KRAMER ELECTRONICS, Ltd.

USER MANUAL

Kramer Genlock Multistandard Black Burst/Bar Generator

Model: SG-6005

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

Table Of Contents

List Of Illustrations

List Of Tables

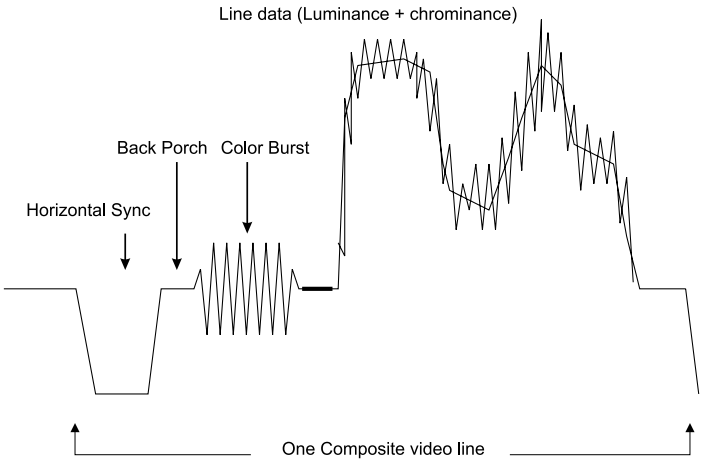
1 INTRODUCTION

Congratulations on your purchase of this Kramer Electronics Genlock Multistandard Black Burst / Color Bar Generator. 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 unit you have just purchased, Kramer also offers a full line of high quality distributors, switchers, processors, interfaces, controllers and computer-related products.

This manual includes configuration, operation and option information for the **SG-6005**.

2 VIDEO SYNC AND RELATED PROBLEMS

All video signals arriving at a monitor carry with them synchronization information. Whether they are analog signals (Composite, Y/C, Component and RGB) or digital (SDI, etc.) synchronization signals are needed for proper alignment of the image on the screen. Many sync related problems mis-diagnosed, and other components of the signals are blamed.

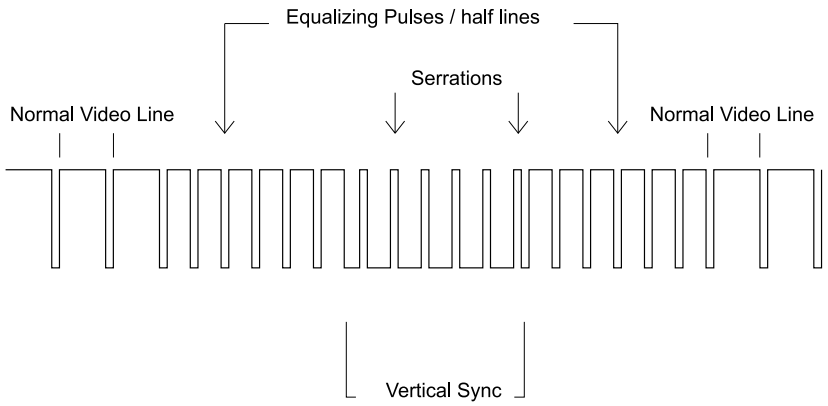


2.1 Sync Types

In most known video formats, there are two types of sync signals – horizontal and vertical sync. The horizontal sync, often referred to as the line sync in a composite video signal, is a short, negative pulse at the beginning of each scan line of the monitor. The number of line sync pulses equals the number of video lines. Basically, this pulse tells the monitor – "be prepared – a line of data is coming". The horizontal sync resides in the blanking area – the unseen part of the signal, where it is not seen on the screen.

The vertical sync, sometimes referred to as the field sync, is also a negative set of pulses at the beginning of each video field (60 field/sec. in NTSC, 50 fields/sec. in PAL). The vertical sync is a more complicated signal than the horizontal sync and it tells the monitor – "be prepared, a new field of data is coming". The vertical sync also resides in the blanking area, and is not seen on the screen.

Vertical Sync signal



2.2 SYNC Location

Sync signals appear in the following locations in the various video formats:

- In the Composite video signal, sync is an integral part of the signal as the Composite video signal is a package including horizontal and vertical sync, luminance and chrominance (color) information.
- The s-Video signal format is made of two parts – the luminance (brightness, black & white information) and the chrominance (color information). The sync signals in this format are part of the luminance (Y) signal, in a manner similar to that of the Composite video signal.
- In the Component video signal, which is comprised of three signals – the luminance signal (Y) and the two color difference signals, R-Y and B-Y - the sync signals reside in the Y signal, as in the Composite and s-Video signals.
- In RGB (Red, Green, Blue) signals, used in professional computer graphics and display applications, there are several options for the sync signals to be carried along with the data.
  - The most common is called RGBS. It has a separate Analog Sync channel – and there are therefore 4 wires carrying signals, Red, Green, Blue and Sync.
  - Another popular format uses only three wires – Red, Blue (as in the above configuration) and Green+Sync, where the sync rides on the green signal. In this format, the signal levels are not identical, as the Green signal has a larger amplitude due to the sync it carries, (and the sync signals must be stripped off in order to recover the normal green sync level.)
  - A subset of this format inserts the sync signals in all three data channels – e.g., Red+Sync, Blue+Sync and Green+Sync.
- The format generated by a Computer Graphics card is normally made of 5 different signals: Red, Green, Blue, Horizontal sync and Vertical sync (sometimes referred to as Hs and Vs.) To make things more complicated – the data channels – R, G, B - are analog (their level varies in a continuous way from 0 to maximum) but the sync signals are digital – (TTL level) being either 0 or 1 (0 volts or 5 volts). To make things even more complicated, in contrast to the analog sync signals which are negative pulses, the computer generated logic-level syncs can appear in both directions. Sometimes one of the syncs is positive and the other is negative, sometimes both are either positive or negative. The sync direction is dictated by the source, the graphics card, and is dependent on the resolution required. In the past, the sync direction instructed the monitor which resolution to choose. Nowadays, most of the monitors are smarter and set the resolution automatically, but nevertheless, the cards still generate those sync signals.
  - Another twist to this format is the fact that in most cases the logic-level syncs are separated and each sync runs in its own channel, but there are cases when the logic-level syncs are composite – joined together in the same mix of directions.
- In the digital world – SDI, DV, MPEG and other formats, the synchronization signals either travel in a special digital sync channel or, in most cases, are embedded in the digital signal. Retrieving the sync information when embedded in the digital signal involves complicated circuitry and the problems related to digital syncs will not be discussed here.

