The Best of Both Worlds: Viewing a PC on a TV

Introduction

As high definition televisions become common in the home, and the growing trend of convergence between consumer electronics and computer systems, many people are finding it desirable to view their computer on a television screen instead of a traditional computer monitor.

The process, however, is challenging. Computers and televisions, as display devices, were developed along two different paths, and their video works very differently. Those differences create potential roadblocks that must be overcome to make a computer's output signal compatible with a television and achieve a desirable result.

The following are some of the primary challenges that must be addressed:

- Colorspace compatibility
- Resolution compatibility
- Refresh Rate compatibility
- Overscan

Audio Authority Corp. offers several devices to assist in allowing a high definition television to display a computer's output. Some additional adjustments to the computer or display device may be required with these devices.

The purpose of this document is to explore the reasons such converter devices are necessary, and to discuss several applications, suggesting which Audio Authority solution would be best for each.

But First, Do I Even Need a Converter?

If your television has a VGA input, you probably don't. Most computers offer either VGA or DVI-I (which can often be adapted to VGA) output, and if a corresponding input is available on your display device, you can probably just hook the computer up using a standard cable! Check to make sure those inputs accept the output resolution and refresh rate your computer offers.

Oftentimes, a computer will only offer VGA outputs. Many television makers are eliminating such inputs from their digital televisions to cut costs, so you may be presented with a mixture of inputs – composite, s-video, and component – none of which may be available from your computer.

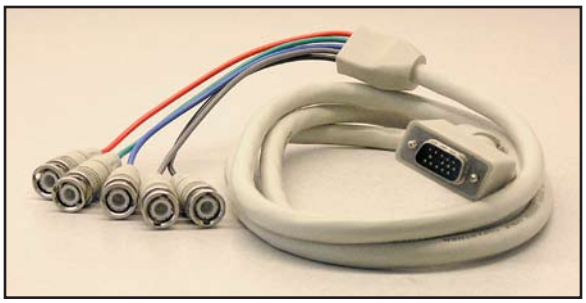
Composite and s-video only provide very low resolutions, so should be disregarded for this application. Component video inputs generally can display a computer's full resolution, so they should be utilized. However, you will need a transcoder to connect your VGA output to your television's component inputs.

Steps to Achieve the Goal: Colorspace, Resolution, Refresh, and Overscan

Why Do I Need a Transcoder?

The answer is simple – colorspace! Not many people are aware of the differences in various video signal types, assuming "video is video". This couldn't be further from the truth.

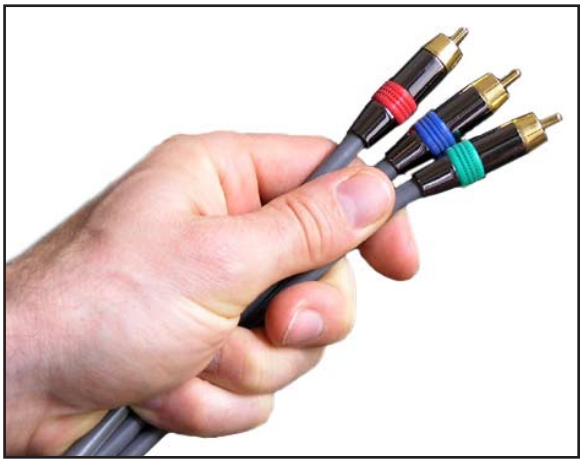
VGA is a generic term sometimes applied to "HD-15" connectors, which are 15-pin connectors. VGA connections are generally carrying an RGBHV signal. "RGBHV" signal is sometimes abbreviated as RGB.



RGBHV "Breakout" cable with BNC plugs and HD-15 connector.

RGBHV stands for Red/Green/Blue/Horizontal Sync/Vertical Sync. It requires five pathways to pass its signal. Component video uses the "YPbPr" colorspace, and its cables are often terminated in RCA plugs or BNC plugs. Component video is sometimes erroneously referred to as RGB due to the common red, green, and blue coloration of its RCA jacks, causing confusion. YPbPr divides the video information in a particular way, which requires three pathways to pass these signals.

"Y" = luminance (black & white information) and sync
"Pb" = blue image data,
"Pr" = red image data,



Component video cable (YPbPr) with RCA plugs.

