm condition exists (such as the absence of a video reference). The alarm LED is green otherwise.

## I/O Cards

The I/O cards are labeled according to their type and have an alarm LED and a power LED. The power LED is green when the control card has good power and red if power is faulty. The alarm LED is red when an alarm condition exists (such as the absence of a video reference). The alarm LED is green otherwise.

### 3Gig

The 3Gig card has 16 “coax” inputs and 16 coax outputs:



The “3Gig” I/O cards support video, with or without embedded audio, at 2.966Gb/s, and 2.97 Gb/s video rates as well as a number of HD and SD bit rates and formats. The 3Gig cards relock at 270Mb/s, 1.483 Gb/s, 1.485 Gb/s, 2.966 Gb/s, and 2.97 Gb/s. The 3Gig cards bypass re-clocking for other rates. Video reference must be nominally 800mV p-p and bi-level or tri-level in nature.

The 3Gig cards also support DVB-ASI.

### AES

The AES card has 16 “coax” inputs and 16 coax outputs:

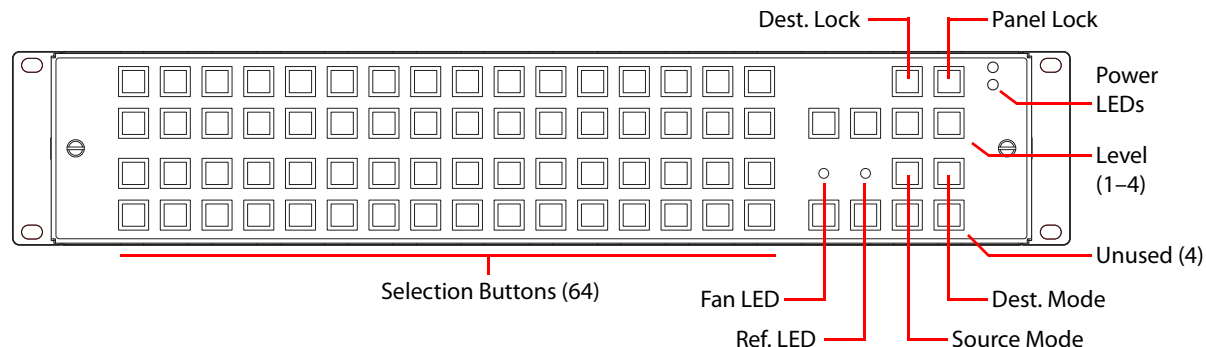


The AES router switches AES3id audio.

Each of the 64 AES inputs is a stereo pair. Similarly, each of the 64 AES outputs is a stereo pair. The inputs are switched as stereo pairs. There is no other switching option for the CR6464-AES routers.

## The Control Panel

A thin 2RU control panel — the CP6464 — can mount directly on the front of the router as shown here:



The control panel has an array of 64 device selection buttons at the left and 12 function buttons at the right. The panel's default button functions are shown here. The default functions include:

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

In the default function set, four of the buttons are unused.

When a remote panel module is configured in CRSC (Compact Router System Configurator), all the buttons of the associated panel are configurable and include salvos, which are not available in the default function set.

### Default Button Functions

When coupled with stand-alone routers, the panel has a default button set. These are the button functions:

- Level 1–Level 4. These 4 buttons enable switching on (up to) 4 routers in a network. Each router is considered a level. Typically, levels are used to organize the switching of different signal types.  
In a router network, signals are switched according to which levels are selected using the level buttons. If a level is unselected, switching on that router is disabled.  
If the panel is controlling a single router, and the router's rotary switch is set to position 1, 2, 3, or 4, the matching level button will be illuminated but disabled because it is not needed.
- Panel Lock. Prevents accidental use of the entire panel.  
The panel lock button, normally low-tally green, goes high tally red when the panel is locked. All other buttons become disabled until the operator presses the panel lock button again to unlock the panel.
- Destination Lock. Prevents takes to one or more destinations.  
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 turns high tally red — as a warning — if you press it.
  - ▲ If you have two or more routers in a network, destinations are locked on selected levels. A destination button might indicate a lock or might not, depending on the levels the operator has selected.

- Destination Mode.

The destination mode button enables *destination* selection using the array of selection buttons.

When a panel operator presses the destination selection button, we say the panel is in destination mode. The 64 selection buttons turn *amber* and permit the selection of one of 64 destinations.

- Source Mode.

The source mode button enables *source* selection using the array of selection buttons.

When a panel operator presses the source selection button, we say the panel is in source mode. The 64 selection buttons turn *green* and permit the selection of one of 64 sources.

### Stand-Alone Definitions

The terms *source* and *destination* have specific meaning with respect to routers.

In general, a *source* is a set of associated input ports and a *destination* is a set of associated output ports. (The *source's* inputs connect to a device at which a signal originates. That can be called a source device. A *destination's* outputs connect to a device to which you are sending the signal and that can be called a destination device.)

A *level* is the set of signals that are routed by one router. A network of 4 routers therefore has 4 levels — one for each router.

*Breakaway* is defined as a route in which a destination receives input from different sources on different levels.

### For a Single Router

- 1 A source is an input (i.e., a connector) on the CR6400 router.
- 2 A destination is an output (i.e., a connector) on the CR6400.

(When you have just a single router, the set of inputs for a source is just a single port and the set of outputs for a destination is just a single port.)

### For a Router Network (Up to 4 Routers)

- 1 A *source* is set of  $N$  inputs on the routers in the network, where  $N$  is the number of routers. A source comprises the same input on all  $N$  routers. (All levels are included in the source).  
Example: in a network of 3 routers, source 5 is the set of input 5 on router A, input 5 on router B and input 5 on router C.
- 2 A *destination* is set of  $N$  outputs on the CR6400s in the network, where  $N$  is the number of routers. It is the same output on all  $N$  routers. (All levels are included in the destination).
- 3 If the operator routes source  $J$  to destination  $K$ , then input  $J$  on all routers is taken to output  $K$  on all enabled levels. (A level — i.e., a router — is enabled when a level button on a CP6464 panel selects it.)
- 4 Breakaway can occur by choosing different levels for separate takes to the same destination. (The concept of breakaway is undefined for a single router.)

## Stand-Alone Button Color

A panel's buttons have color: green, amber, red and are either bright (high-tally), dim (low-tally), or off (disabled). Buttons go high-tally when selected (pressed) and remain low-tally when they are not selected. In general, green means source and amber means destination. These colors have other meanings, however.

If a selection button is red when the panel is in destination mode, the destination is locked on the selected levels. The destination lock button will also be red in that case. The selection button is high-tally red when that destination is selected and low-tally red when some other destination is selected.

The panel lock button turns red when the panel is locked.

Operating a control panel (at first release) is very simple. See Chapter 5, [Stand-Alone Operation](#) on page 41.

- ▲ Buttons are not labeled at the factory. If you want button legends, you must create your own. See [Button Legends](#) on page 24.

## Feature Summary

### Router

The CR6400 has 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 to specify the level of a router. The router's IP address is also derived from the switch setting.
- Quick and easy control panel mounting.
- Non-volatile memory. Routes (and IP addresses) are preserved if power is shut off.
- One RS-422/RS-485 port, for connection to an automation system or control system.
- Four I/O card slots.

At first release, the I/O cards must be all AES cards or all 3Gig cards.

Each card has an alarm LED and a power LED.

- One pair of video reference connectors (BNC, 75 Ω, loop-through).
- An LED indicates whether the router has video reference. Another LED provides fan status.

### Control Panel

A control panel can operate in stand-alone (or default, or factory-default) mode or can operate in CRSC mode, in a CRSC network or an NV9000 network.

(In a CRSC network, only panels mounted on remote panel modules are configurable. Panels mounted on routers — "captive" panels — function in default mode, are not configurable, and have limited capabilities.)

## Stand-Alone Mode

In stand-alone operation, the CP6464 has the following characteristics:

- The meaning of I/O buttons is fixed and the mapping of buttons to I/O connectors is fixed. The set of 64 buttons represents sources when the source mode button is pressed and represents destinations when the destination mode button is pressed.
- Function buttons:
  - 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).
  - The 4 buttons (immediately below the lock buttons) select levels 1 to 4, in that order.
  - Pressing the source mode button makes the selection buttons (or I/O buttons) turn green (high- or low-tally) In source mode, the selection buttons select sources.
  - Pressing the destination mode button makes the selection buttons (or I/O buttons) turn amber (high- or low-tally) In destination mode, the selection buttons select destinations.
  - Other function buttons are reserved for future use.
- Each button has a clear plastic cap that can be easily removed to accommodate customer-defined button legends.
- Two LEDs indicate whether the power supplies of the router on which the control panel is mounted are connected and functioning.
- An LED indicates whether the router has reference. Another LED provides fan status.
- A control panel mounts easily and quickly on the router with two knurled screws and electrical connectors. The CR6400 routers have two connectors. The CP6464 presently has one connector that mates to one of the connectors on the router.

## CRSC Mode

These are the panel's characteristics in CRSC mode:

- The meaning of I/O buttons is completely configurable and the mapping of buttons to I/O connectors is also configurable.
- Function buttons:
  - 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).
  - There are several "paging" button types that can be configured on the panel. These select which subset of button functions appear on the matrix of 64 buttons.
  - A source button is green (high- or low-tally).
  - A destination button is amber (high- or low-tally).
  - Panels may have salvo buttons.

- Each button has a clear plastic cap that can be easily removed to accommodate customer-defined button legends.
- Two LEDs indicate whether the power supplies of the router on which the control panel is mounted are connected and functioning.
- If the panel is mounted on a router, an LED indicates whether the router has reference. Another LED provides fan status. When the panel is mounted on a remote panel module, those LEDs have no function. (There is no fan in the remote panel module and the remote panel module takes no reference signal.)
- A control panel mounts easily and quickly on a router or remote panel module with two knurled screws and electrical connectors.  
(In a CRSC network, only panels mounted on remote panel modules are configurable. Panels mounted on routers — “captive” panels — function in default mode and have limited use.)

See [CRSC Networks](#) on page 25 and Chapter 6, [CRSC Network Operation](#) (page 49).



# 3 Installation

Chapter 3 provides installation instructions.

## Topics

<a href="#">Package Contents</a> .....	15
<a href="#">Design Considerations</a> .....	16
<a href="#">Rack Mount</a> .....	17
<a href="#">Creating a Router Network</a> .....	18
<a href="#">Testing</a> .....	20

## Package Contents

If you have ordered CR6400 routers (and products related to them) 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 items that can ship include:

- One or more routers. The router's crosspoint card and control card will have been inserted in their respective slots.
- I/O modules (inserted in I/O slots of the router).
- A shielded Ethernet cable (7', about 2 m, for each router).
- One or more control panels.
- One or more power supplies.
- User's guides (this document in particular), router firmware, CRSC configuration software, and button legend templates in different file formats, on a CD.
- A quickstart guide (hard copy).

Other than the 7' shielded Ethernet cable, the package does not contain network cables, video cables, BNC terminators, mounting screws, or grounding wire.

There are no 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 the CR6400 family products.

## 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.

### Stand-Alone CR6400 Routers

A single CR6400 router operates in stand-alone mode with an attached (or “captive”) control panel. A single stand-alone router will work reliably and operation is extremely simple.

The single CR6400 can switch signals according to the type of I/O cards installed in the 4 slots at the rear of the router. The CR6464-3Gig switches video; the CR6464-AES switches audio.

### Stand-Alone CR6400 Networks

A stand-alone network includes 1–4 routers and one CP6464, mounted on one of the routers.

- ▲ Additional CP6464s could be mounted on the other routers, but they would provide little or no additional capability.

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

- ▲ The term *level*, in a stand-alone network, means little more than a router number.

### CRSC Networks

A CRSC network includes a number of CR Series routers and panels of any type, all of which have been configured in CRSC.

- ▲ (It is actually remote panel modules that are configured, not the panels themselves.)

See [CRSC Networks](#) on page 25 and Chapter 6, [CRSC Network Operation](#) (page 49).

In CRSC, nearly every button of a control panel can be configured. Panels do not exhibit or rely on factory default behavior. (Salvo buttons are also available.)

Under CRSC, a level is a *router partition*. Up to 8 levels can be defined in a CRSC network.

Under CRSC, the mapping of inputs and outputs to sources and destinations is completely configurable.

(In a CRSC network, only panels mounted on remote panel modules are configurable. Panels mounted on routers — “captive” panels — function in default mode and have limited use.)

### NV9000 Networks

CR Series routers and panels can also be deployed in an NV9000 network. CR Series remote panel modules must be set up (in CRSC) to function in NV9000 networks.

A remote panel module must be given a panel ID and configured in NV9000-SE Utilities. NV9000-SE Utilities is the configuration software for NV9000 router control systems.

NV9000-SE Utilities communicates with routers using specific router protocols. For CR Series routers, the protocol to use is ‘NV Compact Router Ethernet’.

## Rack Mount

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.

Refer to [Levels and IP Addresses in Stand-Alone Networks](#), on page 19 for information on how the rotary switch is used.

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.

As you install the panel, its buttons might flicker until you secure the panel in place. This is harmless.

You may install a control panel's button legends at any time. See [Button Legends](#) on page 24.

- 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 screws to secure the router to the rack.

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

See [Creating a Router Network](#), on page 18.

- 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 supplies are described in [Power Specifications](#) on page 77. Each connector has 4 pins.

- ▲ The enclosing ring of the cable connectors are connected to ground. Be careful not to short the power pins (+48V) to the ring.
- ▲ 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 75 if the power LED 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.

Following are recommended practices for installing CR6400 routers:

- If the router is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room's ambient temperature. Install the router in an environment compatible with the maximum ambient temperature (T<sub>ma</sub>) specified for the router.
- Install the router in a rack so that the amount of air flow required for safe operation of the router is not compromised.
- Mount the router in the rack so that a hazardous condition does not arise from uneven mechanical loading.
- Connect the router to your supply circuit with consideration of the effect that overloading the circuits might have on overcurrent protection and supply wiring. Observe the nameplate ratings when addressing this concern.
- Maintain reliable earthing (grounding) of rack-mounted equipment. Give particular attention to indirect supply connections such as power strips.

## Creating a Router Network

A router network is necessary if you wish to perform multi-level tasks and locks. Otherwise, a single stand-alone router is sufficient.

A CRSC network is required if you want configurable router levels, configurable IP addresses, or configurable button panels.

A stand-alone CR6400 network is sufficient if you don't require a CRSC network.

Stand-alone networks are discussed here. See [CRSC Networks](#) on page 25 and Chapter 6, [CRSC Network Operation](#) (page 49).

## 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 stand-alone network of CR6400 routers:

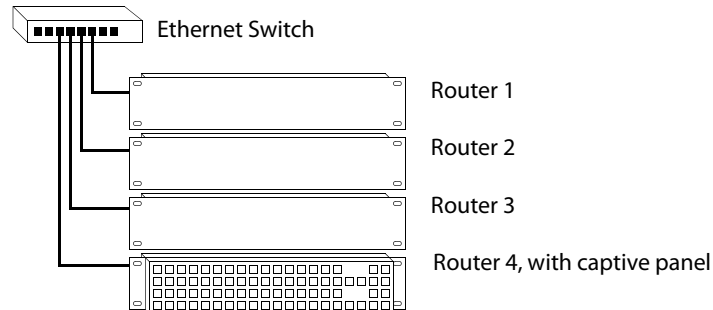


Fig. 3-1: Network of Routers

The panel can switch signals on the 4 routers (if they are correctly set up). 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.)

## Levels and IP Addresses in 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.

- ▲ If the switch is at setting 0, the router will reset to its factory state, losing crosspoint values. You should avoid leaving the switch at setting 0.

## Testing

If your system fails in any way, please refer to [Trouble-Shooting](#), on page 75.

### Stand-Alone Router

A stand-alone CR6400 router is a single router 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 PS0012 Power Supply](#) on page 89.

- 2 Examine the captive panel. Are all the *selection* buttons illuminated? (Most will be low-tally.) Some of the function buttons (at the right) will be illuminated and some will not.

- 3 Perform one or more takes using the panel.

(Press the destination mode button followed by a selection button. Then press the source mode button followed by a selection button.)

You do not need to connect any devices to a router to see whether it switches, but it helps in testing if you do. 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. Select 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. The other level buttons should be off. (There are 4 level buttons; the high-tally button corresponds to the level you configured with the rotary switch.)

▲ If no level selection button is lit, you might have set the router's rotary switch to a position other than 1–4.

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 on your installation.

Report any failures to Grass Valley customer service.

## Stand-Alone Network

A stand-alone network comprises 1–4 CR6400 routers, a CP6464, and an Ethernet switch.

- 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.

## Further Testing

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

Report failures to Grass Valley customer service.





# 4 Configuration

Chapter 4 provides configuration instructions for the CR6400 routers and the CP6464 panel.

