GRASS VALLEY GROUP

TECHNICAL REFERENCE

Ordering Guide

SEPTEMBER 2001

CONCERTO™

MULTI-FORMAT ROUTING SWITCHER

CONTENTS

CONCERTO PRODUCT OVERVIEW

Concerto is a compact, multi-format routing switcher platform that scales from 32x32 to 128x128 in a single 7RU frame. There are six types of matrix boards: serial digital video (SD), stereo, dual mono, or mono (same board), analog audio, digital audio, analog video, time code/data and high definition video. Additionally, there are two types of SD, analog video and HD video matrix boards: standard Concerto128 (expandable to 128x128) and CSE or Concerto64 (expandable to 64x64). The Concerto64 boards are merely "depopulated" versions of the Concerto128 board. Concerto64 matrix boards help reduce the cost of systems that do not require expansion to 128x128.

Concerto offers the flexibility, intelligent control, and linear scalability necessary for a variety of routing and monitoring applications. Its flexible matrix frame lets users mix analog and digital formats within a single frame with unparalleled flexibility. Concerto's small frame size (up 128x128 in a single 7RU frame) complimented by its linear board expansion capability make it ideal for both central routing applications and space limited applications like mobile trucks.

Concerto is uniquely optimized for a wide range of applications:

- Central Facility Routing
- Distributive Facility Routing
- Monitoring Matrices (analog & digital)
- Mobile & Outside Broadcast
- Satellite & Cable Distribution
- Presentation Rooms
- JumboTron' & Related Venues
- Broadband & Telecom Hubs
- Master Control & Subrouting
- Device & Machine Control (Data Matrix)

Mix and Match Formats in the Same Frame

The Concerto platform allows users to mix and match supported signal types in the same frame (including analog audio and video, serial digital video (SD), high-definition digital video, AES/EBU digital audio and time code/port data (machine control). The module slots in the frame are not format sensitive and the appropriate rear panels (plug in style) can be easily removed or reconfigured in the field to accommodated input, output and level changes. This design makes Concerto one of the easiest routing systems to expand or reconfigure available. Plus, it provides tremendous flexibility when laying out a multi-format system to accommodate design requirements.

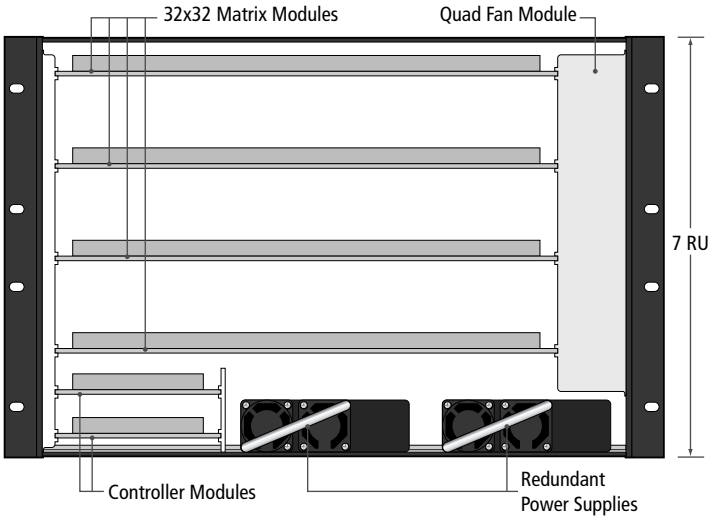
As one would expect from a true multi-format solution, Concerto provides two independent internal sync reference lines for video to eliminate the need for multiple frames in multi-standard facilities. For example, users can assign PAL and NTSC references to the same frame (user-selectable outputs).

Concerto is also equipped with a 48 VDC external power connector to accommodate telecommunications and cable head-end applications.

Flexible Design

The unique bussing and I/O architecture of Concerto makes it the perfect tool for bridging both analog and digital environments. The same frame accommodates analog and digital – video and audio signals simultaneously.

Digital and analog (stereo, dual mono or mono) audio signals are transported from board-to-board using a unique TDM (time division multiplexed) bussing technique. Additionally, the Concerto analog audio matrix boards include built-in A/D and D/A conversion. This means that analog-to-digital and digital-to-analog conversion for audio is handled within the Concerto frame (or from frame to frame) when switching audio. Concerto is equipped with the ability to process analog and digital audio signals: summing, swapping and inverting. The capabilities simplify wiring and reduce the requirement for dedicated audio conversion equipment.



Linear Scalability

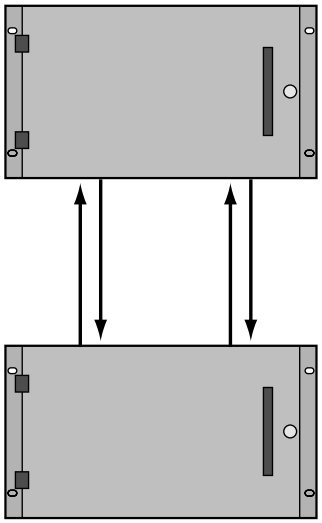
Expansion of Concerto matrices is easy and affordable. Unlike most systems that require dedicated input, output and crosspoint modules for configuration and expansion—it takes only a single board to change a 32x32 Concerto matrix to a 64x64 configuration, and only four boards to configure a full 128x128 Concerto matrix. A plug-in (no wires) rear panel is used for configuring the inputs and outputs on Concerto. One plug-in rear panel is required for each matrix board, or additional rear panels (more I/O than matrix boards) can be installed to allow for future expansion (reduces down-time). The process of adding additional rear panels to accommodate future expansion is often referred to as "pre-wiring for expansion".

TDM Expansion for Multi-Frame Systems (Beyond 128x128)

Optional TDM Expansion Modules are available to allow Concerto audio matrices to be expanded linearly beyond 128x128 (a single frame). This TDM Expander Module also provides a means to bus signals from frame to frame for A/D and D/A conversion. It also provides a method for busing I/O for multiple levels of analog and digital audio, time code and machine control data from frame to frame.

This TDM Expansion Module provides the means for easily connecting one frame to another (for expansion of audio, time code or data) merely by connecting four coax cables (or eight when redundancy is required). These two (or four) coax cables carry the audio, time code and data signals from frame to frame thus reducing installation costs and overall integration requirements.

This unique, straightforward approach for handling audio and related signals simplifies cabling between frames and eliminates the need for secondary switches and distribution amplifiers.



Control of Concerto Matrices

Concerto is controlled by Grass Valley Group's Encore™ control system—a flexible control platform that scales to the application.

Encore control can be as simple as a dedicated personal computer enabling complete system control and configuration of Concerto matrices—or it can be as sophisticated and robust as multiple, redundant hardware controllers controlling Concerto in mission critical environments. The Encore real-time controllers provide redundancy and processing throughput.

To learn more about the Encore control system, please refer to the Encore Data Sheet or Ordering Guide.

Designed for Demanding Environments

Concerto matrices can be configured with complete control and power redundancy for the more demanding "mission critical" applications—or with single controller and power supply for less demanding applications. The Concerto frame conforms to safety and emission standards such as UL, FCC and CE to ensure acceptance in even the most demanding facilities and environments. Built-in multi-fan, forced-air cooling ensures optimal performance and reliability without requiring external fan units. The Concerto frame features alarm relay outputs to alert facilities management and engineering personnel of module failures.

Compatible With Many Control Systems

Concerto matrices can be controlled by our Encore scalable facility control system, the widely used Series 7000 control system, and many other third-party control and automation systems. It is also compatible with the Grass Valley Group's NetCentral™ software for Simple Network Management Protocol (SNMP)-based monitoring and diagnostics.

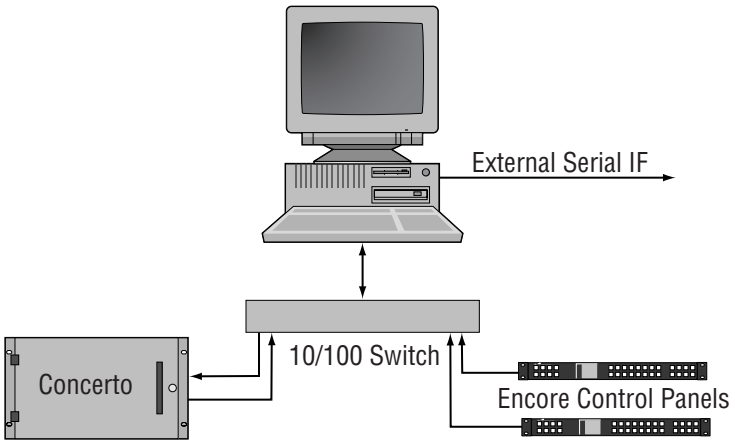
Hot Swappable Modules with QC Monitoring

All processing modules are front-removable and hot swappable for safe, on air maintenance. In addition, all video and audio modules have monitor ports for quality assurance and signal integrity analysis.

