



Kramer Electronics, Ltd.

USER MANUAL

**XGA Line Amplifier
& Converter**

Model:

VP-103

IMPORTANT: Before proceeding, please read paragraph entitled
"Unpacking and Contents"

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1 INTRODUCTION

Congratulations on your purchase of this Kramer Electronics VGA/XGA/UXGA Line Amplifier / Converter. Since 1981, Kramer has been dedicated to the development and manufacture of high quality video/audio equipment. The Kramer line has become an integral part of many of the best production and presentation facilities around the world. In recent years, Kramer has redesigned and upgraded most of the line, making the best even better. Kramer's line of professional video/audio electronics is one of the most versatile and complete available, and is a true leader in terms of quality, workmanship, price/performance ratio and innovation. In addition to the Kramer line of high quality VGA/XGA/UXGA Line Amplifiers, such as the one you have just purchased, Kramer also offers a full line of high quality video distribution amplifiers, switchers, processors, format interfaces, controllers and other computer-related products. This manual includes configuration, operation and option information for the **VP-103**.

1.1 A Word on VGA/XGA/UXGA Amplifiers

VGA/XGA/UXGA Amplifiers route signals to one or more selected users. They vary in looping capability, number of outputs, bandwidth and input/output coupling. VGA/XGA/UXGA Amplifiers, such as the one described in this manual, are used to split VGA/XGA/UXGA graphics card outputs to remote monitors. Some of them allow control of signal level and cable equalization of each channel independently, as well as control of the horizontal and vertical sync delay on the outputs. A good quality VGA/XGA/UXGA amplifier pre-compensates the signal for potential losses (resulting from the use of long cables, noisy sources, etc.) and routes the signal to buffered and amplified outputs. The front panels of all Kramer Amplifiers are designed to be simple to operate.

1.2 Handling Graphics signals

A computer generated graphics signal is usually composed of 5 signals: Red, Green, Blue -which are analog level signals - and two TTL (logic) level signals - Horizontal Sync and Vertical Sync. (Digital graphics cards and monitors use a different signal format, and will not be discussed here, as they are not relevant to the amplifier.).

Computer graphics resolution is measured in pixels and signal bandwidth. The more pixels (picture elements) on the screen, the more detailed the image. VGA, S-VGA, XGA, S-XGA and U-XGA are terms describing the graphics resolution and the color depth. Color depth represents the maximum number of simultaneously displayed colors on the screen and is measured in bits. 24 and 32-

36 bits of color depth represent millions to billions of shades of color available on the screen at any given moment. It should be born in mind though, that the human eye can resolve only a few thousands colors! The more detailed the image (higher resolution) and the higher the color depth, the more real the image looks. The highest resolution of standard VGA was 640x480 pixels with 4 bits of color (16 colors). It was able to use more colors (256) but at a lower, very crude, resolution - around 320x200 pixels. Common resolutions used now for computer graphics vary between 1024x768 up to 2000x1600 pixels with “high color” - 16 bits of color, representing 64,000 different colors, up to “true color” - 24 bits or more, representing from 16.7 million colors up to several billion. Displaying such a detailed and colorful image on the screen needs enormous graphics memory per frame, as well as very high speeds, for “writing” so many pixels on the screen in real time. The amplifiers that carry those signals must be able to handle those speeds and signal bandwidth.

The standard VGA, at 640x480 resolution, needed amplifiers with 20-30MHz bandwidth. At 1600x1200 (UXGA) or even at 1280x1024 (SXGA), such amplifiers fail completely. In order to faithfully amplify and transmit modern high-resolution graphics, amplifiers with bandwidths of 300 MHz and more are needed. Those amplifiers, besides the enormous bandwidth they handle, need to be linear, to have very low distortion and be stable.

Stability of an amplifier is its ability to avoid bursting into uncontrolled oscillation, which is in adverse relationship to the speed it can handle. The tendency to oscillate is further enhanced by the load impedance. The load impedance of a system is usually not just a resistor. A cable connected to an amplifier (leading to the receiver or monitor) may present a capacitive and/or an inductive load to the amplifier. This is the main cause of instability. The deficient behavior of a load or cable may severely degrade the performance of the amplifier, its bandwidth, linearity and stability and in general its ability to faithfully reproduce the signal.

