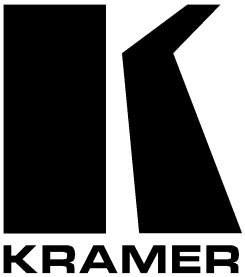
Kramer Electronics, Ltd.



USER MANUAL

Model:

VS-311HDMI

Automatic HDMI / Audio Switcher

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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 500-plus different models now appear in 8 Groups[1], which are clearly defined by function.

Congratulations on purchasing your Kramer **VS-311HDMI** *Automatic HDMI / Audio Switcher*, which is ideal for:

- Systems requiring automatic HDMI routing
- Presentation and multimedia applications

Each package includes the following items:

- **VS-311HDMI** *Automatic HDMI / Audio Switcher*
- Power adapter and Null-modem adapter
- Windows®-based Kramer control software[2]
- Windows®-based Ethernet Configuration Manager and Virtual Serial Port Manager
- Kramer **RC-IR1** Infra-Red Remote Control Transmitter[3] (including the required battery and a separate user manual[4])
- This user manual[4]

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 HDMI cables[5]

2.1 Quick Start

This quick start chart summarizes the basic setup and operation steps.

---

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 Downloadable from our Web site at http://www.kramerelectronics.com

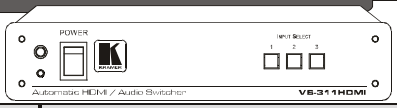
3 Previously known as the IR-1 / IR-1-01

4 Download up-to-date Kramer user manuals from our Web site at http://www.kramerelectronics.com

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

Step 1: Mount the machine

Mount the machine in a rack (using the RK-80 Rack Adapter) or stick the 4 rubber feet to the underside



Step 2: Connect the inputs and outputs - see section 5

Connect the audio inputs and outputs

Connect the video inputs and the video output

Step 3: Set the machine - see section 5

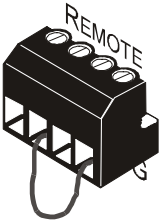
SET THE SWITCHING PRIORITIES

Set the switching priorities via dipswitches 1, 2 and 3

Set the operation mode via the AUTO dipswitch:
OFF: the manual mode
ON: the automatic mode (according to the priority setup)

CONNECT THE REMOTE CONTROL CONTACT CLOSURE

Switch between inputs by momentarily connecting the appropriate input number PIN (1, 2 or 3) to the G (Ground) PIN



DO NOT connect more than one PIN to the G PIN at the same time

Step 4: Turn the power ON

Step 5: Operate the machine

Operate via the front panel buttons, IR remote control, RS-232, remote control contact closure and ETHERNET

3 Overview

The Kramer **VS-311HDMI** is a high performance 3x1 HDCP (high definition digital content protection) compatible[1] automatic switcher for HDMI signals, digital audio (S/PDIF) signals, and stereo audio signals.

The **VS-311HDMI** switches any one of three HDMI HDCP compliant[1] sources to a single display device, on HDMI connectors with the corresponding:

- Digital audio (S/PDIF) input signals switched to an S/PDIF output, on RCA connectors **and/or**
- Unbalanced stereo audio input signals on 3.5 mini-jack connectors switched to an unbalanced stereo audio output on a 3.5 mini-jack connector, as well as to a balanced stereo audio output on a 5-pin terminal block connector

The **VS-311HDMI** can operate either in the manual mode or in the auto mode.

In the manual mode, the **VS-311HDMI** acts as a regular switcher, switching the input video and audio signals to the output via the three front panel INPUT SELECT buttons.

In the auto mode, you can switch any input to the output via the three front panel INPUT SELECT buttons, but once the selected video signal is lost, the machine automatically switches to the highest priority input, according to the input priority setup[2]. The **VS-311HDMI** will switch back to the primary input when an HDMI signal is detected on that input.

The **VS-311HDMI** is housed in a desktop-sized enclosure and is 12 VDC fed.

Control the **VS-311HDMI** using the front panel buttons, or remotely via:

- RS-232 serial commands transmitted by a touch screen system, PC, or other serial controller
- The Kramer infra-red remote control transmitter
- The ETHERNET
- Remote control contact closure

1 HDCP is a standard, developed by Intel, to protect copyright holders (movie studios, and so on) from having their programs copied and shared. The HDCP standard provides for the secure, encrypted transmission of digital signals over HDMI or DVI connections between two HDCP-enabled devices. The source device (such as a DVD player or HDTV tuner) encrypts the digital signal using the HDCP standard, and then sends that signal over the HDMI or DVI connection to the receiving device (for example, an HDTV). The receiving device decodes the signal using HDCP and uses the signal as it is allowed

2 As described in section 5.1

3.1 About HDMI

High-Definition Multimedia Interface (HDMI) is an uncompressed all-digital[1] audio/video interface, widely supported in the entertainment and home cinema industry. It delivers the highest high-definition image and sound quality. Note that Kramer Electronics Limited is an HDMI Adopter[2] and an HDCP Licensee[3].

In particular, HDMI:

- Provides a simple[4] interface between any audio/video source, such as a set-top box, DVD player, or A/V receiver and video monitor, such as a digital flat LCD / plasma television (DTV), over a single lengthy[5] cable
- Supports standard, enhanced, high-definition video, and multi-channel digital audio[6] on a single cable
- Transmits all ATSC HDTV standards and supports 8-channel digital audio, with bandwidth to spare to accommodate future enhancements and requirements
- Benefits consumers by providing superior, uncompressed digital video quality via a single cable[7], and user-friendly connector
- Is backward-compatible with DVI (Digital Visual Interface)
- Supports two-way communication between the video source (such as a DVD player) and the digital television, enabling new functionality such as automatic configuration and one-button play

HDMI has the capacity to support existing high-definition video formats (720p, 1080i, and 1080p/60), as well as standard definition formats such as NTSC or PAL.

1 Ensuring an all-digital rendering of video without the losses associated with analog interfaces and their unnecessary digital-to-analog conversions

2 See http://www.hdmi.org/about/adopters_founders.asp

3 See http://www.digital-cp.com/list/

4 With video and multi-channel audio combined into a single cable, the cost, complexity, and confusion of multiple cables currently used in A/V systems is reduced

5 HDMI technology has been designed to use standard copper cable construction at up to 15m

6 HDMI supports multiple audio formats, from standard stereo to multi-channel surround-sound. HDMI has the capacity to support Dolby 5.1 audio and high-resolution audio formats

7 HDMI provides the quality and functionality of a digital interface while also supporting uncompressed video formats in a simple, cost-effective manner

3.2 Recommendations for 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 your **VS-311HDMI** away from moisture, excessive sunlight and dust

Caution – No operator-serviceable parts inside unit.

