# Kramer Electronics, Ltd.

# USER MANUAL

## Models:

**VS-402XL**, ***4x2 Vertical Interval Video-Audio Matrix Switcher***

**VS-602XL**, ***6x2 Vertical Interval Video-Audio Matrix Switcher***

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# 1 Introduction

Welcome to Kramer Electronics! Since 1981, Kramer Electronics has been providing a world of unique, creative, and affordable solutions to the vast range of problems that confront the video, audio, presentation, and broadcasting professional on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better! Our 1,000-plus different models now appear in 11 groups[1] that are clearly defined by function.

Congratulations on purchasing your Kramer **VS-402XL** 4x2 *Vertical Interval Video-Audio Matrix Switcher* and/or **VS-602XL** 6x2 *Vertical Interval Video-Audio Matrix Switcher*.

Your Kramer **VS-402XL**/**VS-602XL** is ideal for the following typical applications:

- Live broadcast or presentation applications such as switching between cameras in real-time
- CCTV, home theater
- Rental and staging applications
- Video production studios

The **VS-402XL** and/or the **VS-602XL** package include the following items:

- Vertical Interval Video-Audio Matrix Switcher
- Windows®-based control software
- Power cord, Null-modem adapter and this user manual[2]

# 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 cables[3]

## 2.1 Quick Start

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

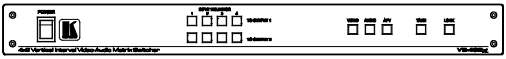
1 GROUP 1: Distribution Amplifiers; GROUP 2: Switchers and Matrix Switchers; GROUP 3: Control Systems; GROUP 4: Format/Standards Converters; GROUP 5: Range Extenders and Repeaters; GROUP 6: Specialty AV Products; GROUP 7: Scan Converters and Scalers; GROUP 8: Cables and Connectors; GROUP 9: Room Connectivity; GROUP 10: Accessories and Rack Adapters; GROUP 11: Sierra Products

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

3 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 or stick the 4 rubber feet to the underside



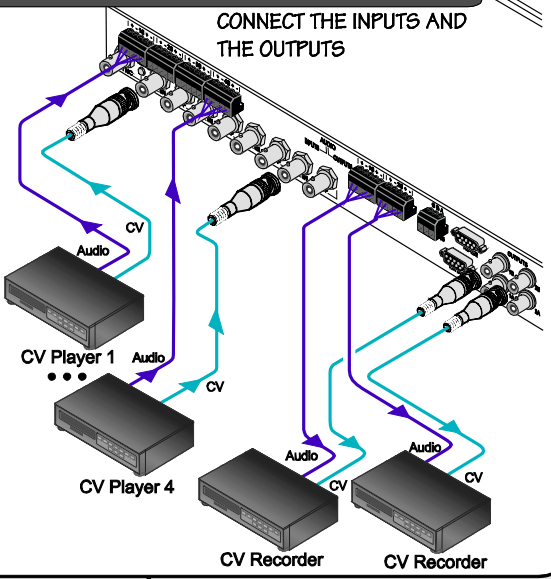
Applies to VS-402xl and VS-602xl

## Step 2: Connect the inputs and outputs - see section 6

SET THE DIP-SWITCHES

By default, DIP-switches 4 and 6 are set to ON


CONNECT THE INPUTS AND THE OUTPUTS




## Step 3: Turn the power ON

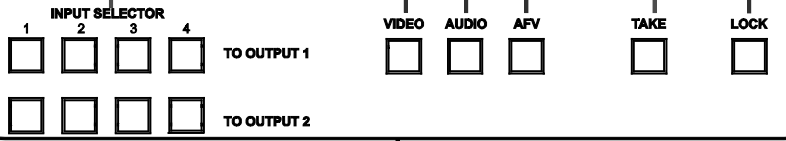
## Step 4: Operate the machine - see section 7

Use the SELECTOR buttons to switch the inputs to the outputs

AFV - Audio follows video when switching
VID - Switching relates to the video signal
AUD - Switching relates to the audio signal

Press TAKE to confirm actions

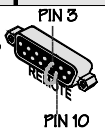
LOCK the front panel



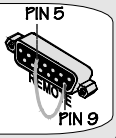

Operate via the front panel buttons, the REMOTE connector, RS-232 and RS-485

SWITCH AN INPUT TO AN OUTPUT VIA THE REMOTE CONNECTOR

For example, switch input 3 to output 1A and 1B by attaching PIN 3 to PIN 10




For example, switch input 5 to output 2A and 2B by attaching PIN 5 to PIN 9



# 3 Overview

The Kramer **VS-602XL** (a 6x2 switcher) and **VS-402XL** (a 4x2 switcher) are high performance vertical interval matrix switchers for composite video and stereo balanced audio signals. Both the **VS-602XL** and the **VS-402XL** feature:

- A video bandwidth that exceeds 300MHz, ensuring that they remain transparent even in the most critical applications
- LEVEL (gain) and EQ (peaking) controls for each output
- Looping inputs
- Selectable input signal termination
- A TAKE button[1] for precise switch control and a LOCK button to prevent tampering with the front panel
- Two sets of INPUT SELECTOR buttons (one set for each output) and five front panel control buttons
- Audio-follow-video or audio breakaway option
- Glitch-free transitions, when sources share a common reference sync[2]
- Switching synchronization either to an external reference or the incoming video
- Two duplicate[3] outputs per set of INPUT SELECTOR buttons (4 outputs in total)
- Control via the front panel buttons; remotely by RS-485 or RS-232 serial commands transmitted by a touch screen system, PC, or other serial controller; and/or via contact closure switches
- Standard 1U 19” rack mount size, with rack "ears" included

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 that may adversely influence signal quality and position your Kramer **VS-402XL** or **VS-602XL** away from moisture, excessive sunlight and dust

# 4 Your Vertical Interval Video-Audio Matrix Switcher

Figure 1 and Table 1 define the front and rear panels of the **VS-402XL** and the **VS-602XL**.

1 Also enables the user to place multiple switches in a queue and then activate them with one touch of this button, or via a single serial command

