CR6400 Family

Digital Compact Routers and Control Panels

User's Guide

UG0078-00

30 May 2014

grass valley

A **BELDEN** BRAND

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Title	CR6400 User's Guide
Part Number	UG0078-00
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Change History

Rev.	Date	ECO	Description	Approved
1.0	29 May 14	19241	Initial Release.	D.Cox

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.

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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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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.

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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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.

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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.

Table of Contents

Table of Contents

1 Preface

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

Topics

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, Operation, provides operating instructions.

- Chapter 6, Maintenance, provides maintenance and trouble-shooting instructions.

- Chapter 7, Technical Details, provides electrical, video, audio, mechanical, and environmental specifications, product drawings, and default settings.

- Chapter 8, 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.

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

- 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[1].
- 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

Introduction

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

Topics

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.
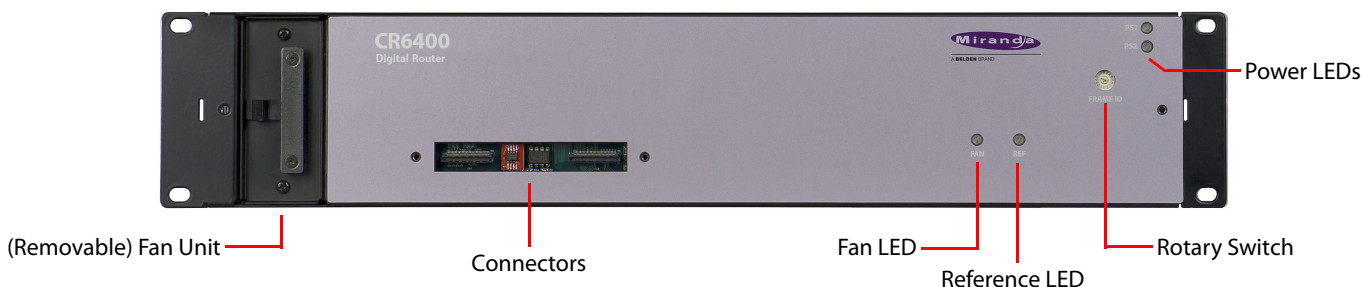
A thin 2RU control panel — the CP6464 — can mount directly on the front of the router as shown here:
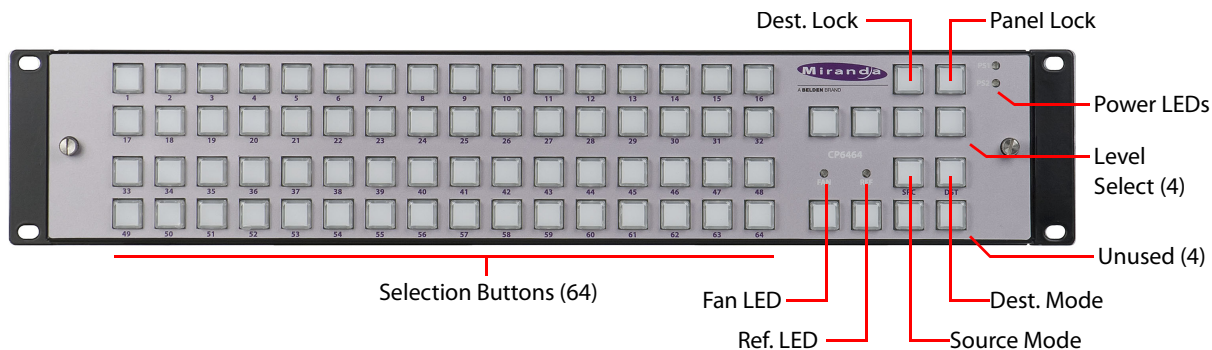
The control panel has an array of 64 device selection buttons at the left and 12 function buttons at the right.

Function buttons include:
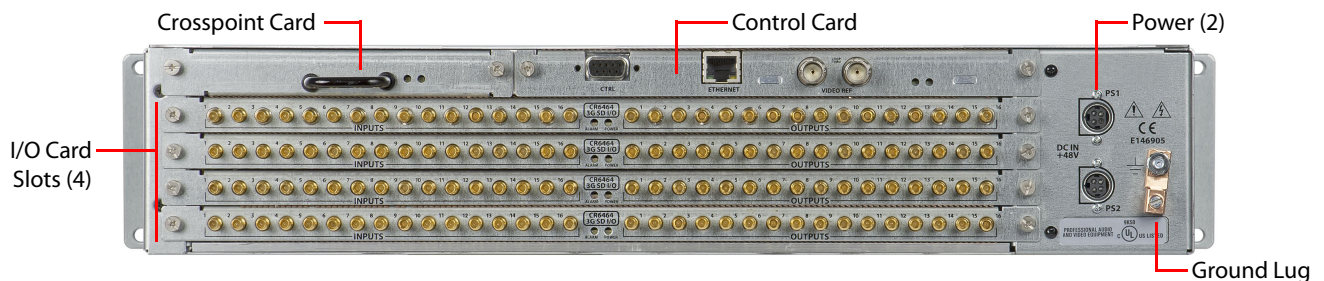
Panel lock	Destination Lock	Level 1–Level 4
Source Mode	Destination Mode	

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

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 first 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." Note that CR6400 routers and CP6464s do not (yet) operate in conjunction with remote panel modules or other CR series routers and panels. See the glossary for a definition of "remote panel module."

The 1RU routers have switching matrices up to 16×16 and the 2RU 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. Note that the CR6400 is a standard router, not a "clean and quiet" router.

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, possibly with remote panels, possibly with 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 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 up to the customer and is not addressed in this document.

Compact routers and remote panel modules come from the factory ready for stand-alone operation. They must be configured for use either in a CRSC network or in an NV9000 network. Once configured, they must be reset to work in stand-alone mode.

A remote panel module must be configured to work either in a CRSC network or in an NV9000 network. The two configuration modes are not compatible.

CR6400 Usage

The CR6400 routers, at first release, operates only in stand-alone mode (also known as "default" mode) either as a single router or in a small network.

