VideoEase VGA Balun
(500010, 500011, 500014)

500010   **500011**   **500014**

Application Guide
Version 1.39

Feb 2007

Purpose

The purpose of this document is to explain how to apply the VGA Balun under different operating conditions and to discuss issues not covered in the Installation Guide that comes with the product.

Function of the VGA Balun

The function of the VGA Balun is to allow the traditional VGA cable to be replaced by Category 5 (or better) twisted pair, thereby allowing VGA display screens to be located **up to 450 feet from the source**, exceeding standard VGA cable distance limitations.   The VGA Balun finds applications in the following areas:

Multimedia Projector Systems: Allows the multimedia projector to be placed at extended distances from a laptop or PC in a conference room or training room environment. Allows the presenter to stand at a distance from the projector so as not to obstruct the view of its audience.

Classroom PC Instruction: Allows a CRT monitor or projector to be connected to an instructor's PC via cost-effective Cat 5 twisted pair cable.

Video Information Systems: Allows display monitors or flat-screens to be distributed throughout a complex via pre-installed Cat 5 twisted pair cable.

Industrial Process Monitoring: Allows CRT monitors or flat-screen displays to be located at a remote distance from the central processor via pre-installed Cat 5 twisted pair.
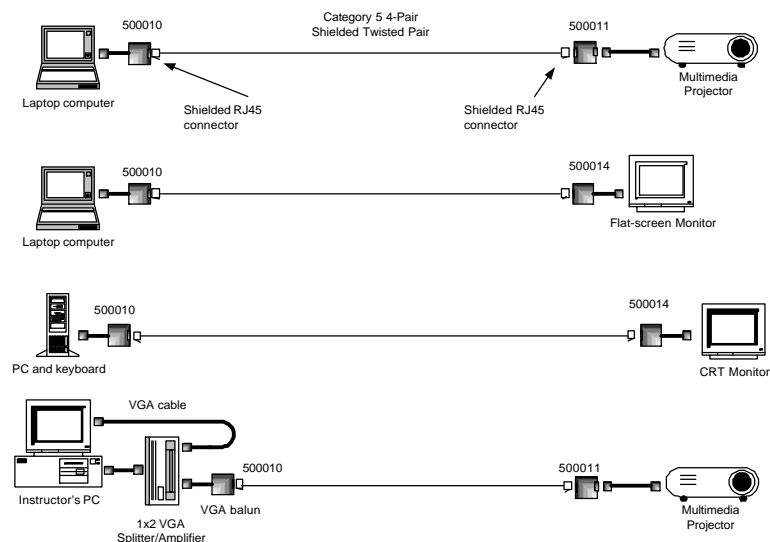
Equipment With Which the VGA Balun Works

The VGA Balun works with any equipment that supports VGA, XGA or SVGA signals, including; PCs, laptops, multimedia projectors, CRT monitors, flat-screen LCD monitors, plasma displays, VGA signal boosters, VGA signal splitters and VGA scan converters.

Application Table

There are currently three (3) product items in the VGA Balun range. The following table summarizes their application

Part	Connector	Usage
500010	DB15HD Plug	VGA - PC Side*
500011	DB15HD Receptacle	VGA - Monitor Side
500014	DB15HD Plug	VGA - Monitor Side

*The 500010 is electrically different from the 500011/500014.

When Must Shielded Twisted Pair (STP) Be Used

Cat 5 Shielded Twisted Pair must be used with the VGA Balun when either the VGA source or destination equipment does not have a built-in 3-prong power plug. This is due to the fact that the VGA Balun requires a reliable ground on both sides of the connection to transmit the horizontal and vertical synchronization signals. If the equipment is not properly grounded, then a common reference point must be supplied by using shielded twisted pair cable. Furthermore, the STP cable must be terminated with shielded RJ45 modular plugs on both sides. The outer cladding of the shielded plug makes contact with the shield of the RJ45 jack in the VGA Balun to provide a continuous ground. The following photos show a shielded RJ45 plug and the spliced end of a Cat 5 STP cable. Note the four twisted pairs, the foil shield and the drain wire. The foil shield and drain wire must be fold back on the cable and then crimped inside the RJ45 plug along with the other conductors. *The foil shield and drain wire must make contact with the shield of the RJ45 plug.* The last photo shows the finished connection. For more information please refer to page 7 of Tyco Electronics (AMP) Application Specification 114-6016. A copy of this document is available from MuxLab on request.
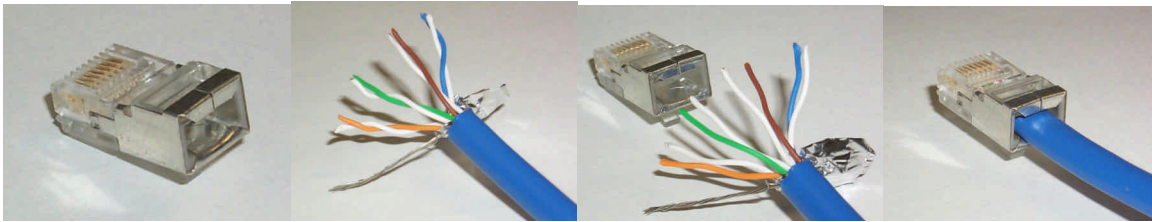
Typically, laptops, some multimedia projectors and flat-screen LCD monitors do not have built-in 3-prong power plug but rather are sold with external power adapters. **In these cases, shielded twisted pair cable must be used. If STP is not used in these situations, the result will be a total or intermittent loss of picture.** The following table summarizes the type of cable required based on the connection configuration.