2 As it switches during the vertical interval

3 1A and 1B, 2A and 2B

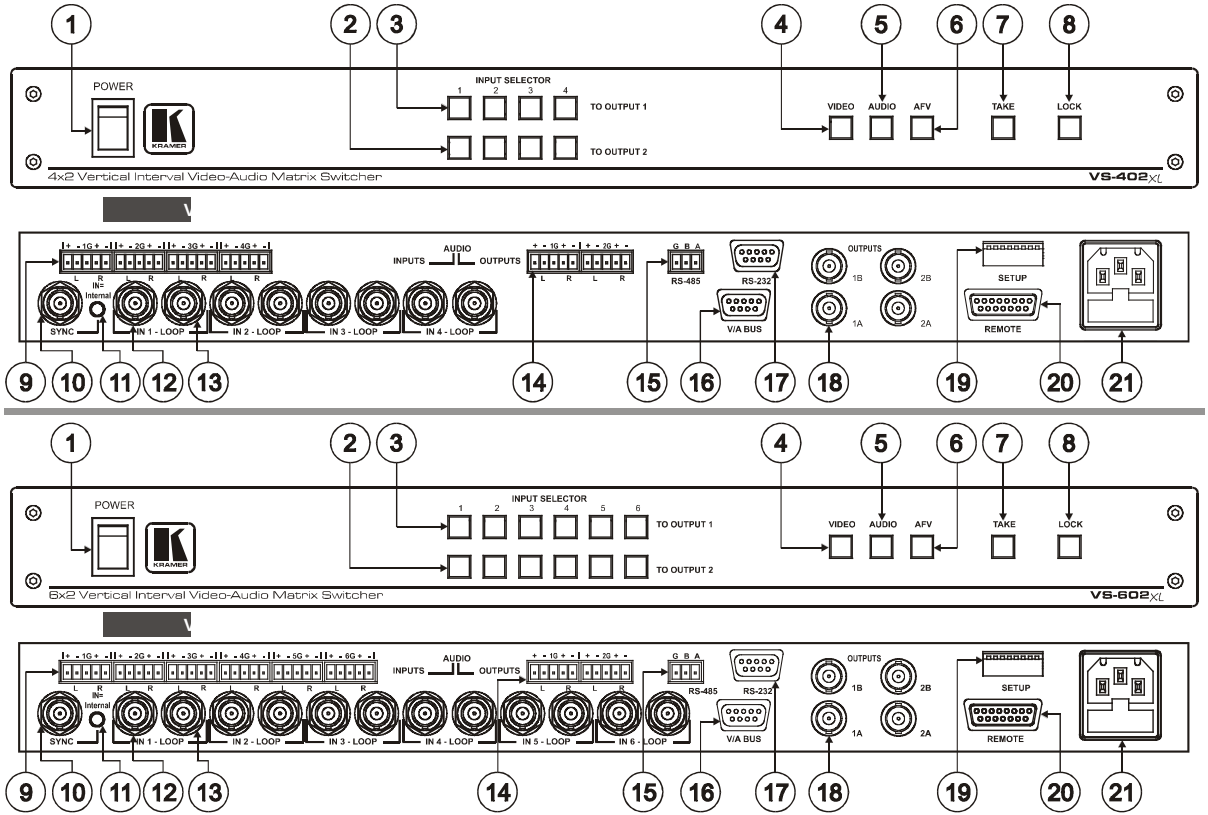



*Figure 1: Vertical Interval Video-Audio Matrix Switchers*

*Table 1: Vertical Interval Video-Audio Matrix Switcher Features*

| # | Feature | Function |
|---|---|---|
| 1 | *POWER* Switch | Illuminated switch for turning the unit ON or OFF |
| 2 | *INPUT SELECTOR TO OUTPUT 2* Buttons[1] | Select the input to switch to OUTPUTS 2A and 2B |
| 3 | *INPUT SELECTOR TO OUTPUT 1* Buttons[1] | Select the input to switch to OUTPUTS 1A and 1B |
| 4 | *VIDEO* Button[2] | When pressed actions relate to video |
| 5 | *AUDIO* Button[2] | When pressed actions relate to audio |
| 6 | *AFV* Button[3] | When pressed audio channels follow the video channels |
| 7 | *TAKE* Button | Pressing *TAKE* toggles the mode between the *CONFIRM* mode[4] and the *AT ONCE* mode (user confirmation per action is unnecessary) |
| 8 | *LOCK* Button | Disengages the front panel switches |
| 9 | *AUDIO INPUTS* Terminal Block Connectors[1] | Connects the audio sources |
| 10 | *SYNC* BNC Connector | Connects to the external SYNC source |
| 11 | *SYNC* Source Selector *(IN=Internal)* Button | Pushing in selects internal sync[5], releasing selects the external sync[6] source |
| 12 | *IN* BNC Connectors[1] | Connects the composite video sources |
| 13 | *LOOP* BNC Connectors[1] | For looping to increase output availability |
| 14 | *AUDIO OUTPUTS* Terminal Block Connectors | Connects the two audio acceptors |
| 15 | *RS-485* Connector | RS-485 detachable terminal block port |
| 16 | *V/A BUS* Connector | 9-pin D-sub connector connects to the *V/A BUS* Connector on the next unit(s) via a short DB9M flat cable when cascading in an input expansion configuration |
| 17 | *RS-232* Connector | 9-pin D-sub connector connects to PC or other Serial Controller |
| 18 | *OUTPUTS 1A; 2A; 1B; 2B* BNC Connectors | Connect to the output acceptors |
| 19 | *SETUP* | DIP-switches for setup |
| 20 | *REMOTE* Connector | Attach a specific PIN to PIN 9 or PIN 10 to switch an input via a remote contact closure switch[7] (refer to section 6.4) |
| 21 | Power Connector with Fuse | AC connector enabling power supply to the unit |

1 Four on the VS-402XL; six on the VS-602XL

2 Refer to section 8.1.2

3 Refer to section 8.1.1

4 When in Confirm mode, the TAKE button illuminates

5 On the IN 1 connector

6 On the SYNC connector

7 The appropriate front panel INPUT SELECTOR button illuminates

Figure 2 and Table 2 define the six TERM switches and the four trimmers on the underside of the **VS-602XL** unit[1]. Figure 2 shows to which LOOP connector each TERM switch relates and the location of the trimmers for adjusting OUTPUTS 1 and 2 and for adjusting EQ. 1 and EQ. 2.

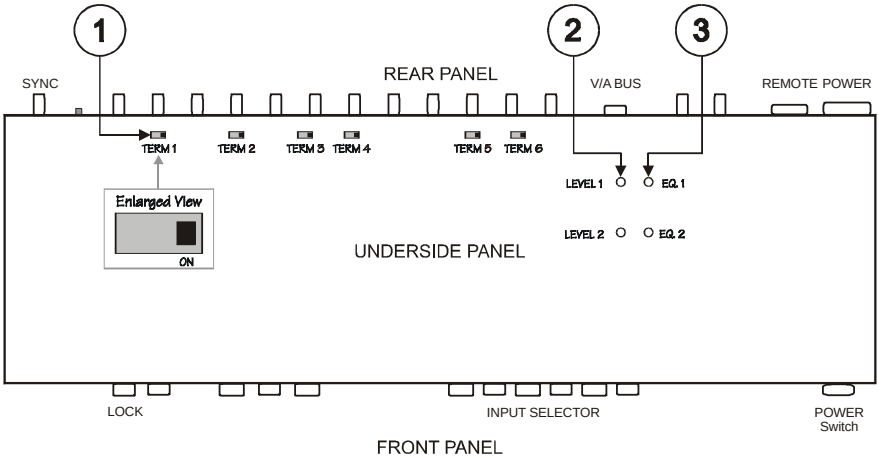



*Figure 2: VS-602XL Underside*

*Table 2: VS-602XL Underside Features*

| # | Feature | Function |
|---|---|---|
| 1 | *TERM* Switch | Move to the right (ON position) to terminate with 75Ω, or move to the left for looping[2] |
| 2 | *LEVEL* Trimmers | Adjusts[3] the output signal level for OUTPUTS 1 and 2 |
| 3 | *EQ.* Trimmers | Adjusts[3] the equalization level (EQ.) for OUTPUTS 1 and 2 |

1 The underside of the VS-402XL unit contains four TERM switches

2 The factory default

3 Insert a screwdriver into the small hole and carefully rotate it, trimming the OUTPUT level or EQ level

# 5 Installing in a Rack

This section describes what to do before installing in a rack and how to rack mount.

