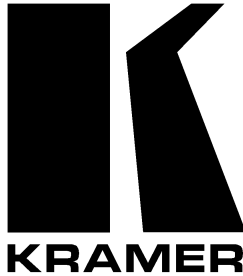


Kramer Electronics, Ltd.



USER MANUAL

Models:

VP-128H, *Matrix Switcher*

RC-1616, *Remote Control*

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1 Introduction

Welcome to Kramer Electronics (since 1981): a world of unique, creative and affordable solutions to the infinite range of problems that confront the video, audio and presentation professional on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better! Our 350-plus different models now appear in 8 Groups¹, which are clearly defined by function. Congratulations on purchasing your Kramer **VP-128H Matrix Switcher** and/or **RC-1616 Remote Control**. The **VP-128H Matrix Switcher** is ideal for the following typical applications:

- Switching between up to 12 VGA computer inputs and up to eight VGA display outputs, in which the use of native HD15 connectors for the inputs and outputs eliminates the need for awkward HD15-to-BNC breakout cables. The entire **VP-128H** is only 1RU high compared to 3RU that would be required if the unit were built with BNC connectors on its rear panel
- Any professional system requiring outstanding value in a 12x8 matrix

The **RC-1616 Remote Control** is ideal for sophisticated control from various locations via the Ethernet. You can connect up to 512 **RC-1616 Remote Control** panels to one router: 256 XY panels and 256 single bus panels.

The package includes the following items:

- **VP-128H Matrix Switcher** with a power cord and a Null-modem adapter; and/or **RC-1616 Remote Control** with a power adapter
- Windows®-based Kramer control software and this user manual²

2 Getting Started

We recommend that you:

- Unpack the equipment carefully and save the original box and packaging materials for possible future shipment
- Review the contents of this user manual
- Use Kramer high performance high resolution cables³

1 GROUP 1: Distribution Amplifiers; GROUP 2: Video and Audio Switchers, Matrix Switchers and Controllers; GROUP 3: Video, Audio, VGA/XGA Processors; GROUP 4: Interfaces and Sync Processors; GROUP 5: Twisted Pair Interfaces; GROUP 6: Accessories and Rack Adapters; GROUP 7: Scan Converters and Scalers; and GROUP 8: Cables and Connectors

2 Download up-to-date Kramer user manuals from the Internet at this URL: <http://www.kramerelectronics.com>

3 The complete list of Kramer cables is on our Web site at <http://www.kramerelectronics.com>

3 Overview

This section summarizes the:

- **VP-128H** *Matrix Switcher*, see section 3.1
- **RC-1616** *Remote Control*, see section 3.2

3.1 About the VP-128H

The **VP-128H** is a true 12x8 matrix switcher for VGA / XGA signals that lets you simultaneously route any or all of the 12 inputs to any or all of the 8 outputs. The high performance **VP-128H** is rugged, easy to service¹, and fits into one vertical space (1U) of a standard 19" rack. In particular, the **VP-128H** includes:

- A very reliable modular design² (without any internal adjustments³), with a detachable⁴ front panel that is fastened into the frame with two front panel hand operated slide action latches. The detached front panel can be used as a local control panel, by attaching it to the main electronics module within the **VP-128H** using a 9-wire ribbon flat cable
- 12 input and eight output selector buttons
- Video bandwidth of 315MHz that ensures transparent VGA / XGA performance
- DC coupled inputs and outputs
- Storing and recalling setup options
- The ability to store 10 setups in the control system in Flash
- A RGB delayed switching mode (with a user selectable delay increment of 500ms for each output ranging from 0 to 3.5 seconds) for any output through black for clean transitions when switching between non genlocked sources
- A linear circuit path for the H and V channels, to cope with any non-standard H and V sync levels

1 You can easily remove the front panel to access all the components from the front, without having to remove it from its rack

2 That has many advantages over competing systems that are not modular (for example, the Mean Time To Repair (MTTR) using replacement modules would only take a few seconds, as opposed to hours for a non-modular design). All modules are secured with positive latches (slide latches or positive leverage long-handle ejector/insertor devices with built-in latching clasps). All plug-in modules are supported on all four sides. The rear panel is recessed 0.7 inches to protect the rear panel connectors from damage

3 Video gain is set by 0.1% resistors

4 Removing the front panel reveals the two major slide in components—the main switching module and the plug-in power supply unit—secured by latches to prevent accidental disconnection in mobile installations

- A passive two BNC sync loop - useful to ensure deterministic switching¹
- Two **VP-128H** units can be cascaded

Control the **VP-128H** via the front panel buttons, or remotely:

- By 10 Base T Ethernet² or RS-232 serial commands transmitted by a touch screen system, PC, or other serial controller

3.2 About the RC-1616

The **RC-1616 Remote Control** is ideal for sophisticated control from various locations via the Ethernet. You can connect up to 512 **RC-1616 Remote Control** panels to one router: 256 XY panels and 256 single bus panels.

3.3 Achieving the Best Performance

To achieve the best performance:

- Connect only good quality connection cables, thus avoiding interference, deterioration in signal quality due to poor matching, and elevated noise levels (often associated with low quality cables)
- Avoid interference from neighboring electrical appliances and position the **VP-128H / RC-1616** away from moisture, excessive sunlight and dust

4 Your VP-128H Matrix Switcher

The **VP-128H Matrix Switcher** can be used:

- With the front panel and rear panel intact, see section 4.1
- Without the front panel (the front panel is blocked off), but with the rear panel intact, see section 4.2
- With the **VP-128H** front panel detached, which functions as a local control panel, see section 4.3

4.1 The VP-128H with the Front Panel and the Rear Panel Intact

Figure 1 and Table 1 and Table 2 define the front³ and rear panels of the **VP-128H Matrix Switcher**:

1 Connect video with sync to either BNC. If desired, use the second BNC to loop the signal to another device

2 Ethernet control will allow more powerful panels to store in the panel setup and recall schemes that are tailored to the configuration of the panels controls. An entire router configuration can be sent to the router from the panel in under one millisecond

3 The same switch assemblies and metalwork that make up the front panel are used on the remote control panel. You can connect up to 512 remote control panels to one router: 256 XY panels and 256 single bus panels

Your VP-128H Matrix Switcher

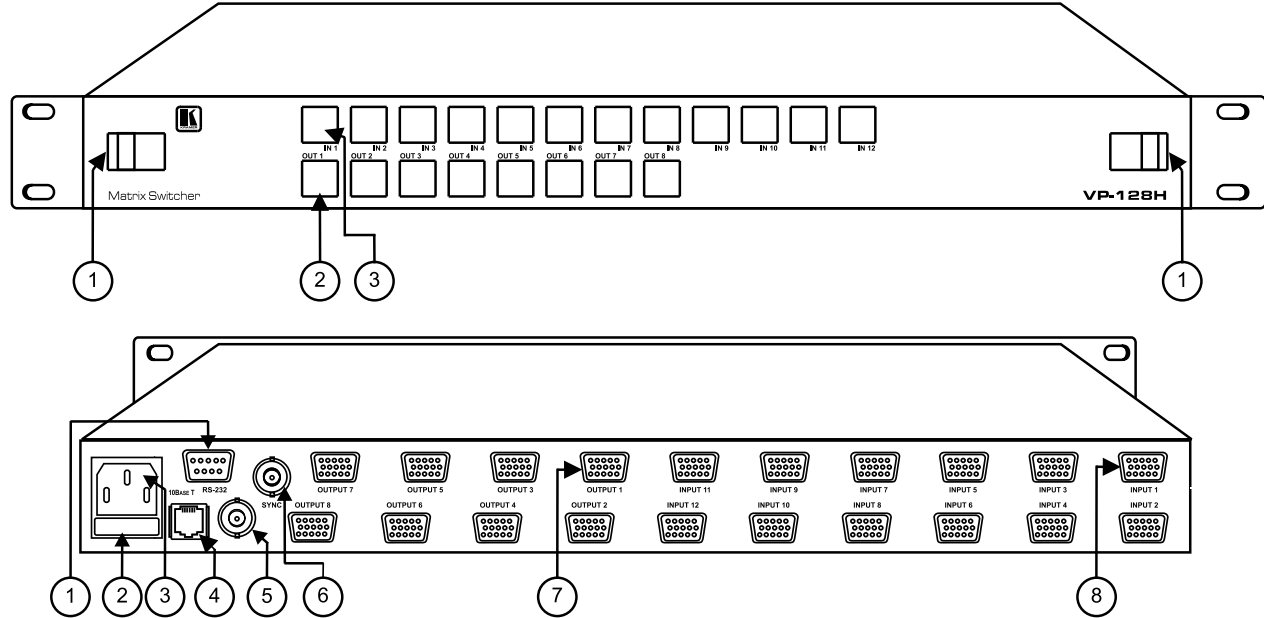


Figure 1: VP-128H Matrix Switcher

Table 1: VP-128H Matrix Switcher Front Panel Features

#	Feature	Function
1	Slide Action Latches	Fasten the front panel into the frame
2	OUT Selector Buttons ¹	Select the output ² to which the input is switched (from 1 to 8)
3	IN Selector Buttons ³	Select the input to switch to the output (from 1 to 12)

Table 2: VP-128H Matrix Switcher Rear Panel Features

#	Feature	Function
1	RS-232 DB 9F Connector	Connects to the PC or other Serial Controller
2	Slow Blow Fuse	20x5mm 0.5A slow blow fuse
3	Power Connector ⁴	AC connector enabling power supply to the unit
4	Ethernet 10 Base T Port	Connects to the LAN
5	REF SYNC BNC Connector	When connected unit switches in vertical interval ⁵
6	REF SYNC BNC Connector	When connected unit switches in vertical interval ⁵
7	VGA/XGA Video INPUTS	Connects to the VGA/XGA video inputs (1 to 12)
8	VGA/XGA Video OUTPUTS	Connects to the VGA/XGA video outputs (1 to 8)

4.2 The VP-128H Without the Front Panel (but with the Rear Panel)

You can purchase, configure and operate the **VP-128H** without a front panel⁶—as Figure 2 illustrates—when operating the **VP-128H** via a remote panel, RS-232 control, or 10 Base T Ethernet control.

