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NETWORK SERVICES

Video Converters

Ten Questions You Should Ask Before Buying a Computer to Video Scan Converter

So you're thinking of buying a computer video scan converter. If you're brand new to the technology of converting computer video to TV, you might benefit from first reading *Six Common Misconceptions About Converting Computer to Video*, which starts on **page 4**. That section will introduce you to the technology behind the conversion process and give you answers addressed in this section. If you're already somewhat familiar with video scan conversion technology, then this section will help you in making an intelligent purchase decision.

Before proceeding with our questions and answers, let's address a few basics. When we speak of a "scan converter," we mean a device that changes the electrical signals coming from the monitor port of a computer to the type of signal that is used by conventional TVs and VCRs. To do this change, a scan converter must perform two basic functions. First, the horizontal and vertical sync frequencies (sometime referred to as "scan rates") must be changed from that of the computer to that of the TV. Secondly, the separate red, green, blue, and sync signals coming from the computer must be changed into a single composite signal by a process called "encoding." (The "Six Common Misconceptions" section addresses these processes in greater detail.)

These two functions, scan-rate changing and encoding, are typically performed completely by hardware devices equipped with a variety of analog and digital electronic circuits. We call this type of scan converter "software-free" because all the functions are accomplished in the hardware. However, in an effort to hold down costs, some scan converters perform the first function, scan-rate changing, via a software driver that gets executed in the computer. The role of this driver is to program the graphics controller chip inside the computer to produce a scan rate that is the same as that of TV. In these cases, the hardware portion of the scan converter performs only the encoding function. We'll refer to these types of scan converters as "software-aided."

Finally, for the sake of simplicity, this section is intended to only address issues concerning VGA and Macintosh® compatible scan converters in the "under £2,000" price range. Also, please keep in mind as you read this guide that when we use the term "TV monitor," in most cases we are referring to any type of professional or consumer video equipment that is designed to work with a standard NTSC video signal as its input. Examples of this include video monitors, video projectors, VCRs, professional video recorders and video teleconferencing equipment.

1. Does the scan converter require a software driver to support its various display modes or operating features?

A software driver is used as a way to reduce hardware costs. In "software-aided" scan converters, the software driver is typically used to support different display modes and enable the user to control the operating features of the scan converter.

When shopping, ask whether a scan converter must use a software driver to properly support various display modes. (Examples of different display modes include 640 x 480 and 800 x 600 VGA or 640 x 480 and 832 x 624 Macintosh.) If it does, be certain that the driver is compatible with your VGA chip or graphics card, as well as the operating system and application software you are using. Some application programs will talk to the graphics card directly and corrupt the software driver's control over the graphics card. The results can be unpredictable and may result in a system crash. If the scan converter you are planning on buying is software-aided, ask the manufacturer if it will guarantee operation with your configuration and software. If you're planning to use the scan converter on multiple PCs, see that it will work with all of them.

2. What computer display modes does the scan converter support?

There are many display modes or display "resolutions" that your computer can generate. 640 x 480 is probably the most common, but depending on your needs, you might want to consider scan converters that support higher resolutions, such as 800 x 600 and 1024 x 768. If you are interested in scan converters with these capabilities, be sure to ask whether they are able to display the entire image on the screen at one time. Sometimes advertising may claim that a converter can support 800 x 600, but the ad doesn't mention that the converter can only display a 640 x 480 segment at any one time. You have to scroll across or down the screen to view the remaining image. (All Black Box converters that support 800 x 600 can display the entire screen.)

Also, every resolution comes in many "variations" depending on the vertical sync or "refresh rate," and you should not assume a scan converter will support them all.

3. Does the scan converter provide simultaneous support of a computer monitor and a TV monitor?

It is very important that a scan converter provide this function. Why? Because many times, the TV monitor or VCR connected to the scan converter is not in your view. In these instances, you will not be able to see what your

computer is doing without the use of your computer monitor. Another advantage of having both monitors functional is that if you are using a scan converter featuring a freeze function, you can freeze the image on your TV monitor, but still view the actual computer output on your computer monitor.