2.3 Some common problems

Sync-originating problems very often disguise themselves so that the data seems faulty, and the sync section is not suspected at all.

The standard video sync level in Composite, s-Video (Y/C) and Component video formats is approximately 0.3 Volts (negative). Most signal acceptors, monitors, VCRs, etc., are designed to accept this level without any problem. The tolerance in most cases is quite large. Most monitors are able to lock on signals as low as 0.2 Volts or even 0.15 Volts.

This is the basic standard. However, a host of acceptors such as video grabbing cards and special monitors require a sync level which is substantially higher: 1 Volt, 2 Volts, 4 Volts and so on. Those acceptors usually have a special sync input socket as in the RGBS format. If those acceptors receive a signal with lower sync levels than they require, - which leads one to believe that there is something wrong with the data.

In Composite, s-Video (Y/C) and Component video formats the image does not get distorted or vanish. When the sync level goes below an acceptable standard level, the image gets distorted or starts rolling on the screen, but doesn't vanish.

A common problem in high generation copies is attenuation of the narrow signals surrounding and within the vertical sync (the serration and the equalization pulses that are needed for proper image display on the screen.)

The most common effect when the vertical sync is damaged is either a jittery image on the screen or the "flagging effect" where the upper part of the screen is skewed sidewise and looks like a flag.

Processors which insert signals into the vertical blanking area – such as time code, teletext and copy protection schemes - may cause image instability, mainly due to indirect sync deterioration as a result of the AGC (automatic gain control) of the acceptor being activated unnecessarily. The result is image instability, rolling picture, "flagging" and a host of other negative effects.

The main cause of the above-mentioned problems is improper analog sync levels. In the logic-level sync world this shouldn't happen. At least in theory! However, other problems – level oriented - also exist in the logic-level sync world.

Until recently, logic levels were defined as 0 volts for logic level "0" and 5 volts (nominal) for logic level "1". There was a certain tolerance about where level "1" starts and what level can be declared as "0". In the last years, as computers got faster and faster and hence hotter, it was decided to drop some logic supply voltages down to 3.3 volts and even lower. When this happened, the "0" level remained 0 volts, but the "1" level became 3.3 volts. To make the "0" and "1" levels cope with the real world, the tolerance definitions were changed. Now, in some cases, one device can send a logic signal of "1", using 3.3 Volts logic or lower, but the receiving device interprets this level as "0". When it comes to sync signals, this immediately causes all the negative effects mentioned above.

Logic incompatibility problems are treated quite well by most manufacturers using logic-translators circuitry, but another "mine-field" is being set. The computer graphics world is very linked nowadays to the analog world. Many video productions are made, edited and stored in computers. Some are outputted from the computer using special cards, some use the graphics cards themselves. The analog world needs to get, in most cases, a composite sync signal of 0.3 Volts. If computer related syncs are transformed to video levels, the following problem: assume that in order to convert a standard logic level sync (5 Volts) to analog video sync levels, a voltage divider from 5 Volts to 0.3 Volts is needed, a 16-fold division. If a logic level of 3.3 volts is used, running at a lower tolerance of 2.8 Volts – then the division will result in a sync signal level of 0.17 volts (2.8 Volts divided in 16.6) which is lower than acceptable. There's no need to describe what will happen to the analog signal!

Another catch – what if the horizontal sync is negative and the vertical sync is positive and they are translated into an analog signal?

2.4 Solutions

The first step in choosing a solution is to correctly identify the problem. When data disappears from the screen, the initial response is to look for problems in the data path, but it should be born in mind that it could be a sync-related problem. A technical person, using an oscilloscope, can monitor the data channels and the sync channels and the answer is straightforward. If the problem identified is sync related:

- When analog sync levels are too low, a standard video amplifier with level adjustments should be used. The sync is inserted as a video signal, and by using the controls of the amplifier, the level is adjusted to the standard level.
- When an analog sync signal seems to be distorted at the vertical blanking area – missing equalizing pulses or serrations or having sync disturbing information in this area –an expensive solution, such as a TBC (Time Base Corrector) can be used, or less expensive, dedicated machines may be used. Such machines include sync stabilizers which "clean-up" the teletext, time-code, closed-caption and other information and machines such as Black-Burst Restoring devices which replace the whole horizontal and vertical blanking area, and the color burst, with newly generated signals.
- When logic level syncs are involved, it should be decided whether the sync direction is the problem – (positive instead of negative, for example) or the analog-converted sync level is wrong. If the problem results from wrong sync direction, then devices that "rectify" the syncs into the right directions are needed. Sync-direction-rectifying processors are usually part of other devices which combine TTL syncs with analog signals (Sync-to-Green Adders, for example). Those devices usually include additional circuitry that may solve the second problem – syncs with wrong logic level. Those devices include a sync logic-level translator to correct level incompatibility.
- Even when everything seems correct – the sync source generates a signal within its specifications and the acceptor is designed to accept standard sync information - a quick check to determine whether both machines "talk" the same language is needed. Please refer to the last page of the manual, where the technical specifications are described.
- If a sync signal rides on all the data signals – Red, Green and Blue - and the signals are inputted to a machine which accepts Red, Blue and Green+Sync, the wrong color will shown on the output, usually with a purplish tint. This is the result of feeding Red and Blue signals higher than normal (as they "ride" on the sync). To solve this problem, some acceptors have built-in switches or software commands to ignore those incorrect signals and those controls should be activated. Alternatively, a "sync-shaver" machine should be used, one for each of the Red and Blue channels. This device "shaves-off" and strips the sync signal from the data signal. This is a very common problem and the above-mentioned simple solution is often ignored.
- Sometimes, a video image shows instability due to slowly rolling horizontal bars. It can be assumed that this is a sync-related problem, but very often it's not. Image instability and rolling bars can result from ground-related problems. When two devices are connected with a cable, they may be fed from sources with different ground potentials. The difference in ground potentials (which should be "0" volts) creates a ground induced current that flows with the signal, modulates it and creates the phenomenon described above. The solution to this problem is ground isolation. It can be done either by special transformers (that unfortunately might impair the frequency response of the signals involved) or by electronic devices utilizing opto-isolator technology or other electronic means. Checking whether this is the source of the problem is easy – using a voltmeter simply measure whether a ground potential exits between the two points. Care should be taken to avoid touching devices or wires carrying dangerous mains voltages.