	Destination			
Source	*CRT*	*LCD Flatscreen*	*Multimedia projector*	*Plasma display*
Desktop PC	UTP* or STP	STP	STP	STP
Laptop	STP	STP	STP	STP

Note: STP may be required when a desktop PC is connected to a CRT monitor if:
   a) the AC ground of CRT is different from the AC ground of the PC or
   b) the AC outlet of the CRT or PC is not grounded at all.
   c) there is an absence of signal ground continuity between the two baluns.

Shielded Cat 5 and Shielded RJ45 Components

In order to prepare a shielded Cat 5 cable connection, the following material is needed:

Two (2) shielded RJ45 plugs
One (1) spool 4-pair shielded Cat 5 cable cut to the desired length.
One (1) Twisted Pair Cable Stripping Tool
One (1) Crimping Tool and RJ45 Die Insert.

Shielded Cat 5 cable is sold as 26 AWG stranded twisted pair or as 24AWG solid copper twisted pair.   Stranded cable is usually used for patch cables. **If stranded twisted pair is used, then RJ45 plugs for stranded cable must be ordered**. If solid copper Cat 5 STP is ordered, then RJ45 plugs for solid copper twisted pair must be used (See Tyco/AMP Application Specification 114-6016). The crimping tool crimps the drain wire to the RJ45 shielded plug.

When crimping shielded RJ45 plugs onto shielded Cat 5 twisted pair cable, the drain wire from the shield inserts into the RJ45 plug along with the eight (8) conductor wires prior to crimping. When the crimping tool is compressed, all nine (9) wires will be crimped into the plug.

Shielded Cable and Connector Sources

In order to provide a complete shielded Cat5 cabling solution for the VGA Balun, the following table lists a few sources for shielded twisted pair cable and connectors.

Vendor	Part #	Description	Tel	Loc
Black Box	FM733	Shielded RJ45 Plug for Solid Cat 5 Cable	724-746-5500	USA
Black Box	FM731	Shielded RJ45 Plug for Stranded Cat 5 Cable	724-746-5500	USA
Black Box	EVNSL60-20	Cat5 STP 20 ft. Patch Cable terminated with shielded RJ45 on both ends. – 26AWG, Stranded, PVC.	724-746-5500	USA
Black Box	EVNSL71-0050	Cat5 STP 50 ft. Line Cord terminated with shielded RJ45 on both ends. – 24AWG, Solid copper, PVC.	724-746-5500	USA
Black Box	EVNSL71-0100	Cat5 STP 100 ft. Line Cord terminated with shielded RJ45 on both ends.– 24AWG, Solid copper , PVC.	724-746-5500	USA
Video Ware		Shielded Cat5 Cable and Connectors http://www.svideo.com/cat5e.html	877-857-5553	USA
Anixter	CM-00424CSG-5B	Belden 1624R Cat5 STP solid http://onlinecatalog.anixter.com/	1-800-Anixter	USA
Anixter	CM-00424FTPD-5B-06	Belden 1730A Cat5E STP solid	1-800-Anixter	USA
Anixter	CM-00424MWK-5E-ODS	4-pair Cat5e STP – Outdoor rated - solid Mohawk/CDT p/n M57562	1-800-Anixter	USA
Anixter	214944	Shielded RJ45 plug for 24AWG solid copper shielded twisted pair. Tyco/Amp p/n 5-569550-3	1-800-Anixter	USA
Anixter	176273	Shielded RJ45 plug for 4-pair stranded shielded twisted pair Tyco/Amp p/n 5-569542-3	1-800-Anixter	USA
Graybar	99576510	4-pair 24AWG shielded twisted pair.		USA
Connect Technologies	18-1253	RJ45 shielded pass-thru jack for keystone type plates http://www.connecttech.net/	615-726-0847	USA
Connect Technologies	06-3755	RJ45 shielded coupler adapter.	615-726-0847	USA
My Cable Shop	KEY110S	Keystone RJ45 Shielded http://www.mycableshop.ca/sku/KEY110S.htm	866-449-4498	CAN
My Cable Shop	Z45-STP-STR-100	Shielded RJ45 Plug http://www.mycableshop.ca/sku/Z45-STP-STR-100.htm	866-449-4498	CAN
Ortronics		Clarity Shielded Solution http://www.ortronics.com/us/tools/download/?dfp=lit&dfn=ClarityShielded.pdf		USA
Tyco	1116515-1	110connect Cat5e Shielded Mod Jack http://www.ampnetconnect.com/documents/Enhanced_Cat_5e_110Connect_Shielded_Jack_Cut_Sheet.pdf	800-553-0938	USA
Tyco	1339015-1	SL Series Tool-Less Cat5e Shielded Jack http://www.ampnetconnect.com/documents/Cat_5e_Shielded_Toolless_Jack_Cut_Sheet_rev1.pdf	800-553-0938	USA