1 These buttons operate in the 'one out of n' mode. When one of these buttons is pressed the previous button is cleared and the new selection is latched and tallied. If the selected output is 'locked' the lamp in the output button flashes and the correct input status is tallied via the input select buttons

2 Each output can be muted independently; and can be set to a delayed switch through black, with a user selectable delay increment for each output

3 These buttons operate in the 'one out of n' mode. When one of these buttons is pressed the previous button is cleared and the new selection is latched and tallied. When an output is selected the current state of the corresponding input is tallied in the appropriate button. If the source is a breakaway, a flashing lamp indicates the audio selection. If the output being controlled is locked, pressing the input select button has no affect

4 If the power supply needs to be replaced, you can access it from the front after removing the front panel (see section 4.3). There is no harm leaving the power turned ON continuously, or in using the AC cord as the ON/OFF switch

5 With an HD15-to-BNC breakout, these two SYNC BNC connectors can be connected in a looping manner to a VP-128H input or output. Inside the VP-128H, the BNC connectors connect to a sync separator circuit, which separates vertical sync from composite video, composite sync, positive V pulse or negative V pulse. If left unconnected, the VP-128H operation is not adversely affected. If two or more of the VP-128H inputs are already synchronized to each other, connect the BNC connectors. By using the same reference to the cameras and to the VP-128H, a much cleaner switch will occur because it will happen in the vertical interval

6 That is, the front panel (or local control panel) is blocked off with a blank cover

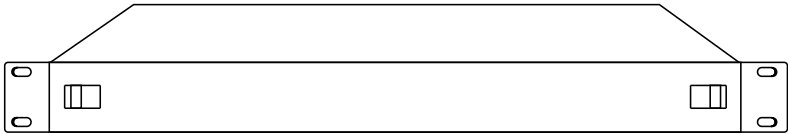


Figure 2: VP-128H Without the Front Panel

4.3 The VP-128H Local Control Panel (Detached Front Panel)

Figure 3 illustrates the front view of the **VP-128H** local control panel¹:

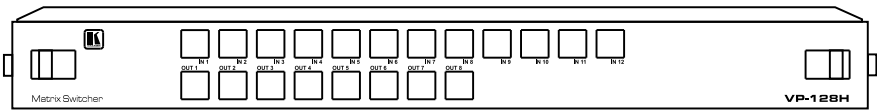


Figure 3: VP-128H Local Control Panel¹

The local control panel¹ connects via a flat cable to the main switching module inside the **VP-128H**. Figure 4 and Table 3 define the front view of the **VP-128H** after its local control panel¹ is detached:

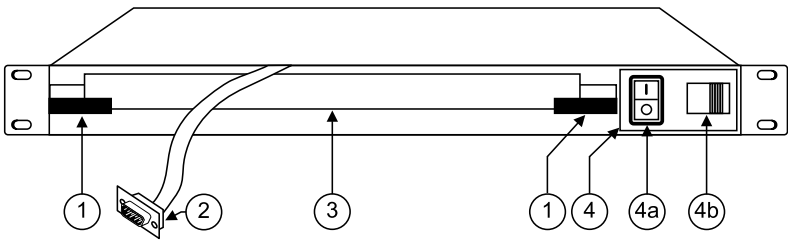


Figure 4: VP-128H Front View with Front Panel Detached

Table 3: VP-128H Front View with Front Panel Detached Features

#	Feature	Function
1	Release Latches	Fasten the main switching module into the frame
2	9-wire Ribbon Flat Cable with DB9M connectors	Connects the circuitry on the (detached) front panel to the main electronics module
3	Main Switching Module	Provides easy accessibility for service and repair
4	Plug-in Power Supply Unit	Detachable power module with a power switch and slide action latch on the front side, and 6-pins on the rear side that transmit power to the power connector (see item 3 in Table 2)
4a	Power Switch	Illuminated switch for turning the unit ON or OFF
4b	Slide Action Latch	Fastens the plug-in power supply unit into the frame

¹ The front panel when it is detached

5 Connecting a VP-128H Matrix Switcher

You can control the **VP-128H** via:

- Its front (local) panel, see section 5.1
- RS-232. For example, by connecting a PC via the null-modem adapter (when using the Kramer Control software or other controller) if control via RS-232 is required (see section 5.2)
- ETHERNET (see section 5.3)
- The **RC-1616** Remote Control (see section 6)

5.1 Connecting the VP-128H Matrix Switcher

This section describes how to connect the **VP-128H**.

To connect your **VP-128H Matrix Switcher**¹, connect the following²:

1. Connect up to 12 VGA/UXGA sources to the 12 HD15F input connectors. For example¹, connect a computer graphics source to the INPUT 1 HD15F connector, and a laptop graphics source to the INPUT 12 HD15F connector.
2. Connect up to 8 HD15F output connectors to up to³ 8 VGA/UXGA acceptors. For example¹, connect the OUTPUT 1 HD15F connector to the VGA/UXGA acceptor 1, for example, a projector, and connect the OUTPUT 8 HD15F connector to the VGA/UXGA acceptor 8, for example, a display.
3. Connect the Sync reference BNC connectors (optional).
4. Connect a PC (if required) to the RS-232 port, see section 5.2.
5. Connect the ETHERNET port (if required), see section 5.3.
6. Connect the power cord⁴.

¹ As the example in Figure 7 illustrates

² Switch OFF the power on each device before connecting it to your VP-128H. After connecting your VP-128H, switch on its power and then switch on the power on each device

³ When less than 8 outputs are required, connect only those outputs of the VP-128H and leave the other outputs unconnected

⁴ We recommend that you use only the power cord that is supplied with this machine

5.2 Controlling via RS-232 (for example, using a PC)

You can connect a PC to the RS-232 port of the **VP-128H** unit, with or¹ without using a Null-modem adapter (provided with the machine):

To connect a PC to the **VP-128H** unit, using the Null-modem adapter provided with the machine:

- Connect the RS-232 DB9 rear panel port on the **VP-128H** unit to the Null-modem adapter and connect the Null-modem adapter with a 9 wire flat cable to the RS-232 DB9 port on your PC

To connect a PC to the **VP-128H** unit without using a Null-modem adapter:

- Connect the RS-232 DB9 port on your PC to the RS-232 DB9 rear panel port on the **VP-128H** unit, as Figure 5 illustrates (depending on whether the PC has a 9-pin or 25-pin connector)

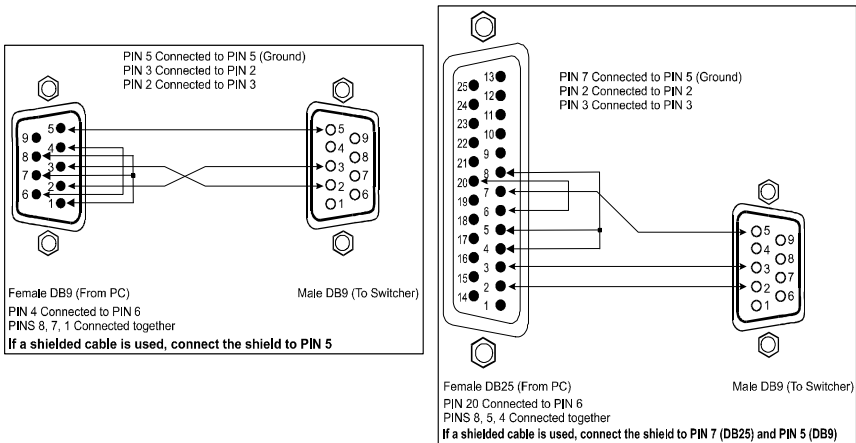


Figure 5: Connecting a PC without using a Null-modem Adapter

¹ The construction of the RS-232 I/O includes internal jumpers that allow the VP-128H to require an external null modem or use a generic pin-to-pin 9 pin cable to a PC with no Null-modem adapter

5.3 Connecting the VP-128H (also RC-1616) via the ETHERNET port

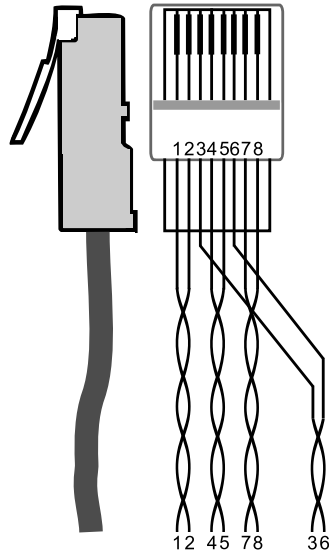
To connect the **VP-128H** (also the **RC-1616**) via the 10 Base T ETHERNET port, do the following:

- Connect the **VP-128H** 10 Base T port to the LAN port of your PC, or the **VP-128H** 10 Base T port to the **RC-1616** 10 Base T port, when not using a hub, via a crossover cable with RJ-45 connectors, as Table 4 and Figure 6 define

Figure 6: RJ-45 PINOUT

Table 4: Crossover Cable RJ-45 PINOUT

EIA /TIA 568A Side 2		EIA /TIA 568B Side 1	
PIN	Wire Color	PIN	Wire Color
1	Green / White	1	Orange / White
2	Green	2	Orange
3	Orange / White	3	Green / White
4	Blue	4	Blue
5	Blue / White	5	Blue / White
6	Orange	6	Green
7	Brown / White	7	Brown / White
8	Brown	8	Brown
Pair 1		Pair 1	
4 and 5		4 and 5	
Pair 2		Pair 2	
3 and 6		1 and 2	
Pair 3		Pair 3	
1 and 2		3 and 6	
Pair 4		Pair 4	
7 and 8		7 and 8	



- If connecting the **VP-128H** / **RC-1616** 10 Base T port to the LAN port on a network hub (for example, to connect multiple **RC-1616** panels to one **VP-128H**, and/or for a long distance connection) or network router, use a straight-through cable with RJ-45 connectors, as Table 5 defines