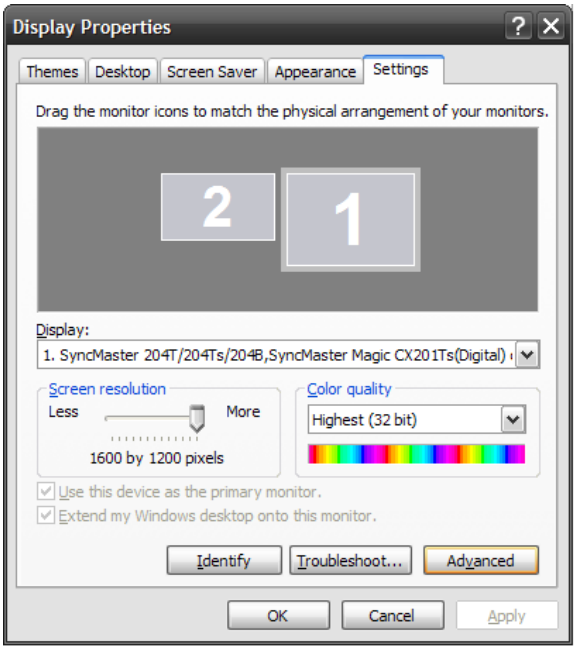
As you can see, RGB and YPbPr employ completely different colorspaces, and are not compatible with each other in their native states. Simple "VGA to Component" cables are intended for different applications, not signal conversion – they simply can't work in such an application because they do nothing but change the connector type, not the signal they carry.

Solution: To address this issue, a quality transcoder, like our Audio Authority Model 9A60 or Model 1365, must be installed to change the colorspace.

Resolution Compatibility

The first step in making a computer's output compatible with a television is to make the computer's output resolution compatible with the television's inputs.

Take a look at the video output settings on your PC or Mac. You will likely see a resolution like 1024x768, 800x600, or perhaps 1440x900.



None of these are resolutions that most HDTVs will accept from their component video inputs. Those inputs expect standard consumer electronics video signals, not VESA computer standards. Component inputs often support only 480i, 480p, 720p, and 1080i signals. Check your display device's manual for its supported resolutions.

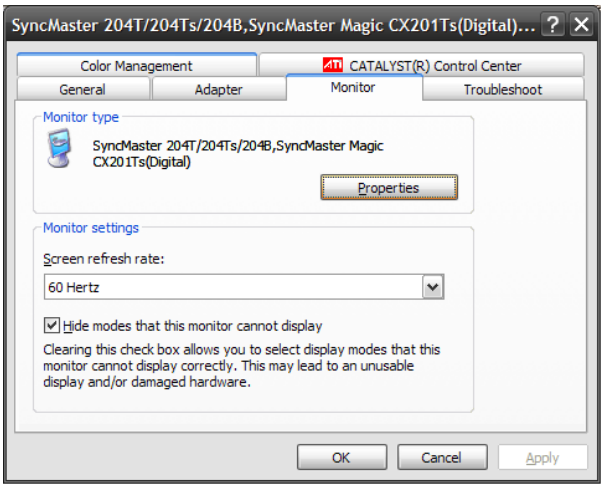
Solution: Adjust the computer's resolution to one directly compatible with the HDTV set (1280x720, for example), or use a third party software program (PowerStrip, DisplayConfigX) to achieve such a resolution.

Alternatively, a simpler option would be to use an outboard video scaler (like the Audio Authority Model 1365). The scaler can be used to make both resolution and refresh rate compatible without adjusting the computer's video output.

Refresh Rate Compatibility

Take a look at your computer's settings again - the refresh rate might be anywhere from 60 Hz to 85 Hz, or above (this is the number of times a device is asked to renew what is on the screen).

Most televisions can only accept 60 Hz refresh rates (50 Hz is common in countries that use the PAL standard) – higher refresh rates could even potentially damage your television set! Computers often run at much higher refresh rates, so it is important to get the signal to a point where it is compatible with your television set.



Caution: Never apply a custom refresh rate setting without first confirming your television is compatible with that setting!

Solution: Adjust the computer's refresh rate to one directly compatible with the HDTV set (60 Hz, most commonly) or use a third party software program (PowerStrip, DisplayConfigX) to achieve such a refresh rate.

Alternatively, a simpler option would be to use an outboard video scaler (like the Audio Authority Model 1365). The scaler can be used to make both resolution and refresh rate compatible without adjusting the computer's video output.

