Plasma Screen Interfacing.

A technical briefing by J. S. Technology.

Introduction.

Plasma screens in home cinemas offer some unique problems for interfacing domestic video sources. It's not uncommon to have a DVD player, Digital TV and a VCR all requiring to be connected to the screen. There are a number of solutions to connecting these devices to the screen, but to ensure that you are making the best out of both your sources and the display does require careful attention to interfacing to the screen.

Interfaces and video converters are employed as it is not always possible to connect directly between equipment. It is possible to convert from a higher quality signal to one of similar quality, and in some cases such a conversion will be required, for others an interface may offer the most efficacious solution.

This document will present a system for connecting a DVD player, Digital Set-top box and VCR to a plasma screen monitor. Care has been taken to ensure that each source delivers the most appropriate video signal for its performance, and options on how to connect will be presented. Solutions presented here will also have relevance to other areas of home-cinemas, such as a projector based system.

While some home-cinemas are now utilising video scalars, describing how these work is beyond the scope of this document. It is still vitally important to use a high quality video source with scalars, which typically requires "Component (YUV / YPbPr)" video sources. Component video connection is covered in this document, and should give insight in how to get the best source video to the scalar.

Plasma Screen Connections.

		
PC Monitor inputs, with serial interface.	RGBHV and Component input. BNC terminals are adapted to phonos	Composite video and S-Video input with audio connectors visable.

Figure 1. Available connections on the typical plasma screen. Most have the VGA monitor input with the optional terminal board to provide additional video inputs.

Plasma screens are designed as IT monitors and therefore are not typically equipped with SCART connectors or tuners. This makes their connection requirement somewhat unique. While some screens are now becoming available with these connections, it is often as the expense of their performance and adds significantly to their cost. A typical plasma screen will be supplied with a VGA (PC monitor) connection and space for optional input cards. The most popular input cards offer component

(YUV/YPbPr), RGBHV, S-Video and composite inputs. Sharing of the YUV and RGBHV input is common, and for some screens so too is the S-Video and composite input shared as the one video input.

Obviously from Figure 1 you can see there is no SCART connector on the typical plasma screen, but most domestic sources output their video via SCART. As we will discover later the solution is to interface from the SCART connector to these inputs.

Source Connections.

In this document we will investigate three different sources:

1. Digital Set-top Box.
2. DVD Player.
3. Video Cassette Recorder (VCR).

Their connections are shown in Figure 2, in this example the video recorder show is a DVD recorder.

Digital Set-top Boxes cover satellite TV, digital cable, and digital terrestrial. These services are typically provided under the banners of Sky, Telewest, NTL, and On/ITV digital with the later now know as Freeview. Each of these provides a SCART output with two settings, PAL which is composite video and RGB. RGB is the higher quality output of the two and is the preferred option.

DVD Players have a plethora of connection possibilities. Typically they will have composite and RGB, and it is not uncommon to find S-Video too. Recently, component video output is being included with some DVD players. Component video output is of particular importance for those with progressive scan DVD players as progressive video is typically only available via component.

VCRs come in several flavours. By far most common is VHS, which is composite based. An improvement is S-VHS which prefers S-Video. D-VHS and DV are two other possibilities, typically offering S-Video output. A more modern alternative is the DVD recorder and one example of such is shown in Figure 2.

		
Connections on a Digital Set-top Box.	Component video output from a DVD player.	Variety of connections on a DVD recorder.

Figure 2. Variety of connection possibilities from the source equipment.

Most video sources in the UK are SCART based, which is a multi-purpose connector for use with domestic video equipment. It provides video, audio, and control interconnections via a standard 21-pin connection. The SCART connector is able to carry three different types of video information:

1: Composite. The lowest quality signal carried by SCART due to “cross colour” interference between the luminance and chrominance. A standard VHS VCR would produce composite.

2: S-Video. This is a high quality type of video, sometimes incorrectly referred to as S-VHS. S-Video has luminance and chrominance information in the same way as composite, but with the two signals being separate, there is no interference.

3: RGB. Similar to S-Video, RGB is a high quality video interface. RGB simply stands for Red, Green, and Blue.

More information on SCART can be found in the "The SCART Connector", another technical briefing available from J.S. Technology.

Component video, while not available via a SCART connector, is another high quality means to interface between source equipment and plasma screens. Until recently component video was more commonly found in the USA, but is becoming commonplace in the UK. DVD players and video processors are two possible sources, but perhaps the most significant development for component video is that home-cinema amplifiers are now starting to offer switching for component video. Home-cinema amplifiers typically include video switching for composite and S-Video sources, and with the addition of component video switching, offering more alternatives for interfacing to plasma screens from multiple source.