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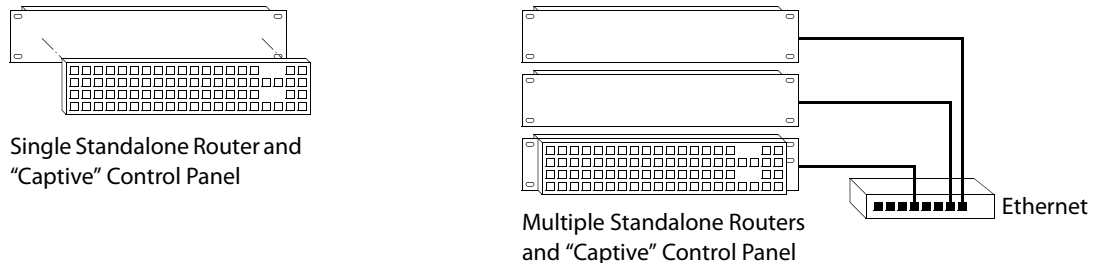

Single Standalone Router and
"Captive" Control Panel

Multiple Standalone Routers
and "Captive" Control Panel

Ethernet

Fig. 2-1: Standalone CR6400s

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

(Future releases will support CRSC and NV9000 network modes.)
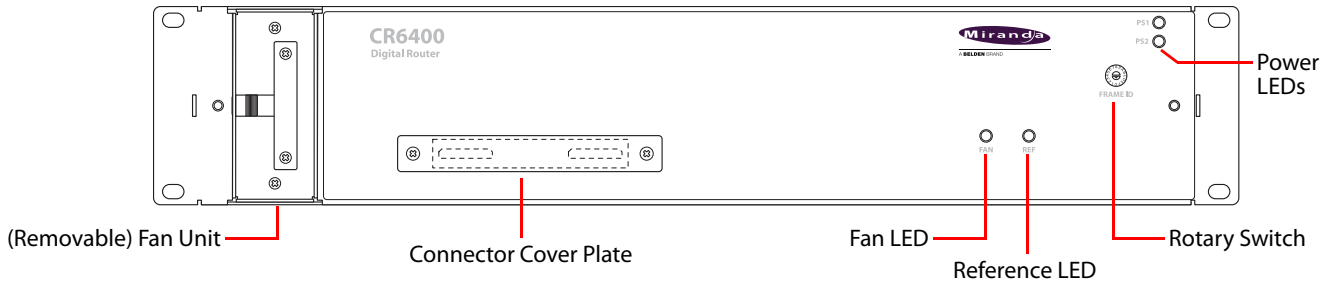
Software

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

At this release, CRSC is not needed for the CR6400 or the CP6464. However, you can use CRSC to change the IP addresses of your routers.

In the near future, CRSC will be essential for performing firmware updates and other configuration tasks.

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:

(Removable) Fan Unit — Connector Cover Plate — Fan LED — Reference LED — Rotary Switch — Power LEDs

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).

Crosspoint Card — Control Card — Power (2)

I/O Card Slots (4) — Ground Lug
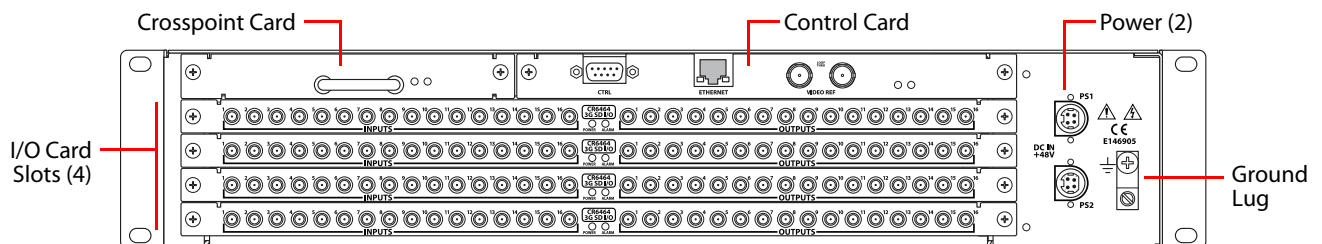
The control card has several connectors and 2 LEDs: an alarm LED and a power LED. The cross-point card has no external connectors, but does have an alarm LED and a power LED.

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.

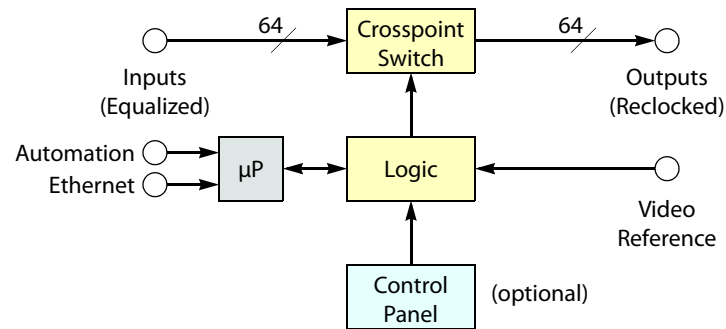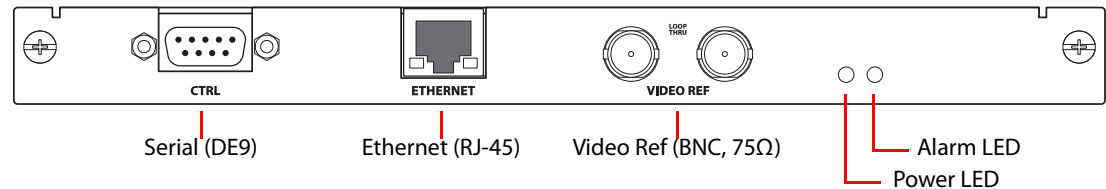Figure 2-2 shows a simplified block diagram of a CR6400 router:

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.
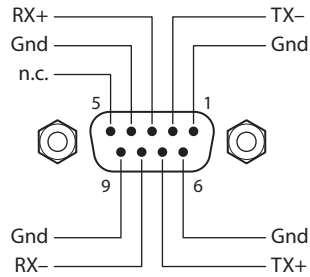
Ports

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:

```
RX+ ─────────        ──────── TX–
Gnd ──────           ──────── Gnd
n.c. ────            
        5      1
       ⦿ • • • • ⦿
         • • • •
        9      6

Gnd ──────           ──────── Gnd
RX– ─────            ──────── TX+
```

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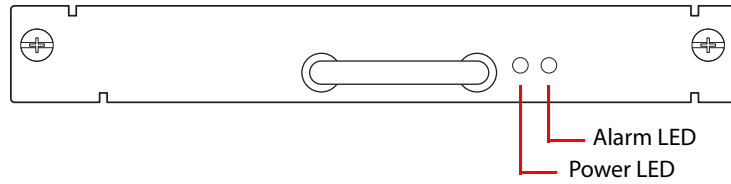
The alarm LED is red when an alarm condition exists (such as the absence of a video reference). The alarm LED is green otherwise.