## Topics

<a href="#">Stand-Alone Routers</a> .....	23
<a href="#">Stand-Alone CR6400 Networks</a> .....	25
<a href="#">CRSC Networks</a> .....	25
<a href="#">NV9000 Networks</a> .....	38

There are several ways to use the CR6400 routers:

- As a single stand-alone CR6400 router with a “captive” CP6464 control panel.
- As a network of stand-alone CR6400 routers, with a captive CP6464 panel (or panels).
- In [CRSC Networks](#). These are networks of CR Series routers of mixed type, with panels of mixed type. The panels mount on remote panel modules all of which have been configured for operation in the network.
- In [NV9000 Networks](#). Routers and panels in an NV9000 router control system must be configured in NV9000-SE Utilities. They must be set up for NV9000 operation, in CRSC, before they can be configured in NV9000-SE Utilities.

## 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 IP address.

### 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) at the rear of 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

The 3Gig and AES I/O cards have 32 DIN 1.0/2.3 connectors. (We call them “coax” connectors.) All the inputs are on the left and all the outputs are on the right. The alarm and power LEDs (and the card label) separate the two sections of a card.

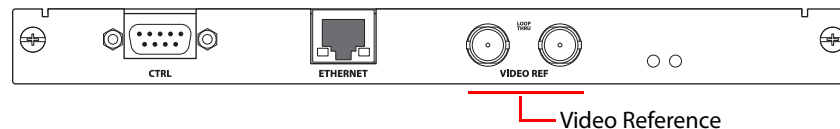
In the 4 card slots, the inputs are numbered 1–64 as slots go from the top of the router to the bottom. The same is true of the outputs.

Connect input devices and output devices to the router according to the requirements of your system.

- ▲ See [Video Specifications](#) on page 82 for cable length limits.

### External Video Reference

The reference connectors are a pair of 75Ω BNCs, loop-through, on the control card:



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 change the rotary switch position, power-cycle the router.

### 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. We recommend that you not use adhesive.

- ▲ Button legend templates (in Word,® Illustrator,® and Freehand® formats) are available on the documentation and software CD (SB0033) you received with your CR6400 product(s). Simply type (or draw) the legends you want, print the page on transparent film, and cut the buttons apart.
- ▲ Note: selection buttons of the CP6464 represent both sources and destinations. Therefore button legends must accommodate both source mnemonics and destination mnemonics. To fit on the button and be legible, your mnemonics must be relatively short.

## Stand-Alone CR6400 Networks

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

### IP Addresses and Levels

A stand-alone network allows up to 4 routers (levels 1–4). Decide what signal types (3Gig, AES, etc.) you want on which levels and set the rotary switch position to configure the levels accordingly. To summarize, the switch positions of your routers must be 1, 2, 3, or 4 and they must all be different.

See [Levels and IP Addresses in Stand-Alone Networks](#), on page 19, for information on rotary switch settings and subnet addresses.

## CRSC Networks

CRSC networks have more capabilities than stand-alone networks because the routers and panels are configurable. Because they are configurable, they are more flexible and offer more choices. However, CRSC networks are more complex than stand-alone networks.

In a CRSC network, all routers and remote panel modules must be configured using CRSC.

Every CR Series device in a CRSC network requires an IP address. Under CRSC, the IP addresses are not tied to a rotary switch position.

For routers, you must specify a level. You can assign up to 4 levels for each router, but the CRSC network is limited to 8 levels in total. (A level is a router partition.)

For panels, you must choose an operating mode (standard, enhanced with hold, enhanced without hold) and configure the panel's buttons. Buttons that are to remain unused need not be configured. There are shortcuts that make configuring panels quick and relatively easy.

During the configuration of a panel's source and destination buttons, you will be creating a mapping of routers' I/O ports to source and destination buttons — for all panels in the network. This is a non-trivial task often requiring a lot of design work.

Please refer to the CRSC User's Guide for complete detailed information about configuring remote panels. (This document focuses only on the CR6400 routers and panels.)

### Essential Information

A *remote panel* is a control panel mounted on a remote panel module.

A remote panel sends control messages to a network of routers and receive status information from the network.

These panels are called "remote" because they need not be attached to a router and can be used at a distance, as far as cable restrictions allow.

### Terms

Please review the following definitions:

- An **input** or an **output** is a single port at the rear of a compact router. Different routers have different kinds of connectors (e.g., BNC, DB25, RJ-45, "coax").

- A **source** is a set of inputs on one or more routers, on one or more levels. The inputs might, or might not, belong to a single physical device.
- A **destination** is a set of outputs on one or more routers, on one or more levels. The outputs might, or might not, belong to a single physical device.
- A **salvo** is a sequence of primitive takes. The takes execute, in order, when a panel operator presses a salvo button. A primitive take in a salvo comprises 3 values: level, input, and output. A primitive take routes a single input to a single output on a single level.
- The **primary level** is the first level defined for a particular destination.
- The **precedence** of level buttons depends on the location of the level buttons on the panel. In general terms, level buttons have higher precedence if they are to the left of, or are above, other level buttons. (Precedence governs which sources and destinations become enabled for selection on a panel that is configured in standard mode.)
- A **normal take** is a non-breakaway take.

Operators control a CR6400 system using remote panels. An operator is presented with a large and potentially bewildering array of buttons. It is the configurator's task to produce a panel that is easy to understand and to use:

- When your system has multiple panels, exercise caution so that you do not create panel configurations that conflict with each other.
- Avoid configuring source buttons and destination buttons that do not match the actual router connections and the numbering given by the router partitions.
- Create meaningful button legends that accurately describe what the buttons do. There are button templates available on the installation CD (SB0033-xx).

## Remote Panel Modes

Remote panels operate in one of three modes: (1) standard mode, (2) enhanced mode with hold, and (3) enhanced mode without hold.

### Standard Mode

*In standard mode, takes are performed on (manually) selected levels only.*

Level selection is persistent and at the discretion of the panel operator. Once the operator makes a level selection, it remains until the operator changes the selection. The current level selection enables some sources and destinations and disables others. The sources and destinations that are enabled depend on which level button has *precedence*. See [Button Order](#) on page 53 for information about precedence.

If no levels are selected, no sources or destinations are enabled. A take cannot occur.

If the panel has no level buttons, all of a destination's levels are always selected and all destinations are enabled.

Which level button has precedence depends on the order of level buttons on the panel and the order in which the operator presses the level buttons. See [Button Order](#) on page 53.

Standard mode allows breakaway. A breakaway is when you route to some, not all, of a destination's levels. By default, all valid levels are automatically selected when you set up a take. By creating a breakaway, you route only to the levels you have individually selected.

### Enhanced Mode (Hold and No-hold)

*'Takes' are performed on all the levels specified by the destination.*

In enhanced mode, level selection is applicable only to breakaway. Level selection governs the selection of sources for the breakaway. All sources and destinations are always enabled.

Enhanced mode has 2 submodes:

- Hold mode — the level selection persists after the destination button is pressed (initiating a take) and continues indefinitely until the operator changes it. This allows an operator to try different sources. To clear a breakaway, the operator starts a new normal take (non-breakaway) to that destination. See [Normal Takes](#) on page 59.
- No-hold mode — a level selection reverts to the levels defined by the destination after the operator presses a source button (completing a take). To clear a breakaway, either start a new normal take to that destination or press a source without a level selection. See [Normal Takes](#) on page 59.

The choice between hold mode and no-hold mode is meant to accommodate operator or administrator preferences.

### Salvos

A “salvo” is a sequence of predefined (primitive or simple) takes. When you assign a salvo to a button, an operator need only press that button to execute the entire take sequence.

Salvos do not:

- Execute source selections, destination selections, or level selection functions.
- Execute other salvos. (That is, salvos cannot be nested.)
- Contain loops or branches.

A simple take is expressed (in CRSC) as 3 values: level, input and output. These three values uniquely define a single crosspoint in the set of routers and router partitions.

A salvo can include up to 64 primitive takes and a panel configuration can have up to 64 individual salvo buttons, subject to a limit of 1024 primitive takes in total. (Thus, your panel could have, for example, 64 salvos of 16 takes or 16 salvos of 64 takes.) Each panel can have a different set of salvos.

### Paging

Certain CR Series control panels can have buttons that control the presence or absence of sets of sources and destinations that can be controlled by the panel. We call these sets of sources or destinations “pages.”

The panels that have “paging” buttons are the CP6464 and CP32-6464. These are the panels that can control networks that include CR6400 family routers. (The CP6401 also controls CR6400 family routers but does not have paging buttons.)

See [Select a paging method](#) on page 32.

## Panel Types for CR6400 Routers

These are the panel types available in CRSC:

CP32-6464      CP6401      CP6464

- The CP6464 is a 2RU panel capable of switching 64 sources to 64 destinations.
- The CP6401 is a 2RU single-destination panel. In CRSC, it has a single “default destination” button in CRSC, but the actual panel has no destination buttons.  
The CP6401 is an artificial panel type. There is no physical CP6401. The CP6401 is a fiction that allows CRSC to configure a (real) CP6464 as a single-destination panel.
- The CP32-6464 is another artificial panel type. The CP32-6464 is a fiction that allows CRSC to configure a CP3232 (2RU) in such a way that it can control the 64 sources and 64 destinations of CR6400 routers in a network.

## IP Addresses in CRSC

### How to Add Routers to a Network

CRSC allows you to have any number of routers on a subnet. Although you can exploit this capability for ease of configuration, you must ensure that your compact router system observes the network limits when it is running.

Routers from the factory are usually all set to the same subnet: 192.168.2.xxx. Routers that are freshly reset to default also use that subnet.

Adding a router to the CR system creates a *new level*. Routers are assigned to a subnet and no more than 8 levels *in any single subnet* are allowed.

If you add too many routers to a subnet, you will have created too many levels. However, CRSC will not let you delete a router you just added because each router must correspond to at least one level. To be able to remove the router, either disconnect the router physically, delete one or more levels (other than those just added), or move the router to another subnet.

Follow these steps to add routers to your network:

- 1 Connect up to 4 routers to your network with unique rotary switch settings in the range 1 to F (hex).

---

Remember to cycle power after you change a rotary switch.

However, if a rotary switch is set to zero (0), and you then power-cycle the router or remote panel module, the device reverts to the factory default state, and loses its previously configured state.

---

- 2 Go to CRSC’s ‘CR Series Ethernet Settings’ page.
- 3 Verify that all routers appear in the list. Click ‘Refresh List’ if necessary.
- 4 For each router, click on the cell in the ‘IP Address’ column to edit the field. Enter a unique IP address.
- 5 Repeat steps 1 through 4 for additional router. Remember that no more than 4 routers can operate to a single subnet.
- 6 Click **Apply Updates** to send the changes to the selected frames. Only those frames with ‘Update’ checked in the table rows are updated. The data are stored in the frames internally.

## How to Add Remote Panel Modules to a Network

Follow these steps to add remote panel modules to your network:

- 1 Connect up to 15 remote panel modules to the network with unique rotary switch settings in the range 1 to F.

---

Remember to cycle power after you change a rotary switch.  
However, if a rotary switch is set to zero (0), and you then power-cycle the router or remote panel module, the device reverts to the factory default state, and loses its previously configured state.

---

- 2 Go to the 'CR Series Ethernet Settings' page.
- 3 Verify that all added remote panel modules appear in the list.
- 4 For each remote panel module, click on the cell in the 'IP Address' column to edit the field. Enter a unique IP address.
- 5 Repeat steps 1 through 4 for additional remote panel modules.
- 6 Click **Apply Updates** to send the changes to the selected frames. Only those frames with 'Update' checked in the table rows are updated. The data are stored in the frames internally.

## Configuring a Router in CRSC

Use the 'Router Levels' page in CRSC to define router levels (i.e., partitions).

You can divide a router into as many as 4 partitions. (Those partitions could overlap if it would suit your system design.)

Every router is at least one level.

There can be as many as 8 levels on any single subnet. To work with the routers on a subnet, you must choose an "active subnet."

### Active Subnet

CRSC detects all subnets for which there are connections in your configuration PC. You can place different CR Series devices on different subnets and use any available subnet you want. Choose the subnet from the 'Active Subnet' drop-down list.:

Active Subnet:  ▼

The page refreshes its lists of levels after you choose a different subnet.

The designation "active" applies only in CRSC itself: it is the subnet you are configuring. In the actual network, all subnets operate independently and concurrently.

### How to Update a Level

- 1 In the 'Setup Crosspoint Ranges for Levels' table, locate the row listing the level you want to change.
- 2 Optionally, in that row, click in the 'Level Number' or 'Level Name' cell to activate the field and enter new values. Level numbers must be unique and in the range 1 to 250. Level names are limited to 16 characters.

- 3 Define the physical start and end numbers for the level. These numbers identify physical connections on the router. The numbers you enter will of course depend on what you want to do with the router.

The default level for the router covers the entire span of inputs and outputs. For example, the default values for a 64×64 router are

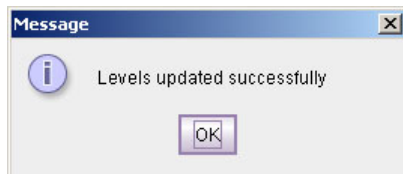
input start = 1, input end = 64,  
output start = 1, output end = 64.

- 4 If you have remote panel(s) in your system, you might need to specify 'Controller Input Start' and 'Controller Destination Start' values for the level.

Click a field to enter a value in the field.

(The controller end values are derived from the controller start fields and the physical start and end fields. Therefore, you cannot enter controller end values.)

- 5 When you have finished changing level data, click **Update Router Levels** to send the level configuration data to the applicable routers. You should see a confirmation message:

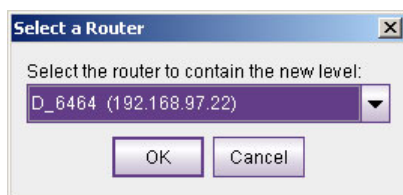


Note that the 'Update Router Levels' button updates only the levels that were changed. Other levels remain unaffected. .

## How to Add a Level

- 1 Go to the 'Configure Router Levels' page.
- 2 Optionally, select the subnet on which you want to add routers levels.
- 3 Click the **Add Level . . .** button.

If your subnet has more than one router, a dialog appears:



Choose a router from the drop-down list and click OK. (The routers you choose are those that exist in the selected subnet.)

If your subnet has no routers, you will receive a message stating that CR6400 cannot create levels where there are no routers.

If your subnet has more than 8 levels, you will receive a message stating that a subnet cannot have more than 8 levels.

- 4 If there were no failures in step 3, CR6400 creates a new level, with a new (unique) level number for the router you chose.  
If your subnet has only a single router, CR6400 simply adds a level identical to the existing level.

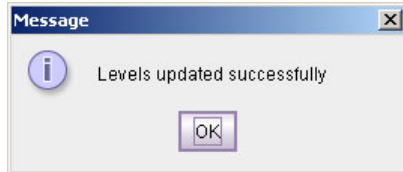


If your subnet has more than one router, CR6400 adds a default level for the router you chose in the dialog of step 3.

You can now edit the parameters for this level. (See [How to Update a Level](#) on page 29.)

5 Repeat steps 2–4 for additional levels.

When you have finished adding levels, click **Update Router Levels** to send the level configuration data to the routers. You should see a confirmation message:



Note that adding a level creates an additional level for one of the routers that already exists on the subnet. You cannot create levels that do not correspond to a router.

This is especially useful when you are planning to use an AES router to switch multiple AES levels.

## Configuring a Panel in CRSC

- 1 Go to the 'Remote Panels' page of CRSC.
- 2 Select a Remote Panel Module

At the bottom of the page, in the 'Network Frame Summary' is a 'Remote Panels' tab:

Remote Panels					
Levels					
All CR Frames					
Edit/Update	Name	Frame Type	Panel Type	IP Address	Identify CP
<input checked="" type="radio"/>	D_RP32	RP32	CP3232	192.168.97.21	Identify CP
<input type="radio"/>	D_RP16	RP16	CP1616	192.168.97.20	Identify CP

### Remote Panels Tab

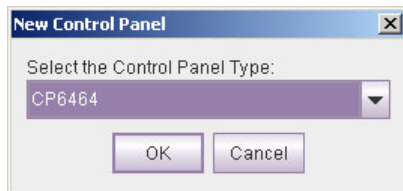
Click the radio button in the row of the remote panel module that you want to configure.

- 3 Specify the panel type that is assigned to this remote panel module.

If the panel type is undefined, click in the 'Panel Type' field of the selected row. A drop-down list of panel types appears. Choose a panel type from that list.

If the panel type has already been defined, and you want to change it (and the configuration assigned to the remote panel module) click the 'New' button at the bottom of the page.

In either case, CRSC will present a dialog in which you can choose a panel type:



The panel types that are listed in the dialog depend entirely on what actual panel CRSC believes is mounted on the remote panel module. (You might need to click the 'Refresh

Summary' button at the bottom of the page to bring CRSC and the actual hardware into sync.)

Among the various panel types, these are the panel types related to CR6400 routers:

CP32-6464      CP6401      CP6464

You will be able to choose CP32-6464 only if a CP3232 is mounted on the remote panel module (or if no panel is mounted.)