Cables affect image resolution. Longer cables, due to imperfect characteristics, cause high frequency deterioration, image “smear” and loss of resolution. In computer graphics especially, this adverse effect is very much accentuated. Amplifiers should therefore cope with an additional task, compensating for cable losses up to the maximum useful operation distance. High-resolution graphics systems must use very high quality cables for image transmission. The cables should be shielded to eliminate externally induced interference even though the shield itself can increase the capacitance of the cable, and therefore, cause deterioration in the image’s resolution and clarity. Standard cables should only be a few meters long. For longer distances, the compound cable is broken into five individual coax cables, which are bulky and cumbersome for use. Even so, the distance is limited to several tens of meters.

The imperfect behavior of a cable may create other problems resulting from the failure to accurately match the system's required impedance. The result of this, especially at high frequencies, is "shadows" or "ghosts" on the image, resulting from standing waves and electronic reflections running back and forth between transmitter and receiver. Another aspect to consider is the sync. As sync signals are logic signals, which are not treated as analog signals, the receiver does not terminate the line, and therefore the line is not matched. A host of problems can occur when signals are sent over long, unterminated, unmatched cables. The result can be image breakdown or distortion due to improper sync information. The amplifier that drives the analog section of the graphics data should also be able to buffer, recover and send the sync information in such a way that it will be received properly at the receiver end.

1.3 Factors Affecting Quality of Results

There are many factors affecting the quality of results when signals are transmitted from a source to an acceptor:

- **Connection cables** - Low quality cables are susceptible to interference; they degrade signal quality due to poor matching and cause elevated noise levels. They should therefore be of the best quality.
- **Sockets and connectors of the sources and acceptors** - So often ignored, they should be of highest quality, since "Zero Ohm" connection resistance is the objective. Sockets and connectors also must match the required impedance (75ohm in video). Cheap, low quality connectors tend to rust, thus causing breaks in the signal path.
- **Amplifying circuitry** - Must have quality performance when the desired end result is high linearity, low distortion and low noise operation.
- **Distance between sources and acceptors** - Plays a major role in the final result. For long distances between sources and acceptors, special measures should be taken in order to avoid cable losses. These include using higher quality cables or adding line amplifiers.
- **Interference from neighboring electrical appliances** - These can have an adverse effect on signal quality. Balanced audio lines are less prone to interference, but unbalanced audio should be installed far from any mains power cables, electric motors, transmitters, etc. even when the cables are shielded.



2 HOW DO I GET STARTED?

The fastest way to get started is to take your time and do everything right the first time. Taking 15 minutes to read the manual may save you a few hours later. You don't even have to read the whole manual. If a section doesn't apply to you, you don't have to spend your time reading it.

3 UNPACKING AND CONTENTS

The items contained in your Kramer package are listed below. Please save the original box and packaging materials for possible future shipment.

Amplifier (VP-103)

This User Manual

Power Supply

Kramer Concise Product Catalog

Rubber Feet

3.1 Optional Accessories

The following accessories, which are available from Kramer, can enhance implementation of your machine. For information regarding cables and additional accessories, contact your Kramer dealer.

VP-61xl - (6x1 VGA/XGA Audio Switcher) can be serially inserted between up to 6 VGA sources and the Amplifier for source selection. It is a full bandwidth switcher, designed for computer and workstation applications. The **VP-61xl** switches one of six VGA/SVGA/XGA graphics card outputs and the appropriate audio channels to one monitor (or DA, etc.), with no discernible signal degradation. The **VP-61xl** also has RS-232 control. Input and output are direct coupled and conform to the highest standards.

VP-200/300/400 - (1:2/1:3/1:4 High Resolution VGA Distribution Amplifiers) can be serially inserted between the loop output of the Amplifier and the local receptors for additional signal distribution. They are full bandwidth DAs, designed for computer and workstations applications. The **VP-200/300/400** split a VGA/SVGA/XGA graphics card output to 2/3/4 monitors, with no discernible signal degradation. State-of-the-art video amplifying circuitry and microchip technology make the **VP-200/300/400** the first choice Graphics Component Distributor. Signal bandwidth of 345MHz allow the **VP-200/300/400** to be used with the highest quality graphics workstations.