Key Features

- Compact, space-saving 7 RU frame
- Robust, efficient design with single-module linear expansion in 32x32 increments up to 128x128.
- TDM backbone for linear expansion of audio and data for multi-matrix systems beyond 128x128.
- Unique signal bussing technology for mixing and matching signal types in the same frame, including analog audio and video, SD and HD digital video, AES/EBU digital audio, and port data.

- Front accessible boards, modules, and fans for quick, hot-swappable service and expansion.
- Integrated A/D and D/A conversion for audio with selectable processing for mono mix, invert, swap, and dual left/right. It also allows for AES to analog and analog to AES conversions within the router.
- Sophisticated output monitoring for quality control and signal integrity analysis.
- NetCentral II software compatibility for comprehensive SNMP monitoring and diagnostics.
- Control options including Encore scalable facility control system, Series 7000 control system, stand-alone browser based control and other third-party control systems.
- An optional time division multiplexing (TDM) backbone for audio and data, users can easily link multiple matrices together to create larger systems.

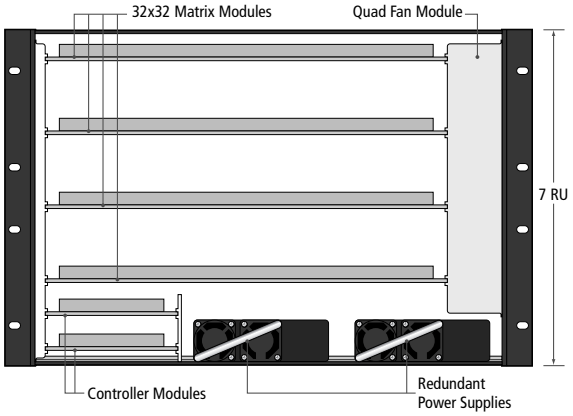


CONCERTO ORDERING INFORMATION

All Concerto matrices are made up of various combinations of the following boards and assemblies.

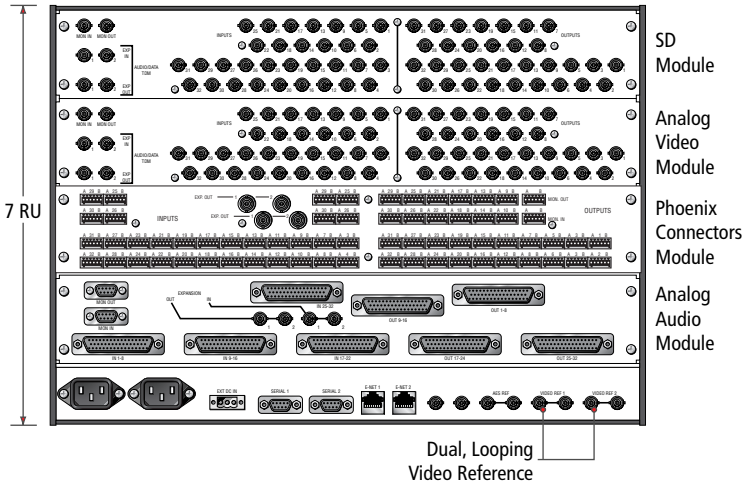
Concerto Flexible Matrix Frame **CRS-CNRTO-FRM**

The Concerto matrix frame accepts four matrix boards (and associated rear panels), two matrix controller boards (redundant pair), two power supplies (shared redundancy) and one redundant fan assembly.



The Concerto matrix frame can be configured to house either a mixture of signal types or a single signal type.

If a frame is used to house a single signal type or format (i.e., video only) it can accommodate matrices as large as 128x128. Each matrix board increments the matrix size in steps of 32 inputs and 32 outputs. Unlike conventional matrix platforms, the Concerto matrix features linear board expansion. This means that one matrix board (of any signal type) provides 32 inputs to 32 outputs, two matrix boards provide 64 input to 64 outputs, three matrix boards provide 96 inputs to 96 outputs and four matrix boards provide 128 input to 128 outputs. This applies specifically to the standard Concerto matrix boards. In the case of the Concerto64 matrix boards—the maximum matrix size is 64 inputs by 64 outputs.



If the frame is configured to house multiple signal types, the number of available slots determines the maximum matrix size per signal type. Here are some examples of configurations the can be house in a signal frame:

- 32x32 SD/AES/AA/V (four board slots)
- 64x64 SD/AA (four board slots)
- 96x96 SD & 32x32 AES (four board slots)
- 64x64 SD, 32x32 AES & 32 Port Data

The Concerto frame can also be configured for operation from an external 48 Volt DC power source using dedicated connections on the rear of the chassis.

TDM Expansion Module

CRS-CNRTO-TDM

Analog audio, digital audio, time code and RS-422 data (machine control) signals are bussed from board-to-board or frame-to-frame using a technique called Time-Division Multiplexing or TDM. TDM technology is a bussing scheme that allows numerous digital signals to be combined or concentrated for transmission on one or more communication channel(s).

Concerto's TDM Expansion Module allows digital audio, analog audio, time code and data signals to be concentrated (or multiplexed) into a single data path for transmission from one Concerto frame to another Concerto frame. When the TDM Expansion Module's data stream is received at the destination matrix frame, the data is expanded (or de-multiplexed) for distribution to all destinations.

This TDM Expansion Module is used to transmit (or extend) the internal TDM busses from one matrix frame to another (as described above). One or two (for redundancy) TDM Expansion Modules can be mounted in each frame. The TDM Expansion Modules mount as a mezzanine on either an analog audio, digital audio or Data/TC board. The maximum number of TDM Expansion Modules required per frame is two.

Frame-to-frame expansion of the TDM buss (via the TDM Expansion Module) allows linear audio expansion to 256 inputs by 256 outputs (per level). This applies only to analog audio, digital audio (AES), time code or data (not SD, analog video or HD). Extending the TDM buss from one frame to another also enables audio A/D (analog-to-digital) and D/A (digital-to-analog) conversion from one frame to another.

The bandwidth of this TDM buss (when using the TDM Expansion Module) is 270 Mb/s. This transmission line is based on the SMPTE305M (SDTI) standard; therefore, a standard video coax cable can be used for interconnecting frames. At minimum, two coax connections are required to connect the frames. Each coax between the frames carries 64 stereo pairs.

Concerto Power Supply **CRS-CNRTO-PS**

Each Concerto matrix frame can house either one or two (for redundancy) power supplies. The Concerto matrix frame can also be powered by an external 48V DC power supply to accommodate telephony and related requirements.

All configured Concerto matrices found in the "Common Configurations" section of the price list include two (redundant) power supplies.

Concerto Matrix Control **CRS-CNRTO-MC**

Each Concerto matrix frame can house either one or two (for redundancy) Matrix Controller Modules. The Matrix Control module manages crosspoint & attribute control information. Additionally, the Matrix Control module manages and distributes sync information within the frame. This board also serves as a watchdog for reporting alarm conditions, i.e., power supply failures, over-temperature conditions, etc. At least one Matrix Control module is required for each Concerto Matrix Frame.

All configured Concerto matrices found in the "Common Configurations" section of the price list include two (redundant) Matrix Control boards.

Concerto Fan Assembly **CRS-CNRTO-FAN**

Each Concerto matrix frame can house one Fan Assembly. The Fan Assembly pushes air from the right side of the frame to the left side of the frame (when facing the front of the frame). A Fan Assembly is required in all Concerto matrix frames to ensure proper cooling of the matrix boards, matrix control boards and power supplies.

All configured Concerto matrices found in the "Common Configurations" section of the price list include a Fan Assembly.

Concerto Serial Digital (SD) Video Board — CRS-CNRTO-SD

Up to four Concerto Serial Digital (SD) Video boards can be housed in each Concerto matrix frame. The Concerto SD video board is the central matrix building block for configuring SD matrices (from 32x32 to 128x128 in size). Each board provides 32 inputs by 32 outputs. Four of these boards can be used to linearly expand (within a single frame) to 128 input by 128 outputs (in increments of 32 inputs by 32 outputs).

The Concerto Serial Digital Video board is designed to route digital video signals that conform to the following specifications: SMPTE259M and EBU Tech3267. This board will either re-clock or "bypass" switch all digital video signals (ranging from 5 Mb/s to 360M b/s). The re-clocked bit rates include 143 Mb/s, 177 Mb/s, 270Mb/s and 360Mb/s.

One BNC Rear Panel (CRS-CNRTO-BNC-RP) is required for each SD Video board. More than one BNC Rear Panel per board can be mounted on a frame to accommodate pre-wire requirements (refer to the Matrix Size Terminology section more information).

Concerto accommodates up to two sync references per matrix frame. Sync reference is assigned on an output-by-output basis.