Warning – Use only the Kramer Electronics input power wall adapter that is provided with this unit[1].

Warning – Disconnect power and unplug unit from wall before installing or removing device or servicing unit.

3.3 Terminology Used in this User Manual

Table 1 defines some terms that are used in this user manual.

Table 1: Terminology Used in this User Manual

Term	Definition
802.3	The standard specification for ETHERNET that is maintained by the Institute of Electrical and Electronics Engineers (IEEE).
Dynamic Host Configuration Protocol (DHCP)	Allows the network administrator to distribute IP addresses from a central point and automatically send a new IP address when an Ethernet point is plugged into a different network location.
Gateway	A network position serving as an entry to another network. On the Internet, a node or stopping point can be either a gateway node or a host (end-point) node.
IP Address	A 32-binary digit number that identifies each sender or receiver (within a network via a particular server or workstation) of data (HTML pages or e-mails) that is sent in packets across the Internet. Every device connected to an IP network must have a unique IP address. This address is used to reference the specific unit.
Local Area Network (LAN)	Computers sharing a common communications line or wireless link, which often share a server within a defined geographic area.
Media Access Control (MAC) Address	A computer's unique hardware number (or address) in a LAN or other network. On an Ethernet LAN, the (MAC) address is identical to the Ethernet address.
Transmission Control Protocol/Internet Protocol (TCP/IP)	The basic communication language or protocol of the Internet that breaks the message into appropriately sized packets for the network, and can be used as a communications protocol in an intranet or an extranet.

1 For example: model number AD2512C, part number 2535-000251

4 Your VS-311HDMI Automatic HDMI / Audio Switcher

Figure 1 illustrates the front and rear panels of the **VS-311HDMI**. Table 2 defines the front and rear panels of the **VS-311HDMI**.

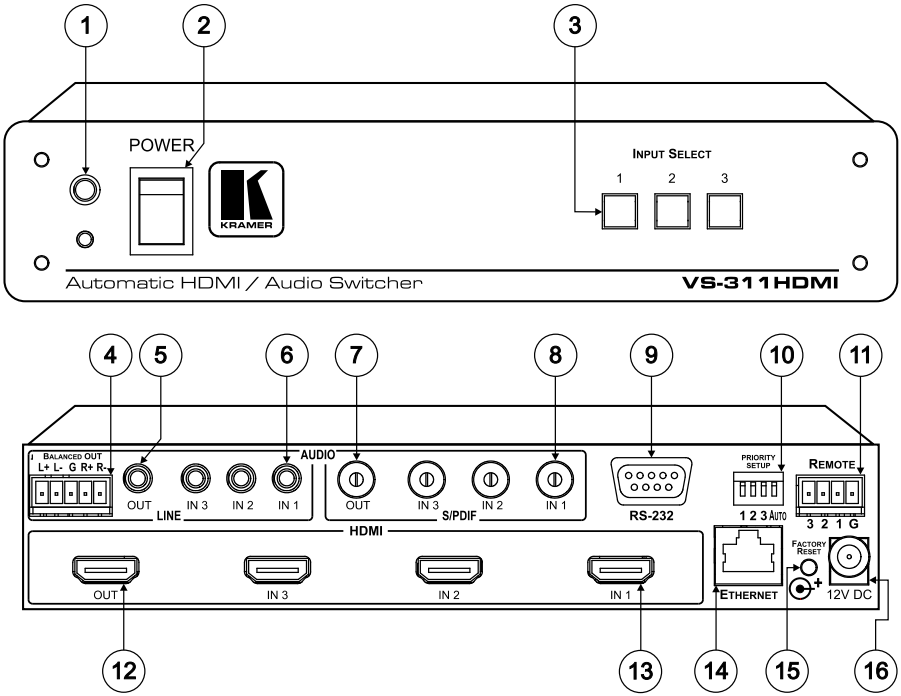


Figure 1: VS-311HDMI Automatic HDMI / Audio Switcher

Table 2: VS-311HDMI Automatic HDMI / Audio Switcher Features

#	Feature			Function
1	IR Receiver			The red LED lights when receiving signals from the Infra-red remote control transmitter
2	*POWER* Switch			Illuminated switch for turning the unit ON or OFF
3	*INPUT SELECT* Buttons			Press the INPUT button to select the input to switch to the output (from 1 to 3)
4	*AUDIO*	*LINE*	*BALANCED OUT* Terminal Block Connector	Connect the balanced stereo audio output to a balanced stereo audio acceptor
5			*OUT* 3.5mm Mini Jack	Connect to an unbalanced stereo audio output
6			*IN* 3.5mm Mini Jack	Connect to the unbalanced stereo audio inputs (from 1 to 3)
7		*S/PDIF*	*OUT* RCA Connector	Connect to a digital audio (S/PDIF) output
8			*IN* RCA Connectors	Connect to the digital audio (S/PDIF) inputs (from 1 to 3)
9	*RS-232* DB 9F Port			Connect to the PC or the Remote Controller
10	*PRIORITY SETUP* Dipswitches			Dipswitches for setup of the machine: DIPs 1, 2 and 3 are for setting the signal priorities; DIP 4 is for setting to the manual or the AUTO mode (see section 5.1)
11	*REMOTE* Terminal Block			Connects to a dry contact switch (see section 5.2)
12	*OUT* HDMI Connector			Connect to the HDMI acceptor
13	*IN* HDMI Connectors			Connect to the HDMI sources (from 1 to 3)
14	*ETHERNET* Connector			Connect to the PC or other Serial Controller through computer networking
15	*FACTORY RESET* Button			Press the ETHERNET factory reset button to reset to the factory default definitions[1]: IP number – 192.168.1.39 Mask – 255.255.255.0 Gateway – 192.168.1.1
16	12V DC			+12V DC connector for powering the unit

1 First, disconnect the power and then connect it again while pressing the RESET button. The unit will power up and load its memory with the factory default definitions

5 Connecting the VS-311HDMI Automatic HDMI / Audio Switcher

To connect[1] the **VS-311HDMI** *Automatic HDMI / Audio Switcher*, as illustrated in the example in Figure 2, do the following[2]:

1. Connect an HDMI source (for example, an HDMI DVD player[3]) to the IN 1 HDMI connector and connect the digital audio input[4] to the IN 1 S/PDIF RCA connector.
2. Connect an HDMI source (for example, an HDMI set top box source) to the IN 3 HDMI connector and connect the digital audio input[5] to the IN 3 3.5 mini-jack connector.
3. Connect the OUT HDMI connector to the HDMI acceptor (for example, an HDMI plasma display).
4. Connect the AUDIO OUT S/PDIF RCA connector[6] and the AUDIO OUT 3.5 mini-jack connector to a digital audio acceptor (for example, an AV receiver).
5. Set the PRIORITY SETUP dipswitches (see section 5.1)
6. If required, connect a PC and/or controller to the RS-232 port (see section 5.3) and/or the ETHERNET port (see section 5.4).
7. If required, connect[7] the contact closure remote control PINs (see section 5.2).
8. Connect the 12V DC power adapter to the power socket and connect the adapter to the mains electricity (not shown in Figure 2).