2.5 Genlock

Video signals coming from different sources have different timing (time based sync relationships) and different random color phase relationships. When only one video source is used, there is no problem. In professional applications all the video sources should be synchronized. Synchronization involves both the syncs and the color phase.

Synchronization is needed mainly in two applications – video mixing and video switching / routing. A video mixer or SEG (special effects generator) takes two sources or more and blends them together. This process creates nice looking transitions from one scene to another, and enables many artistic special effects. The video sources may not be mixed or blended unless they are synchronized one to the other or "Genlocked". One of the sources for the term Genlock is the abbreviation of the words GENeral LOCKing, which means that the sources are "locked" to each other sync-wise and color subcarrier-wise.

The other important application requiring synchronized (genlocked) sources is video switching and routing. If two sources are used, and the operator switches from one source to the other, if the sources are genlocked, and the switching occurs during the vertical interval blanking period, a clean transition occurs, free of artifacts and image breakdown. The receiving end of the switched sources does not need to resynchronize its circuitry to the newly switched source, resynchronization does not take place and the transition is smooth.

There are two major ways to synchronize sources. The first is to use an expensive device called a frame synchronizer. A frame synchronizer is a digital video device which synchronizes a video source (sync and color) to an external reference or to another video source. The second way is to use Genlockable devices in the studio which allow syncronization of the sync and color to an external source.
The source may be a full video signal or a Black Burst signal. The black burst reference signal, commonly used in video production and production studios, is a video signal showing a clean, black screen, hence the name Black Burst. The Black Burst signal is comprised of sync signals (horizontal + vertical), the color burst signal at the beginning of the video lines and a zero level video signal – a black screen.
A Black Burst generator supplies several parallel black burst outputs and can therefore simultaneously genlock several video sources in a studio. A Black Burst generator can sometimes Genlock itself to an external video source, providing black burst outputs genlocked to the incoming reference.

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 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 (over 15 meters) 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.

4 SPECIFICATIONS

	SG-6005
FUNCTION	Genlock Multistandard Black Burst / Color Bar Generator
INPUTS	1 composite video, looping, 1Vpp /75Ω, on BNCs with a termination switch.
OUTPUTS	6 black burst signals, 0.3 Vpp/75 Ω, (sync) 1 color bar output 1Vpp/75Ω, 2x 1kHz, +4dBm/47Ω outputs on XLRs, 2x 1kHz, 1Vpp/100Ω outputs, on RCAs.
COLOR BAR	13 selectable patterns.
CONTROLS	H control: 1 Line, 37 nS steps; V control: 4 lines, ½ line steps. SCH control: 360 Degrees, by front touch switches. RS-232 control and software update.
PHASE ERROR	Less than 1 degree
SYNC OSCILLATOR	Crystal controlled.
SC OSCILLATOR	Crystal controlled.
SYNC/SC	Fully Genlocked
STABILITY	Better than 5 PPM
ACCESSORIES	Power cord, Windows 95/98 control software, Null modem Adapter
DIMENSIONS	48.3(W) x 17.8(D) x 4.5(H) cm. / 19 inch (W), 7 inch (D), 1U (H) rack mountable
WEIGHT	2.5 Kg. (5.5 Lbs.) Approx.
POWER SOURCE	230 VAC, 50/60 Hz, (115VAC, U.S.A.) 10 VA.

5 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.

6 UNPACKING AND CONTENTS

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

- **The SG-6005 Machine**
- **Kramer Concise Product Catalog**
- **Power cord**
- **This User Manual**
- **Null Modem Adapter**
- **Rubber Feet**
- **Optional Windows 95/98 ™ control software (may be downloaded from Kramer's website: www.kramerelectronics.com).**

6.1 Optional Accessories

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

- **VM-1010 -** a high performance distribution amplifier for composite video signals on BNC connectors. Using a simple front panel switch, it can be configured either as a single 1:10 DA, or as two separate 1:5s. In either mode its purpose is to provide identical outputs to drive multiple monitors, projectors or other receiving devices. The looping connectors located adjacent to each input may be used as an additional output in some cases, and can make it easy to create larger systems. Rear panel switches allow the user to select DC or AC output coupling for maximum flexibility. The **VM-1010** is housed in a rugged, professional rack mountable enclosure with an internal power supply allowing the use of a standard, detachable power cord.
- **VM-1110** - a high performance distribution amplifier for balanced audio signals using XLR connectors. Using a simple front panel switch, it can be configured as a 1:10 for mono signals, or as a 1:5 for stereo signals. In either mode, its purpose is to accept a single input and provide identical outputs for a wide variety of studio and live applications. State-of-the-art Bi-Fet amplifying circuitry, and a high power discrete buffering system make the **VM-1110** an excellent performer. All circuitry is active with no transformers, thus ensuring hum-free, full bandwidth operation. It is rugged, dependable, and is housed in a professional rack mountable enclosure requiring one vertical space in a standard 19" rack.
- **VM-1411** - an exceptionally high performance distribution amplifier for composite video and balanced audio signals. Using front panel controls, the video and audio sections can be independently configured as a single channel 1:10, or as a two channel 1:5. In either mode its purpose is to provide identical outputs to drive multiple monitors, projectors, audio power amps, mixers or other receiving devices. Looping connectors located adjacent to each input may be used as additional outputs in some cases, and can making it easy to create larger systems. Rear panel switches are provided to set coupling and termination, and recessed front panel controls allow the user to set optimum video and audio output levels. The **VM-1411** is rugged, dependable, and is housed in a professional 19" rack mountable enclosure requiring one vertical space in a standard rack.
- **VIDEO TESTER** - A unique, patented, indispensable tool for the video professional, the Video Tester is used to test a video path leading to/from an amplifier. By pressing only one touch switch it can trace missing signals, distinguish between good and jittery (VCR sourced) signals, and identify the presence of good signals. Whenever a video signal is missing, because of bad connections, cable breaks or faulty sources, the Video Tester is all you need.