Pin Configuration

The cable between the two VGA Baluns must respect the pin configuration of the baluns. The twisted pairs must mate with the correct pins and the polarity must be straight-through. That is, Pin 1 on one end must connect to Pin 1 at the other, and so on for the other seven pins. Each of the following pin-pairs constitute a twisted pair; Pins 1&2, Pins 7&8, Pins 4&5, Pins 3&6 as shown in the following diagram.

Twisted Pairs

Pair 2 Pair 1 Pair 3 Pair 4

1 2 3 4 5 6 7 8
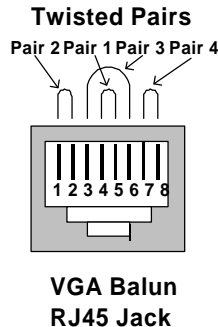
**VGA Balun
RJ45 Jack**

## When Can Unshielded Twisted Pair (UTP) Be Used

Cat 5 Unshielded Twisted Pair (UTP) cable may be used with the VGA Balun when **both** VGA Baluns share a perfect common reference ground. This is possible if both equipment are plugged into the same AC power mains. For example most CRT monitors and desktop PCs.   Under these conditions, the user can also take advantage of pre-installed Cat 5 UTP cable.

However, even when both devices share a common AC power ground, it is still possible that there is no commons signal ground between the two VGA Baluns. The reason is that the display may have internal circuitry that blocks continuity between the AC ground and the VGA signal ground. In this case even though it appears that both baluns share a common ground, in reality they may not.

An example would be if the internal power supply of the equipment does not transfer the AC ground to the VGA signal ground. Or there may be noise blocking circuitry between the AC ground and the VGA ground.   One would need to be familiar with the internal design of the monitor to verify this.   This may be one reason why one monitor may work with UTP and another monitor may not. In this case shielded twisted pair must be used even though both VGA devices are plugged into the same 3-prong AC power source.

How to Provide a Common Ground if UTP is Used

In the event that UTP has already been installed and it is not practical or feasible to install STP cable, an alternative solution is to connect a spare wire between the VGA Baluns to provide a commons signal ground. One method of achieving this is to use shielded RJ45 plugs at both ends of the UTP cable and to crimp or solder the extra wire to the RJ45 metal shroud. Another option is to solder both ends of the wire to the DB15HD metal shell. This will provide a common ground path to ensure reliable signal transmission as shown in the following diagram.
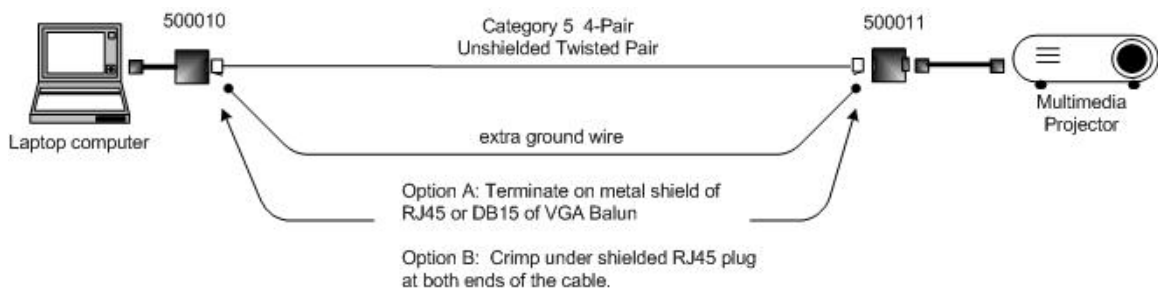
Displays Equipped with DB15HD Receptacle

Due to the product design, the VGA Balun-PC Side (500010) must be connected to the source and the VGA Balun-Monitor Side (500011, 500014) must be connected to the display. Most plasma and LCD screens have a DB15HD receptacle and therefore it is recommended to use the 500014.