You will be able to choose CP6401 or CP6464 only if a CP6464 is mounted on the remote panel module.

- 4 Select a panel mode: (1) standard, (2) enhanced with hold, or (3) enhanced without hold. The button functions differ subtly depending on the mode. See [Remote Panel Modes](#) on page 26.

▲ The differences between the modes are difficult to understand until you see the panels in operation in the different modes. We recommend that you spend some time experimenting.

- 5 Select a paging method.

The functions you assign to buttons for the panel configuration depend on the how the button pages will be switched during operation.

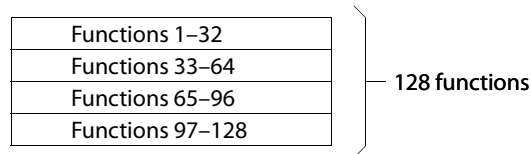
You can assign paging functions only to the 10 configurable buttons at the right side of the panel.

There are several paging button types:

<b>For the CP32-6464</b>	<b>For the CP6464</b>
Display Page 1	Display Page 1
Display Page 2	Display Page 2
Toggle Page 1 and Page 2	Toggle Page 1 and Page 2
	Display Sources
	Display Destinations
	Toggle Sources/Destinations

(The CP6401 does not have, or need, paging.)

Either panel — the CP32-6464 or CP6464 — has an array of 64 function buttons at the left and 12 function buttons at the right. This array of 64 buttons represents 128 functions, which are divided into 4 segments:



Paging occurs on the array of 64 buttons; the 12 function buttons at the right are not affected.

The 'Display Page 1' button causes the panel to present

Segments 1 and 3	Functions 1–32	On the top 32 buttons
	Functions 65–96	On the bottom 32 buttons

and the 'Display Page 2' button causes the panel to present

Segments 2 and 4	Functions 33–64	On the top 32 buttons
	Functions 97–128	On the bottom 32 buttons

The 'Display Sources' button (CP6464 only) causes the panel to present

Segments 1 and 2	Functions 1–64	On the 64 buttons
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and the 'Display Destinations' button (CP6464 only) causes the panel to present

Segments 3 and 4	Functions 65–128	On the 64 buttons
------------------	------------------	-------------------

The default button mnemonics for the 'Display Sources' and 'Display Destinations' buttons are 'SHOW SRC' and 'SHOW DST'.

When you click on any paging button in the configuration page, CRSC changes the graphic to display the button page represented by the paging button you clicked.

The terms 'Display Sources' and 'Display Destinations' denote that destination buttons are not permitted on the page of source buttons and source buttons are not permitted on the page of destination buttons. (The 'Display Page 1' and 'Display Page 2' buttons do not have this restriction.)

If, while you are editing a CP6464, you click 'Show SRC' and the source page is visible and attempt to change a source button to a destination button, CRSC gives an error message:



Level buttons and salvo buttons are permitted anywhere.

(The mnemonics apply only in the 'Remote Panels' page. Actual panels require you to fabricate appropriate clear plastic button legends if their buttons are to have legends.)

## 6 Define button functions

It can take a certain amount of planning — away from CRSC and the CR6400 — to know what you want your panel(s) to do, especially if you have a complex system.

Any configurable button on any remote panel can be configured to perform one of several functions:

- [Defining Destination Buttons](#)
- [Defining Level Buttons](#)
- [Defining Salvo Buttons](#)
- [Defining Source Buttons](#)

Buttons that you do not define remain undefined (called "unused" in the drop-down list for button types) and remain unlit (dark) when the panel is in use.

The buttons in the graphic image of the configuration page correspond in number and position to the buttons of the actual control panel. (The CP6401 is an exception: the graphic has a button for the configured destination, but the panel has no such button.)

The 'Destination Lock' and 'Panel Lock' buttons (both red in the panel graphic) are not configurable for any panel.

7 Save the remote panel configuration.

Click 'Update Panel' to transfer the remote panel configuration to the selected remote panel module. (The transfer takes about one minute.)

You can also click 'Save to File ...' at the bottom of the page to save a copy of the remote panel configuration to your file system. At any time you can click 'Read from File ...' to retrieve a saved configuration.

- ▲ It is a good idea to save all your remote panel configurations in case your remote panel modules are ever reset to their factory-default state.

## Defining Destination Buttons

To configure a button as a destination button:

- 1 Click on the image of the particular button you want to configure.
- 2 Choose 'Destination' from the 'Button Function' drop-down list. The 'Configure Button's Outputs' table appears. It has 8 rows. Each row can represent a level/output pair.

Level	Output
1) Level 1	1
2) Level 2	1
3) Level 3	1
4) Level 4	1

- 3 Enter (level, output) pairs on rows of the table. Click on 'Level' field to select a level from drop-down list. Click in the 'Output' field to enter an output number manually.

You can use the context menu to edit the destination table.

You can drag-and-drop levels from the 'Levels' table to the destination table.

- 4 Optionally enter a mnemonic in the 'Device Name / Button Label' field.

The purpose of the table is to identify the output ports that compose the destination.

The outputs you specify are *in the range you specified as the "Controller Outputs" in the 'Router Levels' page*. For example, suppose a 32x32 AES router is divided into 4 equal partitions:

Level A = outputs 1–8,

Level B = outputs 9–16,

Level C = outputs 17–24,

Level D = outputs 25–32 where each level's *controller outputs* start counting at 1.

When entering an output on level C, you specify an output in the range 1–8, not 17–24. Output 3 of level C is router output 19 (in this example). You would specify (level C, output 3) in the table and run cable to the router's output BNC numbered 19.

Entries in the 'Level' column are drop-down lists. The drop-down list shows available levels. The number of choices in the list diminishes as you add levels to the destination button's level list. CR6400 does not allow you to represent the same level more than once.

How you organize levels is up to you. It is recommended that you place, as the first entry in the list, the level you want to be considered the primary level. Typically this would be a video level.

---

Special Case:

The CP6401 does not have destination buttons because it is single-destination control panels. (A "default destination" button does, however, appear in the configuration page for a CP6401, just to the left of the **Destination Lock** button.)

To configure the implicit destination of a CP6401, select the button labeled 'DEF DEST' and specify its levels and outputs as you would any ordinary destination.

The default destination does not correspond to any physical button an operator can press.

---

## Defining Level Buttons

A level is a partition within a router. A group of levels the router partitions that can be switched simultaneously by a take performed at a control panel.

To configure a button as a level button:

- 1 Click on the image of the particular button you want to configure.
- 2 Choose 'Level' from the 'Button Function' drop-down list. The 'Level Button Setup' table appears. It has one field: a drop-down list of defined levels. Select a level from the drop-down list.

Select Button Functions

Button Type	Device Name / Button Label	Panel Mode
Level	Level 1	Standard

Level Button Setup

Select a Level: 1) Level 1

- 3 Optionally enter a mnemonic in the 'Device Name / Button Label' field. (Button mnemonics are used only in the 'Remote Panels' page, but they can be helpful.)

A panel requires one level button for every level that is to be controlled at the panel. 'Takes' do not occur on unselected levels. A level cannot be selected unless it is on a button, with one exception: if a panel has *no* level buttons defined, 'takes' and locks occur on *all* levels defined for the destination selected.

## Defining Salvo Buttons

A salvo is a stored sequence of primitive takes. A primitive take routes one router input to one router output, on a designated level (or partition). You can define up to 64 different salvos for a panel and each salvo can execute up to 64 primitive takes, subject to a total of 1024 primitive takes. (That could mean, for example, 16 salvos of 64 takes or 64 salvos of 16 takes, or any other combination.)

To configure a button as a salvo button:

- 1 Click on the image of the particular button you want to configure.
- 2 Choose 'Salvo' from the 'Button Function' drop-down list. The 'Configure Salvo Buttons' table appears. It shows the sequence of takes. The salvo (one of 64) is identified by number at the left.

Select Button Functions

Button Function: Salvo | Device Name / Button Label: Salvo 3 | Panel Mode: Standard

Configure Salvo Buttons

Salvo ID: 3

Level	Input	Output
1) HD	1	1
2) AES12	1	1
3) AES34	1	1
4) MC	1	1

Buttons: Clear Table, Delete Row

- 3 Choose the salvo you want to assign to the salvo button in the 'Salvo' drop-down list at the left. (Salvos are numbered from 1 to 64.)
- 4 Enter simple take data in each row of the table until you have completed the salvo. (A salvo can include up to 64 primitive takes.)

A primitive take entry consists of a level specification in the 'Level' column, a router input in the 'Input' column and a router output in the 'Output' column.

You can drag-and-drop levels from the 'Levels' table to the destination table.

You can right-click the salvo table to get a context menu to build a salvo more quickly. The context menu applies to the column in which you have selected a field. Be careful to select one or more fields before you right-click a column. See the *CRSC User's Guide* for information.

The input and output numbers are "controller" numbers, not physical I/O numbers. Controller numbers are relative to the partition (level) chosen for the take.

*A zero value in any of the fields renders the take a no-op.*

- 5 Optionally enter a mnemonic in the 'Device Name / Button Label' field.

Salvos execute in the remote panel module. Salvos cannot contain loops. It is indeterminate what happens when salvos in more than one remote panel module execute simultaneously.

## Defining Source Buttons

To configure a button as a source button:

- 1 Click on the image of the particular button you want to configure.
- 2 Choose 'Source' from the 'Button Function' drop-down list. The 'Configure Button's Inputs' table appears. It has 8 rows. Each row can represent a level/input pair.

Select Button Functions

Button Type: Source | Device Name / Button Label: SRC 1 | Panel Mode: Standard

Configure Button's Inputs

Level	Input
1) Level 1	1
2) Level 2	1
3) Level 3	1
4) Level 4	1

Buttons: Set In All, Sort Table, Clear Table, Delete Row

- 3 Enter (level, input) pairs on rows of the table. Click on 'Level' field to select a level from drop-down list. Click in the 'Input' field to enter an input number manually.

You can use the context menu to edit the destination table.

You can drag-and-drop levels from the 'Levels' table to the destination table.

- 4 Optionally enter a mnemonic in the 'Device Name / Button Label' field.

The purpose of the table is to identify the input ports that compose the source.

The inputs you specify are *in the range you specified as the "Controller Inputs"* in the 'Router Levels' page. For example, suppose a 32x32 AES router is divided into 4 equal partitions:

Level A = inputs 1–8,

Level B = inputs 9–16,

Level C = inputs 17–24,

Level D = inputs 25–32 where each level starts counting at output 1.

When entering an input on level C, you specify an input in the range 1–8, not 17–24. Input 3 of level C is router input 19 (in this example). You would specify (level C, input 3) in the table and run cable to the router's input BNC numbered 19.

Entries in the 'Level' column are drop-down lists and list available levels. The number of choices diminishes as you add levels to the source button's level list. CR6400 does not allow you to represent the same level more than once.

How you organize levels is up to you. It is recommended that you place, as the first entry in the list, the level you want to be considered the primary level. Typically this would be a video level.

## Unused Button Type

A fifth entry appears in the 'Button Type' drop-down list—*unused*. Buttons that you designate "unused" perform no function (and remain unlit on the panel).

## Shortcuts

There are several shortcuts in CRSC's 'Remote Panels' page that make configuring remote panels quick and easy. Please refer to the *CRSC User's Guide*.

## NV9000 Networks

### Routers

For CR Series routers, you must specify an IP address, in CRSC, that is appropriate for use in the NV9000 control system. Subsequently you will define an entry for that router, in NV9000-SE Utilities, that has that same IP address and that uses 'NV Compact Router' protocol. You will also specify, in NV9000-SE Utilities, the router's physical level(s), in much the same way as you would in CRSC.

In NV9000-SE Utilities, router I/Os must be defined (and grouped into "devices"). Considering all the routers in the entire NV9000 system, this is a fairly complex task. Defining router I/Os in NV9000-SE Utilities is different from defining router I/Os in CRSC.

After specifying the router's IP address, you must connect it into the NV9000 system's Ethernet network. This might require removing the router from the subnet on which you used it in CRSC.

### Panels

If CR Series control panels are to be used in an NV9000 system, you must set up, in CRSC, one or more remote panel modules for NV9000 operation. (Do this in the 'NV9000 Remote Panel Settings' page. Please refer to the *CRSC User's Guide* for details.)

There is an option in the 'NV9000 Remote Panel Settings' page *not* to use DHCP for panel discovery, instead giving the panel a static IP address. (That is not recommended because DHCP is NV9000-SE Utilities' normal method of identifying panels.)

In NV9000-SE Utilities, create panel configurations for your remote panel modules, specifying either NVRP16 or NVRP32 as the panel type. Your remote panels are then configurable according to the methods and constructs of NV9000-SE Utilities. The configurations of remote panels created in NV9000-SE Utilities have only a slight resemblance to panels configured in CRSC.

In NV9000-SE Utilities, all panels require *unique* panel IDs. Be careful about defining panel IDs.

When you create, or change, a panel configuration, eventually you will write the entire NV9000 configuration to the system controller. You can use the 'Dynamic Update' button in NV9000-SE Utilities to save time if all you have to update are panel changes.

### How to Convert a Remote Panel Module

- 1 Go to the 'NV9000 Remote Panel Settings' page.
- 2 In the 'Remote Panel' tab, click the radio button on the row listing the remote panel module you want to convert.
- 3 Either *check* the 'Enable NV9000 Mode' check box to convert the remote panel module.  
Or *uncheck* the 'Enable NV9000 Mode' check box to revert the remote panel module to use in a CRSC network.



- 4 If you have enabled NV9000 mode, enter a panel ID in the 'NV9000 Panel ID' field.  
The panel ID must be a number unique within the NV9000 configuration. It must contain no special characters, spaces, or punctuation marks.  
By default, the panel ID is composed of the last two octets of the module's current IP address. For example, if its IP address is 192.168.97.21, then the default panel ID is 97021.
- 5 If you have enabled NV9000 mode, check the 'Use DHCP to acquire IP Address' check box if you want the NV9000 system to use DHCP to determine the remote panel module's IP address. Otherwise, the panel's IP address will be fixed in the NV9000 system and will retain its present IP address.  
Using DHCP is strongly recommended.
- 6 Click **Update Remote Panel** to complete the conversion.



# 5 Stand-Alone Operation

Chapter 5 provides operating instructions for the CR6400 routers and the CP6464 control panel in a stand-alone system.

## Topics

<a href="#">Summary</a> .....	41
<a href="#">Stand-Alone Router</a> .....	42
<a href="#">Stand-Alone Network</a> .....	45

## Summary

There are 3 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).
- In a CRSC network of mixed router and panel types (with remote panel modules).

This section is about *stand-alone operation*. Please refer to Chapter 6, [CRSC Network Operation](#), on page 49, for information about using CRSC networks.

## Terminology

It is essential for understanding 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. However, 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 even when it is not 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 a port that receives a signal.

An output port, or just **output**, is a port that sends a signal.

### For a Single Stand-Alone Router

- 1 A **source** is a one input at the rear of the CR6400 router.
- 2 A **destination** is one output at the rear of the CR6400 router.

A CR6400 router has a 64×64 switching matrix and thus supports up to 64 inputs and 64 outputs.

#### For a Stand-Alone Router Network

1 A **destination** is set of  $N$  outputs on the CR6400s 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)

2 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.)

3 If the operator routes source  $J$  to 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 CR6400 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 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.

For a single stand-alone CR6400, level selection is disabled, although a level button might be illuminated.

## Takes

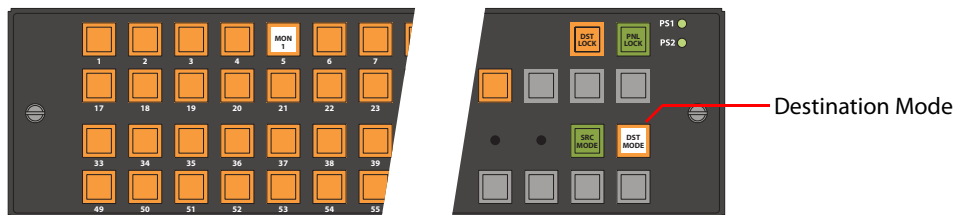
There are 4 very simple steps to perform a take (using a CP6464 panel):

- 1 Press the destination mode button. (The selection buttons turn amber, representing destinations.)
- 2 Press one of the 64 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 64 selection buttons to select a source. The source's button goes high-tally. The take is complete.

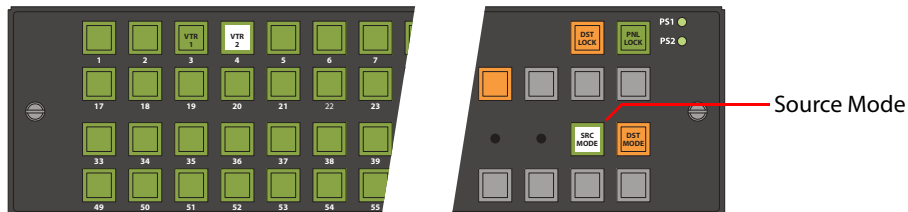
## Example

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.