Table 5: Straight-through Cable RJ-45 PINOUT

EIA /TIA 568A Side 2		EIA /TIA 568B Side 1	
PIN	Wire Color	PIN	Wire Color
1	Orange / White	1	Orange / White
2	Orange	2	Orange
3	Green / White	3	Green / White
4	Blue	4	Blue
5	Blue / White	5	Blue / White
6	Green	6	Green
7	Brown / White	7	Brown / White
8	Brown	8	Brown

Figure 7 illustrates how to connect the **VP-128H** (without a remote control panel):

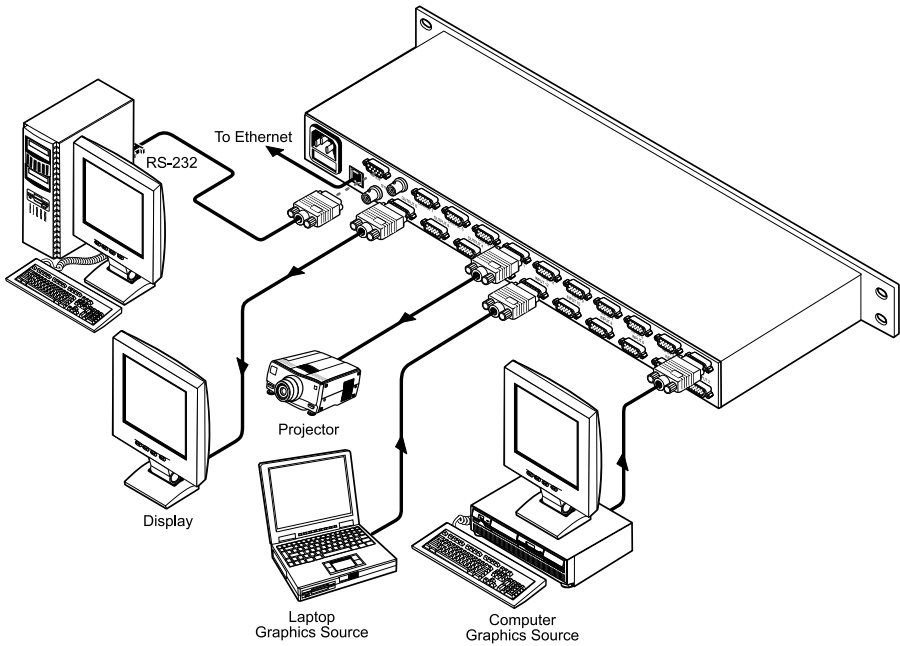


Figure 7: Connecting a VP-128H Matrix Switcher

6 Your RC-1616 Remote Control

The **RC-1616 Remote Control**¹ can be used:

- With the front panel and rear panel intact, see section 6.1
- With the **RC-1616** front panel detached, see section 6.2

6.1 The RC-1616 with the Front Panel and the Rear Panel Intact

Figure 8, Table 6 and Table 7 define the front and rear panels of the **RC-1616**:

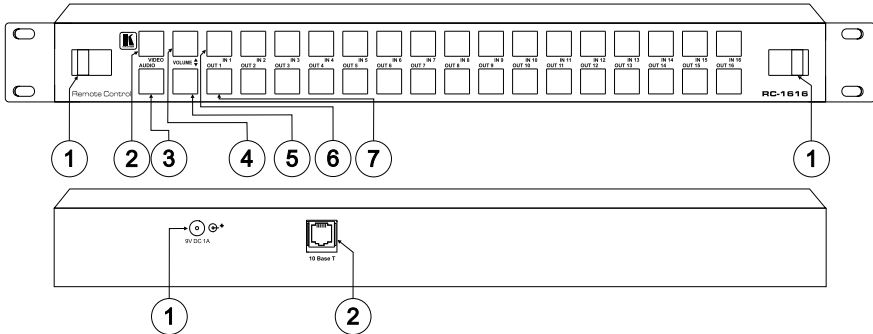


Figure 8: RC-1616 Remote Control

Table 6: RC-1616 Remote Control Front Panel Features

#	Feature	Function
1	Slide Action Latches	Fasten the front panel into the frame
2	VIDEO ² Button	Affects video (audio does not switch)
3	AUDIO ² Button	Affects audio (video does not switch)
4	VOLUME Up ³ Button	Pressing together with an IN / OUT Selector button decreases the level
5	VOLUME Down ³ Button	Pressing together with an IN / OUT Selector button increases the level
6	IN Buttons	Select the VGA/XGA input to switch to the VGA/XGA output (from 1 to 16)
7	OUT Buttons	Select the VGA/XGA output ¹ to which the VGA/XGA input is switched (from 1 to 16)

1 It is fully enclosed on all sides, 2 inches deep, and includes a small processor board that performs the button functions and provides the Ethernet interface

2 When the panel is powered ON, this button is OFF. Pressing this button will cause that button to latch ON. Pressing the same button again will turn off this button. If either button is in the ON mode, pressing the other button will turn OFF the first button (both buttons on, is an invalid condition). If both buttons are pressed at the same time, both buttons turn OFF ("AFV") and then re-selecting the desired button is required to turn ON that mode. When the video and audio sources are different, the audio input lamp flashes on and off to indicate "breakaway"

3 The VOL UP button takes precedence over the VOL DOWN button if both are pressed. The VOL UP and VOL DOWN buttons illuminate when pressed, but do not cause the Input Selector or Output Selector buttons to illuminate

Table 7: RC-1616 Remote Control Rear Panel Features

#	Feature	Function
1	9V DC 1A Connector	+9V DC connector for powering the unit ²
2	Ethernet 10 Base T Port	Connects to the LAN (used for remote panels and other types of Ethernet control)

6.2 The RC-1616 Front Panel Detached

The detached **RC-1616** front panel connects via a flat cable to the main switching module inside the **RC-1616**.

Figure 9 and Table 8 define the **RC-1616** with its front panel detached³:

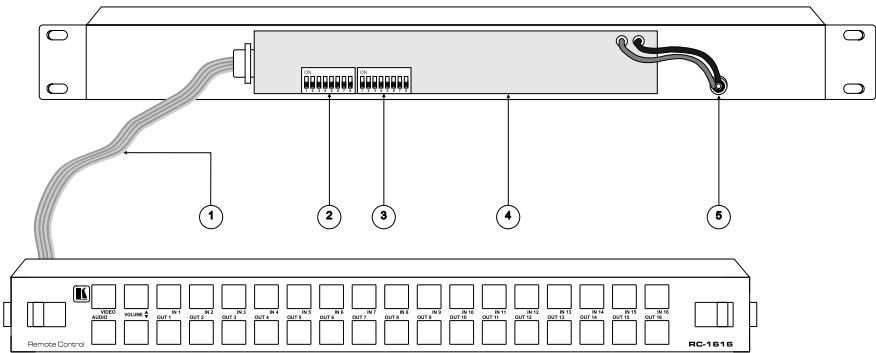


Figure 9: RC-1616 Remote Control with its Front Panel Detached

Table 8: RC-1616 Front View with Front Panel Detached Features

#	Feature	Function
1	9-wire Ribbon Flat Cable with DB9M connectors	Connects the circuitry on the (detached) front panel to the main electronics module
2	Dipswitches (first set 1 to 8 is named: S1-1 to S1-8) ⁴	Set the panel's network address ⁵ (by default, set to OFF)
3	Dipswitches (second set 1 to 8 is named: S2-1 to S2-8) ⁴	Determine the single bus or the "XY" operation, as well as the video and audio control levels (see section 6.2.1)

1 Each output can be muted independently; and can be set to a delayed switch through black, with a user selectable delay increment for each output

2 Connect to an external 'desk-top' universal AC input power supply

3 Slide-in units held in place by latches to prevent accidental disconnection in mobile installations

4 You can access the dipswitches without removing the unit from its rack, as they are located inside the panel. You can access them by unfastening the front panel via the slide action latches (item 1 in Figure 8)

5 These dipswitches have a dual purpose. There are two groups of 256 network addresses (512 in total). When the panel type is 'XY' S1 to S8, select network addresses 1 to 256. When the panel type is 'Single bus' (determined by the setting of S2-1 – refer to section 6.2.1), S1 through S5 serve a dual purpose. S1 through S5 select the OUTPUT bus controlled by that panel and S1 through S5 select the 5 LSBs of network address 257 through 512. When the scan determines that the panel is a single bus type panel, S1-6, S1-7 and S1-8 are the three MSB's of the panel's network address. This scheme puts a limit of 8 single bus panels that can be set to the same output

#	Feature	Function
4	Main Switching Module	Provides easy accessibility for service and repair
5	Power Wires	The red wire connects to the "+9V" and the black wire connects to the "GND"

6.2.1 Setting the Dipswitches

You need to set the dipswitches when using more than one **RC-1616** remote panel. Configure the **RC-1616** unit by setting the dipswitches, as Table 9 and Table 10 define:

Table 9: Dipswitch Definitions S2-1 to S2-8

DIP	Set as follows:
S2-1	ON for Single bus operation, OFF for "XY" operation
S2-2, S2-3, and S2-4	OFF (not in use)
S2-5, S2-6, S2-7, and S2-8	Select the levels controlled by the panel (see Table 10)

Table 10: Dipswitch Settings (Levels controlled by the Panel)

S2-5	S2-6	S2-7	S2-8	Levels controlled by the Panel
OFF	OFF	OFF	OFF	Not a valid situation
ON	OFF	OFF	OFF	This panel only controls Level 1 ¹
OFF	ON	OFF	OFF	This panel only controls Level 2 ¹
OFF	OFF	ON	OFF	This panel only controls Level 3 ¹
OFF	OFF	OFF	ON	This panel only controls Level 4 ¹
ON	ON	OFF	OFF	'Video' controls Level 1. 'Audio' controls Level 2
OFF	ON	ON	OFF	'Video' controls Level 2. 'Audio' controls Level 3
OFF	OFF	ON	ON	'Video' controls Level 3. 'Audio' controls Level 4
ON	OFF	ON	OFF	'Video' controls Level 1. 'Audio' controls Level 3
ON	OFF	OFF	ON	'Video' controls Level 1. 'Audio' controls Level 4
OFF	ON	OFF	ON	'Video' controls Level 2. 'Audio' controls Level 4
ON	ON	ON	OFF	'Video' controls Level 1 and 2. 'Audio' controls Level 3
ON	ON	OFF	ON	'Video' controls Level 1 and 2. 'Audio' controls Level 4
OFF	ON	ON	ON	'Video' controls Level 2. 'Audio' controls Level 3 and 4
ON	OFF	ON	ON	'Video' controls Level 1. 'Audio' controls Level 3 and 4
ON	ON	ON	ON	'Video' controls Level 1 and 2. 'Audio' controls Level 3 and 4

¹ Any 'Audio', 'Video Only', 'Audio Only', 'AFV' or separate 'Audio IN' buttons in this situation do not function. When a user wants to designate one of the above levels as audio, the legend in the switch (switches) may be changed accordingly

7 Connecting a RC-1616 Remote Control

To connect a single **RC-1616 Remote Control**, do the following:

1. Connect the **RC-1616** 10 Base T port to the LAN, see section 5.3.
2. Detach the **RC-1616** front panel by unfastening the slide action latches (see item 1 in Figure 8) and set the dipswitches (see section 6.2.1).
3. Connect the 9V DC 1A power adapter (wall transformer) to the 9 V DC socket and connect the transformer to the mains electricity.

