Installation Planning Guide

Tektronix

Grass Valley Model 4000 Series Digital Production Switcher

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Model 4000 Installation and Service	TP0621-xx
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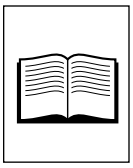


Contents

Introduction

This guide describes basic functions, configurations, and installation for the Model 4000 Series Component Digital Production Switchers, the Model 4000-2A, 4000-2B and the 4000-3. Included are hardware and electrical specifications, physical dimensions and weights, equipment rack layout, cable routing and interconnections, and timing requirements.

System Overview

The Model 4000 Series digital switchers process CCIR 601 4:2:2 serial component digital and component analog video and key signals.

Each switcher model can accommodate up to 64 inputs for video and key sources, which can be component serial digital or analog, depending on the options and configuration chosen. Outputs are serial digital, some with companion analog outputs.

The following models are available in the 4000 Series:

The Model 4000-2A Switcher has 2 full-function mix / effects systems and a program / preset mixer that is functionally similar to a mix / effects. Up to 24 video / key inputs, in any combination, may be accessed directly from the control panel, plus another 24 shifted inputs for a total of 48 video / key inputs.

The Model 4000-2B Switcher has 2 full-function mix / effects systems and a conventional program / preset mixer with dual downstream keyer. Up to 16 video / key inputs may be accessed directly from the compact control panel, plus another 16 shifted inputs for a total of 32 video / key inputs.

The Model 4000-3 Switcher provides three full-function mix / effects systems and a program / preset mixer with a dual downstream keyer. The full-function control panel is designed to meet the demanding needs of the broadcaster with its undelegated key bus, separate E-MEM section for each M / E, and 24 video or key inputs accessed directly from the control panel, plus 24 shifted crosspoints for a total of up to 48 video or key inputs.

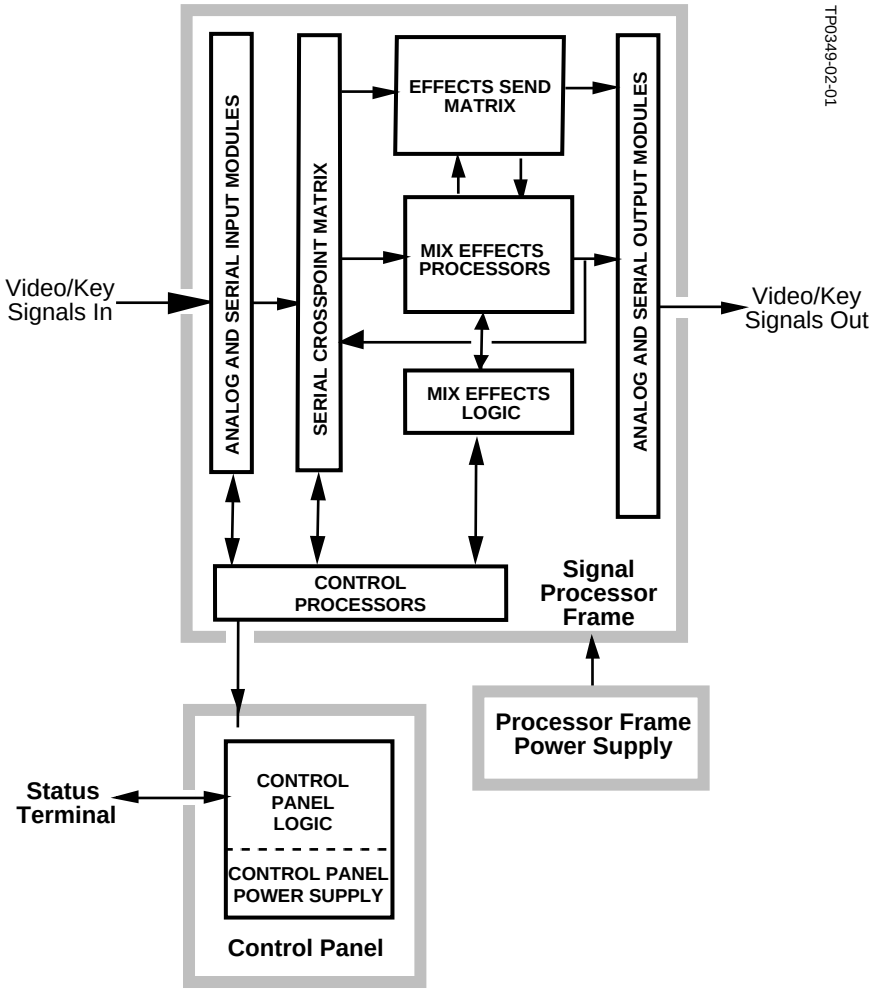


Figure 1. Basic Model 4000 System Block Diagram

Modularity extends throughout the Model 4000 systems, providing simple configuration and expansion to meet your present and future needs. The basic systems consist of a Signal Processor Frame, Signal Processor Frame Power Supply, and a Control Panel. See Figure 1 for a basic block diagram of the Model 4000 system.

System Features

Signal Formats

The Model 4000 switcher processes CCIR 601 4:2:2 serial component digital video. It is switchable between 525 line 60 Hz and 625 line 50 Hz modes. The modes are selected using switches on the Sync Generator in the Signal Processor Frame. An aspect ratio of 4X3 or 16X9 (both 13.5MHz) may be selected in the software menus during system configuration.

Video Input Options

The Signal Processor Frame will accept up to 64 inputs in any combination of video or key. All the inputs can be serial or up to 32 of them can be analog, 16 analog video (RGB, YUV, Beta or MII) and 16 analog keys.

Each optional Serial Input Module adds 8 inputs and each optional Analog Input Module adds 2 CAV and 2 key terminating inputs.

Up to 3 optional component analog Chroma Key Input Modules can be installed to feed the Chromatte™ Advanced Chroma Key Module. Each input module provides 2 inputs, giving a total of 6 terminating inputs. The format of these inputs is user selectable and may be RGB, YUV, Beta or MII.

Other input features include the following:

- Serial inputs are auto-timed.
- Analog inputs are in a fixed time, relative to the switcher reference.
- All digital inputs and outputs are 8 or 10 bits.
- Any input can be used either as a video or as a key source and can be mapped to any source selector button.
- Inputs can be shaped or unshaped and can have an associated key signal.
- Analog input gains are adjustable.
- Two washable dual color background generators as well as an internal black generator are available as sources.
- An analog reference input is provided.

Video Output Modules

The following outputs are available in component analog RGB or color difference format from the standard Analog Output Module:

- Program Video
- Switched Preview

The following outputs are available in serial format from the optional Serial Output Modules:

- Clipped Mask Bus
- Switched Preview
- DSK Program Video and Key
- M/E 1, M/E 2 and M/E 3 Program video and Program Key switchable with Clean Feed
- Aux Buses 1–4 (Video and Key pairs for Effects Send)
- Untimed Aux Bus Outputs. Aux pairs 5–9 may be delegated to video/video or video/key
- Timed Aux Bus Outputs - Aux buses pairs 5–8 (Aux Bus 9 is not timed)
- M/E 1, M/E 2, M/E 3 and DSK Preview
- Effects Send Video and Key
- DSK Clean Feed Video and PGM/PST Preview Video
- Frame Store Video and Key

Source Selection

The Model 4000-2A and the Model 4000-3 Switcher have 24 source selection buttons on the main Control Panel. An additional 24 inputs can be selected using a shift key. The Model 4000-2B Switcher has 16 source selection buttons. An additional 16 inputs can be selected using a shift key. Each video source can have a key source assigned using the soft panel menus so that the key is automatically selected with the video.

Mix/Effects

Listed below are some of the capabilities of each mix/effects:

- Each M/E is switchable between standard mode and Lamina™ Image Layering Mode (DSK in Model 4000-2A may also be switched into Layering Mode)
- Key Priority Transition Mode
- Layering Mode where each M/E produces a composited key signal which may be re-entered into another mix/effects
- Unlimited re-entry
- Six independent dual matte generators with wash capability
- Look Ahead Preview option
- Preset Mix to black
- Non-Additive Mix (NAM) and Full Additive Mix (FAM) Modes
- M/E Swap, M/E Copy, Matte Copy and Key Swap/Copy
- Separate processors in each M/E for fault tolerance

Wipe Generators

Each mix/effects (including the PGM/PST/DSK in the Model 4000-2A) has a standard Primary Wipe Generator and an optional Secondary Wipe Generator. The output from the Secondary Wipe Generator can be mixed with the output from the Primary Wipe Generator to create novel wipe patterns. This option also allows the preset wipe pattern and matte washes to differ from the transition wipe pattern.

In addition to providing wipe transitions, the wipe generators may be used to wash mattes and background generators, make preset patterns and mask keys. They feature the following:

- 60 standard patterns and 6 user-definable patterns
- Pattern Mix
- Texture Generator
- Adjustable Softness and Symmetry

Keying

A unique feature of the Model 4000 Switcher is that each video path through the switcher has an accompanying key path. The Model 4000 has two full-function keyers in each M/E, featuring comprehensive force and inhibit mask and optional BORDERLINE® functionality. In the Lamina™ Image Layering Mode, the keyers on the two background buses allow complex effects to be composited in one M/E, which can feed another M/E for compositing with more sources.

Effects Memory

Each of the Model 4000 Control Panels include an E-MEM® system with Effects Dissolve, Sequencer and Key Framing modes. The E-MEM registers can store and recall panel setups in addition to multiple event effects dissolves and sequences using any of 100 registers (10 banks with 10 registers each).

The Model 4000-2A/B Control Panels have a central E-MEM sub-panel which allows any portion or all of the switcher configuration to be learned and recalled.

The Model 4000-3 Control Panel has separate E-MEM subpanels in each mix/effects for learning and recalling effects in each M/E, plus a central Master E-MEM system which defines, stores and recalls effects for the entire switcher.

Disk storage for the E-MEM data is provided via an internal 3.5 inch floppy disk drive.

Communications I/O

Communications I/O capability is provided for connecting to external devices. The interfaces provided are as follows:

- Serial Editor Port — A dedicated RS-232/RS-422 port is provided for editor control.
- DPM Interface — Four ports used for connecting digital effects devices.
- Peripheral Bus II — A proprietary control interface bus that allows devices to communicate with each other.
- Serial Port — An extra asynchronous RS-232/RS-422 port.
- GPI inputs and outputs

Safe Title/Action Area Generator

This feature provides up to four different patterns that can be superimposed on the Switched Preview output of the switcher. These can be used to define a safe title and safe action area, or for screen centering and horizontal/vertical alignment of picture elements.

Extender Module

Two extender modules are supplied, one for servicing the input and output modules in the rear of the frame, and a second for servicing the processor and video boards which plug into the front of the frame. These allow you to extend a module outside of the signal frame so components are readily accessible for testing.

Control Panel Options

Model 4000-3 Input Readout Display

The Input Readout Display Option for the Model 4000-3 provides 24 4-character readout displays which mount in the lower left of the upper Accessory Panel. At the present time, the first four digits of each primary crosspoint name (as assigned during system configuration) will be displayed.

Redundant Power Supply

An optional backup redundant control panel power supply is available for all models. It is provided for protection if the primary supply fails. The redundant supply is mounted inside the control panel tub next to the standard supply. Both power supply units contain automatic switching circuitry that makes on or the other the active supply.

System Options

Chromatte™ Advanced Chroma Keying System

The Model 4000 will accommodate one optional Dual Chromatte™ Advanced Chroma Keyer in each mix / effects and can be assigned to each of the two mix / effects key layers. Up to six optional analog component inputs provide 4:4:4 chroma keying for the most discerning applications. Any 4:2:2 input to the switcher, or a re-entry from another mix / effects can also be used as a chroma key source.

BORDERLINE® Key Edge Generation

BORDERLINE® Key Edge Generators are optional for each key layer in the switcher. Each BORDERLINE Generator supports 1, 2, or 3 line wide borders or outlines. The key fill can be video or matte.

Shadow and Extrude modes create 1-to 6-line wide edges, positioned below and to the left or right of the key fill. Independent matte generators are provided for edge and fill. Borderline and Shadow edge opacity are adjustable.

Effects Send Option

The Effects Send option allows digital effects devices to be integrated into the Model 4000 Switcher mix / effects system through an effects loop system. Up to four send channels can be used to route the video and key from an M / E via Aux Buses 1-4 to and from an external digital effects system.

Video and keys can also be sent to and received from external sources. For example, effects send can send to and receive video and keys from digital effects devices, paint systems, or disk recorders.

Secondary Wipe Pattern Generator Option

Two types of Secondary Wipe Pattern Generator options are available for the Model 4000 series: the Secondary Wipe Pattern Generator for each Mix/Effects and the Secondary Wipe Pattern Generator for the Program/Preset Mixer (Model 4000-2A only).

The Mix/Effects option provides a second wipe pattern for each mix/effects system. This allows for two independent wipe patterns to be present at the same time. The secondary wipe pattern may also be mixed with the primary generator's pattern to create unique new patterns. This option also functions as an additional mask source and as a matte generator and wipe modulator within each M/E.

The second option provides a Secondary Wipe Pattern Generator for the Program/Preset Mixer with wipe capabilities in the Model 4000-2A switcher only (see NOTE below). This allows for two independent wipe patterns at the same time. The secondary wipe pattern may also be mixed with the primary generator's pattern to create unique new patterns. This option also functions as an additional mask source and as a matte generator and wipe modulator within the Program/Preset mixer.

NOTE: *The Program/Preset Secondary Wipe Pattern mezzanine is standard on the Model 4000-2B. It is required to provide the circuitry for creating the secondary wipe wash for the backgrounds and the user defined wash angle for the DSK. In this position however, it does not provide the same functionality as in the Model 4000-2A switcher for secondary wipes in the DSK.*

Look-Ahead Preview

This option provides look-ahead preview (viewing of the next event) processing for all M/E systems, Program/Preset and the DSK. It also provides a Clean Feed output from the M/Es in place of the M/E Key output. Serial Output options are required in Cells D6 and D5 for viewing the M/E and DSK Program preview outputs.

Tally Output Options

The Tally Module provides on-air indicators for each of the mix/effects systems in the switcher. Sixty-four tally relay outputs and "on-air" outputs are provided for each M/E.

An Extended Tally Option is also available to allow expanded tally relay outputs. Three additional Tally Modules provide 64 tally relay outputs per module. The additional Tally Modules are housed in a separate two rack-unit frame which connects to the main frame via a standard SMPTE interconnect cable not to exceed 1000 feet (305 meters).

Frame Store

The Frame Store option allows storage and retrieval of images at a resolution of 10 bits. Frame Store is source oriented in that its inputs are fed with an AUX/effects send bus (Aux 4) and the outputs are available as primary inputs to the crosspoint matrix. Frame Store can be connected in the effects send loops. Frame Store features are listed below:

- Video filter functions include hue, rotate, or blur (mutually exclusive).
- Frame Store functions can be controlled by E-MEM.
- Real-time video bit map effects include Mosaic, Posterize, Solarize, Color modulate, Contrast stretching or Hue modulate and subpixel repositioning. Effects can be applied to frozen or live video.
- Write after read capability allowing layering of stills in a recursive manner. (i.e., frame store could receive output from an M/E that is using the frame store as one of its inputs).
- Ability to provide a real-time drop shadow on a key that can be positioned anywhere in the raster. Shadow can be blurred and opacity adjusted independently of Video and Key framestores.
- Frame Store Video and Key may be keyed on top of a background source.
- Four pages of two-field images may be captured at 525 line rate (3 pages at 625 line).
- If Field 1 or Field 2 are frozen, interpolation modes can be applied.
- Independently adjustable crop on video and/or key.

Redundant Frame Power Supply

A back-up redundant power supply is available for protecting against primary power supply failure for the Signal Frame. The Signal Frame Redundant supply must be installed directly under the primary power supply which is mounted directly below the Signal Frame.

Aux Bus Option Systems

There are a total of nine video / key auxiliary bus pairs available in each Model 4000 system. Outputs for the aux buses are provided by the optional Serial Output Modules. You may configure the aux bus pairs in several different ways as listed below:

- Untimed Aux bus pairs 5a–9b (no Timed Aux Output Module installed). Pairs can be any combination of video / key or video / video configuration.
- Effects Send Aux bus pairs 1a–4b (1a=video, 1b=key, 2a=video, 2b=key, 3a=video, 3b=key, and 4a=video, 4b=key) to accompany the Effects Send option for sending video / key pairs to external digital effects or other devices for manipulation then returning them to the switcher.
- Timed Aux Bus Output Module pairs 5a–8b are timed to match the Program output. Aux pair 9 is not timed in any configuration.

Aux Bus Control Panels

The Aux Buses may be controlled from a delegated PVW AUX bus in the main control panel or by optional Remote Aux Control Panels.

Remote Aux Control Panels

The Remote Aux Control Panels allow you to control the switcher aux buses from a remote location. There are three models of the Remote Aux Panels, each identified by the number of rack units (RUs) it occupies in the equipment rack. The depth of each unit is 2.5 inches (6.35 cm).

- One RU panel
- Two RU panel
- Three RU panel

Remote Aux Panel features include the following:

- Each crosspoint lamp on the two or three RU panel will high tally (bright lamp) when that input is on air. There is an ON AIR lamp on the one RU panel which will illuminate to indicate that the selected input is on air. The on-air tally can be permanently enabled on all panels.
- Joystick override is available on each panel for up to 8 external user-supplied switch closures to enable the override. The aux bus switches to a user-defined crosspoint selection when the switch is closed. When the switch is released, the aux bus returns to its previous selection.
- Chop mode provides two fields of one source followed by two fields of another source at frame rate. This function is intended for system calibration.

The one RU and two RU panels (Figure 2.) are functionally identical. The one RU panel is designed for areas with very restricted space, and has small crosspoint buttons containing LED tally lamps. The two RU panel has large crosspoint buttons with internal tally lamps. Each of these panels must be set up to control a specific aux bus and must have the setup changed to control another bus.