If this is not possible, then connect a short VGA male-to-male extension cable or gender changer between the 500011 and the display. A photo of a typical VGA extension cable and gender changer is shown below. The gender changer shown at the bottom right can be found at the following link: http://www.cablesnmor.com/vga-gender-benders.html

To locate a source for a VGA extension cable or gender changer please consult the table of VGA cabling equipment vendors provided at the end of this document.

Cable Stiffness

It has been related by several customers that when terminating solid copper STP cable at the VGA Balun, movement of the stiffer solid copper STP cable applies excess torque on the RJ45 plug inside the balun thereby causing intermittent contact, leading to color changes or lost signals.   Jiggling the RJ45 plug inside the balun restores the picture. In order to avoid this problem one option is to terminate the STP cable at the wall outlet and then to connect stranded STP jumper cords between the wall outlets and the baluns.

Picture Problems

During the installation of the VGA Balun various picture problems may result.   It is important to know what is causing these problems and how to correct them.

Total or Intermittent Loss of Image
This problem is almost always due to loss of synchronization due to improper grounding and manifest itself by an intermittent flashing display or total loss of image. This will occur if UTP is used with VGA equipment that does not have a built-in 3-prong power plug. The solution is to replace the UTP by Cat 5 STP and terminate both ends with shielded RJ45 modular plugs.

Smearing
Smearing occurs when the edge of an image leaves trail traces similar to smudging a line of ink on a piece of paper. This may occur as the length of twisted pair cable increases. As the maximum distance specification is neared, the physical properties of the cable and baluns begin to show this effect. This is due to the effects of propagation delay and attenuation. Aside from using an active device with built-in tilt-amplifier to correct the problem, the other possible solutions are; a) to shorten the length of cable or b) adjust the contrast and brightness of the monitor.

Flutter
Flutter occurs when the background fluctuates between light and dark. This symptom may be due to problems with the grounding between the VGA equipment or the connection may be picking up some external interference from a nearby power transformer. A solution to minimize this effect is to adjust the monitor's contrast and brightness

Ghosting
Ghosting is characterized by a second video image being received after the main image, resulting in a double image that is skewed in relation to the first. This is usually due to a problem with the UTP cable connection itself. Poor crimping, untwisted pairs, some of the twisted pairs may be longer than others, poor quality cable, or impedance mismatch

between the CPU and the monitor are all some of the causes. In these cases it is best to replace the existing cable with a new one.

Wrong Colors
If the wrong colors appear in an image (i.e. blue appears where green should appear), the problem may be due to swapped or split twisted pairs. The key is to verify the pin configuration of the cable between the CPU and the monitor to ensure that the correct pin configuration is respected. Please refer to the Installation Guide for further details about pin configuration.

Loss of Image Detail
Loss of image detail may occur as the length of twisted pair cable increases.   As the maximum distance specification is neared, the physical properties of the cable and baluns will begin to show this effect. This is due to the effects of propagation delay and attenuation. Other than using an active device with built-in tilt-amplifier, one can improve the image by shortening the length of twisted pair or reducing the picture resolution. If the application operates adequately at a lower resolution (i.e. 800x600 instead of 1024x768), then setting the monitor to a lower resolution will help improve the image. Another way to improve the image is to adjust the contrast and brightness of the monitor.

Loss of Image with LCD Projectors
If there is a loss of image or image detail when a PC is connected to an LCD projector, it is possible that the screen resolution is been set too high. Try to lower the resolution to 800x600 and try again. Position the mouse on the Desktop and right-click. Select "Properties". Select the tab marked "Settings" and adjust the "Display Area" to 800x600.   Click on "Apply" and then "OK".   Return to the original application and check the image on the projector.

Laptop Touchpad Mouse and Image Flicker

It has been noted that when certain touchpad laptops are connected to a monitor using UTP cable and VGA Baluns, some background flicker or flutter in the image has been noticed when the touchpad mouse cursor is moved. This phenomena has been traced to additional EMI/RFI noise generated by the laptop when the touchpad is activated consequently interfering with the VGA video signal.   The problem can be resolved by replacing the UTP cable between the VGA Baluns by Category 5 shielded twisted pair (STP) cable. In order to ensure proper shielding, at least one end of the cable shield must be connected to ground.