You can connect up to 512 **RC-1616 Remote Control** units to a single **VP-128H Matrix Switcher** via the Ethernet (see Figure 10):

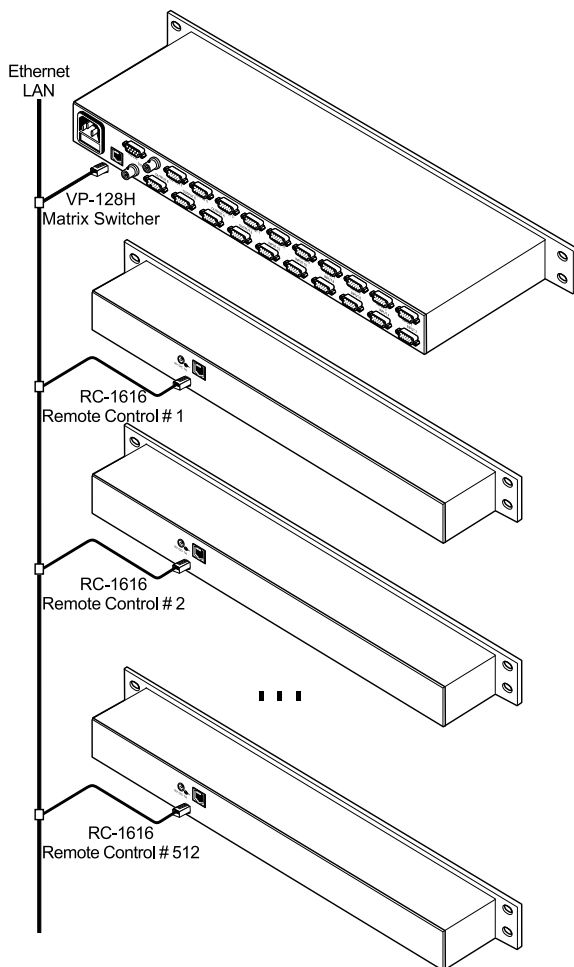


Figure 10: Connecting up to 512 RC-1616 Remote Control Units to a VP-128H

8 Operating the VP-128H Matrix Switcher

Operate your **VP-128H** via:

- The front panel buttons
- Remotely, by 10 Base T Ethernet and/or RS-232 serial commands transmitted by a touch screen system, PC, or other serial controller
- Remotely, from any one of up to 512 **RC-1616** remote control panels

8.1 Choosing the Audio-Follow-Video or Breakaway Option

The **VP-128HA** is a 2RU form of the **VP-128H** with audio, and has a 25-pin connector, which is used to link frames together. When using the **VP-128HA**:

You can switch stereo audio signals in one of two ways, either:

- Audio-follow-video (AFV), in which all operations relate to both the video and the audio channels (the audio will follow the video); or
- Breakaway, in which video and audio channels switch independently

8.1.1 Setting the Audio-Follow-Video Option

The **VP-128HA** operates in the Audio-follow-video (AFV) mode when the VID ONLY and the AUD ONLY buttons are both off¹.

8.1.2 Setting the Breakaway Option

When the video and audio sources are different, the audio input lamp flashes ON and OFF to indicate “breakaway”.

To set the Breakaway option:

1. Press either the AUD ONLY (for audio control only) or the VID ONLY (for video control only) button.
2. If the AUD ONLY button illuminates, switching relates to audio.
3. If the VID ONLY button illuminates, switching relates to video.

¹ To turn both buttons (VID ONLY and AUD ONLY) off, press both buttons at the same time

8.2 Switching OUT-IN Combinations

To switch an input to an output, do the following:

1. Press an OUTPUT SELECTOR¹ button².
The button lights.
2. Press an INPUT SELECTOR³ button².
The button lights.

8.2.1 Operating in the AT ONCE Mode

The **VP-128H** only operates in the AT ONCE mode (that is, there is no CONFIRM mode option) and pressing an OUT-IN combination implements the switch immediately.

1 If the selected output is 'locked' the lamp in the output button flashes and the correct input status is tallied via the input select button

2 This button operates in the 'one out of n' mode. When a button is pressed the previous button is cleared and the new selection is latched and tallied

3 When an output is selected the current state of the corresponding input is tallied in the appropriate button. If the source is a breakaway, a flashing lamp indicates the audio selection. If the output being controlled is locked, pressing the input select button has no affect

9 Technical Specifications

Table 11 includes the technical specifications:

Table 11: Technical Specifications¹ of the VP-128H

INPUTS:	12 analog red, green, blue signals - 0.7 Vpp / 75Ω; H & V syncs, TTL level on HD15F connectors. The H and V channels are not TTL, they are linear
OUTPUTS:	8 analog red, green, blue signals - 0.7 Vpp / 75Ω; H & V syncs, TTL level on HD15F connectors. The H and V channels are not TTL, they are linear
MAX. OUTPUT LEVEL:	+/- 1.5V
BANDWIDTH (-3dB):	315MHz, Fully Loaded
DIFF. GAIN:	< 0.06 %
DIFF. PHASE:	< 0.17 deg.
K-FACTOR:	<0.05%
S/N RATIO:	60dB weighted to 5MHz
CROSSTALK (all hostile):	> 45dB@150MHz
CONTROLS:	24 front panel switches, RS-232
COUPLING:	DC
POWER SOURCE:	90-240VAC 47-63Hz, 120mA AC
DIMENSIONS:	48.3cm x 30.5cm x 4.5cm (19-inch x 12-inch x 1U, W, D, H) rack mountable
WEIGHT:	5.5 kg. (12.2 lbs.) approx.
ACCESSORIES:	Power cord, Null modem adapter, Control software

¹ Specifications are subject to change without notice

10 Communication Protocols

The **VP-128H** is compatible with the Kramer 2000 Protocol Supported Subset (see section 10.1), the Sierra Video Systems (SVS) RS-232 Compatible Protocol (see section 10.2), and the Generic Protocol Supported Subset (see section 10.3), as well as with the Ethernet Protocol Document (see section 10.4).

The following commands (as defined in in Table 12) are used to switch between ASCII protocols and Protocol 2000:

Table 12: RS-232 Commands for Selecting Different Protocols

<div> <div>To Protocol →</div> <div>From Protocol ↓</div> </div>	Protocol 2000	Generic Protocol	Sierra Protocol
Protocol 2000		0x38 0x80 0x82 0x81	0x38 0x80 0x81 0x81
Generic Protocol	A1<Enter>		A2<Enter>
Sierra Protocol	*CHANGE HEX!	*CHANGE NORT!	

10.1 Kramer 2000 Protocol Supported Subset

This RS-232 communication protocol uses four bytes of information as defined below. The default data rate is 9600 baud, with no parity, 8 data bits and 1 stop bit.

MSB

LSB

	DESTINATION	INSTRUCTION					
0	D	N5	N4	N3	N2	N1	N0
7	6	5	4	3	2	1	0

1st byte

	INPUT						
1	I6	I5	I4	I3	I2	I1	I0
7	6	5	4	3	2	1	0

2nd byte

	OUTPUT						
1	O6	O5	O4	O3	O2	O1	O0
7	6	5	4	3	2	1	0

3rd byte

	MACHINE NUMBER						
1	OVR	X	M4	M3	M2	M1	M0
7	6	5	4	3	2	1	0

4th byte

D – “*DESTINATION*”: 0 - for sending information to the switchers;
 1 - for sending to the PC (from the switcher).
N5...N0 – “*INSTRUCTION*”

I6...I0 – “INPUT”.

06...00 – “OUTPUT”.

M4...M0 – MACHINE NUMBER.

For a single machine controlled via the serial port, always set M4...M0 = 1, and make sure that the machine itself is configured as MACHINE NUMBER = 1.

10.1.1 Use of Kramer Machines

A router may be represented via the Kramer protocol as a maximum of two machines. Based on the largest supported, 8 level switcher, the levels correspond accordingly:

Level	Machine #	Function
1	1	Video
2	2	Video
3	1	Audio
4	2	Audio
5	1	RGB Mute
6	2	RGB Mute
7	1	Audio Levels
8	2	Audio Levels

Parameter Terminology:

Setups - Setup # 0 refers to the present switcher status. Setup # 1 and higher are the settings saved in the switchers memory, (i.e., those used for store and recall).

Bi-Directional - specifies a bi-directional command. If the switcher receives the code, it will perform the instruction; if the instruction is performed, the switcher will use the same codes for its response.