Component (YUV) video is also known as Y, Pb, Pr and Y, Cb, Cr, although the latter is only for numerical representation within a computer system. Y, B-Y, R-Y is sometimes referred to as component video, but a more accurate name is "colour difference" signals. Colour difference signals used in a domestic environment would produce a tinted picture, which is undesirable. Most commonly component is know by either YUV or Y, Pb, Pr and are identical.

Direction connections.

In this example there are two direct connections which are possible. First, there is video/S-Video, secondly component video interfacing is presented.

Figure 3 shows a mini-DIN connector is used to connect S-Video from a video recorder directly to the plasma screen. Alternatively we could have used composite video to the "video in" on the screen, but since we have the higher quality S-Video signal we will use the preferred option.

Source connection by S-Video to the plasma screen, with audio.

Figure 3. Direct connection of S-Video between video recorder and plasma screen.

Typical video recorders have a SCART output, which would require a SCART to Phono lead to break out the video and audio signals, Figure 4. Similarly if the SCART were to output S-Video which we wished to interface to the screen, a SCART to S-Video lead would be required. These leads work because SCART can carry such signals, but only if the video source is able to output the correct signals. A normal video recorder will not be able to produce S-Video and use of a SCART to S-Video lead would be folly, resulting in a black and white picture.

SCART to Phono and SCART to S-Video leads come in a variety of designs.

Figure 4. Direct SCART to composite and S-Video is possible if SCART is carrying these signals.

The second direct connection which is possible is to use component video. Some DVD players are equipped with component video; with progressive scanning DVD player almost exclusively using component output for progressive video.

Figure 5 shows the interfacing between a DVD player with component video output. In this example the plasma screen terminal board has BNC connectors. Such connectors are common on plasma screens and adaptors are used to convert the BNC terminals to phonos, there no penalty is associated with using such adaptors. Component cables can be specified with BNC plugs rather than phonos to forgo the adaptors.

Component cable connected to DVD player source via phono connectors.

Adaptors are used from BNC to phono terminals to allow component leads to connect.

Component leads installed on the plasma screen's inputs.

Figure 5. Connection of component video from DVD player to plasma screen, with the use of phono to BNC adaptors.

Interface Connections.

It is not always possible to directly connect to the plasma screen, employment of an interface is imperative to obtain the optimal picture. Digital set top boxes and DVD players offer RGB via a SCART connector, which is a high quality video format. Plasma screens typically will not accept RGB natively, and for the few that do, there are often other issues. With some screens a combination of inputs is required just to allow RGB to be interfaced, rendering other inputs useless and severely restricting the connectivity. Some have compatibility issues with the RGB output from a SCART connector. Therefore, in plasma screen based home-cinemas it is often advantageous that some sort of interface be utilised to connect digital sources from SCART to either the VGA (PC) or Component (YUV) inputs to obtain the optimal picture quality.

Two such interfaces are show in Figure 5, as well as a third to add an extra input. The RGB to Plasma VGA unit allows for the RGB to be directly connected to the screen's PC input, and provides the necessary interfacing to the VGA video interface. RGB to Component (YUV / YPbPr) converter, like the RGB to Plasma VGA unit, allows for RGB to be connected to a plasma screen, but performs a conversion on the RGB signals to a similar format known as YUV / YPbPr. These will both be considered in more detail below. The third interface, the Master SCART Controller, can be used to connect two RGB video sources to the one converter. Being an automatic priority SCART switcher, extra remote controls are not required and picture quality is maintained.

		
RGB to Plasma VGA, Version 2.	RGB to Component (YUV)	Master SCART Controller

Figure 6. Interface products suitable for use with plasma screens.

RGB to Plasma VGA.

VGA (Video Graphics Array) is a means of connecting from Personal Computer (PC) to a computer monitor. Since most plasma screens were originally intended to be used as a monitor they have a PC monitor connection. Digital set-top boxes use the SCART connector, which is quite different from that of a VGA connector. The RGB to Plasma VGA unit is an interface product which will allow connection from a digital set-top box to the VGA input of a compatible plasma screen, while maintaining the picture quality.

Figure 7 shows connection to the VGA input of a plasma screen. Working backwards from the screen, the VGA lead is connected to the PC monitor input of the screen from the output of the RGB to Plasma VGA unit. Input to the RGB to Plasma VGA unit is via SCART from the TV output of the digital set-top box.

While not shown, the output from the RGB to Plasma VGA unit can also be used on the RGBHV input to the screen. The RGBHV input is shared with YUV on most screens, and using a VGA to five BNC/Phono leads will allow for an additional VGA input.

			
VGA input of the plasma screen.	Output of the RGB to Plasma VGA unit.	RGB to Plasma VGA fully connected.	SCART TV output from digital set-top box.