**Before Installing in a Rack**

| Before installing in a rack, be sure that the environment is within the recommended range: | |
|---|---|
| Operating temperature range | +5° to +45° C (41° to 113° F) |
| Operating humidity range | 10 to 90% RHL, non-condensing |
| Storage temperature range | -20° to +70° C (-4° to 158° F) |
| Storage humidity range | 5 to 95% RHL, non-condensing |

**CAUTION!!**

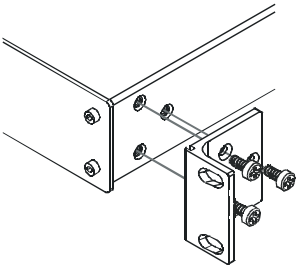
When installing in a 19" rack, avoid hazards by taking care that:

1. It is located within the recommended environmental conditions, as the operating ambient temperature of a closed or multi unit rack assembly may exceed the room ambient temperature.
2. Once rack mounted, enough air will still flow around the machine.
3. The machine is placed straight in the correct horizontal position.
4. You do not overload the circuit(s). When connecting the machine to the supply circuit, overloading the circuits might have a detrimental effect on overcurrent protection and supply wiring. Refer to the appropriate nameplate ratings for information. For example, for fuse replacement, see the value printed on the product label.
5. The machine is earthed (grounded) in a reliable way and is connected only to an electricity socket with grounding. Pay particular attention to situations where electricity is supplied indirectly (when the power cord is not plugged directly into the socket in the wall), for example, when using an extension cable or a power strip, and that you use only the power cord that is supplied with the machine.

**How to Rack Mount**

To rack-mount a machine:

1. Attach both ear brackets to the machine. To do so, remove the screws from each side of the machine (3 on each side), and replace those screws through the ear brackets.



2. Place the ears of the machine against the rack rails, and insert the proper screws (not provided) through each of the four holes in the rack ears.

Note that:

- **In some models, the front panel may feature built-in rack ears**
- Detachable rack ears can be removed for desktop use
- Always mount the machine in the rack before you attach any cables or connect the machine to the power
- If you are using a Kramer rack adapter kit (for a machine that is not 19"), see the Rack Adapters user manual for installation instructions (you can download it at: http://www.kramerelectronics.com)

# 6 Connecting a Vertical Interval Video-Audio Matrix Switcher

To connect the **VS-402XL**/**VS-602XL**, as illustrated in the example in Figure 3, do the following[1]:

1. Connect up to four/six composite video and stereo audio[2] sources (for example, composite video players) to the IN BNC connectors and terminal block connectors, respectively.
2. Connect the two OUTPUT BNC connectors and terminal block connectors to up to two composite video and stereo audio[2] acceptors (for example, composite video recorders).
3. Set the DIP-switches (see section 6.3).
4. Connect[3] the power cord[4].
5. If required, connect the following[4]:
   - A PC (when using the Kramer Control software, for example) or other RS-232 (see section 6.1) or RS-485 controller (see section 6.2).
   - A REMOTE contact closure switch (see section 6.4)

1 Switch OFF the power on each device before connecting it to your VS-402XL/VS-602XL Switcher. After connecting your VS-402XL/VS-602XL Switcher, switch on its power and then switch on the power on each device. Switching on the VS-402XL/VS-602XL Switcher, recalls the last status prior to powering down

2 Balanced or unbalanced (see section 6.5)

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

4 Not shown in Figure 3

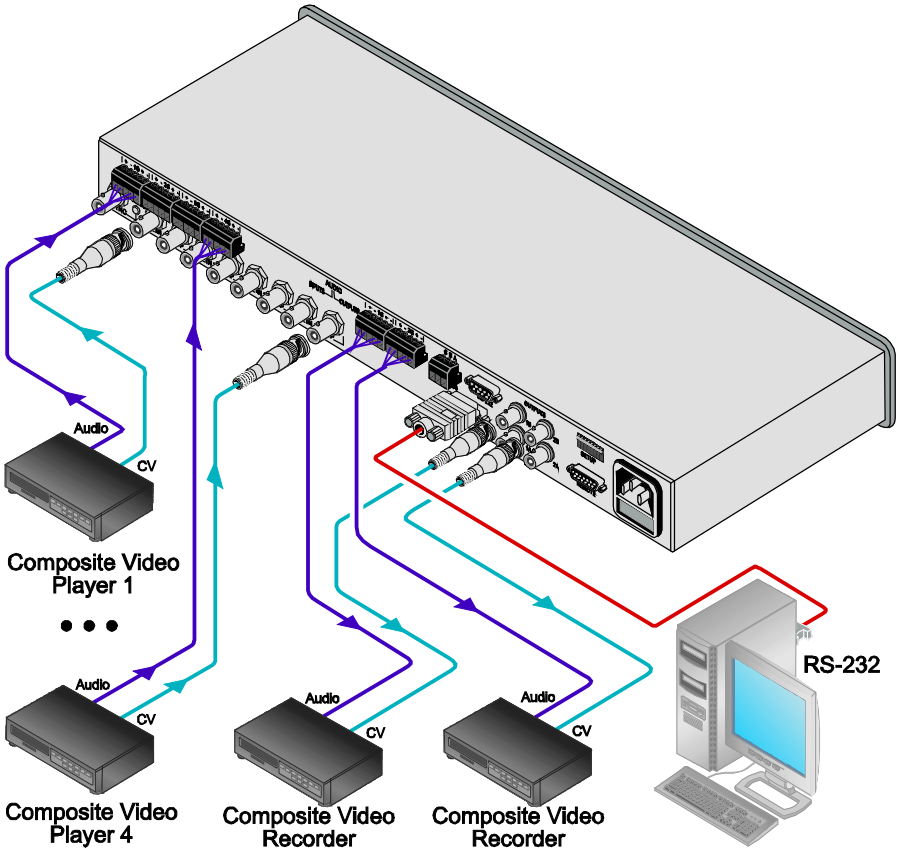



*Figure 3: Connecting the VS-402XL Vertical Interval Video-Audio Matrix Switcher*

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

To connect a PC to the **VS-402XL**/**VS-602XL** unit, using the Null-modem adapter provided with the machine (recommended):

- Connect the RS-232 9-pin D-sub rear panel port on the **VS-402XL**/ **VS-602XL** unit to the Null-modem adapter and connect the Null-modem adapter with a 9 wire flat cable to the RS-232 9-pin D-sub port on your PC

To connect a PC to the **VS-402XL**/**VS-602XL** unit, without using a Null-modem adapter:

- Connect the RS-232 9-pin D-sub port on your PC to the RS-232 9-pin D-sub rear panel port on the **VS-402XL**/**VS-602XL** unit, as Figure 4 illustrates

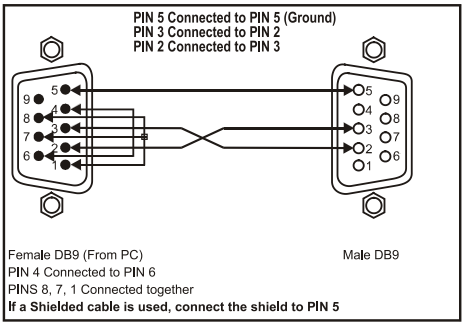



*Figure 4: Connecting a PC without using a Null-modem Adapter*

You can connect up to eight **VS-402XL**/**VS-602XL** units to the PC via the Null-modem adapter and the RS-232 port, and the RS-485 ports, as Figure 13 illustrates.