Some scan converters that use software drivers alter the monitor output from the computer in such a way that the computer monitor can no longer show an image when the scan converter is being used. Sometimes software drivers are required for all display modes; sometimes only in modes other than 640 x 480. In order to circumvent this problem, you can purchase a special, multisync monitor (capable of supporting 15 kHz horizontal sync) to use in place of your standard computer monitor. Or, better yet, buy a software-free scan converter that provides simultaneous computer and TV video outputs in all display modes.

4. What video outputs does the scan converter provide and do the outputs adhere to the NTSC standard?

All scan converters provide a composite video output. This is sometimes called an NTSC or video output. These last two terms are really too general. In fact, many different types of NTSC video outputs can be found on a scan converter. In addition to composite, look for an S-Video output to take advantage of higher resolution TV monitors and projectors. And to use with professional quality monitors and video projectors, a scan converter that features an RGB output will provide you with the highest quality image. If you intend to use your scan converter in other countries, confirm that the unit also provides these outputs in the PAL TV standard. (PAL is the equivalent of NTSC outside North America and Japan.)

And now for a word regarding the importance of adhering to the NTSC standard. The NTSC television standard is the TV standard used in North America and Japan. It is the set of technical "rules" governing how a color TV image is defined in electrical terms. Some scan converters—mostly the ones that are software-aided—bend the rules in order to save cost. Most consumer TVs and VCRs are tolerant of non-standard NTSC video. However, most professional video equipment is not. One of the most common ways a scan converter might violate the NTSC standard is by not locking the colors in sync with the brightness portion of the TV image. This is called unlocking the color subcarrier and will make the colors on the TV appear to wave or "swim" from left to right, even on a consumer TV.

5. How does the flicker reduction work?

One of the primary reasons for the annoying flicker present on TV monitors is that televisions use an interlaced signal. In interlacing, an entire image is painted on the screen from top to bottom in two separate passes—first the odd lines, then the even. All scan converters provide some kind of circuitry to reduce the annoying flicker that is inherent in a TV signal. Flicker reduction is a compromise between reducing the flicker and preserving the detail in the image. But not all converters reduce flicker in the same way. One technique, called interpolation, averages the image in one screen with the image in the next on a line-by-line basis, 30 times a second. In effect, what this process does is make the images displayed in the "odd" and "even" lines more similar to each other so that as the lines are alternately displayed, the flicker becomes less noticeable. At the same time, this averaging process causes some of the detail in the original image to be lost. A key advantage of interpolation is that it preserves the integrity of the NTSC video signal.

Some scan converters use a less expensive method, called progressive scanning, to reduce flicker. In progressive scanning, every other line is "thrown away" and the remaining lines are displayed twice, in two consecutive passes. While progressive scanning will eliminate practically all the flicker, it also cuts the resolution in half and destroys the integrity of the NTSC output. An example of where progressive scanning could cause serious problems is in the display of a spreadsheet with thin, horizontal lines. This method of flicker reduction could potentially eliminate all of these lines in the converted image.

Finally, consider whether you'll be able to turn off flicker reduction. In some instances, such as when displaying animation, you will not want to use flicker reduction. The resolution lost when using this feature can be more troublesome than the flicker you're trying to avoid.

. How does the underscan mode work?

All TV monitors overscan the images they display. In other words, they bleed the image off the edges of the picture tube. The underscan feature in scan converters is necessary to compensate for this overscanning in TVs. Without underscan, it would be impossible to view the outer edges of the computer image on the TV screen.

When evaluating scan converters featuring an underscan mode, make sure they underscan both horizontally and vertically at least 10% in all directions. It is common in software-aided scan converters to underscan only in the horizontal direction, leaving the top and bottom of the image still hidden beyond the edge of the picture tube. (All Black Box converters underscan in both directions.)

A helpful additional feature offered by some scan converters is the horizontal and vertical positioning controls. These enable you to centre the image in the TV monitor screen.