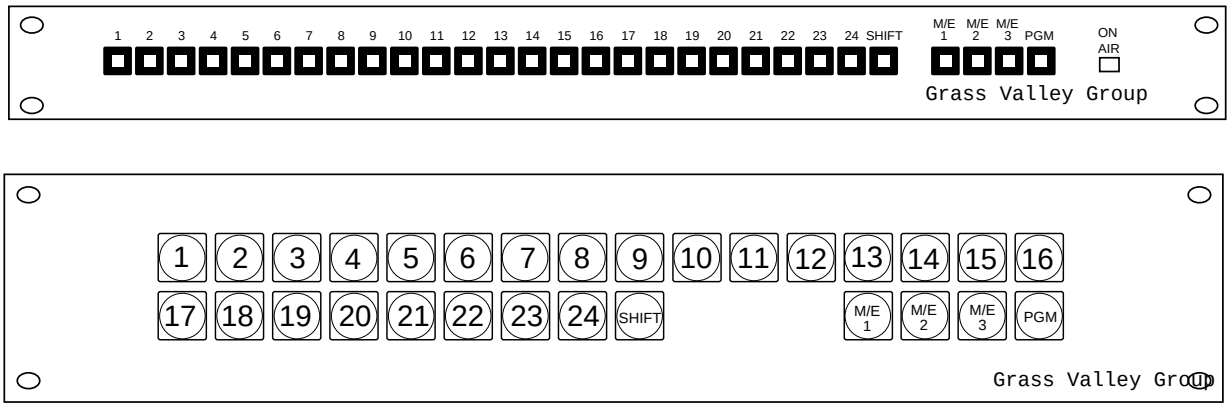


Figure 2. One RU and Two RU Remote Aux Control Panels

The three RU panel (Figure 3.) has large buttons and is designed for locations where it is desirable to operate more than one bus. This panel will normally control all aux buses but can be set up to lock out specific buses.

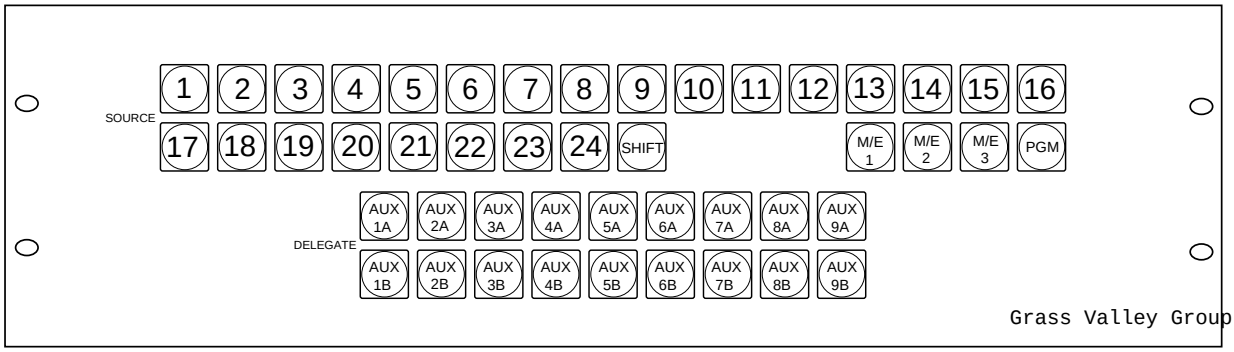


Figure 3. Three RU Remote Aux Control Panel

As many as 32 Remote Aux Panels can be attached to one switcher. These are connected by a single cable with a total cable length not to exceed 1000 ft. (320 m). Each Remote Aux panel comes with a 49 foot (15 meter) cable. This cable has a D-connector at one end and stripped wires on the other. The D-connector plugs into the Aux Bus Control connector J4 on the Com I/O Module (C3) located on the rear of the Model 4000 Signal Processor Frame.

The other end of the cable will be plugged into the Communications Bus connector on the rear of the Remote Aux Panel using the connector shipped with the Remote Aux Panel Option. Any additional panel(s) will be connected to the previous panel in daisy-chain fashion as illustrated in Figure 4.

If an additional Remote Aux panel is required, the cable connecting the next panel must also be inserted into the connector and secured in a daisy-chained manner with each additional panel connected to the previous panel. If you are building your own cable, use a shielded twisted pair such as Belden 8451 and refer to Table 1.

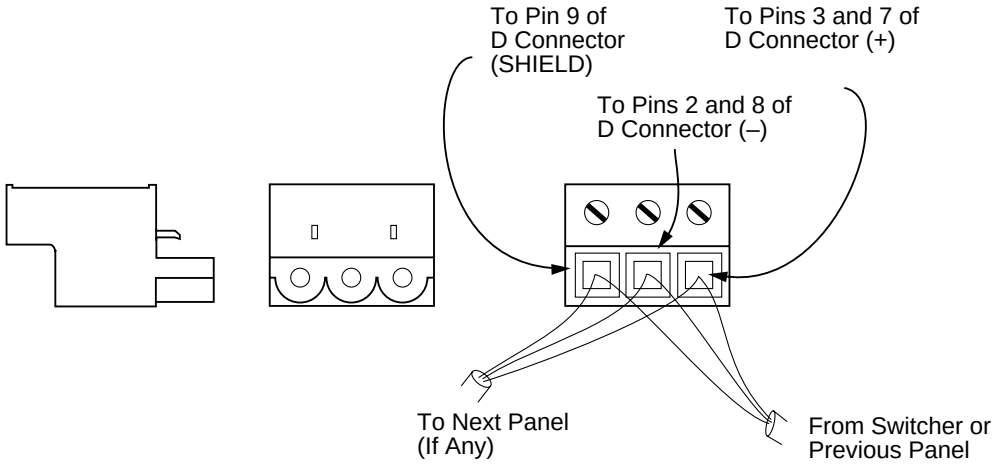


Figure 4. Remote Aux Panel Daisy-chain Connection

Table 1. Cable Polarity

Panel Connector	D-Connector	Factory Supplied Cable
+ (Plus)	3 and 7	Red
–(Minus)	2 and 8	Black
Shield	9	Shield

Control Panel Installation

The Model 4000-2A / B and 4000-3 Upper and Lower Control Panels are designed to be mounted in a console.

The control panel tub drops into a cutout from the top and is secured by wood screws (not supplied) which go through the edge of the tub into the console. The top edge of the tub projects out to hold the panel in place in the hole; countersinking is not required.

The console cutout and cable clearance dimensions for each switcher type are detailed on the following pages.

Model 4000-2A and 4000-2B Control Panel Dimensions

The side dimensions for the Model 4000-2A and 4000-2B Control Panels are shown in Figure 5. Figure 6 illustrates the console cutout dimensions and Figure 7 shows the required cable clearances.

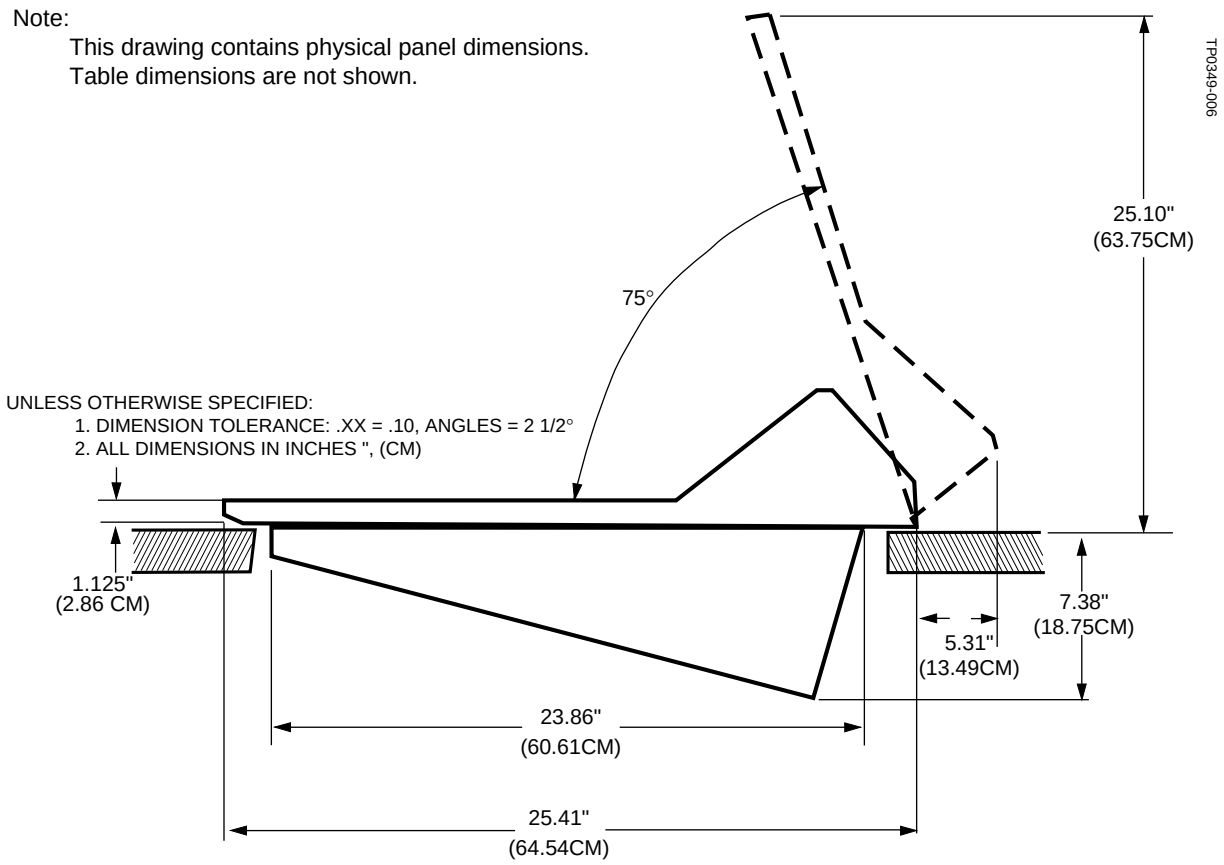


Figure 5. Model 4000-2A/B Control Panel Side Dimensions

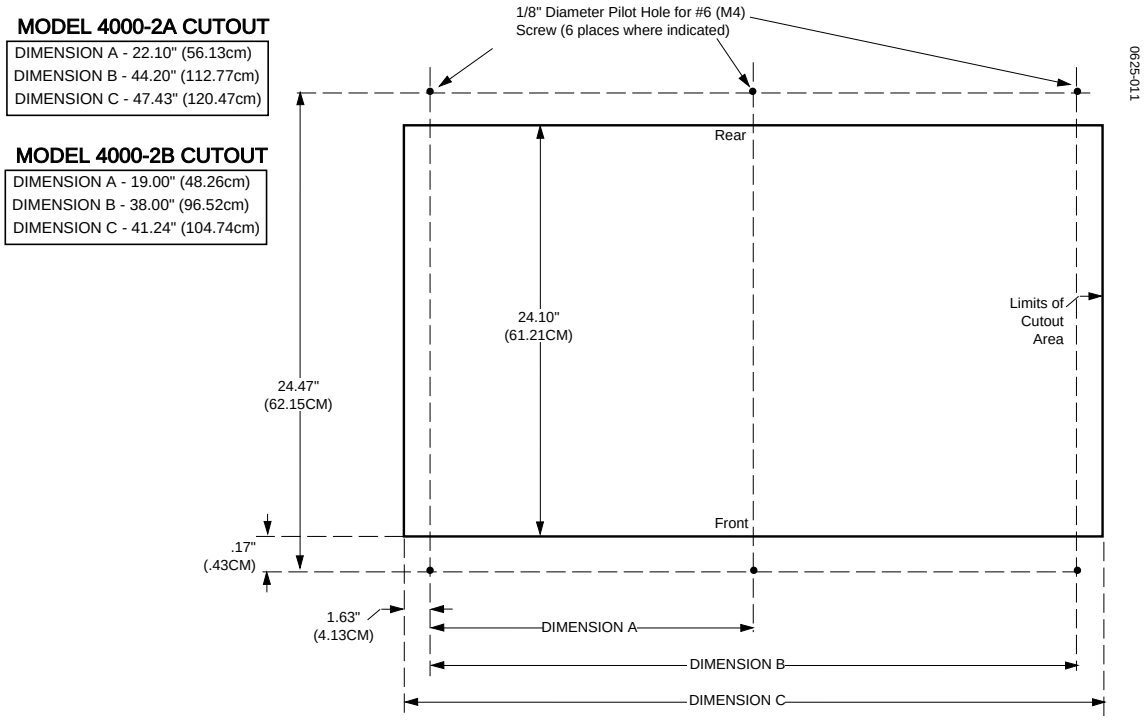


Figure 6. Model 4000-2A/B Cutout Dimension Detail

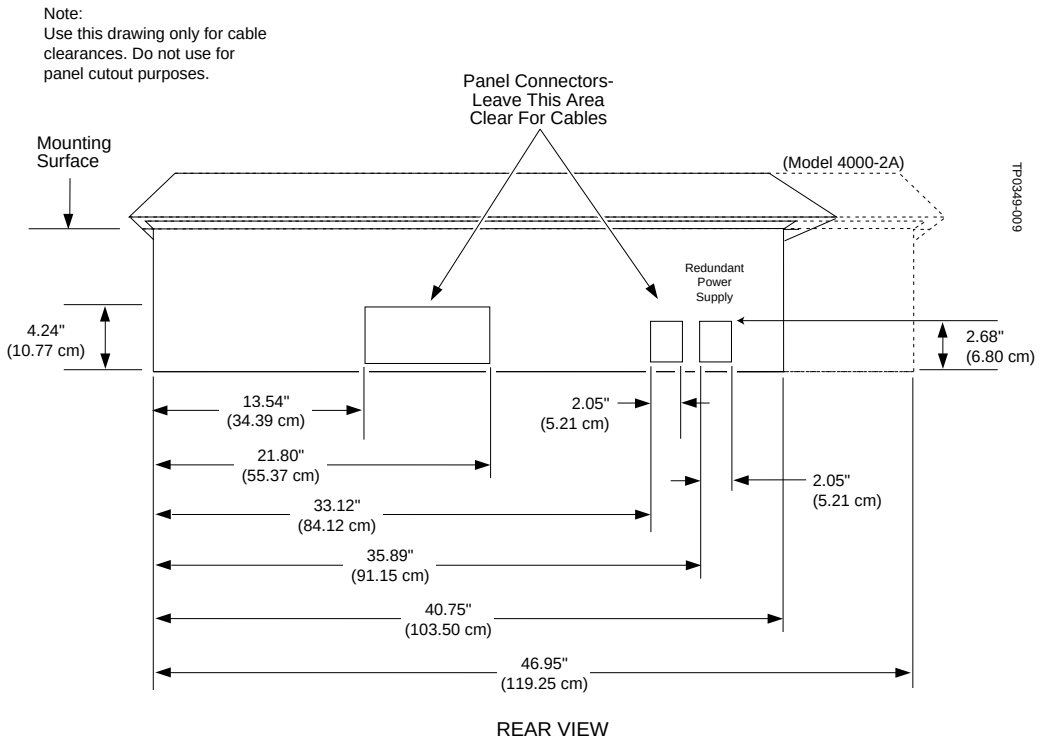


Figure 7. Model 4000-2A/B Required Cable Clearances

When the panel lid is closed, the tub assembly is completely hidden. The dimensions for the Model 4000-2A / B closed lid bezel-to-bezel lengths are given in Figure 8.

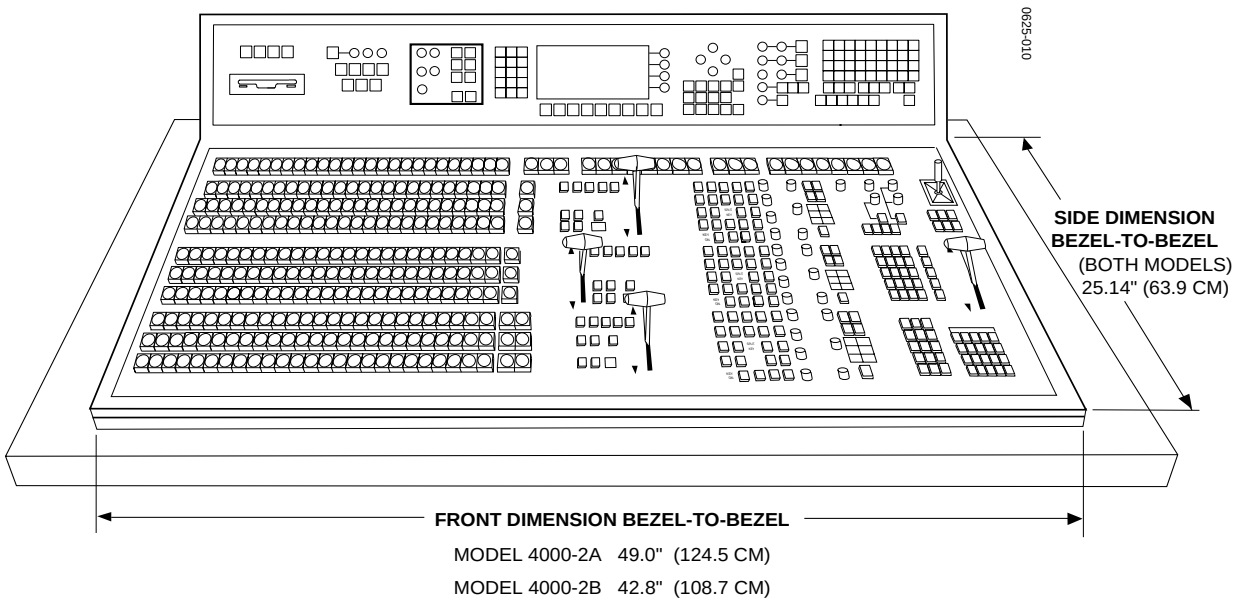


Figure 8. Model 4000-2 Closed Lid Bezel-to-Bezel Dimension Detail

Control Panel Power Supply

Power is provided to the control panel by a standard power supply mounted inside the control panel tub. An optional redundant supply is also available which is mounted alongside the standard power supply unit inside the tub. Input voltage for the supplies is 110 VAC (nominal) or 220 VAC (nominal) at 50 / 60 Hz. Power consumption of the control panel power supply is less than 300 watts. The panel is convection cooled through vents in the sides, rear and underside of the tub.

Model 4000-3 Control Panel Dimensions

The Model 4000-3 Control Panel is designed so that it may be semi flush-mounted or full flush-mounted (countersunk) in your console. For the semi flush-mount application, simply cut the console to the dimensions indicated in Figure 11, and set both upper and lower Control Panels in place. Secure the panels using 27 screws inserted through the overhanging flanges at the front, rear and sides.

