

VGA Cabling Simplified via Twisted Pair

BY JEFFREY HERMAN



The VGA display is almost taken for granted today. It is the de facto video interface technology for PCs in almost every application, from basic desktop PC stations to multimedia projection systems.

From the cabling perspective, it is almost expected that a VGA monitor be near the source in order to work. Traditional VGA cable has a distance limitation of around 25 to 50 feet before a signal booster is needed. Aside from the distance, VGA cable is unwieldy to work with, and it does not lend itself to structured cabling techniques. Many people are not aware that VGA may be transmitted extended distances via Category 5 twisted pair without the need for signal boosting by using a simple passive device known as a VGA balun.

What Is a VGA Balun?

A VGA balun (Figure 1) is a passive device that allows traditional VGA cable to be replaced by twisted pair (Category 5 or better), thereby allowing VGA display screens to be located extended distances from the source without the need for signal boosters.

Exceeding standard VGA cable distance limitations, VGA baluns work in pairs and support any equipment with VGA, SVGA, XGA or SXGA interfaces, such as desktop PCs, laptops, multimedia projectors, CRT monitors, flat-screen LCD

monitors, plasma displays, VGA signal boosters, VGA signal splitters and VGA scan converters. (See Figure 2.)

VGA cards transmit not only video, but also control signals to set picture attributes such as brightness or contrast. Since there are only four twisted pairs under one horizontal Category 5 cable, passive VGA baluns can only support the RGB video and horizontal and vertical synchronization signal. Passive VGA baluns do not support the control signals and therefore, the monitor settings must be adjusted before the equipment is installed in its final location. The following section describes some VGA applications that benefit from Category 5 cabling techniques.



Figure 1

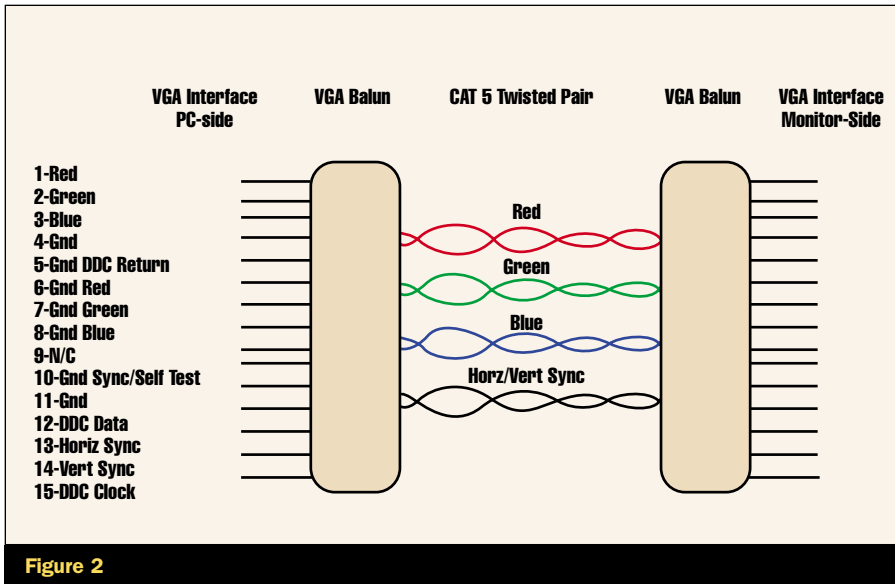


Figure 2

Applications

MULTIMEDIA PROJECTOR SYSTEMS. Multimedia projector systems are used in almost every area of activity, from corporate presentations to education and tradeshow demonstrations. The new generation of projectors provides outstanding image quality when used with laptops or PCs. Normally, the presenter connects a laptop to the projector via standard VGA cable. The drawback is that the laptop must be situated near the projector. This may be inconvenient in some circumstances, especially if the operator needs to access the computer during a presentation. In order to eliminate this constraint, the connection between the laptop and the projector could be extended via Category 5 STP, and the VGA baluns would play the essential role, as shown in Figure 3.