7. How many samples of the computer image does the scan converter take?

A scan converter "digitises," or samples, the video from your computer into hundreds of thousands of samples for every image your computer produces. The number of samples it takes directly impacts the quality of image ultimately displayed on your TV monitor. The higher the number of samples, the better your picture quality will be. As a minimum, look for scan converters that sample 640 times per line.

Some better video converters actually convert frame by frame rather than line by line. For those converters, of course, the number of samples per line isn't relevant.

8. Into how many bits is each sample converted?

When a scan converter takes a sample, it simultaneously samples the red, green, and blue signals coming from the computer. It is the job of a scan converter to digitise the information it receives in each sample into various bits of information. The higher the number of bits, the more colours and shades of gray the scan converter can recreate. Terms like 8-bit colour, 16-bit high colour and 24-bit true color refer both to the number of bits computers generate for each pixel of colour and the number of bits into which scan

converters digitise each sample.

It is important to differentiate between the number of bits that your computer supports and the number of bits per sample taken by your scan converter. For example, if your computer features 24-bit colour but your scan converter features only 12-bit sampling, the colours on your computer monitor will appear full and varied with smooth transitions and blends, while your TV monitor will show visible, awkward "stair steps" in the color blends and display inaccurate colour reproduction. Conversely, if your computer features only 12-bit colour but your scan converter features 24-bit sampling, the image displayed on your TV monitor will be limited to the smaller number of colours generated by your computer.

The following chart indicates the maximum number of colours and grays that can be generated by scan converters featuring different number of bits per sample.

Number of bits	Maximum # of Colours	Maximum # of Grays
6	64	4
12	4,096	16
18	262,144	64
24	16,777,216	256

Now, a word of caution. Beware of misleading advertising materials. In the world of scan conversion, there is a difference between "supporting" 24-bit colour and "sampling" it. Supporting can often mean that a scan converter simply won't crash if given 24-bit colour input from a computer. The scan converter itself may only sample 16-bit colour or less. Today, almost all VGA cards and most Macintosh graphics cards generate 24-bit colour. If you want to get the most from your computer and scan converter, with the ability to reproduce all the subtle colour shading and hues, make sure that your scan converter not only supports 24-bit colour but samples at 24 bits as well.

9. What other special features does it offer?

Going beyond the basics, some scan converters come with special features that enhance the value of your purchase. One example is Freeze, which freezes the image on your TV to the last image received from your computer. Another feature, Genlock, is necessary if the video from the scan converter must be "in sync" with another video signal for video editing and production purposes. Overlay will superimpose the computer image on top of another TV video signal. Magnify enlarges portions of the image displayed on the TV, making small text more readable.

If you plan to use your scan converter outside of North America, you'll need to look for a unit that provides both an NTSC and PAL output as well as the correct AC line voltage requirements. Some scan converters also offer a built-in Test Pattern Generator. The ability to generate test patterns, such as color bars, will help you to properly adjust your TV monitor and will also serve as an aid in identifying any problems with hook up.

10. What accessories come with it?

At a minimum, make sure your scan converter comes with three cables: the cable to connect to your computer, a composite video cable, and an S-video cable (if the converter supports S-video). These last two should be at least 10 ft long to allow easy connection to your TV monitor. If you intend to take the scan converter outside North America, make sure it has a universal AC input to accept voltages around the world.

Technically Speaking: Six Common Misconceptions About Converting Computer to Video

Because both computer and TV monitors are such ubiquitous items in today's world, there is a common misconception that these two technologies are practically interchangeable. This section is intended to address this misconception, as well as others, and to provide a basic foundation of knowledge before you begin your search for a computer video scan converter.

If you are already familiar with the fundamentals of converting computer to video, you may prefer to begin reading *Ten Questions You Should Ask Before Purchasing a Computer Video Scan Converter*, which starts on **page 1**.

Throughout this section, we will only be addressing scan conversion as it relates to VGA and Macintosh® computers. Also, although this section will repeatedly refer to "computer monitors versus TV monitors," we are actually referring to computer monitors versus any display device that uses a standard NTSC or PAL TV video signal as its input. This includes video monitors, video projectors, VCRs, professional video recorders, and videoconferencing equipment.