## 6.2 Controlling via RS-485

You can control a **VS-402XL**/**VS-602XL** unit via an RS-485 controller, for example, a PC (equipped with an RS-485 interface) or a Master Programmable Remote Control system such as the Kramer **RC-3000**.

To connect an **RC-3000** to a **VS-402XL**/**VS-602XL** unit[1] (see Figure 5):

1. Connect the RS-485 terminal block port on the **RC-3000** to the RS-485 port on the **VS-402XL**/**VS-602XL** unit, as follows:
   - Connect the "A" (+) PIN on the RS-485 rear panel port of the **RC-3000** to the "A" (+) PIN on the RS-485 rear panel port of the **VS-402XL**/**VS-602XL** unit
   - Connect the "B" (-) PIN on the RS-485 rear panel port of the **RC-3000** to the "B" (-) PIN on the RS-485 rear panel port of the **VS-402XL**/**VS-602XL** unit
   - If shielded twisted pair cable is used, the shield may be connected to the "G" (Ground) PIN on one of the units (for example, on the **RC-3000**)
2. Set the **VS-402XL**/**VS-602XL** unit as MACHINE # 1, according to Table 4
3. Set the SETUP DIP-switches on the **VS-402XL**/**VS-602XL** unit, as follows:
   - Set DIP 4 ON, Dip 6 ON and Dip 7 ON
   - Set DIP 5, and Dip 8 OFF

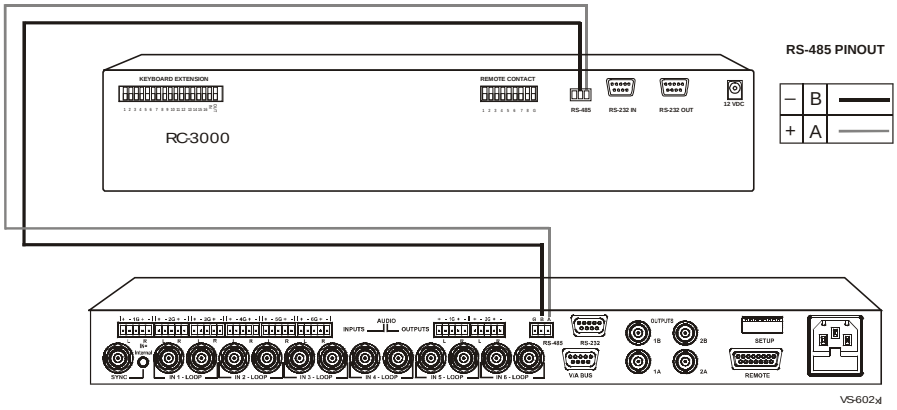



*Figure 5: Controlling via RS-485 (for example, using an RC-3000)*

1 You can control up to 8 VS-402XL/VS-602XL units, as section 7.3.2 describes

## 6.3 Setting the DIP-switches

Figure 6 illustrates the factory default SETUP DIP-switches:

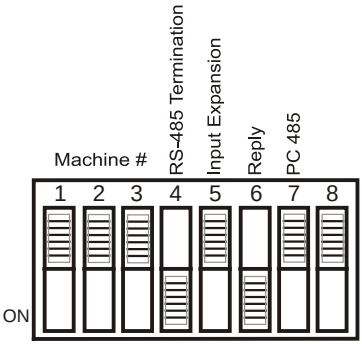



*Figure 6: DIP-switch Default Setup*

*Table 3: DIP-switch Settings*

| Function | DIPs | Description |
|---|---|---|
| Machine # | 1, 2, 3 | Determines the position of a unit in the sequence (refer to section 6.3.1) |
| RS-485 Termination | 4 | Set ON to terminate the RS-485 line on the first and last cascaded units (refer to section 7.1) |
| Input Expansion | 5 | Set ON to enable input expansion mode (refer to section 7.1) |
| Reply | 6 | Set ON to enable the Reply option in accordance with Protocol 2000 |
| PC 485 | 7 | Set ON when connecting the PC (or other controller) via the RS-485 port, set OFF when connecting the PC via the RS-232 port or when not connecting a PC |

### 6.3.1 Setting the MACHINE #

The MACHINE # determines the position of a **VS-402XL/VS-602XL** unit or a set of **VS-402XL/VS-602XL** units in the sequence[1], specifying which **VS-402XL/VS-602XL** unit is being controlled when several **VS-402XL/VS-602XL** units connect to a PC or serial controller.

Set the MACHINE # on a **VS-402XL/VS-602XL** unit via DIPs 1, 2 and 3, according to Table 4. When using a standalone **VS-402XL/VS-602XL** unit, set the MACHINE # to 1.

When connecting more than one **VS-402XL/VS-602XL** unit, set the first machine (the Master) that is closest to the PC, as MACHINE # 1[2].

1 Set the MACHINE # on the first unit to one, on the second unit to 2, on the third unit to 3

2 Set the dipswitches to OFF

*Table 4: Machine # DIP-switch Settings*

| MACHINE # | DIPSWITCH | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| 1 Master | OFF | OFF | OFF |
| 2 | ON | OFF | OFF |
| 3 | OFF | ON | OFF |
| 4 | ON | ON | OFF |
| 5 | OFF | OFF | ON |
| 6 | ON | OFF | ON |
| 7 | OFF | ON | ON |
| 8 | ON | ON | ON |

## 6.4 Connecting the REMOTE Connector

Connecting the REMOTE connector to a contact closure switch enables you to route an input to an output by remote control. To do so, touch (momentarily) the PIN corresponding to that input to PIN 9[1] (for output # 2) or PIN 10 (for output # 1).

For example, to connect input # 1 to output # 1, touch PIN 1 to PIN 10; to connect input # 2 to output # 1, touch PIN 2 to PIN 10. To connect input # 3 to output # 1, touch PIN 3 to PIN 10. To connect input # 1 to output # 2, touch PIN 1 to PIN 9. To connect input # 2 to output # 2, touch PIN 2 to PIN 9.