Bandwidth and Operation at SXGA (100MHz)

Although the VGA Balun has a bandwidth specification of 60 MHz, it will still operate at screen resolutions with higher bandwidth; i.e.; SXGA (100MHz). This is because the bandwidth roll-off above 60 MHz is gradual and not sharp, allowing the higher frequency components through.

Projectors Equipped with Wireless Mouse and USB Port

On higher-end multimedia projectors, a wireless mouse is offered that allows the presenter to control the laptop cursor via remote control. In order to do this, the laptop must be connected to the projector via the USB port. Due to the distance limitations of the USB interface (16.4 feet / 5 meters), the laptop must be near the projector.   This would prevent the use of the VGA Baluns to extend the distance between the laptop and the projector.   If it is essential that the laptop be connected via twisted pair at an extended distance from the projector then the user has two options:

B) Refrain from using the wireless mouse and rather use the laptop mouse, or

B) Buy a set of USB extenders from companies like Icron or Gefen (Icron private label).

DVI-I to VGA Adapters

The DVI-I interface is a combined analog and digital interface found on some PCs and screens. In applications where the analog (VGA) portion of a DVI-I interface needs to be connected to a VGA monitor, the VGA Balun may be used in conjunction with a DVI-VGA Adapter. The adapter extracts the analog video (VGA) portion of the DVI-I interface and converts it to DB15-HD as shown in the following picture.

Proxima 6150 Projector

It has been found that in some installations, the Proxima 6150 Projector has not been able to synchronize when used with the VGA Balun. The cause at this time is unknown.

Canon LV Series Projectors

MuxLab has encountered an unresolved technical support issue where certain laptop computers failed to sync up properly with the Canon LV (LV-S2, LV-7565) series when used with the VGA Balun.   In some cases, the laptop was able to sync up when the refresh rate was changed. The laptops that would not sync up with the baluns include the Fujitsu S-Series and Toshiba Satellite Pro. At the time of this document revision, the cause is unknown and whether the problem is an isolate case or a general compatibility issue.

Laptops with External Display Checking

Some laptops periodically checks to see if the external display monitor is connected to the VGA port. It achieves this by sending handshaking signals to the external display monitor.   Since the VGA Balun does not pass handshaking signals, the VGA Baluns will not support laptops with this feature. Models include the IBM ThinkPad I-Series.

Laptops with External Switching Power Supplies

One problem that has been documented is that when certain laptops are connected to a projector using Cat 5 unshielded twisted pair cable (UTP) and are powered from the external switching power supply cube, image distortions appear on the screen. These distortions range from ghosting to cropped edges and background interference patterns. The cause has been traced to the high level of EMI radiating from some switching power supplies. The interference may enter externally or internally via the VGA port of the laptop. When the power supply is disconnected from the laptop and the laptop runs off its own internal power supply, the problem disappears. In order to alleviate the problem, one of two solutions is offered;

a) Use shielded twisted pair cable between the VGA Balun and to terminate both ends on shielded RJ45 plugs

b) Replace the power supply by a transformer-based supply or another switching power supply with lower EMI emissions.

Cable on the Reel

Frequently it may be necessary to pre-test a VGA Balun installation with some spare twisted pair cable. It is important to note that when the cable is on the reel, the picture will be inferior. This is due to the increased magnetic induction created by the spool of cable. In order to properly pre-test a configuration, it is recommended to un-coil the cable and lay it out flat on the floor or in a cable farm structure.

VGA Distribution Amplifiers

In some applications it is necessary to distribute a VGA source to multiple screens. The VGA Balun works in conjunction with commercially available VGA distribution amplifiers (DA). In order to operate correctly it is necessary that the VGA outputs on the DA be fully isolated in order not to interfere with the synchronization pulses. It has been found that with certain VGA distribution amplifiers (i.e.; Kramer Model VP-6x1), when more than three (3) screens were connected, there was a disruption in the sync signal leading to a loss of image on all screens. When the same amplifier was replaced by a 1:6 DA from Altinex, the problem was eliminated and all six (6) screens were stable. It is recommended to test the VGA Balun with the DA before final deployment. The following page provides a list of some of the VGA distribution amplifiers on the market. MuxLab cannot guarantee performance for them.

