



## **SIERRA VIDEO**

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Sierra Pro Series 64XL Routing Switcher

# User's Manual





SIERRA PRO SERIES 64XL ROUTING SWITCHER

# User's Manual

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# Introduction

## Before You Begin

There are several terms and acronyms that you should become familiar with before reading this manual. They are shown below.

Term/Acronym	Definition
Crosspoint	The electronic switch that assigns one of the inputs on the matrix crosspoint modules to an output.
Destination	A device that receives signals from the output of the switcher.
Output Source	The signal that connects to the destination device. The signal that is connected to the input of the routing switcher.
Input	Connected to the source that provides the signal to the switcher.
Matrix	An array of the switch modules that connects an input to an output.
Protocol	The command structure used to affect a switch or multiple switches on the routing switcher or to control other functions.
Routing Switcher	Consists of one or more crosspoint modules that switch together, or sometimes independently, to connect the desired signals through the switcher.
Serial Port	The 9-pin RS232 connector that allows you to control the switcher using a standard personal computer or other external device. Sends control protocol commands in ASCII.

# Regulatory Warnings & Safety Information

The information in the following section provides important warnings and safety guidelines for both the operator and service personnel. Specific warnings and cautions may be found throughout this manual. Please read and follow the important safety precautions noting especially those instructions relating to risk of fire, electrical shock and injury to persons.

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

## Warnings

- Heed all warnings on the unit and in the operating instructions.
- Disconnect AC power before installing or removing device or servicing unit.
- Do not use this product in or near water.
- This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting inputs or outputs.
- Route power cords and other cables so that they are not likely to be damaged, or create a hazard.
- Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch unsafe connections and components when the power is on.
- To avoid fire hazard, use only the specified type, correct voltage, and current rating of fuse. Always refer fuse replacement to qualified service personnel.
- Have qualified personnel perform safety checks after any completed service.
- To reduce risk of electrical shock, be certain to plug each power supply cord into a separate branch circuit employing a separate service ground.
- If equipped with redundant power, this unit has two power cords. To reduce the risk of electrical shock, disconnect both power cords before servicing.
- Operate only with covers and enclosure panels in place – Do Not operate this product when covers or enclosure panels are removed.
- This is an FCC class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take necessary measures.

## Cautions

- Use the proper AC voltage to supply power to the switcher. When installing equipment, do not attach the power cord to building surfaces.
- To prevent damage to equipment when replacing fuses, locate and correct the trouble that caused the fuse to blow before applying power.
- Use only the recommended interconnect cables to connect the switcher to other frames.
- Follow static precautions at all times when handling the equipment.
- Power this product only as described in the installation section of this manual.

## Cautions (continued)

- Leave the sides, top, and bottom of the frame clear for air convection cooling and to allow room for cabling. Slot and openings in the frame are provided for ventilation and should not be blocked.
- Only an authorized Sierra Video technician should service the switchers. Any user who makes changes or modifications to the unit without the expressed approval of Sierra Video will void the warranty.
- If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than the room ambient temperature. Therefore, consideration should be given to installing the equipment in an environment compatible with the manufacturer's maximum rated ambient temperature (TMRA).
- Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
- Use a shielded data cable connection between the parallel data ports and peripherals of this equipment.
- Other connections between peripherals of this equipment may be made with low voltage non-shielded computer data cables.
- Network connections may consist of non-shielded CAT 5 cable.
- Do not cover chassis ventilation slots or block enclosure openings.

### FCC Notice

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

The user may find the following publication prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems" (Stock number 004-000-00345-4).

Available exclusively from the Superintendent of Documents, Government Printing Office, Washington, DC 20402 (telephone 202 512-1800).

### Warning

Changes or modifications not expressly approved by the party responsible for compliance to Part 15 of the FCC Rules could void the user's authority to operate the equipment.

## Power Supply Cords

Use only power cord(s) supplied with the unit.

If power cord(s) were not supplied with the unit, select as follows:

- For units installed in the USA and Canada: select a flexible, three-conductor power cord that is UL listed and CSA certified, with individual conductor wire size of #18 AWG, and a maximum length of 4.5 meters. The power cord terminations should be NEMA Type 5-15P (three-prong earthing) at one end and IEC appliance inlet coupler at the other end. Any of the following types of power cords are acceptable; SV, SVE, SVO, SVT, SVTO, SVTOO, S, SE, SO, SOO, ST, STO, STOO, SJ, SJE, SJO, SJOO, SJT, SJTOO, SP-3, G, W.
- For units installed in all other countries; select only a flexible, three-conductor power cord, approved by the cognizant safety organization of your country. The power cord must be Type HAR (Harmonized), with individual conductor wire size of 0.75 mm<sup>2</sup>. The power cord terminations should be a suitably rated earthing-type plug at one end and IEC appliance inlet coupler at the other end. Both of the power cord terminations must carry the certification label (mark) of the cognizant safety organization of your country.
- A non-shielded power cord may be used to connect AC power to every component and peripheral of the system.
- Connect an external 18 AWG wire from earth ground to the chassis of the system as designated by the earth ground symbol.

### North American Power Supply Cords

This equipment is supplied with North American power cords with molded grounded plug (NEMA-15P) at one end and molded grounding connector (IEC 320-C13) at the other end. Conductors are CEE color coded, light blue(neutral), brown(line), and green/yellow(ground). Operation of the equipment at voltages exceeding 130VAC will require power supply cords that comply with NEMA configurations.

### International Power Supply Cords

If shipped outside North America, this equipment is supplied with molded ground connector (IEC 320-C13) at one end and stripped connectors (50/5mm) at the other end. Connections are CEE color coded, light blue (neutral), brown(line), and green/yellow(ground). Other IEC 320-C13 type power cords can be used if they comply with safety regulations of the country in which they are installed.

## EMC Regulatory Notices

Federal Communications Commission (FCC) Part 15 Information: This device complies with Part 15 of the FCC standard rules. Operation is subject to the following conditions:

This device may not cause harmful interference

This device must accept any interference received including interference that may cause undesirable operations.

## Delivery Damage Inspection

Carefully inspect the frame and exterior components to be sure that there has been no shipping damage. Make sure all modules are seated correctly and have not detached during shipment.

# Sierra Pro Series 64XL Routing Switcher

## Introduction

500MHz RGBHV Routing Switcher up to 64x64

The Sierra Pro Series 64XL wideband video routing switcher from Sierra Video is for those applications requiring worry-free performance and mission critical reliability. The advanced features and performance set it apart from the competition. These include:

- Compact frame size – 10RU smaller than most competitive units (in RGBHV)
- Redundant power supplies
- Standard front control panel
- Full range of Sierra control hardware and software components, including remote control panels, IP and serial control. Supported by all major third party control systems.

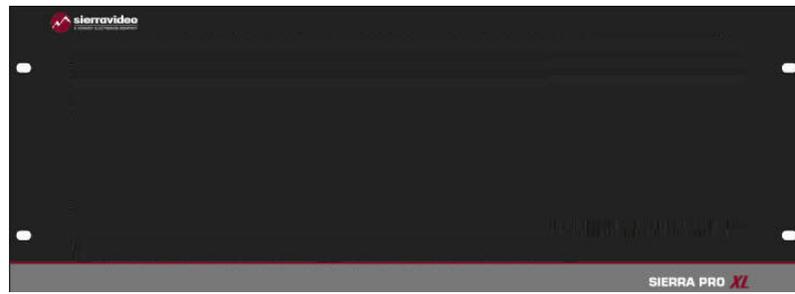
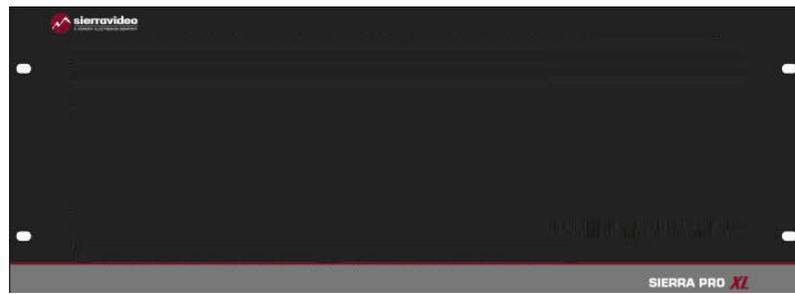
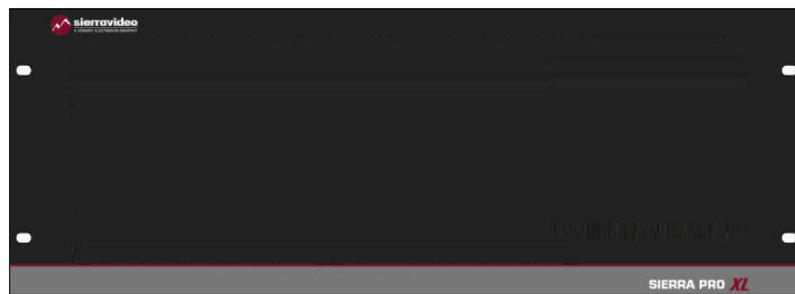
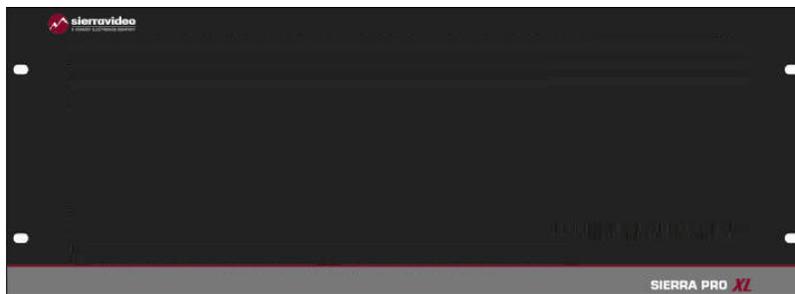
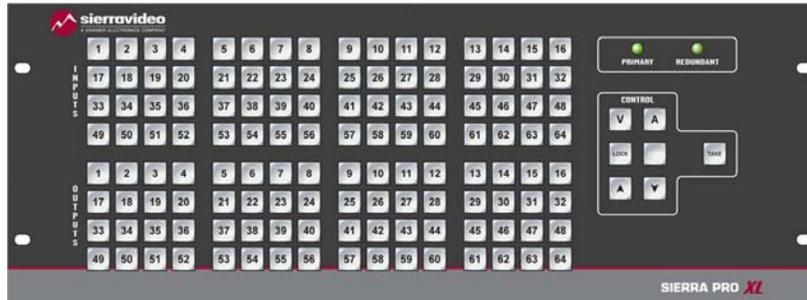
For applications requiring companion audio, the wideband routing switcher is compatible with our time-tested line of audio routing switchers. Sierra Video advanced SCP line of programmable control panels manage the routing system along with our TyLinx Pro™ router control software featuring the most intuitive router interface in the industry.

This manual covers only the Sierra Pro Series 64XL routing switcher. These robust routers offer RGB/HV in multiple compact frames. Moreover, these durable frames can be populated from one to five video and sync channels. They have been engineered for high bandwidth with very low crosstalk. Many other features include control via serial ports and optional power redundancy. The Sierra Pro Series 64XL can be configured to support composite, s-video, YC, YUV, RGBHV, analog HD.

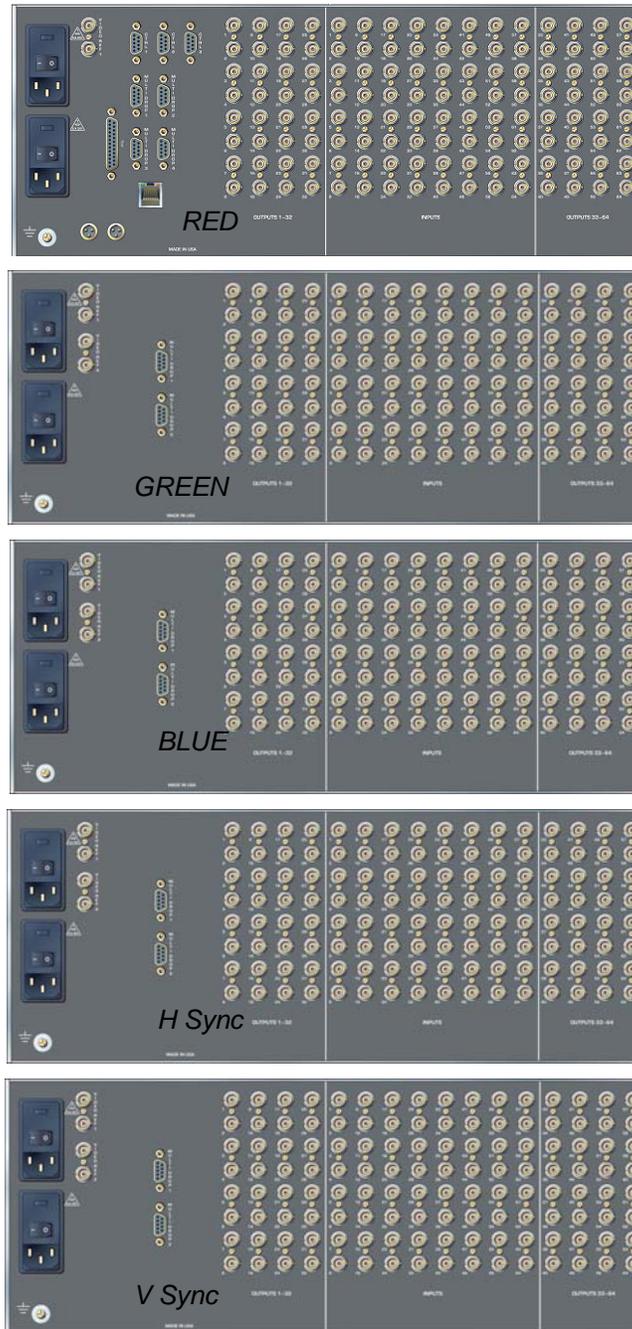


# RGBHV Frames

## Frame Front Panels



## Frame Rear Panels

**Note**

The models shown here and in the subsequent sections are fully populated video matrices. In some cases, the system may be configured with fewer video channels and/or frames. i.e. Sierra Pro models also offer redundant power supplies. Consult the rear panel serial number and model number to verify your order and product. The system you receive is customized for the size & type requested at time of purchase from Sierra Video.

## Factors Affecting Quality of Results

There are many factors affecting the quality of results when signals are transmitted from a source to a destination.

- Signal cables — Use only the best quality cables to avoid interference, degraded signal quality and elevated noise levels.
- Sockets and connectors of the sources and destinations — Use only the highest quality, since "zero ohm" connection resistance is the target. Connectors should also match the required impedance (75 ohm in video) to minimize return loss.
- Amplifying circuitry — Must have quality performance when the desired end result is high linearity, low distortion, and low noise.
- Distance between sources and destinations — Plays a major role in the final result. For long distances (over 15 meters) between sources and destinations, special measures should be taken to avoid high frequency cable losses. These measures include using higher quality cables and/or adding line cable equalizing amplifiers.
- Interference from neighboring electrical appliances — These can have an adverse affect on signal quality. Balanced audio lines are less prone to interference, but unbalanced audio should be installed away from any main power lines, electric motors, transmitters, etc. even when the cables are shielded.