10.1.2 Command Details

“Switch Video”: Switch Video Crosspoint”

Request: 0x01 <input> <output> <machine>

Response: 0x41 <input> <output><machine>

Action: Set output to input

The “Switch Video” command is used to request that a connection be made. Input and output are specified in hexadecimal notation. If 0 is specified for output, all outputs will be switched to the specified input. If 0 is specified for input, the specified output will be disconnected (Video Mute). Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x01 0x85 0x88 0x81	Connect video input 5 to output 8
Response From Switcher	0x41 0x85 0x88 0x81	Video input 5 connected to output 8

“Switch Audio”: Switch Audio Crosspoint”

Request: 0x02 <input> <output> <machine>

Response: 0x42 <input> <output><machine>

Action: Set output to input

The “Switch Audio” command is used to request that a connection be made. Input and output are specified in hexadecimal notation. If 0 is specified for output, all outputs will be switched to the specified input. If 0 is specified for input, the specified output will be disconnected (Audio Mute). Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x02 0x85 0x88 0x81	Connect audio input 5 to output 8
Response From Switcher	0x42 0x85 0x88 0x81	Audio input 5 connected to output 8

“Request Video Output Status”

Request: 0x05 <setup#> <output> <machine>

Response: 0x45 <setup#> <input><machine>

Action: Request status of Output

The “Request Video Output Status” command is used to request the current input connected to a specified output. This allows clients to poll the current status of the switcher. Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x05 0x80 0x88 0x81	Request video input on output 8
Response From Switcher	0x45 0x80 0x85 0x81	Video input 5 is connected

“Request Audio Output Status”

Request: 0x06 <setup#> <output> <machine>

Response: 0x46 <setup#> <input> <machine>

Action: Request status of Output

The “Request Audio Output Status” command is used to request the current input connected to a specified output. This allows clients to poll the current status of the switcher. Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x06 0x80 0x88 0x81	Request video input on output 8
Response From Switcher	0x46 0x80 0x85 0x81	Video input 5 is connected

Setup Save”: Store / Delete Video Status

Request: 0x03 <setup#> <options> <machine>

Response: 0x43 <setup#> <options> <machine>

Action: Saves or deletes a Setup

The “Setup Save” command can be used to either save a setup based on the current switcher status, or to erase an existing setup.

Options:

1 – Save

0 – Delete

Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x03 0x81 0x81 0x81	Save current status to setup location 1
Response From Switcher	0x43 0x81 0x81 0x81	

“Setup Recall”

Request: 0x04 <setup#> 0x00 <machine>

Response: 0x44 < setup#> 0x00 <machine>

Action: Recalls a setup to the active status

The “Setup Recall” command is used to recall an existing setup. Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x04 0x81 0x80 0x81	Recall setup location 1
Response From Switcher	0x44 0x81 0x80 0x81	Setup location 1 recalled

“Breakaway Setting”: Audio follows video

Request: 0x08 <command> <value> <machine>

Response: 0x48 <command> <value> <machine>

Action: Sets breakaway switching behavior

The “Breakaway Setting” runs in two command modes. Specifying a 0 for the command parameter gives you value options 0 for “Audio-Follows-Video” and 1 for “Audio Breakaway”. Specifying a 1 for the command parameter gives you value options 0 for “Follow Mode” and 1 for “Normal Mode”. Follow mode is used when several different types of routers (RS-422, AES/EBU etc.) will all follow each other, not just video and audio units. Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x08 0x80 0x80 0x81	Enables “Audio follow video” mode
Response From Switcher	0x48 0x80 0x80 0x81	“Audio follow video” enabled

“Request Breakaway Setting”*Request: 0x0b <setup#> <value> <machine>**Response: 0x4b <setup#> <response> <machine>**Action: Request breakaway switching setting*

The “Request Breakaway Settings” command is used to poll either the current breakaway configuration of the switcher, or a setup breakaway configuration. Specifying a value parameter of 0 requests current audio breakaway setting, and a value parameter of 1 requests the “follow” setting. Breakaway switching / follow is stored in setups. Example:

	Command	Meaning
Command To Switcher	0x0b 0x80 0x80 0x81	Request current breakaway setting
Response From Switcher	0x4b 0x80 0x81 0x81	Audio currently in breakaway mode

“Error Response”*Request: Not Valid**Response: 0x50 0x00 <error> <machine>**Action: Response sent to client from switcher*

The “Error Response” is used by the switcher to send error messages to the client. An error code is returned to the PC if an invalid instruction code was sent to the switcher, or if a parameter associated with the instruction is out of range (e.g., trying to save to a setup greater than the highest one, or trying to switch an input or output greater than the highest one defined). Reception of this code by the switcher is not valid. The error value can be any of the following values:

Error:

0 – Error

1 – Invalid Instruction

2 – Out of Range

3 – Machine Busy

Example:

	Command	Meaning
Command To Switcher		
Response From Switcher	0x50 0x80 0x82 0x81	Out of Range error message

“Store Audio Status”

Request: 0x13 <setup#> <value> <machine>

Response: 0x53 <setup#> <value> <machine>

Action: Saves current audio status to specified setup

The “Store Audio Status” is used to manage audio status in setups. Specifying a value of 0 for “value” will store the existing audio crosspoint status to a specified setup number. Specifying a value of 1 for “value” will delete the current audio information stored in the specified setup. This command will overwrite any existing audio settings in the specified setup. Example:

	Command	Meaning
Command To Switcher	0x13 0x85 0x80 0x81	Store current audio status to setup 5
Response From Switcher	0x53 0x85 0x80 0x81	Audio setup 5 stored

“Recall Audio Status”

Request: 0x14 <setup#> 0x00 <machine>

Response: 0x46 <setup#> 0x00 <machine>

Action: Restores audio status from specified setup

The “Recall Audio Status” command loads the audio settings in a specified setup to the current switcher crosspoints. Example:

	Command	Meaning
Command To Switcher	0x14 0x85 0x80 0x81	Recall audio setup 5
Response From Switcher	0x54 0x85 0x80 0x81	Audio setup 5 recalled

“Set Audio Parameter”

Request: 0x16 <input/output> <value> <machine>

Response: 0x56 <input/output> <value> <machine>

Action: Sets an audio parameter of a specified input/output

The “Set Audio Parameter” command is used to directly set a parameter on an input or output. This command is precluded by an “Audio Parameter Settings” command, used to set further properties for this command. Bi-Directional command example:

	Command	Meaning
Command To Switcher	0x16 0x85 0xff 0x81	Sets Audio Gain to 127 on in/out 5
Response From Switcher	0x56 0x85 0xff 0x81	In/out 5 has a value of 127

“Request Audio Parameter”

Request: 0x19 <input/output> 0x00 <machine>

Response: 0x59 <input/output> <value> <machine>

Action: Request an audio parameter of a specified input/output

The “Request Audio Parameter” command is used to retrieve a parameter on an input or output. This command is precluded by an “Audio Parameter Settings” command, used to set further properties for this command.

Example:

	Command	Meaning
Command To Switcher	0x19 0x85 0x00 0x81	Request audio parameter for in/out 5
Response From Switcher	0x59 0x85 0xff 0x81	In/out 5 has a value of 127

“Increase / Decrease Audio Parameter”

Request: 0x18 <input/output> <value> <machine>

Response: None

Action: Increases or decreases a specified audio parameter

The “Increase / Decrease Audio Parameter” command is used to adjust input or output values on the left, right, or both audio channels. This command is precluded by an “Audio Parameter Settings” command, used to set further properties for this command. Use the table below for value options.

Value:

- 0 – Increase Output
- 1 – Decrease Output
- 2 – Increase Left Output
- 3 – Decrease Left Output
- 4 – Increase Right Output
- 5 – Decrease Right Output
- 6 – Increase Input
- 7 – Decrease Input
- 8 – Increase Left Input
- 9 – Decrease Left Input
- 10 – Increase Right Input
- 11 – Decrease Right Input

Example:

	Command	Meaning
Command To Switcher	0x18 0x85 0x80 0x81	Increase output value on output 5
Response From Switcher		

“Audio Parameter Settings”

Request: 0x2A <input bits> <value> <machine>

Response: None

Action: Set Parameters for the next command

The “Audio Parameter Settings” command is used to provide further information for the “Request Audio Parameter”, “Increase / Decrease Audio Parameter”, and “Set Audio Parameter” commands. Use the table below for input bit and value options.

Input Bits:

0 – (0 = Input; 1 = Output)

1 – 1 = Left

2 – 1 = Right

Value:

0 – Gain

Example:

	Command	Meaning
Command To Switcher	0x2a 0x86 0x80 0x81	Selected Gain on left & right input
Response From Switcher		

“Set Auto-Save”

Request: 0x39 <save> 0x00 <machine>

Response: 0x79 <save> 0x00 <machine>

Action: Enable / disable auto save feature

The “Set Auto-Save” command is used to disable the saving of switcher status at power down. This value is stored in volatile memory. At each startup, auto set is automatically enabled. If bits 3 and 4 are set in the save parameter, auto save will be enabled.

Save Bits:

Bit 3 – (1 = No Save)

Bit 4 – (1 = Save)

Example:

	Command	Meaning
Command To Switcher	0x2a 0x84 0x80 0x81	Enable Auto Save
Response From Switcher	0x79 0x84 0x80 0x81	Auto Save Enabled

“Execute Loaded Data”

Request: 0x3A <setup#> <value> <machine>

Response: None

Action: Commits current cached crosspoint information

The “Execute Loaded Data” command is used in conjunction with the “Load Video Data” and “Load Audio Data” commands to commit loaded crosspoint information to the actual running status, or to a specified setup location. Setting the “setup #” parameter to 0 writes cached crosspoint information to running status.