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

Crosspoint Card

The crosspoint (XPT) card contains the switching matrix:


Alarm LED
Power LED

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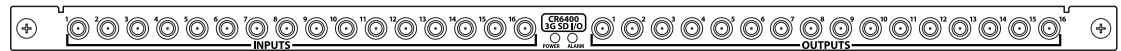
The "3Gig" I/O cards support video, with or without embedded audio, at 2.966 Gb/s, and 2.97 Gb/s video rates as well as a number of HD and SD bit rates and formats. The 3Gig cards reclock at 270 Mb/s, 1.483 Gb/s, 1.485 Gb/s, 2.966 Gb/s, and 2.97 Gb/s. The 3Gig cards bypass re-clocking for other rates.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

9

The Control Panel

A thin 2RU control panel — the CP6464 — can mount directly on the front of the router as shown here:
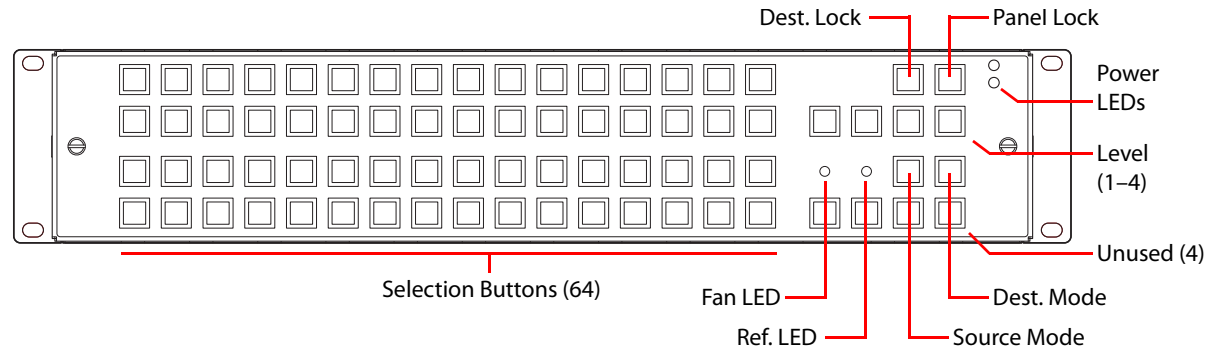
The control panel has an array of 64 selection buttons at the left and 12 function buttons at the right. Function buttons include:

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

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

Button Functions

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, 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, the 64 selection buttons turn *green* and permit the selection of one of 64 sources.

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.)

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, Operation on page 25.

▲ Buttons are not labeled at the factory. If you want button legends, you must create your own. See Button Legends on page 22.

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

Stand-alone operation is the only option available at first release of the product. 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.

Installation

Chapter 3 provides installation instructions.

Topics

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.

At first release, the CR6400 routers operate in stand-alone mode with an attached (or "captive") control panel. The other modes, available to other compact routers, are not available for the CR6400.

Stand-Alone Router

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 Network

A stand-alone network will include 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,* at this release, means nothing more than a router number.

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 18 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 22.

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 Ω 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 35. 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 33 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 (Tma) 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 connectionssuch as power strips.

Creating a Router Network

A router network is necessary if you wish to perform multi-level takes and locks.

Stand-Alone Networks

A stand-alone CR6400 network comprises the following items:

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

Figure 3-1 shows a sample network of routers:

Ethernet Switch

Router 1

Router 2
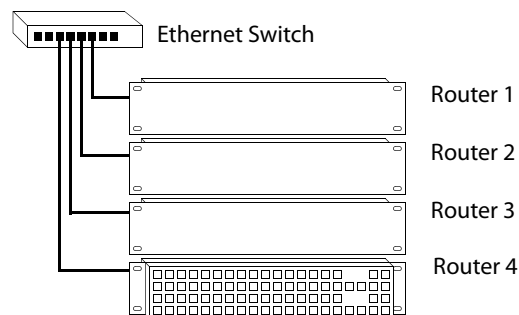
Router 3

Router 4

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 33.

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 47.

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 only 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, Operation, for instructions.

Report failures to Grass Valley customer service.

Configuration 4

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

Topics

There are two ways to use the CR6400 routers:

- A single stand-alone router with a "captive" CP6464 control panel.

- A network of stand-alone routers, with a captive panels or panels.

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 40 for cable length limits.

External Video Reference

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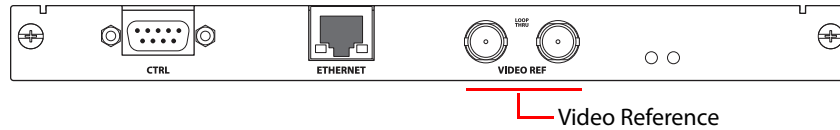
Video Reference

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″ (10 mm square). A 3/8″ (9.5 mm) 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 Network

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 18, for information on rotary switch settings and subnet addresses.

Panel Configurations

At this release, the CP6464 panels do not require configuration and it is not possible to configure them.

5

Operation

Chapter 5 provides operating instructions for the CR6400 routers and the CP6464 control panel.

Topics

Summary

There are two 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).

Terminology

It is essential for the material that follows to define the terms "source" and "destination."

In general, the terms source and destination refer to devices (e.g., VTRs, cameras, monitors) that can be connected to the I/O cards of the router. In discussions of routers, we usually think of sources and destinations only as the connectors to which a device is connected and we ignore the devices. (In fact, the router functions properly regardless of whether it is actually connected to any devices.)