VP-222 - (2x1 VGA switcher distributor) can be serially inserted between 2 VGA/XGA sources and the Amplifier. It is a full bandwidth switcher, 2x1 VGA switcher distributor designed for computer and presentation applications. The **VP-222** allows selection of one out of two VGA/XGA sources and distribution of the selected source to two independent outputs. Signal bandwidth of 365MHz

ensures that the **VP-222** remains transparent even in the most critical applications. The VP-222 is part of the Kramer TOOLS family of compact, high quality and cost effective solutions for a variety of applications.

VP-23 - can be serially inserted between the loop output of the **VP-103** and a presentation system. It is a high quality Presentation Switcher combining the functions of a 4x1 switcher for composite video and audio, a 4x1 switcher for s-Video and audio, and a 4x1 switcher for VGA-type signals with audio, all into a single high performance unit. The **VP-23** is designed to become a one-box solution for systems, which would otherwise require several separate products. Each section can be controlled independently from the others. The **VP-23** can be controlled by front panel buttons or by RS-232 serial commands transmitted by a touch screen system, personal computer, or other serial controller. The **VP-23** has an additional audio switching section which routes one of the pre-selected audio inputs from the other switching sections to a separate output. This switching section can insert an additional microphone channel - either by switching, mixing or talk-over. Front-panel controls allow adjustment of VGA/XGA/UXGA output level and EQ., Master audio output level and Microphone level.

4 XGA LINE AMPLIFIER/CONVERTER

This section describes the controls and connections of your amplifier. Understanding the controls and connections helps you realize the full power of your machine.

4.1 Getting to Know Your VP-103 Line Amplifier/Converter

The Kramer **VP-103** is a high performance VGA/XGA/UXGA to BNC converter designed to allow a single VGA/XGA/UXGA source to drive a local monitor and up to two compatible large display devices simultaneously. Many projectors and large monitors provide BNC connectors rather than multi-pin D connectors. The **VP-103** solves this physical incompatibility, and provides the local monitor loop-through, as well as necessary buffering, amplification, and sync processing for remote acceptors applications. Note that the **VP-103** does not perform any scan rate conversion.

The **VP-103** will accept all typical VGA modes such as VGA, SVGA, XGA, SXGA, UXGA and will output RGsB, RGBS, or RGBHV. Video bandwidth of 315 MHz ensures transparent operation at multiple resolutions including XGA. For applications not requiring a local monitor, a front-panel termination switch is provided eliminating the need for external termination plugs. The machine provides Level and Cable Equalization from panel, easy-access controls. The

VP103 is rugged, dependable, and runs on a standard 12VDC source, and is therefore perfectly suitable for fieldwork as well.

Front/Rear panel features of the VP-103 are described in Figure 1 and in Table 1.