Altinex: http://www.altinex.com/Products/Dedicated_AV/Distribution_Amplifiers/DA1506RT/DA1506RT.htm

Kramer: http://www.kramerelectronics.com/pdf/VP-8.pdf

MSC: http://www.mycableshop.com/sku/MSC-MSV2010.htm

GVS:http://www.tigerdirect.ca/applications/SearchTools/item-details.asp?EdpNo=506041

Startech:http://www.startech.com/ststore/itemdetail.cfm?ProductID=ST122&topbar=topbarav.htm

VGA Dual head Cards

As an alternative to inserting a VGA distribution amp in front of the VGA Balun, some vendors offer dual head VGA cards. When used, a pair of VGA Baluns may be connected to each port thereby providing a neat point-to-point connection. The advantage of this approach is that there are fewer points of failure and no extra power is required. Matrox, for example offers the Millenium Dual Head VGA Card.

http://www.matrox.com/mga/products/mill_g450/pci.cfm

Classroom Instruction – Example #1

In many schools, classrooms now feature an overhead projector connected to an instructor's PC or laptop. The instructor typically sits at a PC or laptop at the front of the class while an overhead projector displays the screen that appears on the instructor's PC. The instructor usually needs to be able to view the local PC screen while the class is watching the projection display. From the cabling perspective, it is more cost-effective to use Cat 5 twisted pair versus traditional bulky VGA cable. VGA Baluns at either end convert the VGA interface to twisted pair cable. In order to ensure required signal continuity, it is recommended to install shielded twisted pair cable between the two VGA Baluns.   In cases where only one VGA output is available and a local monitor is required, it is recommended to use an active VGA distribution amplifier to split the VGA signal so that one output goes to the local screen and the other goes to the remote projector. It is not recommended to use a passive "Y" cable assembly as there is greater signal loss and a higher risk of impedance mismatch and image "ghosting".   Therefore it is recommended to use an "active" 1x2 VGA distribution amplifier at the PC such as the ST122 from Startech as shown in the following diagram.
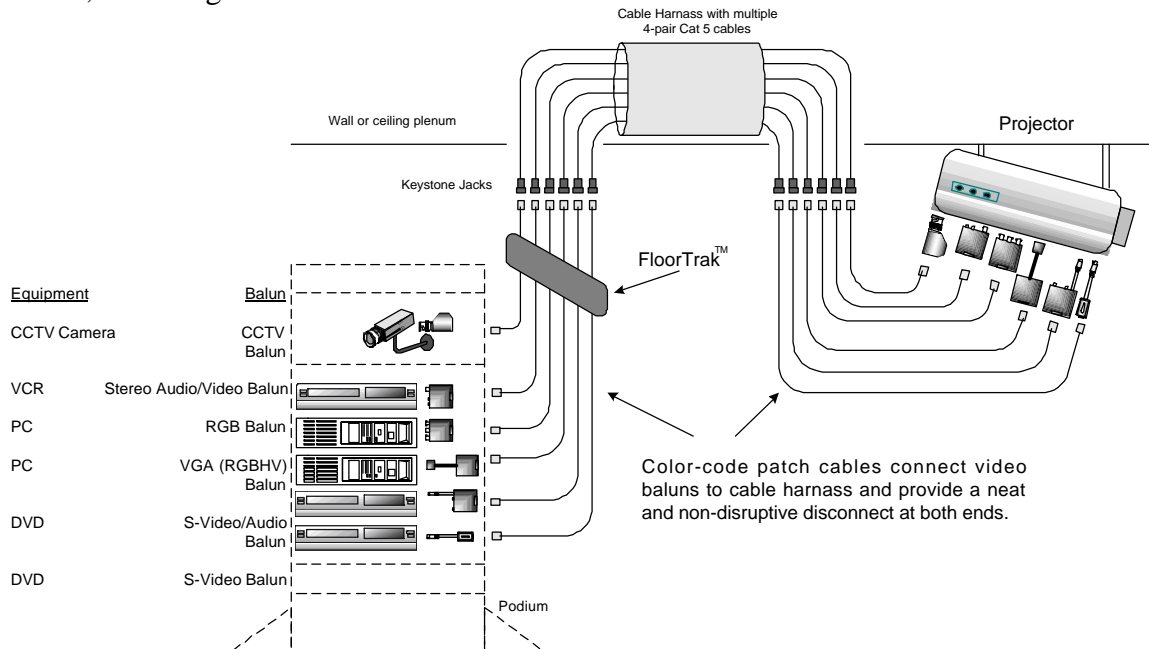

VGA Splitter/Amp
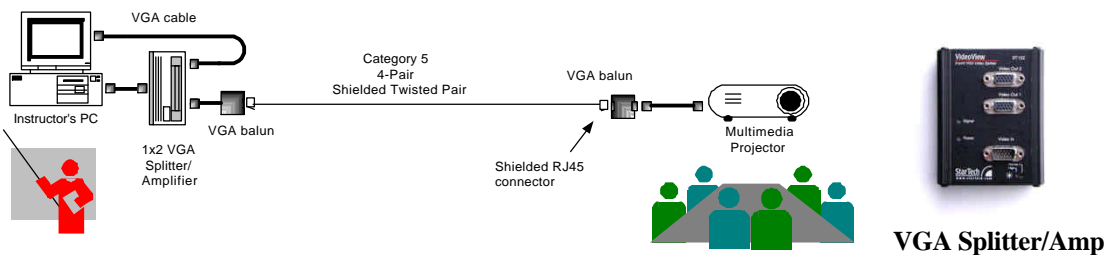
Classroom Instruction – Example #2