A **port** is a single connector (DIN 1.0/2.3) on a router.

An input port, or just **input,** is one that receives a signal.

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

For a Single 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 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)

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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 selection buttons to select a destination. The destination's button goes high-tally. It will be red if the destination is locked and the take will not be allowed.)

3 Press the source mode button. (The selection buttons turn green, representing sources.)

4 Press one of the selection buttons to select a source. The source's button goes high-tally. The take is complete.

Example

You want to route input 4 (VTR2) to output 5 (MON1). The monitor is presently connected to input 3 (VTR1).

1 Press the 'Destination Mode' button. The selection buttons turn amber. Then press selection button 5. It is labeled 'MON1' in this example. It goes high tally:

Destination Mode
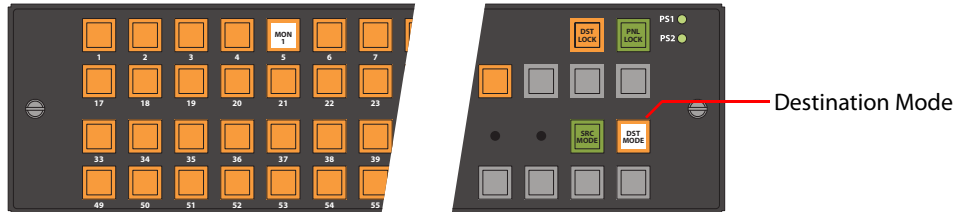
2 Press the 'Source Mode' button. The selection buttons turn green. Then press selection button 4. The button for input 3 goes low tally and selection button 4 (VTR2) goes high-tally.
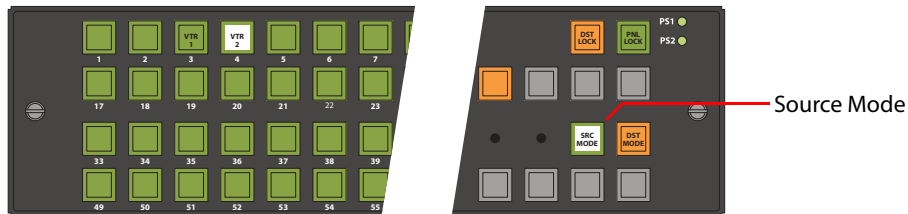
Source Mode

3 The take is complete.

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

▲ If a destination is locked, it will be low-tally red. If you press its button, it will go high-tally red. The panel remains in destination mode. You cannot perform a take for a destination that is locked. See Locks.

Locks

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

Destination Lock   Panel Lock
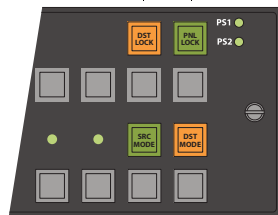
Panel Lock

Pressing 'Panel Lock' disables the control panel. Only the Panel Lock button remains enabled. Pressing it again re-enables the control panel.
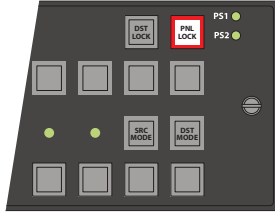
When the control panel is locked, the lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The panel lock button is low tally green when the control panel is not locked.

Destination Lock

Destination lock prevents selecting another source for the currently selected destination. To lock a destination,

1 Press the 'Destination Mode' button.

2 press the desired selection button.

3 Press 'Destination Lock'.

This sample shows destination 5 locked:

2. Destination

3. Destination Lock
1. Destination Mode
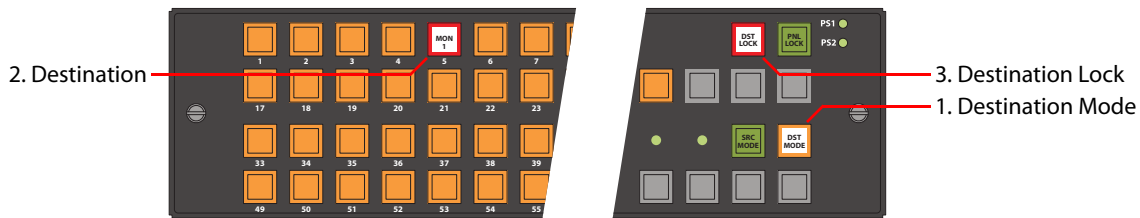
(Press 'Source Mode' to see the source that feeds the destination. The button for that source is high-tally.)

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.

Locked Destination

Selected Destination

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.

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:

29
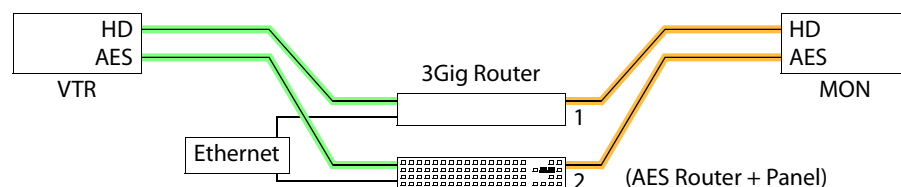
The four level buttons on a control panel correspond to the four router levels, with level 1 on the left and level 4 on the right.

(Destination Lock) ☐   ☐ (Panel Lock)

☐ ☐ ☐ ☐
1   2   3   4
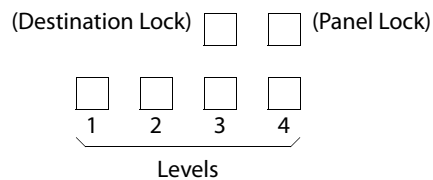
Levels

A level button is illuminated (in amber) if a router at that level is present in the network. The button is dark if not.

A level button is high-tally when the level is selected and low-tally when not.

Exceptions

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

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

Takes

A network of routers is capable of multi-level takes.

Follow these steps to perform a multi-level take:

1 Press the level buttons on a panel to select the levels for the take. Be aware of the level selection exceptions, listed under Exceptions above. The buttons for selected levels are high-tally.