CLASSROOM PC INSTRUCTION. In a school setting, PC instruction is often used by teachers to present educational material or course information to students in multiple classrooms. Using VGA baluns together with a VGA splitter, a VGA source PC could be connected to multiple VGA screens in local classrooms via Category 5 twisted

pair. (See Figure 4.) If the equipment at either end of the VGA baluns has built-in 3-prong AC plugs, then pre-existing Category 5 UTP could be used. On the other hand, if either piece of equipment connected to the VGA baluns is not equipped with built-in 3-prong AC connectors, then Category 5 STP would need to be used. The reason for this is

explained later in this article.

For budget-conscious schools, using VGA baluns and Category 5 twisted pair is an economical way to bring PC-instruction to each classroom without investing in expensive LAN or video-conferencing systems.

VIDEO INFORMATION SYSTEMS. PCs are often used as sales or demonstration tools in many commercial enterprises such as retail, distribution and tradeshow kiosks to disseminate eye-catching and informative programs. For example, VGA baluns could be used to allow a store operator to convey sales-related material to its storefront VGA monitors using Category 5 cable, eliminating the need for the CPU to be near the kiosk. (See Figure 5.)

The store operator can manage the kiosk screens from the comfort of his or her office and the kiosks can be moved around to any location that is pre-wired for Category 5.

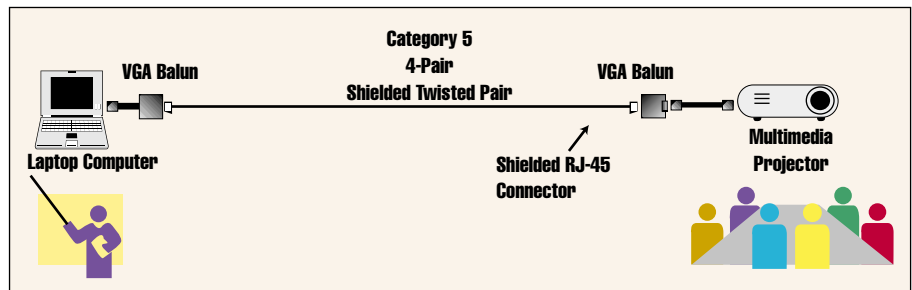


Figure 3 Multimedia Projector System

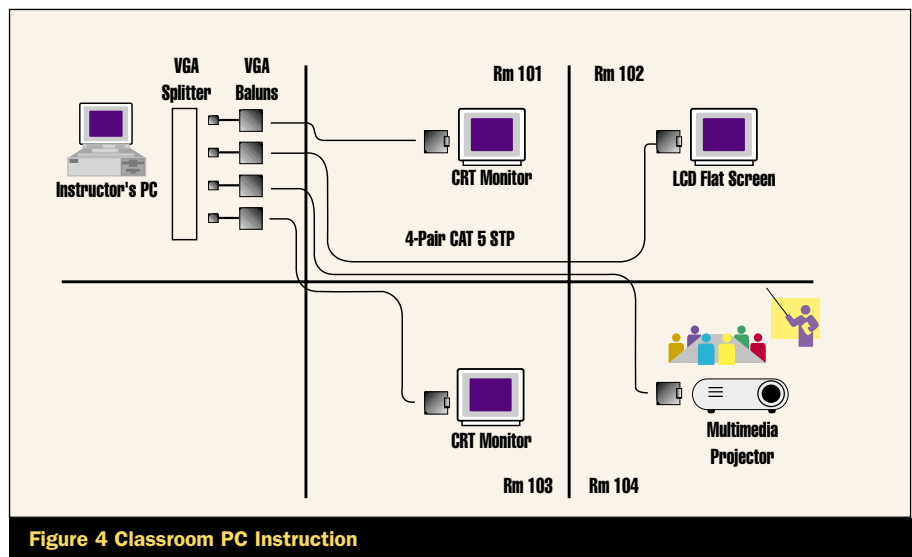


Figure 4 Classroom PC Instruction

INDUSTRIAL PROCESS MONITORING. In the industrial process market, sophisticated sensing and process control equipment is often located in inaccessible areas. VGA output from these devices could be transmitted via Category 5 cable back to a VGA monitor located in a secure viewing area. (See Figure 6.) The noise immunity provided by Category 5 is ideal in an industrial setting and VGA baluns would enable this benefit to be realized.