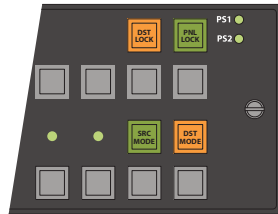
The panel remains in source mode until you again press 'Destination Mode'. If you forget the destination to which you made the route, the destination will be high-tally when you press 'Destination Mode'.

- ▲ 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

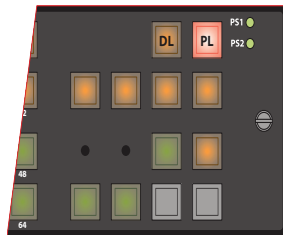
The CP6464 has 12 function buttons. Two of the function buttons are locks:

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.



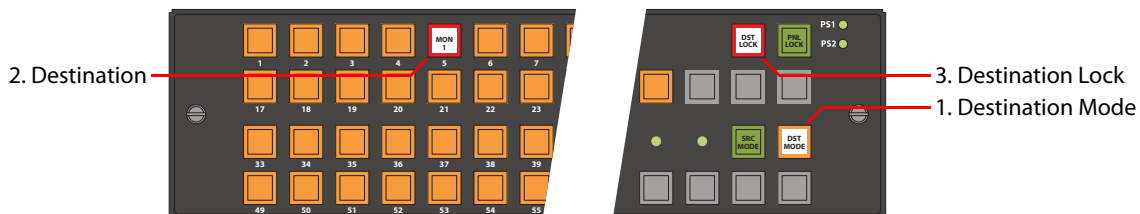
When the control panel is locked, the lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The panel lock button is low tally green when the control panel is not locked.

### 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 Network

A stand-alone network includes 1–4 CR6400 routers, one CP6464 panel, and an Ethernet switch. (Automation is possible, but this document does not address automation.)

### 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

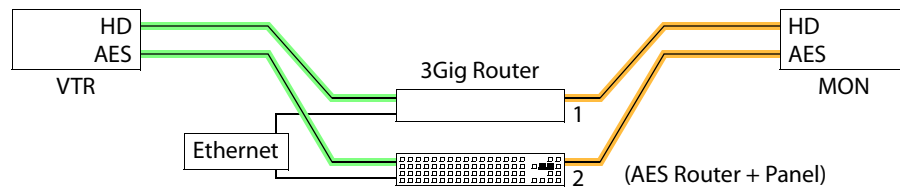
A video or audio device typically receives or transmits signals of several types. A VTR might handle HD, SD, AES, and machine control signals that need to be switched simultaneously. The different signal types are considered "levels" in a router network.

In a stand-alone CR6400 network, multiple levels can be taken to a destination simultaneously (in a single button press).

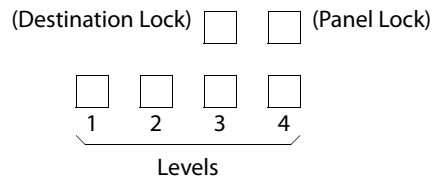
In a stand-alone CR6400 network, multiple levels of a destination can be locked simultaneously (again, in a single button press).

### 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.



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.

- ▲ If the rotary switch setting of a router is not in the range [1–4] then its level cannot be controlled by the level buttons.

### 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.

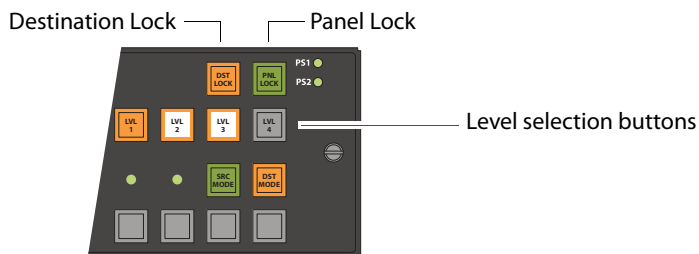


## Locks

Performing locks in a network is almost the same as performing locks for a stand-alone CR6400. 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!
- Locks can be released using CRSC.

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*.

## Stand-Alone Operation

### Stand-Alone Network

- ▲ 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.

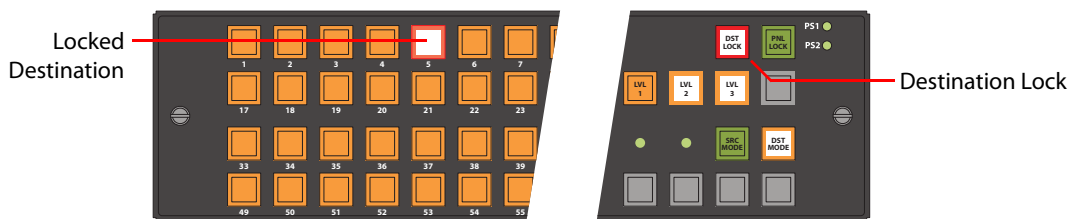
To lock a destination,

- 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 (1) clear the lock on the locked levels you have selected and (2) set the lock on unlocked levels you have selected.

# 6 CRSC Network Operation

Chapter 6 provides operating instructions for control panels under a CRSC network (a network of routers and remote panels of mixed type).

## Topics

<a href="#">Summary</a> .....	49
<a href="#">Control Panel Buttons</a> .....	50
<a href="#">Power Up and Reset</a> .....	55
<a href="#">Performing Takes</a> .....	59
<a href="#">Performing Locks</a> .....	68
<a href="#">Executing Salvos</a> .....	70
<a href="#">Performing Level Selection</a> .....	70

## Summary

A CRSC network can include a mix of different CR Series routers, panels, and remote panel modules, in which the routers and remote panel modules have been configured in CRSC.

Among the devices in a CRSC network can be CR6400 family routers and CP6464 panels. In addition, a CRSC network can include two artificial panel types — the CP32-6464 and CP6401 — panels that can control the 64×64 matrices of CR6400 routers.

The CP32-6464 “type” is really just a configuration option for an actual CP3232; similarly, the CP6401 “type” is just a configuration option for an actual CP6464.

Although a CRSC network can contain many panel types, we focus here on those 3 panels: the CP32-6464, CP6401, and CP6464. These panels are the ones that can control CR6400 routers.

Please refer to the *CRSC User's Guide* for information regarding other routers and panels.

## Terminology

- ▲ Please be aware that the definitions applicable to CRSC network operation often differ from those applicable to stand-alone networks.

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. However, 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 real devices.)

A **port** is a single I/O connection 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.

A **source** is a set of inputs from among all the inputs of all the routers in the network. In a CRSC network, there is no constraint on which inputs may compose the source.

A **destination** is a set of outputs from among all the outputs of all the routers in the network. In a CRSC network, there is no constraint on which outputs may compose the destination.

(The inputs belonging to a source are presumably related and connected to a source device, such as a camera. The outputs belonging to a destination are presumably related and connected to a destination device, such as a monitor.)

The inputs of sources and the outputs of destinations collectively form **levels**. For example, a VTR might send and receive HD, AES, and analog audio. Three routers could carry these three signal types, each router itself being considered a level.

A router could also be divided into two partitions, each half the size of the router. That way the router could carry two levels.

Levels in CRSC are numbered. Level numbers must be in the range [1–250]. A CRSC network supports up to 8 defined levels in total. Each router may be partitioned into a maximum of 4 levels, subject to the limit of 8 levels for the network.

It is important for persons operating control panels to understand these concepts.

## Panel Operation

Operating a control panel is usually quite simple, but can also be quite confusing if you do not understand the way the panels work in their particular modes. The basic operations are the same for all panels with some minor exceptions:

- The CP3201 and CP6401 are slightly different because they are single-destination panels having “default” destinations.
- The panels that can control the 64×64 matrices of CR6400 routers (the CP32-6464, CP6401, and CP6464) are different from others because they can have “paging” buttons.

This chapter briefly describes how to use the control panel to perform the following tasks:

- Perform ‘takes’ (normal and breakaway). See [Performing Takes](#) on page 59.
- Lock or unlock destination or control panels. See [Performing Locks](#) on page 68.
- Execute salvos. See [Executing Salvos](#) on page 70.
- Select levels. See [Performing Level Selection](#) on page 70.

Although operations are usually straightforward, the meaning of the operations differ according to panel mode. See [Remote Panel Operating Modes](#) on page 112.

Before using a panel, it is recommended that you become familiar with how its buttons are grouped and what different button illuminations denote, as described in [Control Panel Buttons](#), following.

## Control Panel Buttons

Most CR Series control panels were designed before the existence of CRSC. Their button layouts (and button colors) are appropriate to what has been called “default” mode (and what this document calls “stand-alone” mode) where green buttons are grouped together and labeled “Source” and amber buttons are grouped together and labeled “Dest.” *The fixed coloring of the early panels has little meaning in a CRSC network.*

On these early panels, the labels "Source" and "Dest" at the left *have no meaning*. Operators must ignore these colors and these labels.

The newer CP6464, a 64x64 panel, does not suffer from the fixed coloring of the earlier panels. Any button can be green or amber (or red), depending on its function. For the CP6464, source buttons are in fact green and destination buttons are in fact amber, regardless of their position on the panel.

The color red indicates one of several conditions. See [Red Buttons](#), following. A button that is unlit is either (1) undefined or (2) momentarily turned off.

Figures 6-1, 6-2, and 6-3 show the CP6464, CP6401, and CP32-6464 respectively:



Fig. 6-1: CP6464



Fig. 6-2: CP6401



Fig. 6-3: CP32-6464

There are two fixed-function buttons on all control panels at the top right, as shown in Figures 6-1, 6-2, and 6-3. The two fixed-function buttons are locks:

- Panel Lock (the rightmost button). Prevents accidental changes on the entire panel.
- Destination Lock. A locked destination is one to which a source may *not* be routed. This prevents the route(s) to the destination from being changed. When the lock is released, the destination's content can be changed.

## Button Types

For most panels, all buttons *except* the lock buttons are configurable as:

- Level selection buttons.
- Source buttons.
- Destination buttons.
- Salvo buttons.

The panels that can control the 64×64 matrices of CR6400 routers (CP32-6464, CP6401, and CP6464) also have what are called *paging buttons* — buttons that control (1) whether sources or destinations are presented on the panel or (2) which set of sources and destinations is presented.

The CP6401 does not have destination buttons. They are single-destination panels.

## Panel Modes

Panel modes are applicable to all panels (*except* the CQX panel). Panels can be configured in one of 3 modes:

- Standard
- Enhanced, with hold
- Enhanced, without hold

These modes control level selection in quite different ways. Operators will need to know how levels are managed in the panels they use.

### Standard Mode

*In standard mode, takes are performed on (manually) selected levels only.*

Level selection is persistent and at the discretion of the panel operator. Once the operator makes a level selection, it remains until the operator changes the selection. The current level selection enables some sources and destinations and disables others. The sources and destinations that are enabled depend on which level button has *precedence*. See [Button Order](#), following, for information about precedence.

If no levels are selected, no sources or destinations are enabled. A take cannot occur.

If the panel has no level buttons, all of a destinations' levels are always selected and all destinations are enabled.

Which level button has precedence depends on the order of level buttons on the panel and the order in which the operator presses the level buttons. See [Button Order](#), following.

Standard mode allows breakaway. A breakaway is when you route to some, not all, of a destination's levels. By default, all valid levels are automatically selected when you set up a take. By creating a breakaway, you route only to the levels you have individually selected.

### Enhanced Mode (Hold and No-hold)

*'Takes' are performed on all the levels specified by the destination.*

In enhanced mode, level selection is applicable only to breakaway. Level selection governs the selection of sources for the breakaway. All sources and destinations are always enabled.

Enhanced mode has 2 submodes:

- Hold mode — the level selection persists after the destination button is pressed (initiating a take) and continues indefinitely until the operator changes it. This allows an operator to try different sources. To clear a breakaway, the operator starts a new normal take (non-breakaway) to that destination. See [Normal Takes](#) on page 59.
- No-hold mode — a level selection reverts to the levels defined by the destination after the operator presses a source button (completing a take). To clear a breakaway, either start a new normal take to that destination or press a source without a level selection. See [Normal Takes](#) on page 59.

The choice between hold mode and no-hold mode is meant to accommodate operator or administrator preferences.

## Red Buttons

Depending on context, red means:

- Lock. (The panel is locked or a destination is locked.)
- Breakaway. (Applicable to all panels *except* the CQX panel.)
- Occasionally, red can also indicate an unintentional breakaway that occurs as result of an improper configuration.

## Button Order

The order in which buttons appear on a control panel affects the meaning of level buttons. Buttons other than level buttons are not affected by button order.

## Spatial Ordering

(This means the organization of the buttons on the panel.)

Buttons on a control panel are numbered from left to right, and then from top to bottom. This is the ordering for the 2RU panels:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	(65)	(66)	67	68
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	69	70	71	72
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	(73)	(74)	75	76
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	77	78	79	80

(Some button numbers do not correspond to an actual button.)

The button order affects the meaning of level buttons in standard mode: level buttons with lower numbers have *precedence* over level buttons with higher numbers.

*In standard mode, precedence governs which sources and destinations are enabled for selection when level buttons are pressed.*

Briefly stated, on any button row, level buttons to the left have higher precedence than buttons to the right. All buttons on an upper row have higher precedence than any button on rows below that row.

See [Performing Level Selection](#) on page 70.

## Temporal Ordering

(This means the order in which you press buttons.)

In standard mode, the order in which you press level buttons affects the outcome of your operation. However, after a level selection, the order in which the buttons were pressed is no longer evident. Any set of selected levels can therefore represent a number of different sets of sources and destinations.

(In enhanced mode, the button pressing order is irrelevant.)

See [Performing Level Selection](#) on page 70.

## Button Illumination

Button illumination is applicable to all panels. To discuss button lighting, there are some terms that are helpful when discussing button states:

Current destination	The destination that is currently selected.
Routed source	A source that matches or partially matches what is routed to the current destination.
Primary level	The first configured level for the destination button.
Primary source	The routed source on the primary level.

Figure 6-4 illustrates the terms:

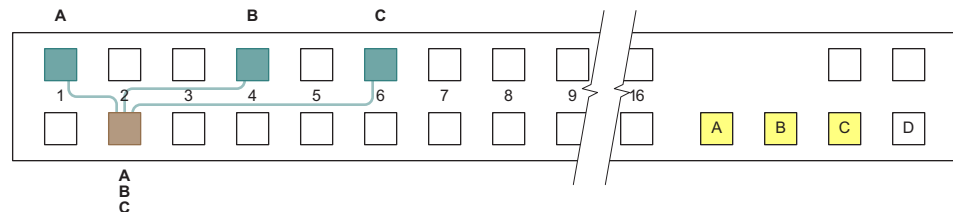


Fig. 6-4: Buttons on a Panel

In this illustration, blue buttons are **routed sources**. The brown button is the **current destination**. Yellow buttons are selected levels. Buttons without any specific color are unselected.

In this example, the destination uses levels A, B, and C. Level A is the **primary level** because it is the first. Source 1 is the **primary source** because it routes level A (indicated by the letter A over the source button).

(The example uses blue, brown, and yellow buttons for the purpose of discussion. Real control panels have green, amber, and red buttons.)

## Source Button Colors

In a normal (non-breakaway) take, the (single) source button selected is always high-tally green (or possibly amber, on a CP32-6464).

In a breakaway in enhanced mode, the primary source is high-tally green (or possibly amber, on a CP32-6464). Non-primary sources taken are high-tally red.

In a breakaway in standard mode, all taken sources are high-tally green (or possibly amber, on a CP32-6464).



### Destination Button Colors

The current destination is high-tally amber (or possibly green, on a CP32-6464). All other destinations are unselected and low-tally.

However, if the destination on a button is locked, the button is red, high-tally if selected, and low-tally if not.

### Level Button Illumination

#### Enhanced Mode

- A level button is high-tally (green or amber) if it is selected and represents the primary level.
- A level button is low-tally (green or amber) if it is not selected and represents the primary level.
- A level button will be red (in a breakaway only) if it does **not** represent the primary level. If the level button is selected, it is high-tally. Otherwise it is low-tally.
- A level button is **off** if the current destination does not include this level.

#### Standard Mode

- A level button is high-tally (green or amber) if the level is selected.
- A level button is low-tally (green or amber) if the level is not selected.

## Power Up and Reset

Operators generally do not need to bother about startup— unless there is a power outage.

At power-up, and at every *reset*, a control panel's 'Panel Lock' button is on and red. An operator must turn the panel lock off before the panel can be used. At power-up, a remote panel (module) "discovers" the state of the routers in the network and illuminates its buttons to reflect the routes and levels that were selected prior to power-up (reset). It can take up to 60 seconds to finish the discovery. The operator can actually start using the panel before the discovery completes.

### Routers at Power-Up

At power-up, a router loads stored program code into its internal FPGA and restores its previous operational state. (Its "state" includes the name, crosspoint map, levels, 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. Its entire state and all configuration data are lost and will need to be reconfigured.

---

At power-up, the router detects the presence or absence of a video reference signal.