For the full flush-mount installation, follow the detailed instructions in Section 2 of the Installation and Service Manual.

NOTE: *If the lower Control Panel is installed at an angle significantly greater than 10°, the gas shocks may not be able to support the panel lid in the fully extended position.*

To guarantee adequate cable clearances leave a minimum of 11.5" (29.0 cm) of clear space inside the console behind the upper Control Panel, and 3.25" (8.3 cm) of clear space inside the console behind the lower Control Panel for control, signal, and power cables and connectors. See Figure 9 *and* Figure 10*. If you elect to reduce these minimums, we suggest the Control Panels be on site before you prepare the console.*

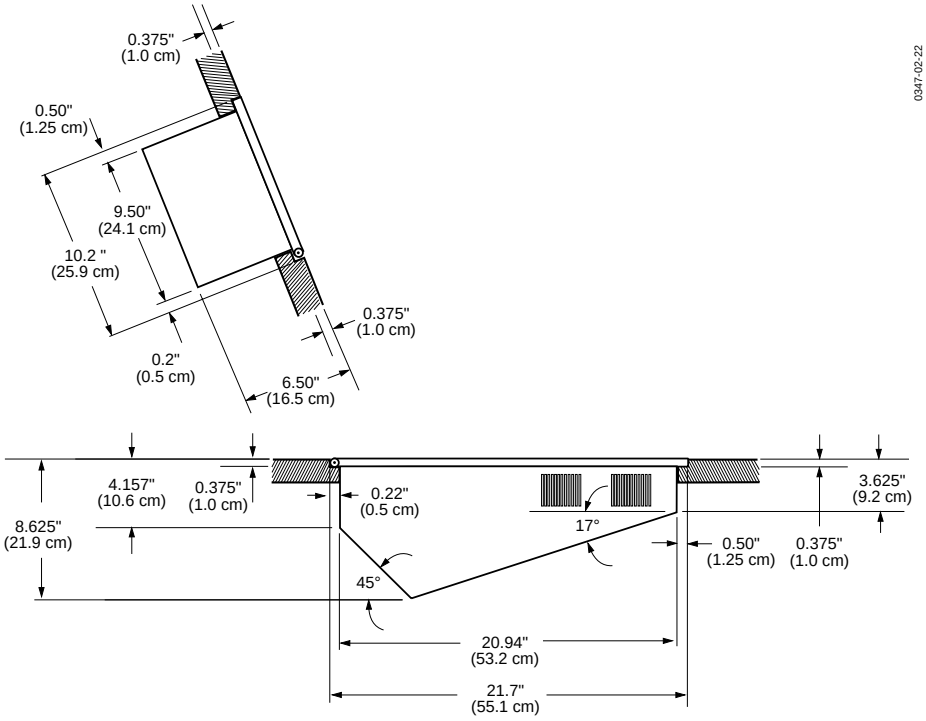


Figure 9. Model 4000-3 Control Panel Side Dimensions

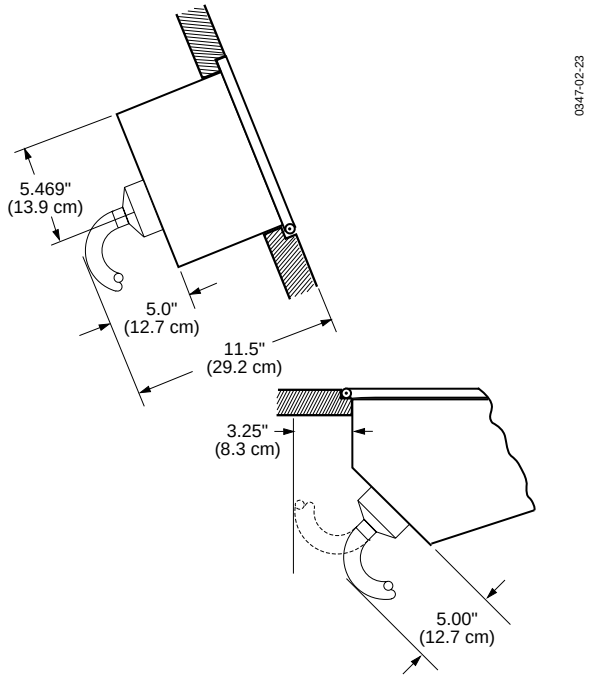


Figure 10. Model 4000-3 Cable Clearance

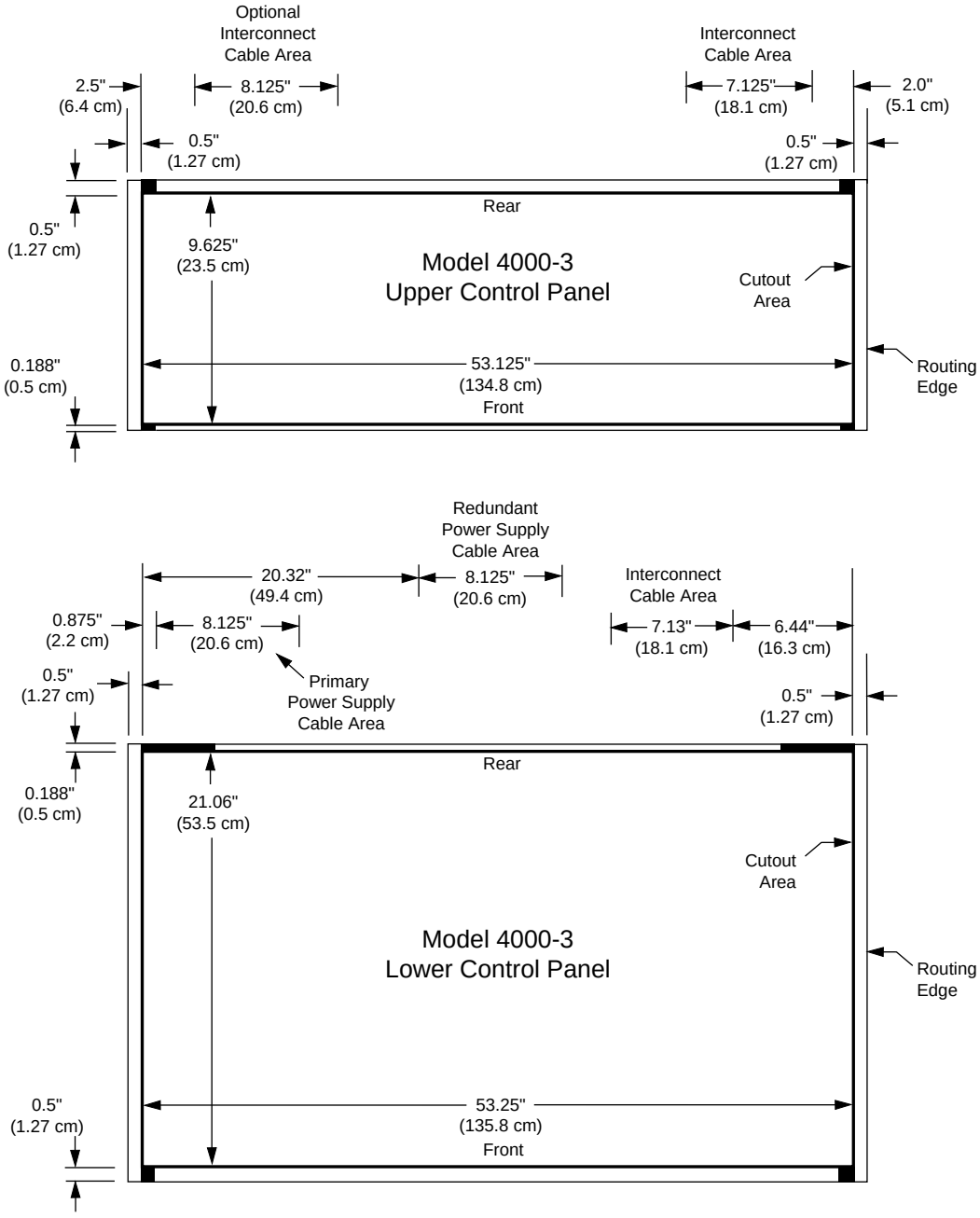


Figure 11. Model 4000-3 Cutout and Cable Clearance

Model 4000-3T Control Panel Dimensions

The 4000-3T is a 3 M/E production switcher based on GVP's Model 4000-3 that is designed to meet the needs of the mobile production market. It gives mobile production users maximum flexibility by allowing remote panels to be mounted on either side of the main panel in numerous configurations: perpendicular or parallel to the wall, in drawers, or on hinges or velcro.

The 4000-3T's software, user interface, electronics frame, and functionality are exactly the same as those of the standard 4000-3. Consistent installation/location of the remote panels will significantly reduce the learning curve for freelance operators and technical directors.

The main control panel consists of the crosspoint buses, E-MEM subpanels, Transition subpanels, pattern positioner, and Master E-MEM. The Upper panel consists of the PVW/AUX Bus controls. The remote panels include the M/E Keyer/Matte Panel (3 panels), DSK Keyer/Matte Panel, Chroma Key Panel, Mask/Wipe Panel, Menu Panel, FrameStore Panel, and the Floppy Disk Assembly. The maximum cable length for connecting to remote panels is 10 feet.

The dimensions for the main control panel, the upper control panel, and each of the remote panels are given in Figure 2.

The control panel power supply fits into a 19-inch rack and must be within four feet of the main console. It has a depth requirement of 7" (17.78 cm). An optional redundant power supply is available with the same dimensions.

Table 2. Model 4000-3T Control Panel Dimensions

Panel Name	Dimensions	Depth Required	Cutout Required
Lower Control Panel	44.0" wide x 21.625" high (111.76 cm x 54.92 cm)	2.25" Front (5.715 cm) 8.5" Rear (21.59 cm)	43.125" wide x 21.125" high (109.5 cm x 53.65 cm)
Upper Control Panel	44.0" wide x 3.5" high (111.76 cm x 8.89 cm)	2.25" (5.715 cm)	41.5" wide x 3.0" high (105.41 x 7.62 cm)
Keyer/Matte (3 panels)	9.5" wide x 4.825" high (24.13 cm x 12.25 cm)	1.25" (3.175 cm)	8.375" wide x 4.625" high (21.27 cm x 11.75 cm)
DSK Keyer/Matte	9.5" wide x 4.825" high (24.13 cm x 12.25 cm)	1.25" (3.175 cm)	8.375" wide x 4.625" high (21.27 cm x 11.75 cm)
Chroma Key	6.125" wide x 4.825" high (15.56 cm x 12.25 cm)	1.25" (3.175 cm)	4.825" wide x 4.625" high (12.25 cm x 11.75 cm)
Mask/Wipe	17.375" wide x 7.75" high (44.13 cm x 19.68 cm)	1.25" (3.175 cm)	14.625" wide x 7.125" high (37.14 cm x 18.09 cm)
Menu	17.375" wide x 7.75" high (44.13 cm x 19.68 cm)	1.25" (3.175 cm)	14.625" wide x 7.125" high (37.14 cm x 18.09 cm)

Table 2. Model 4000-3T Control Panel Dimensions

Panel Name	Dimensions	Depth Required	Cutout Required
FrameStore	6.125” wide x 4.825” high (15.56 cm x 12.25 cm)	1.25” (3.175 cm)	4.825” wide x 4.625” high (12.25 cm x 11.75 cm)
Floppy Disk Assembly	5.0” wide x 1.375” high (12.7 cm x 3.49 cm)	6.0” (15.24 cm)	4.125” x 1.375” high (10.47 cm x 3.49 cm)

Pushbutton Lens Designation

You will receive a standard set of pushbutton lens designations for each bus in the system. These lenses label each pushbutton in the crosspoint buses with the input source name. Figure Figure 12 illustrates the installation of lens designation chips. Two lens designation strips are typically installed in crosspoint buttons using both shifted and unshifted selection.

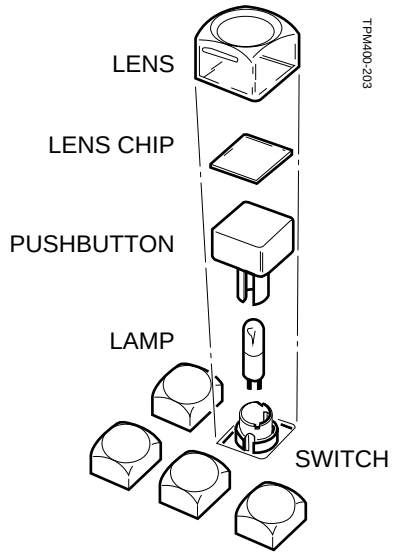


Figure 12. Lens Chip Installation

Signal Processor Frame Installation

The Signal Processor Frame is 25 Rack Units high (43.75 inches, 111.13 cm), 22.58 inches (57.35 cm) deep, and mounts in a standard 19-inch (48.3 cm) wide equipment rack as illustrated in Figure 13. **The Signal Processor Frame needs to be mounted immediately above its primary and redundant power supplies.** Note that the frame is forced air cooled and contains air filters which require periodic cleaning. Be sure to leave adequate space between equipment for air flow and allow enough room in front and back of the switcher for extender board access.

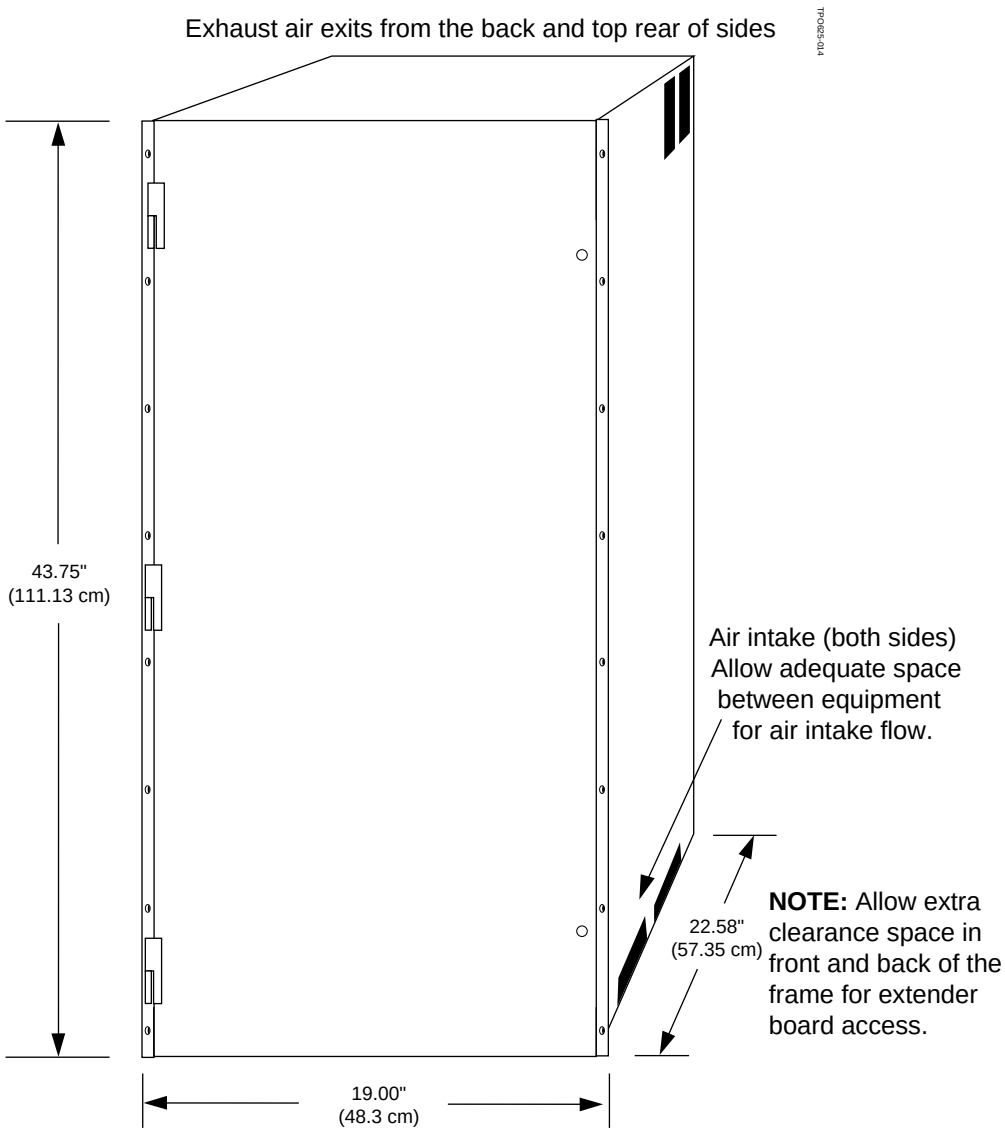


Figure 13. Signal Processor Frame (power supply not shown)

Module Locations

The standard and optional modules housed in the Signal Processor frame are illustrated on the following pages. The frame is divided into four card cages referred to as Bay A (upper front), Bay B (lower front), Bay C (upper rear), and Bay D (lower rear).

NOTE: *There are two versions of Model 4000 Signal Processor Frames covered in this guide: frames shipped before January, 1996 for all model switchers (Matrix 094800-00) and those modified for the Model 4000-3 (Matrix 094803-00). The matrix number is labeled on the top left rear of each frame. Any differences between the frames will be explained in the text for clarity.*

Front Bay A is identical for all models and is shown in Figure 14. Figure 15 shows the module locations in Bay B for all models shipped before 1/96 and Figure 16 illustrates the Bay B module locations for all models shipped after 1/96.

Rear bays C and D are shown in Figure 17 and Figure 18.