COLLABORATIVE WORK. In many applications such as technical writing or engineering design, work is often done in a collaborative

atmosphere and people sometimes need to meet to discuss information that is displayed on a local PC. In order to allow the VGA screen to be viewed more easily, a second VGA monitor could be placed in an area where other participants could see. By installing a second VGA card in the source PC and by connecting a remote monitor using VGA baluns and Category 5 cable, a second viewing station could be quickly set up in another room without having to install additional expensive video-conferencing equipment. (See Figure 7.)

The following section will highlight

some cabling guidelines when using VGA baluns.

Cabling Guidelines

CABLE TYPE. Some VGA baluns support only UTP Category 5. Other VGA baluns support both STP and UTP. In regard to VGA baluns for STP, Category 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 RJ-45 modular plugs on both ends of the link to provide a common signal ground between the VGA baluns.

Typically, laptops, multimedia projectors and flat-screen LCD monitors are equipped with external power adapters, and therefore, the unit itself does not have a built-in 3-prong power plug. In this case, 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. Table 1 summarizes the cable type required when using VGA baluns that support STP.

Category 5 unshielded twisted pair (UTP) cable may be used with the VGA balun when both the VGA source and destination equipment have built-in 3-prong power plugs; i.e. CRT monitors and desktop PCs. This would allow pre-existing Category 5 UTP cable found in most buildings to be used. Incidentally, when testing a VGA balun connection with spare twisted pair cable, it is important to first uncoil the cable from the spool or reel.

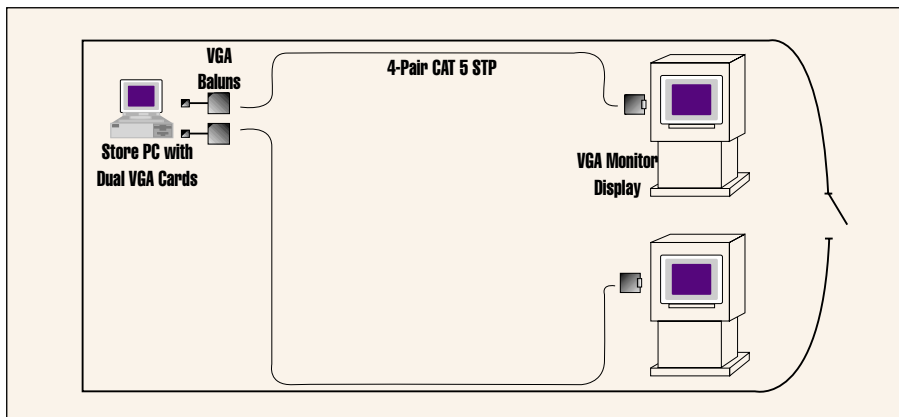


Figure 5 Video Information System

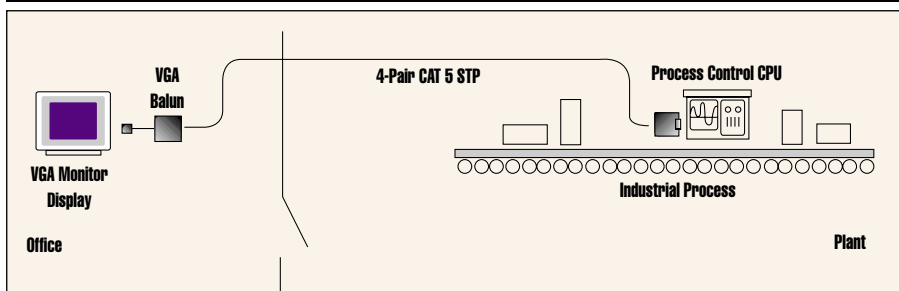


Figure 6 Industrial Process Monitoring

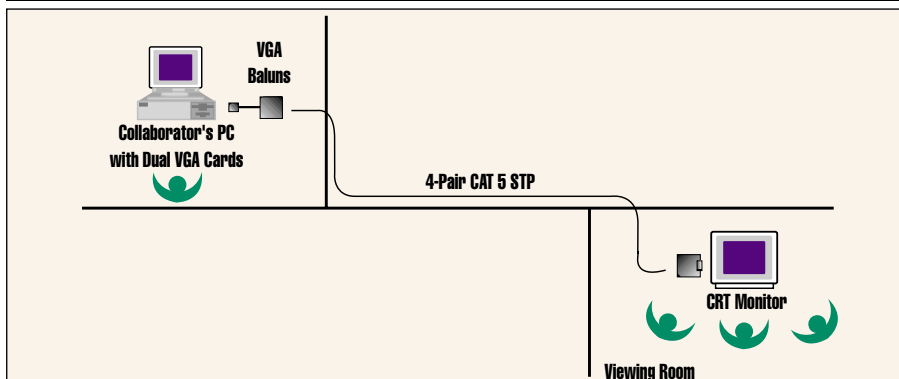


Figure 7 Collaborative Work Environment

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

Table 1

PIN CONFIGURATION. VGA baluns require four twisted pairs:

- Pair 1: Red Video
- Pair 2: Green Video
- Pair 3: Blue Video
- Pair 4: Horizontal and Vertical Synchronization

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. A VGA balun assigns a signal to each pair, as shown in Figure 8.

PICTURE RESOLUTION. The monitor's resolution should be set according to the application. If an application is only going to be displaying large text fonts and graphics, then a lower resolution should be used. This will optimize the image quality and maximize distance. Typically, a VGA balun should be able to operate at the maximum distances shown in Table 2 depending on the vendor specifications.

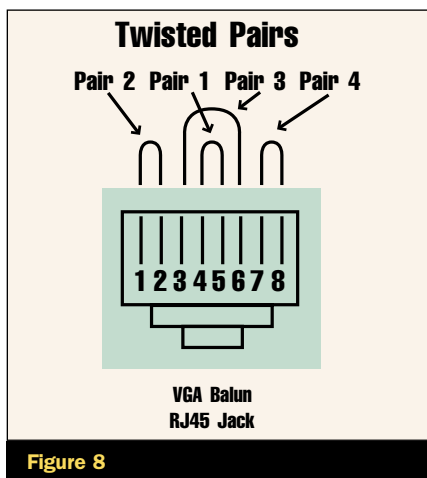


Figure 8

CABLE TYPE. Cable type is an important factor in determining picture quality. In order to minimize signal loss, Category 5 or superior cable should be used.

CABLE DISTANCE. The maximum distance is influenced by monitor resolution. If the required distance exceeds the specifications for a given resolution, then it is advised to lower

VGA BALUN VENDORS

- NHC Communications
- E.T.S. (Energy Transformation Systems)
- Intelix

the monitor resolution to improve the picture quality.

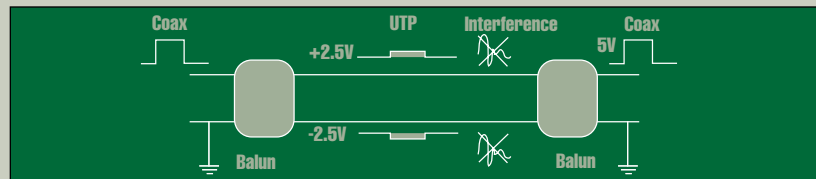
MONITOR SETTINGS. As the signal travels down the cable, the image may lose some brightness and contrast. This can be compensated by increasing the brightness and contrast at the monitor. It is advised to set the brightness and contrast levels to

Video Vocabulary

RGB (red, green, blue): The component video signals that comprise a VGA signal.

Horizontal and Vertical Synchronization: The signals that accompany the RGB components of the VGA signal to synchronize the video image in the horizontal and vertical directions.

Balun: A device that converts an unbalanced signal to a balanced signal to support transmission via twisted pair. The net effect is to help cancel out electromagnetic interference (EMI).



Tilt-amplifier: A video signal amplifier that provides greater amplification for the higher frequencies and less amplification at the lower frequencies.

USB (Universal Serial Bus): A PC interface that supports high-speed serial communications.

VGA (Video Graphics Array): One of the defacto standards for PC video transmission. Enhanced versions that offer higher resolution and more colors include: XGA (Extended Graphics Array), SVGA (Super VGA), and SXGA (Super XGA). For more information, refer to the following web site: (PC Video Basics) www.hut.fi/misc/electronics/faq/vga2rgb/basics.html.

VGA Balun: A passive device that converts the unbalanced VGA signal into a balanced signal to support transmission via twisted pair.

VGA Scan Converter: An active device that converts a VGA video into another video format such as composite video.

VGA Splitter: An active device that distributes a single VGA signal source to two or more outputs.

