Cromemco™

MULTIPLE SDI SYSTEM

APPLICATION NOTE

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INTRODUCTION

A single Cromemco SDI Interface can be used in one of two resolution modes using a 48K image memory. In high resolution mode, a 756 x 484 pixel display is generated in two different colors (or shades of gray). In normal resolution mode, a 378 x 242 pixel display is generated in 16 different colors.

This application note describes two methods of using multiple SDIs to increase the number of colors displayed in a given image. The first approach presented involves the direct connection of an SDI to each of the red, green and blue color inputs of the RGB color monitor. The second approach involves the use of an analog color mixer to sum the outputs of each SDI to generate a composite image.

DIRECT DRIVE APPROACH

The most straightforward method of generating a multiple color, high resolution SDI system is to use separate SDI board sets in a parallel configuration to directly drive the separate red, green, and blue color gun inputs. This approach is outlined in Figure 1 for a system displaying 8 colors in high resolution, (or 4096 colors in medium resolution) using 3 SDIs, each driving one of the red, green, or blue color guns.

Notice that in all of these system configurations, each **Slave** SDI must be synchronized to a **Master** SDI set. This is accomplished by use of a special **Master-Slave** Sync-Lock cable assembly (Cromemco part no. 901-0023) which enables 3 SDI sets to be synchronized by connecting J4 of the master video card to J4 on each slave card. Each SDI must have its own dedicated 48K of two port memory and each of these memory blocks must reside in separate memory banks. In order to input status information from the SDI, each SDI set must be given a separate base port address. The recommended port addresses are D4, D8, and DC.

The system shown in Figure 1 is configured for the maximum allowable 2 pages of two port memory for each SDI set. It may be converted to a one page configuration by using only one 48KTP per SDI and setting all of the 48KTP boards to reside at the same page.

The method described above is easy to implement with immediately available hardware. The multi-colored picture needs to be broken down into its red, green, and blue components and stored separately in each of the corresponding 48 KTPs. Unfortunately, the restriction of separate red, green, and blue information bits prevents one from having, for instance, 8 shades of green displayed in high resolution with the above implementation.

COLOR MIXING APPROACH

A more general approach is possible through the use of an analog color mixing module, shown in Figure 2. In this approach, the video color gun outputs of each SDI are fed into a resistive summing junction, so that the resulting display is a composite image from all color guns from each SDI. This will greatly increase the color menu. For example, multiple shades of the same color, or multiple grey scale black and white pictures in high resolution may now be displayed.

A Thevenin model of the SDI is shown in Figure 3. The output impedance of the SDI color gun drivers, denoted by RS, is 75 ohms and the input impedance of the RGB color monitor, denoted by RL, is also 75 ohms. It is clear that for impedance matching, the required added resistance RA is given by:

$$(RS + RA) / n = RL \Longrightarrow RA = n\,RL - RS$$

where n is the number of SDI sets, and is not restricted to 3 as in the parallel direct drive configuration. Since RL = RS = 75 ohms, we have:

$$RA = (n - 1)\,RL$$
$$= (n - 1)\ (75 \text{ ohms})$$

Notice that in this implementation, we are no longer restricted to a maximum of 3 SDI sets. A 16 color high resolution system with one page of two port memory per SDI is shown in Figure 4.

This far, we have only discussed the high resolution application of the multiple SDI system configurations. An additional feature of these expanded systems is an

enormous increase in normal resolution color capability.

In normal resolution (378 x 242 pixel display in 16 colors for one SDI), the number of colors available to be displayed on one image is given by:

$$N = (16)^{n}$$

where n is the number of SDI sets. For example, using a configuration of 3 SDI sets, as many as 4096 colors can be displayed in normal resolution on a single image (or 256 colors for a configuration of 2 SDI sets).

In all cases without color mixing, the color menu is restricted to a maximum of 4096 colors. The addition of the color mixing network increases the color menu to:

$$M = (16\ n)^{3}$$

where n is the number of SDI sets. In the example above, using a color mixing configuration of 3 SDI sets, the user is able to choose from a color map of up to 110,592 colors.

A suggested design for a color mixing module is shown in Figure 5. Notice that the use of SIP resistor networks will provide good matching for summing the outputs of the SDI's. It is important to use several of the ground pins of the video output cable to provide a stable, solid ground potential for the RGB monitor inputs. The value of the three resistor networks will vary with the number of SDI sets that are being mixed. Table 1 shows some suggested, commonly available values to be used for RA.