Figure 7. Connecting to the VGA PC monitor input to a plasma screen with a digital set-top box as a source.

RGB to Component (YUV).

Component video has already been discussed for DVD players, but it is also possible to convert the output from digital set-top boxes to component video. The RGB to Component (YUV) converter is one such product which performs this conversion.

While a direct connection is detailed in Figure 8, a component video switching home-cinema amplifier could be used to switch between the DVD player and component converter. This would allow two or more sources to share the one input in the plasma screen.

			
Component leads installed on the plasma,	Component output from converter	RGB to Component converter connected	SCART TV output from digital set-top box.

Figure 8. Component video conversion and connection to a plasma screen from a digital TV source.

Not all plasma screens are compatible with RGB video, even via the RGB to Plasma VGA interface. Most are compatible with component video and therefore the RGB to Component video converter is the ideal solution. Conversion of the RGB to component, while complex, gives similar picture quality to that of RGB if a converter such as the one shown here is employed.

The component converter presented here is able to convert the RGB from a DVD player, or set-top box, for interfacing to plasma screens YUV / Y, Pb, Pr input. Care should be taken when selecting the conversion product as a poor quality conversion will defeat the purpose of using component video. The converter presented here uses high specification components to offer a large bandwidth for the video signal, resulting in a faithful conversion. It also incorporates some RGB to Plasma VGA technology to ensure accurate timing with the original source.

The Complete System.

Example 1:

This system is based upon the equipment described in the previous sections, we have our three sources; DVD player with component video, Digital TV and a DVD recorder.

First, as per Figure 3 the video recorder is directly connected via S-Video to the plasma screen. Since we have an S-Video connector, we do not require the use of a SCART to S-Video lead. For a normal VCR, a SCART to Phono lead can be employed.

Figure 5 shows how to connect a DVD player which has component video output. In this example, our DVD player also has component video output and this is ideal.

Finally, our Digital TV provides us with RGB via SCART. We wish to keep using RGB as it is a high quality video format. With the video input and component inputs used, we decide to use and RGB to Plasma VGA unit to interface to the PC monitor input.

Figure 9 shows the complete system.

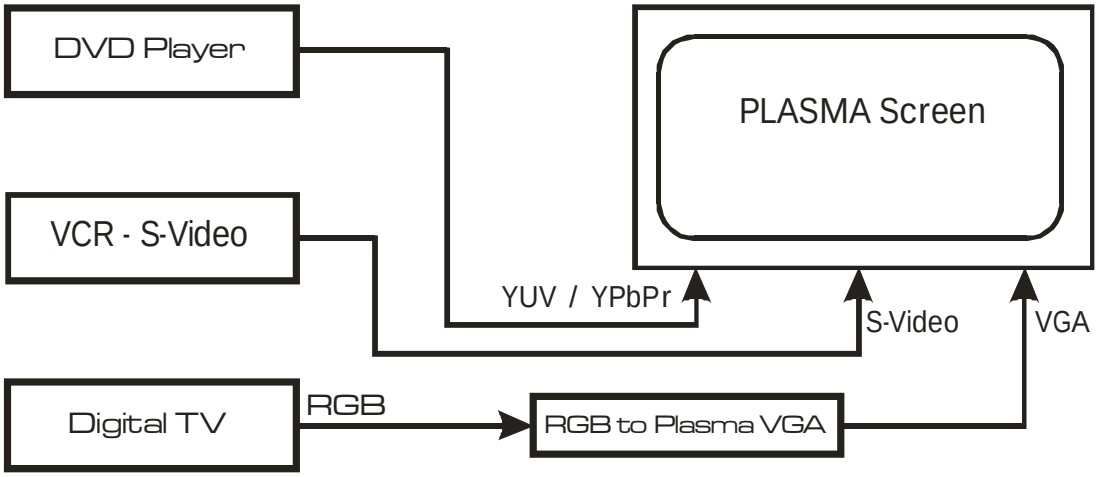

Figure 9. Use of an RGB to Plasma VGA unit to interface Digital TV to a plasma screen.

Example 2:

In this example, there are two differences to our previous example. First, our DVD player has RGB SCART and no component video output. Secondly, the PC monitor input is exclusively being used for a computer.

As in the previous example, the video recorder will go in via the S-Video input. However, we now have two RGB sources, the DVD player and digital TV. The solution to integrating the two sources is to employ the Master SCART Controller. This then gives one output connection even though there are two sources. More importantly, picture quality is maintained.

An example where the Master input is in operation is shown in Figure 10. The Master source would be the DVD player, automatically taking priority and being passed though the Master SCART Controller. This is then converted to Component (YUV) video for display on the plasma screen. To be able to display the Secondary input, which would be Digital TV, simply switch off the DVD player.