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### **CAUTION!**

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*Only an authorized Sierra Video technician can service the switchers. Any user who makes changes or modifications to the unit without the expressed approval of the manufacturer will void the warranty.*

*Use the proper AC voltage to supply power to the switcher.*

*Use only the recommended interconnect cables to connect the switcher to other frames*

# Installation

## Introduction

Installation procedures are similar for all frames covered within this manual. Exceptions, if any, have been noted in each of the following paragraphs.

## Rack Mounting

Carefully inspect the frame to ensure that there has been no shipping damage. Make sure all shipping material is removed from the router frame.

Each of the routing switchers described in this manual can be rack mounted in a standard 19" (RU) EIA rack assembly and includes rack "ears" at the ends of the front of the frames. None of the switcher models require spacing above or below the unit for ventilation. If ample space exists, a 1RU spacing gap is recommended.

To rack mount any of the routing switchers, simply place the unit's rack ears against the rack rails of the rack, and insert proper rack screws through each of the holes in the rack ears. Always rack mount the routing switcher prior to plugging the unit into a power receptacle or attaching any cables.

**Important:** Rear mounting brackets must be installed prior to installation of the router into a rack. The rear mounting brackets are contained in the accessory kit supplied with your router.

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### **CAUTION!**

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*The operating temperature range of the Sierra Pro series router is 0 to 40 °C. Do not exceed the maximum (40 °C) or minimum (0 °C) operating temperature.*

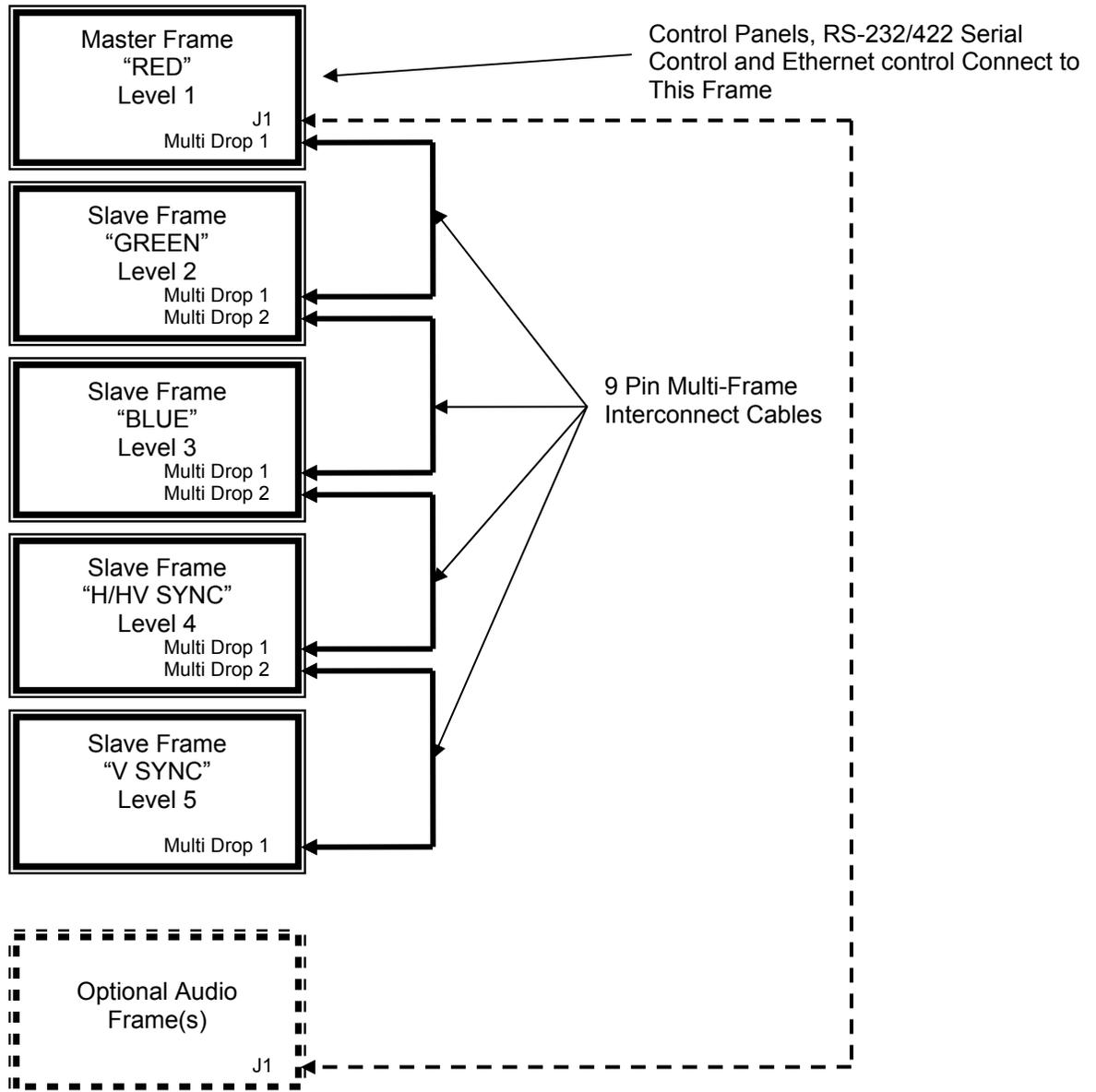
Rear mounting brackets must be installed prior to installation of the router into a rack. The rear mounting brackets are contained in the accessory kit supplied with your router.

If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than the room ambient temperature. Therefore, consideration should be given to installing the equipment in an environment compatible with the manufacturer's maximum rated ambient temperature (TMRA).

Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.

# Multi-Frame Connections

The Series 64 RGBHV system consists of 5 individual frames connected together so that all 5 frames operate as a single routing system. The “RED” frame contains the “Master” processor whereas the other 4 frames each contain a “Slave” processor. The action of the slave frames are controlled exclusively by the frame with the master processor. The frames are connected via a “looping” 9-pin cable connected from the “multi-drop 1” port to the “multi-drop 2” port between each frame. The 25 pin J1 connector is used when the audio option is ordered.



See the “Connecting Peripherals” section of this manual for details.

## Connecting To Video Devices

Video sources and output devices (such as monitors, or recorders) may be connected to the routing switchers through the BNC type connectors located on the back of the unit. Keep in mind that the output signal format will be that of the input signal format.

All signal connections that use more than one cable interconnecting between devices should be of equal timing length (example: cables between a camera and the switcher should have the same time delay).

The rear panel of the frame is laid out in the most logical fashion possible. The individual frames are RED, GREEN, BLUE, H/HV SYNC, and V SYNC. The H/HV and V conventions, used for the H and V sync channels, are arbitrary and these two channels are interchangeable. Each channel can have only "H" or "V" signals – not both. All inputs are factory set for 75 ohm termination. Unused outputs do not need to be terminated.

### Sync

Horizontal ("H") and Vertical ("V") sync input termination is factory set to 75 ohms. Sync input terminations can be changed to 510 ohms.

To change sync input terminations;

1. Connect the COMM port from a computer to "CTRL 1" on the back of the "Master" frame.
2. Open HyperTerminal, Hyper Access or other similar terminal emulation program.
3. Set the program's parameters to 115.2K baud, 8 Data bits, No parity, 1 stop bit, ANSI emulation.
4. Establish communication to the router's processor by typing \*\*!! on the keyboard. The terminal program screen will answer \*\*OK!! confirming communication.

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#### **Note:**

*To change sync input termination the "CTRL 1" port must be in the "Host" protocol mode. "CTRL 1" is factory default to the "Host" mode. However, the CTRL 1 port can be changed to "terminal" via software or DIP switch. To change the CTRL 1 port to "Host" mode type \*\*HOST1!! (see the operation chapter section of this manual).*

The following commands will set the input terminations to either on or off for both the H sync and V sync frames.

Set all boards input termination to 1 "ON" (75 Ohm)

```
** G XFER_ASCII,253,0,0,0f40ff730401ff~!!    inputs 1-8
** G XFER_ASCII,253,0,0,0f40ff730402ff~!!    inputs 9-16
** G XFER_ASCII,253,0,0,0f40ff730403ff~!!    inputs 17-24
** G XFER_ASCII,253,0,0,0f40ff730404ff~!!    inputs 25-32
** G XFER_ASCII,253,0,0,0f40ff730405ff~!!    inputs 33-40
** G XFER_ASCII,253,0,0,0f40ff730406ff~!!    inputs 41-48
** G XFER_ASCII,253,0,0,0f40ff730407ff~!!    inputs 49-56
** G XFER_ASCII,253,0,0,0f40ff730408ff~!!    inputs 57-64
```

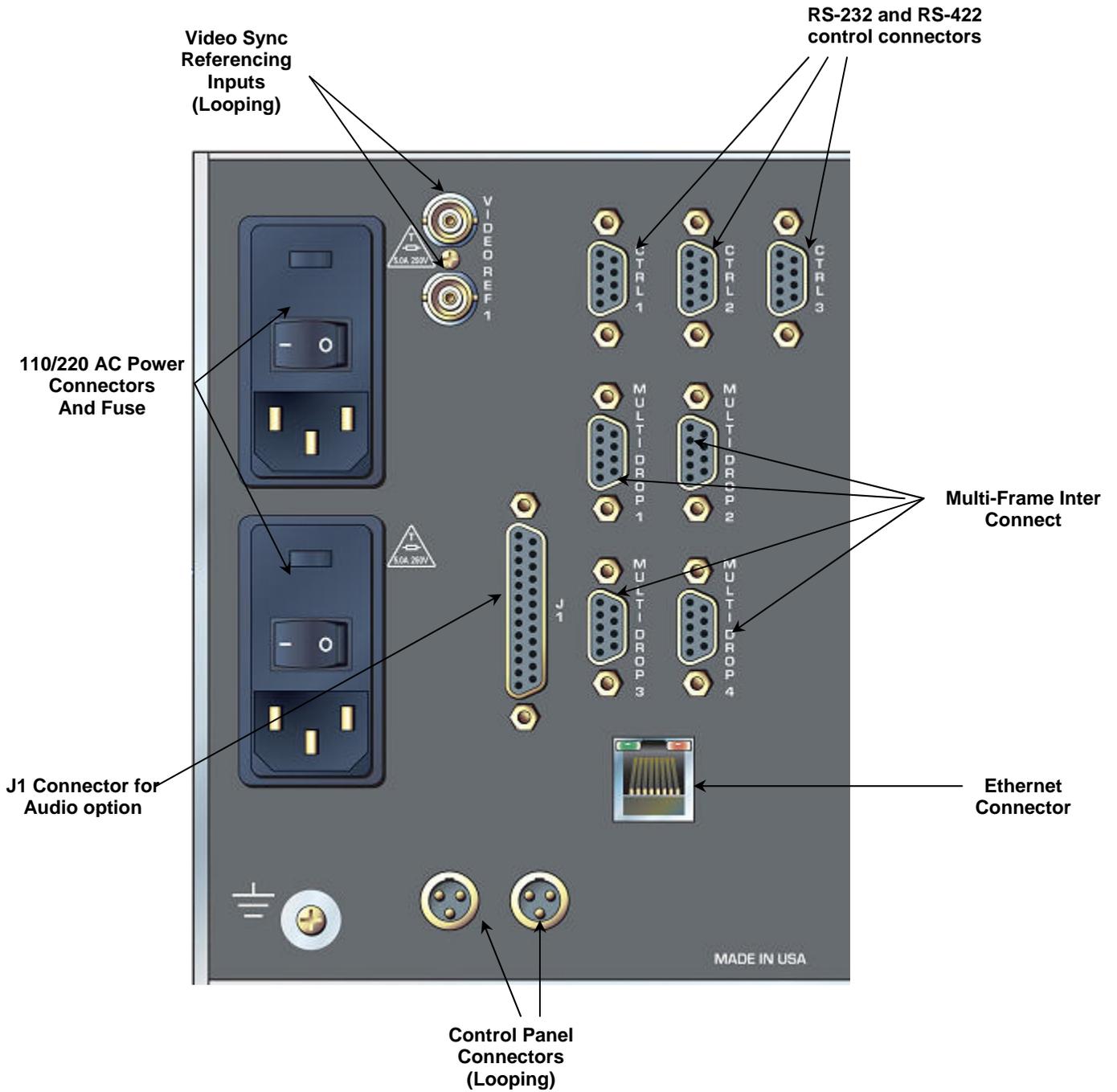
Set all boards input termination to 0 "OFF" (510 Ohm)

```
** G XFER_ASCII,253,0,0,0f40ff73040100~!!    inputs 1-8
** G XFER_ASCII,253,0,0,0f40ff73040200~!!    inputs 9-16
** G XFER_ASCII,253,0,0,0f40ff73040300~!!    inputs 17-24
** G XFER_ASCII,253,0,0,0f40ff73040400~!!    inputs 25-32
** G XFER_ASCII,253,0,0,0f40ff73040500~!!    inputs 33-40
** G XFER_ASCII,253,0,0,0f40ff73040600~!!    inputs 41-48
** G XFER_ASCII,253,0,0,0f40ff73040700~!!    inputs 49-56
** G XFER_ASCII,253,0,0,0f40ff73040800~!!    inputs 57-64
```

## Connecting Peripherals

Control panels, sync inputs, and power are all connected to the rear of the "Master" frame. The peripherals area may vary depending on the model size and type.

### Master Frame Rear Panel



## Reference Sync

There are two “looped” sets of BNC connectors labeled “VIDEO REF 1”, “VIDEO REF 2”. These are “looping” inputs for sync referencing. Connect either composite sync or video with sync to either set of BNCs. If desired, use the second BNC in the set to loop the signal to another device. If the loop is not used, terminate the second BNC with 75 ohms.

**The set of sync connectors labeled “VIDEO REF 2” is for future use and are not connected.**

If no sync is available, the routing switcher will switch at a random point rather than during the vertical interval of the reference signal.