1. Connecting a TV to my computer is basically a simple process.

Many people think that from a technical perspective, TV monitors and computer monitors are basically the same. After all, they both have a picture tube and display video images. Therefore, it must be a relatively straightforward process to connect a TV to a computer—simply a matter of finding the right cable or, at worst, a simple widget box. Well, it's a lot more complicated than you might think.

Computer and TV monitors differ technically in two important ways. First of all, the rate at which an image is "painted" onto a computer monitor can be more than twice as fast as the rate at which it is "painted" onto a TV monitor. This is called the scan rate. A computer paints an image onto a computer monitor going from left to right at a horizontal scan rate of 24,000 to 65,000 times a second (also referred to as 24 to 65 kilohertz [kHz]), and from top to bottom at a vertical scan rate or refresh rate of up to 72 times a second (72 Hz). By contrast, a TV scans much more slowly, going from left to right approximately 15,000 times a second and from top to bottom 60 times a second. The role of a scan converter is to change or convert the faster scan rate of the computer image to the slower scan rate that is compatible with TV technology. This basic process is called scan rate conversion.

The second fundamental difference between computer and TV monitors is the form of the video signal received by the monitor. When a computer sends an image to the computer monitor, the video signal is divided into separate red, green, blue and sync components. A TV monitor, on the other hand, is designed to receive a single electrical signal, called composite video, that combines all the necessary visual information together. A scan converter changes the multiple video signals coming from the computer to the single composite video signal that the TV can receive. This process is called encoding. Today, even with state-of-the-art microelectronic circuits, this is still an expensive process to do well.

Finally, a brief word about the mechanics of actually hooking up a scan converter to your TV monitor. Fortunately, this is a relatively easy process. Most TVs today feature a video input (RCA jack) on the back that allows you to hook up a scan converter with a simple cable. Older sets, however, may not have this feature. In this case, you need to purchase a small device called an RF modulator that permits the attachment of a scan converter through the antenna jack. When using an RF modulator, your incoming computer signal will "ride" on a TV channel, such as Channel 3.

2. I should get the same quality picture on my TV monitor as on my computer monitor.

Only if you have a really bad computer monitor and a really super TV!

TVs are based on a video standard developed 40 years ago, called NTSC.

Computer monitors, by comparison, were developed using today's improved technology, allowing us to create affordable displays with more information content (bandwidth) and higher resolutions. TV monitors have benefited from the technological advancements made in the development of computer monitors, but ultimately, the television image is still constrained by the limited bandwidth and resolution of the 40-year-old NTSC signal.

So what are the primary differences between NTSC and the technology used in today's computer monitors?

First of all, computer monitors receive their video signal in a more basic, pristine form than TVs do. As discussed earlier, the video signal sent by a computer to its monitor is broken into multiple electrical components while a TV signal has all necessary information combined into a single composite signal. In order to process this composite signal, a TV must break it up into its original components, inevitably degrading the picture quality and creating distortions. This partially explains why unlike all computer monitors, only professional video monitors or TVs with S-video inputs can precisely display 80-column text.

A second factor contributing to the inferior quality of images displayed on TV monitors is interlacing, a technique by which a complete TV picture is drawn in two passes from top to bottom on the picture tube. In interlacing, the first pass paints all the "odd" lines and the second pass paints the "even" lines. Noticeable flicker occurs when the images in the odd lines are very different from the images in the even lines. As the odd and even lines are alternately displayed, the eye perceives the quick appearing and disappearing of visual information. Flicker is especially noticeable when viewing thin horizontal lines that only take up a single odd or even row. If, for example, the line happens to be on an odd row, it totally disappears every time the even rows are displayed.

Unlike TV monitors, computer monitors paint an entire image in one pass from top to bottom, in a display format called non-interlaced. Images displayed in a non-interlaced format do not suffer from the same flicker problems.

In short, TV monitors and computer monitors draw the same image in two very different ways, resulting in significantly different levels of quality. After all, if TV technology was sufficient as a means of displaying all computer images, computer monitors would never have been invented.