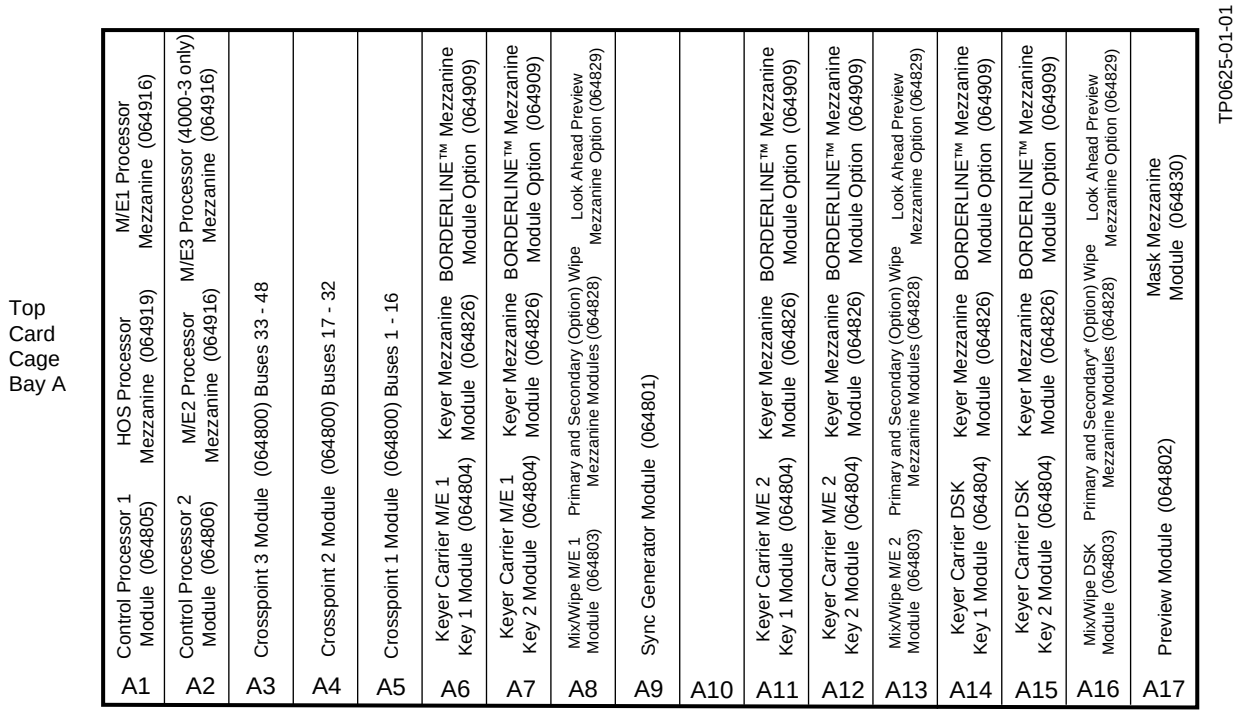
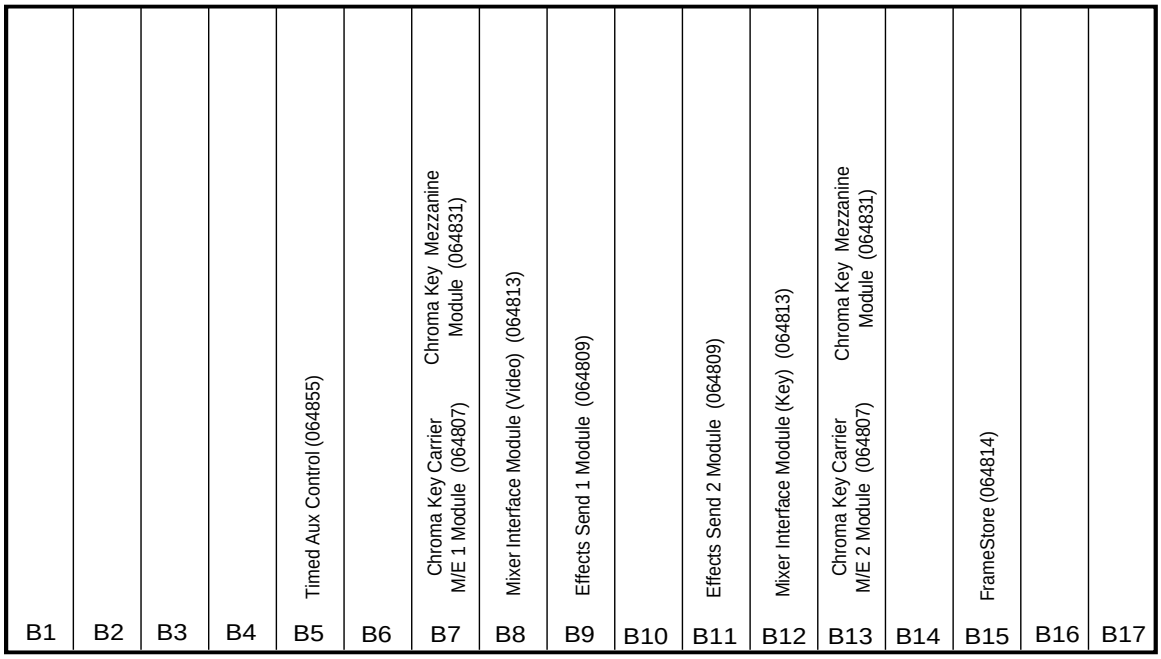
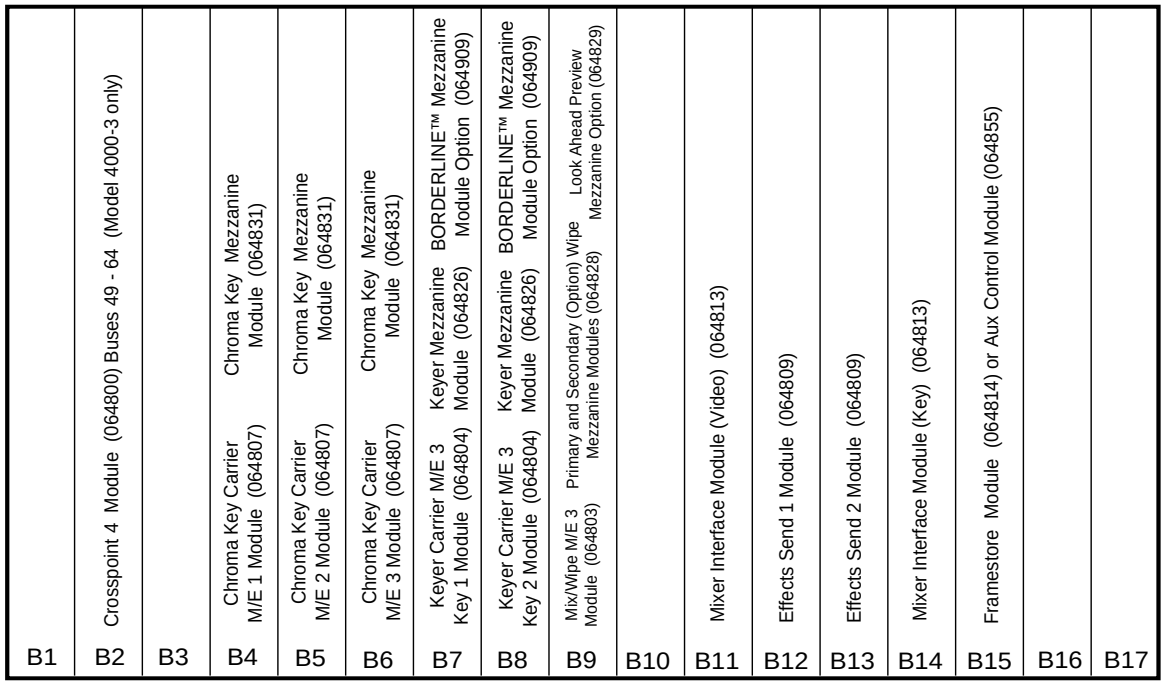


Figure 14. Upper Front Bay A Module Locations (All Models)



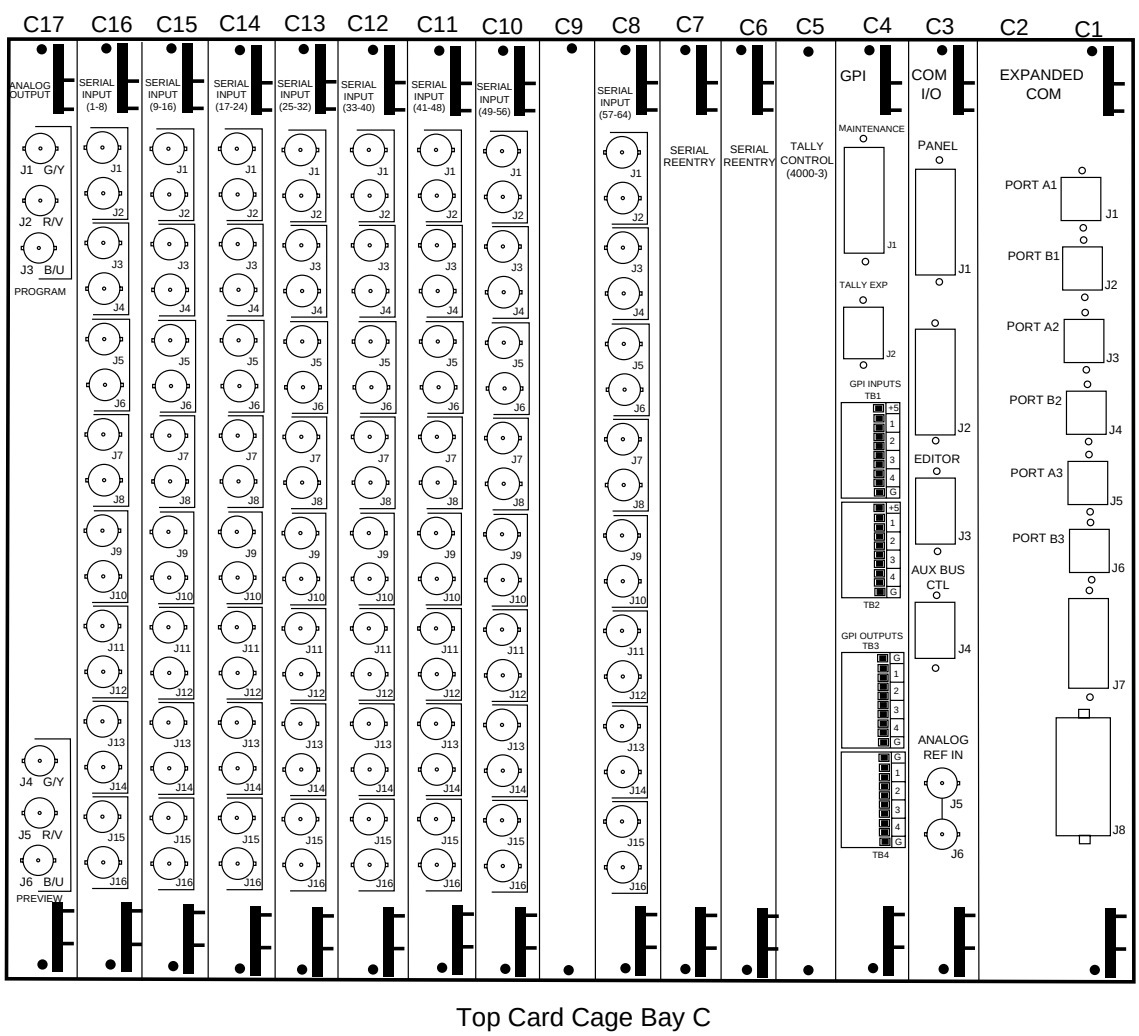
FRONT VIEW

Figure 15. Lower Front Bay B Modules - Models Shipped Before 1/96



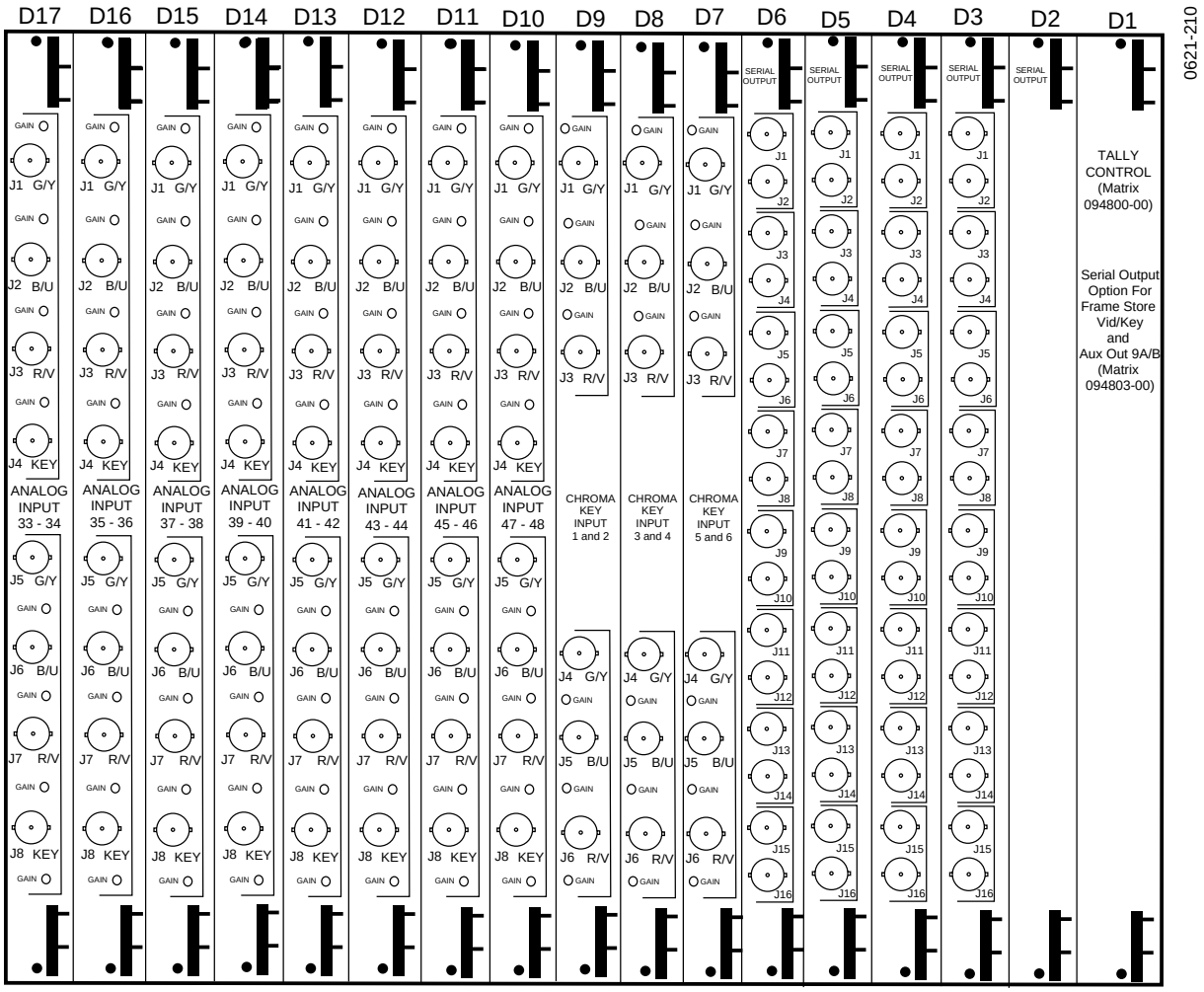
FRONT VIEW

Figure 16. Lower Front Bay B Modules - Models Shipped after 1/96



Top Card Cage Bay C

Figure 17. Rear View of Signal Processor Modules - Bay C (All Models)



Bottom Card Cage Bay D

Figure 18. Rear View of Signal Processor Modules - Bay D (All Models)

NOTE: *The Timed Aux Output Option Module (Aux 5 A/B through 8 A/B) is a double-width module which is installed in Slot D3 and extends to Slot D2. There are eight single BNC output connectors on the module; no looping BNC's are available.*

Signal Processor Frame Power Supply Installation

Dimensions

The Signal Processor Frame Power Supply is 7 Rack Units high (12.25 inches, 31.21 cm), 22 inches (55.88 cm) deep, and mounts in a standard 19-inch (48.3 cm) wide equipment rack *immediately beneath the signal processor frame*. It supplies primary power (+ 5V, - 5.2V, + 13V, - 13V, and + 48V) to the signal processor frame. Refer to Figure 19 for an illustration of the power supply.

NOTE: *The Signal Processor Frame Primary Power Supply and the optional Redundant Power Supply must be mounted directly below the Signal Processor Frame.*

Cooling

The Signal Processor Frame power supply is forced air cooled. Air is drawn in through vents in the upper sides and exhausts through vents in the rear of the unit. The air filters in this frame require periodic cleaning.

CAUTION

Be sure to leave adequate space between equipment for air flow to the intake vents.

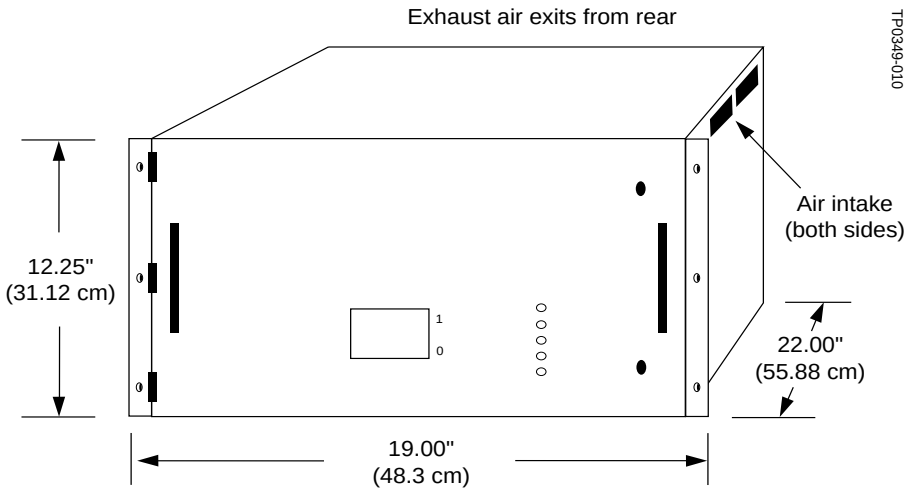


Figure 19. Signal Processor Frame Power Supply

Power Requirements

Input voltage for the frame supply is 176-264 VAC at 50/60 Hz. Power consumption is less than 2500 watts maximum.

NOTE: *Model 4000-2A/B Switchers with power supply assembly 098901-03 (Todd Power Supplies) can operate at 100 - 264VAC (auto-ranging).*

Redundant Supply

A secondary redundant Signal Processor Frame Power Supply is available as an option. It will provide power to the switcher if the primary supply fails. This secondary power supply, which is the same size as the primary supply, must be mounted directly beneath the primary supply in the equipment rack.