2 Press 'Destination Mode'.

3 Select a destination.

4 Press 'Source Mode'.

5 Select a source.

The take is complete. A routing switch occurs on each level you selected at the remote panel module.

Locks

Performing locks in a network is almost the same as performing locks for a stand-alone 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.

Destination Lock — ⌐   ⌐ — Panel Lock

Level selection buttons
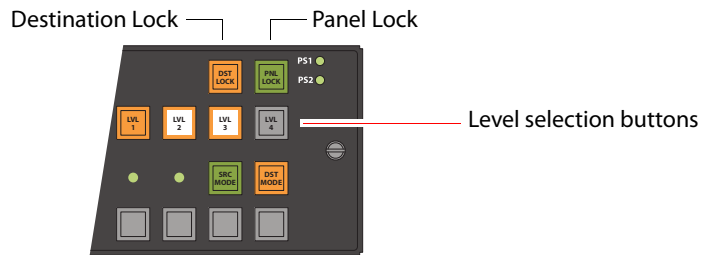
This illustration shows a system that has 3 levels (1–3), two of which are selected. Buttons for selected levels are high-tally. The button for (non-existent) level 4 is dark.

Panel Lock

Pressing 'Panel Lock' disables the control panel on which you press 'Panel Lock'. Only the 'Panel Lock' button remains enabled. Pressing it again re-enables the control panel.
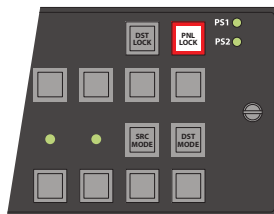
When the control panel is locked, the Panel Lock button is bright red and the state of the entire control panel is protected. Changes from the control panel are disabled. The 'Panel Lock' button is low tally green when the control panel is not locked.

▲ Remember that a 'Panel Lock' button locks *that panel only*. It does **not** lock any router, other control panels, or the network.

Destination Lock

Destination lock prevents an operator from selecting another source for the currently selected destination. In a network, sources and destinations comprise one or more levels. When you lock a destination, it is locked *on the levels you select*. And when you unlock a destination, it is unlocked *on the levels you select*.

▲ To unlock the destination completely, you must select exactly the levels on which it was locked. But, after you lock a destination on levels, it is difficult to remember on which levels you have locked it.

To lock a destination,

1 Press level buttons on a panel to select the intended levels.

The following illustrations show a system that has 3 levels (1–3), two of which are selected. Buttons for selected levels are high-tally.

2 Press 'Destination Mode'.

3 Press the selection button for the destination you want to lock.

4 Press 'Destination Lock'.

This sample shows destination 5 locked on levels 2 and 3, but not level 1:

Locked
Destination
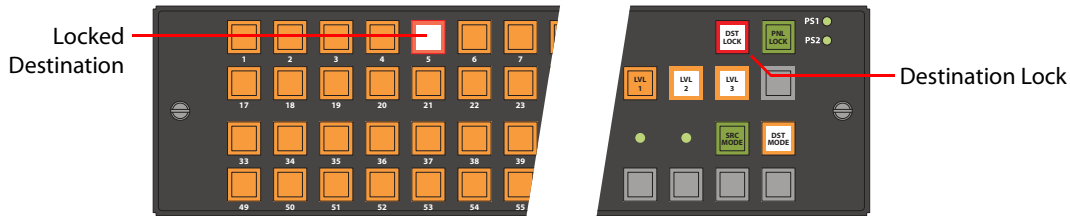
Destination Lock

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:

Locked
Destination

Selected
Destination

To *unlock* a destination,

1 Press level buttons on a panel to select the intended levels.

2 Press 'Destination Mode'.

3 Press the selection button for the destination you want to unlock.

4 Press 'Destination Lock'.

   This will clear the lock on the locked levels you have selected and set the lock on unlocked levels you have selected.

6

Maintenance

Chapter 6 provides information regarding maintenance.

This document does not address maintenance of NV9000 equipment.

Topics

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 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.

7

Technical Details

Chapter 7 provides electrical, video, audio, and mechanical specifications for the CR6400 family products.

Topics

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:
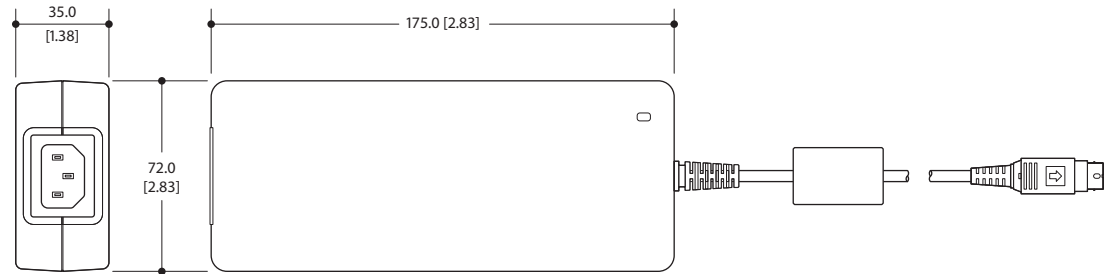
Fig. 7-1: Power Supply

Its power output has a 4-pin plug:
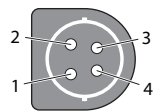
Pins 1 and 4 are +48V;

Pins 2 and 3 are ground, nominally 0V. The metal ring is ground also.

The power supply's output is rated at 48 VDC, 160 W max, 3.34 A max.

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

Reference Specifications

CR6400 Video Reference Specifications

Detail
Connectors: 2 BNC (1 pair, loop-through), non-terminating, 75Ω characteristic imped-ance. All digital routers (HD, SD, AES) accept these video reference rates:

Composite	HD Tri-level		
525i / 59.94 (NTSC) 625i / 50 (PAL)	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
Input level range: 500 mV p-p to 2 V p-p. Input return loss: > 40 dB, to 6 MHz			

Compatibility between Video Formats and Reference Rates

Video Format	Comp		Tri-Level Sync																				
	NTSC (525i59.94)	PAL (625i50)	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 Power Specifications on page 35. Ethernet: 1 connector, 10/100 BaseT, 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:
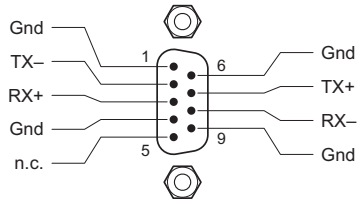
The connector is RS-485, but can be used as RS-422.