1 You do not need to connect all the inputs

2 Switch OFF the power on each device before connecting it to your VS-311HDMI. After connecting your VS-311HDMI, switch on its power and then switch on the power on each device

3 You can also connect a DVD player with a DVD connector, using an DVI-HDMI adapter to transfer video signals

4 Alternatively you can connect it to the 3.5 mini-jack connector

5 Alternatively you can connect it to the S/PDIF RCA connector

6 If the inputs are connected only to the 3.5 mini-jack connectors, connect the AUDIO OUT 3.5 mini-jack connector and/or the BALANCED OUT terminal block connector only

7 The connection is not illustrated in Figure 2

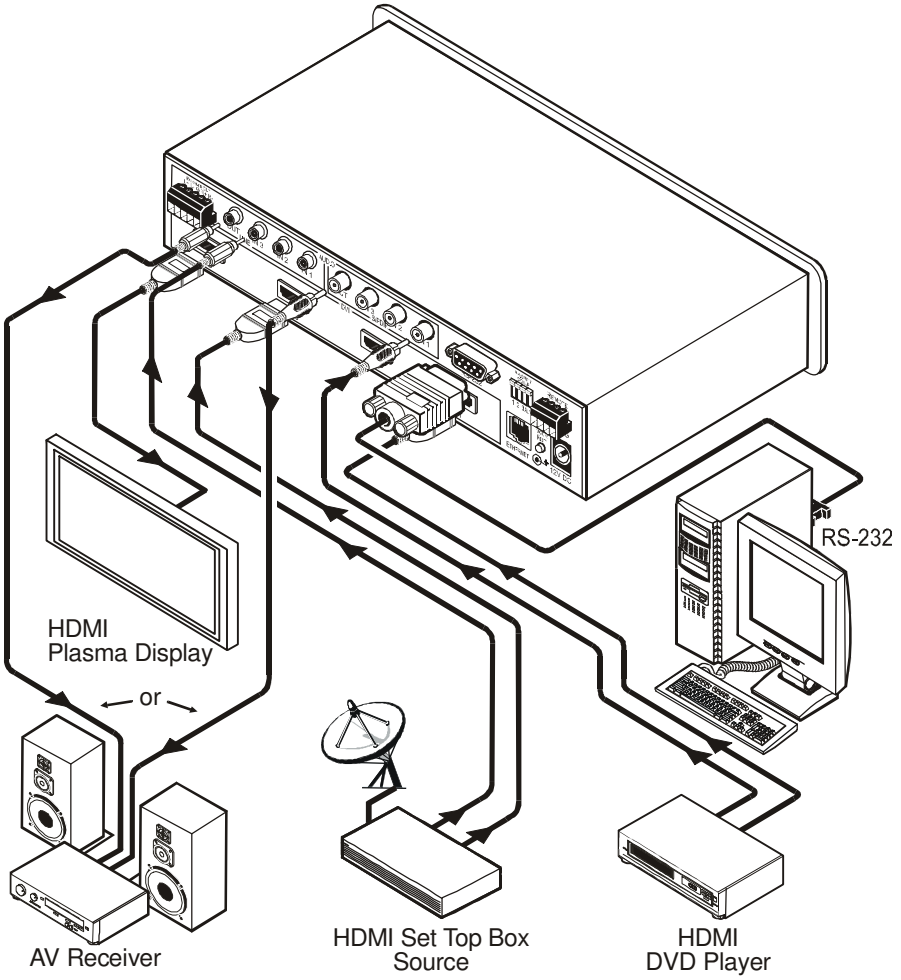


Figure 2: Connecting the VS-311HDMI Automatic HDMI / Audio Switcher

5.1 Setting the Dipswitches

This section describes the machine set-up and dipswitch selection.

By default, all the **VS-311HDMI** dipswitches are set to OFF.

Figure 3 and Table 3 describe the **VS-311HDMI** unit dipswitches.

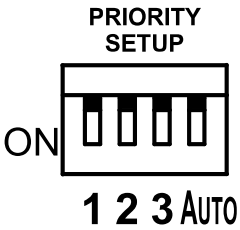


Figure 3: Dipswitches

Table 3: Dipswitch Settings

DIPS	Function	Description
1, 2, 3	Priority setup	Set the inputs priority (see Table 4)
4	AUTO	OFF: manual mode, switch between channels manually; ON: automatic mode, inputs switch automatically to the output according to the priority setup

Inputs 1, 2 and 3 can be set in priority according to your needs. The **VS-311HDMI** will switch to the secondary input upon loss of the primary input signal, and back to the primary input when a signal is detected.

Table 4 describes the priority setup:

Table 4: Dipswitch Priority Setup

Priority	Dip Position		
1, 2, 3	OFF	OFF	OFF
3, 2, 1	OFF	OFF	ON
2, 3, 1	OFF	ON	OFF
1, 3, 2	ON	OFF	OFF
3, 1, 2	ON	OFF	ON
2, 1, 3	ON	ON	OFF

5.1.1 Priority Switching Applications

In the following example, dipswitches 1, 2, and 3 are set to OFF, OFF and OFF respectively, meaning that the highest priority input is IN 1; IN 2 is the secondary input; and IN 3 the third. Dipswitch 4 is set ON, enabling AUTO mode operation.

If all the inputs are connected, you can, for example, press the INPUT SELECTOR 2 button to switch IN 2 to OUT. The plasma display shows the IN 2 signal.

If the HDMI signal on IN 2 is cut off, the switcher automatically switches IN 1 to the output, and if that fails too, IN 3 is automatically switched to the output. If, in the meantime, the IN 2 signal is restored, IN 2 will take priority once again.

5.2 Connecting the Contact Closure Remote Control PINs

The contact closure remote control pins operate in a similar way to the input buttons.

For example, you may override[1] the presently routed input by using the remote control contact closure. To do so[2], connect the appropriate input number[3] pin on the REMOTE terminal block connector to the G (Ground) pin[4], as Figure 4 illustrates.