## Remote Panel Modules at Power-Up

At power-up, a remote panel module also loads stored program code into its internal FPGA and restores its previous operational state. (Its “state” includes all the button definitions and its own panel mode.)

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If a remote panel module’s rotary switch is set to the 0 position, the remote panel module reverts to the *factory default state*, not its previous state. Its entire state and all configuration data are lost and will need to be reconfigured.

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## Choosing a Button Page

To operate a CP6464 or CP32-6464 control, it is essential to know how to switch between button pages. These two panel provide several different “paging” buttons:

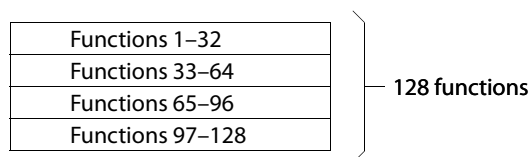
For the CP32-6464	For the CP6464
Display Page 1	Display Page 1
Display Page 2	Display Page 2
Toggle Page 1 and Page 2	Toggle Page 1 and Page 2
	Display Sources
	Display Destinations
	Toggle Sources/Destinations

(The CP6401 does not have, or need, paging.)

- ▲ The buttons of your control panel might or might not have button legends or button graphics. The legends or graphics might or might not be related to the names of the buttons we list here.

### What Paging Is

Either panel—the CP32-6464 or CP6464—has an array of 64 function buttons at the left and 12 function buttons at the right. This array of 64 buttons represents 128 functions, which are divided into 4 segments:



Paging occurs on the array of 64 buttons; the 12 function buttons at the right are not affected.

The ‘Display Page 1’ button causes the panel to present

Segments 1 and 3	Functions 1-32	On the top 32 buttons
	Functions 65-96	On the bottom 32 buttons

and the ‘Display Page 2’ button causes the panel to present

Segments 2 and 4	Functions 33-64	On the top 32 buttons
	Functions 97-128	On the bottom 32 buttons

The ‘Display Sources’ button (CP6464 only) causes the panel to present

Segments 1 and 2	Functions 1-64	On the 64 buttons
------------------	----------------	-------------------

and the ‘Display Destinations’ button (CP6464 only) causes the panel to present

Segments 3 and 4	Functions 65-128	On the 64 buttons
------------------	------------------	-------------------

The terms 'Display Sources' and 'Display Destinations' denote that destination buttons are not permitted on the page of source buttons and source buttons are not permitted on the page of destination buttons. The 'Display Page 1' and 'Display Page 2' buttons do not have this restriction.

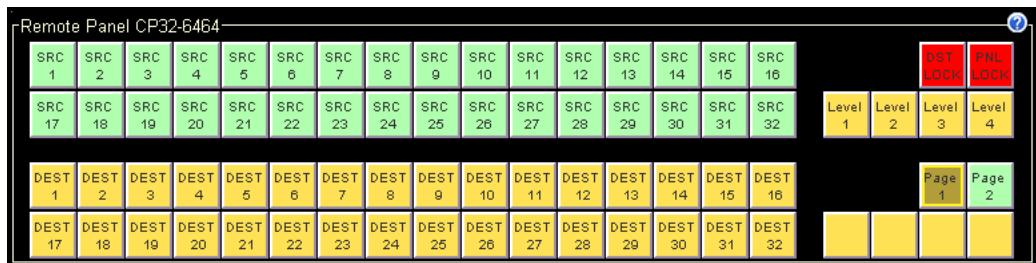
Level buttons and salvo buttons are permitted anywhere.

### Paging Button Types

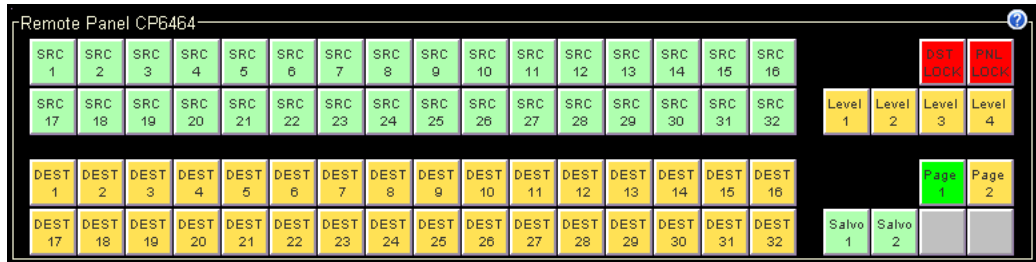
- Display Page 1

This button causes functions 1–32 and 65–96 to appear on the 64-button array.

For the CP32-6464, this is a typical result (as represented by the configuration page which shows the button functions):



For the CP6464, this is a typical result:



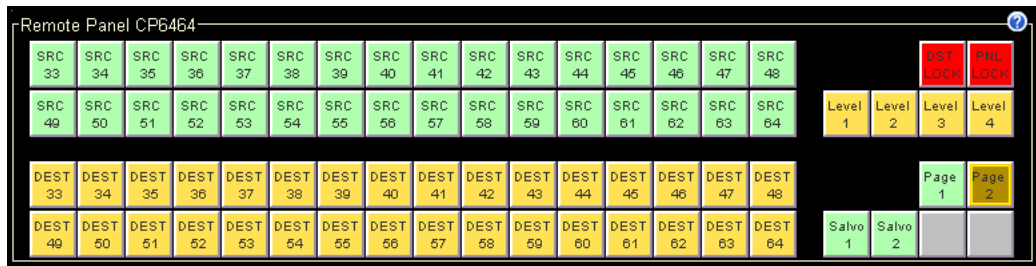
- Display Page 2

This button causes functions 1–32 and 65–96 to appear on the 64-button array.

For the CP32-6464, this is a typical result:



For the CP6464, this is a typical result:



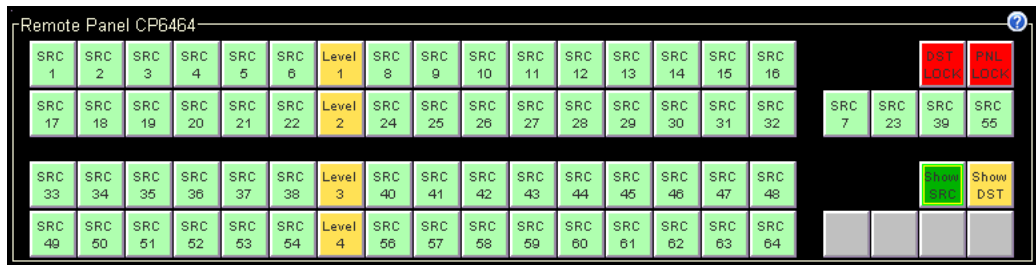
- Toggle Page 1 and Page 2

This toggle button switches the panel between the effects of the 'Display Page 1' and 'Display Page 2' buttons.

- Display Sources

This button applies only to the CP6464. It causes functions 1–64 to appear on the 64-button array. In typical configurations, most of these are source buttons (green).

This is a possible result (here showing the buttons as represented in the configuration page where the button functions are given):



- Display Destinations

This button applies only to the CP6464. It causes functions 65–128 to appear on the 64-button array. In typical configurations, most of these are destination buttons (amber).

This is a possible result:



- Toggle Sources and Destinations

This toggle button switches the panel between the effects of the 'Display Sources' and 'Display Destinations' buttons.

## Performing Takes

A take is the switching of a signal from a source to a destination. 'Takes' are performed using the control panel; pressing buttons that have been configured to represent specific sources or destinations. Sources may only be taken to destinations on the same level.

For the CR6400 family routers and panels, there are 3 types of 'takes':

- Normal 'takes' have no breakaway; the source and destination are on the same level. See [Normal Takes](#) on page 59.
- A *breakaway* take has multiple sources on different levels to a destination. See [Breakaway Takes](#) on page 60.
- *Single-destination* 'takes' apply to the CP6401 which has only a default destination that can neither be selected nor deselected. See [Single-Destination Takes](#) on page 65.

### Normal Takes

By "normal take" we mean a non-breakaway take.

First press a destination button and then a source button. The take occurs immediately. The previous route (for the destination) is lost.

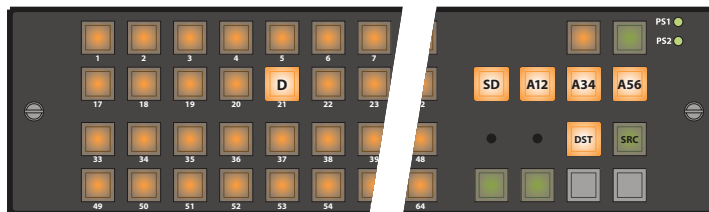
Please note:

- Takes on CP6401s are different. See [Single-Destination Takes](#) on page 65.
- If a destination is locked, the destination button is usually red, high-tally when selected. You cannot perform a take for a destination that is locked. See [Performing Locks](#) on page 68.

### Example — Normal Take in Standard Mode

You want to route source *S* to destination *D*.

- 1 Optionally, select the levels on which you want the take to occur. Potentially, this changes the sources and destinations enabled for the take. See [Level Selection in Standard Mode](#) on page 70. (Selecting levels prior to the destination does not result in breakaway.)
- 2 Switch to the page containing destination *D*. Press destination *D*.



- 3 Switch to the page containing source *S*. Press source *S*.



Pressing another destination button (always) starts a new take.

In standard mode, a normal take occurs on *all selected levels*.

### Example—Normal Take in Enhanced Mode

You want to route source *S* to destination *D*.

- 1 Do **not** press any level buttons. Doing so initiates a breakaway for the previously chosen destination.
- 2 Switch to the page containing destination *D*. Press destination *D*.



- 3 Switch to the page containing source *S*. Press source *S*.



Pressing another destination button (always) starts a new take.

In enhanced mode, a normal take occurs on *all the levels defined for the destination*.

### Breakaway Takes

A *breakaway* takes multiple sources, *on different levels*, to a destination.

To perform a breakaway, first press a destination button. Then alternately press level buttons (one or more) and then a source button, repeating for any levels for which you want to specify a source. The take occurs immediately when you press the source buttons. The previous route (for that destination) is lost (on the levels you selected).

Please note:

- Takes on CP6401s are different. See [Single-Destination Takes](#) on page 65.
- If a destination is locked, the destination button is usually red, high-tally when selected. You cannot perform a take for a destination that is locked. See [Performing Locks](#) on page 68.

### Example—Breakaway in Standard Mode

You want to take SD video from source *S1* to destination *D2*. But you also want to take AES12 from source *S3* and both AES34 and AES56 from source *S4*.

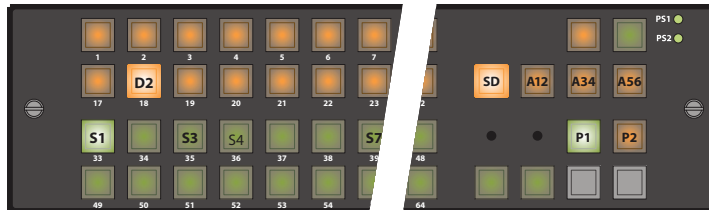
(Assume that these sources and destinations are enabled and remain enabled.)

The level buttons are SD, A12, A34, and A56.

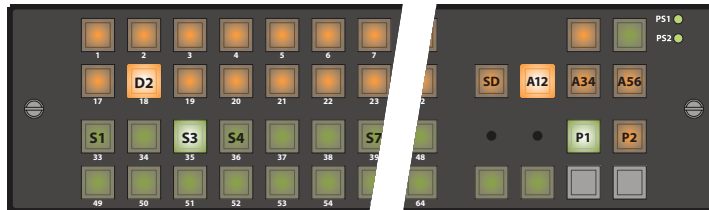
- 1 Switch to the page containing destination *D*. Press destination *D2*. The previous source was source *S7* so it is high-tally.



- 2 Select level SD (only). Press source 1.



- 3 Select level A12 only. Press source *S3*.



- 4 Select levels A34 and A56 only. Press source *S4*.



Double-press any of the level buttons to make visible the source that contributes that level. (You might have to switch pages to see the source.)

You can continue to break sources away, ad infinitum, and you can come back to the destination later and it will still show the breakaway. You could add or remove breakaway sources at that time too.

### Example — Breakaway in Enhanced Mode without Hold — Variant 1

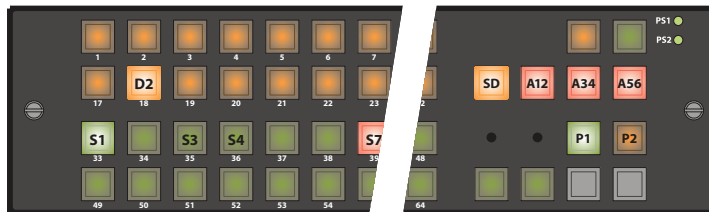
You want to take SD video from source *S1* to destination *D2*. But you also want to take AES12 from source *S3* and both AES34 and AES56 from source *S4*.

The levels defined for the destination are SD, A12, A34, and A56. SD was defined first in the destination description. Therefore it is considered the **primary level**.

- 1 Switch to the page containing destination *D2*. Press destination *D2*. The previous source was source *S7* so it is high-tally.

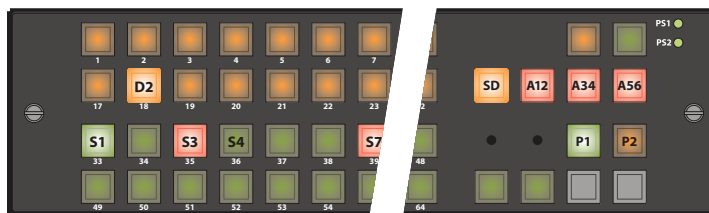


- 2 Select just level SD. Press source *S1*, switching to its page if necessary.



Source *S1* is high-tally because you have taken SD—the primary level—from this source. Source *S7* is red because the other levels still come from source *S7*. (The SD level button is amber because SD is the primary level. The other level buttons are red because they are not primary. All level buttons go high-tally once again, either red or amber.)

- 3 Select just level A12. Press source *S3*.



Source *S3* goes high-tally red because it is not the primary source. All level buttons go high-tally once again.

- 4 Select both A34 and A56 levels. Press source *S4*.



Source *S4* goes high-tally red because, like source 3, it is not the primary source. All level buttons go high-tally once again. Source *S7* goes dim because no other levels come from source *S7*.



Pressing another source button without selecting a level would effect a new *normal* take, undoing the breakaway you had created.

Pressing another destination button (always) starts a new take.

### Example — Breakaway in Enhanced Mode without Hold — Variant 2

You want to take all levels from source *S1* to destination *D2* *except* CTL, which is to come from source *S4*. Destination *D2* is presently connected to source *S6*.

The levels defined for the destination are HD, A12, A34 and CTL. HD was defined first in the destination description. Therefore it is considered the **primary level**.

- 1 Switch to the page containing destination *D2*. Press destination *D2*. The previous source was *S6* so it is high-tally.



- 2 Do not press a level button. Press source *S1*.



Source *S1* goes high tally because it provides all levels including the primary level. (All of the level buttons are amber because all levels belong to the primary source.)

- 3 Press level CTL. Press source *S4*.



Source *S4* goes high-tally red because it is not the primary source. All the level buttons go high-tally. The CTL level button turns red because now CTL is not from the primary source.

The HD, A12, and A34 buttons remain amber because they are from the primary source.

Pressing another source button without selecting a level would effect a new *normal* take, undoing the breakaway you had created.

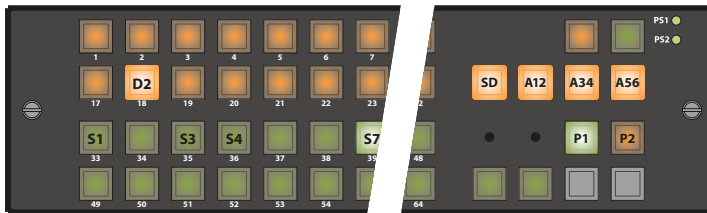
Pressing another destination button (always) starts a new take.

### Example—Breakaway in Enhanced Mode with Hold

You want to take SD video from source *S1* to destination *D2*. But you also want to take AES12 from source *S3* and both AES34 and AES56 from source *S4*. The previous source was *S7*.

The levels defined for the destination are SD, A12, A34, and A56. SD was defined first in the destination description. Therefore it is considered the **primary level**.

- 1 Switch to the page containing destination *D2*. Press destination *D2*. The previous source was source *S7* so it is high-tally.

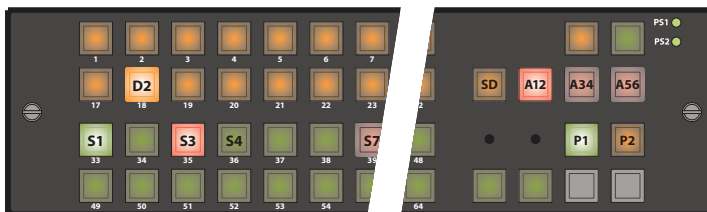


- 2 Select just level SD. Press source *S1*, switching to a different page if necessary.