7 GETTING TO KNOW YOUR SG-6005 GENERATOR

The Kramer **SG-6005** is a broadcast quality multi-standard black burst, color bar, sync and audio generator designed for a variety of video studio applications. It is exceptionally full featured, offering six identical black burst outputs, a color bar output, a user programmable color matte, horizontal and vertical sync outputs, as well as balanced and unbalanced 1 kHz, crystal stabilized audio outputs. The unit maybe genlocked to an external video reference or it may operate as a stand-alone generator based on its high precision timing components. It uses digital synthesis technology for signal generation and allows full SCH/Phase control, delay of output relative to the genlock input and additional delay of the sync outputs.
The **SG-6005** may be RS-232 controlled from a PC, and firmware is easily upgraded using a computer. The required SCH/Phase shifts and delay may be displayed on a large seven-segment LED display. The number of outputs may be increased by using a Kramer video distribution amplifier like the **VM-1010**, **VM-1015**, or **VM-1021,** etc.

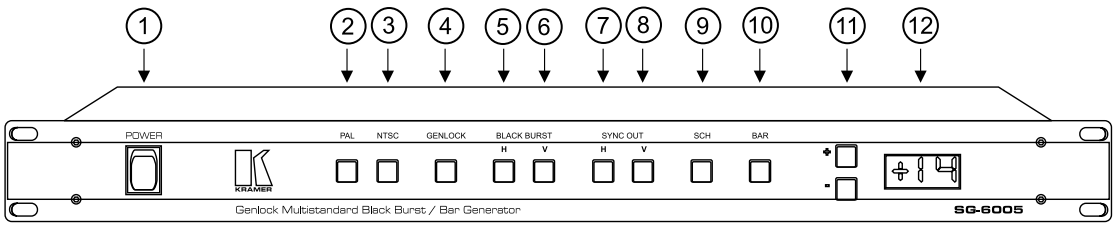


Figure 1: SG-6005 Front Panel Features

7.1 Front Panel Features Description

(1) POWER

Rocker switch to turn the machine ON or OFF. In the ON position, the switch is illuminated.

(2), (3) PAL OR NTSC

Selects the video standard of the machine. The illuminated switch indicates the selected standard. To change the video standard, press the non-illuminated switch. The machine takes about a second to modify its internal settings - during which time the machine will ignore the pressing of any front-panel switch, and the 7-segment display indicates that the machine is "busy".

(4) GENLOCK

Toggles between a "genlocked" and a "free-running" generator.

When the switch is illuminated, the machine will "genlock" to a valid reference input (REF-IN). When not illuminated, the timing of the generator is internally generated (free-running).

To toggle between genlocked and free-running mode, press the GENLOCK switch. The machine takes about a second to modify its internal settings - during which time the machine will ignore the pressing of any front-panel switch, and the 7-segment display indicates that the machine is "busy".

(5) H (BLACK BURST)

Selects / deselects the control of the generator's horizontal synchronization relative to that of the genlock (REF-IN) input.

When selected, this switch will flash, and the 7-segment display (12) will indicate the delay (in microseconds) of the generator's horizontal synchronization (relative to the genlock input). Use the "+" and "-" switches (11) to change the delay, in steps of 37ns. Note that since the display only shows up to 3 digits, increasing and decreasing the delay will not always change the value displayed (but it *will* always increase or decrease the delay).

When this function is not selected, the machine will still delay according to the previously selected settings. The selection allows display and control of this function, not the enabling and disabling of it.

Note that it is not possible to select this function if the machine is not in GENLOCK mode!

(6) V (BLACK BURST)

Selects / deselects the control of the generator's vertical synchronization relative to that of the genlock (REF-IN) input.

When selected, this switch will flash, and the 7-segment display (12) will indicate the delay (measured in horizontal lines) of the generator's vertical synchronization (relative to the genlock input). Use the "+" and "-" switches (11) to change the delay, in steps of half-lines.

When this function is not selected, the machine will still delay according to the previously selected settings. The selection allows display and control of this function, not the enabling and disabling of it.

Note that it is not possible to select this function if the machine is not in GENLOCK mode!

(7) H (SYNC OUT)

Selects / deselects the control of the generator's HOR output (20), relative to that of the horizontal synchronization of the Black Burst (18) and Bar (19) outputs.

When selected, this switch will flash, and the 7-segment display (12) will indicate the delay (in microseconds) of the HOR output (relative to the horizontal sync of the generator's video outputs). Use the "+" and "-" switches (11) to change the delay, in steps of 37ns. Note that since the display only shows up to 3 digits, increasing and decreasing the delay will not always change the value displayed (but it *will* always increase or decrease the delay).

When this function is not selected, the machine will still delay according to the previously selected settings. The selection allows display and control of this function, not the enabling and disabling of it.

(8) V (SYNC OUT)

Selects / deselects the control of the generator's VER output (20), relative to that of the vertical synchronization of the Black Burst (18) and Bar (19) outputs.

When selected, this switch will flash, and the 7-segment display (12) will indicate the delay (measured in horizontal lines) of the VER output (relative to the vertical sync of the generator's video outputs). Use the "+" and "-" switches (11) to change the delay, in steps of half-lines.

When this function is not selected, the machine will still delay according to the previously selected settings. The selection allows display and control of this function, not the enabling and disabling of it.

(9) SCH

Selects / deselects the control of the SCH (subcarrier to horizontal) phase of the Black Burst and Bar outputs.

When selected, this switch will flash, and the 7-segment display (12) will indicate the SCH phase (measured in degrees) of the generator's video outputs. Use the "+" and "-" switches (11) to change the SCH, (in steps of 1.4 degrees).

When this function is not selected, the machine will still generate the outputs according to the previously selected settings. The selection allows display and control of this function, not the enabling and disabling of it.

(10) BAR

When this function is selected, the user may select which of the machine's pre-programmed color bars is generated at the "COLOR BAR" output (19).

When selected, this switch will flash, and the 7-segment display (12) will display the number of the selected bar.

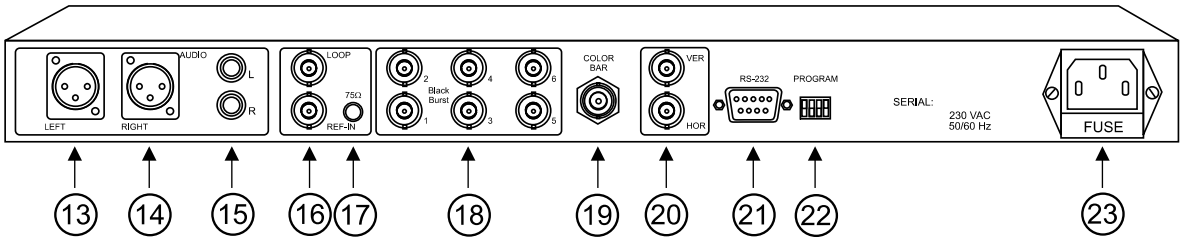
When this function is not selected, the machine will still generate the previously selected bar. The selection allows display and selecting of this function, not the enabling and disabling of it.