DO NOT Connect more than one PIN to the Ground PIN at the same time

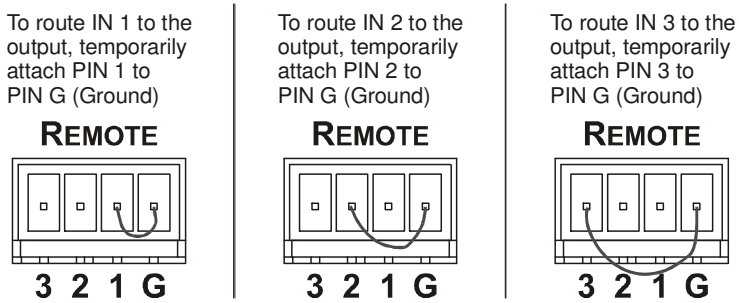


Figure 4: Connecting the Contact Closure Remote Control PINS

1 Equivalent to pressing a different input button

2 When in the manual mode (dipswitch 4 set to OFF), you can switch an input to the output using the front panel INPUT SELECT buttons

3 Input 1, 2 or 3

4 Note that unless the connection is permanent, the VS-311HDMI will revert to an automatic switcher when the connection is removed

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

To connect a PC to the **VS-311HDMI** unit, using the Null-modem adapter provided with the machine (recommended):

- Connect the RS-232 DB9 rear panel port on the Master **VS-311HDMI** 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 **VS-311HDMI** 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 Master **VS-311HDMI** unit, as Figure 5 illustrates

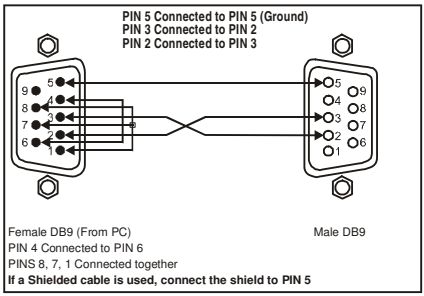


Figure 5: Connecting a PC without using a Null-modem Adapter

5.4 Controlling via the ETHERNET

You can connect the **VS-311HDMI** via the Ethernet, using a crossover cable (see section 5.4.1) for direct connection to the PC or a straight through cable (see section 5.4.2) for connection via a network hub or network router.

5.4.1 Connecting the ETHERNET Port directly to a PC (Crossover Cable)

You can connect the Ethernet port of the **VS-311HDMI** to the Ethernet port on your PC, via a crossover cable with RJ-45 connectors, as Table 5 and Figure 6 define.

Figure 6: RJ-45 PINOUT

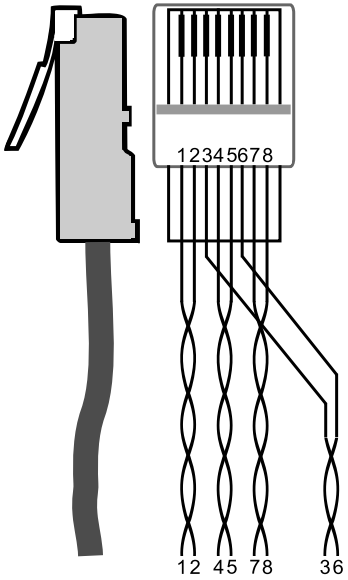


Table 5: Crossover Cable RJ-45 PINOUT

EIA /TIA 568A Side 1	
PIN	**Wire Color**
1	White-orange
2	Orange
3	White-green
4	Blue
5	White-blue
6	Green
7	White-brown
8	Brown
Pair 1	4 and 5
Pair 2	1 and 2
Pair 3	3 and 6
Pair 4	7 and 8

EIA /TIA 568B Side 2	
PIN	**Wire Color**
1	White-green
2	Green
3	White-orange
4	Blue
5	White-blue
6	Orange
7	White-brown
8	Brown
Pair 1	4 and 5
Pair 2	3 and 6
Pair 3	1 and 2
Pair 4	7 and 8

This type of connection is recommended for identification of the factory default IP Address of the **VS-311HDMI** during the initial configuration

After connecting the Ethernet port, configure your PC as follows:

1. Right-click the My Network Places icon on your desktop.
2. Select **Properties**.
3. Right-click Local Area Connection Properties.
4. Select **Properties**.
   The Local Area Connection Properties window appears.

5. Select the Internet Protocol (TCP/IP) and click the **Properties** Button (see Figure 7).

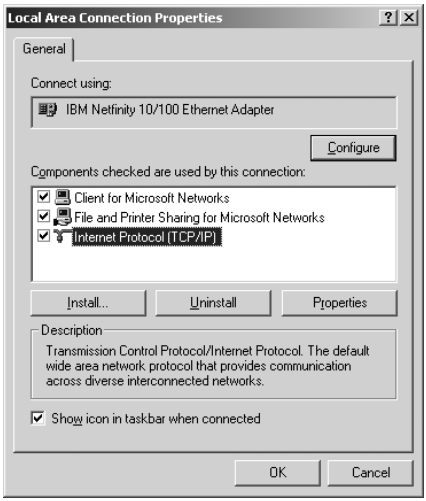


Figure 7: Local Area Connection Properties Window

6. Select Use the following IP Address, and fill in the details as shown in Figure 8.
7. Click **OK**.

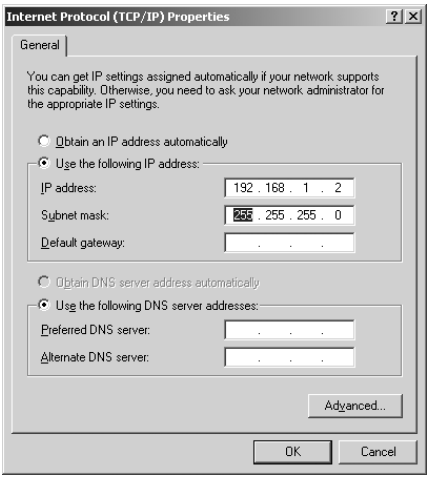


Figure 8: Internet Protocol (TCP/IP) Properties Window

5.4.2 Connecting the ETHERNET Port via a Network Hub (Straight-Through Cable)

You can connect the Ethernet port of the **VS-311HDMI** to the Ethernet port on a network hub or network router, via a straight-through cable with RJ-45 connectors, as Table 6 defines:

Table 6: Straight-through Cable RJ-45 PINOUT

Side 1	
PIN	**Wire Color**
1	White-orange
2	Orange
3	White-green
4	Blue
5	White-blue
6	Green
7	White-brown
8	Brown

Side 2	
PIN	**Wire Color**
1	White-orange
2	Orange
3	White-green
4	Blue
5	White-blue
6	Green
7	White-brown
8	Brown

5.5 Configuring the Ethernet Port

To configure the ETHERNET port, do the following:

1. Connect the ETHERNET port as described in section 5.4.1.
2. Insert the CD-ROM in the CD-ROM drive, double click the Set *Setfc11eth_confxx.exe*[1] file and follow the on-screen instructions[2]. The Ethernet Configuration Manager is installed.
3. Click the appropriate shortcut in the Start menu's Programs folder. The Configuration Manager window (see Figure 9) opens.
4. Click the Search button[3] (or the Action menu's, Search Board command). The MAC Address for the found ETHERNET port appears in the Device List.
5. Change the settings according to your network requirements and then click the Config button (or the Action menu's, Config command) to apply the settings.