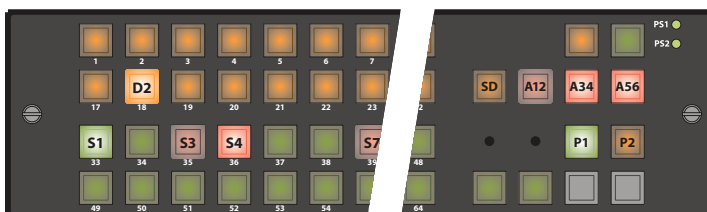
Source *S1* goes high tally because you have taken SD—the primary level—from this source. Source *S7* is red, indicating that the other levels still come from source *S7*. (The SD level button is amber because SD is the primary level. The other level buttons are red because they are not primary. They are low-tally because this is hold mode and, thus far, SD remains the only level selection.)

- 3 Select just level A12. Press source *S3*.



Source *S3* goes high-tally red because it is not the primary source. The level buttons remain unchanged. You could choose another source at this point if you made a mistake.

- 4 Select levels A34 and A56. Press source *S4*.



Source *S4* goes high-tally red because, like source *S3*, it is not the primary source. The level buttons remain unchanged. Again, you could choose another source at this point. Pressing

another source button without selecting another level simply changes the source for that selected level (or levels).

Pressing another destination button (always) starts a new take. If you wish to clear the breakaway for destination *D2*, press destination *D2*, then press a source without selecting any levels.

## Single-Destination Takes

Single-destination takes are slightly different. A CP6401 has only a default destination that can neither be selected nor deselected.

### Example—Normal Take for CP6401

You want to route source *S* to the default destination. Just press source *S*. It is a single button press.

A normal take occurs on all the levels defined for the default destination.

### Example—Breakaway for CP6401 in Standard Mode

You want to take *SD* from source *S1* (to the default destination). But you also want to take *AES12* from source *S3* and both *AES34* and *AES56* from source *S4*.

(Assume that these sources and destinations are enabled and remain enabled.)

The level buttons are *SD*, *A12*, *A34*, and *A56*.

- 1 Select just level *SD*. Press source *S1*.



- 2 Select just level *A12*. Press source *S3*.



- 3 Select levels *A34* and *A56*. Press source *S4*.



If these levels are selected, you can double-press any of the level buttons to make visible the source that contributes that level.

You can continue to break sources away, ad infinitum.  
To clear the breakaway, select all levels and then press a source.

### Example—Breakaway for CP6401 in Enhanced Mode with Hold

You want to take SD from source 1 to the default destination. But you also want to take AES12 from source 3 and both AES34 and AES56 from source 4. The previous source was source 7. The levels defined for the destination are SD, A12, A34, and A56. SD was defined first in the destination description. Therefore it is considered the *primary level*.

This example shows a CP3201:

- 1 Select just level SD. Press source S1.



Source S1 goes high tally because you have taken SD—the primary level—from this source. Source S7 is red indicates that the other levels still come from source S7. (The SD level button is amber because SD is the primary level. The other level buttons are red because they are not primary. They are low-tally because this is hold mode and SD remains the selection.)

- 2 Select just A12. Press source S3.



Source 3 goes high-tally red because it is not the primary source. The level buttons remain unchanged. You could choose another source at this point.

- 3 Select just A34 and A56. Press source S4.



Source S4 goes high-tally red because, like source S3, it is not the primary source. The level buttons remain unchanged. Again, you could choose another source at this point. Pressing another source button without selecting another level simply changes the source for that selected level (or levels).

To clear the breakaway, select all levels for the default destination and then press a source.

### Example—Breakaway Take for CP3201 in Enhanced Mode without Hold

You want to take SD from source *S1* to the default destination. But you also want to take AES12 from source *S3* and both AES34 and AES56 from source *S4*. The previous source was *S7*.

The levels defined for the destination are SD, A12, A34, and A56. SD was defined first in the destination description. Therefore it is considered the **primary level**.

- 1 Select just level SD. Press source *S1*.



Source *S1* is high-tally because you have taken SD—the primary level—from this source. Source *S7* is red because the other levels still come from *S7*. (The SD level button is amber because SD is the primary level. The other levels are red because they are not primary.)

- 2 Select just A12. Press source *S3*.



Source *S3* goes high-tally red because it is not the primary source. All level buttons go high-tally once again.

- 3 Select both A34 and A56. Press source *S4*.



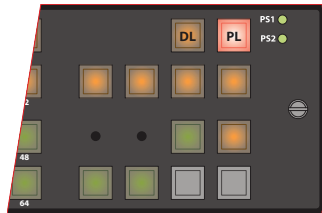
Source *S4* goes high-tally red because, like source *S3*, it is not the primary source. All level buttons go high-tally once again.

Pressing another source button without selecting a level reverts the take to a normal take, clearing the breakaway you performed.

## Performing Locks

### Panel Lock

Pressing a 'Panel Lock' button disables the control panel. Panel locks apply to all control panels, including CQX panels. Only the 'Panel Lock' button remains enabled. Pressing it again re-enables the control panel. Panel locks are available on all panels, including the CQX panel.



When the control panel is locked, the lock button is high tally red and the state of the entire control panel is protected. Changes from the control panel are disabled.

### Destination Locks

When the operator presses a 'Destination Lock' button, the current destination is locked to its source(s). No operator may choose another source for that destination at any panel. Destination locks are available on all panels, including the CQX panel.

A destination lock occurs on all the levels defined for the destination *except those levels that have been deselected*.

A **simple lock** protects a destination on *all levels defined for the destination*.

A **complex lock** protects a destination only on the *levels defined for the destination that are selected*. Sources may still be taken to that destination on other levels.

Unlocking a locked destination can be simple or moderately complex.

You *can* route the source that feeds a locked destination to any number of other destinations:

- A destination lock on a CP3201 or CP6401 is slightly different because such a panel has only a "default destination." See [Single-Destination Locks and Unlocks](#) on page 69.
- You cannot unlock, at a panel, a destination locked by someone else. It is possible to release those locks using CRSC. See [Locks Page](#) on page 99.
- A destination might be locked (at another panel) on levels that you cannot see or control on your panel. If that is the case, you cannot route any source to it.

### Simple Locks

Press a destination, then press 'Destination Lock'.

Under a simple lock, the destination button is:

- High-tally red when it is selected and at least one of the levels on which it is locked is selected.
- High-tally amber when it is selected and none of the levels on which it is locked is selected.
- Dark (in standard mode) when none of its levels are selected. (The destination cannot be selected.)
- Low-tally red when it is not selected.

The 'Destination Lock' button is:

- High-tally red when the destination is selected and at least one of the levels on which it is locked is selected.
- Low-tally amber otherwise.

To undo a simple lock, press the destination and then press 'Destination Lock'.

### **Complex Locks**

Press the button for a destination, then alternately select a level (or levels) and press 'Destination Lock'.

Under a complex lock, the destination button is the same as for a simple lock:

- High-tally red when it is selected and at least one of the levels on which it is locked is selected.
- High-tally amber when it is selected and none of the levels on which it is locked is selected.
- Low-tally red when it is not selected.

The 'Destination Lock' button is the same as for a simple lock.

- High-tally red when the destination is selected and at least one of the levels on which it is locked is selected.
- Low-tally amber otherwise.

To undo a complex lock, select all locked levels, press the destination and then press 'Destination Lock'. The level you select are unlocked if they are locked and locked if they are unlocked.

### **Single-Destination Locks and Unlocks**

Because a CP6401 has only a default destination, locks are different.

#### **Simple Lock—CP6401**

Select all levels and press the destination lock button. The panel's destination is locked on all levels defined for the destination: its current source(s) cannot be changed on any level.

The destination lock button remains red until you press it again to unlock the default destination.

To undo a simple lock, select all levels and then press 'Destination Lock'. You might have to press the lock button twice. That is because the first press might accidentally lock a level you did not know was unlocked.

#### **Complex Lock—CP6401**

Select one or more levels and press the destination lock button. The panel's destination is locked on all selected levels: its current source(s) cannot be changed on any of those levels.

The destination lock button is high-tally red if you have selected any levels and low-tally amber otherwise.

To undo a complex lock, select all levels and then press 'Destination Lock'. You might have to press the lock button twice. That is because the first press might actually lock a level you did not know was unlocked.

To unlock a single locked level, select that level only and then press 'Destination Lock'.

## Executing Salvos

A salvo is a pre-defined list of up to 32 basic ‘takes’. A salvo is assigned to a control panel button. When the operator presses a salvo button, the ‘takes’ defined in the salvo execute in order. Salvos do not loop and must not execute simultaneously. An attempt to run two or more salvos at once will have unpredictable results.

Salvos are available on all panels except the CQX panel.

No instructions are required for pressing a salvo button. However, the configurer should let the operator know at least what the general effect of the salvo is. Meaningful button labels help.

If a level specified in the salvo is not enabled, or if the input or output does not exist, the take(s) on that level do not occur. Salvos with errors take longer to execute because of multiple attempts to perform ‘takes’ and the resulting time-outs. There is no error reporting or warning if a salvo fails at any point.

A salvo button goes high-tally when it is executing and returns to low-tally when the salvo completes. As a rule of thumb, no salvo should require more than a few hundred milliseconds.

## Performing Level Selection

Level buttons enable or disable levels. When a level button is high-tally, the level is enabled. The levels enabled at any particular time are called the *selected levels*. A panel must have a level button for each level it controls. The panel will not switch a source on a level for which there is no level button. The exception to this is that when a panel has no level buttons, all levels defined for the destination are selected. Level selection has no effect on routed signals until you perform a take.

The result of level selection depends on panel mode: standard, enhanced with hold, or enhanced without hold.

### Level Selection in Standard Mode

A level selection affects all ‘takes’ made after the level selection. The levels you select persist until you change them. This is true for normal ‘takes’ and for breakaway.

In most cases, the level buttons are toggles: press the level button to select the level if it is unselected or deselect the level if it is selected. However, there are 2 exceptions:

- When you have selected *all* the levels on the panel, pressing any level button deselects the *other* levels and leaves the one you pressed selected.
- When you have only one level on your panel, pressing the level selection button has no effect. The single level is always selected.

Level selection in standard mode is affected by button order.

Level selection in standard mode enables the selection of some sources and destinations and disables other sources and destinations. The buttons of disabled sources and destinations are turned off (dark).



## Button Order

The ordering of buttons on a panel affects the meaning of level selection under standard mode. We call this *spatial ordering*.

The order in which the operator presses level buttons affects the meaning of level selection under standard mode. We call this *temporal ordering*.

To illustrate, the following examples use a set of 6 sources and 6 destinations. Three of the sources and three of the destinations have AV, AES, and TC levels. The remaining sources and destinations have SD, AES, and TC levels. The four level buttons are AV, AES, TC, and SD.

Button order is important only in standard mode. The examples are for panels in standard mode.

In standard mode, pressing level buttons enables certain sources and destinations and disables other sources and destinations. The button for a disabled source or destination is off. The operator may perform 'takes' only for enabled destinations and sources.

## Spatial Ordering

**Rule 1:** when *all* levels are selected, the sources and destinations that are enabled are those that include the level that is controlled by the level button with the lowest button number. If no levels are selected, no sources and destinations are enabled.

The level on the level button with the lowest button number has *precedence* or priority over other levels.

These examples show the difference between two orderings of level buttons. Figure 6-5 shows level buttons in the order AV, AES, TC, SD:

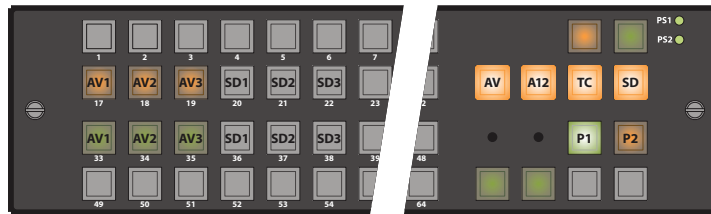


Fig. 6-5: Spatial Ordering AV, AES, TC, SD

Level AV is on the left and has the lowest button number. Because all levels are selected, sources and destinations that include level AV are enabled (low-tally) and other sources and destinations are disabled (buttons turned off).

Figure 6-6 shows level buttons in the reverse order (SD, TC, AES, AV):

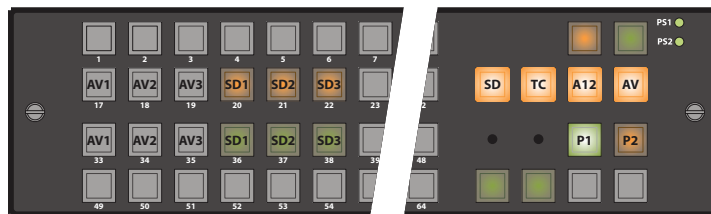


Fig. 6-6: Spatial Ordering SD, TC, AES, AV

Here, level SD is on the left and has the lowest button number. Again, all levels are selected. Sources and destinations that include level SD are now enabled and other sources and destinations are disabled (buttons turned off).

Thus, with one particular level button ordering, AV sources are enabled. With the other ordering, SD sources are enabled.

If a panel's level buttons are distributed across the panel, one should remember the ordering method: (1) buttons in any row have higher precedence than buttons in lower rows and (2) within a row, buttons to the left have higher precedence than any to the right.

Precedence determines — for a panel in standard mode — which source and destination buttons are enabled for selection.

### Temporal Ordering

**Rule 2:** when not all levels are selected, the sources and destinations that are enabled are those that include the level that you select *last*. If no levels are selected, no sources and destinations are enabled.

Figure 6-7 shows level buttons again in the order AV, A12, TC, SD, but this time with level AV unselected:

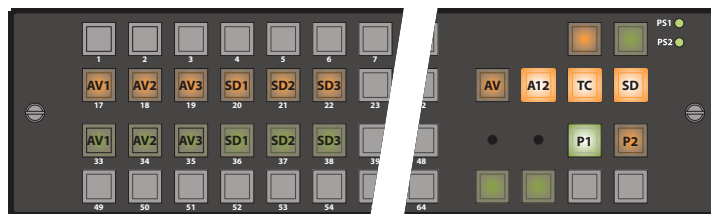


Fig. 6-7: Temporal Ordering AES, TC, SD

Although it is not visually apparent, when the A12 button is pressed last, the sources and destinations that include A12 are enabled.

Figure 6-8 shows the same selected level buttons, but this time level SD was pressed last:

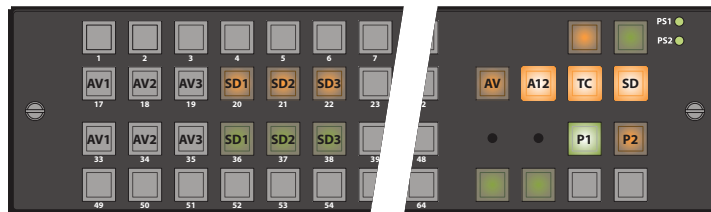


Fig. 6-8: Temporal Ordering AES, TC, SD

The same level buttons were pressed here as in Figure 6-7, but in different order with a very different result. Sources and destinations that include level SD are enabled.

### The Double-Press

To reselect a level, first deselect the level, then select the level. That is, press the level button twice. You can consider this action a “double-press.”

A double-press gives the level *precedence* over other selected levels.

In the example of Figure 6-8, if you double-pressed A12, the result would again be like Figure 6-7.

### Standard Mode Summary

**Rule 1:** when *all* levels are selected, the sources and destinations that are enabled are those that include the level that is controlled by the level button with the lowest button number.

**Rule 2:** when *not all* levels are selected, the sources and destinations that are enabled are those that include the level that you select *last*.

'Takes' occur on all selected levels. Destinations (and sources) are enabled by the level with precedence:

- (Rule 1) precedence given by the lowest level button number.
- (Rule 2) precedence given by the most recently pressed level button.

'Takes' can occur only for enabled destinations and sources.

### Level Selection in Enhanced Mode

In enhanced mode, level buttons do not *enable* or *disable* levels, but *select* levels. What enables and disables the levels is the destination: whatever levels the destination includes are enabled *when you press the destination button* to begin a take. These levels remain enabled during the take. Other levels are disabled and remain disabled during the take.

Enhanced mode has two submodes: hold and no-hold. The submodes affect breakaway. In fact, level selection applies only in breakaway:

- In ***no-hold mode***, the selected levels persist only until you press a breakaway source. Then they revert to the levels of the destination.  
Not pressing a level button before pressing a source results in a normal take from that source. It clears the breakaway condition during the take.
- In ***hold mode***, the selected levels persist until you change the level selection or you press another destination. (This allows the operator to try different sources.)

Clearing a breakaway condition during the take requires more effort in hold mode than in no-hold mode.

Clearing a breakaway *after a take* (perhaps after many intervening 'takes' to other destinations) is as simple as performing a normal take to a destination that has breakaway.

For normal 'takes' in enhanced mode, the levels selected are always exactly those included in the destination's level list.

In enhanced mode, all defined sources and destinations remain enabled without regard to level selection. Button ordering (spatial or temporal) is not a factor in enhanced mode.