The bars which may be generated at the "COLOR BAR" output (19) are:

0. Black screen
1. 75% color bar
2. 100% color bar
3. Black and white steps
4. Modulated steps
5. Red screen
6. Green screen
7. Blue screen
8. RGB bar
9. Black / white screen
10. Color matte
11. White screen
12. Gray screen

The "Matte" (BAR # 10) is a screen with a single, user-defined, color. The matte color may be changed by selecting BAR # 10, and then pressing the BAR button (10) again. The decimal point then flashes in the first digit of the 7-segment display (12), and the display now indicates the Y value of the matte, which may be changed using the "+" and "-" buttons (11). Pressing the BAR button (10) again causes the decimal point to flash in the second digit of the 7-segment display (12), and the display now indicates the (B-Y) value of the matte, which may be changed using the "+" and "-" buttons (11). Pressing the BAR button (10) yet again will causes the decimal point to flash in the third digit of the 7-segment display (12), and the display now indicates the (R-Y) value of the matte, which may be changed using the "+" and "-" buttons (11).

Figure 2: SG-6005 Rear Panel Features



7.2 Rear Panel Features Description

(13), (14) BALANCED AUDIO OUTPUTS

A 1kHz, +4dBu, balanced audio signal (sine wave) is generated on these two XLR outputs.

(15) LINE LEVEL AUDIO OUTPUTS

A 1kHz, 1V p-p audio signal (sine wave) is generated on this pair of RCA outputs.

(16) REF-IN AND LOOP INPUTS

The bottom BNC is the reference input for genlocking the SG-6005. The top BNC may be used for looping the genlocking source. When looping, the 75Ω termination switch (17) should not be pressed in. When not looping, terminate the line by pressing in the 75Ω termination switch (17).

(17) 75Ω TERMINATION SWITCH

When pressed, the genlock (REF-IN) input is terminated. When released, the input has high impedance (Hi-Z). The switch should be in the Hi-Z position when looping the REF-IN input.

(18) BLACK BURST OUTPUTS

These are the 6 identical black burst outputs.

(19) COLOR BAR BURST OUTPUTS

This is the color bar output of the machine. This output is always genlocked to the Black Burst outputs.

(20) HORIZONTAL AND VERTICAL SYNC OUTPUTS

These are the horizontal and vertical sync pulses of the Black Burst. Each may be delayed via the "Sync Out" H and V buttons ((7) and (8)) on the front-panel (and via the RS-232 control). The syncs are downward pulses, at TTL levels when unloaded, and approximately 1V when loaded with 75Ω.

(21) RS-232 PORT

Serial port for RS-232 control and monitoring. A null-modem connection to the port should be used, as detailed in the protocol description and in figure 3 below.

(22) DIP-SWITCHES

There are 4 DIP-switches. These are numbered 1 to 4 (from left to right when looking at the back-panel) and the numbering is printed on the plastic DIP-switches.

Switch # 1 is the machine address for RS-232 control. This is usually set to OFF, so that A0 (in the 4th byte of the protocol) is 0. To set A0 as 1, the switch should be set in the ON position.

Switch # 2 and switch # 3 should be set in the OFF position.

Switch # 4 selects whether or not to insert a pedestal (7.5 IRE setup) when generating NTSC. The switch is ON if the pedestal is to be used.

(23) POWER SOCKET

Mains inlet socket. The fuse is located within the socket.

8 RESETTING THE SG-6005

The SG-6005 has non-volatile memory so that the machine will turn on to the state in which it was prior to being shut down. That is, changes made via the front-panel and via RS-232 will be "remembered" even after the machine is turned off.
To reset the machine to its factory-default state turn the machine off, and then press and hold down the "+" and "-" switches (11) whilend turning the machine on again. Release the "+" and "-" switches after the 7-segment display has flashed "+" (about 5 seconds after the machine has been turned on).

9 CONTROLLING THE SG-6005 WITH RS-232

The SG-6005 has an RS-232 port for serial control. A Windows-based control program is provided which may be used to monitor and control the machine. If required, install this program on your hard-disk, and connect the serial port of the PC to the SG-6005 as described in the protocol description below. Turn on the SG-6005 and then run the program.

10 COMMUNICATION PROTOCOL FOR SG-6005 (VER-0.2 13/2/00)

RS-232 communication between the SG-6005 and the PC is done using the following protocol. The protocol uses four bytes of information, and data is at 9600 baud, no parity, 8 data bits and 1 stop bit.
The controller and machine should be connected via a null-modem connection. This may be done using the null-modem adaptor provided with the machine: simply plug the adaptor into the PC's serial port, and connect

the other end to the machine via a flat-cable. Alternatively, the connection may be made without the adaptor, as follows:

- Connect pin 5 of the PC to pin 5 of the machine.
- Cross pins 2 and 3, i.e. connect pin 2 of the PC to pin 3 of the machine, and connect pin 3 of the PC to pin 2 of the machine.
- On the PC side, short pins 4 and 6.
- On the PC side, short pins 1, 7 and 8.

This protocol complements Kramer's "Protocol 2000" (Kramer's switcher protocol). That is, the two protocols can co-exist without disturbing one another. (According to Protocol 2000 definitions, the SG-6005 would be machine number 16 (for A0=0) or 17 (for A0=1), therefore care should be taken not to set a switcher with this machine number).

10.1 STRUCTURE OF PROTOCOL

MSB **LSB**

		INSTRUCTION					
0	**TO PC**	**I5**	**I4**	**I3**	**I2**	**I1**	**I0**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**

1st byte

	DATA						
1	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**

2nd byte

	EXTENDED DATA						
1	**E6**	**E5**	**E4**	**E3**	**E2**	**E1**	**E0**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**

3rd byte

	MSB's						ADDR
1	**E7**	**D7**	**1**	**0**	**0**	**0**	**A0**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**

4th byte

Note that the MSB's of the DATA (D7) and the EXTENDED DATA (E7) are in the fourth byte.
Terminology:
TO PC is the "DESTINATION BIT"
I4..I0 is the "INSTRUCTION"
D7..D0 is the "DATA"
E7..E0 is the "EXTENDED DATA"
A0 is the "LSB of the MACHINE ADDRESS"
The destination bit, TO PC, is 0 when sending from the PC to the machine, or 1 when sending from the machine to the PC.
The address bit, A0, is determined by the setting of DIP-switch 4 on the SG-6005. If the switch is in the ON position, ADDR should be set as 1; if it is in the OFF position, ADDR should be set as 0.