Note that clicking the Config button will alter the IP settings of the ETHERNET port

1 File names are liable to change from time to time

2 The latest version appears on our Web site at http://www.kramerelectronics.com

3 To automatically search for devices

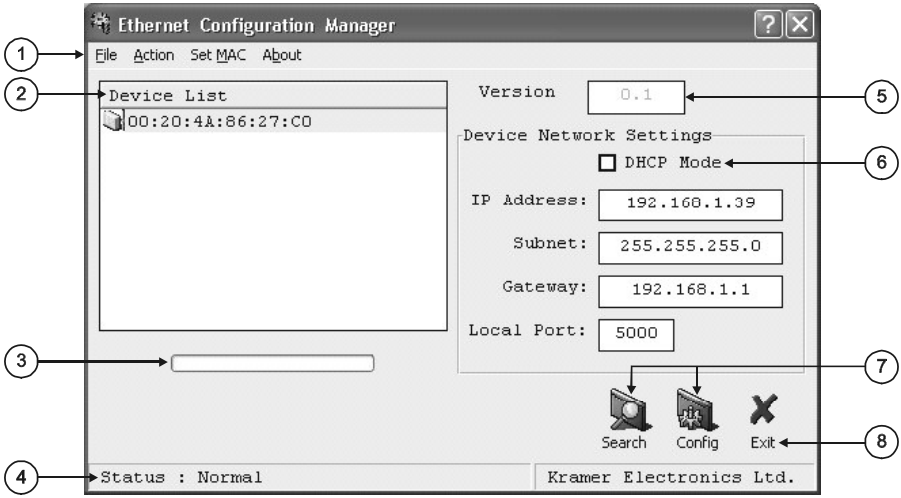


Figure 9: The Ethernet Configuration Manager Window

Table 7: Ethernet Configuration Manager Window Functionality

#	Feature		Function
1	Menu bar	File	The *Exit* command closes the Configuration Manager application
		Action	The *Search Board* command seeks the **VS-311HDMI** device that connects to the PC via the ETHERNET port, and displays it and its corresponding settings; The *Config* command adjusts the **VS-311HDMI** according to the displayed data
		Set MAC[1]	For factory use only (click the *Password* command to enter the password)
		About	Displays software information, including the software version
2	Device List		Displays the MAC Address
3	Progress Bar		Shows the progress
4	Status Bar		Shows the status
5	Version		Displays the firmware version
6	Device Network Settings Area		**DHCP**[1] **Mode** Check Box: When selected, configures the Ethernet port to obtain an IP address automatically from the DHCP server. When cleared, manual configuration of the Ethernet port is required to obtain an IP address (Static IP) **IP Address**: A 32-binary digit number obtained from your Network Administrator that identifies the Ethernet port that is currently being configured **Subnet**: A 32-binary digit number obtained from your Network Administrator, which combined with the IP Address, identifies which network your device is on **Gateway**: A network position serving as an entry to another network or to the Internet (only relevant in the Active Routing mode)
7	Action Buttons		**Search**: seeks the devices that connect to the PC via the ETHERNET port, and displays them and their corresponding settings **Config**: adjusts the according to the displayed data
8	Exit Button		Closes the Configuration Manager application

1 See the definition in Table 1

5.5.1 Setting a Virtual Port

If the control application cannot work with an Ethernet driver, use the Kramer Virtual port driver as follows:

1. Insert the CD-ROM in the CD-ROM drive, double click the *SetKVSP_xx.exe*[1] file and follow the on-screen instructions[2].
   The virtual serial port is installed.
2. Run the Virtual Serial Port Manager Application.
   The Virtual Serial Port Manager window appears (see Figure 10).

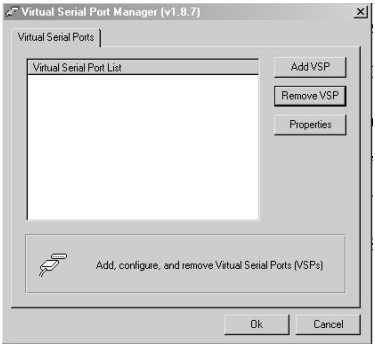


Figure 10: The Virtual Serial Port Manager Window

3. Press the **Add VSP** button to add a serial port and type the IP settings according to the IP address and local port of your **VS-311HDMI** (see Figure 11).

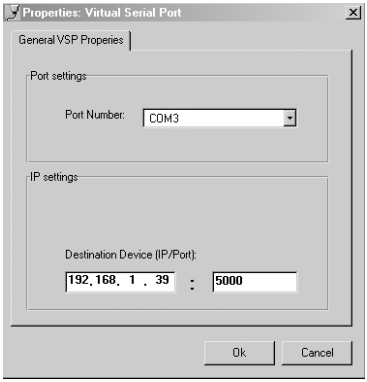


Figure 11: The Virtual Serial Port Properties Window

1 File names are liable to change from time to time

2 The latest version appears on our Web site at http://www.kramerelectronics.com

4. You can set a virtual port for each local port on your **VS-311HDMI** (see Figure 12).

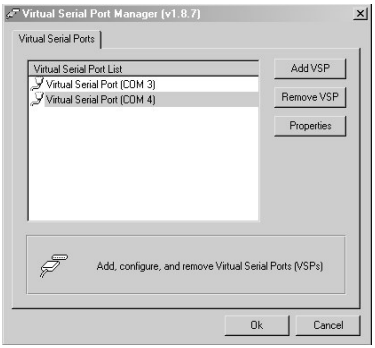


Figure 12: The Virtual Serial Port Properties Window (COM 3 and COM 4)

5. In the control application, choose the COM-port connection according to your virtual serial port connections (see Figure 13).