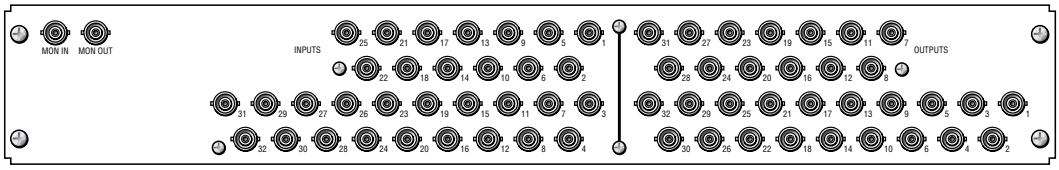
Concerto64 Serial Digital (SD) Video Board — CRS-CNRTO-SD64

The Concerto64 Serial Digital Video board is a "de-populated" version of the standard Concerto Serial Digital Video board (CRS-CNRTO-SD). It is identical in performance—but limited to 64 inputs by 64 outputs in size when expanded within a frame.

This board was developed to address small matrix requirements (at a reduced price point). One BNC Rear Panel is required for each board.

Concerto BNC Rear Panel — CRS-CNRTO-BNC-RP

The Concerto BNC Rear Panel mounts on the rear of a Concerto Matrix Frame to provide input and output connectors for SD video, analog video and 75Ω AES/EBU audio matrices. Up to four Concerto BNC Rear Panels can be mounted on each frame.



One BNC Rear Panel is required for each Concerto SD, Analog Video or Digital Audio board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one BNC Rear Panel can be used.

Matrix Size Terminology

Pre-wiring the frame is an effective approach for reducing downtime and re-cabling requirements associated with expanding a routing switcher.

It is often wise to pre-wire or pre-configure matrix frames for expansion. In other words, configure the chassis to accept additional matrix boards by adding an increased number of rear panels. This allows expansion (plugging in boards) without reconfiguring rear panels or rewiring a frame or equipment rack. Pre-wiring is often preferred in mission critical environments like television stations, satellite networks, etc.

The following terminology can be used for communicating active and pre-wired size requirements:

64x64 (128x128) V/AA

The first size shown indicates the active size of the matrix. The pre-wired or pre-configured size is identified in parenthesis. The matrix levels are identified by short-hand: SD = Serial Digital Video (standard definition), WB = Wide Band (format independent / re-clock all standard bit rates), HD = High Definition Video, V = Analog Video, AA = Stereo or Dual Mono Analog Audio

Concerto Analog Video Board — CRS-CNTRO-AV

Up to four Concerto Analog Video boards can be housed in each Concerto matrix frame. The Concerto analog video board is the central matrix building block for configuring analog video matrices (from 32x32 to 128x128 in size). Each board provides 32 inputs by 32 outputs. Four of these boards can be used to linearly expand (within a single frame) to 128 input by 128 outputs (in increments of 32 inputs by 32 outputs).

The Concerto Analog Video board is designed to route wideband analog video signals. This board has terminating, single-ended inputs and outputs, DC coupling, and wideband signal performance (100MHz).

One BNC Rear Panel (CRS-CNRTO-BNC-RP) is required for each analog Video board. More than one BNC Rear Panel per board can be mounted on a frame to accommodate pre-wire requirements (refer to the Matrix Size Terminology section more information).

Concerto accommodates up to two sync references per matrix frame. Sync reference is assigned on an output-by-output basis.

Concerto64 Analog Video Board — CRS-CNRTO-AV64

The Concerto64 Analog Video board is a “de-populated” version of the standard Concerto Analog Video board (CRS-CNRTO-AV). It is identical in performance—but limited to 64 inputs by 64 outputs in size when expanded within a frame.

This board was developed to address small matrix requirements (at a reduced price point). At least one BNC Rear Panel is required for each board.

Concerto Analog Audio Board — CRS-CNRTO-AA

Up to four Concerto Analog Audio boards can be housed in each Concerto matrix frame. The Concerto analog audio board is the central matrix building block for configuring stereo, dual mono or mono (mapped) analog audio matrices (from 32x32 to 128x128 stereo in size). Each board provides 32 inputs by 32 outputs (stereo). Four of these boards can be used to linearly expand (within a single frame) to 128 input by 128 outputs (in increments of 32 inputs by 32 outputs).

At least one Analog Audio Rear Panel (CRS-CNRTO-AA-RP or CRS-CNRTO-AA50-RP) is required for each analog audio board. More than one analog audio rear panel per board can be mounted on a frame to accommodate pre-wire requirements (refer to the Matrix Size Terminology section more information).

The Concerto system provides true stereo audio processing and performance. The analog audio board also includes built-in A/D signal conversion. To take advantage of this capability, a digital audio board must be present in the system – either within the same frame, or on an adjacent frame that is connected via the TDM expansion module. This allows any signal processed (in groups of 32) through the analog audio module to be switched to a digital output without the use of tie lines or other external A/D conversion products. In addition, through the Encore control system, you can process the audio attributes on the output to swap channels, invert either channel, sum the two channels, or replicate a channel to feed a mono input to both outputs.

As mentioned above, there are two rear panel options for the Analog Audio Board:

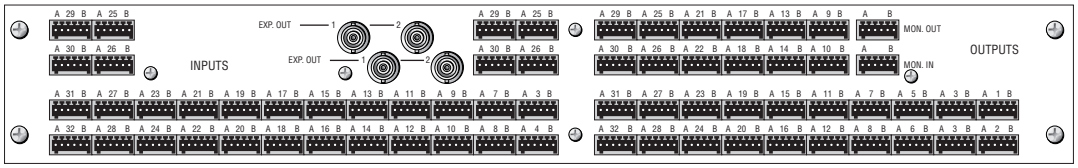
CRS-CNRTO-AA-RP: The standard rear panel is used to provide balanced input/output connections (configured with Phoenix strip style connectors as shown below).

CRS-CNRTO-AA50-RP: Alternatively, a balanced DB50 rear panel is available for high density input/output connectivity.

Concerto Balanced Audio Rear Panel (Phoenix Connectors) — CRS-CNRTO-AA-RP

The Concerto Balanced Analog Audio Rear Panel mounts on the rear of a Concerto Matrix Frame to provide input and output connectors for analog audio matrices. This rear panel features a unique Phoenix style connector (standard with "Common Configurations"). Up to four Concerto Balanced Audio Rear Panels can be mounted on each frame.

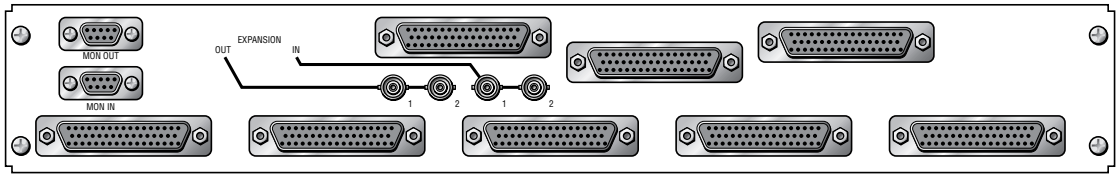
A Balanced Audio Rear Panel is required for each Concerto analog audio board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one Balanced Audio Rear Panel can be used.



Concerto Balanced Audio Rear Panel (DB50 Connectors) **CRS-CNRTO-AA50-RP**

The CRS-CNRTO-AA50-RP DB50 configured rear panel is an alternative rear panel to the standard Phoenix connector rear panel (CRS-CNRTO-AA-RP). This rear panel, like the standard Balanced Analog Audio Rear Panel, mounts on the rear of a Concerto Matrix Frame to provide input and output connectors for analog audio matrices. Up to four Concerto Balanced Audio Rear Panels can be mounted on each frame.

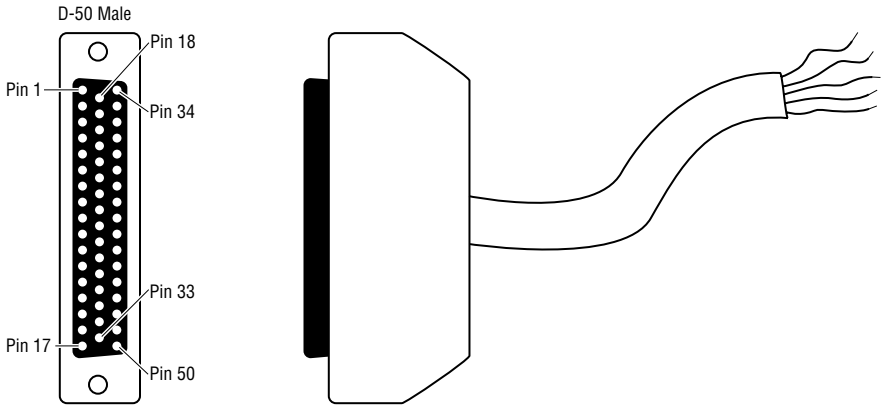
One Balanced Audio Rear Panel is required for each Concerto analog audio board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one Balanced Audio Rear Panel can be used.