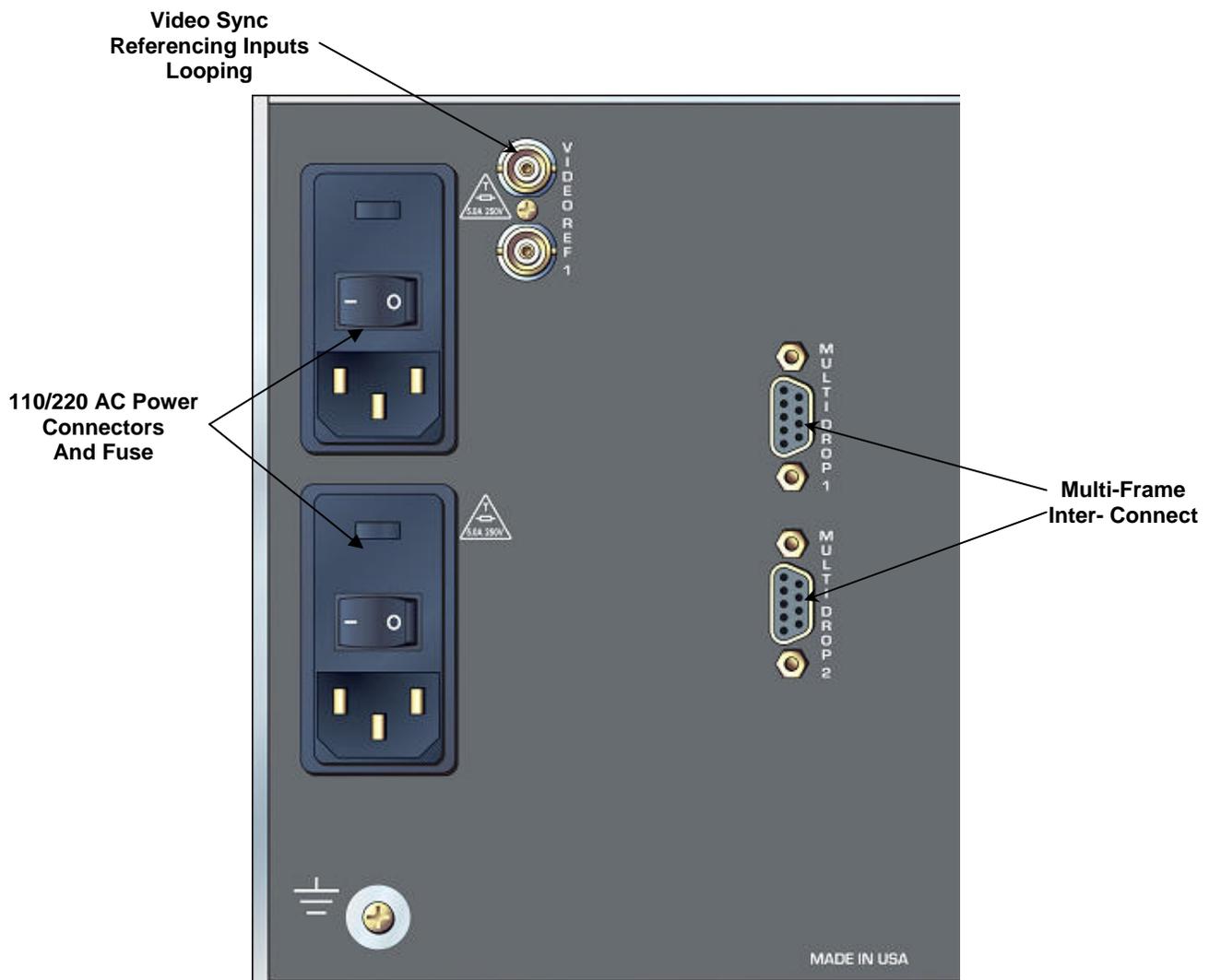
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**Note:**

*Reference sync need only be connected to the “Master” frame. The “Master” frame is the frame where the processor is installed, typically the “RED” frame.*

## Slave Frame Rear Panel

Reference sync need not be connected unless the “Slave” frame contains a different signal type than the “Master” frame, i.e. the master frame has video (which requires video sync) and the slave frame has AES audio (which requires AES sync).





## DIP Switch Settings Cont.

DIP Switch	Action	
	S1	S2
1	Debug Messages ON= Debug Messages *OFF= Normal Operation	Force Crosspoint Initialization ON= Set X-points to 1-1, 2-2, 3-3, etc. *OFF= Last X-point Remembered
2	Bootloader Menu ON= Menu Enable *OFF= Menu Disable	Initialize Non-Volatile Memory ON= Clear All Settings *OFF= Normal Operation
3	Router Application Startup ON= Application Disable *OFF= Application Enable	Port 1 Protocol ON= Terminal Protocol- XOn/ XOff Enabled *OFF= Port Can be Changed by Software
4	Debug Server ON= Server Enable *OFF= Server Disable	Port 1 Type If S2-3 is ON; ON= RS-422 *OFF= RS-232 If S2-3 is OFF Settings Can be Changed by Software
5	Debug Break ON= Break *OFF= No Break	Port 1 Baud Rate If S2-3 is ON; 1.2K Baud 5 = OFF, 6 = OFF 9.6K Baud 5 = OFF, 6 = ON 38.4K Baud 5 = ON, 6 = OFF *115.2K Baud 5 = ON, 6 = ON
6	Unused- Set to OFF	
7	Unused- Set to OFF	Unused- Set to OFF
8	Unused- Set to OFF	Unused- Set to OFF
<b>* = Factory Default Settings</b>		

**Note:**

To manually set Port 1 to RS-422, turn S2-3 ON and S2-4 ON.

(Baud Rate is now set by S2-5 and S2-6)

## Ethernet Setup

There is an Ethernet connector on the “Master” frame labeled “LAN”

**Default IP settings;**

**IP Address- 192.168.1.200**

**Subnet mask- 255.255.255.0**

**Gateway IP Address- 0.0.0.0**

**Telnet Port- 10001**

### To set IP parameters using the Ethernet port;

1. Connect the Ethernet cable to “LAN 1” on the back of the “Master” frame.
2. Open the command prompt on a PC. In Windows XP Pro, you can access the Command Prompt by clicking on the “Start” menu “Programs”, “Accessories”, “Command Prompt”.
3. Verify communications to the router by “Pinging” the router. You can do this by typing in the ping command in the Command Prompt window as follows;  
“ping 192.168.1.200” followed by a carriage return.
4. Once communications have been established you can Telnet into the router. You can do this by typing in the telnet command in the Command Prompt window as follows;  
“telnet 192.168.1.200” followed by a carriage return.
5. To login to the router, type “svsadmin” at the login prompt followed by a carriage return. Then enter the password “TED” the password is case sensitive and must be typed in uppercase characters.
6. To view the current network parameters you need to type in the following command;  
“SvsBootTestParam” followed by a carriage return.
7. To change the IP address the command is as follows;  
“SvsBootTestParam SetParam IP xxx.xxx.x.xxx  
Where the “x” is the IP address you want to assign to the router.
8. To set the Subnet Mask the command is as follows;  
“SvsBootTestParam SetParam SUBNET xxx.xxx.xxx.x  
Where the “x” is the Subnet address you wish to assign to the router
9. Once the IP address and Subnet mask have been set you can close the telnet connection to the router by typing “exit” at the \> prompt then restart the router by power cycling the “Master” frame.
10. Once the system has restarted you can verify that your settings are correct by pinging the IP address you just assigned the router i.e.  
“ping (your new IP address) followed by a carriage return.

---

**Note:**

*192.168.1.200 is the factory default IP address.*

### To set IP parameters using the serial port;

1. Connect the COMM port from a computer to "CTRL 2" on the back of the "Master" frame.
2. Open HyperTerminal, Hyper Access or other similar terminal emulation program.
3. Set the program's parameters to 115.2K baud, 8 Data bits, No parity, 1 stop bit, ANSI emulation.
4. Establish communication to the router's processor by pressing the "Esc" button on the keyboard. The terminal program screen will re-write confirming communication.
5. Turn the power off to the "Master" frame, leaving the terminal program running.
6. Remove the CPU board and set DIP switches S1-1 and S1-2, on the processor module, to on.
7. Replace the CPU board.
8. Turn power to the "Master" frame on.
9. The processor will begin to boot.
10. Within the first 4 seconds of boot-up when the processor is turned on, press the keyboard spacebar. This will interrupt the booting of the unit and enter the configuration menu.
11. Press "0" and enter the IP information, then press ENTER.
12. Turn the "Master" frame off, remove the CPU and set the DIP switches S-1 and S1-2 back to the off position.
13. Replace the board and power the frame up.

---

**Note:**

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*The Ethernet port accepts HOST protocol commands to switch the router. See the section of this manual on Protocol for information on Host protocol commands.*

*\*If your server is capable of IP reservations by the MAC address you can enable the DHCP option. It is advisable to contact the Factory for further information regarding this feature.*

#### **Commands:**

"SvsBootTestParam DHCP 0"    DHCP disabled  
"SvsBootTestParam DHCP 1"    DHCP enabled

## V18 and newer software

Software version 18 and newer contains web pages for switching the router. Once your PC and the routing switcher are on the same Ethernet network, open your internet browser and type in the default address of the routing switcher in the address line of the internet browser (factory default 192.168.1.200). The following will display allowing switching of the router;



## Browser-Based Router Control Panels controlling the Ponderosa Routing Switcher



**Standard Control Panel** easy-to-use alphanumeric entry for AFV routing.



**Breakaway Control Panel** adds A/V breakaway and level-by-level router status view.



**Programmable Control Panel** adds 8x8 programmable X-Y buttons for single-button takes.

*You need Java on your computer to run these panels!*

[Get the latest version of the Java Runtime Environment](#)

See *User's Manual for Installation and Help*

You are provided with 3 different options to switch the router;

**“Standard Control Panel”**- easy to use alphanumeric entry for AFV routing.

The Standard Control Panel is intended for switching “all levels” and is not capable of breaking levels (i.e. Video from Audio).

**SVS Standard Control Panel** (221000-13-0300 V3.00)

Source:

Destination:

**Routing Switcher Connection**

Connect automatically on page load Router UDP Port:

Router Status:

**Routing Switcher Configuration**

Router Model:  Router Name:

Number of Levels:  Number of Destinations:  Number of Sources:

Click on **Connect**. The message “Getting Router Model” will display next to **Router Status**. This is an indication that the program is attempting to contact the router for information.

## Switching

To make a switch, first select a destination from the **Destination** drop down list. The current status of the selected destination will display in the Source window.

Select a new source from the **Source** drop down list and the “**Take**” button will light. Click on “**Take**” and the switch will take place.

You can also switch by entering the numeric value of the Input or Output.

## Status

When a destination is selected, the current status (source currently connected to that destination) is displayed in the source window.

## Lock

You may want to “Lock” a destination to prevent someone on the system from changing the source of that destination.

To “Lock” a destination, after switching, click on the “**Lock**” button. The “Lock” button will change color and the button label will display “Unlock” indicating that the next time the button is pressed the function will be to “Unlock” the destination. The selected destination will now be locked preventing source changes to be made to that destination.

To “Unlock” click on the “**Unlock**” button. The button will change color and the label will display “Lock”.

**“Breakaway Control Panel”** - adds A/V breakaway and level by level router status.

The Breakaway Control Panel gives you the option of switching selected levels or all levels.

**SVS Breakaway Control Panel** (221000-13-0300 V3.00)

Source: [ ] [v] [ ] [Take]

Destination: [ ] [v] [ ] [Lock]

**Routing Switcher Connection**

[Connect]  Connect automatically on page load Router UDP Port: 10021 [Defaults]

Router Status: [ ] Not Connected

**Routing Switcher Configuration**

Router Model: [ ] Router Name: [ ]

Number of Levels: [ ] Number of Destinations: [ ] Number of Sources: [ ]

Click on **Connect**. The message “Getting Router Model” will display next to **Router Status**. This is an indication that the program is attempting to contact the router for information.

## Switching

To make a switch, first select a destination from the **Destination** drop down list. Select the levels to be switched (lit level buttons indicate enabled), then select a source from the **Source** drop down list and the “Take” button will light.

Click **“Take”** and the switch will take place.

This panel can also numerically switch and lock destinations similar to the Standard Control Panel.

## Lock

You may want to “Lock” a destination to prevent someone on the system from changing the source of that destination.

To “Lock” a destination, after switching, click on the **“Lock”** button. The “Lock” button will change color and the button label will display “Unlock” indicating that the next time the button is pressed the function will be to “Unlock” the destination. The selected destination will now be locked preventing source changes to be made to that destination.

## Breakaway Switching

The lit level buttons indicate the levels to be switched (preset).

To turn off a level(s) click on the level button and the button will dim. Click on "All Lvl's" to restore to an "all level" preset.

## Status

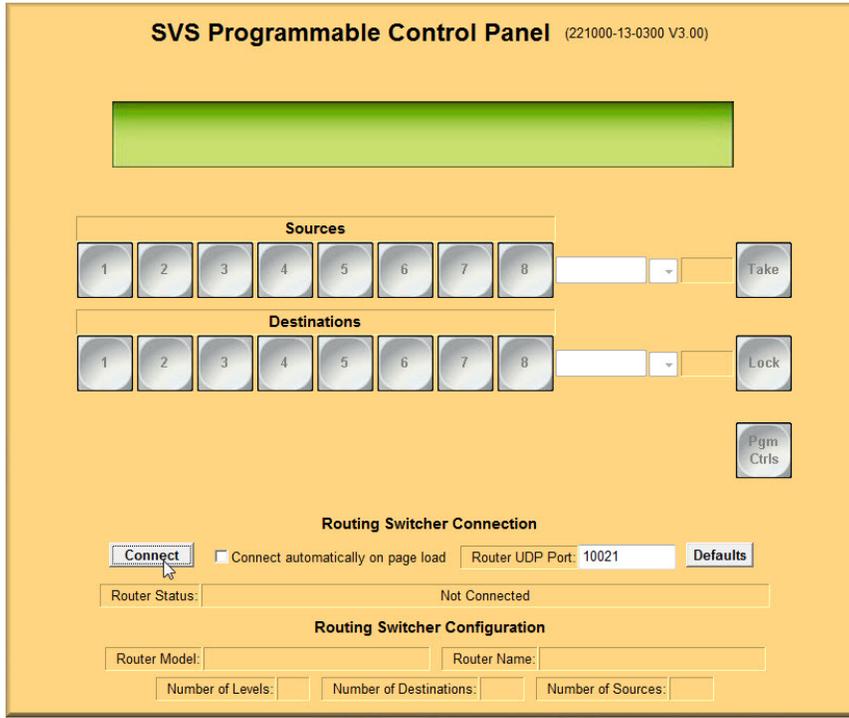
Individual Level status is indicated in the "Status" window at the top of the screen.



**“Programmable Control Panel”** adds 8x8 programmable XY buttons for single-button takes.

The Programmable Control Panel allows the user to program Source and Destination buttons to any source or destination desired.

The programming of this panel can be “Password Protected”.



### Programming Allowable Inputs and Outputs

Buttons can be programmed to specific sources and destinations allowing access to most often used sources and destinations.

To program the panel's defined inputs and outputs;

Click on **Pgm Btns**



This screen will display;



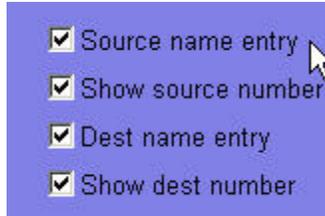
Enter a Password, if desired.

Select the destinations and sources you want the panel to display from the dropdown lists.

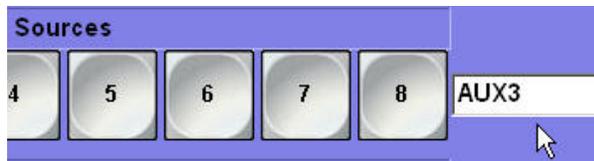


### Panel options

Display and operational options can be selected by placing a check in the appropriate box.



- Source name entry- Placing a check in this box allows the user to select a source by typing the name of the source in the window next to the source buttons. If this box is not checked the window will not be displayed.



- Show source number- Placing a check in this box displays the virtual source number in a screen next to the "Take" button.



- Destination name entry- Placing a check in this box allows the user to select a destination by typing the name of the destination in the window next to the destination buttons. If this box is not checked the window will not be displayed.