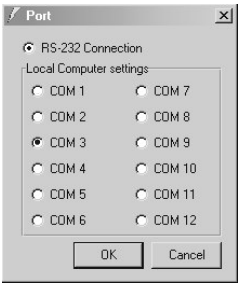


Figure 13: The Port Window – Selecting a Virtual Serial Port

5.5.2 Setting an Ethernet Connection

If the control application can directly connect to the Ethernet driver, select the host IP and port number, as illustrated in Figure 14.

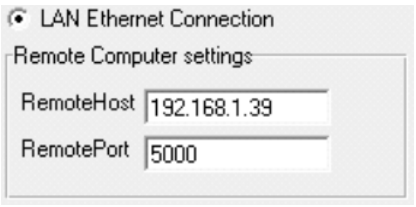


Figure 14: The Port Window – Selecting a Remote Connection

6 Technical Specifications

Table 8 includes the technical specifications:

Table 8: Technical Specifications[1] of the VS-311HDMI

INPUTS:	3 HDMI connectors 3 S/PDIF digital audio on RCA connectors 3 unbalanced stereo audio +4dBm on 3.5mm mini jacks
OUTPUT:	1HDMI connector 1 S/PDIF digital audio on an RCA connector 1 unbalanced stereo audio + 4dBm on a 3.5mm mini jack, with 1 balanced stereo audio on a 5-pin detachable terminal block
DATA RATE:	Up to 1.65Gbps
POWER SOURCE:	12 VDC, 270mA
CONTROLS:	Front panel buttons, infra-red remote control transmitter, RS-232, Ethernet
DIMENSIONS:	21.6cm x 16.1cm x 4.4cm (8.5" x 6.3" x 1.7", W, D, H)
WEIGHT:	1.2 kg. (2.6 lbs.) approx.
ACCESSORIES:	Power supply
OPTIONS:	Rack adapter RK-80

1 Specifications are subject to change without notice

7 Kramer Protocol 2000[1]

The **VS-311HDMI** is compatible with Kramer's Protocol 2000 (version 0.46) (below). This RS-232/RS-485 communication protocol uses four bytes of information as defined below. For RS-232, a null-modem connection between the machine and controller is used. The default data rate is 9600 baud, with no parity, 8 data bits and 1 stop bit.

Table 9: Protocol Definitions

MSB							LSB
	DESTI-NATION	**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							

1st BYTE: Bit 7 – Defined as 0.
D – "DESTINATION": 0 - for sending information to the switchers (from the PC);
1 - for sending to the PC (from the switcher).
N5…N0 – "INSTRUCTION"
The function that is to be performed by the switcher(s) is defined by the INSTRUCTION (6 bits). Similarly, if a function is performed via the machine's keyboard, then these bits are set with the INSTRUCTION NO., which was performed. The instruction codes are defined according to the table below (INSTRUCTION NO. is the value to be set for N5…N0).

2nd BYTE: Bit 7 – Defined as 1.
I6…I0 – "INPUT".
When switching (ie. instruction codes 1 and 2), the INPUT (7 bits) is set as the input number which is to be switched. Similarly, if switching is done via the machine's front-panel, then these bits are set with the INPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

3rd BYTE: Bit 7 – Defined as 1.
O6…O0 – "OUTPUT".
When switching (ie. instruction codes 1 and 2), the OUTPUT (7 bits) is set as the output number which is to be switched. Similarly, if switching is done via the machine's front-panel, then these bits are set with the OUTPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

4th BYTE: Bit 7 – Defined as 1.
Bit 5 – Don't care.
OVR – Machine number override.
M4…M0 – MACHINE NUMBER.
Used to address machines in a system via their machine numbers. When several machines are controlled from a single serial port, they are usually configured together with each machine having an individual machine number. If the OVR bit is set, then all machine numbers will accept (implement) the command, and the addressed machine will reply.

1 You can download our user-friendly "Software for Calculating Hex Codes for Protocol 2000" from our Web site: http://www.kramerelectronics.com

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.

Table 10: Instruction Codes for Protocol 2000

Note: All values in the table are decimal, unless otherwise stated.

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
0	RESET VIDEO	0	0	1
1	SWITCH VIDEO	Set equal to video input which is to be switched (0 = disconnect)	Set equal to video output which is to be switched (0 = to all the outputs)	2, 15
2	SWITCH AUDIO	Set equal to audio input which is to be switched (0 = disconnect)	Set equal to audio output which is to be switched (0 = to all the outputs)	2
3	STORE VIDEO STATUS	Set as SETUP #	0 - to store 1 - to delete	2, 3, 15
4	RECALL VIDEO STATUS	Set as SETUP #	0	2, 3, 15
5	REQUEST STATUS OF A VIDEO OUTPUT	Set as SETUP #	Equal to output number whose status is reqd	4, 3
6	REQUEST STATUS OF AN AUDIO OUTPUT	Set as SETUP #	Equal to output number whose status is reqd	4, 3
7	VIS SOURCE	Set as input # when OUTPUT byte = 6; OR set as output # when OUTPUT byte = 7; OR set as blank period (in steps of 25ms) when OUTPUT byte = 32; OR set = 0. *****	0 - No VIS (immediate) 1 - Input # 1 2 - External digital sync 3 - External analog sync 4 - Dynamic sync 5 - Inter-machine sync 6 - Input # (INPUT byte) 7 - Output #(INPUT byte) 8 - User-defined sync 32 - RGBHV seamless switching 64 - Set for delayed switch 65 - Execute delayed switch 66 - Cancel delayed switch setting	2, 5, 17, 18
8	BREAKAWAY SETTING	0	0 - audio-follow-video 1 - audio breakaway	2
		1	0 - FOLLOW mode 1 - Normal mode	15
9	VIDEO / AUDIO TYPE SETTING	0 - for video	0 - CV 4 - SDI 1 - YC 5 - CV+YC 2 - YUV 6 - VGA scaler 3 - RGBS 7 - DVI	2
		1 - for audio	O0=0 – Unbalanced audio O0=1 – Balanced audio O1=0 – Digital audio O1=1 – Analog audio O4=0, O3=0, O2=0-Mono O4=0, O3=0,O2=1-Stereo	
		2 - for VGA and DVI	1 - 640X480 2 - 800X600 3 - 1024X768	
10	REQUEST VIS SETTING	Set as SETUP #, or set to 126 or 127 to request if machine has this function	0 - VIS source 1 - Input # or output # of source 2 - Vertical sync freq (Hz)	3, 4, 6, 7
11	REQUEST BREAKAWAY SETTING	Set as SETUP #, or set to 126 or 127 to request if machine has this function	0 - Request audio breakaway setting 1 - Request “FOLLOW” setting	3, 4, 6, 15
12	REQUEST VIDEO / AUDIO TYPE SETTING	Set as SETUP #, or set to 126 or 127 to request if machine has this function	0 - for video 1 - for audio 2 - for VGA	3, 4, 6
13	SET HIGHEST MACHINE ADDRESS	0 - for video 1 - for audio	Set equal to highest machine address	2
14	REQUEST HIGHEST MACHINE ADDRESS	0 - for video 1 - for audio	0	4