#	INSTRUCTION	I5	I4	I3	I2	I1	I0
0	Reset	0	0	0	0	0	0
1	Read front-panel switch status	0	0	0	0	0	1
2	Write front-panel switch status	0	0	0	0	1	0
3	Press front-panel switch	0	0	0	0	1	1
4	Read front-panel switch data (LS byte)	0	0	0	1	0	0
5	Read front-panel switch data (MS byte)	0	0	0	1	0	1
6	Write front-panel switch data (LS byte)	0	0	0	1	1	0
7	Write front-panel switch data (MS byte)	0	0	0	1	1	1
8	Write encoder data	0	0	1	0	0	0
9	Write decoder data	0	0	1	0	0	1
10	Write EEPROM data	0	0	1	0	1	0
11	Read EEPROM data	0	0	1	0	1	1
16	Error	0	1	0	0	0	0
57	Enable “Power-down save”	1	1	1	0	0	1
61	Identify machine	1	1	1	1	0	1

Table 1: Instruction Set for the SG-6005

10.2 DESCRIPTION OF INSTRUCTIONS

INSTRUCTION 0 – RESET
DATA=0: initialize the machine.
When the machine is initialized, it will send the RESET code (DATA = 0). If the machine receives this code, it will reset to its “power-up” state.
DATA=1: configure the machine to its factory default state.
When the machine receives this code, all programmable parameters will be reset to their factory-default values.
EXTENDED DATA - set as 0.

INSTRUCTION 1 – READ FRONT-PANEL SWITCH STATUS
DATA = front-panel switch number (see below).
When sending, set EXTENDED DATA as 0.
When receiving, LSB of EXTENDED DATA = status of front-panel switch.
The PC sends this instruction to the machine. The machine replies by setting the EXTENDED DATA according to the current status of the addressed front-panel switch - that is, E0=1 if the switch is on, or E0=0 if it is off.

INSTRUCTION 2 – WRITE FRONT-PANEL SWITCH STATUS
DATA = front-panel switch number; LSB of EXTENDED DATA = status of the front-panel switch.
- When a front panel switch is pressed, its status is sent to the PC if the status of this switch is changed.
- When the PC sends the status of the switch directly to the machine, the machine implements this instruction, and replies by sending the same data back to the PC (if valid).

INSTRUCTION 3 – PRESS FRONT-PANEL SWITCH
DATA = front-panel switch number (see below).
EXTENDED DATA - set as 0.
- When the machine receives this instruction, it implements the function which would be performed if the designated front-panel switch was pressed. If this results in a change in the switch status or a switch value, then this change is sent to the PC.
- This instruction is never *sent* by the machine. (If a button is pressed resulting in a change in the switch status or a switch value, it will send the change to the PC).

INSTRUCTION 4 – READ FRONT-PANEL SWITCH DATA (least significant (LS) byte)
When sending to machine:- DATA = front-panel switch number; EXTENDED DATA - set as 0.

When replying:- DATA = front-panel switch number; EXTENDED DATA = LS byte of the front-panel switch value.
The PC sends this instruction to the machine. The machine replies by sending back a value which relates to that switch. The relationship between this value and the front-panel 7-segment display is expained below.

INSTRUCTION 5 – READ FRONT-PANEL SWITCH DATA (most significant (MS) byte)
For sending to machine, DATA = front-panel switch number.
When replying:- DATA = front-panel switch number; EXTENDED DATA = MS byte of the front-panel switch value.
The PC sends this instruction to the machine. The machine replies by sending back a value which relates to that switch. The relationship between this value and the front-panel 7-segment display is expained below.

INSTRUCTION 6 – WRITE FRONT-PANEL SWITCH DATA (least significant (LS) byte)
DATA = front-panel switch number; EXTENDED DATA = LS byte of the front-panel switch value.
- The PC sends a value directly to the machine. If valid, the machine implements this new value, and replies by sending the same data back to the PC. Note that the addressed front-panel switch does *not* need to be pressed in order to change its value via RS-232.
- If the "+" or "-" button is pressed on the machine, resulting in a change in a switch value, then this switch number and value is sent to the PC.

INSTRUCTION 7 – WRITE FRONT-PANEL SWITCH DATA (most significant (MS) byte)
DATA = front-panel switch number; EXTENDED DATA = MS byte of the front-panel switch value.
- The PC sends a value directly to the machine. If valid, the machine implements this new value, and replies by sending the same data back to the PC. Note that most switches have only one byte values (LS byte). In this case an error code would be returned if this instruction was sent. Note further that the addressed front-panel switch does *not* need to be pressed in order to change its value via RS-232.
- If the "+" or "-" button is pressed on the machine, resulting in a change in a switch value, then this switch number and value is sent to the PC.

INSTRUCTION 8 – WRITE ENCODER DATA
DATA = encoder sub-address; EXTENDED DATA = data to be written to this sub-address.
The PC sends data directly to the encoder. The machine implements this new value, and replies by sending the same data back to the PC.
CAUTION – this function was designated for development and testing purposes. Improper use of this function may cause erratic behaviour of the machine.

INSTRUCTION 9 – WRITE DECODER DATA
DATA = decoder sub-address; EXTENDED DATA = data to be written to this sub-address.
The PC sends data directly to the decoder. The machine implements this new value, and replies by sending the same data back to the PC.
CAUTION – this function was designated for development and testing purposes. Improper use of this function may cause erratic behaviour of the machine.

INSTRUCTION 10 – WRITE EEPROM DATA
DATA = EEPROM sub-address; EXTENDED DATA = data to be written to this sub-address.
The PC sends data directly to the EEPROM. The EEPROM stores this new value, and replies by sending the same data back to the PC.
CAUTION – this function was designated for development and testing purposes. Improper use of this function may cause erratic behaviour of the machine.

INSTRUCTION 11 – READ EEPROM DATA
For sending to machine, DATA = EEPROM sub-address.
When replying:- DATA = EEPROM sub-address; EXTENDED DATA = requested data.
The PC sends this instruction to the machine. The machine replies by sending back the data of this sub-address.

INSTRUCTION 16 – ERROR
If the machine receives an invalid instruction, it replies by sending this error code.