NOTE: *The electrical power provided for each signal processor frame power supply must be a dedicated circuit rated at 220 VAC (nominal), 20 amps. (See note above for Model 4000-2A/B switchers.)*

Control Panel Connections

The control panel communicates with the Signal Processor Frame over RS-422 data links—one per M/E plus a flip/flop mix data link. All of the links are contained within a single RP125 parallel digital cable that may be up to 300 meters (985 feet) long. Standard jacketed (PVC) and plenum rated (Teflon®) cables are available.

The pinout for the parallel digital cable is illustrated in Figure 20.

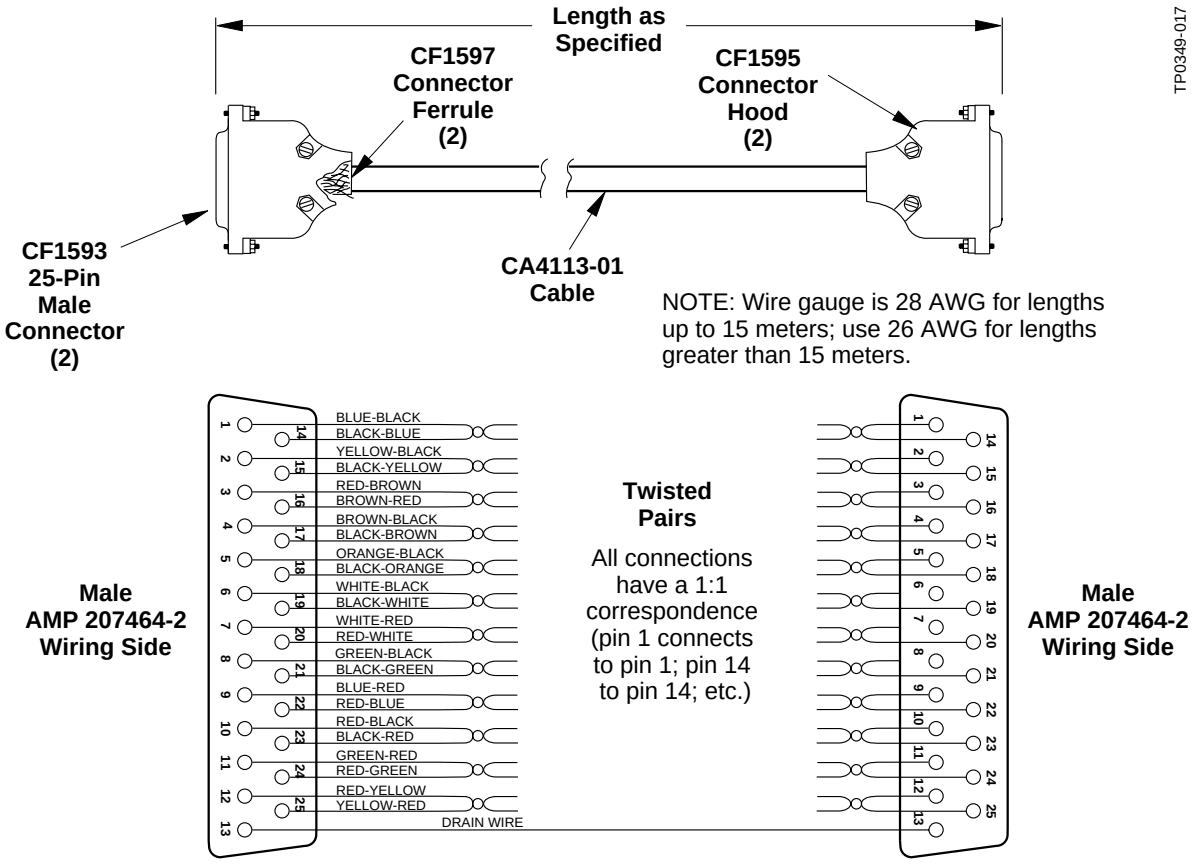


Figure 20. Control Panel to Frame RP125 Parallel Digital Cable

Model 4000-2A/B Control Panel Connection

Figure 21 illustrates the connections at the rear of the control panel to the Model 4000-2A / B Signal Processor Frame.

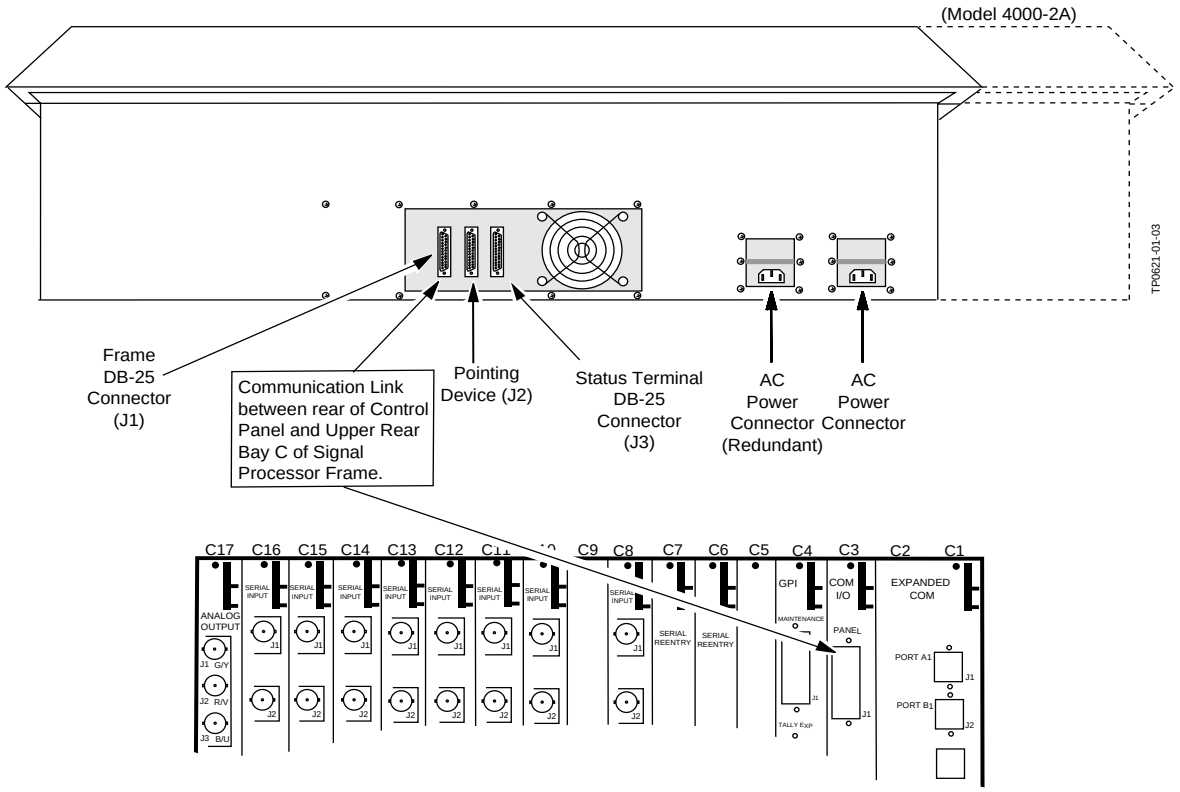


Figure 21. Model 4000-2A/B Control Panel to Frame Connection

Model 4000-3 Control Panel Connections

Figure 22 details the connections between the Model 4000-3 upper and lower control panels and their connection to the Signal Processor Frame.

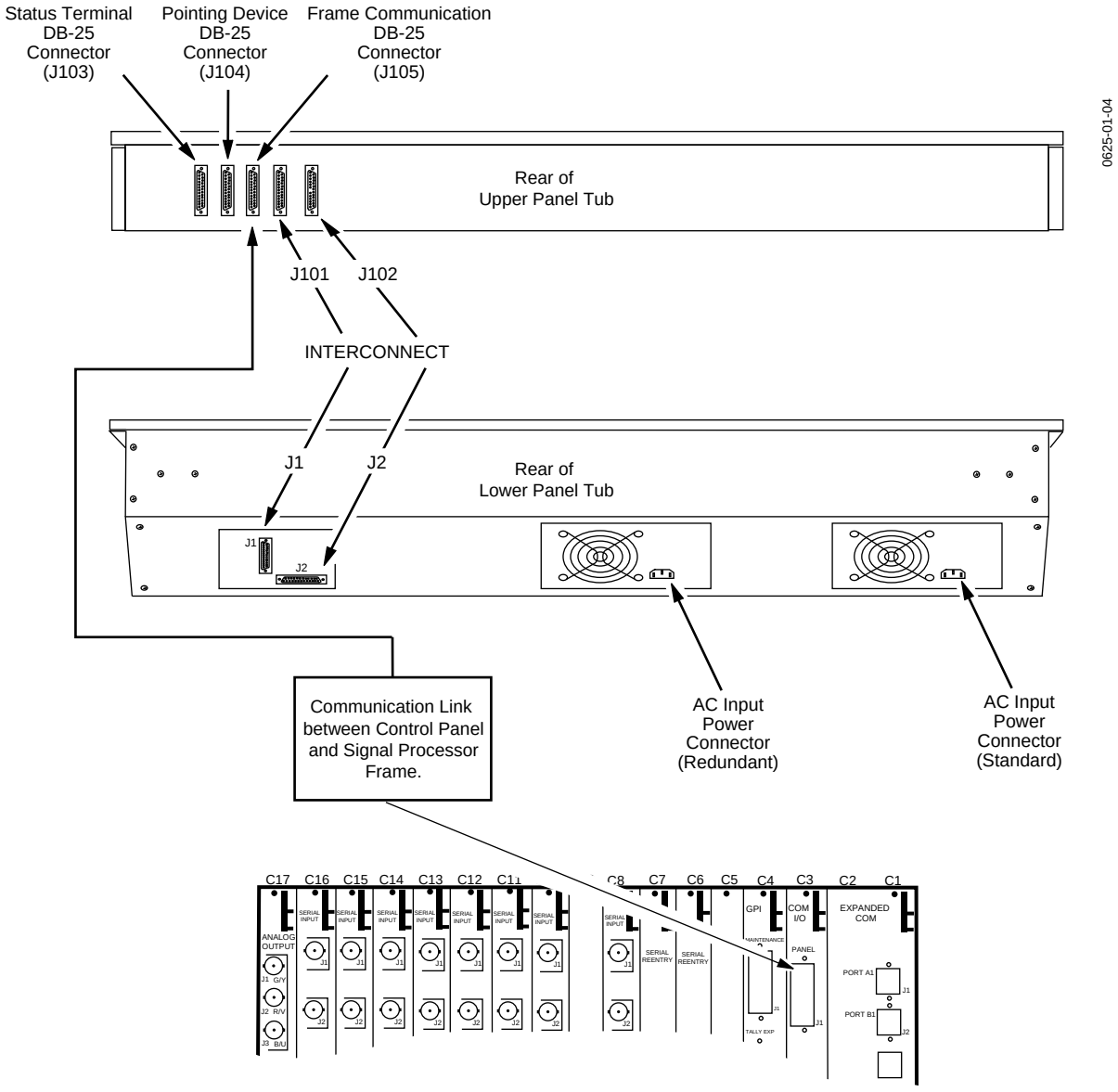


Figure 22. Model 4000-3 Control Panel Rear Connections

Model 4000-3T Control Panel Connections

The Model 4000-3T connections consist of individual ribbon cables from the upper and lower panels which connect to the various remote panels. The maximum ribbon cable length is 10 feet (2.5 meters) between the main panel and each remote panel. The cables enter and exit through oval slots in the rear of the tub as shown in Figure 23. For more detailed information on cabling and cable clearance, refer to the installation instructions accompanying the 3T control panel.

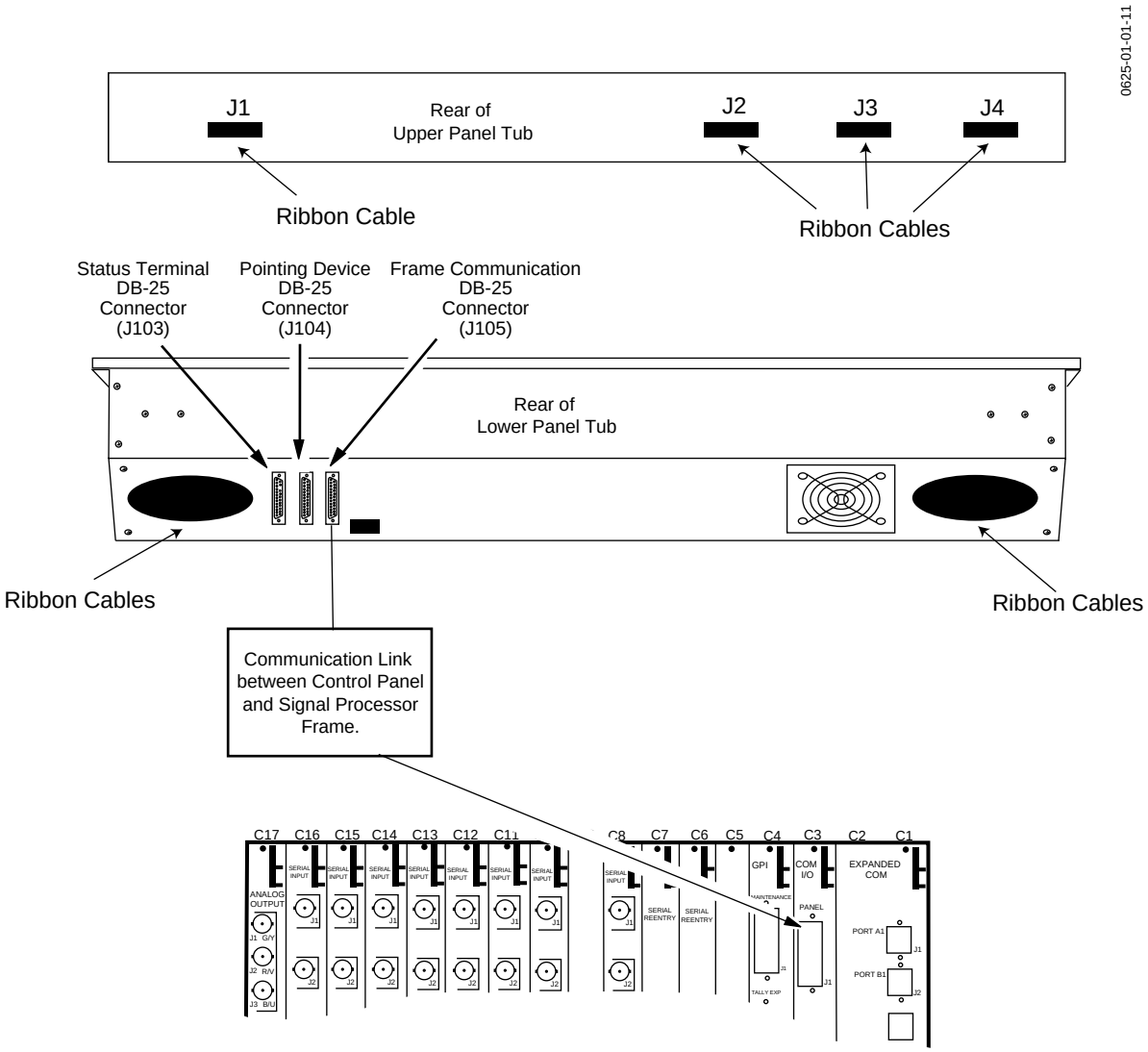


Figure 23. Model 4000-3T Control Panel Interconnections

Interconnect Cabling

The following section details the different types of cables used in the Model 4000 system.

NOTE: *Grass Valley Products does not supply BNC signal cables or terminations for the loop-through BNC connections. These must be obtained from other suppliers.*

Serial Digital Cables

Serial video requires 75 ohm coaxial cables and 75 ohm BNC connectors for looping inputs (see NOTE above). The use of 50 ohm connectors and coaxial cables can create data errors in a serial data stream.The maximum length of serial digital cables is 225 meters (738 feet).

All serial digital inputs are terminated internally. Serial inputs can be either non-looping or active loop-through depending on the option chosen.

RS-422 Cable Design

The RS-422 signal cable follows industry standards using three twisted pairs and ground wire as shown in Figure 24.

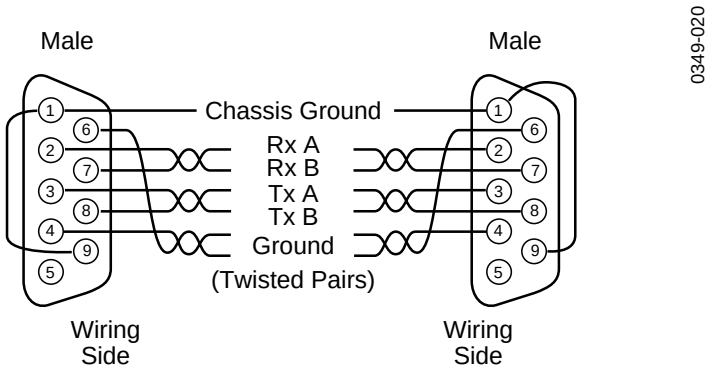


Figure 24. RS-422 Cable Pinout

Serial Output Connections

The Serial Output Module options reside in the rear D Bay of the switcher frames in slots D1 (Matrix 094803-00 only), D3, D4, D5, and D6. The output connections for each slot are illustrated in Figure 25 and Figure 26 for the different frame versions. These outputs are also labeled on the switcher frame with a designation strip.