VGA Booster: An active device that amplifies a VGA signal to allow extended distance to be achieved.

Format	Resolution	Max Distance via CAT 5 TP
VGA	640x480 pixels	400-450 ft
SVGA	800x600 pixels	300-350 ft
XGA	1024x768 pixels	100-250 ft
SXGA	1280x1024 pixels	50-200 ft

Table 2

maximum and then adjust them after the equipment is installed in its final location.

Even after precautions have been taken, various picture problems may surface. The following section describes some of these problems and how to correct them.

Picture Problems

TOTAL OR INTERMITTENT LOSS OF IMAGE. This problem is almost always due to loss of synchronization as the result of improper grounding, and manifests 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 with Category 5 STP and to terminate both ends with shielded RJ-45 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 characteristic. 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) to 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 twisted pairs longer than others, poor quality cable and exceptionally high crosstalk between the CPU and the monitor are all 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 VGA balun vendor's pin configuration is respected.

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 characteristic. 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.

Conclusion

VGA baluns increase cabling flexibility and eliminate the constraints of bulky and expensive VGA cable. In order to ensure satisfactory picture

NHC Announces New VGA Balun

NHCMuxLab announces its newest VideoEase VGA Balun for the PC VGA Video environment. The VGA Balun allows the traditional costly and bulky VGA cable to be replaced by 4-pair Category 5 twisted pair cable. Designed for PC and audio/video cabling specialists, the VGA Balun is suited for many applications.

Sold in two genders, the VGA Balun-PC (500010) connects to the VGA source equipment, such as a PC. The VGA Balun-Monitor (500011) connects to the VGA destination equipment, such as a VGA monitor. The product also works in conjunction with VGA equipment, such as VGA splitters and VGA extenders for a total VGA cabling solution.

The VGA Balun features Velcro® mounting pads for neater installation and built-in VGA cable assemblies for greater reliability. Requiring no power, the VGA Balun supports all VGA signal pins except control and handshaking and comes with an installation guide and lifetime warranty. A pin-configuration label on the product facilitates installation.

The flexible VideoEase video balun smoothly integrates with existing structured cabling systems and allows moves, adds and changes to be made quickly using standard structured cabling techniques. To ensure reliability, NHC live-tests all VideoEase VGA Baluns in the VGA environment.

The VideoEase VGA Balun is available for a suggested list price of \$120 per balun starting in October. For more information, call 800-361-1965 or 514-735-2741. NHC can be found on the Web at www.nhc.com.

results, conduct a pre-installation check to determine the type of VGA equipment to be used, the maximum cable distance required and the

required monitor resolution.



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ity and physical layer switching solutions for the structured cabling and networking industry. Visit MuxLab on the web at www.muxlab.com.

Terminology

We realize the confusion acronyms, abbreviations and other industry jargon can create. To address this dilemma, we provide this ongoing list of terminology as a monthly resource in *CBM*. Be sure to look for it in each issue.

Connecting Hardware

A device used to terminate cable with connectors and adapters that provides an administration point for cross-connecting between cabling segments or interconnecting to electronic equipment.

Connector

A device to connect and disconnect copper wires or fibers in cable to equipment or to other wires or fibers. Copper wire and fiber optic connectors most often join transmission media to equipment or cross-connects.

Connector Panel

A panel designed for use with patch panels; it contains either 6, 8 or 12 adapters pre-installed for use when field-connectorizing fibers.

Connector Panel Module

A module designed for use with patch panels; it contains either 6, 8, or 12 connectorized fibers that are spliced to backbone cable fibers.

Contention

Network access method in which nodes compete for transmission by sending signals at will.

Controller

A device used to control the input/output operations between the host computer and a group of terminals.

Control Unit Terminal (CUT)

CUT refers to the connection of a single-session terminal device to a cluster controller.

Convactor Area

An area allocated for heat circulation and distribution. Convactor areas, typically built into a wall, can be used as a satellite location only if a more suitable area is unavailable.

Convergent Light

Rays coinciding in one point.

Cord

A flexible insulated cable (stranded vs. solid conductors).

Core

(a) The central transmission area of a fiber. The core always has a refractive index higher than that of the cladding or (b) section of building dedicated to utilities, HVAC, mechanical, electrical, etc.