INSTRUCTION 57 – ENABLE "POWER-DOWN SAVE"
DATA = 0 disables power-down saving; DATA = 1 enables saving. EXTENDED DATA - set to 0.

The PC sends this instruction to the machine. The power-down option is enabled or disabled according to the value of DATA. If the power-down option is enabled, then the machine will "remember" its state before being turned off, and revert to this state when turned on again.
Note that whenever the machine is turned on, the power-down save option is enabled.

INSTRUCTION 61 – IDENTIFY MACHINE
For sending, DATA = 1 to request machine name; DATA = 3 to request software version number. EXTENDED DATA - set to 0.
The PC sends this instruction to the machine. The machine relies as follows:
if the machine name is requested, the machine replies with DATA = 60 (hex), and EXTENDED DATA = 05 (hex).
if the software version is requested, the machine replies with DATA as the version number before the decimal point, and EXTENDED DATA is the value following the decimal point. For example, for version 3.4, the machine replies with DATA = 03 (hex), and EXTENDED DATA = 04 (hex).

The table below shows the front-panel switch numbers, as defined for this protocol:

D6	D5	D4	D3	D2	D1	D0	SWITCH
0	0	0	0	0	0	1	PAL
0	0	0	0	0	1	0	NTSC
0	0	0	0	0	1	1	Genlock
0	0	1	0	1	0	0	H (Black burst) – PAL
0	0	0	0	1	0	0	H (Black burst) – NTSC
0	0	1	0	1	0	1	V (Black burst) – PAL
0	0	0	0	1	0	1	V (Black burst) – NTSC
0	0	1	0	1	1	0	H (Sync) – PAL
0	0	0	0	1	1	0	H (Sync) – NTSC
0	0	1	0	1	1	1	V (Sync) – PAL
0	0	0	0	1	1	1	V (Sync) – NTSC
0	0	1	1	0	0	0	SCH – PAL (non-genlock)
0	0	0	1	0	0	0	SCH – NTSC (non-genlock)
0	1	1	1	0	0	0	SCH – PAL (genlock)
0	1	0	1	0	0	0	SCH – NTSC (genlock)
0	0	0	1	0	0	1	Bar
0	1	0	1	0	0	1	Bar 10: Y
1	0	0	1	0	0	1	Bar 10: (R-Y)
1	1	0	1	0	0	1	Bar 10: (B-Y)
0	0	0	1	0	1	0	UP
0	0	0	1	0	1	1	DOWN

Table 2: Front-Panel Switches on the SG-6005

NOTES
The switches are numbered using D0..D3.
The additional data D4, D5 and D6 is used as follows:
To differentiate between PAL and NTSC for H, V, and SCH; and for genlocked or non-genlocked for SCH. This allows reading and writing of their values, without the necessity of changing the machine standard. For reading or writing the status of these switch, only D0..D3 are necessary.
For reading and writing values for the special case of "bar 10", where the user can define the component values of the color matte. They are also used in defining the status of the switch for bar 10.

10.3 RELATIONSHIP BETWEEN "SWITCH DATA" AND DISPLAY

The "switch data" is related to the value displayed on the 7-segment front-panel display as described below:

H – BLACK BURST

Displayed data = (447-switch data) / 27 (ms)

V – BLACK BURST

Displayed data = (13-switch data)/2 (lines)

H – SYNC OUT

Displayed data(PAL) = (switch data-1721) / 27 (ms)
Displayed data(NTSC) = (switch data-1709) / 27 (ms)

V – SYNC OUT

Displayed data = (switch data-4)/2 (lines)

SCH

Displayed data (PAL, no Genlock) = (switch data – 103) X 1.40625 (degr)
Displayed data (PAL, Genlock) = (switch data – 179) X 1.40625 (degr)
Displayed data (NTSC, no Genlock) = (switch data – 36) X 1.40625 (degr)
Displayed data (NTSC, Genlock) = (switch data – 153) X 1.40625 (degr)

BAR

Displayed data = switch data.

11 INSTALLATION

11.1 Rack Mounting

These machines may be rack mounted in a standard 19" (1U) EIA rack, and include rack "ears" at the ends of the front panel. To mount them, simply place the unit's ears against the rack rails of your rack, and insert standard screws through each of the four corner holes. These devices do not require any specific spacing for ventilation above or below the unit.

11.2 Connecting to Video and Audio Devices

Video acceptors and output devices may be connected to the SG-6005 through the BNC type connectors on the back of the machines (Black Burst / Color Bar). The Black Burst and Color Bar signals are very high frequency carrying signals, and are very sensitive to cable quality and length. Keep the length of the cables to the absolute minimum ecessary. Audio acceptors may be connected to the machine either through the XLR type connectors (for balanced audio use) or through the RCA type connectors (for unbalanced audio use).

11.3 Connecting to Horizontal and Vertical Sync acceptors

The horizontal and vertical sync acceptors should be connected to the VER and HOR BNC connectors, using standard high quality video cables.

11.4 Connecting to an External reference (Genlock)

An external reference source should be connected, if needed, to the REF-IN connectors. A loop connection is provided for the reference IN connection. If looping is used, the 75Ω termination switch should be released. If looping is not used, the switch should be pushed in for 75Ω proper termination.

11.5 Connecting to a PC

Connect the PC COM port to the provided Null Modem adapter. Connect the Null modem adapter to the RS-232 port of the SG-6005 using a flat cable with the appropriate sockets.