Each CRS-CNRTO-AA50-RP accepts up to eight CRS-CNRTO-AE-CBL1 Analog Audio Pigtail or breakout Assemblies (DB50 cable assembly). The Analog Audio Pigtail Assembly can be used for direct connection to an audio punch block or related device.

Concerto Analog Audio Pigtail Assembly **CRS-CNRTO-AE-CBL1**

The CRS-CNRTO-AE-CBL1 Analog Audio Pigtail Assembly is a cable assembly that provides 26 AWG breakout wires on one end and a male DB50 connector on the other. The cable itself is 4.5 meters (14.5 feet) in length. Up to eight Analog Audio pigtails can be used on each analog audio (stereo) rear panel.



Concerto Digital Audio Board **CRS-CNRTO-AES**

Up to four Concerto Digital Audio boards can be housed in each Concerto matrix frame. The Concerto Digital Audio Board is the central matrix building block for AES/EBU Digital Audio signals (48k reference). Each board provides 32 inputs by 32 outputs (stereo). Four of these boards can be used to linearly expand (within a single frame) to 128 input by 128 outputs (in increments of 32 inputs by 32 outputs).

At least one Digital Audio Rear Panel (CRS-CNRTO-BNC-RP, CRS-CNRTO-AES-RP or CRS-CNRTO-AS50-RP) is required for each digital audio board. More than one digital audio rear panel per board can be mounted on a frame to accommodate pre-wire requirements (refer to the Matrix Size Terminology section more information).

The Encore control system enables users to process the audio attributes on the output to swap channels, invert either channel, sum the two channels, or replicate a channel to feed a mono input to both outputs.

The digital audio processing found in Concerto is truly unique. Not only does it comply with AES and EBU standards for digital audio, but it includes more advanced features like synchronous AES/EBU switching (for signals sampled at 48kHz), attributes control and “soft” or “V-fade” switching to eliminate pops and clicks that can be introduced by signal level differences. If the audio signal being switched does not conform to the required 48kHz-sampling rate, Concerto will bit rate convert these signals to switch synchronously using a sample add/drop technology.

The Concerto Digital Audio Board also enables A/D and D/A conversion when used with a Stereo Analog Audio Board (refer Stereo Analog Audio Board). This A/D and D/A conversion is only possible with Concerto systems (with TDM bussing) or frames that includes both analog and digital audio boards.

As mentioned above, there are three rear panel options for the Digital Audio Board:

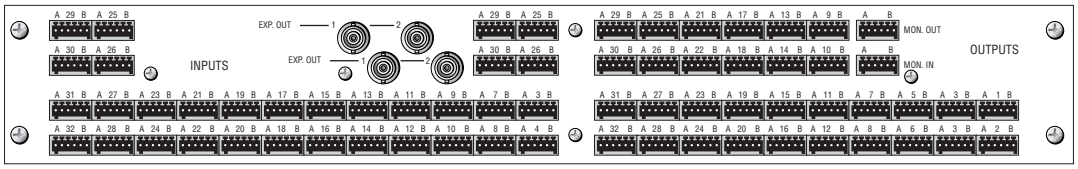
CRS-CNRTO-BNC-RP: The standard BNC rear panel can be used with the Digital Audio board to provide unbalanced, 75Ω input/output connections.

CRS-CNRTO-AES-RP: The standard 110Ω rear panel is used to provide balanced input/output connections (configured with Phoenix style connectors as shown below).

CRS-CNRTO-AS50-RP: Alternatively, a balanced DB50 rear panel is available for 110Ω high density input/output connectivity.

Concerto AES/EBU Audio Rear Panel (Phoenix Connectors) CRS-CNRTO-AES-RP

The Concerto Balanced AES/EBU Audio Rear Panel mounts on the rear of a Concerto Matrix Frame to provide input and output connectors for digital audio matrices. This rear panel features a unique Phoenix style connector (standard with "Common Configurations"). Up to four Concerto Balanced AES/EBU Audio Rear Panels can be mounted on each frame.

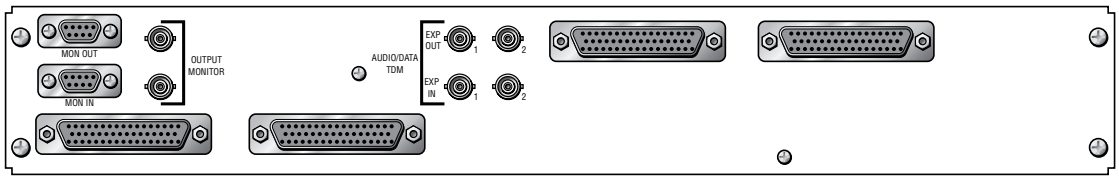


At least one Balanced AES/EBU Audio Rear Panel is required for each Concerto digital audio board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one Balanced AES/EBU Audio Rear Panel can be used.

Concerto Balanced AES/EBU Rear Panel (DB50 Connectors) CRS-CNRTO-AS50-RP

The CRS-CNRTO-AS50-RP DB50 configured rear panel is an alternative rear panel to the standard Phoenix connector rear panel (CRS-CNRTO-AES-RP). This rear panel, like the standard Balanced AES/EBU Audio Rear Panel, mounts on the rear of a Concerto Matrix Frame to provide input and output connectors for digital audio matrices. Up to four Concerto Balanced AES/EBU Audio Rear Panels can be mounted on each frame.

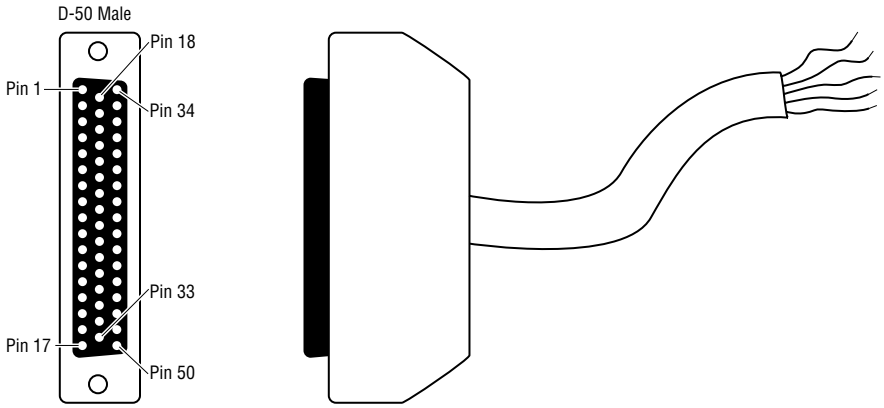
At least one Balanced AES/EBU Audio Rear Panel is required for each Concerto digital audio board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one Balanced AES/EBU Audio Rear Panel can be used.



Each CRS-CNRTO-AS50-RP accepts up to four CRS-CNRTO-AE-CBL2 AES/EBU Audio Pigtail or breakout Assemblies (DB50 cable assembly). The Digital Audio Pigtail Assembly can be used for direct connection to an audio punch block or related device.

Concerto Digital Audio Pigtail Assembly CRS-CNRTO-AE-CBL2

The CRS-CNRTO-AE-CBL2 Digital Audio Pigtail Assembly is a cable assembly that provides breakout cables on one end and a male DB50 connector on the other. The cable itself is 4.5 meters (14.5 feet) in length. Up to four Digital Audio Pigtails can be used on each digital audio rear panel.



Concerto Data & Time Code Board CRS-CNRTO-DATA

Up to four Concerto Data/Time Code boards can be housed in each Concerto matrix frame. The Concerto Data/Time Code Board is the central matrix building block for Data and Time Code signals (determined by the rear panel selected). Each board provides either 32 data (RS-422/485) ports or 32 time code inputs by 32 time code outputs. Four of these boards can be used to linearly expand (within a single frame) to either 128 data ports (increments of 32 ports) or128 time code input by 128 time code outputs (increments of 32 inputs by 32 outputs).

The type of rear panel determines whether or not this board operates as a data board or a time code board. There are two rear panel options:

- CRS-CNRTO-DATA-RP Concerto Data (RS-422/485) Rear Panel, DB9
- CRS-CNRTO-TC-RP Concerto Time Code Rear Panel, Phoenix

At least one data or time code rear panel is required for each data/time code board. More than one rear panel per board can be mounted on a frame to accommodate pre-wire requirements (refer to the Matrix Size Terminology section more information).

The data board has been designed to provide precise switching of RS-422/485 machine control data. The Concerto data board provides sophisticated, "port oriented" processing of the bi-direction RS-422/485 signals. This processing that complies with ANSI/SMPTE 207M standards. It provides dynamic pin-configuration modes for master vs. slave control (automatic switching of both controlling and controlled devices).