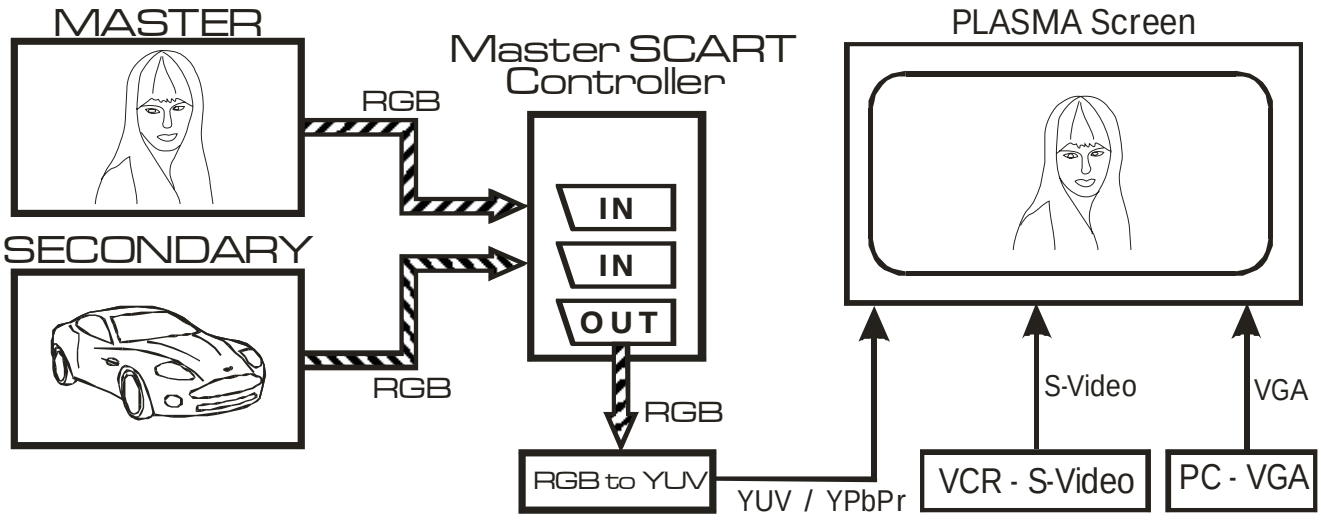

Figure 10. Component video conversion and connection to a plasma screen from a digital TV source.

Conclusion.

Care should be taken to ensure that the right connection scheme is selected for the source equipment to obtain the best from that source. Plasma screens were originally intended to be used a computer monitors, and therefore typically are not supplied with SCART connectors or similar interfaces. Some video equipment can be directly connected to the screen via composite or component video, but for others an interface or converter should be utilised to obtain optimal picture quality.

RGB video interfacing presents a challenge to the plasma screen home-cinema, but not one which can not be overcome. While some screens do offer RGB inputs, this is often at the expense of connectivity. A better solution is to use an interface such as the RGB to Plasma VGA to allow RGB to be connected to the PC monitor or VGA input. This input is not normally used within a home-cinema, therefore does not sacrifice connectivity but enhances it. Care, however, should be noted as not all plasma screens are compatible with RGB, even via such an interface and for those cases conversion to component video should be considered.

RGB can be converted to component YUV/ Y, Pb, Pr video for direct connection to the screen, or if supported, via an A/V amplifier. While component video conversion is a complex process, when performed correctly will give similar results to RGB. Component video is essential with many video scalars as it this is the highest quality input supported. For projectors too, often component is the premier input.

This document has described connecting three devices to the plasma screen, a DVD player, digital set-top box, and a VCR. VCRs typically can go directly to the plasma screen either via S-Video or composite to their respective input. Some DVD players, especially those with progressive scanning output, will require a component video connection which most plasma screens will provide. For those screens where inputs are limited, the Master SCART Controller can add an extra high quality input to an existing SCART connection scheme.

References:

[BBC, 1998] "The SCART Interface." BBC Scotland North – Engineering Information.
http://www.bbc.co.uk/aberdeen/eng_info/scart_connector.shtml
[E-P Rebel] "Scart Connector." Eric-Paul Rebel,
http://utopia.knoware.nl/users/eprebel/SoundAndVision/Engineering/SCART.html
[Sim, J. 2004] "Video Signals." Dr John Sim, J.S. Technology, 2004.

Version: 1.20
Release Date: 3/2004.
Author: Dr John Sim

J. S. Technology.
APL Centre,
Stevenston Ind. Est.,
Steveston.
Ayrshire.
KA20 3LR
United Kingdom.