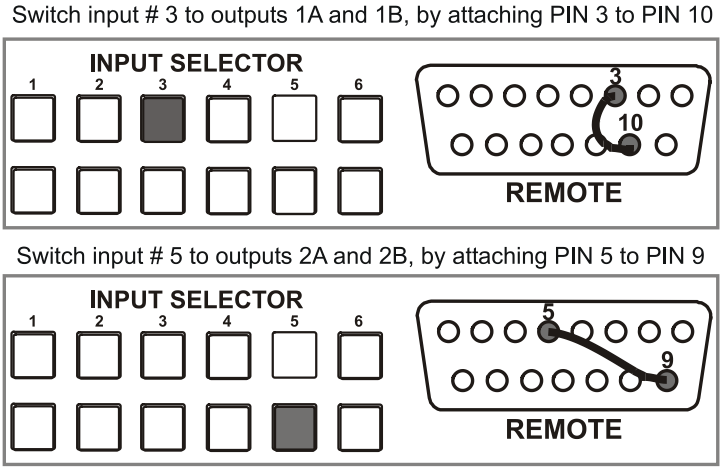



*Figure 7: Remote Connector PIN # Settings*

1 The appropriate front panel INPUT SELECTOR button illuminates

## 6.5 Connecting the Balanced/Unbalanced Stereo Audio Input/Output

Figure 8, Figure 9, and Figure 10 illustrate how to wire a balanced/unbalanced input and/or output connection:

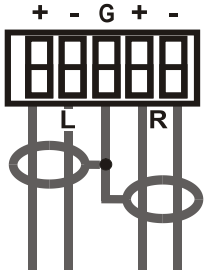



*Figure 8: Connecting a Balanced Stereo Audio Input/Output*

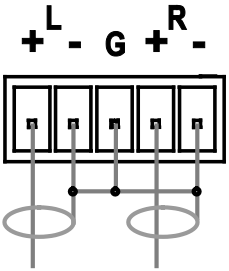



*Figure 9: Connecting an Unbalanced Stereo Audio Input*

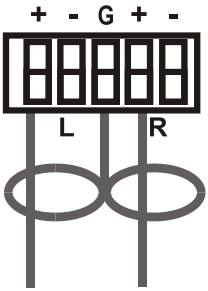



*Figure 10: Connecting an Unbalanced Stereo Audio Output*

# 7 Cascading Vertical Interval Video-Audio Matrix Switchers

For certain applications, you may need more than just 4 or 6 inputs. Cascading **VS-402XL**/**VS-602XL** units[1] enables you to expand the number of inputs by looping up to eight individual **VS-402XL**/**VS-602XL** units.

You can cascade **VS-402XL**/**VS-602XL** units, as follows:

- Up to eight interconnected **VS-402XL**/**VS-602XL** units in an input expansion configuration
- A set of **VS-402XL**/**VS-602XL** units in a parallel configuration (for example, 2 **VS-402XL**/**VS-602XL** units for Y/C, 3 **VS-402XL**/ **VS-602XL** units for RGB or YUV, 4 **VS-402XL**/**VS-602XL** units for RGBS)
- Up to eight individual **VS-402XL**/**VS-602XL** units in a control configuration
- Up to eight interconnected **VS-402XL**/**VS-602XL** units in an output expansion configuration

## 7.1 Cascading Units in an Input Expansion Configuration

You can cascade up to eight interconnected **VS-402XL**/**VS-602XL** units to form an input expansion configuration. For example, to create a 48 x 2 switcher, with 48 inputs and two outputs, connect as Figure 11 illustrates.

To cascade **VS-402XL**/**VS-602XL** units to expand the number of inputs, connect as follows:

1. Connect the composite video sources and acceptors, as well as the appropriate audio sources and acceptors, as section 6 describes.
2. Connect the RS-232 port on the first **VS-402XL**/**VS-602XL** unit (MACHINE # 1) to the PC using the Null-modem adapter provided with the machine (recommended), as section 6.1 describes.
3. Connect the RS-485 terminal block port on the first **VS-402XL**/**VS-602XL** unit to the RS-485 port on the second **VS-402XL**/**VS-602XL** unit and so on, connecting all the RS-485 ports, as Figure 11 illustrates.

1 You can interconnect VS-402XL units with VS-602XL units, and you are not limited to cascading VS-602XL units with VS-602XL units. For example, for a 10x2 vertical interval video-audio matrix switcher, interconnect a VS-402XL unit with a VS-602XL unit

4. Interconnect the V/A (video/audio) BUS DB9F connectors between the VS-402XL/VS-602XL units[1], as Figure 11 illustrates, using a 9-wire flat cable[2] with DB9M connectors, as follows:
   - Attach the cable's first DB9M connector to the V/A BUS 9-pin D-sub connector on the first **VS-402XL**/**VS-602XL** unit
   - Attach the cable's second DB9M connector to the V/A BUS 9-pin D-sub connector on the second **VS-402XL**/**VS-602XL** unit
   - Continue attaching the DB9M connectors to the V/A BUS 9-pin D-sub connectors on each **VS-402XL**/**VS-602XL** unit, up to and including the eighth **VS-402XL**/**VS-602XL** unit

6. Set the SETUP DIP-switches, as section 6.2 describes. In particular:
   - Set the first **VS-402XL**/**VS-602XL** unit as MACHINE # 1 (when operating via a PC or serial controller) and the following seven **VS-402XL**/**VS-602XL** units as MACHINE # 2 to MACHINE # 8, according to Table 4
   - Set DIP 4 ON on the first and last **VS-402XL**/**VS-602XL** units (terminating the RS-485 line at 120 Ω). Set Dip 4 OFF on the second to seventh **VS-402XL**/**VS-602XL** units
   - Set Dip 5 ON on all eight **VS-402XL**/**VS-602XL** units (enabling input expansion)
   - Set DIP 6 ON on all eight **VS-402XL**/**VS-602XL** units (enabling the Reply option in accordance with Protocol 2000)
   - Set DIP 7 OFF on all eight **VS-402XL**/**VS-602XL** units (as the PC connects via the RS-232 port)
   - Set DIP 8 OFF on all eight **VS-402XL**/**VS-602XL** units

Note: The output signals at OUTPUT 1 and OUTPUT 2 are the same on all the cascaded **VS-402XL**/**VS-602XL** units.