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[1]

Specification	Detail
3Gig	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
	Input & output impedance: 75Ω.
	Input cable equalization
	> 400 m, Belden 1694A or equivalent, 270 MB/s.
	> 150 m, Belden 1694A or equivalent, at 1.5 GB/s.
	> 100 m, Belden 1694A or equivalent, at 3.0 GB/s.
	Input return loss: > 15 dB, 5 MHz to 1.5 GHz.
	Output level: 800 mV pp ± 10%.
	Output offset: 0 VDC ± 0.5 V.
	Output rise/fall time: ≤ 135 ps.
	Output overshoot: ≤ 10% of amplitude.
	Output timing jitter: ≤ 0.2 UI p-p.
	Output alignment jitter: ≤ 0.3 UI at 100 kHz
	Output return loss: > 10 dB, 1.5 GHz to 3.0 GHz.
HD-SDI (SWB)	Data rates: up to 1.5 Gbps, reclocking at 143, 177, 270, 360 & 540 Mb/s and 1.483 & 1.485 Gb/s rates, automatic bypass for other rates.
	Input & output impedance: 75Ω.
	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.
	Input return loss: ≥ 15dB, 5 MHz to 1.5 GHz.
	Output level: 800 mV pp ± 10%.
	Output offset: 0 VDC ± 0.5 V.
	Output rise/fall time: ≤ 270 ps (20% to 80%).
	Output overshoot: ≤ 10% of amplitude.
	Output jitter: ≤ 0.2 UI p-p.
	Output return loss: ≥ 15 dB, 5 MHz to 1.5 GHz.
SD-SDI	Data rates: auto reclocking at 143, 177, 270, 360 & 540 Mb/s and automatic bypass for other rates.
	Input & output impedance: 75Ω.
	Cable equalization: up to 300m Belden 1694A or equivalent cable.
	Input return loss: ≥ 15dB, 5 to 540 MHz.
	Output level: 800 mV pp ± 10%.
	Output offset: 0 VDC ± 0.5 V.
	Output rise/fall time: 0.4 to 1.5 ns.
	Output overshoot: ≤ 10% of amplitude.
	Output jitter: ≤ 0.2 UI p-p.
	Output return loss: ≥ 15dB, 5 MHz to 540 MHz.

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1. The CR6400 routers support DVB-ASI.