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
15	REQUEST WHETHER SETUP IS DEFINED / VALID INPUT IS DETECTED	SETUP # or Input #	0 - for checking if setup is defined 1 - for checking if input is valid	8
16	ERROR / BUSY	For invalid / valid input (i.e. OUTPUT byte = 4 or OUTPUT byte = 5), This byte is set as the input #	0 - error 1 - invalid instruction 2 - out of range 3 - machine busy 4 - invalid input 5 - valid input	9, 25
17	RESERVED	- - - -	- - - -	10
18	RESET AUDIO	0	0	1
19	STORE AUDIO STATUS	Set as SETUP #	0 - to store 1 - to delete	2, 3
20	RECALL AUDIO STATUS	Set as SETUP #	0	2, 3
21	SET VIDEO PARAMETER	Equal to input / output number whose video parameter is to be set (0 = all)	Set as parameter value	2, 11, 24
22	SET AUDIO PARAMETER	Equal to input / output number whose gain is to be set (0 = all)	Set as parameter value	2, 11, 24
23	INCREASE / DECREASE VIDEO PARAMETER	Equal to input / output number whose video parameter is to be increased / decreased (0 = all)	0 - increase video gain 1 - decrease video gain 2 - increase contrast 3 - decrease contrast 4 - increase brightness 5 - decrease brightness 6 - increase color 7 - decrease color 8 - increase hue 9 - decrease hue 16 - increase H-phase 17 - decrease H-phase 18 - increase V-position 19 - decrease V-position	24
24	INCREASE / DECREASE AUDIO PARAMETER	Equal to input / output number whose parameter is to be increased / decreased (0 = all)	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	24
25	REQUEST AUDIO PARAMETER	Equal to input / output number whose parameter is requested	0	6, 24
26	REQUEST VIDEO PARAMETER	Equal to input / output number whose video parameter is requested	0	6, 24
30	LOCK FRONT PANEL	0 - Panel unlocked 1 - Panel locked	0	2
31	REQUEST WHETHER PANEL IS LOCKED	0	0	16
32 to 35	RESERVED	- - - -	- - - -	10
40	DIRECT MEMORY SAVE	Memory address	Data	20

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
42	AUDIO PARAMETER SETTINGS FOR INSTRUCTIONS 22, 24, 25	INPUT Bit: I0 - 0=input; 1=output I1 - Left I2 - Right	0 - Gain 1 - Bass 2 - Treble 3 - Midrange	24
43	VIDEO PARAMETER SETTINGS FOR INSTRUCTIONS 21, 23, 26	1 – Input 2 – Output	0 - video gain 1 - contrast 2 - brightness 3 - color 4 - hue 5 - H-phase 6 - V-position	24
56	CHANGE TO ASCII	0	1 - SVS protocol 2 - Generic protocol	19
57	SET AUTO-SAVE	I3 - no save I4 - auto-save	0	12, 2
58	EXECUTE LOADED DATA	Set as 0, or as SETUP #.	1-Take 2-Cancel	22, 3
59	LOAD VIDEO DATA	Set equal to video input (0 = disconnect) (127 = load SETUP #)	Set equal to video output (0 = to all the outputs) or SETUP #	22, 23
60	LOAD AUDIO DATA	Set equal to audio input (0 = disconnect) (127 = load SETUP #)	Set equal to audio output (0 = to all the outputs) or SETUP #	22, 23
61	IDENTIFY MACHINE	1 - video machine name 2 - audio machine name 3 - video software version 4 - audio software version 5 - RS422 controller name 6 - RS422 controller version 7 - remote control name 8 - remote software version 9 - Protocol 2000 revision	0 - Request first 4 digits 1 - Request first suffix 2 - Request second suffix 3 - Request third suffix 10 - Request first prefix 11 - Request second prefix 12 - Request third prefix	13
62	DEFINE MACHINE	1 - number of inputs 2 - number of outputs 3 - number of setups	1 - for video 2 - for audio 3 - for SDI 4 - for remote panel 5 - for RS-422 controller	14
63	EXTENDED DATA	7 MSBs for INPUT data	7 MSBs for OUTPUT data	20

NOTES on the above table:

NOTE 1 - When the master switcher is reset, (e.g. when it is turned on), the reset code is sent to the PC. If this code is sent to the switchers, it will reset according to the present power-down settings.

NOTE 2 - These are bi-directional definitions. That is, if the switcher receives the code, it will perform the instruction; and if the instruction is performed (due to a keystroke operation on the front panel), then these codes are sent. For example, if the HEX code

01 85 88 83

was sent from the PC, then the switcher (machine 3) will switch input 5 to output 8. If the user switched input 1 to output 7 via the front panel keypad, then the switcher will send HEX codes:

41 81 87 83

to the PC.

When the PC sends one of the commands in this group to the switcher, then, if the instruction is valid, the switcher replies by sending to the PC the same four bytes that it was sent (except for the first byte, where the DESTINATION bit is set high).

NOTE 3 - SETUP # 0 is the present setting. SETUP # 1 and higher are the settings saved in the switcher's memory, (i.e. those used for Store and Recall).

NOTE 4 - The reply to a "REQUEST" instruction is as follows: the same instruction and INPUT codes as were sent are returned, and the OUTPUT is assigned the value of the requested parameter. The replies to instructions 10 and 11 are as per the definitions in instructions 7 and 8 respectively. For example, if the present status of machine number 5 is breakaway setting, then the reply to the HEX code

0B 80 80 85

would be HEX codes

4B 80 81 85

NOTE 5 – For the OUTPUT byte set as 6, the VIS source is the input selected using the OUTPUT byte. Similarly, for the OUTPUT byte set as 7, the VIS source is the output selected using the OUTPUT byte. Note also, that on some machines the sync source is not software selectable, but is selected using switches, jumpers, etc!

NOTE 6 – If INPUT is set to 127 for these instructions, then, if the function is defined on this machine, it replies with OUTPUT=1. If the function is not defined, then the machine replies with OUTPUT=0, or with an error (invalid instruction code).