In some installations, the PC, projector and keyboard mouse are in different locations. In order to streamline the cabling over Cat5, it may be more cost-effective to manage the video and keyboard/mouse cabling separately. The following diagram illustrates:
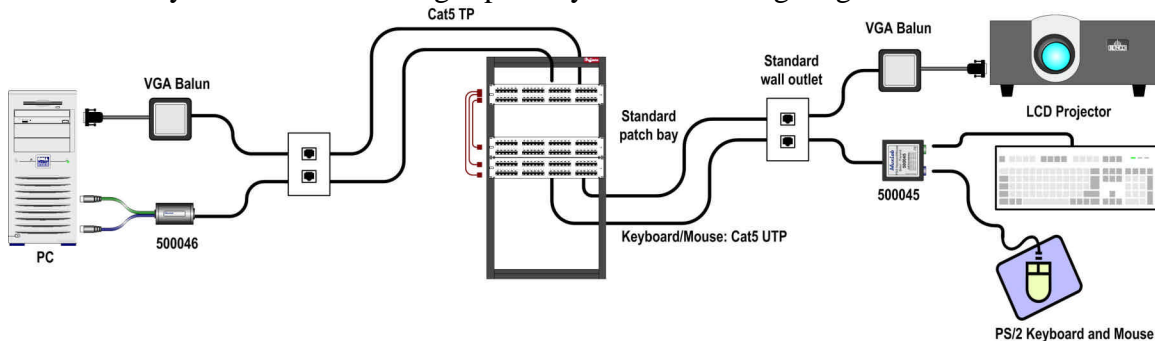
Podium – to – Projector Cabling

The typical presentation system comprises a speaker's podium and a projector.   Instead of installation complex and expensive switching systems, videobaluns and the appropriate cable harnesses can provide a neater and more cost-effective cabling structure, that can be set-up and taken down quickly and without damaging the furnishings in the presentation hall. The following diagram illustrates a typical presentation setup using MuxLab video baluns, including the VGA Balun.

Cable Harnass with multiple
4-pair Cat 5 cables

Wall or ceiling plenum

Projector

Keystone Jacks

FloorTrak™

Equipment	Balun
CCTV Camera	CCTV Balun
VCR	Stereo Audio/Video Balun
PC	RGB Balun
PC	VGA (RGBHV) Balun
DVD	S-Video/Audio Balun
DVD	S-Video Balun

Color-code patch cables connect video baluns to cable harnass and provide a neat and non-disruptive disconnect at both ends.

Podium

A primary cable harness provides the options to connect a variety of audio and video signals to the projector and may be hidden under a raised floor or in the ceiling plenum. Keystone jacks at either end provide an versatile means to connect or disconnect audio-video equipment via Cat 5 line cords.   This is desirable in situation where the equipment must be set up and torn down quickly.   The keystone jacks may be color-coded according the type of audio/video signal to be connected.   MuxLab's wide range of video baluns allows different audio/video formats to be supported. Since Cat 5 cables are used, the diameter of the cable harness is much less than if coaxial cables were bundled together.

Point-of-Sale Restaurant Application

In the restaurant and fast-food industry, a point-of-sale (POS) terminal is typically connected to a display monitor in the kitchen. The monitor displays information generated by the POS terminal about customer orders to be prepared. The kitchen monitor is often a VGA monitor connected to a PC-based POS terminal. The distance between the POS terminal and the kitchen monitor is typically under 100 feet and the screen resolution is usually 800x600 or lower. VGA cable is normally used to connect the monitor to the POS terminal. However, VGA cable is costly and if there are multiple connections, the total cost will be significant. By using the VGA Baluns, VGA cable can be replaced by Cat 5 twisted pair as shown in the following diagram.
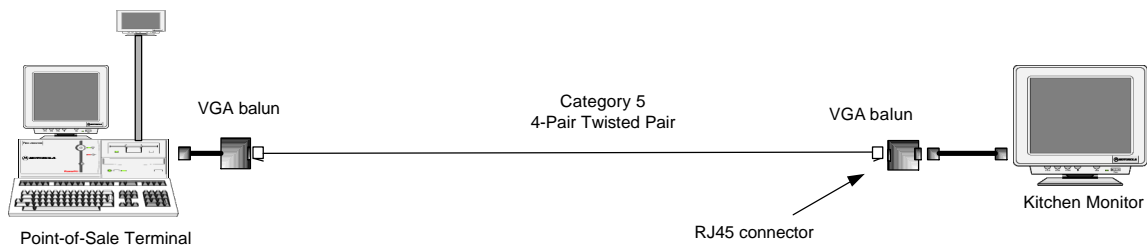
On-Line Video Information Systems