Value:

- 1 – Take
- 2 - Cancel

Example:

	Command	Meaning
Command To Switcher	0x3a 0x85 0x81 0x81	Store current cached info to setup 5
Response From Switcher		

“Load Video Data”

Request: 0x3B <input> <value> <machine>

Response: None

Action: Cache video crosspoint changes for later execution

The “Load Video Data” command is used to write a crosspoint change into cache for later recall using the “Execute Loaded Data” command. The “input” parameter can be a specified input to set (0 = Disconnect), or can be set to a value of 127 to specify a setup location. Depending on the value set for “input”, “value” is either a video output (0 = All Outputs), or a setup location. Example:

	Command	Meaning
Command To Switcher	0x3b 0xff 0x85 0x81	Load setup 5 video data into cache
Response From Switcher		

“Load Audio Data”

Request: 0x3C <input> <value> <machine>

Response: None

Act Action: Cache audio crosspoint changes for later execution

The “Load Audio Data” command is used to write a crosspoint change into cache for later recall using the “Execute Loaded Data” command. The “input” parameter can be a specified input to set (0 = Disconnect), or can be set to a value of 127 to specify a setup location. Depending on the value set for “input”, “value” is either an audio output (0 = All Outputs), or a setup location. Example:

	Command	Meaning
Command To Switcher	0x3c 0xff 0x85 0x81	Load setup 5 audio data into cache
Response From Switcher		

“Define Machine”

Request: 0x3D <command> <options> <machine>

Response: 0x7D <command> <response> <machine>

Action: Gets machine physical configuration information

The “Define Machine” command is used to request information about a specified machine’s physical configuration. See “command” and “options” below for specific configuration information.

Command:

- 1 – Number of inputs
- 2 - Number of outputs
- 3 – Number of setups

Options:

- 1 – For video
- 2 – For audio

	Command	Meaning
Command To Switcher	0x3d 0x81 0x82 0x81	Requests the number of audio inputs
Response From Switcher	0x7d 0x81 0x90 0x81	16 inputs

10.2 Sierra Video Systems¹ (SVS) RS-232 Compatible Protocol

Target hardware application: the protocol is designed to be compatible with most existing applications that have driven the RS232 port on SVS routers. In some cases commands have been shortened and should be compatible with all SVS external drivers. The protocol only uses one command format to set crosspoints, on format to load setups and one for the structure of all reply messages.

10.2.1 Command Details I

"Clear": Clear Matrix

"Config" Configure system (requires 4 digit password)

"Change" Change from this protocol to another protocol

"X": Connect Crosspoint

"D": Delay Vertical Sync Intervals

"P": Setup a Salvo Connect Sequence

"T": Trigger a Salvo Connect Sequence

"A" Audio gain controls

"M" RGB Mute switching time

"S": Status Inquiry

"U": Automatic Output Change Reporting On/Off

"?" Query

"E" Error messages

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.

A command string consists of a leader asterisk character, zero or more commands, and a trailer character, an exclamation mark. When a command string is received, it is not acted upon until the final trailer character (!) of the command string is received. At that time, the routing switcher executes 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. Alphabetic characters within the command string may be in either upper-case or lower-case letters. The router always sends upper case characters. When sending commands to the router, SPACE characters are optional, but if used should only appear before and after each individual command and NOT embedded within an individual command.

¹ A Kramer Electronics company

Just before the router begins executing a command string, it sends a leader character (asterisks) to the host. As it executes the commands, some commands call for a response back to the host. Many of these strings contain <CR> characters within the string in order to make the message more human readable when viewed as raw data as would be the case when emulating a terminal. Software written to drive these routing switchers may ignore all spaces and <CR> characters in reply strings. After the command string has been executed, the routing switcher returns the string " ****OK!!** " followed by a trailer character (!) and a <CR> (carriage return, ASCII 0D) character, to the host. This indicates that the command has executed successfully. 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>**

All responses from the router to the host begin with the asterisk character and end with the exclamation character. In addition many response strings end with a <CR> character. Status messages for multiple outputs from the router to the host are delimited with a <CR> at the end of the data for each output and before the beginning of data for the next output. When viewing the response this produces easy to read data in columns. When read as part of a driver program, these <CR> characters can be ignored if desired.

10.2.2 Command Details II

"Clear": Clear Matrix

*Request: **CLEAR!!*

*Response: **OK!!<CR>*

Action: Clear entire router matrix.

The command "**CLEAR**" requests that the switch matrix be cleared so that all outputs are disconnected from inputs (in routers where this is possible) or else all outputs at all levels have input #1 as their source (when disconnecting is not possible). If output locks are supported, all output locks are removed by this command. This command can take several seconds to execute (depending on the size of the switch matrix), and therefore the OK response at the end of the command string could be quite late. 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>**

This command only clears the crosspoint settings. Any data stored in the setup memory space or the values from the audio gains are not changed by this command. In order to clear or reset these values, the following additional types or clear commands are used:

"Config": Configure Matrix

*Request: **CONFIG1234 , oo , ii , l , f1 , f2!!*

The Configuration command is protected with a four-digit password (1234 in the above example is a placeholder). The command tells the software the size of the switching matrix, the number of levels and several special functions such as the assignment of levels used for RGB muting and audio gain controls. Like the clear commands explained above, the configure command must begin with the six letters CONFIG, upper or lower case and without spaces between the letters. The present software will accept output values from 1 to 64 (oo) and input values from 2 to 64 (ii) and level values up to 8 (l). f1 and f2 are eight bit (0-255) flag values that can be used to define special system operations. They are normally sent as 000 and 000.

The Config command must have all six arguments in order to affect a change in the router configuration.

Note: changing the router configuration with this command does not change the contents of the non-volatile memory that stores the router's current state or the contents of the setup registers. Most routers are based on an eight level scheme. When the configuration flags are both set to 000 and 000, the eight levels are used as follows:

Level 1. First video level. If the router is an RGBHV router this level is used for RGBHV.

Level 2. Second video level. This video level can be another RGBHV level or it can be composite video or SDI video, etc.

Level 3. First stereo audio level. The crosspoint hardware will switch left and right channels together as one level.

Level 4. Second stereo audio level. The crosspoint hardware will switch left and right channels together as one level.

Level 5. Used to effect RGB mute switching in conjunction with Level 1.

Level 6. No assignment – can be used as a video or audio channel as needed.

Level 7. Used in conjunction with level 3 to effect remote control of audio levels.

Level 8. Used in conjunction with level 4 to effect remote control of audio levels.

For other uses of the eight levels and other future features, either the first or second or both flag values will be non-zero.

When the router has received a valid Config command and after it has reconfigured itself accordingly, the router sends the following response message:

***CONFIGURATION <CR>**

OUTPUTS (oo) <CR>

INPUTS (ii) <CR>

LEVELS (l) <CR>

FLAG 1(nnn)<CR>

FLAG 2(nnn)!

In addition when the router is powered up the message above is sent with one of two added lines:

Crosspoints restored from memory!

or

Crosspoint restore failed!

The last flag in this situation is followed by a <CR> in place of the ! character.

"Change": Change protocol

*Request: **CHANGE HEX!!*

or

***CHANGE NORT!!*

The Change commands are used to exit from this protocol to either the Kramer 2000 protocol or the Generic protocol. When used with the Kramer 2000 protocol the system appears as a maximum of two machines.

Tentatively the eight levels are:

Level 1: Machine 1 video

Level 2: Machine 2 video

Level 3: Machine 1 audio

Level 4: Machine 2 audio

Level 5: Machine 1 RGB Mute

Level 6: Machine 2 RGB Mute

Level 7: Machine 1 audio levels

Level 8: Machine 2 audio levels

When using the "NORT" protocol the system appears as only levels one through four as follows:

Level 1: Video crosspoint control

Level 2: Audio crosspoint control

Level 3: RGB Mute

Level 4: Audio levels

"X": Connect Crosspoint

*Request: **X!! out,in,lvl*

*Response: **OK!! or an 'Update' message when updates are turned on.*

Action: Make a connection to an output on a level.

The command "X" is used 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(s).

For example, the command:

****X24,13,2!!**

says that a connection is to be made between output 24 and input 13 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!!**

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

The above structure of the x command is 100% compatible with all SVS routers. Expanding on this, this protocol can address more than one level identity in a single message. For example:

****X8,3,2,3,4!!**

Tells the router to switch output 8 to input 3 on levels 2, 3 and 4 while leaving level 1 unchanged.

Or

****X8,3,2,3,4X8,7,1!!**

Tells the router to switch output 8 to input 3 on levels 2, 3, 4 and to switch level 1 to input 7.

"D": Delay Vertical Sync Intervals

*Request: !D numsyncs**

*Response: **OK! !<CR>*

Action: Delay a number of 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:

****X1,5,0 D200 D100 X1,6,0 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. Note: the spaces shown in the string above are optional.

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.

"P": Setup a Salvo Connect Sequence

*Request: **P reg connect connect ... ~!!*

*Response: **OK!!<CR>*

Action: Store a list of connect commands in a salvo register.

The command "P" is used to set up a salvo, which is a series of connect commands for later execution with the "T" command (see below). It must be followed by a register letter from A to Z giving the register into which the connect sequence is to be stored, followed by zero or more connect commands followed by a "~" (tilde) character. For example, the command:

****PB X2,5,0 x1,7,0 ~ !!**

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).

The connect commands do not take effect until the register is triggered using the "T" command below.

The contents of each setup register is determined by one message string. If a second string is sent to the same register, the first message is ignored and overwritten by the second message.

To clear a setup the host can send:

****PB ~ !!**

The tilde in the above examples is for compatibility with existing SVS drivers. It may be omitted if desired without causing errors. Likewise the spaces in the above command string examples may be omitted.

"T": Trigger a Salvo Connect Sequence

*Request: **T reg!!*

*Response: **OK!!<CR>*

Action: Trigger a list of connect commands stored in a salvo register.

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

For example, the command:

****TB D180 TC!!**

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

When the Updates mode is turned on and a salvo connect sequence is triggered the only reply is as noted above.

If the command:

****TB? D180 TC?!!**

Is sent to the router instead, two full crosspoint status messages will be sent. Each with its own * and ! delimiters. If setup C contains changes to setup B, the two status reports will indicate both switch changes to the same output buses.

"A" : A Command Audio Gain Control

The "A" commands are used to change the audio input or output gain values. The gain values can be set to an absolute value, incremented up or down.

In a A command the A must be followed by an I or O to designate input or output then the number of that input or output followed by a comma. Then a L or R to designate left or right. This combination is then either followed by a U to indicate increment up one step, a D to indicate increment down by one step or a number between 0 and 255 indicating the absolute value of the gain. Where 127 is unity gain, 0 is mute or minimum gain and 255 maximum gain. Like all other commands the A command either ends with a <CR> or it can be strung in a multiple command string, which may include multiple gain settings executed in a 'stack-and-load' sequence.