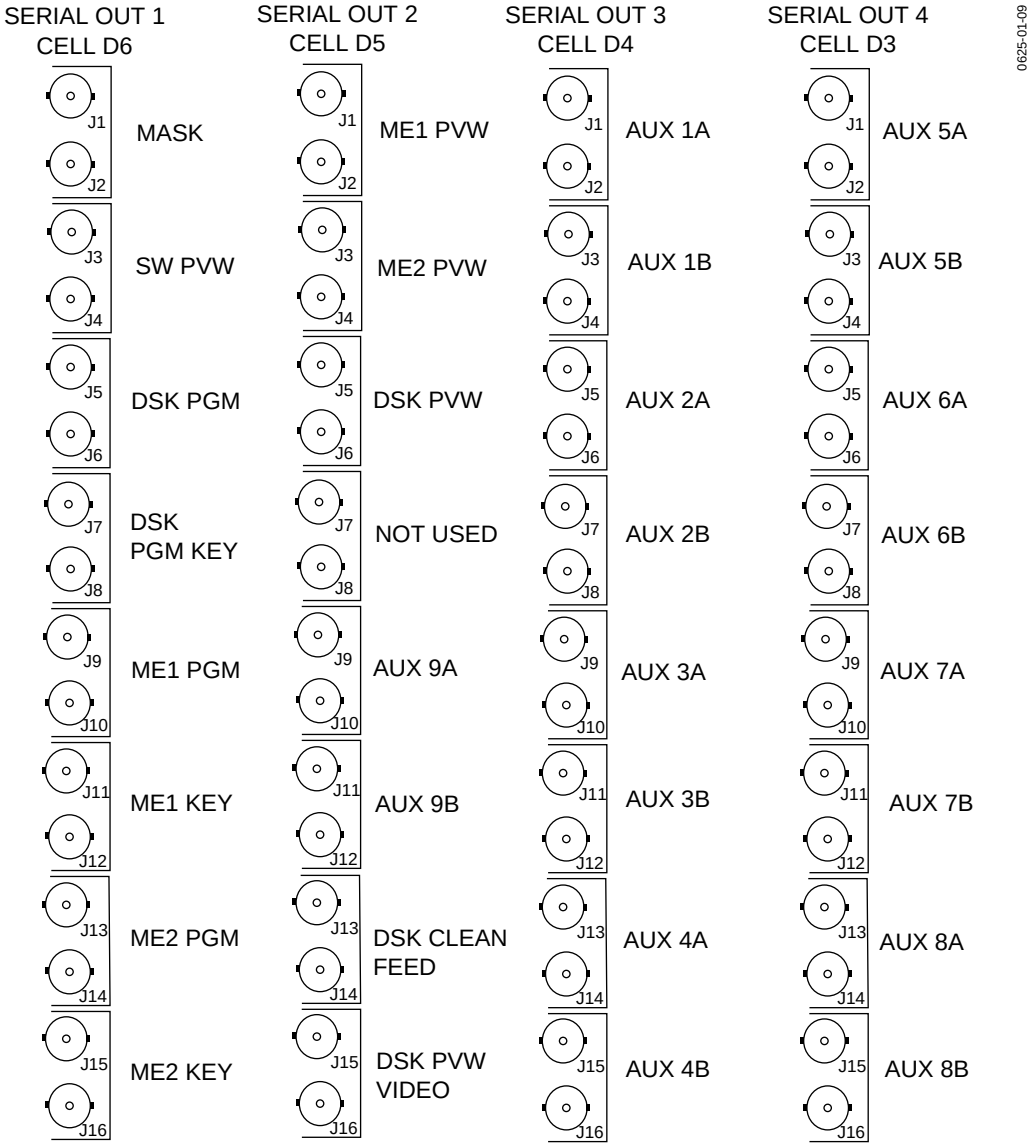


Figure 25. Serial Output Signal Connections for Models Shipped Before 1/96

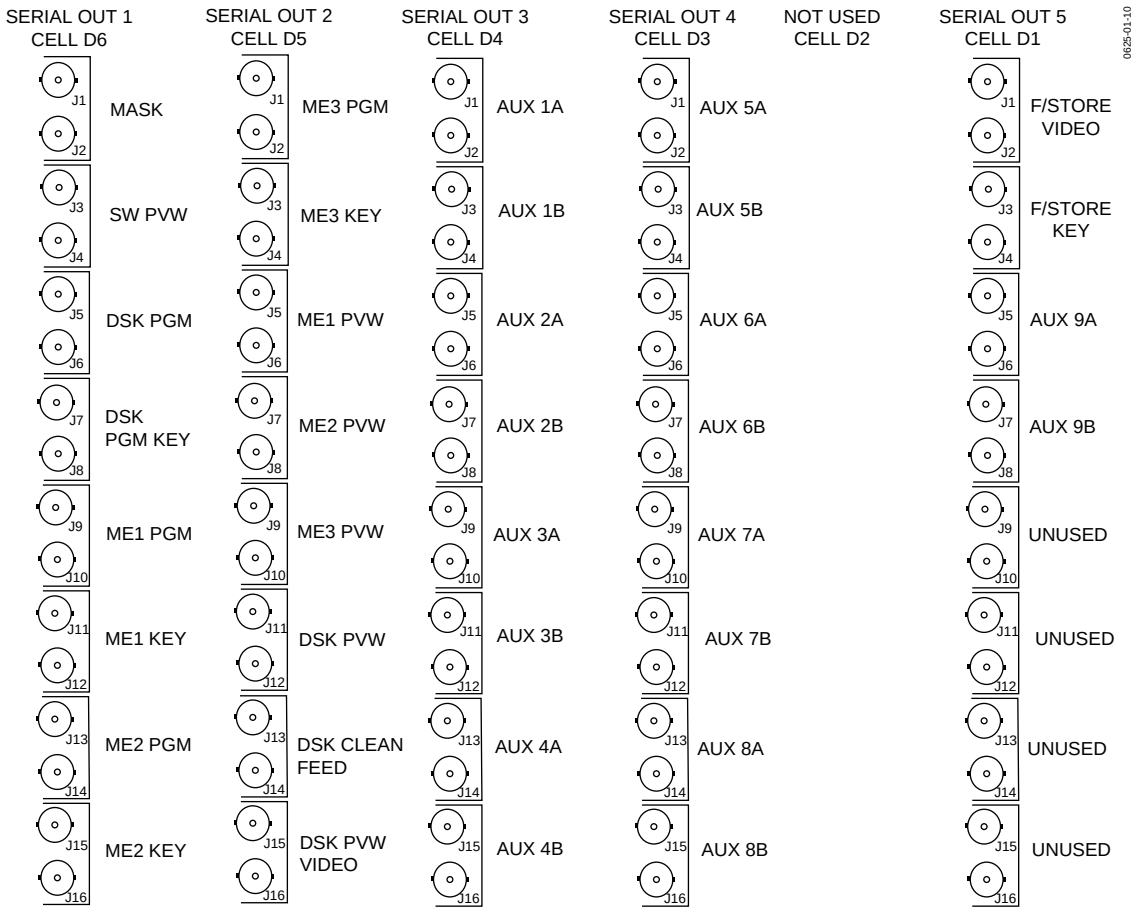
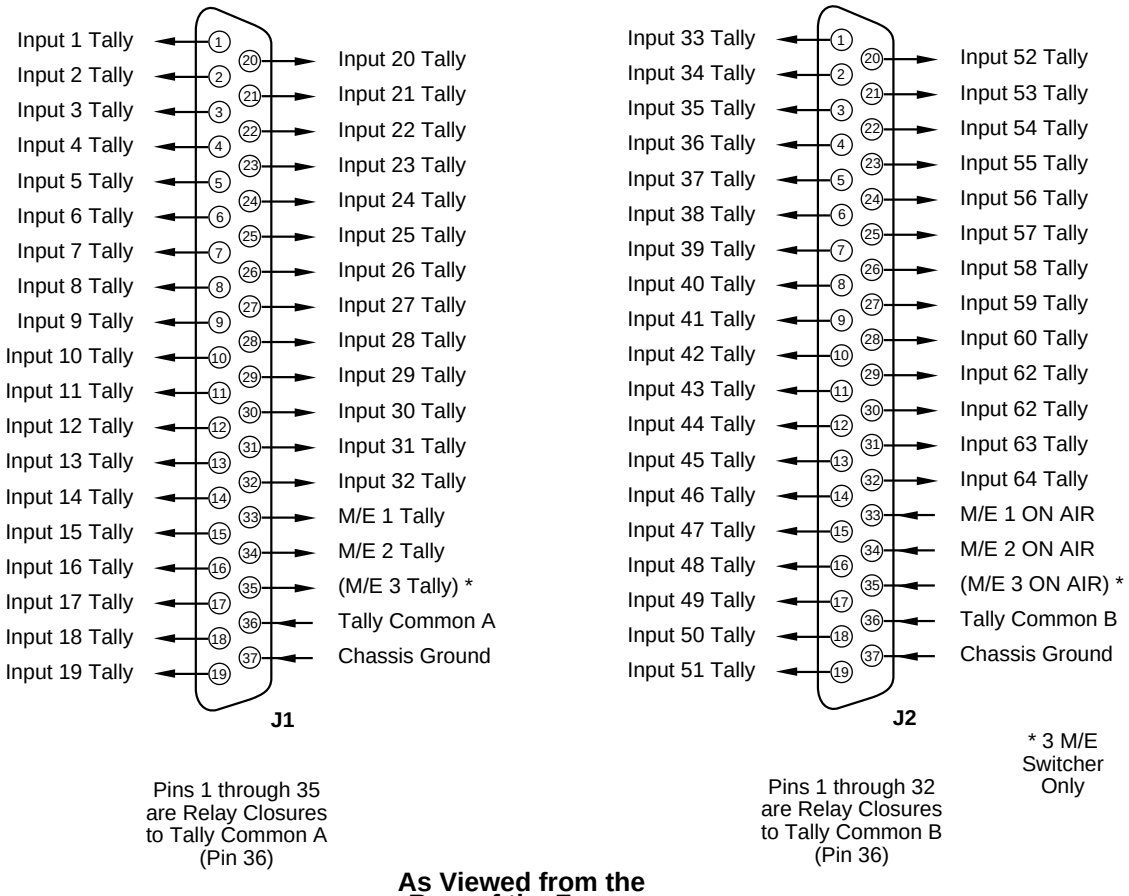


Figure 26. Serial Output Connections for Models Shipped After 1/96

Tally Output Connector Pinouts

The Tally Output Option provides relay closures for the on air sources in the Model 4000. These contact closures may be used for camera, monitor, or machine tally indicators. The Tally Connector Kit (051925) contains two 37-pin connectors. Pinouts for the two connectors are shown in Figure 27.



NOTE: Tally Common A is tied to Tally Common B on the module. Either A or B or both can be connected. Maximum Relay Current is 1 Amp at 32 Volts

Figure 27. Tally Output Connector Pinouts

Krystal Cabling

Model 4000s Aux Bus video and key outputs are connected to the Krystal's video and key inputs. (There is also an optional mask connection available with a Krystal option.) The Krystal's modified outputs can then be connected to any of the Model 4000 physical inputs (1 to 64). Refer to Figure 28 for Switcher and Krystal backplane connector locations.

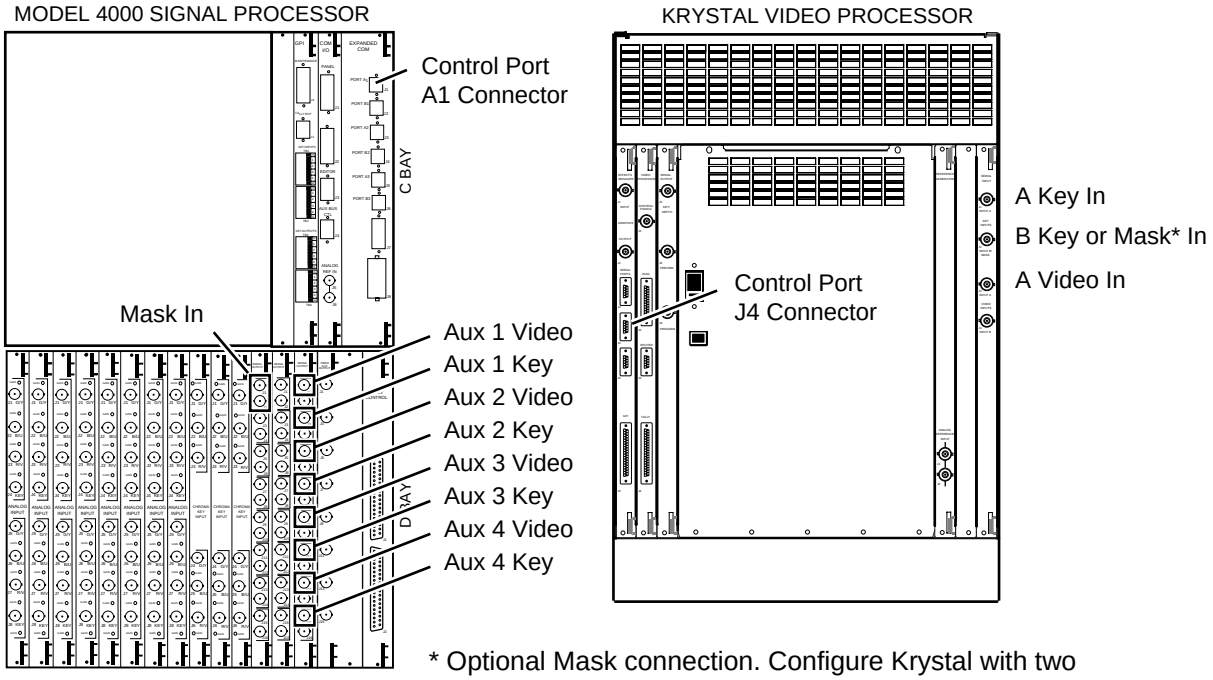


Figure 28. Model 4000 and Krystal Backplane Connector Locations

In any Krystal / Model 4000 interface, we recommend that you match the Aux Bus Effects Send Outputs—1 A / B, 2 A / B, 3 A / B, and 4 A / B—to the matching Krystal Channels 1, 2, 3, and 4 (that is, Aux Bus 1 A / B to Krystal Channel 1, and Aux Bus 2 A / B to Krystal Channel 2, and so on).

Figure 29 illustrates a typical Model 4000 and a single channel Krystal Digital Effects System.

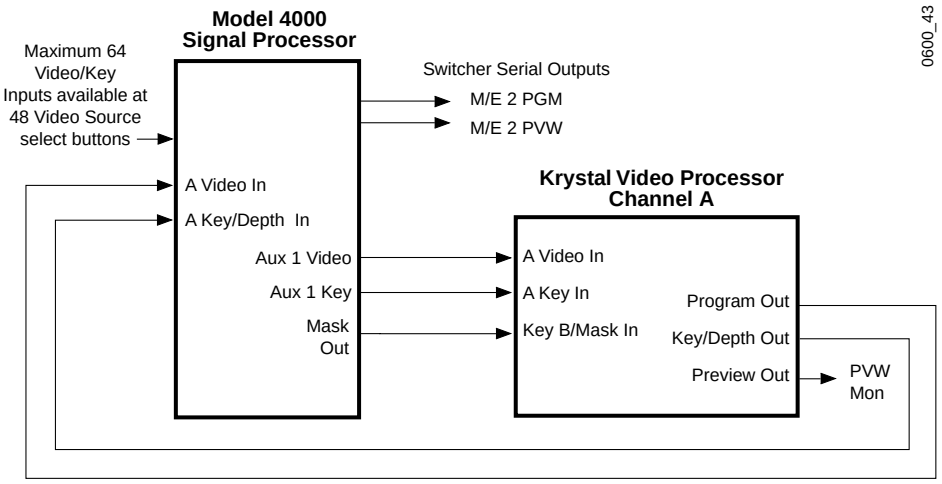


Figure 29. Example of the Model 4000 and a Signal Channel Krystal Configuration

Figure 30 illustrates the Model 4000 and a Two Channel Krystal configuration using the Small System Combiner.

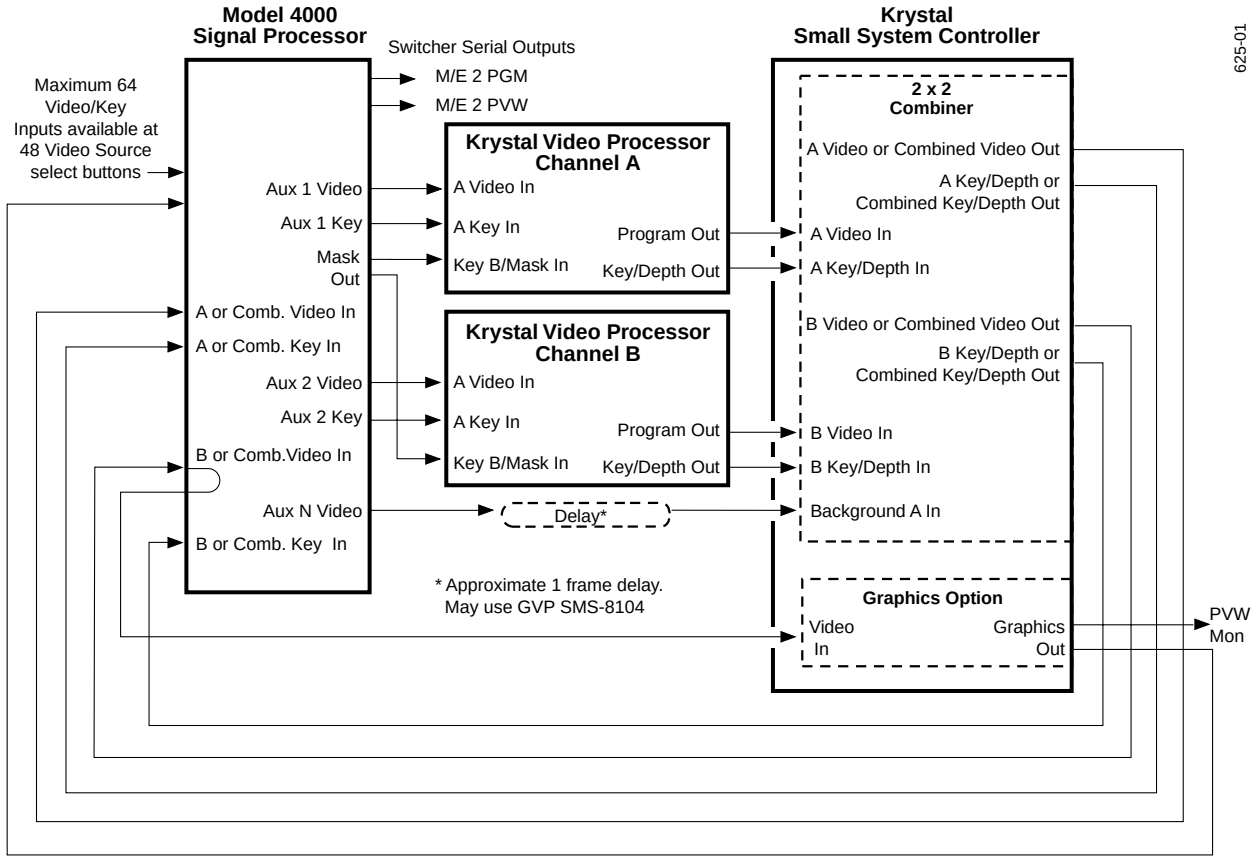


Figure 30. Model 4000 and a Krystal Two Channel Combiner Configuration

Figure 31 illustrates a Model 4000 interfaced to a Krystal Two User, Four Channel Combiner.