# Maintenance

Chapter 7 provides information regarding maintenance.  
This document does not address maintenance of NV9000 equipment.

## Topics

<a href="#">Prevention</a> .....	75
<a href="#">Trouble-Shooting</a> .....	75

## Prevention

The CR6400 routers and the CP6464 require little maintenance.

The CR6400 routers has removable (i.e., replaceable) modules, including a fan module.

The CP6464 has no serviceable parts.

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 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 CR6400 router or CP6464 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 powered on and functioning properly. Verify that the video reference is functioning if you are using a reference.

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.
- The fan LED is red or the reference LED is red.  
(The reference LED is red when there is no video reference supplied. You may choose not to use a video reference. In that case, you can ignore the reference LED.)
- 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 Grass Valley power supplies (part number PS0012-00) 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, you will probably introduce switching transients. Because SMPTE specifies the switch point for HD as NTSC line 4, using a composite reference might cause the switch point to occur at the wrong place in the HD stream. You might see switching transients. (The composite switch point is specified as NTSC line 10.) Embedded audio will have a noticeable discontinuity.

## 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. Please do not think this is a malfunction.

If a router malfunctions, try resetting the router. Set its rotary switch to 0 and cycle power. Doing that restores the router to its factory default state.

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.

# 8 Technical Details

Chapter 8 provides electrical, video, audio, and mechanical specifications for the CR6400 family products.

## Topics

<a href="#">Power Specifications</a> .....	77
<a href="#">Reference Specifications</a> .....	78
<a href="#">Physical Specifications</a> .....	80
<a href="#">Environmental Specifications</a> .....	81
<a href="#">Connectors</a> .....	81
<a href="#">Video Specifications</a> .....	82
<a href="#">Audio Specifications</a> .....	83
<a href="#">Drawings</a> .....	83
<a href="#">Defaults</a> .....	88

## Power Specifications

### CR6400 Router Power Specifications

Specification	Detail
Power consumption	CR6464-3Gig, 77 W maximum, CR6464-AES, 55 W maximum.
Regulatory	UL listed and CE compliant.

### Power Supply Specifications

Specification	Detail
AC power	120–240 VAC, 50–60 Hz, 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 Grass Valley part PS0012-00:

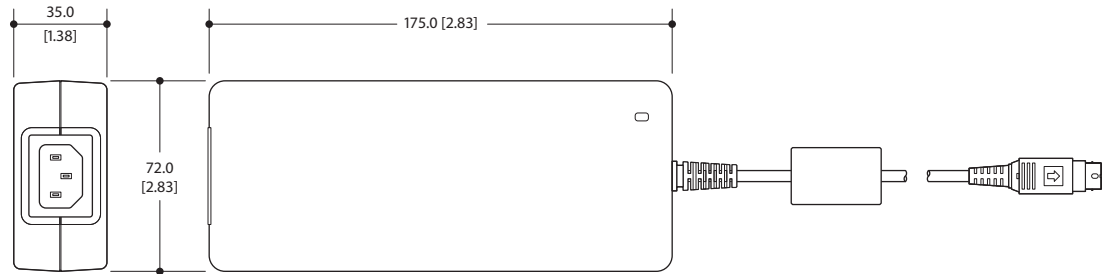
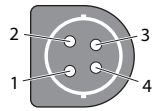


Fig. 8-1: Power Supply

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 48VDC, 160W max, 3.34A max.

Its input is rated for 120–240VAC, 50–60Hz, and 2.0A.

See [Power Cord Retention for the PS0012 Power Supply](#) on page 89.

## Reference Specifications

### CR6400 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: 500mV p-p to 2V p-p. Input return loss: > 40dB, to 6 MHz			



**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

### 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. See the drawing under <a href="#">Power Specifications</a> on page 77. Ethernet: 1 connector, 10/100BaseT, RJ-45 jack. Serial: 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.

### CP6464 Control Panel Specifications

Specification	Detail
Dimensions	Height: 3.41" (86.6 mm), Width: 17.62" (447.5 mm).
Depth	0.50" (12.7 mm) enclosure, 0.82" (20.8 mm) overall.
Weight	1.43 lb (0.65 kg).
Connectors	One 2×60 connector to the CR6400

## Environmental Specifications

### Environmental Specifications

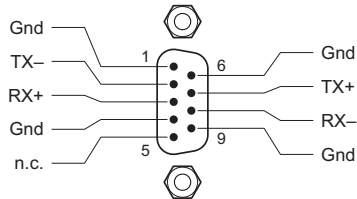
Specification	Detail
Operating temperature	0–45°C, ambient.
Relative humidity	0 to 90%, non-condensing.
Cooling	Removable fan module (two fans).

## Connectors

### Serial Connector

The serial connector is on the control card.

The automation connector for the CR6400 routers has this pinout:



The connector is RS-485, but can be used as RS-422.

Customers who want to operate the router through an automation system or a control system may contact Grass Valley technical support for information.

## Video Specifications

### CR6400 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>Input cable equalization</p> <ul style="list-style-type: none"> <li>&gt; 400 m, Belden 1694A or equivalent, 270 MB/s.</li> <li>&gt; 150 m, Belden 1694A or equivalent, at 1.5 GB/s.</li> <li>&gt; 100 m, Belden 1694A or equivalent, at 3.0 GB/s.</li> </ul> <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>Input cable equalization: up to 150m Belden 1694A or equivalent cable, at 1.483 Gb/s and 1.485 Gb/s, and 400m 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 300m 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. The CR6400 routers support DVB-ASI.

## Audio Specifications

### CR6400 Digital Audio (AES) Specifications

Specification	Detail
Signal inputs	<p>Signal type: AES3id (2 "mono" channels per input).            Sample rate: 32 kHz – 192 kHz.            Input level: 1V p-p nominal into 75 <math>\Omega</math>.            Input range: 200 mV p-p to 3 V p-p into 75 <math>\Omega</math>.            Input return loss: &lt; -25 dB, from 100 kHz to 6 MHz.            Input connectors: BNC, 75 <math>\Omega</math>.</p>
Signal outputs	<p>Signal type: AES3id (2 "mono" channels per input).            Sample rate: async, 32 kHz – 192 kHz; sync, 48 kHz.            Output level: 1V p-p <math>\pm</math> 10% into 75 <math>\Omega</math>.            Output offset: 0.0 VDC <math>\pm</math> 50 mVDC, AC coupled.            Output rise/fall time: 4 ns – 8 ns.            Output jitter: &lt; 1 ns, in synchronous mode.            Output return loss: &lt; -25 dB, from 100 kHz to 6 MHz.            Output-to-output isolation: &gt; 40 dB, from 100 kHz to 6 MHz.            Output connectors: BNC, 75 <math>\Omega</math>.</p>

## Drawings

The following drawings identify features and provide overall and critical dimensions.