Example:

****AI2,L150!!** means Input 2, left channel set to a gain of 150.

Or:

****AO4,LD!!** means decrease the gain of output 4 left channel by 1/256th.

Changes in audio gains are NOT reported when Updates is turned on. Doing so would cause the router to send to the host long strings as panel operators turned up and down the volume. The query (?) command works for the A commands in the same way it operates on the X commands.

When the configuration message flags are both set to 000, the action of these gain commands is upon the audio channel connected to hardware level 3 and effected via level 7.

If there is more than one level with variable audio, possibly levels three and four, then a different configuration flag configuration if required and the A command must specify which audio path levels are being addressed.

M Command (RGB Mute delay)

Purpose: The M command is used to set the delay time for RGB 'mute' switching. It can be set to a different value for each output. This parameter is stored in non-volatile memory when the power is turned off. It is not stored in the individual setup registers.

Example:

****M3,5!!** means switching on output bus 3 will have a 2.5 second mute delay.

The delay is in increments of 1/2 second. A value of 0 means there is no RGB delay mode and the RGBHV channels all switch together to the new source.

Like the A command the M command, with configuration flag values 000,000 operates levels 1 and 5 to achieve control of the RGB and HV channels.

For other configuration flag values, the M command may require the inclusion of which level is being controlled.

"S": Status Inquiry for Crosspoints

*Request: **S!!*

The command "S" requests that matrix status information be returned to the host. The reply from the router to the host is with a list of all outputs and all inputs connected to the outputs.

The number of lines of data in the list is equal to the number of outputs as set up by the Configuration command explained later.

The number of columns in the list is also set by the Configuration command. The configuration command determines the number of levels.

The default sequences across each line of the status message is:

Output number – comma

level 1 input number – comma

.

.

.

level 8 input number– comma <CR>

At the beginning of the first line the router sends an asterisk and after the last line the router sends an exclamation !.

"SA": Status Inquiry for Audio gains

*Request: **SA!!*

The command "SA" requests the status information for all audio gain values be returned to the host. The reply from the router to the host is with a list of all output and all input gain values. The number of lines of data in the list is equal to the number of outputs plus the number of inputs as set up by the Configuration command explained later. The number of columns in the list is also set by the Configuration command. The configuration command determines the number audio channels. The default sequences across each line of the status message is:

Output number – comma

left level– comma

right level<CR>

Then:

Input number – comma

left level– comma

right level<CR>

At the beginning of the first line the router sends an asterisk and after the last line the router sends an exclamation !.

The example above is for a typical system with one stereo audio path. For systems with more than one stereo audio path, each line within the list will have the next channel's left and right gains and so on for whatever number of channels the system may have. The audio level is a number from 0 to 255.

When a system with no audio gain registers is queried by the "SA" command the router may respond with: !* which indicates that there is no data

"U": Automatic Output Change Reporting On/Off

*Request: **U!! { 0 | 1 | 2 }*

Response: (none)

Action: Turn automatic output change reporting off or on.

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 or 2: Automatic output change reporting is turned on, and crosspoint change commands immediately report changed.

Output change reports are automatic messages sent to the host whenever an output's crosspoint status (i.e. connected source) is change via either the local control panel or via some other port such as Ethernet.

Changes are reported in the same structure as described for the S command, except there may be fewer lines to the report.

For example, the command:

****U1!!**

turns on automatic output change reporting. The format of crosspoint reporting is the same for U, S and ? messages.

"?": Query command

*Request: **X5?!!*

*Response: **5,3,3,3,3!!<CR>*

Action: The status of the previous command is requested.

The "?" Query can be added in a command string to cause a response back to the host with selected status information.

The ? command can be placed in a shortened X command as illustrated below to give the status of a single output.

****X5?!!**

The ? command can be put at the end of a valid X command to give the status of a switch after it is made. Such as

****X5,4,1?!!**

In which case the response will confirm that that the above crosspoint selection has been effected. Or it can be used multiple times in a command string:

****X6?X5,4,1?!!**

Is responded to with two messages that will report the status of output 6 and then output 5.

****PA?!!**

Will cause a response string in the same format as used for an S command response, except the data reported is the contents of a setup register A rather than a the status of the current crosspoint configuration. These messages may only contain as many lines of configuration information as stored in the setup register and the order presented is the order in which they have been loaded into the setup.

"E": Error messages (from the router to the host) command

*Response: **E1!!<CR>*

The router produces a number of possible error messages. They are:

E1 means invalid command (other than the specific errors listed below)

E2 means invalid input number

E3 means invalid output number

E4 means invalid configuration password

E5 means invalid level number

E6 through E9 reserved for future use

10.3 Generic Protocol Supported Subset

This RS-232 communication protocol uses a default data rate of 9600 baud, 8 data bits, and 1 stop bit.

10.3.1 Use of Generic Machines

A router may be represented via the Kramer protocol as a maximum of two machines. Based on the largest supported, 8 level switcher, the levels correspond accordingly:

Level	Function
1	Video Crosspoint
2	Audio Crosspoint
3	RGB Mute
4	Audio Levels

10.3.2 Command Details

“Reconfig”: Router Manual Reconfiguration Indicator

Request: None

Response: RECONFIG<CR><LF>

Action: Indicates manual router crosspoint change has been performed via an interface other than the serial client.

“RECONFIG” is a switcher initiated message indicating that a user has adjusted the current configuration of the switcher by a front panel or remote panel interface. Example:

	Command	Meaning
Command To Switcher		
Response From Switcher	RECONFIG<CR><LF>	Manual status change

“RGB Delay”:

Request: <delay><output>D*

Response: Out<output> Dly<delay><CR><LF>

Action: Sets the RGB interval for switches on a specified output.

The “RGB Delay” command is used to set a delay in seconds, from 0 to 10, in .5 second increments.

Examples

	Command	Meaning
Command To Switcher	7*13D	Set 3.5 second delay on out 13
Response From Switcher	Out13 Dly07<CR><LF>	3.5 second delay on out 13
Command To Switcher	13D	Request delay on out 13
Response From Switcher	Out 13 Dly05<CR><LF>	2.5 second delay on out 13

“Audio Input Gain and Attenuation”:

Request: <input><gain>G*

Response: In<input> Aud=<dB Value><CR><LF>

Action: Sets audio gain to a positive value

Request: <input><gain>G*

Response: In<input> Aud=<dB Value><CR><LF>

Action: Sets audio gain to a negative value

Request: <input>|G

Response: In<input> Aud=<dB Value><CR><LF>

Action: Increments audio gain by 1dB

Request: <input>|g

Response: In<input> Aud=<dB Value><CR><LF>

Action: Decrements audio gain by 1dB

The “Audio Input Gain and Attenuation” commands are used to adjust the audio gains on specified inputs. This command is specific to input adjustment, and cannot be used to adjust outputs. Examples:

	Command	Meaning
Command To Switcher	1*2G	Set input 1 audio gain to +2dB
Response From Switcher	In01 Aud=+02<CR><LF>	Audio Gain set to +2dB
Command To Switcher	1*2g	Set input 1 audio gain to -2dB
Response From Switcher	In01 Aud=-02<CR><LF>	Audio Gain set to -2dB
Command To Switcher	5 G	Increment audio input 5 by 1dB
Response From Switcher	In05 Aud=+03<CR><LF>	Audio input 5 incremented 1dB
Command To Switcher	5 g	Decrement audio input 5 by 1dB
Response From Switcher	In07 Aud=-09<CR><LF>	Audio input 5 decremented 1dB

“Global Setups”:

Request: <setup>.

Response: Spr<setup><CR><LF>

Action: Saves current configuration as a setup.

Request: <setup>.

Response: Rpr<setup><CR><LF>

Action: Saves current configuration as a setup.

Request: <esc>P<setup><CR> <standard tie commands> <esc>p<CR>

Response: End Write Setup <setup><CR><LF>

Action: Creates a setup “on-the-fly” with supplied user tie commands

Global setups store and recall the current status of the switcher. Examples:

	Command	Meaning
Command To Switcher	<esc>P14<CR>	Start recording setup 14
Response From Switcher	Write Setup 14 Ready<CR><LF>	Started recording...
Command To Switcher	1*3!	A&V input 1 tied to out 3
Response From Switcher	7*8%	Vid input 7 tied to out 8
Command To Switcher	<esc>p<CR>	Done Recording
Response From Switcher	End Write Setup 14<CR><LF>	Saved Setup 14
Command To Switcher	<esc>.<CR>	Recalls the setup
Response From Switcher	Rpr14<CR><LF>	Recalled setup 14

“Video Mute Commands”:

*Request: <output>*1B*

*Response: Vmt<output>*1<CR><LF>*

Action: Mutes specified output video (video off)

*Request: <output>*0B*

*Response: Vmt<output>*0<CR><LF>*

Action: Disables Mute specified output video (video on)

*Request: <output>*B*

Response: <on/off><CR><LF>

Action: Request video mute state of a specified output

*Request: <on/off>*B*

Response: Vmt1<CR><LF>

Action: Mutes / un-mutes all Video outputs

Controls muting and un-muting video outputs. Examples:

	Command	Meaning
Command To Switcher	2*1B	Mute output 2 video (video off)
Response From Switcher	Vmt2*1<CR><LF>	Output 2 video off
Command To Switcher	1*B	Mute all video (global)
Response From Switcher	Vmt1	All video muted

“Audio Mute Commands”:

*Request: <output>*IZ*

*Response: Amt<output>*I<CR><LF>*

Action: Mutes specified output audio (audio off)

*Request: <output>*0Z*

*Response: Amt<output>*0<CR><LF>*

Action: Disables Mute specified output audio (audio on)

*Request: <output>*Z*

Response: <on/off><CR><LF>

Action: Request audio mute state of a specified output

*Request: <on/off>*Z*

Response: Amt1<CR><LF>

Action: Mutes / un-mutes all audio outputs

Controls muting and un-muting video outputs. Examples:

	Command	Meaning
Command To Switcher	2*1Z	Mute output 2 audio (audio off)
Response From Switcher	Amt2*1<CR><LF>	Output 2 audio off
Command To Switcher	1*Z	Mute all audio (global)
Response From Switcher	Amt1	All audio muted

“Create Ties”:

Request: <input><output>!*

Response: Out<output> In<input> All<CR><LF>

Action: Tie specified input to specified output (All levels).