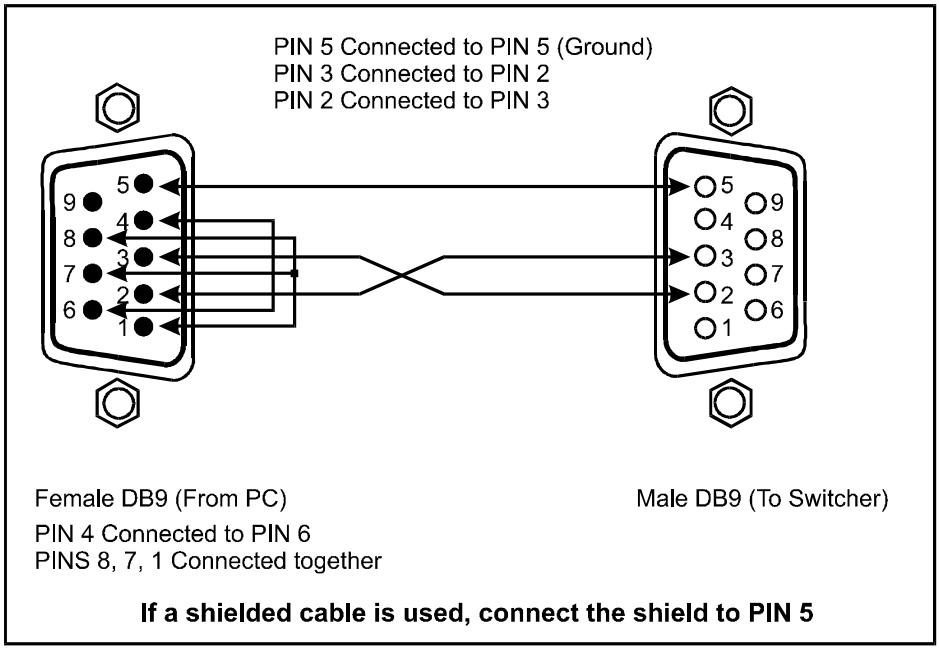
12 TURNING ON THE MACHINE

NOTES

1) The machine 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 signal to the machine 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 supply adapter from the mains socket.

1) Connect the machine's mains socket to the wall socket using the power cord (provided with the machine).
2) Operate the source and the acceptors.
3) Select the required functions of the SG-6005 using the instructions described above.

RS-232 Null Modem Connection



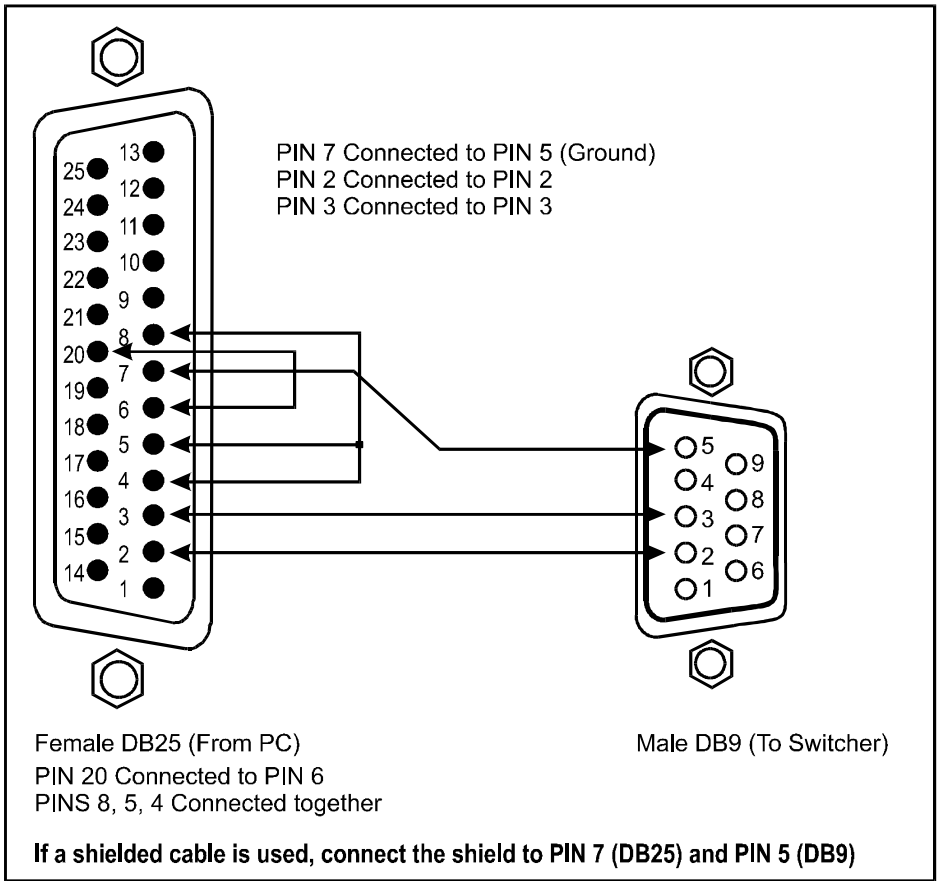


Figure 3: RS-232 Null Modem Connection

13 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.

14 TROUBLESHOOTING

NOTES

1. *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, disconnect power from the machine and reconnect again to reset the machine.*
2. *If the following recommended actions still do not result in satisfactory operation, please consult your KRAMER Dealer.*

14.1 Power and Indicators

Problem	Remedy
No Power	1. Confirm that the rocker switch is in the "ON" position, and that the switch is illuminated. 2. Confirm that power connections are secured at the machine and at the receptacle. Make sure the mains receptacle is active. If still there is no power, remove power cord from AC outlet and then, using a flat head screwdriver, remove the fuse holder located directly below the power connector on your machine. 3. Confirm that the fuse is good by looking for the wire connected between the ends of the fuse. If the wire is broken, replace the fuse with another, with the same rating.

14.2 Video Signal

Problem	Remedy
No video at the output device, regardless of input selected.	1. Confirm that all devices are powered on and connected properly. 2. Confirm that any other device in the signal path have the proper input and/or output selected. 3. Confirm that the maximum cable length is not exceeded.

Noise bars are "rolling" up or down in the output image or: Low Frequency Hum in the output signal	Hum bars (ground loop) are caused by a difference in the ground potential of any two or more devices connected to your signal path. **WARNING!** ***Do not disconnect the ground from any piece of video equipment in your signal path!*** Check the following to remove hum bars: 1. Confirm that all interconnected equipment is connected to the same phase of power, if possible. 2. Remove equipment connected to that phase that may introduce noise, such as motors, generators, etc. 3. Disconnect all interconnect cables and reconnect them one at a time until ground loop reappears. Disconnect the affected cable and replace, or insert an isolation transformer in the signal path.

LIMITED WARRANTY

Kramer Electronics (hereafter Kramer) warrants this product to be 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) Unauthorized 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.

NOTICE

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 of the above mentioned machines is only allowed to a Kramer authorized technician or Engineer. Any user who makes changes or modifications to the unit without the express approval of the manufacturer will void user authority to operate the equipment.
- Use the DC power supply (provided) to supply power to the machine and controllers.
- Please use recommended interconnect cables to connect the machine to controllers and other components.

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

Kramer Electronics, Ltd.
Web site: www.kramerelectronics.com
E-mail: info@kramerel.com
P/N: 2900-004005 REV 2