When used in time code mode, the Concerto Data & Time Code Board provides a clean, reliable platform for processing and switching SMPTE time code streams. It complies with SMPTE 12M standards—and includes optimized signal processing for time code signals.

Concerto Data Rear Panel (DB9 Connectors) **CRS-CNRTO-DATA-RP**

The CRS-CNRTO-DATA-RP DB9 Data Rear Panel is required for switching data information. This rear panel mounts on the rear of a Concerto Matrix Frame to provide I/O connectors for RS-422/485 data matrices. Up to four Concerto Data Rear Panels can be mounted on each frame.

At least one Data Rear Panel is required for each Concerto data/time code board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one Data Rear Panel can be used.

Concerto Time Code Rear Panel (Phoenix Connectors) **CRS-CNRTO-TC-RP**

The Concerto Time Code Rear Panel mounts on the rear of a Concerto Matrix Frame to provide input and output connectors for time code matrices. This rear panel features a unique Phoenix style connector. Up to four Concerto Time Code Rear Panels can be mounted on each frame.

At least one Time Code Rear Panel is required for each Concerto data/time code board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one Time Code Rear Panel can be used.

Concerto High Definition Video Board **CRS-CNRTO-HD**

Up to four Concerto High Definition (HD) Video boards can be housed in each Concerto matrix frame. The Concerto HD video board is the central matrix building block for configuring HD matrices (from 32x32 to 128x128 in size). Each board provides 32 inputs by 32 outputs. Four of these boards can be used to linearly expand (within a single frame) to 128 input by 128 outputs (in increments of 32 inputs by 32 outputs).

The Concerto HD Video board is designed to route digital video signals that conform to the following specifications: SMPTE 292M, SMPTE259M and EBU Tech3267. This board will either re-clock or “bypass” switch all digital video signals (ranging from 10 Mb/s to 1.5 Gb/s). The re-clocked bit rates include 143 Mb/s, 177 Mb/s, 270 Mb/s, 360 Mb/s, 540 Mb/s and 1.485 Gb/s (1080p @ 24Hz).

At least one High Definition Rear Panel (CRS-CNRTO-HD-RP) is required for each HD Video board. More than one HD Rear Panel per board can be mounted on a frame to accommodate pre-wire requirements (refer to the Matrix Size Terminology section more information).

Concerto accommodates up to two sync references per matrix frame. Sync reference is assigned on an output-by-output basis.

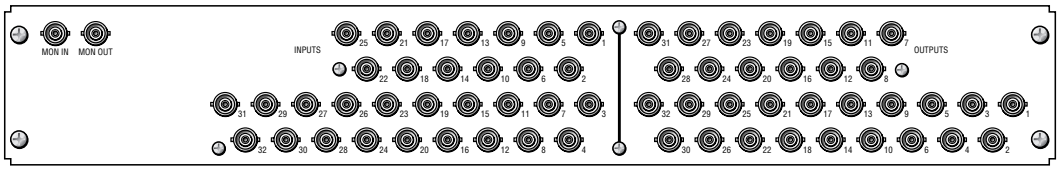
Concerto64 High Definition (HD) Video Board — CRS-CNRTO-HD64

The Concerto64 High Definition Video board is a "de-populated" version of the standard Concerto HD Video board (CRS-CNRTO-HD). It is identical in performance—but limited to 64 inputs by 64 outputs in size when expanded within a frame.

This board was developed to address small matrix requirements (at a reduced price point). At least one HD Rear Panel is required for each board.

Concerto High Definition (HD) Rear Panel — CRS-CNRTO-HD-RP

The Concerto High Definition Rear Panel mounts on the rear of a Concerto Matrix Frame to provide input and output 75Ω BNC connectors for HD video matrices. Up to four Concerto HD Rear Panels can be mounted on each frame.



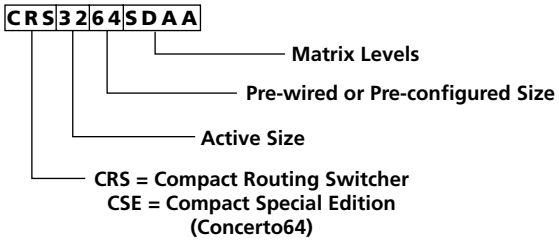
At least one HD Rear Panel is required for each Concerto HD video board. If a matrix must be pre-configured or pre-wired for expansion (recommended), more than one HD Rear Panel can be used.

Common Configurations CSE & CRS Matrices

To increase the ease of ordering Concerto matrices, GVG has developed numerous "Common Configurations". Common Configurations are pre-configured matrices of various different sizes. Each of these matrices includes redundant power supplies and redundant matrix controllers.

All required items to build each of the matrices described are included. The only missing item is control. To control these matrices—and all Concerto matrices—is Grass Valley Group's Encore Control System.

The nomenclature for these matrices identifies the size, pre-wired or pre-configured size and matrix levels:



There are two types of Common Configurations: CRS and CSE

CRS Configurations

The CRS matrix configurations include standard Concerto128 matrix boards. These matrices can be expanded from 32x32 to 128x128 in size.

CSE Configurations

The CSE matrix configurations include Concerto64 matrix boards (described above). These matrices are limited to 64x64 in size. They offer the same performance as the standard CRS configurations—but they are available at a reduced cost.

The CRS and CSE Common Configurations are listed below:

Concerto64 Packages

Concerto64 Matrix, 32x32 SD/AA **CSE32SDAA**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one analog audio matrix board and associated rear panels

Concerto64 Matrix, 32x32 SD/AES **CSE32SDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one digital audio board and associated rear panels

Concerto64 Matrix, 32x32 V/AA **CSE32VAA**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board, one analog audio board and associated rear panels

Concerto64 Matrix, 32x32 HD/AES **CSE32HDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one high definition digital video matrix board, one digital audio board and associated rear panels

Concerto64 Matrix, 32x32 SD **CSE32SD**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board and associated rear panel

Concerto64 Matrix, 32x32 AES **CSE32AES**
Includes frame, redundant power supplies, redundant matrix control boards, one digital audio board and associated rear panel

Concerto64 Matrix, 32x32 AA **CSE32AA**
Includes frame, redundant power supplies, redundant matrix control boards, one analog audio board and associated rear panel

Concerto64 Matrix, 32x32 V **CSE32AV**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board and associated rear panel

Concerto64 Matrix, 32x32 HD **CSE32HD**
Includes frame, redundant power supplies, redundant matrix control boards, one high definition digital video matrix board and associated rear panel

Concerto64 Matrix, 32x32 (64x64) SD/AA **CSE3264SDAA**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one analog audio matrix board and two rear panels for each level (prewire for 64x64 SD/AA)

Concerto64 Matrix, 32x32 (64x64) SD/AES **CSE3264SDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one digital audio board and two rear panels for each level (prewire for 64x64 SD/AES)

Concerto64 Matrix, 32x32 (64x64) V/AA **CSE3264VAA**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board, one analog audio board and two rear panels for each level (prewired for 64x64 V/AA)

Concerto64 Matrix, 32x32 (64x64) HD/AES **CSE3264HDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one high definition digital video matrix board, one digital audio board and two rear panels for each level (prewire for 64x64 HD/AES)

Concerto64 Matrix, 32x32 (64x64) SD **CSE3264SD**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board and two rear panels (prewire for 64x64)

Concerto64 Matrix, 32x32 (64x64) V **CSE3264AV**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board and two rear panels (prewire for 64x64)

Concerto64 Matrix, 64x64 SD/AA **CSE64SDAA**
Includes frame, redundant power supplies, redundant matrix control boards, two SD matrix boards, two analog audio matrix boards and associated rear panels

Concerto64 Matrix, 64x64 SD/AES **CSE64SDAS**
Includes frame, redundant power supplies, redundant matrix control boards, two SD matrix boards, two digital audio boards and associated rear panels

Concerto64 Matrix, 64x64 V/AA **CSE64VAA**
Includes frame, redundant power supplies, redundant matrix control boards, two analog video matrix boards, two analog audio boards and associated rear panels

Concerto64 Matrix, 64x64 HD/AES **CSE64HDAS**
Includes frame, redundant power supplies, redundant matrix control boards, two high definition digital video matrix boards, two digital audio boards and associated rear panels

Concerto64 Matrix, 64x64 SD **CSE64SD**
Includes frame, redundant power supplies, redundant matrix control boards, two SD matrix boards and associated rear panels

Concerto64 Matrix, 64x64 V **CSE64AV**
Includes frame, redundant power supplies, redundant matrix control boards, two analog video matrix boards and associated rear panels

Concerto64 Matrix, 64x64 HD **CSE64HD**
Includes frame, redundant power supplies, redundant matrix control boards, two HD video matrix boards and associated rear panels.