Audio Specifications

CR6400 Digital Audio (AES) Specifications

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

Drawings

The following drawings identify features and provide overall and critical dimensions.
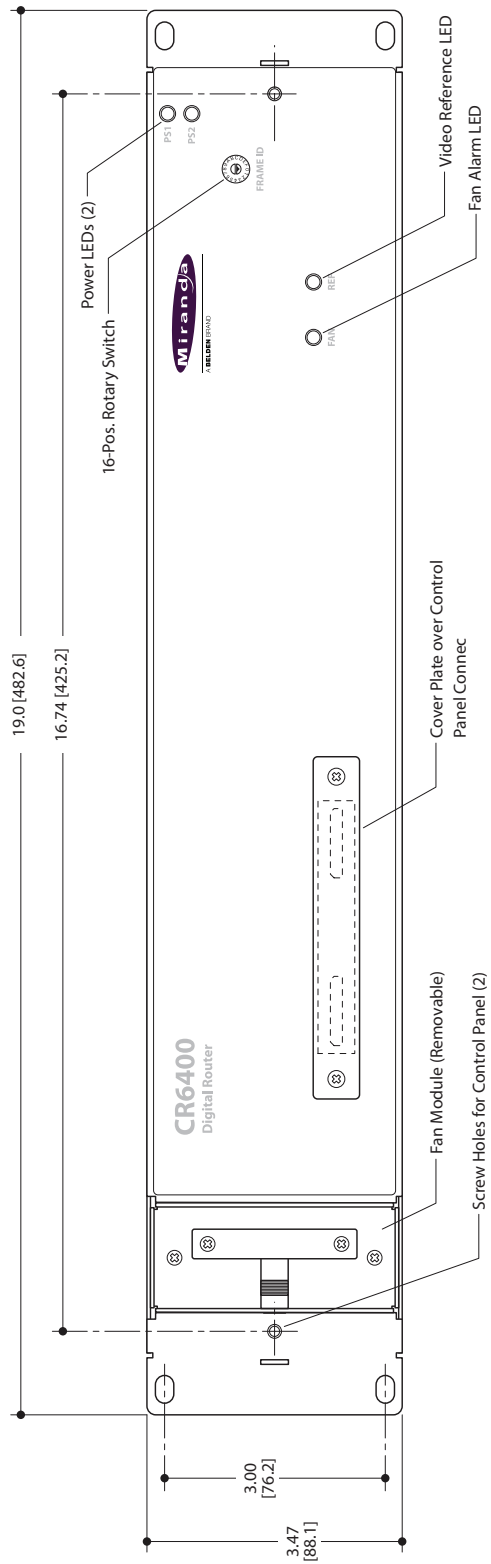
Fig. 7-2: Front View of the CR6400 Family Routers
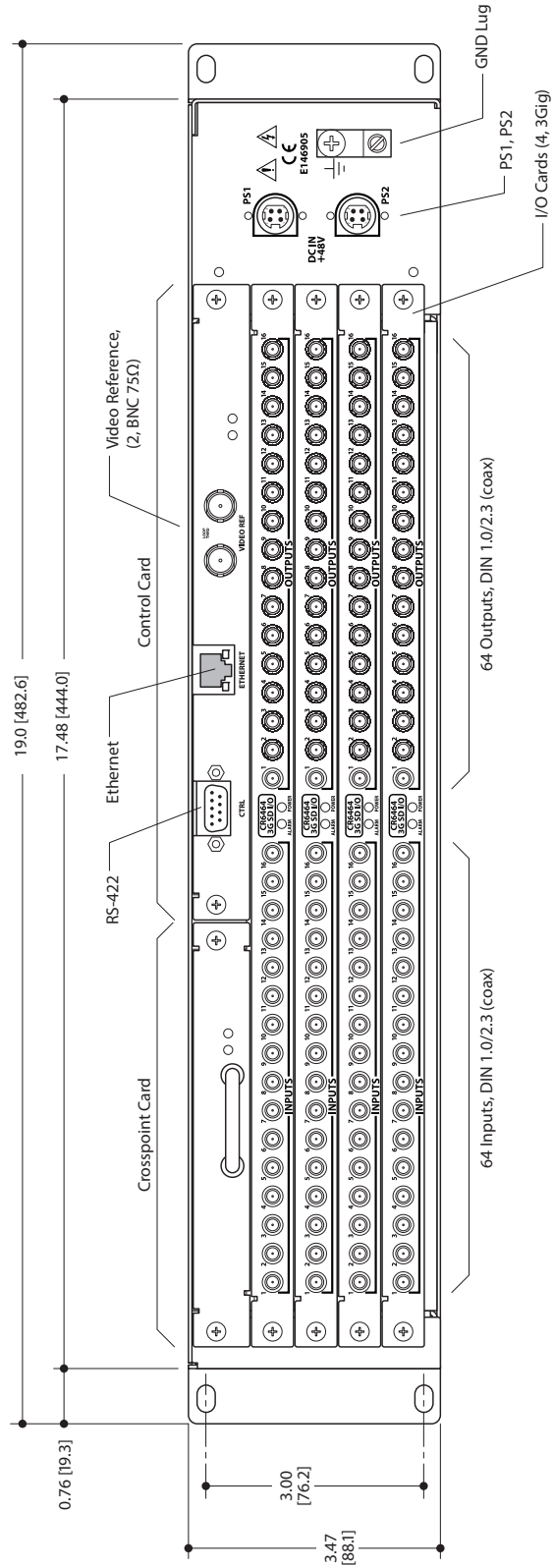
Fig. 7-3: Rear Views of the CR6464-3Gig Router
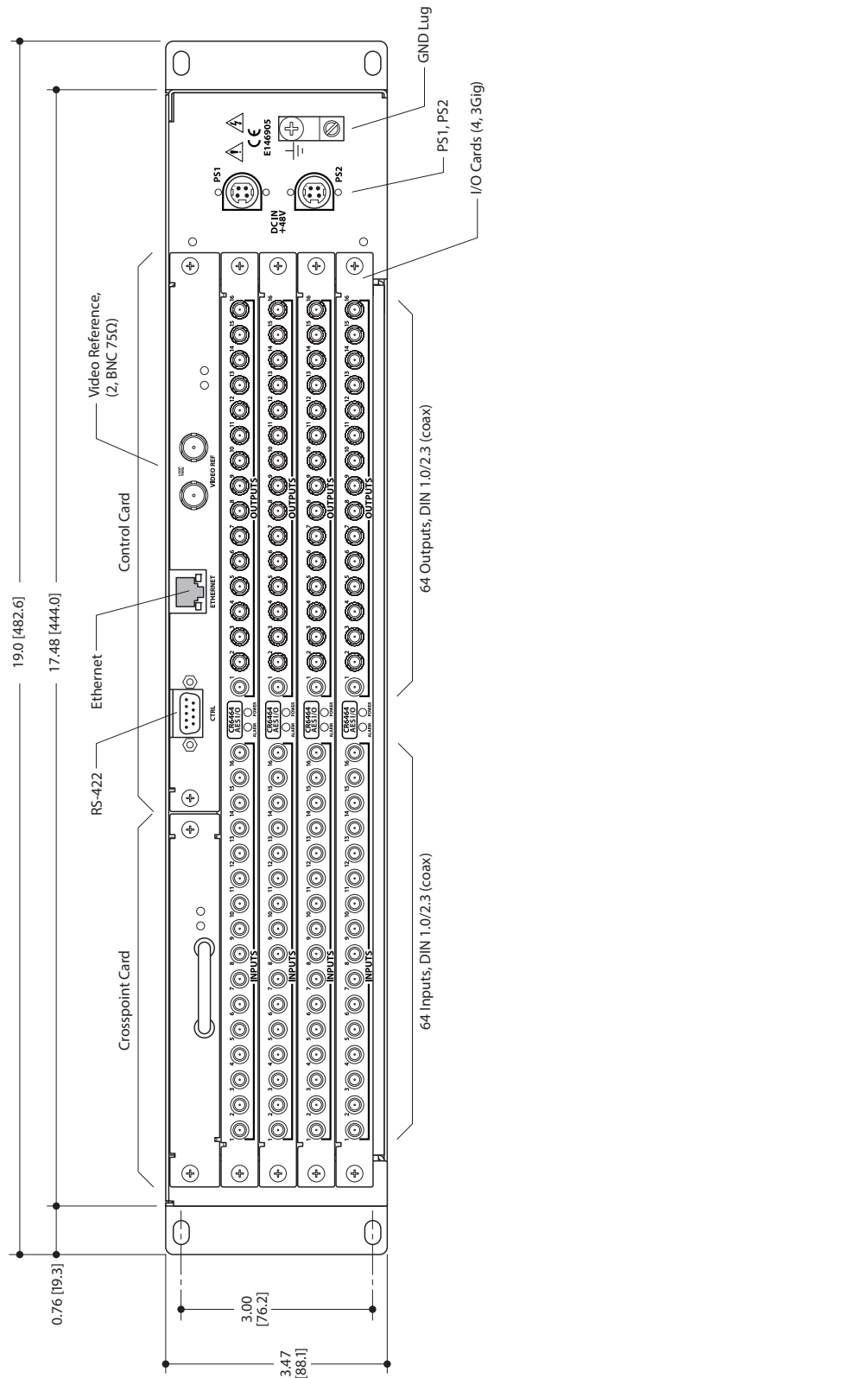
Fig. 7-4: Rear Views of the CR6464-AES Router
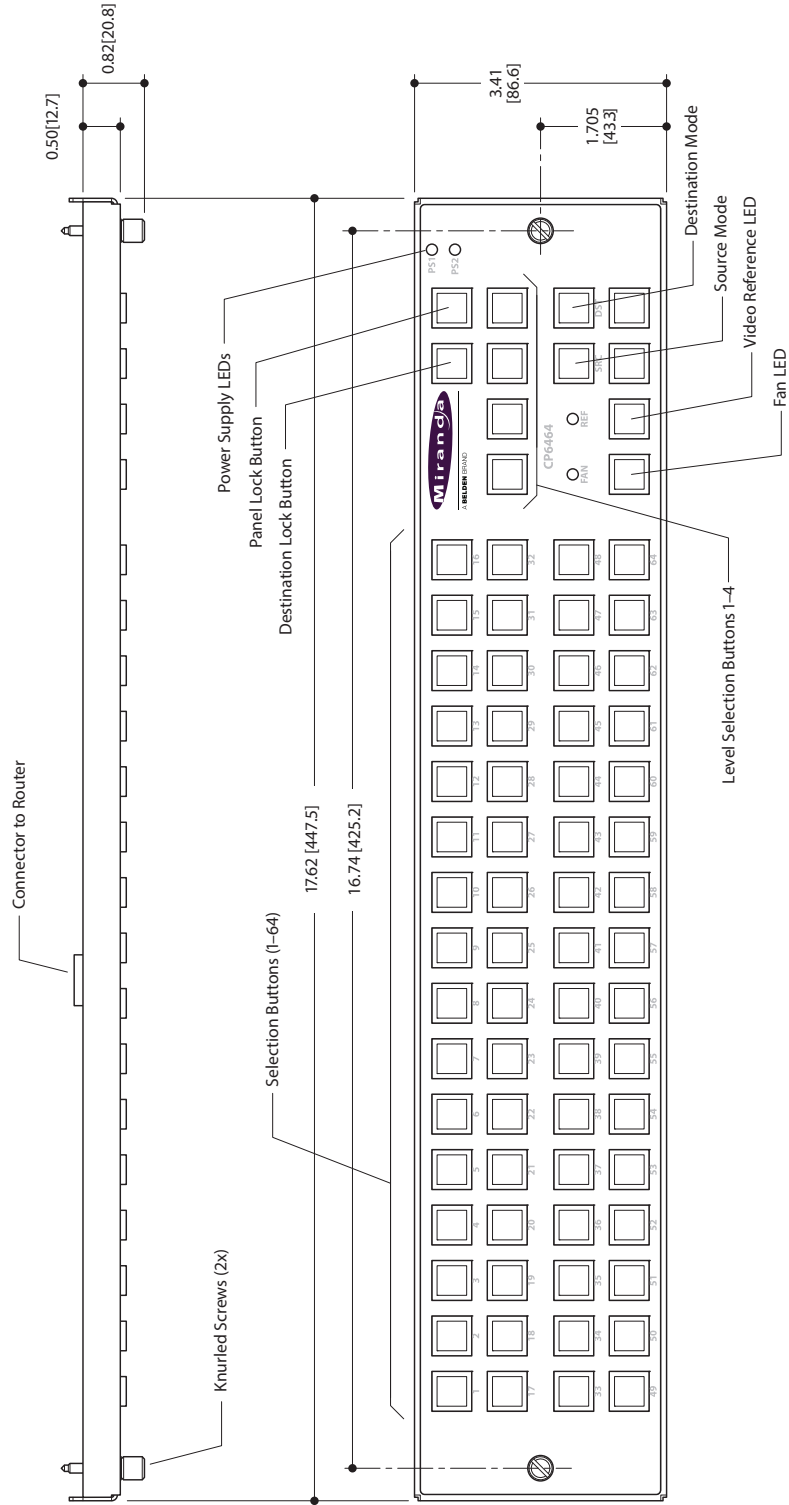
Fig. 7-5: Front and Top Views of the CP6464 Control Panel