Some applications require VGA video to be displayed simultaneously to multiple screens. These applications include airline information systems or retail video kiosk setups as shown in the following diagram.
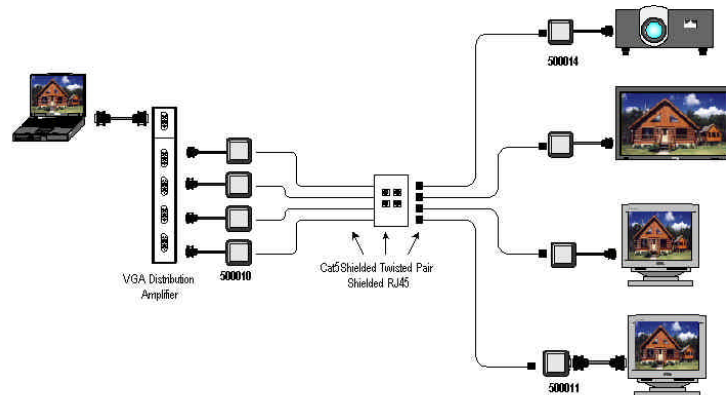
The VGA Balun works in conjunction with third party VGA distribution amplifiers. In order to ensure reliable operation, is important to verify that the VGA distribution amp has buffered (isolated) outputs. If there is not complete isolation between the VGA ports, there may be intermittent image problems. For example, screens may not sync up properly or some screens may drop out when other screens are powered on. It is recommended to test the VGA Balun with the specified the distribution amp before deploying it.

Ground Loop Blocking

Video ground loop is caused by the video source and video display being connected to grounds that are sitting at difference voltage levels, giving rise to a difference ins voltage potential and consequently a current flow between the two devices. Ground loop problems manifest themselves visually by displaying horizontal or wavy bands ("hum" bars) that move up the screen.

In order to confirm that there is a ground loop, try temporarily isolating the video source or display from the building AC ground by plugging the equipment into the AC outlet using a 3-prong to 2-prong AC adapter. For safety reasons and according to the electrical code, it is not advisable to use this method as a permanent solution.

In order to permanently correct the problem, the ground loop must be isolated or attenuated. The following third party devices provide ground loop correction for a single VGA (RGBHV) video channel.

Altinex DA203 1-in 1-out Equalizer
http://www.altinex.com/Products/Special_Application/DA203-101/DA203-101.htm

Extron GLI 350 Ground Loop Isolator
http://www.extron.com/product/product.asp?id=gli350&version=print

Jensen Ground Loop Corrector
http://www.jensen-transformers.com/datashts/vbh3rr.pdf

Newer Plasmas without Tint/Color Adjustment

It has been found that on some newer plasma displays, there is no color/tint adjustment. Therefore, when used with the VGA Balun, as the maximum distance approaches the limit, there may be a visible loss of certain color components due to the inability of the plasma display to automatically compensate for a weaker color component. For example MuxLab has noticed that the Samsung SP-S4223 and Pioneer PDP-433CX were not able to recover a weak green component signal at 200 ft of Cat5. In this situation, it is recommended to use the active VGA Balun Kit (500035).

VGA Cabling Sources

The following table provides a list of vendors who sell VGA equipment and accessories that work in conjunction with the VGA Balun.

Company	*Website*	*Products*
Altinex	http://www.altinex.com/	VGA cables, Distribution Amps
Black Box	http://www.blackbox.com/	VGA cables, splitters
Kramer Electronics	http://www.kramerelectronics.com/	VGA Distribution Amps
Startech	http://www.startech.com/	VGA Splitter, Distribution Amps
Extron	http://www.extron.com/	VGA switchers
Hall Research	http://www.hallresearch.com/index.htm	VGA switchers, VGA converters
NTI Inc.	http://www.networktechinc.com/	VGA switchers, gender changers
Magenta Research	http://www.magenta-research.com/	VGA distribution amps

Conclusion

The VGA Balun is ideally suited for many applications. It is important to verify the type of equipment being used, the type of cable, and the distance required and the picture resolution needed before proceeding with an installation. If in doubt, please contact MuxLab Sales or Customer Technical Support for assistance at 877-689-5228 (North America) or e-mail us at videoease@muxlab.com.

MuxLab Inc.	Telephone : .... +1 514-905-0588
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