Concerto128 Packages

Concerto128 Matrix, 32x32 SD/AA **CRS32SDAA**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one analog audio matrix board and associated rear panels

Concerto128 Matrix, 32x32 SD/AES **CRS32SDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one digital audio board and associated rear panels

Concerto128 Matrix, 32x32 V/AA **CRS32VAA**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board, one analog audio board and associated rear panels

Concerto128 Matrix, 32x32 HD/AES **CRS32HDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one high definition digital video matrix board, one digital audio board and associated rear panels

Concerto128 Matrix, 32x32 SD **CRS32SD**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board and associated rear panel

Concerto128 Matrix, 32x32 AES **CRS32AES**
Includes frame, redundant power supplies, redundant matrix control boards, one digital audio board and associated rear panel

Concerto128 Matrix, 32x32 AA **CRS32AA**
Includes frame, redundant power supplies, redundant matrix control boards, one analog audio board and associated rear panel

Concerto128 Matrix, 32x32 V **CRS32AV**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board and associated rear panel

Concerto128 Matrix, 32x32 HD **CRS32HD**
Includes frame, redundant power supplies, redundant matrix control boards, one high definition digital video matrix board and associated rear panel

Concerto128 Matrix, 32x32 (64x64) SD/AA **CRS3264SDAA**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one analog audio matrix board and two rear panels for each level (prewire for 64x64 SD/AA)

Concerto128 Matrix, 32x32 (64x64) SD/AES **CRS3264SDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board, one digital audio board and two rear panels for each level (prewire for 64x64 SD/AES)

Concerto128 Matrix, 32x32 (64x64) V/AA **CRS3264VAA**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board, one analog audio board and two rear panels for each level (prewired for 64x64 V/AA)

Concerto128 Matrix, 32x32 (64x64) HD/AES **CRS3264HDAS**
Includes frame, redundant power supplies, redundant matrix control boards, one high definition digital video matrix board, one digital audio board and two rear panels for each level (prewire for 64x64 HD/AES)

Concerto128 Matrix, 32x32 (64x64) SD **CRS3264SD**
Includes frame, redundant power supplies, redundant matrix control boards, one SD matrix board and two rear panels (prewire for 64x64)

Concerto128 Matrix, 32x32 (64x64) V **CRS3264AV**
Includes frame, redundant power supplies, redundant matrix control boards, one analog video matrix board and two rear panels (prewire for 64x64)

Concerto128 Matrix, 64x64 SD/AA **CRS64SDAA**
Includes frame, redundant power supplies, redundant matrix control boards, two SD matrix boards, two analog audio matrix boards and associated rear panels

Concerto128 Matrix, 64x64 SD/AES **CRS64SDAS**
Includes frame, redundant power supplies, redundant matrix control boards, two SD matrix boards, two digital audio boards and associated rear panels

Concerto128 Matrix, 64x64 V/AA **CRS64VAA**
Includes frame, redundant power supplies, redundant matrix control boards, two analog video matrix boards, two analog audio boards and associated rear panels

Concerto128 Matrix, 64x64 HD/AES **CRS64HDAS**
Includes frame, redundant power supplies, redundant matrix control boards, two high definition digital video matrix boards, two digital audio boards and associated rear panels

Concerto128 Matrix, 64x64 SD **CRS64SD**
Includes frame, redundant power supplies, redundant matrix control boards, two SD matrix boards and associated rear panels

Concerto128 Matrix, 64x64 V **CRS64AV**
Includes frame, redundant power supplies, redundant matrix control boards, two analog video matrix boards and associated rear panels

Concerto128 Matrix, 64x64 AA **CRS64AA**
Includes frame, redundant power supplies, redundant matrix control boards, two analog stereo (or dual mono) audio matrix boards and associated rear panels

Concerto128 Matrix, 64x64 AES **CRS64AES**
Includes frame, redundant power supplies, redundant matrix control boards, two AES matrix boards and associated rear panels

Concerto128 Matrix, 64x64 HD **CRS64HD**
Includes frame, redundant power supplies, redundant matrix control boards, two HD matrix boards and associated rear panels

Concerto128 Matrix, 64x64 (128x128) SD/AA **CRS64128SDAA**
Includes frames, redundant power supplies, redundant matrix control boards, two SD matrix boards, two analog audio boards and four rear panels for each level (prewire for 128x128 SD/AA)

Concerto128 Matrix, 64x64 (128x128) SD/AES **CRS64128SDAS**
Includes frames, redundant power supplies, redundant matrix control boards, two SD matrix boards, two digital audio boards and four rear panels for each level (prewire for 128x128 SD/AES)

Concerto128 Matrix, 64x64 (128x128) V/AA **CRS64128VAA**
Includes frames, redundant power supplies, redundant matrix control boards, two analog video matrix boards, two analog audio boards and four rear panels for each level (prewired for 128x128 V/AA)

Concerto128 Matrix, 64x64 (128x128) HD/AES **CRS64128HDAS**
Includes frames, redundant power supplies, redundant matrix control boards, two high definition digital video matrix boards, two digital audio boards and four rear panels for each level (prewire for 128x128 HD/AES)

Concerto128 Matrix, 64x64 (128x128) SD **CRS64128SD**
Includes frame, redundant power supplies, redundant matrix control boards, two SD matrix boards and four rear panels (prewire for 128x128)

Concerto128 Matrix, 64x64 (128x128) V **CRS64128AV**
Includes frame, redundant power supplies, redundant matrix control boards, two analog video matrix boards and four rear panels (prewire for 128x128)

Concerto128 Matrix, 64x64 (128x128) HD **CRS64128HD**
Includes frame, redundant power supplies, redundant matrix control boards, two HD matrix boards and four rear panels (prewire for 128x128)

Concerto128 Matrix, 96x96 SD/AA **CRS96SDAA**
Includes frames, redundant power supplies, redundant matrix control boards, three SD matrix boards, three analog audio matrix boards and associated rear panels

Concerto128 Matrix, 96x96 SD/AES **CRS96SDAS**
Includes frames, redundant power supplies, redundant matrix control boards, three SD matrix boards, three digital audio boards and associated rear panels

Concerto128 Matrix, 96x96 V/AA **CRS96VAA**
Includes frames, redundant power supplies, redundant matrix control boards, three analog video matrix boards, three analog audio boards and associated rear panels

Concerto128 Matrix, 96x96 HD/AES **CRS96HDAS**
Includes frames, redundant power supplies, redundant matrix control boards, three high definition digital video matrix boards, three digital audio boards and associated rear panels

Concerto128 Matrix, 96x96 SD **CRS96SD**
Includes frame, redundant power supplies, redundant matrix control boards, three SD matrix boards and associated rear panels

Concerto128 Matrix, 96x96 V **CRS96AV**
Includes frame, redundant power supplies, redundant matrix control boards, three analog video matrix boards and associated rear panels

Concerto128 Matrix, 96x96 HD **CRS96HD**
Includes frame, redundant power supplies, redundant matrix control boards, three HD matrix boards and associated rear panels

Concerto128 Matrix, 96x96 AA **CRS96AA**
Includes frame, redundant power supplies, redundant matrix control boards, three analog stereo (or dual mono) audio matrix boards and associated rear panels

Concerto128 Matrix, 96x96 AES **CRS96AES**
Includes frame, redundant power supplies, redundant matrix control boards, three AES matrix boards and associated rear panels

Concerto128 Matrix, 96x96 (128x128) SD/AA **CRS96128SDAA**
Includes frames, redundant power supplies, redundant matrix control boards, three SD matrix boards, three analog audio boards and four rear panels for each level (prewire for 128x128 SD/AA)

Concerto128 Matrix, 96x96 (128x128) SD/AES **CRS96128SDAS**
Includes frames, redundant power supplies, redundant matrix control boards, three SD matrix boards, three digital audio boards and four rear panels for each level (prewire for 128x128 SD/AES)

Concerto128 Matrix, 96x96 (128x128) V/AA **CRS96128VAA**
Includes frames, redundant power supplies, redundant matrix control boards, three analog video matrix boards, three analog audio boards and four rear panels for each level (prewired for 128x128 V/AA)

Concerto128 Matrix, 96x96 (128x128) HD/AES **CRS96128HDAS**
Includes frames, redundant power supplies, redundant matrix control boards, three high definition digital video matrix boards, three digital audio boards and four rear panels for each level (prewire for 128x128 HD/AES)

Concerto128 Matrix, 96x96 (128x128) SD **CRS96128SD**
Includes frame, redundant power supplies, redundant matrix control boards, three SD matrix boards and four rear panels (prewire for 128x128)

Concerto128 Matrix, 96x96 (128x128) V **CRS96128AV**
Includes frame, redundant power supplies, redundant matrix control boards, three analog video matrix boards\ and four rear panels (prewire for 128x128)