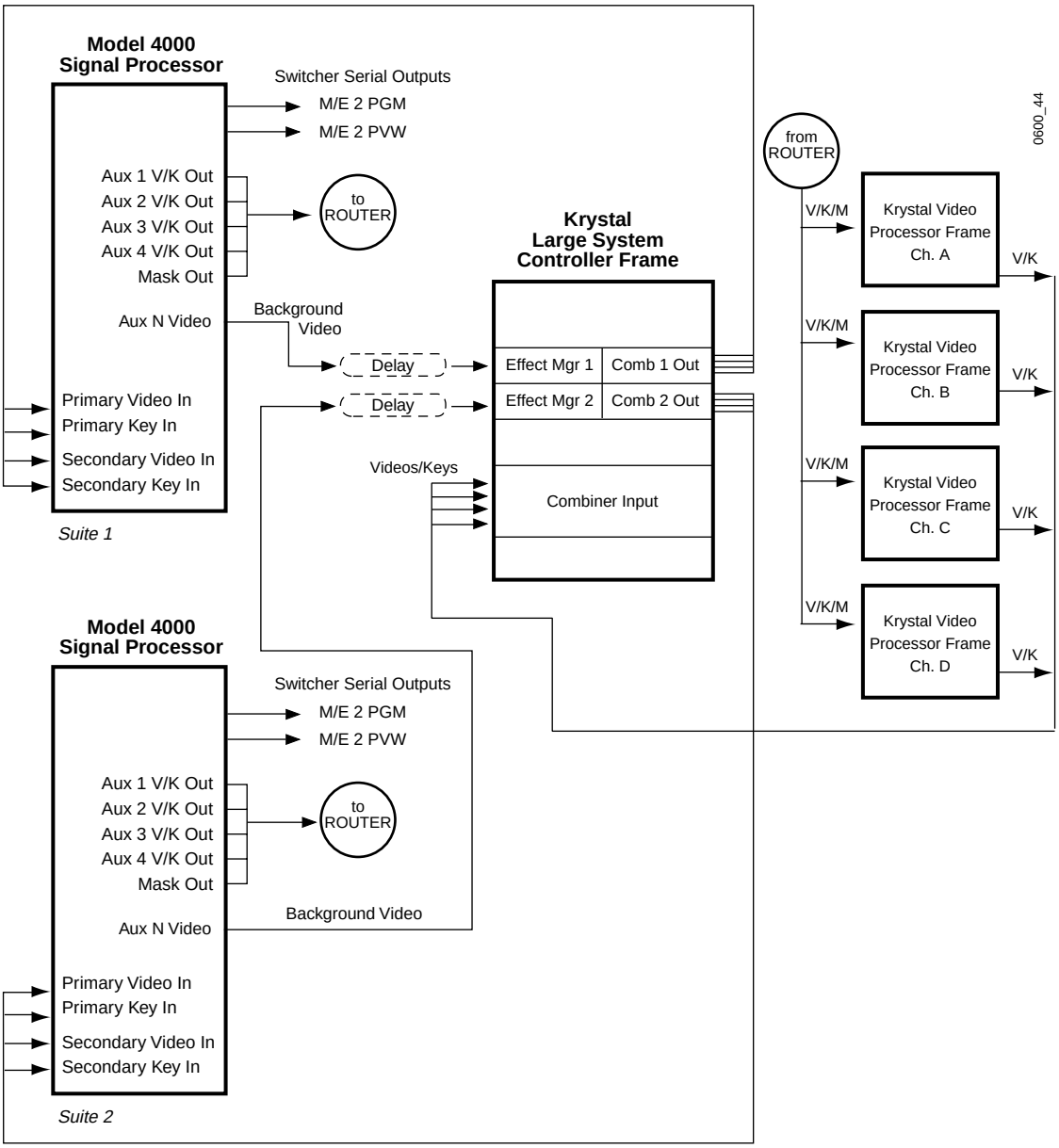


Figure 31. Model 4000 - Two User, Four Channel Combiner Video Cabling

Kaleidoscope Cabling

The Kaleidoscope Controller connects to the Model 4000 through an adapter cable (P / N 151022-00) and an RS-422 control cable (054602-XX). The Model 4000's Aux Bus video and key outputs connect to the Kaleidoscope Channel video and key inputs.

The Kaleidoscope Channel outputs can be connected to any of the Model 4000 physical inputs (1 to 64), in any order. See Figure 32.

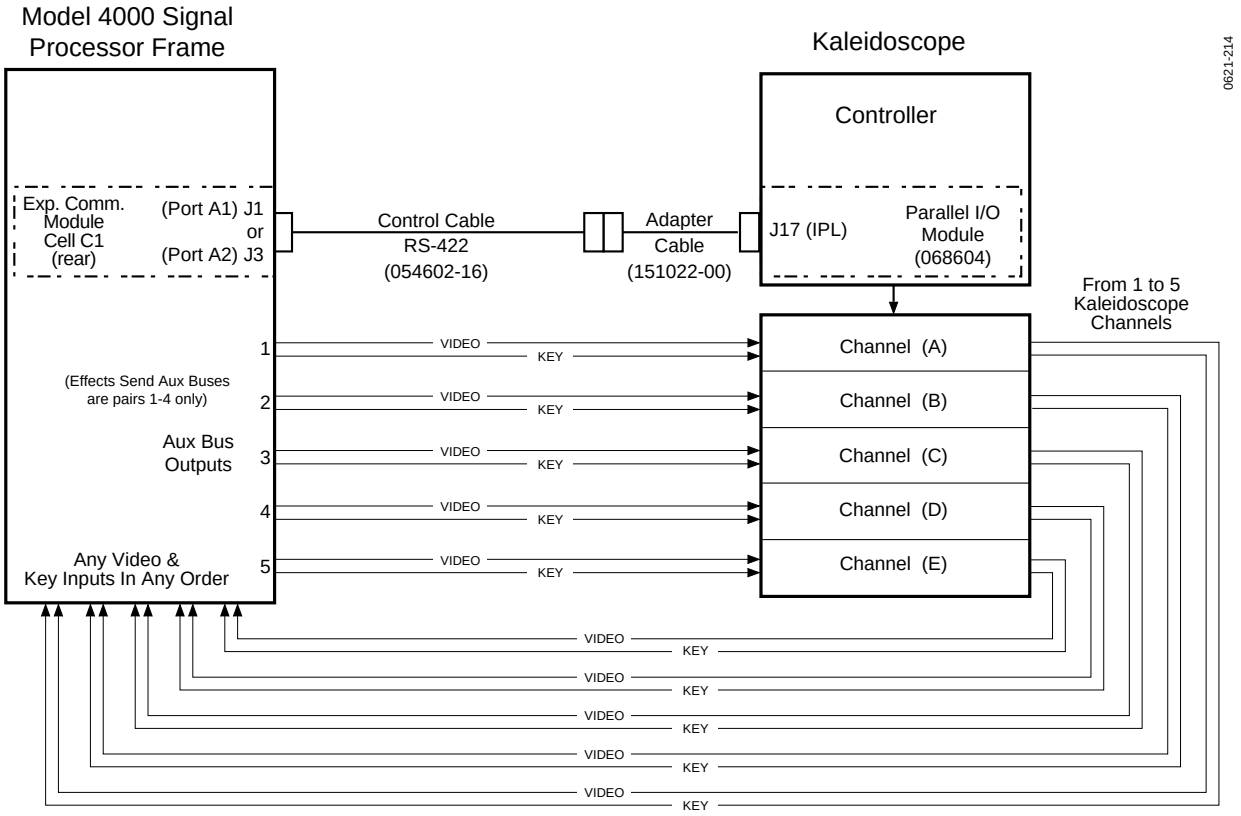


Figure 32. Example of the Model 4000 to Kaleidoscope Cabling

If the Kaleidoscope's outputs are sent to an Output Router, the Primary Video and Key, and Secondary Video and Key outputs may be connected to any four analog inputs on the Model 4000.

DPM-700 Cabling

The Model 4000 and the DPM-700 connections are illustrated in Figure 33. The Model 4000's Aux Bus video and key outputs are connected to the DPM's video and key inputs. The DPM's outputs can be connected to any of the Model 4000 physical inputs (1 to 64).

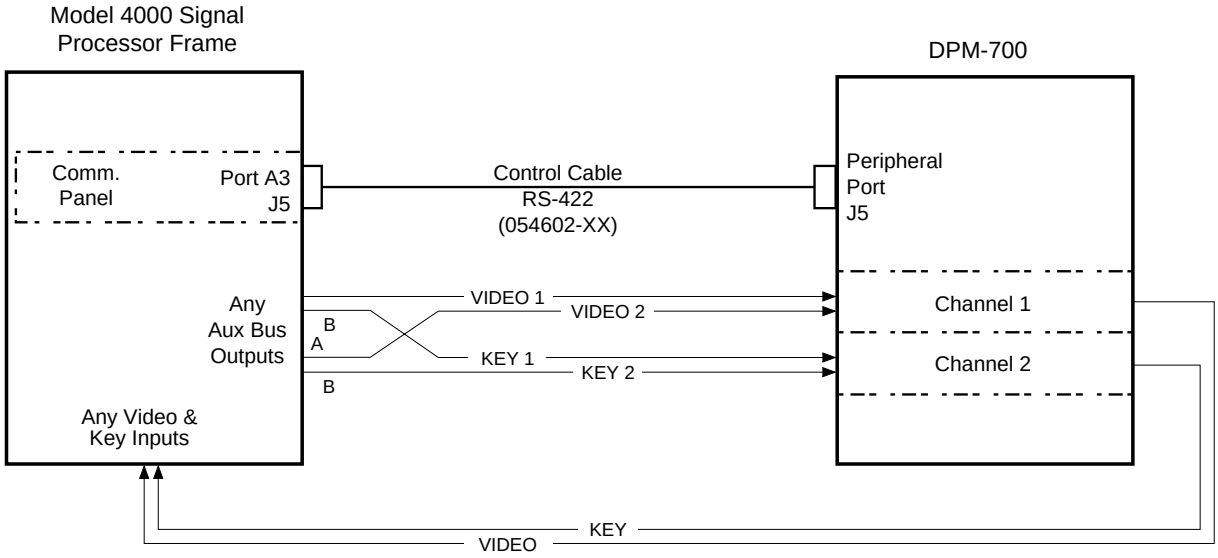


Figure 33. Model 4000 to DPM-700 Cabling

The Kaleidoscope, the DPM-700 and the Krystal connect to the Model 4000 through an RS-422 control cable available from Grass Valley Products (P / N 054602-16). This cable length is 16 meters, with a maximum cable length of 300 meters. Alternatively, you may manufacture your own cable; the cable pinout is illustrated in Figure 24. on page 34.

AC Power Cables

A set of TUV or UL approved power cables must be ordered for use with the Model 4000 Control Panel and Signal Processor Frame.

For European countries, the mandatory option TUV cable set must be ordered. The Control Panel cable has a molded grounding connector (IEC 320-C13) on one end with pigtails on the other. The Signal Processor Frame will have a power cable attached with pigtails on the free end; appropriate connectors to be supplied by the customer per local requirements.

For the United States, Canada, South America and South East Asia, the UL approved mandatory option set of cables must be ordered. The standard 110VAC cable has a molded grounding plug (NEMA 5-15P) at one end and a molded grounding connector (IEC 320-C13) at the other end. The Signal Processor Frame has a power cable attached with a 20 Amp Twist-Lock 240 VAC NEMA Type L6-20P plug on the end as shown in Figure 34.

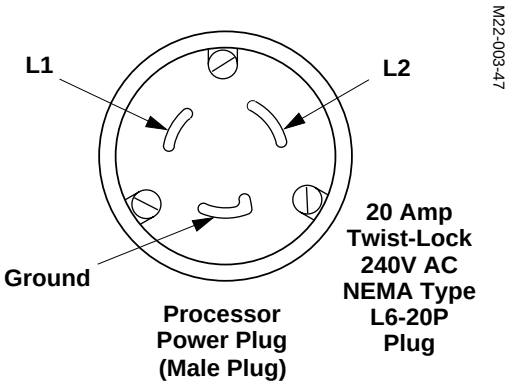
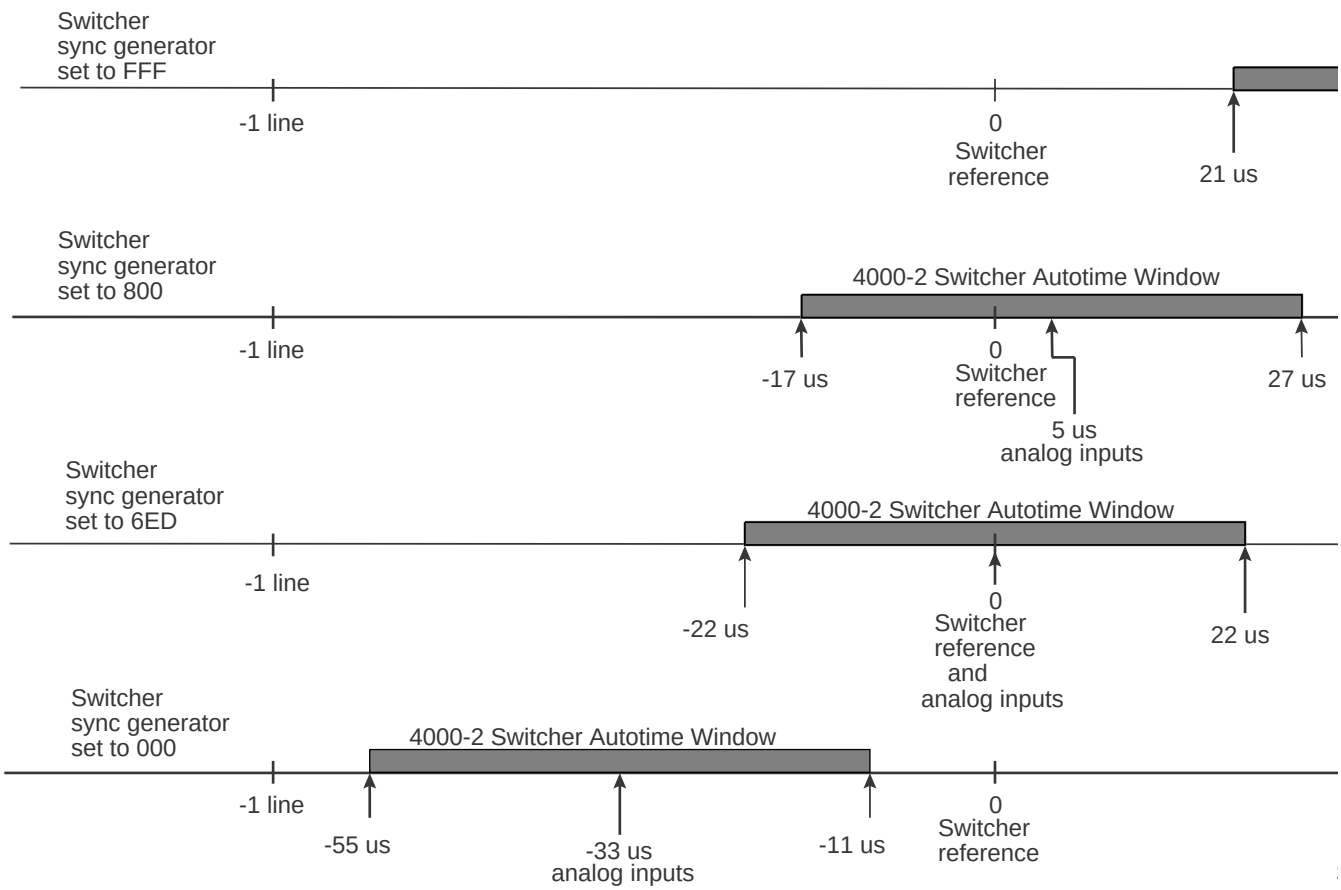


Figure 34. AC Power Connector

Timing Requirements for the Model 4000

The diagrams on the next few pages illustrate the timing requirements for the Model 4000-2A / B (Figure 35) and the Model 4000-3 (Figure 36). Incoming signals must be in the timing range of the switcher to select the proper timing.



Notes: 1 -The absolute dimensions of the digital input autotiming window is dependent upon the output and the path selected through the switcher.

The autotiming windows shown represent the composite worst case of all outputs and paths. Various outputs and paths may have larger autotiming windows than shown.

2 - Switcher digital output timings represent all outputs including *timed* aux bus outputs 5A - 8B. The only exceptions are untimed aux bus outputs 5A - 9B. These output less than 1 us. after the video enters the primary input.

3 - There are two types of optional analog inputs. Up to 16 analog primary inputs are applied to the main switch matrix and can be used on any bus similar to the serial digital inputs. Up to 6 external analog chroma key inputs are applied to the chroma keyers for external chroma keys. Neither of these inputs are auto timed. Both types must be timed externally to arrive at the switcher at the time labeled "analog inputs" on the above timelines. The analog inputs must be in time with the switcher reference when the sync generator is set to 6ED.
There is an external chroma key timing adjustment in the menu system. This is intended for artistic use or to compensate for *minor* external timing errors. This control can position the chroma key hole cutter approximately +- 20 us. However, the external analog chroma key inputs must arrive within -0.5 us to +2.0 us of the time labeled "analog inputs" for correct operation of the analog input clamps.

4 - All numbers are valid for both 525 and 625 standards. The line number marks on the horizontal scale represent 525 system lines (63.5 us).