1 Ensuring double output signal transmission on outputs 1A and 1B and on outputs 2A and 2B, on 2 combined machines

2 The flat cable should be kept as short as possible to preserve video quality and minimize crosstalk

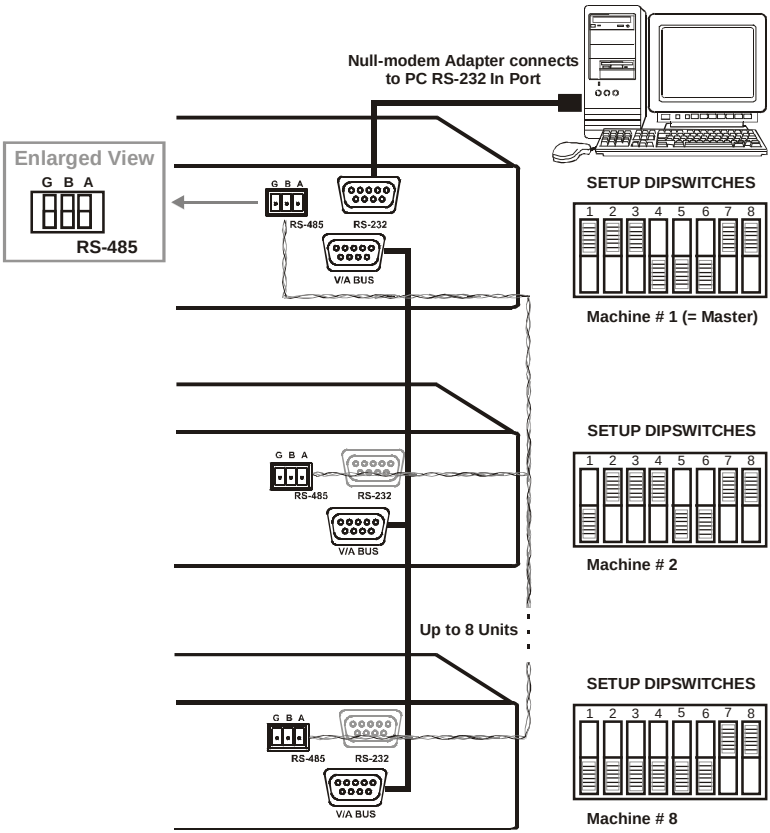



*Figure 11: Cascading Units in an Input Expansion Configuration*

## 7.2 Cascading a set of Units in a (RGB) Parallel Configuration

You can cascade a set of, for example, three **VS-602XL** units to form a 6x2 RGB vertical interval video-audio matrix switcher in parallel configuration.

To form a 6x2 RGB vertical interval video-audio matrix switcher, do the following:

1. Connect the video sources and acceptors, as well as the appropriate audio sources and acceptors, by reassigning the composite video inputs, 1 to 6, as Figure 12 illustrates, as follows:
   - On the first unit, as $R_1$ to $R_6$; on the second unit, as $G_1$ to $G_6$; and on the third unit, as $B_1$ to $B_6$

2. Connect the RS-232 port on the first **VS-602XL** unit to the PC (if required) using the Null-modem adapter provided with the machine (recommended), as section 6.1 describes.
3. Connect the RS-485 terminal block port on the first **VS-602XL** unit to the RS-485 port on the second and third **VS-602XL** units.
4. Set the SETUP DIP-switches, as section 6.2 describes. In particular:
   - Set all the **VS-602XL** units with the same MACHINE # (preferably, as MACHINE # 1)
   - Set Dip 4 ON on the first and last **VS-602XL** units (terminating the RS-485 line at 120 Ω). Set Dip 4 OFF on the second **VS-602XL** unit
   - Set Dip 5 and Dip 8 OFF on all **VS-602XL** units
   - Set Dip 6 ON on all **VS-602XL** units (enabling the Reply option in accordance with Protocol 2000)
   - Set Dip 7 OFF on all **VS-602XL** units (if the PC connects via the RS-232 port)

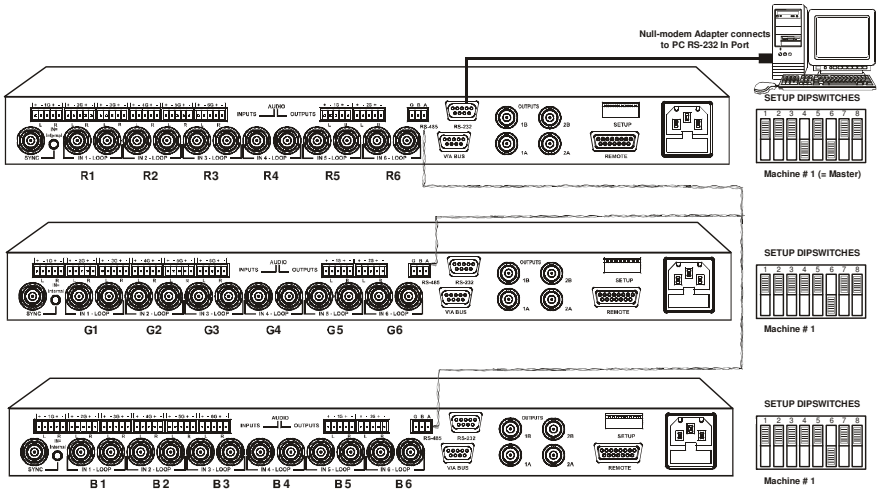



*Figure 12: Cascading a set of three Units in a (RGB) Parallel Configuration*

## 7.3 Cascading Individual Units in a Control Configuration

You can cascade up to eight individual[1] **VS-402XL**/**VS-602XL** units with control from a PC or serial controller.

### 7.3.1 Control Configuration via RS-232 and RS-485

To cascade up to eight individual **VS-402XL**/**VS-602XL** units, via RS-232 and RS-485, do the following:

1. Connect the composite video sources and acceptors, as well as the appropriate audio sources and acceptors, as section 6 describes.
2. Connect the RS-232 port on the first **VS-402XL**/**VS-602XL** unit to the PC using the Null-modem adapter provided with the machine (recommended), as section 6.1 describes.
3. Connect the RS-485 terminal block port on the first **VS-402XL**/**VS-602XL** unit to the RS-485 port on the second **VS-402XL**/**VS-602XL** unit and so on, connecting all the RS-485 ports.
4. Set the SETUP dipswitches, as section 6.2 describes. In particular:
   - Set the first **VS-402XL**/**VS-602XL** unit as MACHINE # 1 and the following seven **VS-402XL**/**VS-602XL** units as MACHINE # 2 to MACHINE # 8, according to Table 4
   - Set DIP 4 ON on the first and last **VS-402XL**/**VS-602XL** units (terminating the RS-485 line at 120Ω). Set Dip 4 OFF on the other **VS-402XL**/**VS-602XL** units
   - Set DIP 6 ON on all **VS-402XL**/**VS-602XL** units (enabling the Reply option in accordance with Protocol 2000)
   - Set DIP 5 and Dip 8 OFF on all **VS-402XL**/**VS-602XL** units
   - Set DIP 7 OFF on all **VS-402XL**/**VS-602XL** units (if the PC connects via the RS-232 port)

1 But not interconnected

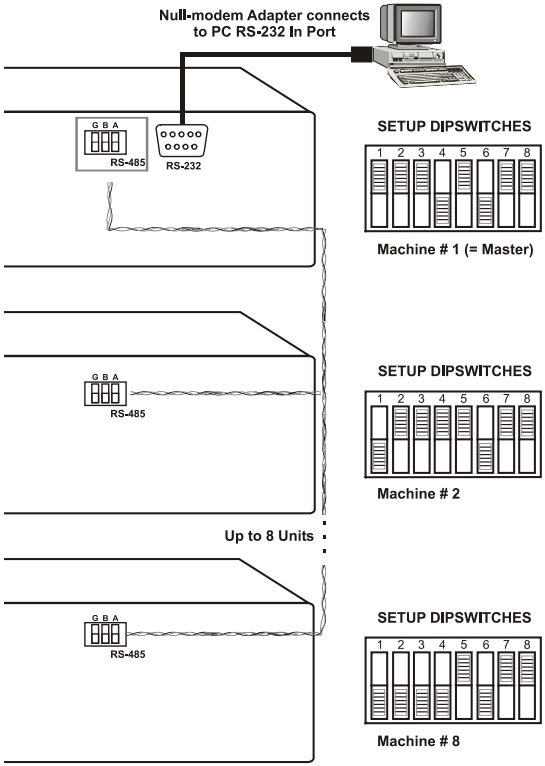



*Figure 13: Cascading Individual Units in a Control Configuration via RS-232 and RS-485*