Concerto128 Matrix, 96x96 (128x128) HD **CRS96128HD**
Includes frame, redundant power supplies, redundant matrix control boards, three HD matrix boards and four rear panels (prewire for 128x128)

Concerto128 Matrix, 128x128 SD/AA **CRS128SDAA**
Includes frames, redundant power supplies, redundant matrix control boards, four SD matrix boards, four analog audio matrix boards and associated rear panels

Concerto128 Matrix, 128x128 SD/AES **CRS128SDAS**
Includes frames, redundant power supplies, redundant matrix control boards, four SD matrix boards, four digital audio boards and associated rear panels

Concerto128 Matrix, 128x128 V/AA **CRS128VAA**
Includes frames, redundant power supplies, redundant matrix control boards, four analog video matrix boards, four analog audio boards and associated rear panels

Concerto128 Matrix, 128x128 HD/AES **CRS128HDAS**
Includes frames, redundant power supplies, redundant matrix control boards, four high definition digital video matrix boards, four digital audio boards and associated rear panels

Concerto128 Matrix, 128x128 SD **CRS128SD**
Includes frame, redundant power supplies, redundant matrix control boards, four SD matrix boards and associated rear panels

Concerto128 Matrix, 128x128 V **CRS128AV**
Includes frame, redundant power supplies, redundant matrix control boards, four analog video matrix boards and associated rear panels

Concerto128 Matrix, 128x128 HD **CRS128HD**
Includes frame, redundant power supplies, redundant matrix control boards, four HD matrix boards and associated rear panels

Concerto128 Matrix, 128x128 AA **CRS128AA**
Includes frame, redundant power supplies, redundant matrix control boards, four analog stereo (or dual mono) audio matrix boards and associated rear panels

Concerto128 Matrix, 128x128 AES **CRS128AES**
Includes frame, redundant power supplies, redundant matrix control boards, four AES matrix boards and associated rear panels

Frame, Power Supply & Modules

Concerto Multi-format Matrix Frame

(no power supply or matrix card included)	**CRS-CNRTO-FRM**
Concerto Power Supply (two for each frame required for redundancy)	**CRS-CNRTO-PS**
Concerto Matrix Control Card (two for each frame required for redundancy)	**CRS-CNRTO-MC**
Concerto128 Serial Digital Video Board	**CRS-CNRTO-SD**
Concerto64 Serial Digital Video Board	**CRS-CNRTO-SD64**
Concerto Digital Audio Board	**CRS-CNRTO-AES**
Concerto128 Analog Video Board	**CRS-CNRTO-AV**
Concerto64 Analog Video Board	**CRS-CNRTO-AV64**
Concerto Stereo or Dual Mono Analog Audio Board	**CRS-CNRTO-AA**
Concerto128 High Definition Video Board	**CRS-CNRTO-HD**
Concerto64 High Definition Video Board	**CRS-CNRTO-HD64**
Concerto Data & Time Code Board	**CRS-CNRTO-DATA**
Concerto BNC Rear Panel	**CRS-CNRTO-BNC-RP**
Concerto Balanced AES/EBU Rear Panel, Phoenix	**CRS-CNRTO-AES-RP**
Concerto Balanced AES/EBU Rear Panel, DB50	**CRS-CNRTO-AS50-RP**
Concerto Time Code Rear Panel	**CRS-CNRTO-TC-RP**
Concerto Analog Audio Rear Panel, Phoenix	**CRS-CNRTO-AA-RP**
Concerto Analog Audio Rear Panel, DB50	**CRS-CNRTO-AA50-RP**
Concerto Data Rear Panel	**CRS-CNRTO-DATA-DRP**
Concerto High Definition Rear Panel	**CRS-CNRTO-HD-RP**

Analog Audio: DB50 to Pigtail (4.5 meters -- 14.5 feet)	**CRS-CNRTO-AE-CBL1**
AES Audio: DB50 to Pigtail (4.5 meters -- 14.5 feet)	**CRS-CNRTO-AE-CBL2**
Concerto Fan Assembly (spare only – Fan Assembly included with the CRS-CNRTO-FRM)	**CRS-CNRTO-FAN**
Concerto TDM Expander Board	**CRS-CNRTO-TDM**

SERVICE AND SUPPORT PRODUCTS

Grass Valley Group offers a variety of service and support products to assist with installation, training and follow up support.

- SmoothStartSM and On-Site Installation Support Services. Critical startup service to get you going. This service includes pre-installation planning, on-site checkout and on-site overview training as well as customized networking and system support services.
- Comprehensive Service Contracts. Up to 5 years of Advanced Exchange of parts shipped next business day, proactive Software Subscription support and discounts on our training classes.
- On-Site or Factory Training. Operations and technical training are available either at Grass Valley Group in California or at your location. Contact your account manager or Customer Training for details.
- Spares Kits. For mission critical applications, this is a must. Our parts kits ensure maximum on-air time.
- Complimentary Services. Technical phone support via our 1-800-547-8949 number, after hours emergency phone support and technical e-mail support. In addition to our call center, we offer on-line technical resources and parts ordering via the web site at: www.grassvalleygroup.com/support

SPECIFICATIONS

CONCERTO FRAME SPECIFICATIONS

MECHANICAL DIMENSIONS		
	CM	IN
Height	7RU, 4.82 cm	7RU, 12.25 inches
Depth	48.26 cm	19 inches
Width	43.82 cm	17.25 inches
Weight (fully loaded)	27.22 kg	60 Lbs
POWER REQUIREMENTS		
Frame (fully loaded)	500 W	
Operating Voltage	85 - 264 VAC, 47 - 60 Hz, 0.99 PF	
ENVIRONMENTAL		
Temperature	0 - 40 degrees Celsius	
Humidity	10-90%, non-condensing	
REFERENCE VIDEO INPUT		
Type	NTSC or PAL Color Black	
Impedance/Connector	High, Looping – BNC	
Return Loss	>25dB (0.1MHz-5MHz) 75 Ohm Termination	

ANALOG VIDEO TECHNICAL SPECIFICATIONS

INPUTS	
Connector	BNC
Impedance	75 Ohm
Return Loss	>40dB DC to 10MHz
Nominal Level	1V p-p
Maximum Level	3V p-p
Signal Type	Terminating
Coupling	DC
Clamping	None
Input Cable Equalization	None
OUTPUTS	
Connector	BNC
Impedance	75 Ohm
Return Loss	>40dB DC to 10MHz
Nominal Level	1V p-p
Maximum Level	3V p-p
Coupling	DC
Output Cable Equalization	None
Output (QC) Monitor	Yes
PERFORMANCE	
Frequency Response	DC to 10MHz +/- 0.1dB 10MHz to 50MHz +/- 0.5dB

	50MHz to 75MHz + 0.5dB, -1.0dB 75MHz to 100MHz +1.0 dB, -3.0dB >100MHz Smooth Rolloff
Differential Phase	<0.15 deg. 3.58MHz & 4.43MHz
Differential Gain	<0.15% 3.58MHz & 4.43MHz
Minimum Rise/Fall Time	<7.5 ns for 714 mV p-p
Signal-to-noise	>70dB unweighted
Crosstalk	DC to 10MHz <-60dB 10MHz to 100MHz <-40dB
Delay Scatter	± 1.0 deg. (any input to any one output)
Electrical Length	<40 ns
POWER REQUIREMENTS	
Concerto128 Analog Video Board	50 W (per board)
Concerto64 Analog Video Board	30 W (per board)

SERIAL DIGITAL VIDEO TECHNICAL SPECIFICATIONS

VIDEO INPUTS	
Type	Serial digital video—conforming to SMPTE 259M
Connector	75 Ohm BNC
Return Loss	(10 MHz to 360 MHz)-15dB minimum
Cable Equalization	Automatic for up to 300 meters of Belden 1694A or equivalent (including 8281) for data rate up to and including 360 Mb/s
VIDEO OUTPUTS	
Type	Serial digital video conforming to SMPTE 259M
Connector:	75 Ohm BNC
Return Loss:	-15dB minimum (10 MHz to 360 MHz)
Signal Amplitude	800mV ±10% when terminated into 75 Ohms
DC Offset	Maximum 0.5V when terminated into 75 Ohms
OPERATIONAL MODES	
Reclocking	Automatic selection of 143 Mb/s, 177 Mb/s, 270 Mb/s & 360 Mb/s (540 Mb/s supported—not tested)
None-standard Bit Rates	Non-reclocked Operation or "bypass" switched from 5 Mb/s to 360 Mb/s with signals that have a maximum ones/zeros ratio of 20:1
PERFORMANCE	
Input-to-output Delay	Concerto128 128x128: 27.5ns Concerto64 64x64: 27.5ns
Input-to-output Delay Match	±7ns
Vertical Interval Switch, Reference One (Normal Single Sync Operation)	525 Line Standard Field switching Line 10 and Line 273. Middle of line