If the INPUT is set to 126 for these instructions, then, if possible, the machine will return the current setting of this function, even for the case that the function is not defined. For example, for a video switcher which always switches during the VIS of input #1, (and its VIS setting cannot be programmed otherwise), the reply to the HEX code

0A FE 80 81 (ie. request VIS setting, with INPUT set as 126_{dec})

would be HEX codes

4A FE 81 81 (ie. VIS setting = 1, which is defined as VIS from input #1).

NOTE 7 – Setting OUTPUT to 0 will return the VIS source setting as defined in instruction #7. Setting to 1 will return the input # or output # of the sync source (for the case where the VIS source is set as 6 or as 7 in instruction #7). Setting to 2 returns the vertical sync frequency (0 for no input sync, 50 for PAL, 60 for NTSC, 127 for error).

NOTE 8 - The reply is as in TYPE 3 above, except that here the OUTPUT is assigned with the value 0 if the setup is not defined / no valid input is detected; or 1 if it is defined / valid input is detected.

NOTE 9 - 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). This code is also returned to the PC if an RS-232 instruction is sent while the machine is being programmed via the front panel. Reception of this code by the switcher is not valid.

NOTE 10 – This code is reserved for internal use.

NOTE 11 – For machines where the video and / or audio gain is programmable.

NOTE 12 - Under normal conditions, the machine's present status is saved each time a change is made. The "power-down" save (auto-save) may be disabled using this code. Note that whenever the machine is turned on, the auto-save function is set.

NOTE 13 - This is a request to identify the switcher/s in the system. If the OUTPUT is set as 0, and the INPUT is set as 1, 2, 5 or 7, the machine will send its name. The reply is the decimal value of the INPUT and OUTPUT. For example, for a 2216, the reply to the request to send the audio machine name would be (HEX codes):

7D 96 90 81 (i.e. 128_{dec}+ 22_{dec} for 2nd byte, and 128_{dec}+ 16_{dec} for 3rd byte).

If the request for identification is sent with the INPUT set as 3 or 4, the appropriate machine will send its software version number. Again, the reply would be the decimal value of the INPUT and OUTPUT - the INPUT representing the number in front of the decimal point, and the OUTPUT representing the number after it. For example, for version 3.5, the reply to the request to send the version number would be (HEX codes):

7D 83 85 81 (i.e. 128_{dec}+ 3_{dec} for 2nd byte, 128_{dec}+ 5_{dec} for 3rd byte).

If the OUTPUT is set as 1, then the ASCII coding of the lettering following the machine's name is sent. For example, for the VS-7588YC, the reply to the request to send the first suffix would be (HEX codes):

7D D9 C3 81 (i.e. 128_{dec}+ ASCII for "Y"; 128_{dec}+ ASCII for "C").

NOTE 14 - The number of inputs and outputs refers to the specific machine which is being addressed, *not* to the system. For example, if six 16X16 matrices are configured to make a 48X32 system (48 inputs, 32 outputs), the reply to the HEX code

3E 82 81 82 (ie. request the number of outputs)

would be HEX codes

7E 82 90 82

ie. 16 outputs

NOTE 15 – When the OVR bit (4th byte) is set, then the "video" commands have universal meaning. For example, instruction 1 (SWITCH VIDEO) will cause all units (including audio, data, etc.) to switch. Similarly, if a machine is in "FOLLOW" mode, it will perform any "video" instruction.

NOTE 16 - The reply to the "REQUEST WHETHER PANEL IS LOCKED" is as in NOTE 4 above, except that here the OUTPUT is assigned with the value 0 if the panel is unlocked, or 1 if it is locked.

NOTE 17 – For clean switching of RGBHV video, the "seamless switching" option may be used. The blanking period for the transition of the RGB sources may be set in this case, in steps of 25 milliseconds.

For example, to set for 350ms blanking time (14 steps), send HEX codes

07 8E A0 81

NOTE 18 – Delayed execution allows switching after a delay dictated by RS-232. To do this, the user sends instruction 7 with the "Set for delayed switch" option (64_{dec}) before sending the switch command (instruction 1) or pressing via front panel. The switch is not executed (unless timed-out) until the "Execute delayed switch" code is sent, or the "Set for delayed switch" code is sent again. (The mode is automatically cancelled after implementation of the switch if the "execute" command is used).
For example, to connect input 4 to output 3 after a delay, send HEX codes

07	80	C0	81	(set for delayed switch)
01	84	83	81	(switch code)

then, after the required delay, send HEX codes

07	80	C1	81	(execute delayed switch)

to implement the switch.

NOTE 19 – After this instruction is sent, the unit will respond to the ASCII command set defined by the OUTPUT byte. The ASCII command to operate with the HEX command set must be sent in order to return to working with HEX codes.

NOTE 20 – When data (ie. the INPUT and/or OUTPUT bytes) of more than 7 bits is required, this instruction is sent before sending the instruction needing the additional bits. The data in this intruction then becomes the Most Significant Bits of that next instruction. For example, to set the audio gain (instruction 22) of output 3 to 681_{dec} ($2A9_{hex}$), you would first send HEX codes

3F	80	85	81

and then send HEX codes

16	83	A9	81.

To set the audio gain of output 6 to 10013_{dec} ($271D_{hex}$), first send HEX codes

3F	80	CE	81

followed by HEX codes

16	86	9D	81.

NOTE 21 – To store data in the non-volatile memory of the unit, eg. the EEPROM for saving SETUPS. The EEPROM address is sent using the INPUT byte, and the data to be stored is sent using the OUTPUT byte. To use this instruction, it is necessary to understand the memory map, and memory structure of the particular machine.

NOTE 22 – Instruction 59 and instruction 60 load data for sending to the crosspoint switcher (or for storing in a SETUP), ie. the data is "lined-up" to be executed later. Instruction 58 executes the loaded data.

NOTE 23 – If the INPUT byte is set as 127_{dec}, then the data stored in a SETUP is loaded. The SETUP # is in the OUTPUT byte.

NOTE 24 – Further information needed in instructions 21, 22, 25 and 26, is sent using instruction 42 – which is sent prior to the instruction. For example, to request the audio gain value of right input # 9, send hex codes

2A	84	80	81

and then send HEX codes

19	89	81	81.

NOTE 25 – For units which detect the validity of the video inputs, Instruction 16 will be sent whenever the unit detects a change in the state of an input (in real-time).
For example, if input 3 is detected as invalid, the unit will send the HEX codes

10	83	84	81

If input 7 is detected as valid, then the unit will send HEX codes

10	87	85	81.

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.

Safety Warning:
Disconnect the unit from the power supply before opening/servicing.

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P/N: 2900-000224 REV 1