Request: <input><output>&*

Response: Out<output> In<input> RGB<CR><LF>

Action: Tie specified input to specified output (Level 1 Only).

Request: <input><output>%*

Response: OutOut<output> In<input> Vid<CR><LF>

Action: Tie specified input to specified output (Level 3 Only).

Request: <input><output>\$*

Response: Out<output> In<input> Aud<CR><LF>

Action: Tie specified input to specified output (Level 2 Only).

Request: <esc>Q<input><output>!...<input>*<output>!<CR>*

Response: Out Multi In Multi All<CR><LF>

Action: Tie specified inputs to specified outputs (All levels).

Request: <input>!

Response: Out Multi In <input> All<CR><LF>

Action: tie specified input to all outputs.

The “Create Ties” commands are used to set crosspoints on the switcher, at one or more levels.

Examples:

	Command	Meaning
Command To Switcher	1*3!	Tie input 1 A&V to output 3
Response From Switcher	Out03 In01 All	Output 3 tied to input 1
Command To Switcher	<esc>Q3*4!3*5!3*6!<CR>	Command stack switches
Response From Switcher	Out Multi In Multi All	Multiple outputs switched

“View Ties, Gain, Mutes, and Setups”:

Request: V/v<output>%

Response: Out<output> In<input> Vid<CR><LF>

Action: View video output tie

Request: V/v<output>.\$

Response: Out<output> In<input> Aud<CR><LF>

Action: View audio output tie

Request: V/v<input>G

Response: In<input> Aud=<numeric dB value><CR><LF>

Action: View gain for specified input

Request: VM/vm

Response: <execMode> <output1 input> <output2 input>...Mut<CR><LF>

Action: View all output mutes. Each position listed in the response is an output, left =1...

Request: V/v<setup>.

Response: <output1> <output2>...Vid <output1> <output2>... Aud<CR><LF>

Action: View setup configuration (setup 0 for current config)

The “View Ties, Gain, Mutes, and Setups” commands are used to retrieve current setup and running status information. Examples:

	Command	Meaning
Command To Switcher	V7%	Get video input tied to output 7
Response From Switcher	Out07 In02 Vid<CR><LF>	Video Output 7 tied to input 2
Command To Switcher	V3\$	Get audio input tied to output 3
Response From Switcher	Out03 In06 Aud<CR><LF>	Output 3 audio tied to input 6
Command To Switcher	VM	View all video mutes
Response From Switcher	0 1 0 2 0 3...Mut<CR><LF>	List of video mutes
Command To Switcher	V4G	Get audio gain for input 4
Response From Switcher	In04 Aud=-02	Gain for input 4 is -2dB
Command To Switcher	V0.	View current switcher status
Response From Switcher	08 08 08...Vid 05 0505...Aud<CR><LF>	Reports current status of each video output, then the status of each audio output.

10.4 Kramer Ethernet Protocol Document

This section describes the Kramer Ethernet Protocol document.

10.4.1 Protocol Overview

All communications between the frame and remote clients use the standard UDP protocol, and is compatible with off the shelf Ethernet hubs / switches.

10.4.2 Packet Structure

The first byte of the packet payload is the command byte. This byte specifies the command type being sent. All other bytes (if present) are modifiers to the command byte, and vary between commands. The second byte is reserved for future use, and is not currently utilized in any existing commands.

10.4.3 Frame Initiated Messages

The Kramer frame utilizes a single, hard coded IP address for all communications with remote clients (172.16.3.254), and communicates on a single port (9995). The frame always transmits as broadcasts, using generic messages, which can be received and used by all listening remote clients.

10.4.4 Crosspoint Status Message

Format: [0] [Unused] [Output Count] [Input Count] [Level Count] [Flags 1] [Flags 2] [Level 1, Output 1] [Level 1, Output 2]..... [Level 2, Output 1] [Level 2, Output 2]....

The crosspoint status message is a fixed size packet that contains the physical output, input, and level configuration of the frame, as well as the crosspoint information for each output on each level stored within the frame. The MSB is utilized on the first level outputs to detect the lock state for each corresponding output. A binary one indicates the output is locked.

10.4.5 Keep Alive Message

Format: [1]

The frame will broadcast a 'keep alive' message every 1-2 seconds, providing remote panels with a mechanism to detect the presence / absence of a frame on the network.

10.4.6 Remote Client Initiated Messages

For the purpose of this document, a remote client represents any Ethernet enabled device interacting with the frame using Ethernet. This includes, but is not limited to, hardware XY / Single Bus panels, or 3rd party control packages.

10.4.7 Lock Change

Format: [0x02] [Unused] [Output] [Locked]

Each output has an associated lock state, which is a logical bit used by single bus remote panels to disable front panel input selection. The lock affects all levels, so only the output is required to set the lock. Set the 'Locked' byte to 0 for unlock; or 1 for locked.

10.4.8 Crosspoint Change

Format: [0x03] [Unused] [Output] [Input] [Level(s)]

The crosspoint change command can be used to switch a specified output to a specified input on one or more levels. The levels are bitwise, meaning that bit 1 represents level 1 and bit 2 represents level 2. After receiving this message, the frame will automatically broadcast an updated crosspoint status update message to all remote clients.

10.4.9 Volume Increment / Decrement

Format: [0x06] [Unused] [Modifiers] [Index]

The volume increment / decrement command adjusts an input or output audio gain up or down by one step on the left, right, or both sides. The lower 4 bits of the modifiers byte is used to set all parameters of the command (see below). The index byte is the input or output number to adjust.

Modifier Bits:

=====

0x01: [1 = Input] [0 = Output]

0x02: [1 = Adjust Left] [0 = Don't Adjust Left]

0x04: [1 = Adjust Right] [0 = Don't Adjust Right]

0x08: [1 = Increment Gain] [0 = Decrement Gain]

10.4.10 Request Crosspoint Status

Format: [0x04]

The request crosspoint status message is a single byte command, which forces the frame to immediately broadcast a crosspoint status message.

LIMITED WARRANTY

Kramer Electronics (hereafter *Kramer*) warrants this product free from defects in material and workmanship under the following terms.

HOW LONG IS THE WARRANTY

Labor and parts are warranted for seven years from the date of the first customer purchase.

WHO IS PROTECTED?

Only the first purchase customer may enforce this warranty.

WHAT IS COVERED AND WHAT IS NOT COVERED

Except as below, this warranty covers all defects in material or workmanship in this product. The following are not covered by the warranty:

1. Any product which is not distributed by Kramer, or which is not purchased from an authorized Kramer dealer. If you are uncertain as to whether a dealer is authorized, please contact Kramer at one of the agents listed in the web site www.kramerelectronics.com.
2. Any product, on which the serial number has been defaced, modified or removed.
3. Damage, deterioration or malfunction resulting from:
 - i) Accident, misuse, abuse, neglect, fire, water, lightning or other acts of nature
 - ii) Product modification, or failure to follow instructions supplied with the product
 - iii) Repair or attempted repair by anyone not authorized by Kramer
 - iv) Any shipment of the product (claims must be presented to the carrier)
 - v) Removal or installation of the product
 - vi) Any other cause, which does not relate to a product defect
 - vii) Cartons, equipment enclosures, cables or accessories used in conjunction with the product

WHAT WE WILL PAY FOR AND WHAT WE WILL NOT PAY FOR

We will pay labor and material expenses for covered items. We will not pay for the following:

1. Removal or installations charges.
2. Costs of initial technical adjustments (set-up), including adjustment of user controls or programming. These costs are the responsibility of the Kramer dealer from whom the product was purchased.
3. Shipping charges.

HOW YOU CAN GET WARRANTY SERVICE

1. To obtain service on you product, you must take or ship it prepaid to any authorized Kramer service center.
2. Whenever warranty service is required, the original dated invoice (or a copy) must be presented as proof of warranty coverage, and should be included in any shipment of the product. Please also include in any mailing a contact name, company, address, and a description of the problem(s).
3. For the name of the nearest Kramer authorized service center, consult your authorized dealer.

LIMITATION OF IMPLIED WARRANTIES

All implied warranties, including warranties of merchantability and fitness for a particular purpose, are limited in duration to the length of this warranty.

EXCLUSION OF DAMAGES

The liability of Kramer for any effective products is limited to the repair or replacement of the product at our option. Kramer shall not be liable for:

1. Damage to other property caused by defects in this product, damages based upon inconvenience, loss of use of the product, loss of time, commercial loss; or:
2. Any other damages, whether incidental, consequential or otherwise. Some countries may not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights, which vary from place to place.

NOTE: All products returned to Kramer for service must have prior approval. This may be obtained from your dealer. This equipment has been tested to determine compliance with the requirements of:

EN-50081:	"Electromagnetic compatibility (EMC); generic emission standard. Part 1: Residential, commercial and light industry"
EN-50082:	"Electromagnetic compatibility (EMC) generic immunity standard. Part 1: Residential, commercial and light industry environment".
CFR-47:	FCC Rules and Regulations: Part 15: "Radio frequency devices Subpart B – Unintentional radiators"

CAUTION!

- ☒ Servicing the machines can only be done by an authorized Kramer technician. Any user who makes changes or modifications to the unit without the expressed approval of the manufacturer will void user authority to operate the equipment.
- ☒ Use the supplied DC power supply to feed power to the machine.
- ☒ Please use recommended interconnection cables to connect the machine to other components.



For the latest information on our products and a list of Kramer distributors, visit our Web site: www.kramerelectronics.com, where updates to this user manual may be found. We welcome your questions, comments and feedback.



Caution

Safety Warning:

Disconnect the unit from the power supply before opening/servicing.



Kramer Electronics, Ltd.

Web site: www.kramerelectronics.com

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P/N: 2900-000024 REV 3