	625 Line Standard Field switching: Line 6 and Line 319. Middle of line ±5 µsec.
Vertical Interval Switch, Reference Two (Dual Sync Switching)	525 Line Standard Field switching Line 10 and Line 273. Middle of line ±10 µsec. 625 Line Standard Field switching Line 6 and Line 319. Middle of line ±10 µsec.
Dual Sync	Automatic vertical interval switched relative to the reference (software assignable on output-by-output basis)
MONITOR INPUT	
Type	Serial digital conforming to SMPTE 259M
Connector	75 Ohm BNC
Quantity	1
Return Loss	(1MHz to 360MHz) –15dB minimum
MONITOR OUTPUTS	
Type	Serial digital video conforming to SMPTE 259M
Connector	75 Ohm BNC
Quantity	1
Return Loss (1 MHz to 360 MHz)	15dB minimum
Signal Amplitude	800mV ±10% when terminated into 75 Ohms
DC Offset	±0.5V when terminated into 75 Ohms
Rise/Fall Times	0.75ns (measured from 20% to 80%) when terminated into 75 Ohms
POWER REQUIREMENTS	
Concerto128 Serial Digital Video Board	80 W (per board)
Concerto64 Serial Digital Video Board	50 W (per board)

DATA & TIME CODE MATRIX TECHNICAL SPECIFICATIONS

Signal Format Data Type	RS-485 or RS422 Data
Connectors	9 Pin "D"
Time Code Type	SMPTE 12M SMPTE Time Code (>300kHz) Connectors Single wire compression (Phoenix) for solid or stranded cable: 20-28 AWG Alternatively: 50 Pin D connector with optional pigtail assembly
INPUT SIGNALS	
Common mode input range	+12V -7V
Sensitivity	+/- 200mV
Input hysteresis	50mV
OUTPUT SIGNALS	
Open circuit	+/- 5V max, ±1.5V full load into 54 ohms

Short circuit	Current 150mA
Risetime	<15ns
PERFORMANCE Maximum Data Rate	
POWER REQUIREMENTS 32 Port Matrix Board	55W (per board)

ANALOG AUDIO TECHNICAL SPECIFICATIONS

Matrix Card	128x32 Stereo 256x64 Mono
Crosspoint Type	Digital – Converted to AES/EBU
Audio Connectors	Single wire compression (Phoenix) for solid or stranded cable: 20-28 AWG Alternatively: 50 Pin D connector with option pigtail assembly
Output Monitor	True output monitor, analog
Time code	Only if bandwidth is limited to 20kHz (due to on-board conversion) The Concerto Data Matrix Board is designed for use with both data and time code signals (software configured, appropriate rear panel selection required)
INPUTS Input Type	Balanced
Maximum Input Level	+24dBu
Input Impedence	24k Ohm (Bridging)
Inpute CMRR	74 dB max (20-20kHz), Typical 90dB
Common Mode Voltage Range	28.5 V Input Signal Peak (Max)
Delay to AES Output	0.8 mSec
OUTPUTS Maximum Output Level (Balanced)	+24dBu
Max Load at Rated Specification (Balanced)	10k Ohm (15nF) All channels loaded
Max Load	600 Ohm
Output Impedance	100 Ohm (Balanced)
Short Circuit Protection	Yes
Delay from AES Inputs	0.6 mSec
Output CMRR	46dB (@ 1kHz)
PERFORMANCE A/D Conversion	24 Bits
D/A Conversion	24 Bits
Analog Signal Delay Through Router	1.4mSec
Frequency Response	20 to 20kHz (±0.1dB)
Gain Accuracy	±0.1dB (1kHz)
Gain Adjustment for 600 Ohms	Yes - Maximum Level to 23.7dBu

Crosstalk	-95dB (20Hz-20kHz, Rin 150 Ohms)
Channel Separation	95dB (20Hz-20kHz)
Noise Floor	-71dBu Max (20Hz-20kHz)
Dynamic Range	95dB (20Hz-20kHz, 24dBu Output)
Input to AES Dynamic Range	100dB Maximum (No Weighting)
Output from AES Dynamic Range	100dB Maximum (No Weighting)
Static Withstanding Voltage	10kV (Human Body Model
Total Harmonic Distortion	0.015% (20Hz-20kHz)
Switching Transients	None – Shaped Edges (Dunking)
POWER REQUIREMENTS	
Concerto128 Analog Audio Board	65 W (per board)

DIGITAL AUDIO TECHNICAL SPECIFICATIONS

GENERAL	
Matrix Card	128x32
Interconnection	Balanced or unbalanced, determined by the rear panel
Connectors Types	BNC for 75 Ohm Interconnection (Unbalanced) Alternatively (110 Ohm Balanced): 50 Pin D connector with optional pigtail assembly Single wire compression (Phoenix) for solid or stranded cable: 20-28 AWG
Output Monitor	True output monitor, digital
AES Control Bits	Comply
Switching Transients	No discontinuity, edge is shaped (dunked)
Signal Format (Balanced)	AES3-1992
Signal Format (Unbalanced—Coaxial)	AES-3id-1995, SMPTE-276-M (AES/EBU)
Input-to-output Delay	64 uSec
INPUTS	
Input Types	Transformer Coupled Balanced, 110 Ohms ±20% Unbalanced 75 Ohm – Nominal
Unbalanced Return Loss	25dB (0.1MHz – 6MHz)
Differentail Voltage Range	± 200mV – 7V p-p (loaded)
Sampling Rate	48kHz
Synchronizing	Yes
Reclocking	Yes
Common Mode Voltage Range	2kV
Cable EQ	None
Jitter Tolerance	± 0.2UI
OUTPUTS (INCLUDING MONITORS)	
Capacitively Coupled	Transformer (Optional for Balanced)

Rise Time, Balanced or Unbalanced	17 nSec (Nominal)
Common Mode Range	+12V, -7V
Balanced Impedance	110 Ohms, ± 20%
Unbalanced Impedence	75 Ohm
Return Loss (Unbalanced)	25dB (0.1MHz-6MHz)
Output Voltage (Balanced)	3V (Nominal)
Output Voltage (Unbalanced)	1V p-p (Nominal)
Output Jitter	<1 nSec
AUDIO REFERENCE INPUTS (AES UNBALANCED)	
Type	SMPTE-276-M, Unbalanced (Audio "Black" Not Necessary)
Impedance/Connector	High/Looping – BNC
Return Loss	> 25dB (0.1MHz-6MHz) 75 Ohm Termination
POWER REQUIREMENTS	
Concerto 128 Digital Audio Board	35 W per board

HIGH DEFINITION TECHNICAL SPECIFICATIONS

SIGNAL/VIDEO INPUTS	
General	Conforms to SMPTE-259M and SMPTE-292M
System Band Width	5 Mb/s > 1.5 Gb/s (well scrambled)
Voltage	800mV ±10%
Impedance/Connector	75 ohms, unbalanced BNC
Return Loss	>15dB 1 Mb/s to 1.5 Gb/s, Self Terminating
Automatic Input Cable EQ	Belden 1505A, 100 meters (all data rates) Belden 1694A, 150 meters (all data rates) Belden 7731A, 200 meters (all data rates)
SIGNAL/VIDEO OUTPUTS	
General	Conforms to SMPTE-259M and SMPTE-292M
Voltage	800mV ±10%
Risetime	Conforms to SMPTE-292M
Impedance/Connector	75Ohms, Unbalanced BNC (single output/destination)
Return Loss	>15dB 10 MHz to 1.5 GHz
Input to Output Delay	28 ns
Input to Output Delay Match	±7ns
POWER REQUIREMENTS	
Concerto128 High Definition Matrix Board	85 W (per board)
Concerto64 High Definition Matrix Board	70 W (per board)

PRODUCT WARRANTY

Hardware Warranty

Standard warranty: Grass Valley Group warrants that this hardware product will be free from defects in materials and workmanship for a period ending at the earlier of one (1) year from the date of installation or fifteen (15) months from the date of shipment. If this product proves defective during this warranty period, Grass Valley Group, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. It includes Hotline Technical Support during regular business hours and after hour support, advanced exchanges and factory depot repairs.

Software Warranty

Grass Valley Group warrants that the media on which this software product is furnished and the encoding of the programs on the media will be free from defects in materials in workmanship for a period of one-year or 15 months from the date of shipment. If any such medium or encoding proves defective during the warranty period, Grass Valley Group will provide a replacement in exchange for the defective medium. Except as to the media on which this software product is furnished, this software product is provided “as is” without warranty of any kind, either express or implied. Grass Valley Group does not warrant that the functions contained in this software product will meet Customer’s requirements or that operation of the programs will be uninterrupted or error-free.

For more information, refer to standard warranty for one-year term at the following web address:
http://www.grassvalleygroup.com/docs/Fact_Sheets/service/SVC-005.pdf

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