- Show destination number- Placing a check in this box displays the virtual destination number in a screen next to the "Lock" button.



### Programming Buttons

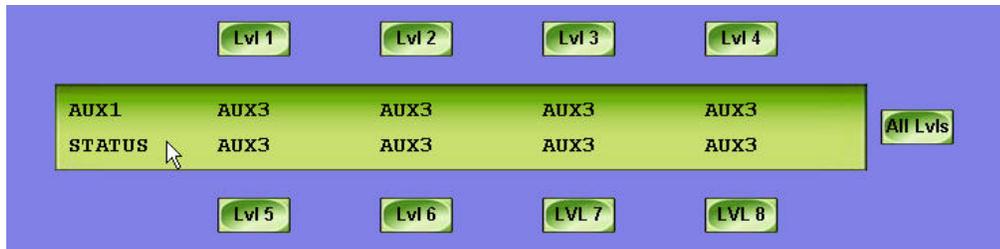
The panel's buttons may be programmed to provide "shortcuts" for the operator.

With the “Pgm Ctrl’s” screen open, select a source or destination from the dropdown list and click on the button to be programmed. The button will display the selection and will select the programmed I/O when pressed.



**Status**

Individual Level status is indicated in the “Status” window at the top of the screen.



**Warning:**

*When switching using programmed buttons, the switch will occur as soon as a new source is selected (auto take).*

**Lock**

You may want to “Lock” a destination to prevent someone on the system from changing the source of that destination.

To “Lock” a destination, after switching, click on the “**Lock**” button. The “Lock” button will change color and the button label will display “Unlock” indicating that the next time the button is pressed the function will be to “Unlock” the destination. The selected destination will now be locked preventing source changes to be made to that destination.



## Software Upgrades

From time to time software upgrades may be required for the processor, modules, or control panels. The factory will send the upgrade file.

When upgrading using the Sierra Video TyLinx Pro software via the RS- 232 serial port, “CTRL port 1” must be used.

# Audio

## Introduction

The Sierra Pro Series 64XL companion Audio routing switchers from Sierra Video are modular for those applications requiring worry-free performance and mission critical reliability. The advanced features and performance set it apart from the competition. These include:

- Modular configurations expandable by 32 input and/or 32 output increments
- Compact frame size – 3RU (6464 frame) or 5RU (128128 frame).
- Hot-swappable I/O boards.
- Standard redundant power supplies.

Front-door access to hot-swappable I/O boards allows for field service or matrix reconfiguration. Serial control is standard in every model.

The analog audio frames populate in increments of 32 on both the inputs and outputs, and come in two compact sizes: 3RU and 5RU. These frames can be configured to be either mono or stereo and are set at the factory. For example, the 3RU frame can be ordered to be either a 64x64 mono or 32x32 stereo audio router. When in the stereo mode, each channel is independently switchable.

## Control System Overview

The Sierra Pro Series 64XL Audio router is a “slave” unit to the video frame. That is, the CPU is contained in the video frame and through control connection (J1) the audio frame is switched.

The audio routing switcher can not be used as a “stand-alone” unit. Control panel and RS-232 control connections on the rear of the frame are inactive.

Control panels, IP, and serial control must be connected to the “master” frame.

The audio unit is factory configured as a “level” of control allowing audio to be switched together or separately from the video.

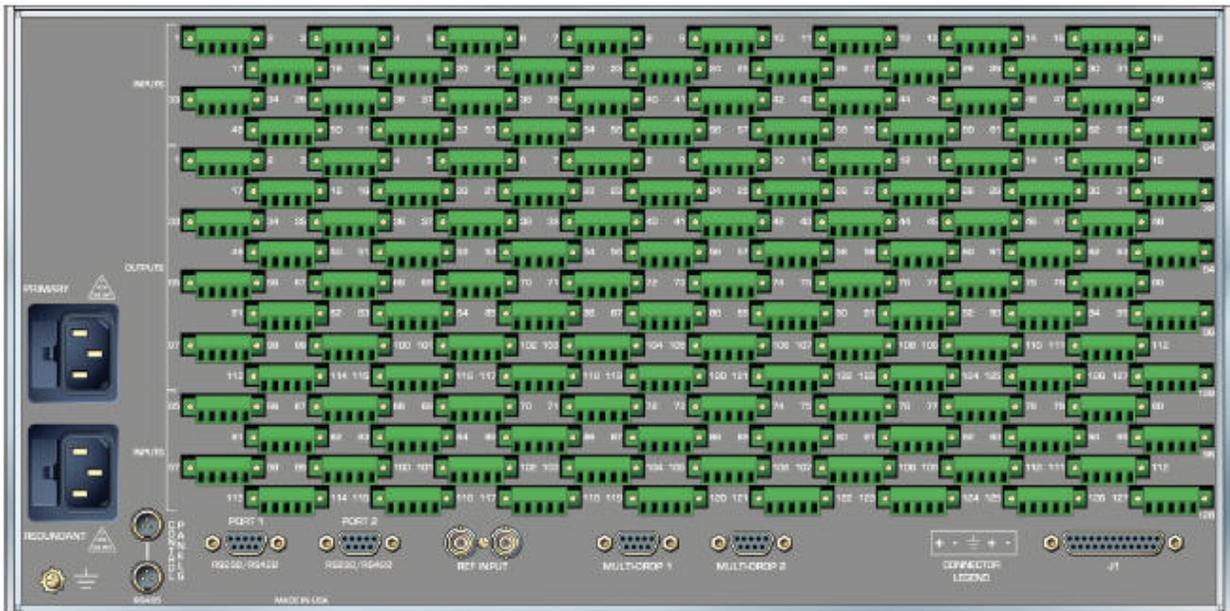
If the system contains 2 channels (or more) separate switching of each audio channel is possible whether they are separate frames or a single frame configured in the “stereo” mode.

# Model 128128A

## Audio Frame Front Panel



## Audio Frame Back Panel

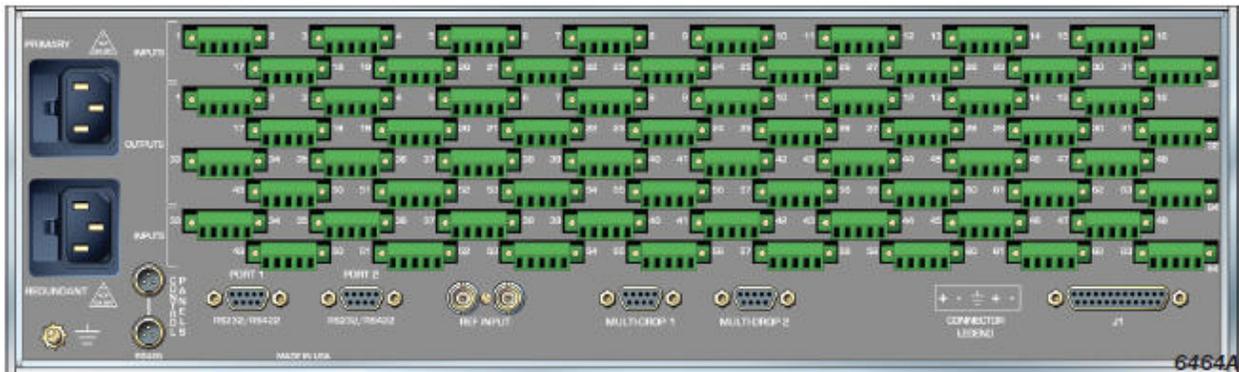


## Model 6464A

### Audio Frame Front Panel



### Audio Frame Back Panel



#### Note

The Sierra Video models shown here and in the subsequent sections are fully loaded matrices. In some cases, these frames may be configured with less outputs or inputs. Consult the rear panel serial number and model number to verify your order and product.

The system you receive is customized for the size & type requested at time of purchase from Sierra Video

## Rear Panel Connections

The Audio frame(s) are used in other Sierra Video audio applications and models. Therefore there are several unused connectors on the rear of the unit.

Unused connectors;

- Control Panels.
- 9 pin Serial Ports (port 1 and port 2).
- REF Input.

Only the J1 connector is used in the Sierra Pro Series 64XL companion Audio models.

A system drawing will be sent with your order indicating the proper connections.



## Frame Configurations

Sierra Pro Series 64XL Audio frames can be configured in a “mono” or “stereo” mode.

Configuration is done at the factory or can be changed in the field (see section on “stereo mode” operation).

<b>Mono Configurations</b>	
<b>128128 A/E Frame</b>	<b>6464 A/E Frame</b>
32x32	32x32
32x64	32x64
64x32	64x32
64x64	64x64
32x96	
96x32	
64x96	
96x64	
96x96	
32x128	
64x128	
128x64	
96x128	
128x96	
128x128	
<b>Stereo Configurations</b>	
<b>128128 A/E Frame</b>	<b>6464 A/E Frame</b>
16x16	16x16
16x32	16x32
32x16	32x16
32x32	32x32
16x48	
48x16	
32x48	
48x32	
48x48	
16x64	
32x64	
64x32	
48x64	
64x48	
64x64	

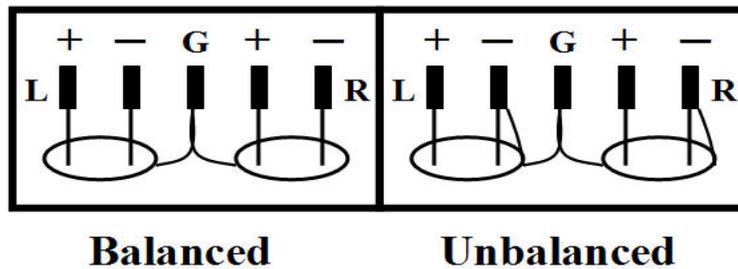
# Connecting to Audio Devices

## Mono Analog Audio

Audio sources and destination devices (such as amplifiers or recorders) may be connected to the switchers via a 5-pin latching, removable, terminal block style connectors located at the back of the switchers.

## Balanced/Unbalanced Analog Audio Connections

All audio sources from the routing switcher are balanced audio. Connect the balanced audio to the balanced input of your destination device(s). To convert balanced to unbalanced audio signals, ground the negative (-) side and use the positive (+) side for both inputs and outputs. Grounding the negative side of the output drive adds +6dB of audio gain. The audio pin outs for balanced and unbalanced audio are described in the tables below:



## Stereo Analog Audio

Audio frames can be ordered in a “mono” or “stereo” mode and are pre-configured at the factory. Input and output connections differ when the unit is in the stereo mode. In the mono mode connectors are wired as silk screened on the rear of the router. However, when ordered in the stereo mode, the input or output is wired as indicated below;

Stereo Audio Wiring											
	Connector #			Connector #			Connector #			Connector #	
I/O #	Left	Right	I/O #	Left	Right	I/O #	Left	Right	I/O #	Left	Right
1	1	2	17	33	34	33	65	66	49	97	98
2	3	4	18	35	36	34	67	68	50	99	100
3	5	6	19	37	38	35	69	70	51	101	102
4	7	8	20	39	40	36	71	72	52	103	104
5	9	10	21	41	42	37	73	74	53	105	106
6	11	12	22	43	44	38	75	76	54	107	108
7	13	14	23	45	46	39	77	78	55	109	110
8	15	16	24	47	48	40	79	80	56	111	112
9	17	18	25	49	50	41	81	82	57	113	114
10	19	20	26	51	52	42	83	84	58	115	116
11	21	22	27	53	54	43	85	86	59	117	118
12	23	24	28	55	56	44	87	88	60	119	120
13	25	26	29	57	58	45	89	90	61	121	122
14	27	28	30	59	60	46	91	92	62	123	124
15	29	30	31	61	62	47	93	94	63	125	126
16	31	32	32	63	64	48	95	96	64	127	128

## Analog Audio Signal Path Overview

The Sierra Pro Series 64XL companion Audio routing switcher is based upon a modular architecture of an integrated frame, motherboard and backplane. Common input and crosspoint modules are used. The same two types of modules are used for both frame sizes: 64x64 and 128x128.

There are two basic modules:

- Input Buffer Module
- Crosspoint/ Output driver Module

The 64x64 frame has positions for two 32-channel input buffer and two crosspoint/output driver modules; and the 128x128 frame has positions for four 32-channel buffer modules and four crosspoint/output driver modules.

All modules are front extractable and “hot-swappable”. The frame is force air cooled using internal cooling fans contained within the front panel.

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**Note:**

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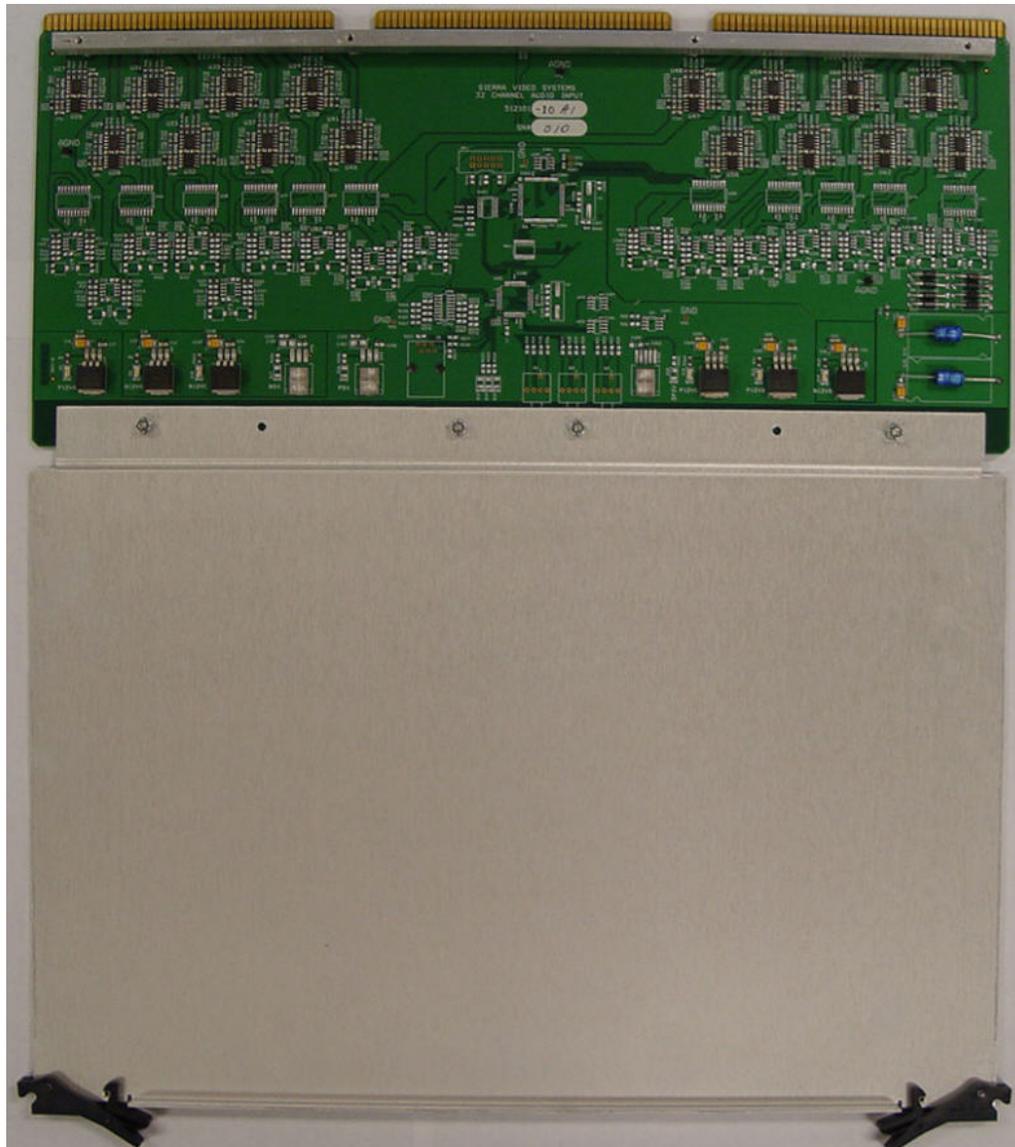
*Although modules are “hot-swappable” it is advised that power be removed when removing or inserting modules when possible.*

### Input Buffers

Each input buffer module has 32 identical circuits. These routers are designed to work in broadcast and production facilities, and are compatible with balanced interconnections.

