

## Introduction

For years, the mainstay video signal used by the consumer market has been composite video. Attempts have been made to support s-video, but it has been limited primarily to high-end S-VHS VCRs and TVs.

With the introduction of DVD players and digital settop boxes, there has been renewed interest in providing high quality video to the consumer market. This new equipment not only supports very high quality composite and s-video signals, but are also allowing consumers the option of using component video.

Using analog RGB or YUV video interfaces eliminates NTSC/PAL encoding and decoding artifacts, such as crawling dots on highly-saturated vertical edges and color strobing on moving tweed patterns. As a result, the picture is sharper and has less noise. More intensity (Y) bandwidth is also available, increasing the horizontal detail.

Typically, the video IC that generates the composite and s-video signals can also generate the analog RGB and YUV video signals.

## Analog RGB

### PAL Consumer Markets

Most consumer video components in Europe support one or two 21-pin SCART connectors (also known as Peritel and Euroconnector). This connection allows s-video, RGB analog video, composite video, and analog stereo audio to be transmitted between equipment using a single cable. The composite video signal must always be present, as it provides the basic video timing for the RGB video signals. It is important to note that the 0.7V RGB signals do not have a blanking pedestal or sync information.

There are now several types of SCART pinouts, depending on the specific functions implemented. Two of the most popular ones are shown in Tables 1 and 2. Pinout details are shown in Figure 1.

**TABLE 1. SCART CONNECTOR SIGNALS (STEREO AUDIO, COMPOSITE, AND RGB VIDEO)**

PIN	FUNCTION	SIGNAL LEVEL	IMPEDANCE
1	Audio Right Out	0.5V <sub>RMS</sub>	<1kΩ
2	Audio Right In	0.5V <sub>RMS</sub>	>10kΩ
3	Audio Left Out	0.5V <sub>RMS</sub>	<1kΩ
4	Audio Ground		
5	Blue Ground		
6	Audio Left In	0.5V <sub>RMS</sub>	>10kΩ
7	Blue	0.7V	75Ω
8	Function Select	9.5V-12V = AV Mode 5V-8V = Widescreen 0V-2V = TV Mode	>10kΩ
9	Green Ground		
10	Data 2		
11	Green	0.7V	75Ω
12	Data 1		
13	Red Ground		
14	Data Ground		
15	Red	0.7V	75Ω
16	RGB Control	1V-3V = RGB, 0V-0.4V = Composite	75Ω
17	Video Ground		
18	RGB Control Ground		
19	Composite Video Out	1V	75Ω
20	Composite Video In	1V	75Ω
21	Safety Ground		

**TABLE 2. SCART CONNECTOR SIGNALS (STEREO AUDIO, COMPOSITE, AND S-VIDEO)**

PIN	FUNCTION	SIGNAL LEVEL	IMPEDANCE
1	Audio Right Out	0.5V <sub>RMS</sub>	<1kΩ
2	Audio Right In	0.5V <sub>RMS</sub>	>10kΩ
3	Audio Left Out	0.5V <sub>RMS</sub>	<1kΩ
4	Audio Ground		
5	Ground		
6	Audio Left In	0.5V <sub>RMS</sub>	>10kΩ
7	Composite Video†	1V	75Ω
8	Function Select	9.5V-12V = AV Mode 5V-8V = Widescreen 0V-2V = TV Mode	>10kΩ
9	Ground		
10	Data 2		
11	Composite Video†	1V	75Ω
12	Data 1		
13	Ground		
14	Data Ground		
15	Chrominance Video	0.3V Burst	75Ω
16			
17	Video Ground		
18			
19	Composite Video Out	1V	75Ω
20	Luminance Video	1V	75Ω
21	Safety Ground		

† Japan adds these signals to their implementation.

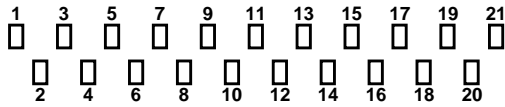


FIGURE 1. EUROPEAN SCART CONNECTOR

## NTSC Consumer Markets

High-end consumer video equipment for NTSC countries, such as projection TVs and line doublers, usually support analog RGB video signals.

To support these markets and applications, the video IC usually has the option of generating 0.714V RGB video signals (including a 7.5 IRE blanking pedestal). A additional 0.286V sync signal is also present on the green video signal, and may optionally be present on the red and blue video signals.

Separate R, G, and B video cables are used rather than a SCART connector.

## Analog YUV

With the introduction of DVD players, an analog YUV video interface was developed for the North American consumer market. This interface is also being incorporated on higher-end TVs.

Since it is such a new standard, there is some confusion of what to label the connector. For now, it may be labelled YUV, Y R-Y B-Y, or YCbCr. Three separate video cables with RCA connectors are used.

## YUV Color Space

YUV is a scaled version of  $Y B'-Y R'-Y$ .

$Y B'-Y R'-Y$  is derived from gamma-corrected RGB as follows:

$$Y = 0.299R' + 0.587G' + 0.114B'$$

The  $B'-Y$  and  $R'-Y$  components are then scaled to generate the desired U and V amplitudes.

## YUV Video Signals

The 1V Y signal includes a 0.3V sync and no blanking pedestal. The U and V color difference video signals have a peak-to-peak amplitude of 0.7V.

For flexibility, the option of generating a 1V Y signal with a 0.286V sync and a 7.5 IRE blanking pedestal is usually done.

## Summary

This Application Note presented some of the analog RGB and YUV signal interfaces for the consumer video market. Some, such as SCART, have been used for years. Others, such as YUV, are recent developments. Both are an attempt to improve the quality of video consumers experience at home.

Using NTSC/PAL encoders that support analog RGB and YUV component video generation, such as the HMP8173, allow the design of DVD players and settop boxes that support these new interfaces in a cost-effective manner.

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