### 7.3.2 Control Configuration via RS-485

To cascade up to eight individual **VS-402XL**/**VS-602XL** units, via RS-485 (with control via a Master Programmable Remote Control system such as the Kramer **RC-3000**), do the following:

1. Connect the composite video sources and acceptors, as well as the appropriate audio sources and acceptors, as section 6 describes.
2. Connect the "A" (+) and "B" (-) PINS on the RS-485 terminal block port of the **RC-3000** to the "A" (+) and "B" (-) PINS, respectively, on each of the eight **VS-402XL**/**VS-602XL** units. (If using shielded twisted pair cable, the shield is usually connected to the "G" (Ground) PIN of the first unit).
3. Set the first **VS-402XL**/**VS-602XL** unit as MACHINE # 1 and the following seven **VS-402XL**/**VS-602XL** units as MACHINE # 2 to MACHINE # 8, according to Table 4.
4. Set the SETUP dipswitches on the **VS-402XL**/**VS-602XL** unit, as follows:

- Set DIP 4 ON on the last unit (terminating the RS-485 line at 120 Ω). Set DIP 4 OFF on the other units
- Set DIP 6 ON on all eight units (enabling the Reply option in accordance with Protocol 2000)
- Set DIP 5 and DIP 8 OFF on all eight units
- Set DIP 7 ON on all units (as the PC connects via the RS-485 port)

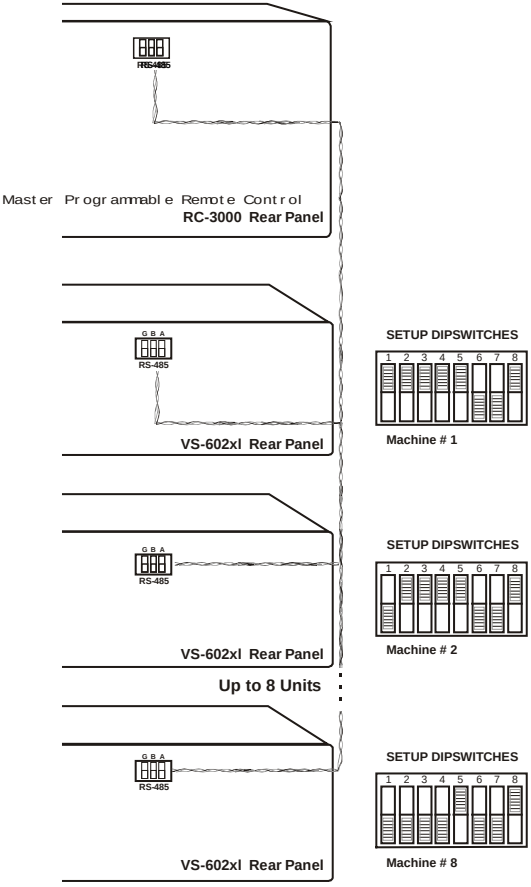



*Figure 14: Cascading Individual Units in a Control Configuration via RS-485*

## 7.4 Looping Units in an Increased Output Configuration

You can loop up to eight **VS-402XL**/**VS-602XL** units to increase outputs.

To form a 6x4 vertical interval video-audio matrix switcher, consisting of 2 **VS-602XL** units, as Figure 15 illustrates, do the following:

1. Connect the six composite video sources to the IN connectors on the second **VS-602XL** unit.
2. Connect the 6 Loop connectors on the second **VS-602XL** unit to the respective six input connectors on the first **VS-602XL** unit.
3. Connect the OUTPUTS connectors on both **VS-602XL** units to the composite video acceptors.

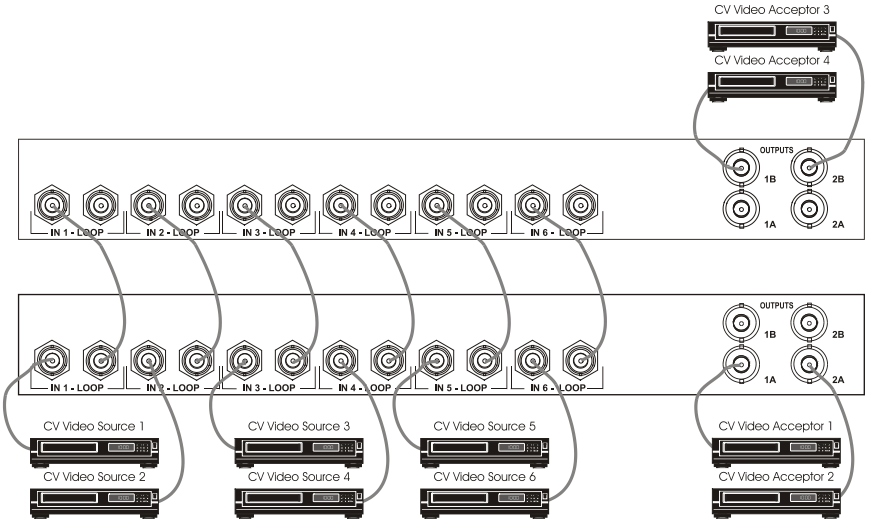



*Figure 15: Adding Outputs by Looping Units*

# 8 Operating the Vertical Interval Video-Audio Matrix Switcher

You can operate your **VS-402XL**/**VS-602XL** via:

- The front panel buttons
- RS-232 (or RS-485[1]) serial commands transmitted by a touch screen system, PC, or other serial controller
- A remote contact closure switch

1 Set DIP 7 ON on all VS-402XL/VS-602XL units when a PC or touch screen system functions via the RS-485 serial port

## 8.1 Choosing the Audio-Follow-Video or Breakaway Option

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; or
- Breakaway, in which video and audio channels switch independently

### 8.1.1 Setting the Audio-Follow-Video Option

To set the Audio-follow-video (AFV) option, when the AUDIO and VIDEO configurations are the same:

- Press the AFV button
  The AFV[1] button illuminates. The audio will follow the video

To set the Audio-follow-video (AFV) option, when the AUDIO configuration differs from the VIDEO configuration:

- Press the AFV button
  The TAKE and the AUDIO buttons flash[2], even when working in the AT ONCE mode[3]
- Press the TAKE button to confirm the modification. The audio will follow the video

### 8.1.2 Setting the Breakaway Option

To set the Breakaway option:

1. Press either the AUDIO (for audio control only) or the VIDEO (for video control only) button.
2. If the AUDIO button illuminates, switching operations relate to Audio.
3. If the VIDEO button illuminates, switching operations relate to Video.

1 When cascading units in an input expansion configuration or RGB(H) mode, as section 7.1 describes, pressing the front panel AFV button on one interconnected VS-402XL/VS-602XL unit also illuminates the AFV button on the other VS-402XL/VS-602XL units. However, pressing the VIDEO or AUDIO button on an interconnected VS-402XL/VS-602XL unit does not illuminate the corresponding VIDEO or AUDIO buttons on the other VS-402XL/VS-602XL units.