The buffers have multiple purposes:

- 1. Present a high impedance to the incoming signal**
- 2. Remove unwanted common mode IE Hum signal**
- 3. Convert the signal to the level and impedance needed by the switching matrix that follows**



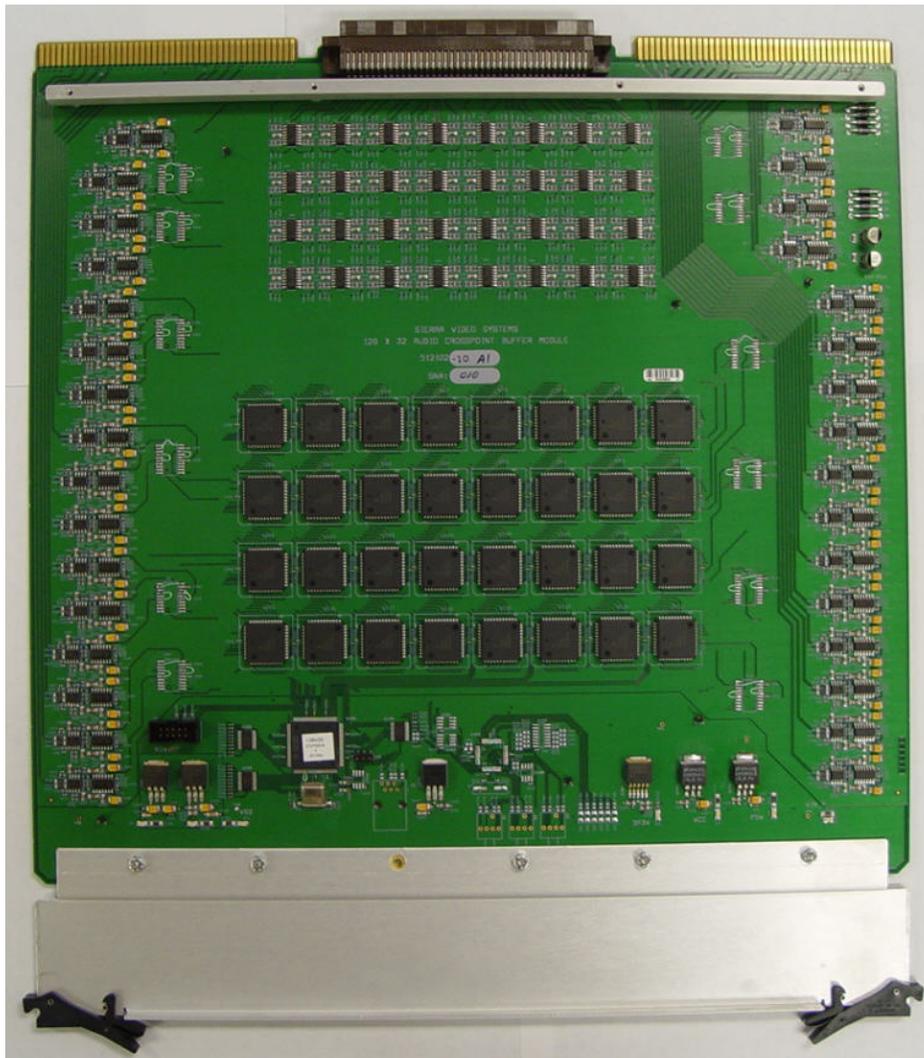
The output of the input buffer circuits are connected to the switching matrix via the internal motherboard. Unlike their analog video counterparts, the input buffers are internally mounted. The 64x64 frame has positions for two 32-channel buffer modules; and the 128x128 frame has positions for four 32-channel buffer modules.

## Crosspoint/ Output Driver Modules

The analog audio crosspoint module used is a 128x32 module. The switching integrated circuit (IC) is a HCMOS 16x8 array. Thirty-two of these switching IC's are arranged to form a 128x32 matrix.

Each output bus from the switching matrix feeds a differential output. The output driver provides a symmetrical low impedance output signal.

The 64x64 frame has positions for two 128x32 / 32-channel output driver modules; the 128x128 frame has positions for four 128x32 / 32-channel output driver modules. Grounding the negative side of the output drive adds +6dB of audio gain.



## Module Layout

For the routing system to function properly, every module must be placed in the proper slot.

Access to the modules is made by removing the front door containing the fans and unplugging the fan harness.

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### **Warning:**

*The unit must not be operated with the front fans removed or damage could be caused to the modules. Although modules are "hot-swappable" it is advised that power be removed when removing or inserting modules when possible.*

## 6464 Frame Analog Mono

The 3RU 6464 has 5 slots for modules with the bottom slot unused.



The top slot in both the analog and digital frame contains the input buffer module for inputs 1-32.

The next (2<sup>nd</sup>) slot down contains the crosspoint/output driver module for outputs 1-32.

The 3<sup>rd</sup> slot from the top contains another crosspoint/output driver module for the outputs 33-64.

The 4<sup>th</sup> slot from the top contains an input buffer module for inputs 33-64.

\*The bottom slot (slot 5) is not used.

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### **Note:**

*If the frame is configured as a 32x32 mono router, only the top 2 slots are loaded with modules.*

## 6464 Frame Analog Stereo

Modules are arranged the same in the stereo mode as the mono mode with the exception of which inputs and outputs the module controls.

The top slot controls stereo (left and right) inputs 1-16.

The next (2<sup>nd</sup>) slot down controls stereo outputs 1-16.

The 3<sup>rd</sup> slot from the top controls stereo outputs 17-32.

The 4<sup>th</sup> slot from the top control stereo inputs 17-32.

\*The bottom slot (slot 5) is not used.

## 128128 Frame Analog Mono

The 5RU 128128 is similar to the 6464 frame except it has 9 slots for modules with the bottom slot unused.

The top slot in both the analog and digital frame contains the input buffer module for inputs 1-32.

The next (2<sup>nd</sup>) slot down contains the input buffer module for inputs 33-64.

The 3<sup>rd</sup> slot from the top contains a crosspoint/output driver module for the outputs 1-32.

The 4<sup>th</sup> slot from the top contains a crosspoint/output driver module for the outputs 33-64.

The 5<sup>th</sup> slot from the top contains a crosspoint/output driver module for the outputs 65-96.

The 6<sup>th</sup> slot from the top contains a crosspoint/output driver module for the outputs 97-128.

The 7<sup>th</sup> slot down contains the input buffer module for inputs 65-96.

The 8<sup>th</sup> slot down contains the input buffer module for inputs 97-128.

\*The bottom slot (slot 9) is not used.

## 128128 Frame Analog Stereo

Modules are arranged the same in the stereo mode as the mono mode with the exception of which inputs and outputs the module controls.

The top slot controls stereo (left and right) inputs 1-16.

The 2<sup>nd</sup> slot from the top controls stereo inputs 17-32.

The 3<sup>rd</sup> slot down controls stereo outputs 1-16.

The 4<sup>th</sup> slot from the top controls stereo outputs 17-32.

The 5<sup>th</sup> slot from the top controls stereo outputs 33-48.

The 6<sup>th</sup> slot from the top contains stereo outputs 49-64.

The 7<sup>th</sup> slot from the top contains stereo inputs 33-48.

The 8<sup>th</sup> slot down contains stereo inputs 49-64.

\*The bottom slot is not used.

## Front Door Fans

Four 12VDC cooling fans are mounted on the front door and plugged into the frame's power supply.

The unit should not be operated without the front door with fans operating as this could cause failure of the modules.



# Operation

## Introduction

The purpose of a routing switcher is to switch any of the inputs (source) to any of the outputs (destination). Any input can be connected to any or all outputs but each output can only be connected to a single input. Control remains the most important component of your new system.

## Control System Overview

The Sierra Pro Family's three port control system incorporates many powerful features, while retaining control compatibility with many leading third party control systems and with earlier generation SVS routing switchers. The control system uses an intuitive interface for routing switcher control and configuration, pass wording, salvo setup, multiple input/output configuration and name configuration. Up to 64 control panels can be linked at any one time, daisy-chained on a single RS-485 network. A variety of programmable control panel styles are available.

Connectors associated with the system's internal control computer are located on the rear of the routing switcher frames. Only one frame in a multi-frame system will have a master control computer module installed all other frames have slave (bypass) CPUs. The following pertains to the frame that contains the master control CPU processor.

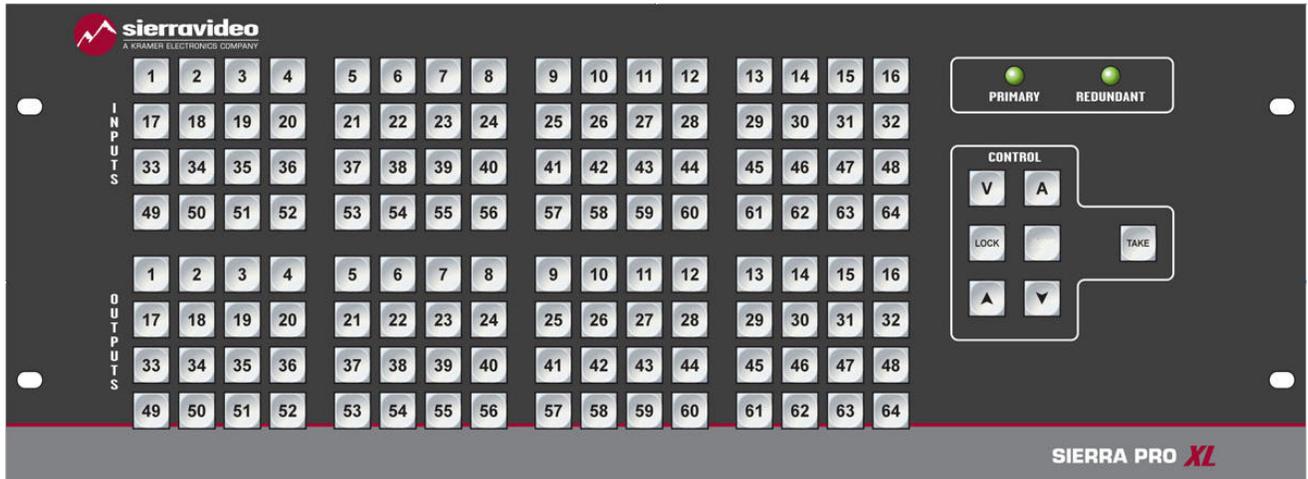
The Sierra Pro RGBHV system is configured with 5 levels of control as indicated below (7 levels if audio option is ordered);

Level #	Signal Type
1	R
2	G
3	B
4	H
5	V
*6	Audio 1
*7	Audio 2

Levels can be switched together or separately. Each video frame is a separate level. If you only have a 3 frame system there are only 3 levels etc.

## Local Control Panel

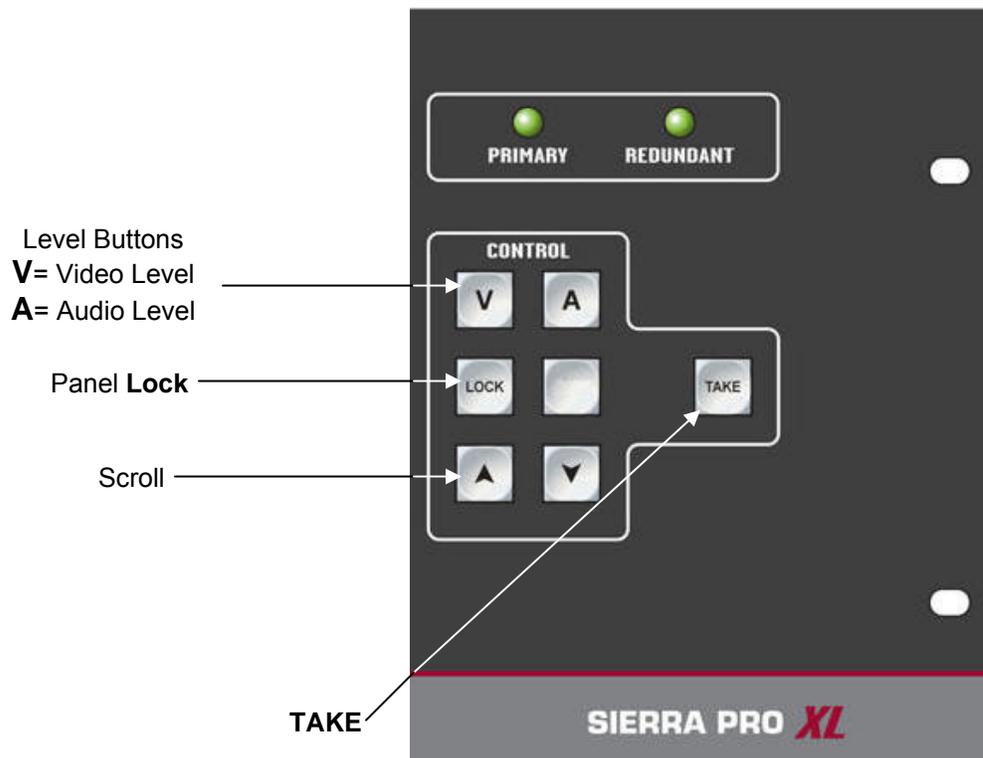
The local control panel operates as an XY panel with break-away when the audio option is ordered. The audio “A” button will be inactive if the audio option is not configured.



The local panel has a button per input and button per output. An input may be sent to one or many outputs. Only one input may be sent to an output (i.e. you can not sent multiple inputs to a single output).

There are 2 power supply status LEDs on the upper right of the panel. A lit LED indicates active power.

## Control Button Definition



To switch AFV (audio follow video);

- Press the “A” and “V” buttons to light the buttons.
- Select the desired output.
- Select the input. The “Take” button will flash indicating the switch is in preset.
- Press “Take” to complete the switch.

To switch video only;

- Press the “V” button to light the button.
- Select the desired output.
- Select the input. The “Take” button will flash indicating the switch is in preset.
- Press “Take” to complete the switch.

To switch audio only;

- Press the “A” button to light the button.
- Select the desired output.
- Select the input. The “Take” button will flash indicating the switch is in preset.
- Press “Take” to complete the switch.