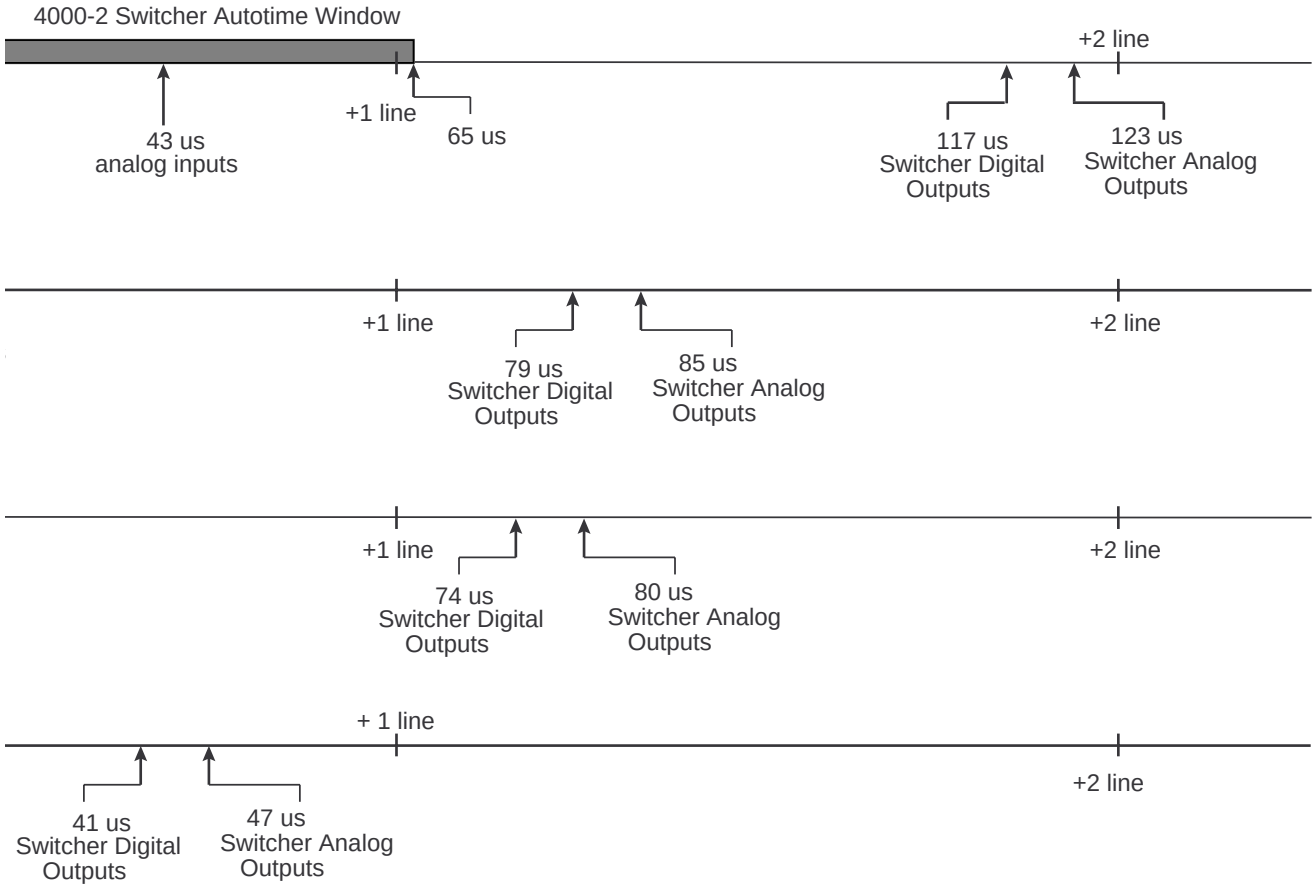
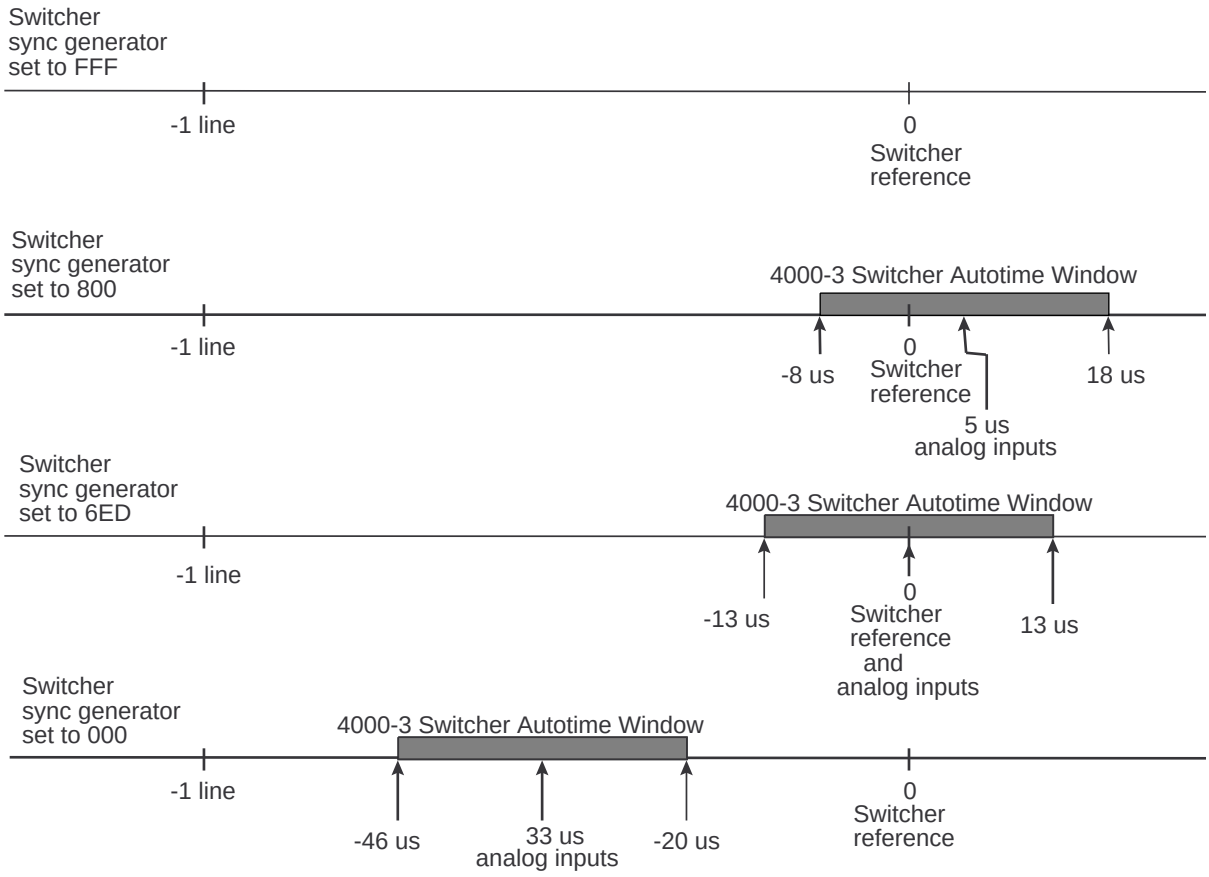


Figure 35. Model 4000-2A/B Timing Diagram



Notes: 1 -The absolute dimensions of the digital input autotiming window is dependent upon the output and the path selected through the switcher.

The autotiming windows shown represent the composite worst case of all outputs and paths. Various outputs and paths may have larger autotiming windows than shown.

2 - Switcher digital output timings represent all outputs including *timed* aux bus outputs 5A - 8B.

The only exceptions are: Untimed aux bus outputs 5A - 9B These output less than 1 us. after the video enters the primary input.

Framestore video & key - these output 10 us before program output.

3 - There are two types of optional analog inputs. Up to 16 analog primary inputs are applied to the main switch matrix and can be used on any bus similar to the serial digital inputs. Up to 6 external analog chroma key inputs are applied to the chroma keyers for external chroma keys. Neither of these inputs are auto timed. Both types must be timed externally to arrive at the switcher at the time labeled "analog inputs" on the above timelines. The analog inputs must be in time with the switcher reference when the sync generator is set to 6ED.

There is an external chroma key timing adjustment in the menu system. This is intended for artistic use or to compensate for *minor* external timing errors. This control can position the chroma key hole cutter approximately +- 20 us. However, the external analog chroma key inputs must arrive within -0.5 us to +2.0 us of the time labeled "analog inputs" for correct operation of the analog input clamps.

4 - All numbers are valid for both 525 and 625 standards. The line number marks on the horizontal scale represent 525 system lines (63.5 us).

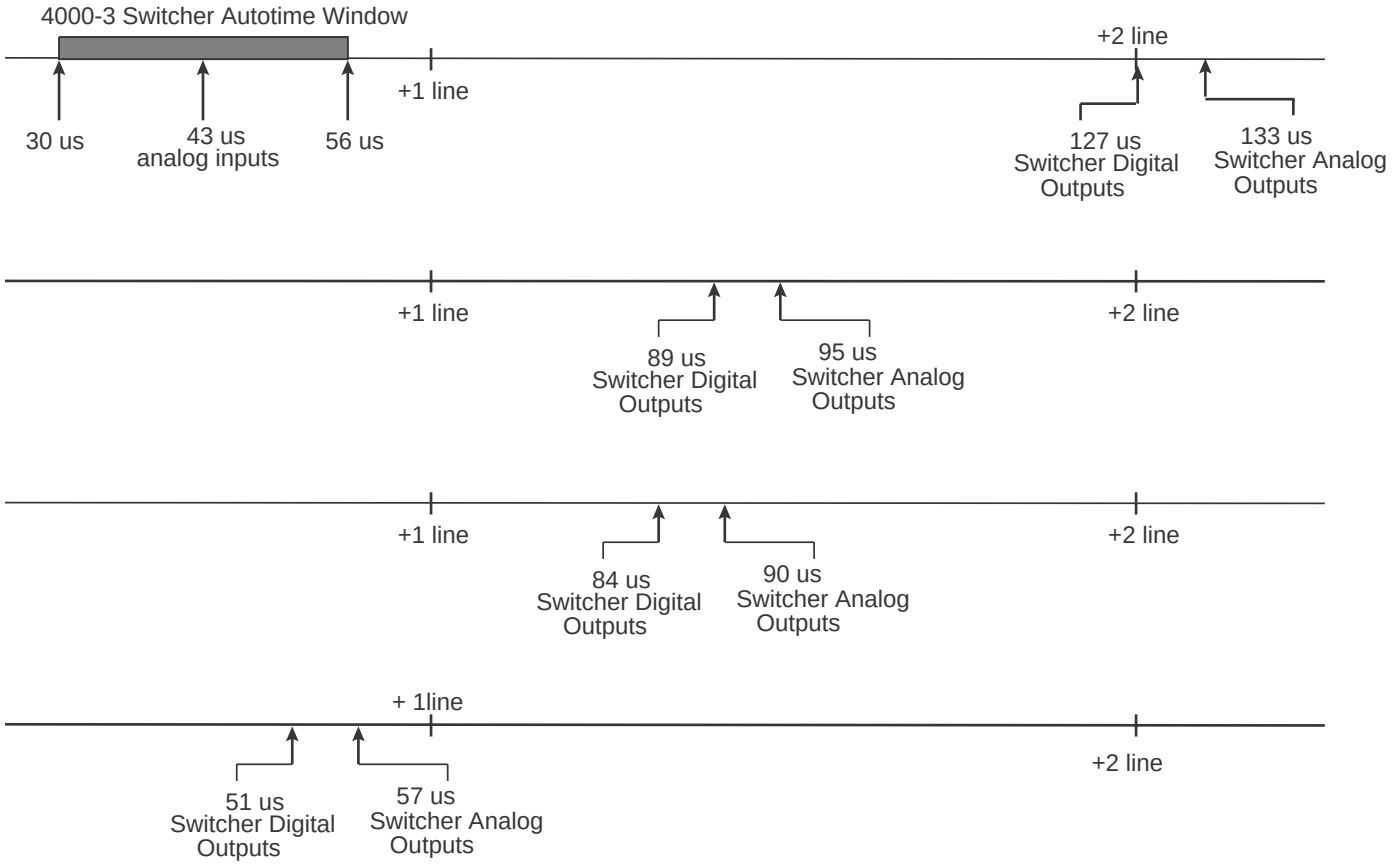


Figure 36. Model 4000-3 Timing Diagram

System Specifications

Specifications listed on the following pages are for the Model 4000 Series Digital Switchers. The analog signal specifications are measured according to the procedures published in Grass Valley Products' "Comprehensive Video Test Methods" (P/N A88-058010-01).

NOTE: *All Model 4000 Digital Switchers meet or exceed all specifications listed. All specifications are subject to change without notice.*

The following specifications are provided in table format:

Table 3. Analog Input Video Specifications

Characteristic	Requirement
Video amplitude (Luminance channel) for primary inputs	714 mV with/without setup or 700 mV without setup (with or without sync) (Each input selectable by CAV input)
Maximum luminance excursion relative to black level (before clipping)	+108 IRE peak positive -6 IRE peak negative
Video amplitude for color difference Chroma key and Analog inputs (100% saturated Bars)	Betacam ±467 mV MII 60 Hz ±324 mV MII 50 Hz ±350 mV SMPTE ±350 mV EBU ±350 mV (Each input selectable by CAV input)
Video amplitude for RGB Chroma Key and Analog Inputs	714 mV with or without setup or 700 mV without setup (with or without sync) (Each input selectable by CAV input)
Linear Key Amplitude	714 mV with or without setup or 700 mV pk without setup (each input selectable by CAV input))
DC offset of blanking level	± 2 Volts
Common mode hum (reference only)	< 2.0 V p-p max
Differential mode hum	< 1.0 V p-p max
Random noise	< -30 dB RMS relative to 1.0 V p-p
Analog Reference Input	Black (loop-through) (burst is not required)
Impedance (Chroma key and analog inputs)	75 Ohms terminating
Return loss	> 40 dB to 5 MHz
Manual timing steps	18 nS (Chroma key inputs)
Manual timing range	±20 nS
Common mode hum attenuation	> 34 dB

Table 4. Serial Digital Input Video Characteristics

Characteristic	Requirement
Channel Coding	Conforms to SMPTE RP-259M
Aux data	Auxiliary data is blanked (Aux Buses 1a/b–4a/b only)
Connector	BNC
Input impedance	75 Ohms
Return loss	> 15 dB from 5 MHz to 270 MHz
Autotiming range	+/- 22 µS (4000-2A/B) +/- 13 µS (4000-3)
Maximum cable length	225 meters (738 feet)
Number of bits	10

Table 5. Serial Digital Output Video Characteristics

Characteristic	Requirement
Rise and Fall Times Between 20% and 80% amplitude points)	Between 400pS and 1.5 nSec across 75Ω termination
Jitter	Timing of rising edges of data signal shall be within ± 0.25 nSec of average timing of rising edges over a period of 1 line
Channel Coding	Conforms to SMPTE RP-259M
Aux data	None
Connector	BNC
Output impedance	75 Ohms
Return loss	> 15 dB from 5 MHz to 270 MHz
Output amplitude	800 mV p-p terminated
DC level on output	< 50 mV
Number of bits	10
Number of outputs	2 (except Timed Aux Output which has one)

Table 6. Video System Characteristics (Analog In to Analog Out)

Characteristic	Requirement
Frequency response	≤± 0.2 dB to 5 MHz, - 40dB at 8 MHz
Group delay error	≤±8 nS to 5 MHz
Field rate tilt	< 0.25%
K Factor (2t Pulse)	< 0.25%
K Factor (Bar)	< 0.25%
K Factor (Pulse to Bar)	< 0.25%
Signal/P-P Noise Ratio (unweighted, 5 MHz bandwidth)	> 60 dB
Line time non linearity	< 0.5%
Gain stability	1%
Crosstalk	> 50 dB to 5 MHz

Table 7. Analog Output Characteristics

Characteristic	Requirement
Output amplitude	1.0 V p-p nominal
DC on output blanking level	< 50 mV
Output return loss	> 34 dB to 5 MHz
Output isolation	> 54 dB to 5 MHz
Output Y/C Timing error	< 10 nS
Number of outputs	2 (RGB or Color Difference - SMPTE/EBU or Betacam)

Table 8. Video System Characteristics (Analog or Digital)

Characteristic	Requirement
Blanking width	10.222 µS (525 line) 10.666 µS (625 line)
Number of quantization bits	10 minimum
Mix tracking error	0
Linearity during mix	Linearity is not affected by mix
Frequency response during mix	Response is not affected by mix
Path length	80 µs (4000-2A/B) 90 µS (4000-3)
Rounding method (digital only)	Adaptive Bit Reduction™(Patent Pending)

Table 9. Environmental Characteristics

Characteristic	Requirement
Operating ambient temperature	0 - 40 degrees C (32–104°F)
Ambient temperature for specifications	20 - 30 degrees C (68–86°F)
Relative humidity	95% max (non-condensing)
4000-2A Control Panel weight 4000-2B Control Panel weight 4000-3 Upper Control Panel weight 4000-3 Lower Control Panel weight	130 lbs (59 kgs) 114 lbs (51.8 kgs) 63 lbs (28.58 kgs) 137 lbs (62.14 kgs)
Digital Signal Processor weight Power Supply weight	300 lbs (136.4 kgs) (max) 143 lbs (65 kgs)

Table 10. Power Requirements

Component	Power	Voltage	Frequency
Control Panel	300 Watts (max)	110/220 VAC (nominal)	50-60 Hz
Signal Processor Power Supply	1300 Watts (no options) 1800 Watts (Typical) 2500 Watts (Max)	176-264 VAC 100-264 VAC - auto-ranging for Model 4000-2A/B only with P/S 098901-03	50-60 Hz

Reference Manuals

A manual set is provided with each switcher to assist in operating, maintaining, and repairing your Model 4000. Table 11 lists all documents related to the Model 4000 Series Systems:

Table 11. Model 4000 Series Digital Production Switcher Manuals

Model 4000 Switcher Manuals	GVP P/N
Model 4000 Switcher Manual Set (includes Installation and Service Manual, Users Guide, Operation Reference, Parts Lists, and Drawings)	TP0789-xx
Model 4000 User's Guide	TP0790-xx
Model 4000 Operation Reference	TP0764-xx
Model 4000 System Information	TP0621-xx
Model 2200/4000 Parts List	TP0623-xx
Model 2200/4000 Drawings	TP0624-xx
Digital Switcher Protocol	TP0350-xx

NOTES