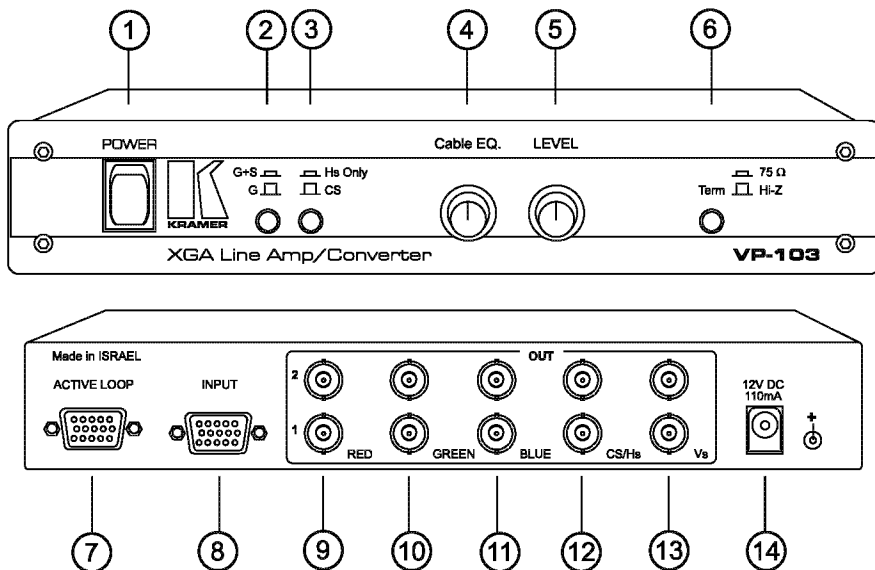


Figure 1: VP-103 Front/Rear Panel Features

Table 1: VP-103 Front Panel Features

	Feature	Function
1.	Power switch	Illuminated switch supplies power to the unit.
2.	S+G/GREEN pushbutton	Selects either Sync +Green or Green at the GREEN BNC connector. (Sync +Green pressed)
3.	H+V/H pushbutton	Selects horizontal & vertical sync (when pressed), or horizontal sync only, (when released) at the H/HV SYNC connector.
4.	BNC OUT EQ. knob	Controls cable equalization of the BNC video outputs.
5.	BNC OUT Level knob	Controls video level of the BNC video outputs.
6.	Termination Switch	When released, allows for looping. When pressed in, looping cannot be used.

Table 1: VP-103 Rear Panel Features (Cont.)

	Feature	Function
7.	VGA/XGA LOOP HD15F connector	Provides VGA/XGA looping capability to increase the number of outputs.
8.	VGA/XGA input HD15F connector	The VGA/XGA input connector.
9-11.	RED, GREEN and BLUE BNC connectors	Two sets of amplified and buffered RED, GREEN & BLUE signal outputs.
12.	CS/Hs SYNC BNC connector	Amplified and buffered horizontal sync (when Hs/Cs pushbutton is pressed) or Composite sync (only when Hs/Cs pushbutton is released.)
13.	Vs SYNC BNC connector	Amplified and buffered vertical sync output.
14.	DC Power supply Connector	A DC connector allows power (12VDC) to be supplied to the unit.

5 INSTALLATION

5.1 Rack Mounting

The **VP-103** line amplifier & processor may be rack mounted in a standard 19" (1U) EIA rack assembly using optional rack adapter model RK-MEDN.

6 CONNECTING TO VGA/XGA/UXGA SOURCES

VGA/XGA/UXGA sources may be connected to the **VP-103** through the HD15F type connectors located on the back of the machine. Output devices (such as monitors, projectors or recorders) may be connected to the machine through the BNC connectors.

7 USING THE MACHINE

7.1 Turning on the Amplifier

NOTES

- 1. The amplifier should only be turned on after all connections are completed, and all source devices have been turned on. Do not attempt to connect or disconnect any video or control signals to the Amplifier while it is turned on!*
- 2. The socket-outlet should be near the equipment and should be easily accessible. To fully disconnect equipment, remove the power cord from its socket.*

- ❖ Press the toggle switch on the left of front panel to the up position. The toggle switch illuminates.
- ❖ Operate the acceptors.

7.2 Output Level Control

The Level Control function enables the operator to control the picture intensity level or compensate for distortions, caused by, for example, cables that are too long or short. Low level signals cause a picture to be too dark and on the other hand, excessive levels "burn" the picture. To correct the incoming signal, adjust the **LEVEL** knob until a satisfactory picture is achieved.

7.3 Looping

The looping function enables the operator to connect several machines to a VGA/XGA source. Always switch the termination switch of the **first** and **middle** machines to "**Hi-z**". The **last** amplifier's termination switch should always be at "**75ohm**" to maintain well-matched lines (of 75ohm impedance) from the first to the last amplifier. If the looping function is not used, the termination switch should be set to "**75 ohm**".

7.4 Equalization Control

Equalization Control function compensates for degradation of the incoming signals due to cable imperfections. Popular cables such as RG-59, RG-11 or RG-179 cause degradation/attenuation as follows:

CABLE TYPE	LENGTH	FREQUENCY	ATTENUATION
RG-59	100 meter	10MHz	3.6dB
	100 meter	100MHz	11dB
RG-11	100 meter	10MHz	2.2dB
	100 meter	100MHz	7.5dB
RG-179	100 meter	10MHz	8dB
	100 meter	100MHz	30dB

Degradation and loss of VGA/XGA signals are caused by stray capacitance inherent in long cables. As longer cables or higher frequencies are used, it becomes a serious problem and fine details of the picture fade. When RGB signals are involved, degradation is even greater, leading to total loss of sharpness in high-resolution signals. It is possible to compensate for the cables' imperfect behavior by using the amplifier's **EQ** knobs, until a satisfactory picture is achieved.