Pressing an output button will illuminate the input currently connected to that output indicating status. Status of the audio input to the selected output is indicated with an amber light, if audio is from a different input than the video (break-away).

If an output is selected and blinks RED, it is an indication that the “V” or “A” button is not enabled.

## Serial Control Ports

The internal control CPU processor has three serial ports for Terminal and/or Host protocol control. These three serial ports are used for overall routing switcher system personalities, local or networked PC computer control, and control panel network operation. Terminal Protocol is a human-readable protocol while Host Protocol is a machine-friendly protocol. The three serial ports are shipped with a factory default as described below;

Ctrl Port #	Protocol	Baud Rate	Data Bits	Parity	Stop Bits	Emulation
1	Host	115.2K	8	None	1	ANSI
2	Terminal	115.2K	8	None	1	ANSI
3	Host	115.2K	8	None	1	ANSI

Connections to the 9-pin connector can be made using a standard one- to-one cable. Pin functions are described below.

Host & Terminal Port Installation		
Pin	RS-232	RS-422
1	Ground	Ground
2	Transmit	Transmit (-)
3	Receive	Receive (+)
4	Not used	Not used
5	Ground	Not used
6	Not used	Not used
7	Not used	Transmit (+)
8	Not used	Receive (-)
9	Ground	Ground

## Host Mode

The Sierra Pro matrix switchers have three 9-pin RS-232/422 connectors that allow you to control the switcher using a standard personal computer or other external devices (such as Creston or AMX). Serial ports shipped in the "Host" mode can be changed to the "Terminal" mode by the following procedure:

- Connect a terminal to the serial port and send the following command:

**\*\*HOST0!!**

The port now uses the terminal protocol.

- To restore back to the Host port, send the following command:

**\*\*HOST1!!**

## Terminal Mode

The 9-pin connector labeled RS-232/422 Control can be used for simple terminal control, (V=T100 emulation capability). The terminal performs the following functions:

- Serves as an overall system controller
- Sets up the personality of the entire system (size, level control, change names, mapping, etc.)

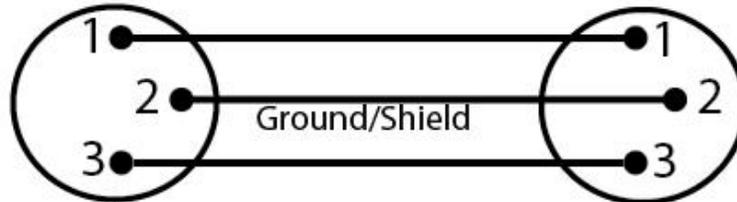
These setups are stored in non-volatile memory so that a terminal is not required unless it is necessary to change a setup.

## Remote Control Panels (RS-485)

The Sierra Pro 64XL family of routing switchers have two male 3-pin connectors labeled “Control Panels” on the rear. These connectors are “looped” together.

The total cable length cannot exceed 5,000 feet at 31,250 baud or 10,000 feet at 9600 baud.

If you make your own interconnect cables, Pin 2 is ground (shield). Pin 1 and 3 connect pin for pin.



Each control panel must have its own unique ID number. ID numbers are set by DIP switches on the panel.

The connectors used are Switchcraft TA3F (mini-XLR). The cable entry hole into these connectors is quite small and we have found that Belden 8451 cable fits quite well through the strain relief.

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**Note:**

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Lights “scrolling” on a panel indicate that the panel is not communicating with the router. Check the control panel cable and baud rate settings.



# Troubleshooting

## Introduction

Before troubleshooting check that all connectors are firmly seated and bypass any external devices.

Many installation problems occur due to incorrect wiring, double check connections to and from the router.

Crosstalk, or signal bleeding, often occurs when poorly shielded video cable or when the shield is not tightly crimped to the BNC connector.

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### NOTES:

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*If the output signal is disturbed or interrupted by electromagnetic interference, the signal should return and stabilize when the interference ends. If not, turn the power switch off and on again to reset the switcher.*

*If the following recommended actions still do not result in satisfactory operation, please consult your Sierra Video Dealer.*

## Power and Indicators

Problem	Remedy
No power	<ul style="list-style-type: none"> <li>▪ Confirm that the rocker switch is in the “ON” position, and that the power lamp is illuminated.</li> <li>▪ Confirm that power connections are secured at the switcher and at the receptacle. Make sure the receptacle is active, with the proper mains voltage.</li> <li>▪ If there is still no power, check the fuse. Remove power cord from the AC outlet and from the switcher and then remove the fuse holder located above the power connector. Confirm that the fuse is good by looking at the fuse wire connected to the ends of the fuse. If the wire is separated, replace the fuse.</li> </ul>

## Video Signal

Problem	Remedy
<p>No video at the output device, regardless of input selected.</p>	<ul style="list-style-type: none"> <li>▪ Confirm that your sources and destination device are powered on and connected properly. Video signals connected to the input of the switcher should be of an identical signal format as the output of your source. Video signals at the output of your switcher should be of an identical signal form required by your video monitor or recorder.</li> <li>▪ Confirm that any other switchers in the signal path have the proper input and/or output selected.</li> <li>▪ Use a Video Tester to test the video path leading to/from your Matrix Switcher.</li> <li>▪ Replace the video crosspoint module with one that is known to be functional.</li> </ul>
<p>Video level is too high or too dim.</p>	<ul style="list-style-type: none"> <li>▪ Verify that the video line is terminated with a precision 75 ohm impedance, otherwise it results in a video level that is too high or too low when looping is performed and the termination is not within 1% of 75 ohms.</li> <li>▪ Confirm that the connecting cables are of high quality, properly built and terminated with 75 ohms. Check level controls located on your source input device or output monitor or recorder.</li> <li>▪ Replace the video crosspoint module with one that is known to be functional.</li> </ul>

Problem	Remedy
<p>Noise bars are "rolling" up or down in the output image or: Low Frequency hum in the audio output of the audio</p>	<p>Hum bars (ground loop) are caused by a difference in the ground potential of any two or more devices connected to your signal path. Passing that voltage difference through any available interconnection, including your video cables, creates hum bars in the picture and/or hum in the audio.</p> <p><b>WARNING!</b> Do not disconnect the ground from any piece of video equipment in your signal path!</p> <p>Check the following to remove hum bars:</p> <ul style="list-style-type: none"> <li>▪ Confirm that all interconnected equipment is connected to the same phase of power, if possible.</li> <li>▪ Remove equipment connected to that phase that may introduce noise, such as motors, generators, etc.</li> <li>▪ Disconnect all interconnect cables and reconnect them one at a time until the ground loop reappears. Disconnect the cable, or insert an isolation transformer in the signal path.</li> </ul>

## Control

Problem	Remedy
No control of Matrix Switcher from PC software	<ul style="list-style-type: none"> <li>▪ Confirm the correct wiring of the connecting cable. Be sure to use a standard one to one 9 pin serial cable.</li> <li>▪ Confirm that all Dip Switches on the control processor are set properly. See Dip switch settings on page 15.</li> <li>▪ Confirm that the baud rate of your computer COM port is set to the same as that of your Matrix Switcher (9600-Baud factory default). Confirm that the proper COM port is selected in the control software.</li> <li>▪ Use a terminal emulator program to send <b>**!!</b> commands and check for <b>**OK!!</b> response.</li> <li>▪ If you do not receive <b>**OK!!</b>, the problem is with the switcher.</li> </ul>

## Switching Malfunctions

Problem	Remedy
The switcher succeeds in switching a number of sources then fails to switch one.	<p>Malfunction in the particular source or cable assembly.</p> <p>NOTE: The most common failure mode in transferring the signal of an audio source is a break in the connecting wire.</p> <ul style="list-style-type: none"> <li>▪ Disconnect the source from a channel that is switching successfully and connect the suspect source to it. If the channel continues to switch successfully, then there is something wrong with the Matrix Switcher or the suspect source was not connected properly. If it does not continue to switch successfully, then there is something wrong with the source or cable assembly.</li> </ul>
The Matrix Switcher turns ON but will not switch at all	<ul style="list-style-type: none"> <li>▪ Check the LEDs on the serial processor board. If they are not counting, the control module is dead. If the control panel is not lit, check the ribbon cable connection between the panel and the processor control module.</li> </ul>

## Technical Support

Sierra Video has made every effort to insure that your unit has been fully tested and is configured to your order specifications. If problems arise that can not be resolved, please contact the Sierra Video technical support department.

Sierra Video factory- (530) 478-1000

Email- [service@sierravideo.com](mailto:service@sierravideo.com)



# Specifications

## Wideband Video Specifications

<b>Wideband Video</b>	
Input/ Output connector type	BNC
Bandwidth	500MHz +/-3dB fully loaded
Video Gain	Unity
Crosstalk	-80dB @ 1MHz, -78dB @ 5MHz, -55dB @ 10MHz, -45dB @ 30MHz, -37dB @ 100MHz
Switching Speed	Deterministic
<b>INPUT</b>	
Video Level	0.03V p-p to 2.5V p-p
Impedance	75 Ohm
Return Loss	< -30dB @ 5MHz
<b>OUTPUT</b>	
Video Level	0V to 2.5V p-p
Impedance	75Ohm
Return Loss	-30dB @ 5MHz

<b>Sync</b>	
Input/ Output connector	BNC
Input Type	RGBHV, RGBS, RGSB, RsGsBs
Output Type	Follows Input
Input Level	.03V to 5.0V P-P
Output Level	AGC to TTL 4.0V to 5.0V P-P Un-terminated
Input Impedance	All Inputs 75 or 510 ohms, switchable
Output Impedance	75 ohms
Max. Input Voltage	5.0V P-P
Max. Propagation Delay	30ns
Max. Rise/Fall Time	4ns
Polarity	Follows Input

<b>Control</b>	
Serial	3 General purpose 9-pin D. Each switchable RS-232 or RS-422 9600, 38.4K, 115.2K baud
Serial Protocols	SVS Host, simple Kramer and select others
Ethernet	10/100 Base-T, full duplex, RJ-45 connector
Ethernet Protocols	ARP, ICMP, TCP/IP, Telnet, HTTP
Web Server	For configuration and control
Redundant Control Processor	Optional
Control Panels	Supports full line of Sierra Video SCP remote control panels

<b>General</b>	
Rack Unit/ Frame Size	4RU per Signal (20RU for RGBHV System)
Dimensions	19" W x 7" H x 20 3/8" D Mounts in Standard 19" rack Depth measurements do not include front panel hardware or rear cabling
Power	90VAC to > 240VAC (<150Watts) Auto-detecting
Redundant Power Supply	Optional
Storage Temperature	-40° to +150° F
Operating Temperature	30° to 100° F Ambient
Humidity	10% to 90% Non-condensing

## Analog Audio Input Characteristics

<b>Analog Audio</b>	
Nominal Input Level	+8 dbm (0dbm + .775Vrms)
Maximum Input Level	+ 21dbm
Input Impedance	15KΩ, balanced
Common Mode Rejection	≥ 40db @ 60hz

## Analog Audio Output Characteristics

<b>Analog Audio</b>	
Nominal Output Level	+8 dbm
Maximum Output Level	+ 21dbm into 150Ω
Output Source Impedance	150Ω, balanced

## Analog Audio System Performance

<b>Analog Audio</b>	
Voltage Gain	Unity $\pm$ 0.5db (High-Z load)
Frequency Response	20Hz 20Khz $\pm$ 0.5db
Bandwidth	100Khz
Signal-to-Noise Ratio (20Hz to 20Khz)	>-79dbm
Crosstalk Isolation (all inputs hostile)	>-90 dB @ 1KHz >-70dB @ 10KHz
IM & THD (20hz to 20Khz)	$\leq$ 0.025% @ + 4dbu

## Mechanical & Operational Characteristics

<b>Frame Height</b>	
64x64 Audio Frame # 804109	3 RU (5.25")
128x128 Audio Frame # 804113	5 RU (8.75")



# Communication Protocol

## Introduction

The protocol uses the 7-bit ASCII character set, usually sent over an RS232-C or RS422 serial link — 115.2K bps is recommended with 8 data bits and no parity. Protocol commands can also be sent over the Ethernet connection.

The protocol is compact, with few characters required to cause switch changes to occur. It is also human-readable and thus easy to understand and use. Several different crosspoint switch request commands are defined, so that the one that is most compact for any given switcher and application can be chosen.

The protocol is useful with both very small and very large routing switchers. The sizes of the numbers representing inputs, outputs, and levels are not fixed, but can be as large or small as necessary. Special provisions allow numbers to be packed one after another with no intervening delimiter character, in order to make the protocol compact, as long as each number is the largest size necessary for that particular switcher.

All input, output, and level numbers begin at number 1, not 0.

The Sierra Pro system is configured with 5 levels of control as indicated below;

Level #	Signal Type
1	R
2	G
3	B
4	H
5	V
*6	Audio 1
*7	Audio 2

Levels can be switched together or separately.

Each frame is a separate level. If you only have a 3 frame system there are only 3 levels etc.

## Generic Protocol

Commands are sent to a routing switcher in a group called a command string. A command string can contain zero or more commands, limited only by the size of the receive buffer of the router, whose size depends on the particular router model.

A command string consists of a leader string of asterisk characters, zero, or more commands, and a trailer string of exclamation marks. Larger routers require two leader (\*\*) and trailer (!) characters, while small routers require only one, in order to make the protocol compact for those routers. The remainder of this document gives examples using doubled characters. Note that two leader/trailer characters may be sent to small routers even when only one is required, and they will still work fine.

If a leader character (\*\*) is encountered within the command string being processed by a router, the command string up to that point is discarded and a new command string is expected. This ensures that a router will always act on a complete command string sent to it, even if the previous one was never completely received.

When a command string is received, it is not acted upon (but rather, is merely buffered up) until the final trailer character (!) character of the command string is received. At that time, the routing switcher begins to execute the commands within the string.

The protocol uses only 7-bit ASCII characters. The 8th bit of received characters is treated as if it is 0. Within the command string, certain ASCII characters may be present and are ignored: any ASCII character whose code is *less than* the SPACE character (includes all control characters and the SPACE character) and the DEL (ASCII 7F) character. Alphabetic characters within the command string may be in either upper-case or lower-case letters. The router always *sends* upper case characters, except for character strings such as input, output, and level names, which may have lower case characters in them.

When sending commands *to* the router, SPACE characters are optional, but if used may only appear before and after each individual command and NOT embedded within an individual command. Within command strings sent *from* the router, a single SPACE character appears before and after each individual command. SPACES may also appear in character strings, such as input, output, and level names.

Certain commands (R, Q, L, and G) have character strings that appear as arguments. The first three, "R", "Q", and "L", have character strings only in commands sent *from* the router, and these character strings are always terminated with a ~ (tilde) character. No special character marks the start of these strings, they simply begin at the appropriate point within the command. The "G" command, on the other hand, uses the ~ (tilde) character to mark both the *start and end* of a character string argument.

Just before the router begins executing a command string, it sends a leader (\*\*) to the host (the same number as are required in commands from the host). As it executes the commands, some of them may generate additional output back to the host. These command response characters are always preceded and followed by a space character, making the response string easily human-readable.