3. A good scan converter will make the colours on my TV monitor look exactly the same as they do on my computer monitor.

Even without using a scan converter, the colours on your TV monitor will tend to look less vivid and less pure than the colours on your computer monitor. This is because of inherent differences in the way computer monitors and TV monitors process colour. Computer monitors have an advantage over TV monitors in that the colours defined by the computer are sent to the monitor using the three

primary colours: red, green, and blue (RGB). The computer monitor has to perform almost no processing in order to display them. TV monitors, on the other hand, receive a composite signal that they must separate and process into meaningful colour components (red, green, and blue) before displaying them on the picture tube. As discussed previously, the additional processing performed by TV monitors degrades both picture quality and colour reproduction.

A scan converter, then, cannot overcome a TV's deficiencies. (Video professionals often joke that NTSC stands for "never the same color.") For example, red on a green background looks fine on a computer monitor but looks terrible on a TV monitor. Fully saturated (bright, intense) colours also look noticeably poorer on TV monitors than they do on computer monitors.

This is not to say that all scan converters perform equally in colour reproduction. To learn more about the specifics of how scan converters differ in their ability to generate colours, refer to Question #8 in *Ten Questions You Should Ask Before Purchasing a Computer Video Scan Converter*.

4. A scan converter should eliminate all the flicker I see on my TV.

Flicker is an artifact of the interlacing process that defines NTSC TV. Scan converters attempt to minimise the flicker by using a number of techniques. Unfortunately, any effort to eliminate flicker has inherent trade-offs. The compromise involved is that as flicker is reduced, so is the TV monitor's vertical resolution or detail. For example, if maximum flicker reduction is employed, small size text may become more difficult to read.

Some scan converters appear to completely eliminate flicker. In these cases, the scan other line of the interlaced image. So, instead of seeing first the odd and then the even lines displayed in two successive passes (from top to bottom) on the TV monitor, the viewer sees two successive passes of odd lines only. The solution may be visually acceptable for displaying large graphic objects, but thin horizontal lines can be completely lost and small text can become unreadable. Another problem with this method for eliminating flicker is that it compromises the actual NTSC standard—the very signal the scan converter was designed to create. (Remember, adherence to the NTSC standard is essential in professional video applications.)

Hardware-based flicker reduction is more effective than software-based, and is less expensive. Advanced scan converters analyse computer signals to minimise flicker while maximizing sharpness.

Extremely high end scan converters will produce sharper detail without adding flicker.

5. When using a scan converter, there isn't much I can do to improve the quality of the picture as it appears on my TV monitor.

While the scan-converter image won't look exactly the same as it did on your computer monitor, there are many things you can do to get the best picture possible. First, if your TV monitor has an S-video input and your scan converter has an S-video output, use them! This is the one thing that will have the most impact on the quality of your picture.

Next, adjust the brightness, contrast, colour, and tint (or hue) controls on the TV monitor. In order to correctly adjust for brightness, turn down the brightness level until the black on your screen appears as true black—not as dark gray. To correctly adjust for contrast, look at the border between a light and dark object displayed on your screen. When contrast is set too high, blooming may occur, in which the light area blends or blooms into the dark. To properly adjust the color and tint, you really should use test colour bars, but if this is impossible and you're using a scan converter, you can use the colors generated by your computer for reference. (As discussed earlier, you won't be able to obtain an exact match.)

Finally, when creating images on your computer for display on a TV monitor, keep in mind the limitations of television technology. To avoid excessive flicker, refrain from using thin horizontal lines whenever possible as they cause the problem to be most visible. Also try to avoid using saturated colours next to each other, such as intense reds and greens. Grays, on the other hand, tend to display quite well in NTSC.

And here's one last pointer. If you intend to record your computer generated image on a VCR, record it in the two-hour mode using a professional quality tape.

6. All scan converters, regardless of price, basically perform the same. They just have different bells and whistles.

And a Yugo and a Mercedes are both cars—one just has power windows.