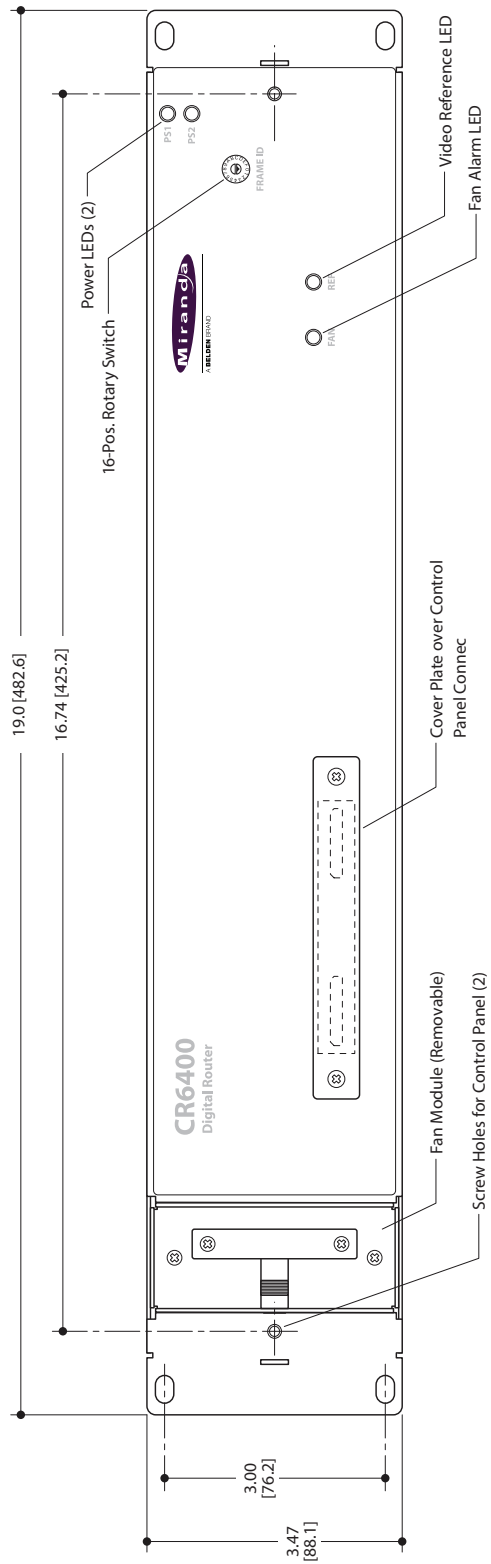


Fig. 8-2: Front View of the CR6400 Family Routers

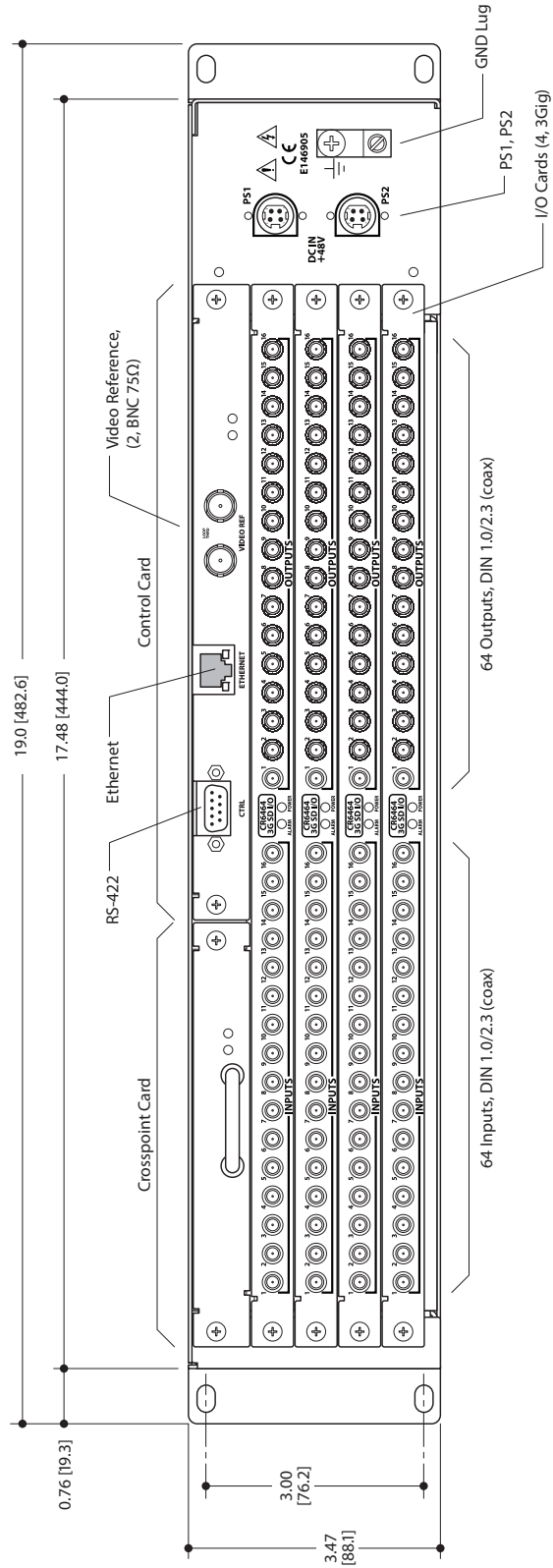


Fig. 8-3: Rear Views of the CR6464-3Gig Router

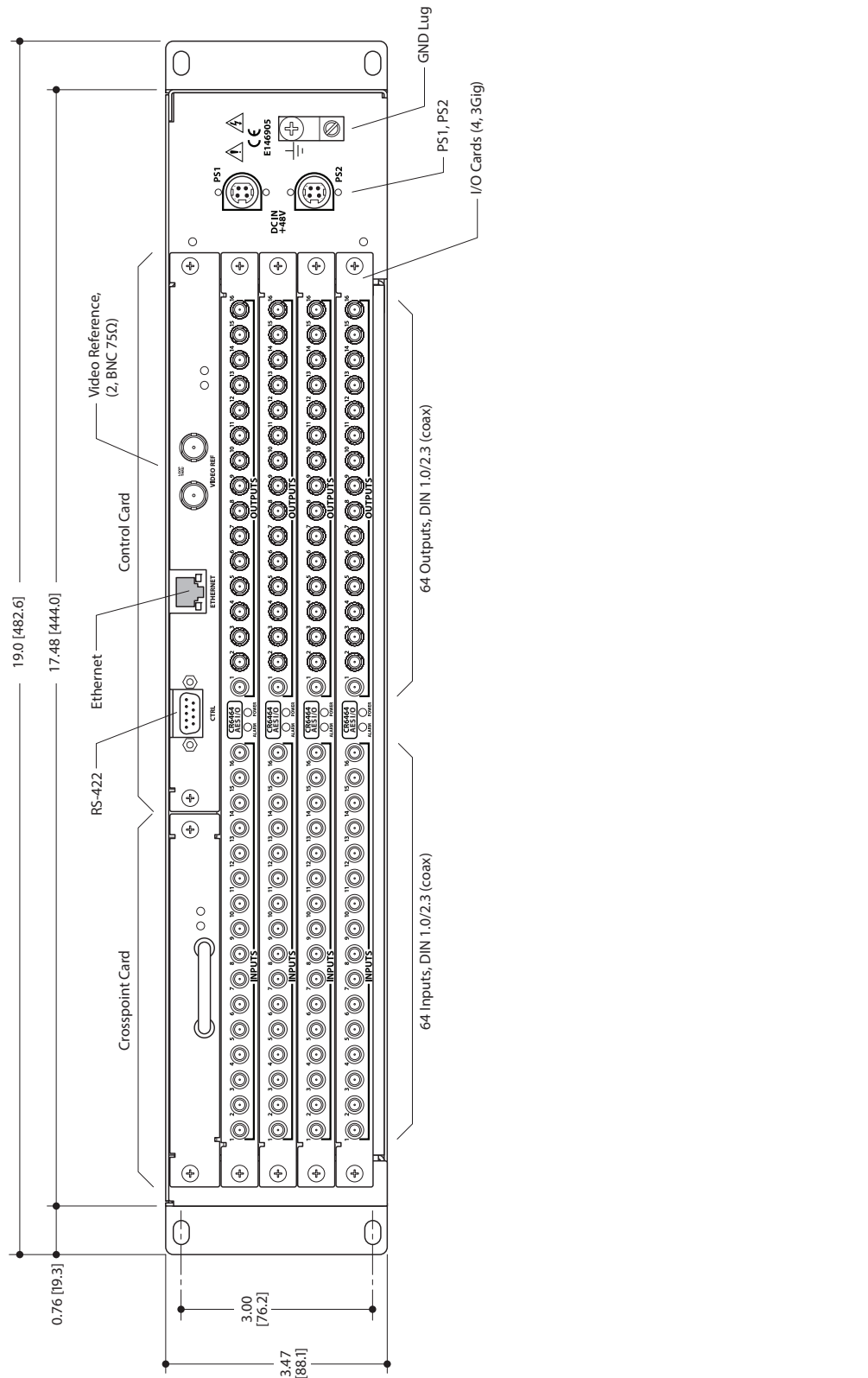


Fig. 8-4: Rear Views of the CR6464-AES Router



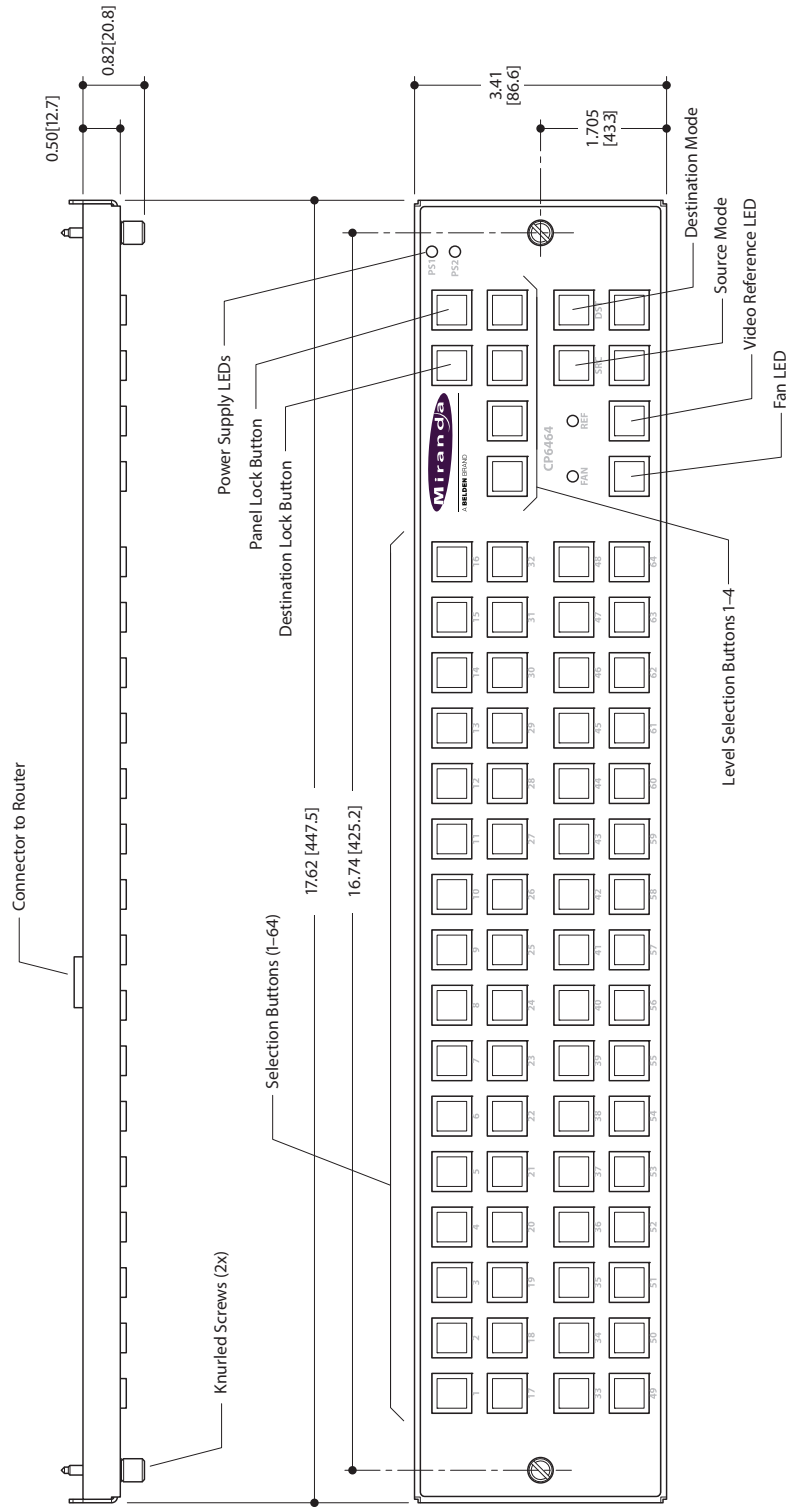


Fig. 8-5: Front and Top Views of the CP6464 Control Panel

## 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.

### 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, other control panels, or a network.

# 9

## Misc. Topics

Chapter 9 provides the following.

### Topics

[Power Cord Retention for the PS0012 Power Supply](#) ..... 89

### Power Cord Retention for the PS0012 Power Supply

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:



## Misc. Topics

### Power Cord Retention for the PS0012 Power Supply

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- 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.

# G

## Glossary

<b>AES/EBU</b>	(Audio Engineering Society/European Broadcasting Union). AES and EBU are standards organizations.
<b>AES3, AES3id</b>	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.  Grass Valley's compact AES routers support AES3id and provide 75Ω BNC connectors. AES3id is specified for 75Ω coaxial cable up to 1000 meters.
<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>CR6400</b>	A family of 2RU routers that have a 64×64 switching matrix and modular construction. The family includes a 2RU control panel.
<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> <p>CR6464 routers and CP6464s do not (yet) operate in conjunction with remote panel modules.</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 SDI 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 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

# Index

## 0–9

3Gig video routers	82
3Gig video routers	92

## A

Acrobat usage	
bookmarks	1
hyperlinks	1
navigating and searching	1
Active subnet	29
Add Level . . . (button)	30
Adding remote panel modules	29
Adding router levels	30
Adding routers	28
Address	
IP	19
Address, IP	91
AES	
Audio Engineering Society	91
mono switching	92
AES/EBU	91
AES3	91
AES3id	9, 91
Africa, contact	99
agreement, license	iii
Amber buttons	50
Americas, contact	99
Apply Updates (button)	28
Apply updates (button)	29
Asia, contact	99
Assembly	
router	17
Audio	
specifications, digital	83
Automation connector	81
Automation, third-party systems	81

## B

Block diagram	
digital video router	7
BNC connectors	17, 24, 91

Bold-face or capital letters	2
Bookmarks, Acrobat	1
Breakaway	50, 53, 60, 73, 91
Button labels	26
Button mapping	13
Button order	53, 71, 73
Button types	52
Buttons	
add level	30
amber	50
apply Updates	28
apply updates	29
control panel	2, 13
destination	34
destination lock	35
function	13
functions	33
green	50
GUI	2
initial states	88
legends	17, 24
level	35
red	51, 53
salvo	36
source	37
unused	37
update remote panel	39
update router levels	30–31
Buttons, level	46

## C

Cable	
Ethernet	17
Capital or bold-face letters	2
Captive panel	2
cautions	vi
CE	iii
Change history	iii
Chapter structure	1
Chapters	
1, Preface	1
2, Introduction	3
3, Installation	15
4, Configuration	23
5, Operation	41, 49
6, Maintenance	75

- 7, Technical Details ..... 77
  - 8, Misc. Topics ..... 89
  - China, contact ..... 99
  - Compact router ..... 2, 15–17, 81
    - features ..... 12
  - Compact router system configurator ..... 5
  - Complex locks ..... 68–69
  - Configuring panels ..... 25
  - Connectors
    - automation ..... 81
    - BNC ..... 17, 24, 91
    - control panel ..... 17
    - DE9 ..... 81
    - input, output ..... 24
    - power ..... 12, 42, 45
  - Contact Miranda ..... 99
  - Control panel ..... 2, 7, 10, 12–15, 17, 24, 47
    - buttons ..... 2
    - features ..... 12
    - initial state ..... 88
  - Control panels, configuring ..... 25
  - Corporate office, contact ..... 99
  - CP3201 ..... 50, 68
  - CP3201 takes ..... 65
  - CP6401 ..... 68
  - CP6464 ..... 87
    - front and top views ..... 87
  - CQX ..... 91
  - CR Series ..... 2, 15, 23, 41
    - overview ..... 3
  - CR6400 ..... 12, 41, 81, 85–86
  - CR6400, defined ..... 91
  - Creating a router network ..... 18
  - Current destination ..... 54
  - Customer support ..... 99
- D**
- DE9 connectors ..... 81
  - Declaration of Conformance ..... iii
  - Default destination ..... 50
  - Default router state ..... 88
  - Defaults ..... 88
  - Defining a salvo button ..... 36
  - Design considerations ..... 16
  - Destination (defined) ..... 92
  - Destination button lighting ..... 55
  - Destination buttons ..... 34, 52
  - Destination lock ..... 10, 43–45, 47–48
  - Destination lock (button) ..... 35
  - Destination locks ..... 50–51, 68, 91
  - Destination mode ..... 11
  - Device (defined) ..... 91
  - DHCP ..... 39
  - Digital audio specifications ..... 83
  - Digital video specifications ..... 82
  - Document revision ..... iii
  - Dolby Digital 5.1 ..... 91
  - Double-press ..... 72
  - Drawings
    - CP6464, front and top views ..... 87
    - CR6400, front view ..... 84
    - CR6464-3Gig, rear view ..... 85
    - CR6464-AES, rear view ..... 86
- E**
- Electrical specifications ..... 77
    - power supply ..... 77
  - Electrostatic discharge ..... 15
  - E-mail address ..... 99
  - Enable NV9000 mode (option) ..... 38
  - Enhanced mode ..... 27, 52, 60, 62–64, 66–67, 70, 73
  - Environmental specifications ..... 81
  - Equalization ..... 7, 82
  - ESD ..... 15
  - Ethernet ..... 12
    - cable ..... 17
    - switch ..... 45
  - Ethernet switch ..... 19
  - Europe, contact ..... 99
  - European Broadcasting Union ..... 91
  - Examples, symbol for ..... 2
- F**
- Factory default state ..... 56
  - Fax number ..... 99
  - FCC statement ..... iii
  - Features
    - compact router ..... 12
    - control panel ..... 12
  - Figures
    - block diagram, digital video router ..... 7
    - CP6464, front and top views ..... 87
    - CR6400, front view (drawing) ..... 84
    - CR6464-3Gig, rear view ..... 85
    - CR6464-AES, rear view ..... 86
  - Find, Acrobat ..... 2
  - First Page, Acrobat ..... 2
  - Formats, video ..... 92
  - FPGA ..... 42, 45
  - Frame ..... 2
  - France, contact ..... 99
  - Function buttons ..... 13, 33



## G

Go to Next View, Acrobat .....	1
Go to Previous View, Acrobat .....	1
Grass Valley technical support .....	81
Green buttons .....	50
Grounding terminal .....	12, 17
GUI buttons .....	2

## H

hardware symbols .....	v
hazardous substance .....	iv
HD .....	9
HD routers .....	82
High tally .....	2, 10, 12, 48, 91
Hold .....	91
Hold (mode) .....	27, 53, 63–64, 66–67, 70, 73
Hours of operation .....	99
How to	
install the router .....	17
perform a take .....	43
How to convert a remote panel module .....	38
Hyperlinks, Acrobat .....	1

## I

Initial control panel state .....	88
Initial I/O mapping .....	88
Input	
connectors .....	24
equalization .....	7
Inputs, connecting .....	18
Installation	
design considerations .....	16
package contents .....	15
receiving and unpacking .....	15
Installing a compact router .....	17
IP address .....	19, 91

## K

Knurled screws .....	13–14
----------------------	-------

## L

Labels, button .....	26
Last Page, Acrobat .....	2
LED, power supply .....	12, 76
Legends, button .....	17, 24

Level button lighting .....	55
Level buttons .....	35, 46, 52, 54, 70
Level selection .....	45, 50, 53–54, 70, 73
Level, physical .....	91
Levels .....	19
Levels, adding .....	30
Levels, updating .....	29
license .....	iii
Lock .....	43–44, 47
destination .....	10, 43–45, 47–48
panel .....	10, 44, 47
Locks .....	91
destination .....	50–51, 68, 91
panel .....	50–51, 68, 91
Low tally .....	2, 12, 43–44, 47, 91

## M

Maintenance, preventive .....	75
Mapping .....	42, 45, 88
button .....	13
initial I/O .....	88
Mask, subnet .....	92
Memory, non-volatile .....	12
Middle East, contact .....	99
Miranda, contact .....	99
Mode	
enhanced .....	52, 60, 62–64, 66–67, 70, 73
hold .....	27, 53, 63–64, 66–67, 70, 73
no hold .....	27, 53
operating .....	50, 52
standard .....	59, 61, 65, 70
Modes, panel .....	26
Modules, remote panel .....	92
Mono AES switching .....	92
Multi-level take .....	46

## N

Network	
operation .....	12
router .....	18–19, 45–46
Network address .....	91
Networks	
adding remote panel modules .....	29
adding routers .....	28
Next Page, Acrobat .....	2
No hold (mode) .....	27, 53
Non-volatile memory .....	12
Normal takes .....	59
NTSC .....	8, 78
NV9000 .....	5
NV9000 remote panel modules .....	38
NV9000 Status GUI .....	1

**O**

Office hours	99
Operating modes	50, 52
Operating temperature	81
Operator	92
Ordering, buttons, spatial	71
Ordering, buttons, temporal	54, 71–72
Output	
connectors	24
reclocking	7, 9, 92
Overview, CR series	3

**P**

Package contents	15
Paging	27
PAL	8, 78
Panel lock	10, 44, 47, 50–51, 68, 91
Panel lock button	55
Panel modes	26, 50, 52
enhanced	27, 52
standard	26, 52
Panel types	28
Panel, captive	2
Panel, control	2, 7, 10, 12–15, 17, 24, 47
Panel, remote	2
Panels	
configuring	25
PCM	91
PDF documents	1
navigating and searching	1
Phone numbers	99
Photos	
power cord retention	89–90
Physical level	91
Physical specifications	
analog video router	80
control panel	80
digital audio router	80
digital video routers	80
Port (defined)	92
Power connectors	12, 42, 45
Power cord retention	89
Power specifications	77
power supply	77
Power supply	15, 23, 42, 45, 75–76, 89
choose 1 or 2	23
LED	12, 76
Power up	55
Power-up	42, 45
Preface	
about PDF documents	1
chapter structure	1
terms, conventions and abbreviations	2

Preventive maintenance	75
Previous Page, Acrobat	2
Primary level	54, 63–64, 66–67, 92
Primary source	54
PS1, PS2	42, 45

**R**

Rack mount	17
Rate, video	92
Receiving and unpacking shipments	15
Reclocking	7, 9, 82, 92
Red buttons	51, 53
Redundancy	12, 42, 45, 75
Reference video	7–8, 12, 17, 23–24, 76
termination	17
Remote panel	2
Remote panel module (defined)	92
Remote panel modules	25, 92
adding	29
converting to NV9000 mode	38
Remote panel page	
shortcuts	38
Remote Panels	
function buttons	33
Remote panels	
configuring	25
restrictions	iv
Revision, document	iii
RJ-45	17
RoHS	iv
Rotary switch	12, 17, 24
Rotary switches	29, 55
Routed source	54
Router	2, 6, 15
3Gig video	82
assembly	17
front view (drawing)	84
HD	82
inputs, connecting	18
network operation	12
SD	82
stand-alone	16
Router network	18–19, 45–46
Router, rear view	85–86
Routers	
3Gig video	92
adding	28
Routers, stand-alone	23
Routing changes	43
RS-422	12, 81
RS-485	81

## S

Safeguards .....	iv
Safety notices .....	iv
Salvo .....	92
Salvo buttons .....	36, 52
Salvos .....	27, 50, 70
SB0033 (installation disk) .....	26
Screws, knurled .....	13–14
SD video router .....	82
Search, Acrobat .....	2
Selecting a remote panel module .....	31
Selection of levels .....	50, 53–54, 70, 73
Setting up NV9000 remote panel modules .....	38
Shielded Ethernet cable .....	17
Shortcuts	
remote panel page .....	38
Simple locks .....	68–69
SMPTE .....	76
software license .....	iii
Source (defined) .....	92
Source button lighting .....	54
Source buttons .....	37, 52
Source mode .....	11
Spatial ordering, buttons .....	53, 71
Special messages, symbol for .....	2
Specifications	
digital audio .....	83
digital video .....	82
environmental .....	81
physical, control panel .....	80
physical, router .....	80
power .....	77
power supply .....	77
video reference .....	78
Stand-alone network .....	21, 45
Stand-alone router .....	16, 20, 42
configuration .....	24
Stand-alone routers .....	23
Standard mode .....	26, 52, 59, 61, 65, 70
Startup .....	42, 45, 55
State, factory default .....	56
Static .....	15
Status GUI .....	1
Strap, power cord retention .....	89
Subnet address .....	19
Subnet mask .....	92
Subnet, active .....	29
Support, contact .....	99
SWB (super wide band) .....	82, 92
Switch, Ethernet .....	19, 45
Switch, rotary .....	12, 17, 24

Switches, rotary .....	29, 55
Switching, mono .....	92
Symbols	
for examples .....	2
for special messages .....	2
symbols, meaning .....	v
Sync, reference .....	12

## T

Tables	
digital audio specifications .....	83
digital video specifications .....	82
environmental specifications .....	81
physical specifications, control panel .....	80
physical specifications, router .....	80
power specifications .....	77
power specifications, power supply .....	77
video reference specifications .....	78
Takes .....	46, 50, 70, 92
multi-level .....	46
normal .....	59
Tally .....	91
high .....	2, 48
high or low .....	12
low .....	2, 10, 43–44, 47
Technical support .....	81, 99
Temperature, operating .....	81
Temporal ordering, buttons .....	54, 71–72
Termination	
video reference .....	17
Terms, conventions and abbreviations .....	2
Testing your installation .....	20
Third-party automation systems .....	81
Transients .....	76
Transitions .....	76
Trouble-shooting .....	75
Types, button .....	52

## U

United Kingdom, contact .....	99
Unused buttons .....	37
Update remote panel (button) .....	39
Update router levels (button) .....	30–31
Updating routers levels .....	29
Use DHCP to acquire IP address (option) .....	39
User's guide, chapter structure .....	1

## V

Velcro strap .....	89
Video	
digital specifications .....	82
reference .....	7-8, 12, 17, 23-24, 76
reference, specifications .....	78
reference, termination .....	17
router, 3Gig .....	82, 92
router, HD .....	82

router, SD .....	82
supported formats .....	92
supported rates .....	92

## W-X-Y-Z

Warnings, hardware .....	v
Warranty .....	iii
Web site .....	99



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