2 Warning that you are about to modify the audio configuration for AFV operation

3 Refer to item 7 in Table 1

# 9 Technical Specifications

Table 5 includes the technical specifications[1]:

*Table 5: Technical Specifications of the VS-402XL/VS-602XL*

| | | |
|---|---|---|
| INPUTS: | 6 (4) composite video with loops, 1 Sync - 1Vpp/75 Ω on BNC connectors with sync select switch<br>6 (4) balanced audio stereo, +4dBm/33kΩ on detachable terminal blocks | |
| OUTPUTS: | 2x2 composite video, 1Vpp/75Ω on BNC connectors<br>2 balanced audio stereo, +4dBu/50Ω on detachable terminal blocks. | |
| BANDWIDTH (-3dB): | Video: 300MHz | Audio: 100kHz |
| MAX. OUTPUT LEVEL: | Video: 2Vpp/75Ω | Audio: 20Vpp max. |
| DIFF. GAIN: | 0.03% | |
| DIFF. PHASE: | 0.01° | |
| K-FACTOR: | <0.05% | |
| S/N RATIO: | Video: 75dB | Audio: 82dB unweighted @1Vpp |
| CROSSTALK (all hostile): | Video: -67dB @5MHz | Audio: -97dB @1kHz |
| CONTROLS: | 17 (13) illuminated front-panel touch switches, RS-232, RS-485 | |
| COUPLING: | Video: DC | Audio: AC |
| AUDIO THD + NOISE: | 0.024% | |
| AUDIO 2nd HARMONIC: | 0.002% | |
| POWER SOURCE: | 100-240VAC, 50/60Hz, 40VA | |
| DIMENSIONS: | 19" x 7" x 1U W, D, H, rack mountable | |
| WEIGHT: | 2.7kg (6lbs) approx. | |
| ACCESSORIES: | Power cord, PC control software | |

1 Specifications are subject to change without notice

# 10 Table of Hex Codes for Serial Communication

Table 6 lists the Hex values for a single machine (*MACHINE #* 1):

*Table 6: VS-402XL/VS-602XL Hex Codes for Switching via RS-232/RS-485*

| | Switching Video Channels | | Switching Audio Channels | |
|---|---|---|---|---|
| | OUT 1 | OUT 2 | OUT 1 | OUT 2 |
| IN 1 | 01 | 01 | 02 | 02 |
| | 81 | 81 | 81 | 81 |
| | 81 | 82 | 81 | 82 |
| | 81 | 81 | 81 | 81 |
| IN 2 | 01 | 01 | 02 | 02 |
| | 82 | 82 | 82 | 82 |
| | 81 | 82 | 81 | 82 |
| | 81 | 81 | 81 | 81 |
| IN 3 | 01 | 01 | 02 | 02 |
| | 83 | 83 | 83 | 83 |
| | 81 | 82 | 81 | 82 |
| | 81 | 81 | 81 | 81 |
| IN 4 | 01 | 01 | 02 | 02 |
| | 84 | 84 | 84 | 84 |
| | 81 | 82 | 81 | 82 |
| | 81 | 81 | 81 | 81 |
| IN 5 | 01 | 01 | 02 | 02 |
| | 85 | 85 | 85 | 85 |
| | 81 | 82 | 81 | 82 |
| | 81 | 81 | 81 | 81 |
| IN 6 | 01 | 01 | 02 | 02 |
| | 86 | 86 | 86 | 86 |
| | 81 | 82 | 81 | 82 |
| | 81 | 81 | 81 | 81 |

# 11 Communication Protocol

This protocol, which enables RS-232 communication between the **VS-402XL/VS-602XL** and the PC, uses 4 bytes of information, and data is at 9600 baud, no parity, 8 data bits and 1 stop bit.

*Table 7: Protocol Definitions*

**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 | 0 | 0 | 0 | 0 | 0 | O1 | O0 |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

3rd byte

| | | | | MACHINE NUMBER | | | |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 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.

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 8: Instruction Codes*

| 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<br>(0 = disconnect) | Set equal to video output which is to be switched<br>(0 = to all the outputs) | 2 |
| 2 | SWITCH AUDIO | Set equal to audio input which is to be switched<br>(0 = disconnect) | Set equal to audio output which is to be switched<br>(0 = to all the outputs) | 2 |
| 5 | REQUEST STATUS OF A VIDEO OUTPUT | Set as SETUP # 0 | Equal to output number whose status is reqd | 4, 3 |
| 6 | REQUEST STATUS OF AN AUDIO OUTPUT | Set as SETUP # 0 | Equal to output number whose status is reqd | 4, 3 |
| 8 | BREAKAWAY SETTING | 0 | 0 - audio-follow-video<br>1 - audio breakaway | 2 |
| 11 | REQUEST BREAKAWAY SETTING | Set as SETUP # 0, or<br>set to 126 or 127 to request if machine has this function | 0 - Request audio breakaway setting | 3, 4, 6 |
| 12 | REQUEST VIDEO / AUDIO TYPE SETTING | Set as SETUP # 0, or<br>set to 126 or 127 to request if machine has this function | 0 - for video<br>1 - for audio | 3, 4, 6 |
| 16 | ERROR / BUSY | 0 | 0 - error<br>1 - invalid instruction<br>2 - out of range | 9 |
| 18 | RESET AUDIO | 0 | 0 | 1 |
| 30 | LOCK FRONT PANEL | 0 – Panel unlocked<br>1 - Panel locked | 0 | 2 |
| 31 | REQUEST WHETHER PANEL IS LOCKED | 0 | 0 | 16 |
| 57 | SET AUTO-SAVE | 0 – no save<br>1 - auto-save | 0 | 12, 2 |
| 61 | IDENTIFY MACHINE | 1 - video machine name<br>2 - audio machine name<br>3 - video software version<br>4 - audio software version | 0 | 13 |
| 62 | DEFINE MACHINE | 1 - number of inputs<br>2 - number of outputs<br>3 - number of setups | 1 - for video<br>2 - for audio | 14 |

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:

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 to SETUP # 15 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

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), or will not reply.

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

4A FE 80 81 (ie. request VIS setting, with INPUT set as 126dec)

would be

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 to the "REQUEST WHETHER SETUP IS DEFINED" is as in TYPE 3 above, except that here the OUTPUT is assigned with the value 0 if the setup is not defined; or 1 if it is defined.

**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 15, 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. The value of the gain is represented in twos complement form to allow for negative values (attenuation).

**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 INPUT is set as 1 or 2, 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. 128dec+ 22dec for 2nd byte, and 128dec+ 16dec 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. 128dec+ 3dec for 2nd byte, 128dec+ 5dec for 3rd byte).

**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

7E 82 90 82

ie. 16 outputs

**NOTE 16** - The reply to the “REQUEST WHETHER PANEL IS LOCKED” is as 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.

**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, or on which the WARRANTY VOID IF TAMPERED sticker has been torn, reattached, removed or otherwise interfered with.
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.

* FCC and CE approved using STP cable (for twisted pair products)

**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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