Scan converters vary widely in price but not simply because some have more features than others. The price differences are mainly due to the differences in circuitry used to accomplish the basic scan converter functions. One key factor greatly influencing the price of a unit is whether the scan converter is "software-free." A software-free unit performs the entire scan conversion process via hardware whereas other, less expensive "software-aided" models perform some of the functions via a software driver.

However, the use of a software driver may conflict with the graphics processing of your computer and/or some of the applications you intend to use.

Another key factor is the speed and accuracy at which a scan converter performs input processing. Better-designed input-processing circuits will have a significant impact not only on the price of the scan converter, but also on the quality of the image it produces. Two additional factors that contribute to a converter's price are memory space, which allows for higher-resolution conversion of the computer image, and the quality of output encoding.

Price/quality trade-offs exist throughout the scan converter design. As with most things in life, you get what you pay for.

This concludes *Six Common Misconceptions About Converting Computer To Video*. If you're seriously considering purchasing a video scan converter, refer to **page 6**.

We recommend the following Video Converters

Here are a few of our video converters—a wide range from economical software-controlled models to feature-loaded professional presentation machines. The lists of features are arranged to answer each of the ten questions at the beginning of this document.

Key Features

VGA to Video Portable (AC311A)

VGA to Video Portable Plus (AC321A)

1. TSR software controls the Converter from your PC.
2. Supports VGA at 640 x 480 (or 800 x 600 in PAL).
3. Outputs to computer monitor and TV simultaneously.
4. Connectors for composite video, S-Video, and VGA; VGA to Video Portable Plus also has a connector for RGBS.
5. VGA to Video Portable has no flicker reduction; VGA to Video Portable Plus has flicker reduction controlled by software.
6. No underscan mode, but screen position is adjustable.
7. 640 samples per line.
8. 24-bit colour.
9. Special features: Supports both NTSC and PAL; S-video output, adjustable brightness, adjustable vertical and horizontal position.
10. All the cables you need are included. VGA to Video Portable Plus also comes with a lavaliere microphone.

Key Features

VGA to Video Portable Pro (AC331A)

1. No software needed.
2. Supports SVGA up to 800 x 600; Mac at 640 x 480.
3. Outputs to computer monitor and TV simultaneously.
4. Connectors for composite and S-Video, VGA, and RGB.
5. Automatic flicker reduction (always on).
6. Underscan mode controlled by switch.
7. Since this is a frame converter, the number of samples per line isn't relevant.
8. 24-bit colour.
9. Special features: S-video output, adjustable brightness, adjustable horizontal position.
10. All the cables you need are included (except and RGB cable, sold separately).

Key Features

VGA to Video Global (AC333A)

1. No software required.
2. Supports SVGA up to 800 x 600.
3. Outputs to computer monitor and TV simultaneously.
4. Has outputs for VGA, composite video, S-video, and RGB.
5. Automatic flicker reduction (always on).
6. Underscan mode controlled by a switch.
7. Since this is a frame converter, the number of samples per line isn't relevant.
8. 24-bit colour.
9. Special features: Supports both NTSC and PAL; S-video output, magnify, freeze-frame, diagnostics, vertical and horizontal picture positioning.
10. All cables included.

Key Features

Pro Video Converter (AC095A)

Video Scan Converter II (AC096A)

1. No software required.
2. ProVideo Converter: Supports VGA or Mac up to 1024 x 768. Video Scan Converter II: Supports VGA up to 800 x 600, Mac up to 832 x 624.
3. Outputs to computer monitor and TV simultaneously.
4. Has outputs for VGA, composite video, S-video, and RGBS.
5. Flicker reduction controlled by a button on the front panel.
6. Underscan mode controlled by a button on the front panel.
7. Samples image 708 times per line.
8. 24-bit colour.
9. Special features: Supports both NTSC and PAL; S-video output, freeze-frame, diagnostics, picture positioning. ProVideo Converter also has a magnify feature.
10. All cables included.

For more information, request faxback document # 16029.

Ordering Information

This information will help you place your order quickly.

PRODUCT NAME	ORDER CODE
VGA to Video Portable Pro	AC331AE
VGA to Video Global	AC333A