Overscan

Have you ever noticed that televisions seem to cut off parts of the image around the edges of the screen? This is due to overscan.

Overscan tolerance was built into television sets and broadcasts due to several CRT-related phenomena, such as image centering irregularities and "stopping" the horizontal motion of the electron beam. Some video synchronization information is also drawn in the "overscanned" area of the image. One of the most unique aspects of computer versus television images is that computers do not overscan at all – properly adjusted, the entire image is contained within the frame of the computer monitor. Some may even appear "underscanned" somewhat.

Since televisions "overscan" their video inputs (with a few exceptions), one major challenge remains – making the image fit the screen so data like the "Start" bar is not lost!

Solution: In virtually every case, overscan will have to be adjusted within the computer operating system itself, using software such as PowerStrip for PC (www.entechtaiwan.com), or DisplayConfigX for Mac (www.3dexpress.de/).**

Some manufacturers offer high end graphics card drivers that include an overscan adjustment wizard as well. Most outboard devices don't have the "screen size" controls necessary to make the appropriate adjustments. In some situations, especially with video being played, however, it isn't important to completely eliminate overscan. It simply depends on the demands of the application.

**Audio Authority cannot provide support for PowerStrip or DisplayConfigX – questions about those programs must be directed to their respective companies.

The Solution Devices

Audio Authority has two solutions for the VGA-to-Component dilemma.

The Model 9A60 is a simple transcoder that takes the RGB signal in a VGA output, and converts it to the YPbPr colorspace, and has the three RCA outputs of a standard component video signal. Simply put, it solves only the colorspace issue, leaving additional adjustments to the user and their computer. (9A60 picture)

The Model 1365 is a more feature-laden device, which allows for not only colorspace conversion from RGB to YPbPr, but can also make the opposite conversion, from Component/YPbPr back to VGA/RGB.
It also has a built-in video scaler, which can take most computer resolutions and turn them in to a standard video output. It solves the colorspace, resolution, and refresh rate dilemmas. Optimum results can usually be obtained by varying the combination of input and output resolution. Some minor adjustments can be made using the video card driver or "front porch" and "back porch" setting in third party display control programs like PowerStrip, however this can cause the image to become unstable if changed inappropriately. (1365 picture)

Overall, the 1365 will make the process easier for the end user, and avoids the need for any software adjustments except for overscan. The 9A60 can work in most situations, but requires significant software adjustments on the computer to achieve the correct video settings.

The 9A60 does have the advantage of using all-analog processing, never making the conversion to a digital signal and back again, which the 1365 must do to in order to apply its picture adjustments. In situations were picture quality is of the utmost importance, using the 9A60 is usually the best choice, since it prevents additional circuitry from being added to the signal pathway.

Application Features

These are the three most common RGBHV to YPbPr conversion applications we are confronted with on a daily basis – one of them likely fits your application.

1. Home
Computer using an HDTV as a Monitor

In this application, the same computer will likely always be hooked to the same TV. In this case, which device is better is really more of a matter of time than it is compatibility – the user could adjust their output settings to create a compatible signal, and leave those settings as-is.

Either the 1365 or the 9A60 will work for this application. The 1365 is recommended due to the greater simplicity and quickness associated with letting it make the complicated video adjustments outboard, rather than manipulating the computer's graphics card.

2. Boardroom
Laptops Using the same Display Device

In this situation, visitors or multiple employees will likely be using a multitude of different laptops with the same display device. Since significant graphics card tweaking is required to make a 9A60-oriented solution work in most cases, it would be very impractical, if not impossible, to make such changes on each computer that is used in the boardroom.

The 1365 would do all signal conversion externally, allowing anyone to enter the room, then "plug-and-play" directly into the 1365 without adjusting any of their computer's other output parameters.

The 1365 is the only recommended device for this application due to the changing variable presented by different computers being used from day to day.

3. Converting a Non-Computer "VGA/RGBHV" Source for Use on a Component Display

The best device for this application would be based on the resolution and refresh rate output by the source. If the source is sending out computer-type resolutions, the 1365 would allow for easy conversion of those signals to standard CE signal formats.

If the output is already in a resolution like 480i/60, 480p/60, 720p/60, or 1080i/60, then simple colorspace conversions are all that is needed; the 9A60 would be appropriate. Most often, the 9A60 is the best choice, but based on the situation, either the 9A60 or the 1365 would be acceptable.