7.5 Sync programming Switches

The **VP-103** normally uses two sets of 5 coax cables each (Red, Green, Blue, Horizontal sync, Vertical sync). Depending on the acceptors capability, this number may be reduced to 4 cables or even three cables. When the acceptors can use Composite sync, then only 4 cables are in use (R, G, B, Cs). In this case, release the front panel switch marked *Hs only/CS* and Composite sync will be outputted at the *CS/Hs* BNC. When the acceptor can use Sync-on-Green, then three cables may be used, connected to the Red, Green and Blue BNCs. In this case, the front panel switch marked *G+S/G* should be pressed in (*G+S* position). The sync programming switches operate simultaneously on both sets of outputs.

8 TYPICAL APPLICATIONS

8.1 Typical VGA/XGA Line Amplification/Conversion

A typical use of the Kramer VGA/XGA/UXGA Line Amplifier / Converter is described below: An incoming VGA/XGA/UXGA signal from a PC graphics source reaches the Line Amplifier/Converter. The **VP-103** splits the VGA/XGA/UXGA graphics card output to a remote monitor or data projector, allowing the user to control the signal level and cable equalization of the BNC outputs. Perform the following steps (as required):

1. Connect the output from your graphics source to the **VP-103**. A local monitor can be connected to the **LOOP** HD15F connector and the **TERM** switch should be released. If looping is not needed, push the **TERM** switch in to **75ohm** position.
2. Connect the VGA/XGA/UXGA outputs of the **VP-103** to remote monitors, projectors or other acceptors.
3. Use the **EQ.** and **Level** Control functions to control the outputs.
4. You can have either separate Horizontal sync or Composite sync on the **CS/HS SYNC** BNC. If the **Hs Only** front panel pushbutton is pressed, Horizontal sync is outputted on this BNC. If the switch is released, Composite sync is available on this BNC.
5. In a three-coax setup, the sync signal resides on the Green signal. Press the **G+S** front panel pushbutton to insert Sync-On-Green. The **GREEN** BNC now outputs Green + Composite sync.



9 TAKING CARE OF YOUR MACHINE

Do not locate your machine in an environment where it is susceptible to dust or moisture. Both of these may damage the electronics, and cause erratic operation or failure. Do not locate your machine where temperature and humidity may be excessive. Doing so may also damage the electronics, and cause erratic operation or failure of your machine. Do not clean your machine with abrasives or strong cleaners. Doing so may remove or damage the finish, or may allow moisture to build up. Take care not to allow dust or particles to build up inside unused or open connectors.

10 TROUBLESHOOTING

NOTES

Please note that if the output signal is disturbed or interrupted by very strong external electromagnetic interference, it should return and stabilize when such interference ends. If not, turn the power switch off and on again to reset the machine.

If the following recommended actions do not result in satisfactory operation, please consult your KRAMER Dealer.

10.1 Power and Indicators

Problem	Remedy
No Power	<ul style="list-style-type: none"><input type="checkbox"/> Confirm that the rocker switch is in the “ON” position, and that the lamp is illuminated.<input type="checkbox"/> Confirm that power connections are secured at the machine and at the receptacle. Make sure the receptacle is active, outputting the proper mains voltage to the DC adapter.<input type="checkbox"/> If there is still no power, check the fuse. Remove power supply adapter from the AC outlet and then, remove the cover of the machine and locate the internal fuse.<input type="checkbox"/> Confirm that the fuse is good by looking at the wire connected to the ends of the fuse. If the wire is broken, replace the fuse with an identical value fuse.