After the command string has been executed, the routing switcher returns the string " OK " (with a single space character before and after the word "OK"), followed by the trailer (!) and a CR (carriage return, ASCII 0D) character, to the host. This indicates that the command has executed successfully. If an error occurs within any command of a command string, the remainder of the command string is ignored and the router returns the string " ERROR ", followed by *an optional descriptive string* followed by a string of

trailer characters and a CR character, to the host. An error can be caused by an unknown command name or bad arguments to a command.

The simplest possible command string would be:\*\*!! which consists of the leader and trailer characters but no commands between them. This command string would generate the response:

```
** OK !!<CR>
```

This can be useful for verifying that the serial link to the router is operational. In routers requiring only one leader/trailer character, the simplest command string would be: \*! which would generate the response:

```
* OK !<CR>
```

(To determine whether a particular router uses one or two leader/trailer characters, send it "!!\*" and check the response to see which of the above two responses it is. It won't hurt to always use two even if only one is required.)

The simplest error response is one with no optional descriptive string. For example, this command string:

```
** XXX !! might generate this response from the router:
```

```
** ERROR Syntax: No Number:XX !!
```

The descriptive string always ends with a colon and up to three characters from the command string that caused the error. Generally, the error can be assumed to have occurred just before these characters.

## Leader and Trailer

The simplest possible command string would be "\*\*\*!!" which consists of the leader and trailer characters but no command between them. This command string would generate the response "\*\*\*OK!!" followed by "CR". This can be useful for verifying that the serial link to the switcher is operational.

The following is the set of commands available for sending to the router, a subset of which may be implemented in any given routing switcher.

Syntax	Example	Description
R	R	Router Reset
I	I	Capabilities Inquiry
Q	Q	Model Name and Software Version Inquiry
L	L	Matrix Size and Level Names Inquiry
O	O5	Output Status inquiry
N	N5	Input Status inquiry
S	S	Status inquiry
C	C	Clear matrix
K	K9999	Set Password to Change Protected Settings
M	M139	Set Remote Address
U {0 1}	U0	Update request on/off
V out,in,in...	V3,1,2,2	Connect levels
W lvl,in,in...	W1,4,19	Connect outputs
X out,in,lvl	X12,9,2	Connect crosspoint
Y out,in	Y1,7	Connect AFV
Z in in...	Z13,12,8	Connect AFV
D numsyncs	D300	Delay vertical sync intervals
T {A-Z}	TB	Trigger a Salvo Connect sequence
P {A-Z}	PBY1,7~	Preset a Salvo connect sequence
B	B21	Output Lock inquiry or change
F	F5	Field Delay for crosspoint output
HOST	HOST0	Select Host or Terminal Protocol

## "R": Router Reset

Use this command to force the routing switcher to reset, by sending it the command **"RESET"**. If an administrator password has been set (using the "G ADMIN\_PASSWORD" command described later in this document), then the password must be sent in a "K" message prior to sending this command, else this command will generate an error. For example, the command:

```
**RESET!!
```

would initiate a reset (if the password has been entered, if required), and when the router finished the reset operation, something like this would be received, just as if the router had powered up:

```
** RESET Tahoe Vx.xx (C) 2000~ !!<CR>
```

## "I": Capabilities Inquiry

The command "I" requests that command capability information be returned to the host. The information is sent as a string of characters. The first characters are a space followed by "I", the next characters are the letters of the commands that are implemented and available in this router, and the last character is "~" (tilde). Do not count on the characters being in any specific order. Search all characters for a particular one.

All routing switchers implement the **I**, **L**, **S**, and **X** commands. The Q command will eventually be added to all.

For example, the command:

```
**I!!
```

might return the following string:

```
** ILSX~ OK !!<CR>
```

indicating that the router supports the **I**, **L**, **S**, and **X** commands from the host.

## "Q": Model Name and Software Version Inquiry

The command "Q" requests that the router model name and software version number string be returned to the host. The information is sent as a string of characters. The first characters are a space followed by "Q", the next characters are the router model name, terminated by a "~" (tilde). Following this are the characters of the software version number string, again terminated by a "~" (tilde).

For example, the command:

```
**Q!!
```

might return the following string:

```
** QSmall~V2.1~ OK !!<CR>
```

indicating that the router model name is "Small" and the software version number is "V2.1".

## “L”: Matrix Size and Level Names Inquiry

The command "L" requests that matrix size (Nout, Nlvl, Nin) and level name information (lvl1, lvl2, etc.) be returned to the host. The information is sent as a string of characters. The first characters are a space followed by "L", some optional values described below, then the number of outputs (Nout), a comma, the number of levels (Nlvl), a comma, the number of inputs (Nin), a comma, and then the level names, each terminated by a "~" (tilde), and the last followed by two tildes.

For example, the command:

```
**L!!
```

might return the following string:

```
** L64,3,32,VIDEO~AudioL~AudioR~~ OK !!<CR>
```

indicating that the router has 64 outputs, 3 levels, and 32 inputs, and the levels are named "VIDEO", "Audio L", and "Audio R".

## “O”: Output Status Inquiry

The command "o" requests that matrix status information for a single output be returned to the host. The status information is sent as a "Y" command or a "V" command or as a sequence of L "X" commands, where L=number of levels.

For example, the command:

```
**O5!!
```

to a 3-level router might have the following three commands as its response:

```
** X65,23,1 X5,-,2 X5,0,3 !!
```

Note the dash, indicating that on level 2, output 65 is not connected to an input. Also note the 0, indicating that the connection on level 3 is either unknown or that output 65 doesn't exist or isn't mapped on level 3.

Or, a 3-level router might have the following single command as its response:

```
** V65,23,-,0 !!
```

which has the same information as the three X commands in the previous example.

If the router has only one level, or if all levels are connected the same, the router might instead use the Y command. For example:

```
** Y65,23 !!
```

## "N": Input Status Inquiry

The command "N" requests that matrix status information for a single input be returned to the host. This command is only useful on those router levels that allow an input to be connected to at most one output. The status information is sent as a "Y" command or a sequence of L "X" commands, where L=number of levels that allow an input to be connected to at most one output (each such level generates a single "X" command of status). Thus, a 6-level router with three single-output-per input levels would generate 3 "X" commands of status command output. A router that has *all of its levels* as single-output-per-input may return a single "Y" command instead of individual "X" commands if all of the levels are connected to the *same output*. The "X" and "Y" commands are formatted exactly as with the "O" command.

For example, the command:

```
**N4!!
```

to a router might have the following three commands as its response:

```
** X12,4,2 X-,4,3 X0,4,4 !!
```

giving the status of levels 2, 3, and 4 (level 1 presumably not being a single-output-per-input level). Note that on level 3 the - (dash) indicates that the input is disconnected, and on level 4 the 0 indicates that the connection to the input is either unknown or that input does not exist or is not available on that level.

If the router has only one level, or if all levels are connected the same, it might instead use the Y command. For example:

```
** Y12,4 !!
```

## "S": Status Inquiry

Use command S to request that status information be returned to the host. The status information is sent as a string of L x O substrings, where L = number of levels and O = number of outputs. Each level/output combination generates a single substring of status command output. Thus, a 21-level 16 output router would generate 2x16 = 32 substrings of status command output. The length of each substring depends on the size of the particular switcher involved. Larger switchers use bigger numbers for inputs, outputs, and levels.

The first substring of status is for level 1 output 2, etc.; however, each substring contains the level and output numbers, so the sequence in which the data is sent is not important). The first characters of each substring are a space followed by "X", then the output number, a comma character, the input number connected to the output (or 0 if no connection exists), another comma, and finally the level number at which the input-output pair is connected. For example, the command:

```
**S!!
```

might have the following two substrings at the beginning of its response:

```
**x01, 12, 1 x02, 02, 1!!
```

This indicates that output 1 is connected to input 12 on level 1, and that output 2 is connected to input 2 on level 1.

The number of digits used for each number is generally the maximum number of digits ever required for that particular switcher. Thus, a switcher with between 10 and 99 inputs would use two digits for the input number, and a switcher with less than 10 levels would use one digit for the level number.

## “C”: Clear Matrix

Use command C to request that the switcher matrix be cleared so that all outputs are disconnected from inputs (in switchers where this is possible) or else all outputs at all levels have input 1 as their source. This command can take several seconds to execute (depending on the size of the switcher matrix). In order to help ensure that this command isn't accidentally executed, it requires four additional characters following the “C” character, to spell out the word “CLEAR” in full. For example, the command:

**\*\*CLEAR!!**

would clear the matrix and when finished — the following response would be generated:

**\*\*OK!!<CR>**

## “K”: Set Password

The command “K” is followed by a password, which may be 0 to *cancel* the previous password, thus causing no password to be specified, or, it may be a value between 1 and 9999 to supply a password, which remains in effect until another password (or password 0) is supplied in another “K” command. The password is stored by the router under the remote address specified using an “M” command, or under the *control port's* remote address if an “M” command was not specified before the “K” command in the same command string as the “K” command. The password that is set remains in effect until another “K” command is received from the same remote address.

It would be used to establish a password for a remote address, to be used for such things as locking and unlocking outputs and modifying the router configuration. When the router receives a protected command (one which requires use of a password) from a remote address, it compares the current password for that remote address with the password required to execute the protected command. Protected commands consist of many of the “G” commands that change router configuration, as well as *take* and *salvo trigger* commands when the output to be taken is locked. In the former case, the administrator password is the one that must be sent in the “K” command to permit the router configuration to be changed, while in the latter case the password that was used to lock the output is the one that must be sent in the “K” command to permit the *take* to occur.

Refer to the “B” command and the “G ADMIN\_PASSWORD” command (in a separate document) for more information.

For example, the command:

**\*\* M197 K1777 !!**

requests that password 1777 be stored as the current password for remote address 197. The command:

**\*\* M197 Y7,9 !!**

requests that output 7 be connected to input 9, using the password stored for remote address 197 as the output lockout override password. The *take* will succeed if output 9 is either not locked or is locked with password 1777. Otherwise, the *take* will fail.

## “M”: Set Remote Address

The command “M” is followed by a remote address value, and it sets the remote address to be used by all remaining commands in the current command string. This command is supported on larger routers. It would be used when a client/server software system on a router control port permits multiple remote users to send commands to the router through that control port. In such a system, the server software that talks to the control port can insert an “M” command at the beginning of each command string it sends to the router on behalf of its clients. The server would assign a different address to each of its clients. The router uses the address to control access to and modification of protected resources. The “M” command will typically work in conjunction with the “K” command, which allows a password to be sent to the router. Some commands, such as those that allow modification of router configuration settings, might require entry of an administrator password before allowing the router configuration to be modified. The “K” command is used to send the password, but the router must be able to record that password in association with a particular remote user. The router would save the password as the one established by the remote address specified in the “M” command. The examples below show how this would work.

If the “M” command is not present in a control string received on a serial port, the address assigned to the *serial port itself* is used as the address for all commands in that command string.

The “M” command works on an honor system. There is nothing to keep a remote device from forging a false address. This conforms with the philosophy of providing protection mechanisms that are not designed to be totally hack-proof, but rather, are designed under the assumption that controlling devices will honor the system. A dedicated hacker can always hack into the system if he chooses. Note, however, that the server in a client/server relationship can provide a great deal of added security for the system, forcing the correct “M” command to be sent each time, and filtering out bogus “M” commands received from clients.

When the router receives an “M” command in a command string, it echoes the same “M” command in its response. This allows the server connected to the serial port to parse the received response string and determine to which client it should route the response.

Normally the server will assign remote addresses to its clients. However, it should always provide a way to send these addresses to the client, because the client needs to know its address in order to know how to interpret some responses. By simply passing each “M” response command received from the router back to the client, the server can let the client know what its address is.

For example, the command:

```
** M139 K9664 !!
```

establishes password 9664 as the password for remote address 139. The response to this command string would be:

```
** M139 OK !!
```

If remote address 13 later sends the command:

```
** M139 Y8,27 !!
```

to request that output 8 be connected to input 27, the router would check to see if output 8 has been locked. If so, the router compares the password of remote address 139 (which has previously been set to 96643) to the password that was used to lock output 8. If they match, the connection request succeeds, but if they don’t match, output 8 is left unchanged.

## “U”: Update Request on/off

The command “u” turns on or off the automatic sending of output change reports. The command letter must be followed by either a number 0, 1, or 2 to specify the new automatic change report state, as follows:

0: Automatic output change reporting is turned off.

1: Automatic output change reporting is turned on. Crosspoint change commands do not immediately report changed status, but instead, the report comes up to a few seconds after the crosspoint change command is received.

2: Automatic output change reporting is turned on, and crosspoint change commands immediately report changed status as part of the response to the command.

Output change reports are automatic messages sent to the host whenever an output is crosspoint status (i.e. connected source) is changed.

For example, the command:

```
**U1!!
```

turns on automatic output change reporting. When a crosspoint is changed, the following message might be received:

```
** X5,17,3 !!<CR>
```

indicating that output 5 is now connected to input 17 on level 3. Alternatively, if the router has only a single level or if all levels of the output are connected the same, it might send:

```
** Y5,17 !!<CR>
```

indicating that output 5 is now connected to input 17. Alternatively, newer routers might use the “V” command instead of “X” commands to report a change:

```
** V5,17,12,0 !!<CR>
```

indicating that output 5 is now connected to input 17 on level 1, to input 12 on level 2, and does not exist or is not available on level 3.

To turn off output change reporting, use the command:

```
**U0!!
```

The difference between an argument value of 1 versus 2 has to do with the response generated by the router when it receives a crosspoint connect command (“V”, “W”, “X”, “Y”, or “Z” command). For example, suppose the router sends the following crosspoint connect commands in a single command sequence:

```
** Y1,18 Y8,34 !!
```

If U1 is in effect, the response to this command will be:

```
** OK !!<CR>
```

and then sometime later, perhaps up to several seconds later, the crosspoint change reports will be sent as separate command sequences for each output:

```
** Y1,18 !!<CR>
```

```
** Y8,34 !!<CR>
```

On the other hand, if U2 is in effect, the response to the original crosspoint change command sequence will be:

```
** Y1,18 Y8,34 OK !!<CR>
```

and no additional crosspoint change reports will be sent because they already HAVE been sent. The U2 mode of operation is generally more convenient because it produces more immediate feedback to the controlling device that is sending a crosspoint change command. The U1 mode of operation is provided for compatibility with older control systems.

## "V": Connect Levels

The command "v" is used to request that a connection be made. It must be followed by an output number, a comma, and a comma-separated list of input numbers, one for each level, up to the number of levels in the router. Fewer than the number of levels may be specified if desired, and the remaining levels will be left unchanged.

For example, the command:

```
**V12,7,8,9!!
```

says that connections are to be made to output 12: from input 7 on level 1, input 8 on level 2, and input 9 on level 3.

An input number of 0 means the output connection is to be left *unchanged*.

An input number of - (dash) means the output is to be *disconnected*. If the router does not support disconnected outputs, the output connection will be left unchanged.

## "W": Connect Outputs

The command "w" is used to request that a connection be made. It must be followed by a level number, a comma, and a comma-separated list of input numbers, one for each output, up to the number of outputs in the router. Fewer than the number of outputs may be specified if desired, and the remaining outputs will be left unchanged.