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.

Misc. Topics

Chapter 8 provides the following.

Topics

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:

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.

Glossary

AES/EBU (Audio Engineering Society/European Broadcasting Union). AES and EBU are standards organizations.

AES3, AES3id 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.

Asynchro-nous 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.

Breakaway A route where signals are taken from different sources. A breakaway might, for example, take video from one source and audio from another source.

CQX An abbreviation for "clean and quiet."

CR6400 A family of 2RU routers that have a 64×64 switching matrix and modular construction. The family includes a 2RU control panel.

Device 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.)

DVB-ASI (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.

High-tally Bright, in reference to a lamp or LED.

Hold During a breakaway take, the level selections remain unchanged. ('No Hold' means that levels are selected anew at the next source or next destination.

Input/output 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."

IP address 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.

Level In a compact router system, a (physical) level is the same thing as a router partition. (The partition can be the entire router.)

Lock A "destination lock" protects a destination from being switched to a different source. A "panel lock" prevents accidental changes at a panel.

Low-tally Dim, in reference to a lamp or LED.

Operator	The term operator refers to control panel users as opposed to system configurers or system administrators. An operator is responsible for making the routes.
Port	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 *port router*.
Remote Panel Module	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.
	The remote panel module is also a place to mount a control panel.
	CR6464 routers and CP6464s do not (yet) operate in conjunction with remote panel modules.
Primary level	A destination's primary level is the first level in the list of levels assigned to the destination.
Salvo	A salvo is a stored group of takes that can be recalled and executed at a control panel.
Source/ Destination	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.
	A device can be both a source and destination. An example of such a device is a VTR.
Subnet mask	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.
SWB	(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 10 Mbps to about 1.5 Gbps. The HD-SDI routers reclock at 143, 177, 270, 360, and 540 MB/s and 1.483 and 1.485 Gb/s. The SDI routers bypass re-clocking for non-video rates.
Synchronous	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 48 kHz, and (2) switching mono channels.
Take	A take is a route. The panel operator "takes" a source (to a destination).
3Gig	The term "3Gig" describes devices capable of operating at 2.97 Gb/s or 2.966 Gb/s[1] and lower rates. (They reclock at 2.97 Gb/s, 2.966 Gb/s, 270 MB/s, 1.483 Gb/s,[1] and 1.485 Gb/s).

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1. 2.97 / 1.001; 1.485 / 1.001

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