10.2 VGA/XGA Signal

Problem	Remedy
No signal at the output device	<ul style="list-style-type: none"> <input type="checkbox"/> Confirm that your sources and output device are turned on and connected properly. <input type="checkbox"/> Confirm that any other switchers in the signal path have the proper input and/or output selected. <input type="checkbox"/> Confirm that the leading cables (RGBHV) were not swapped.
Signal level is too high or too dim.	<ul style="list-style-type: none"> <input type="checkbox"/> Verify that the VGA/UXGA line is well matched through 75ohm impedance, otherwise it results in a signal level that is too high or too dim when looping is performed and the termination switches are not in proper position. <input type="checkbox"/> Confirm that the connecting cables are of high quality, properly built and terminated with 75ohm. Check level controls located on your source input device or output display or recorder. <input type="checkbox"/> If necessary, adjust the LEVEL control.
Noise bars "roll" up or down in the output image or: Low Frequency Hum in the audio output	<p>Hum bars (ground loop) are caused by a difference in the ground potential of any two or more devices connected to your signal path. Passing that voltage difference through any available interconnection, including your video cables, compensates this difference.</p> <p><i>WARNING! Do not disconnect the ground from any piece of video equipment in your signal path!</i></p> <p>Check the following to remove hum bars:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Confirm that all interconnected equipment is connected to the same phase of power, if possible. <input type="checkbox"/> Remove equipment connected to that phase that may introduce noise, such as motors, generators, etc. <input type="checkbox"/> Disconnect all interconnect cables and reconnect them one at a time until the ground loop reappears. Disconnect the affected cable and replace, or insert an isolation transformer in the signal path.



11 TECHNICAL SPECIFICATIONS

INPUT:	Looping Analog Red, Green, Blue signals - 0.7 Vpp/75 Ω , H & V sync, TTL level, on HD15F connector.
OUTPUT:	2 x Analog Red, Green (with or without Composite Sync), Blue signals 0.7 Vpp/75 Ω , H & V syncs-TTL level (Hi-Z load) or Analog Level (75 Ω load) on BNC connectors. Composite Sync - TTL levels (Hi-Z load) or Analog level (75 Ω load).
VIDEO BANDWIDTH:	315 MHz.
S/N RATIO:	75 dB.
DIFF. GAIN:	0.4%.
DIFF. PHASE:	0.15 Deg.
CONTROL:	Composite Sync or Horizontal Sync output, Green or Green + Sync selected via front panel switches, Level control: -1 to +4.1 dB, EQ. control: 0 to +8.6 dB @ 5.8 MHz.
COUPLING:	AC, inputs and outputs, with input protection circuitry.
DIMENSIONS:	24.5cm x 18 cm x 4.5 cm (9.6" x 7" x 1.8", W, D, H.).
POWER SOURCE:	12 VDC, 110mA 1.5 W max.
WEIGHT:	1.1 Kg. (2.4 Lbs.) Approx.
ACCESSORIES:	12 Volts DC power supply.
OPTIONS:	Rack mount kit model RK-MEDN.

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 three 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:
 - a) Accident, misuse, abuse, neglect, fire, water, lightning or other acts of nature.
 - b) Product modification, or failure to follow instructions supplied with the product
 - c) Repair or attempted repair by anyone not authorized by Kramer.
 - d) Any shipment of the product (claims must be presented to the carrier).
 - e) Removal or installation of the product.
 - f) Any other cause, which does not relate to a product defect.
 - g) 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

Kramer's liability for any defective 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.

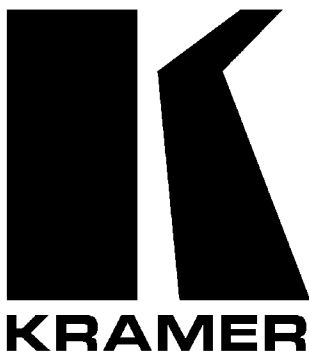
NOTE: All products returned to Kramer for service must have prior approval. This may be obtained from your dealer.

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.



**The list of Kramer distributors appears on our web site:
www.kramerelectronics.com**

**From the web site it is also possible to e-mail factory headquarters.
We welcome your questions, comments and feedback.**

Kramer Electronics, Ltd.

3 Am VeOlamo Street. Jerusalem 95463, Israel Tel: (972-2)-654-4000.
Fax: (972-2)-653-5369, E-mail: kramere@netvision.net.il