For example, the command:

```
**W1,17,3,9!!
```

says that connections are to be made on level 1: from input 17 to output 1, input 3 to output 2, and input 9 to output 3.

If the level number is specified as "0", this means that the connection is to be made on **all levels** (AFV).

For example, the command:

```
**W0,8,3,7!!
```

says that connections are to be made on all levels: from input 8 to output 1, input 3 to output 2, and input 7 to output 3.

An input number of 0 means the output connection is to be left *unchanged*.

An input number of - (dash) means the output is to be *disconnected*. If the router does not support disconnected outputs, the output connection will be left unchanged.

It is an error to request connection of an input or output that doesn't exist on the specified level, even if the input or output does exist on some other level. However, if the level number is "0", any input or output may be used as long as it exists on at least one level, and in that case no connection will be made on any level on which the input and output does not exist. If the requested connection has an output or input number that isn't mapped to a physical connector (on virtual-mapped routers) on one or more levels, those levels are simply not changed.

If “U2” is in effect (see “U” command), the response will include one or more V, Y, or X commands to report the new status of the outputs. The response will be the same as if “O” commands were issued for the outputs immediately following the “W” command. No response is generated if this command is being used to define a salvo.

## “X”: Connect Crosspoint

Use command X to request that a connection be made. It must be followed by an output number, a comma, an input number, a comma, and a level number. For example:

**\*\*X8, 3, 2!!**

This string says that a connection is to be made between output 8 and input 3 on level 2. If the level number is specified as “0”, this means that the connection is to be made on all levels (AFV). For example, the command:

**\*\*X8, 3, 0!!**

This string says that a connection is to be made between output 8 and input 3 on all levels.

## “Y”: Connect AFV

Use command Y to request that a connection be made. It must be followed by an output number, a comma, and an input number. The connection is made on all levels (AFV). For example, the command:

**\*\*Y2, 8!!**

This string says that input 8 is to be connected to output 2 on all levels.

## “Z”: Connect AFV

The command “z” is used to request that a connection be made. It must be followed by a comma-separated list of input numbers, one for each output, up to the number of outputs in the router. Fewer than the number of outputs may be specified if desired, and the remaining outputs will be left unchanged. The connection is made on all levels (AFV).

For example, the command:

**\*\*Z4,18,7!!**

says that input 4 is to be connected to output 1 on all levels, input 18 to output 2 on all levels, and input 7 to output 3 on all levels.

An input number of 0 means the output connection is to be left *unchanged*.

An input number of - (dash) means the output is to be *disconnected*. If the router does not support disconnected outputs, the output connection will be left unchanged.

Any input or (implied) output number may be specified as long as it exists on at least one level. No connection will be made on any level on which an input or (implied) output number does not exist. If the requested connection has an output or input number that isn’t mapped to a physical connector (on virtual-mapped routers) on one or more levels, those levels are simply not changed.

If “U2” is in effect (see “U” command), the response will include one or more V, Y, or X commands to report the new status of the outputs. The response will be the same as if “O” commands were issued for the outputs immediately following the “Z” command. No response is generated if this command is being used to define a salvo.

## “D”: Delay vertical sync intervals

The command “D” is used to delay before continuing execution of the commands that follow. It must be followed by a number giving the number of vertical sync intervals by which to delay. If the number is 1, the delay will be to the VERY NEXT vertical sync interval. If the number is 0, no delay occurs. The number must be no larger than 255. Note that this command will also delay the time at which the remaining command responses and the trailer character are returned to the host.

For example, the command:

```
** Y1,5 D200 D100 Y1,6 S !!
```

says that input 5 is to be connected to output 1 on all levels, then a delay of 300 (=200+100) sync intervals is to occur, then input 6 is to be connected to output 1 on all levels, then a status response is to be returned.

It is generally recommended that the host computer be responsible for timing the initiation of commands, rather than using this command to do the job. The host computer can simply send the appropriate commands at the appropriate times. The “P” and “T” commands described below can aid in ensuring that lengthy connect sequences aren't delayed due to the time it takes to send them to the router.

## “T”: Trigger a Salvo

The command “T” is used to trigger a previously set up *salvo* (set using the “P” command above). It must be followed by a register letter from A to Z or a register number from 1 to 256 giving the *register* to be triggered.

For example, the command:

```
** TB D180 TC !!
```

says to trigger salvo register B (same as 2), delay 180 sync intervals, then trigger salvo register C (same as 3). When the register is triggered, this means that the connect commands stored in it take effect.

If a salvo is triggered and it attempts to connect a locked output or port, or a disallowed input/output pair, or a port to itself, the salvo trigger operation is aborted, no crosspoint changes are performed, and an error is reported: “ERROR Salvo Has Locked Xpts”.

## “P”: Preset a Salvo

The command “P” is used to set up a *salvo*, which is a series of connect commands for later execution with the “T” command. It must be followed by a register letter from A to Z or a register number from 1 to 256 giving the *register* into which the connect sequence is to be stored, followed by zero or more *connect commands* (V, W, X, Y, or Z), followed by a “~” (tilde) character.

Registers A-Z are the same registers as 1-26. The letter designators are allowed to shorten up the command sequence slightly, so that “T” commands can be sent in compact form if one of the first 26 registers is used.

For example, the command:

```
** PB X2,5,0 Z7 ~ !!
```

says that two connect commands (output 2 to input 5 AFV, and output 1 to input 7 AFV) are to be stored into salvo register B (i.e. register 2). Another example:

\*\* P239 Y5,7 ~ !!

says that one connect command (output 5 to input 7 AFV) is to be stored in salvo register 239.

Only *supported connect commands* (those connect commands whose command letters appear in the "I" command response) may follow the register letter up to the tilde character. The connect commands do not take effect until the register is *triggered* using the "T" command below.

The maximum allowed number of connect commands is determined by the particular router. In all cases where this command is implemented, there is guaranteed to be space available to store at least two complete switch matrices AT ONE LEVEL. If more connect commands are received than there is space available to store them, the error response string "FULL ERROR Salvo Space Full" is sent to the host, and only the first part of the salvo is stored. For example:

\*\* FULL ERROR Salvo Space Full !!

says that the salvo request filled memory and the salvo could not be completely stored.

## "B": Output Lock inquiry or change

The command "B" requests that lock information for the specified output be returned to the host, and optionally that the lock status of that output be changed. Whenever the router receives a "B" command, it sends one back.

In routers that support the "B" command, the router reports changes to output lock status using the "B" command, not the "G OUTPUT\_LOCK" command.

When an output is locked, it cannot be routed to a new input unless the password sent using the "K" command matches the password used to lock the output.

In virtual-mapped routers, this command applies lockouts to *virtual destinations* rather than *physical outputs*, so the word "output" should be replaced with "destination" in this command description.

If the "password" and "lock" arguments are both 0, this is a query for lock status of the specified output. A "B" command is sent to report the lock status.

If the "password" argument is not 0, this is a request to change the lock status of the specified output. After changing the lock status, a "B" command is sent to report the new lock status, so a response occurs regardless of which form of the "B" command is sent to the router.

When requesting that lock status be changed, if "lock" is 0, this is a request to unlock the output, and if "lock" is 1, this is a request to lock the output. An attempt to lock an output that is already locked, or to unlock an output that is already unlocked, fails, as does an attempt to unlock an output using a password that is different from the password that the output was locked with and is not the administrator password. Any use of a password larger than 9999 also fails. In any of those cases, the output lock status remains unchanged and an error response is generated. The "B" command response will indicate that the output still has the same lock state as before.

In the "B" command response that is sent by the router, the "password" argument is the current lock password for the output (1-9999), or is 0 if the output is not locked, and the "lock" argument is 0 if the output is not locked, or 1 if it is locked.

When locking an unlocked output, the specified password is recorded by the router as the lock password for that output. When unlocking a locked output, the specified password is compared by the router to the lock password for the output. If they match, or if the specified password is the administrator password, the output is unlocked, else it remains

locked. Attempting to lock an already-locked output, or unlock an already-unlocked output, has no effect on the lock state of that output.

Whenever a *take* is done, the router checks to see if the specified output for the *take* has been locked. If so, the current password of the control port that sent the *take* request (as set with the “K” command) is compared to the output’s lock password. If they match, the *take* is allowed, but if not, the *take* has no effect. The *administrator password may NOT be used in lieu of the output’s lock password to do a take*, so if a controlling device sends the administrator password in a “K” command, that will not permit the device to reroute locked outputs (but it can use the administrator password to unlock locked outputs using the “B” command).

Output lockouts apply on *all levels*. On virtual-mapped routers, a level may be left out of a lockout by making sure the level is unmapped for the destination being locked.

As with all router configuration parameters, the output lockout data is stored in non-volatile storage and thus is retained across router power-ups. When a router is first initialized at the factory, all outputs are set to be unlocked.

This command provides the same functionality as the “G OUTPUT\_LOCK” command. This command, which was added at router software version V5.06, is preferred over that command. Note that the output lock version number is not present in this command. Since output lock status changes frequently, it is not really useful to cache output lock status for outputs, so the output lock version number is not really useful.

For example, to request whether or not output 21 is locked:

```
** B21,0,0 !!
```

The response might be:

```
** B21,0,0 OK !!
```

indicating that output 21 is NOT locked. Or, the response might be:

```
** B21,6741,1 OK !!
```

indicating that output 21 is locked with password 6741. To clear this lockout:

```
** B21,6741,0 !!
```

To lock output 96 using password 439:

```
** B96,439,1 !!
```

If successful, the response would be:

```
** B96,439,1 OK !!
```

If output 122 becomes locked using password 235, the following change report would be sent by the router:

```
** B122,235,1 !!
```

## “F”: Field Delay

The command “F” is used to specify the delay between the time a crosspoint change request is received by the router and the time the crosspoint switch actually occurs. It must be followed by a number giving the number of video fields of delay desired. If the number is smaller than the smallest delay that the router can handle, the smallest delay is used instead. If it is larger than the largest delay the router can handle, the largest delay is used instead. Note that this command does not cause a delay in command processing, as the “D” command does.

To understand this command more fully, consider the way that router software will typically handle a crosspoint command. The last character of the command string, the final “!” (exclamation) character, is received somewhere in a particular video field, call it video field 7. The router parses the command string and, for each crosspoint it contains, it puts the crosspoint in a buffer that is marked to be delivered to the crosspoint hardware on a particular video field. Suppose that previously, an “F5” command has been received. Then crosspoint commands whose final “!” command string character was received on video field 7 would be placed in a buffer that is marked to be delivered to the crosspoint hardware at video field 13 ( $7+5+1=13$ ).

To understand the reason for adding 1 in the previous sum, consider an “F0” command: it would ask for output at the very next video field, field 8 in our case. So, it is necessary to add the “F” argument plus 1 to the field number on which the crosspoint command is received to get the field number at which the crosspoint will be output.

A typical router will have a minimum delay that is between 1 and 2 fields. Suppose a crosspoint command is received just before a vertical field mark. The software may be able to prepare the crosspoint data and send it to the hardware when that vertical field mark occurs, but the hardware itself typically has a one-field delay in it, so the soonest that such a crosspoint would switch would be one field (plus a little) from when it was received. If the command were received towards the beginning of a field rather than the end of a field, the delay would be closer to two fields. Industry parlance is to call this a one-field delay, because only *full fields* of delay are counted.

The *delayfields* argument of this command takes into account the hardware delay. So, if a router has a minimum delay, including the hardware delay, of one full field, as described in the previous paragraph, then a *delayfields* value of 1 causes this minimum delay to be used. A *delayfields* value of 0 will also cause this minimum delay, because the router uses its minimum if a smaller value is specified. A *delayfields* value of 2, however, will add one more field to the minimum possible delay. Thus, *delayfields* specifies the *number of full fields* of delay between end-of-crosspoint-command-string-received and crosspoint-switch-occurs. Note that the actual minimum value of *delayfields* depends on the particular router model.

Routers typically have a limit to the number of crosspoint commands they can process in one field. First, there is an inherent delay in *sending* the command to the router, but beyond that, the router requires time to parse the command and buffer up the crosspoint data, plus it requires time to deliver the buffered data to the hardware when the desired video field arrives. Each individual router has documentation to describe its limitations on how many crosspoints it can process in a given amount of time.

Larger values for *delayfields* give the router more time to process commands. Although the long-term average number of crosspoints that can be processed per unit of time is unchanged, a larger *delayfields* value can improve router performance during a short burst of many crosspoint commands. For example, suppose a large number of crosspoint commands is sent to the router in a single large command. If *delayfields* is small, the router typically won't have time to parse and process all these crosspoint commands and place the data in the crosspoint delivery buffer before the target video field arrives. By

making *delayfields* larger, the user can give the router more time to process the crosspoint commands.

If too many crosspoint commands are received and the router is not able to process them fast enough, it will output the crosspoint connections as soon as it can. Unexpected delays in crosspoint output are a sign that the router is being pushed beyond its limits.

The *fielddelay* value applies to the *entire router*, not just to the control port on which the “F” command is received. It is therefore recommended that a single value be settled on for the *fielddelay* value, rather than changing the value constantly depending on needs. Once changed, the router records the value in non-volatile memory and uses it each time it is powered up, so it is only necessary to change it one time.

Even though a crosspoint isn't changed until the *fielddelay* time has elapsed, the router records the new crosspoint state *immediately upon receiving the crosspoint change request*, so a controlling device may receive a report of a crosspoint change before the change has actually taken effect, and this is more likely to happen the larger *fielddelay* is. Since routers currently make no guarantees about when they will report a crosspoint change anyway, this behavior is usually of no concern. There is a case where this could cause problems. If the *fielddelay* value were to be changed while two different devices were changing the same output, it is possible for the router to report the incorrect input value for that output. This would happen if the earlier device that changed the output did so before the *fielddelay* value was changed, and the later device that changed the output did so after the *fielddelay* value was reduced but soon enough that its input value would be sent to the crosspoint hardware before that of the earlier device. A bit later, the earlier device's input value is sent to the crosspoint hardware, but the router has recorded the later device's input value as being the one in effect. To prevent this scenario, we recommend that an appropriate *fielddelay* value be chosen, set, and left alone.

Here is an example of an “F” command:

```
** F5 Y1,5 X2,6,3 !!
```

This says that input 5 is to be connected to output 1 on all levels and input 6 is to be connected to output 2 on level 3, after a delay of 5 fields from the beginning of the field that follows receipt of the “!” character.

## Commonly Used Switching Commands

This section contains the most commonly used switching commands. These commands are explained in detail in the proceeding section and are merely meant as a "short cut" for programmers.

### **"Y" Command- All Levels**

The "Y" command switches all levels (i.e. video and audio).

For example;

```
**Y2,8!!
```

This string says that input 8 is to be connected to output 2 on all levels.

### **"X" Command- Specify Levels**

Using the "X" command requires that a level is specified.

For example;

```
**X8, 3, 2!!
```

This string says that a connection is to be made between output 8 and input 3 on level 2. If a level number of "0" is used, all levels are switched.

### **"V" Command- Connect Levels**

The "V" command is followed by an output number, a comma, and an input number for each level, up to the number of levels on the router.

For example;

```
**V12, 7, 8, 9!!
```

This string says that connections are to be made to output 12 from input 7 on level 1, input 8 on level 2, and input 9 on level 3

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