TABLE 1

Number of Video Inputs	Suggested Resistor Values
2	75 ohms
3	150 ohms
4	220 ohms
5	300 ohms

SUMMARY

The performance of the Cromemco SDI color graphics interface may be greatly enhanced by configuring a multiple SDI system. The color mixing configuration presented in this application note provides the user with a technique to greatly increase the available color menu and to enhance the high resolution capabilities of our current SDI color graphics system.

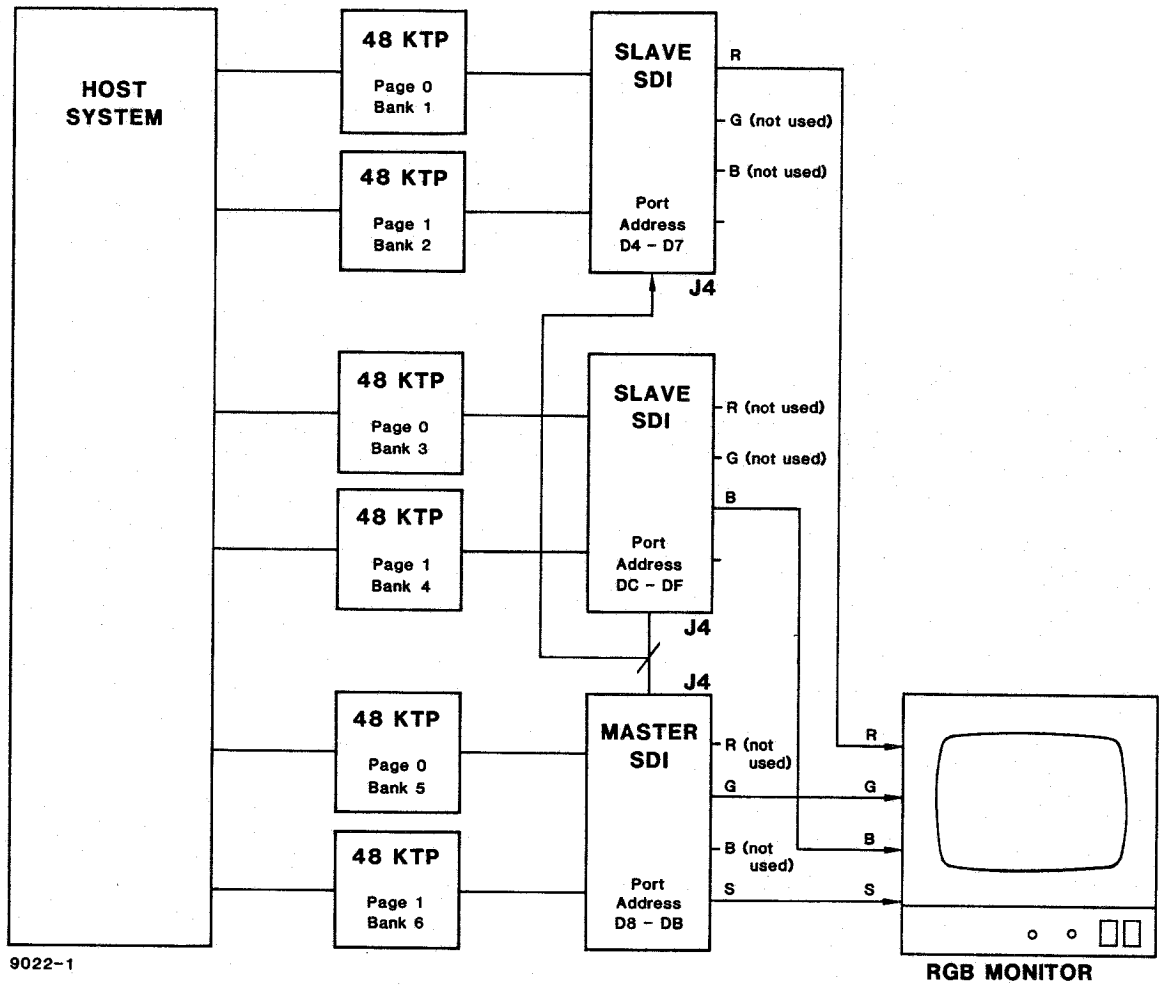

Figure 1: 8 COLOR HIGH RESOLUTION SDI SYSTEM WITH 2 PAGES

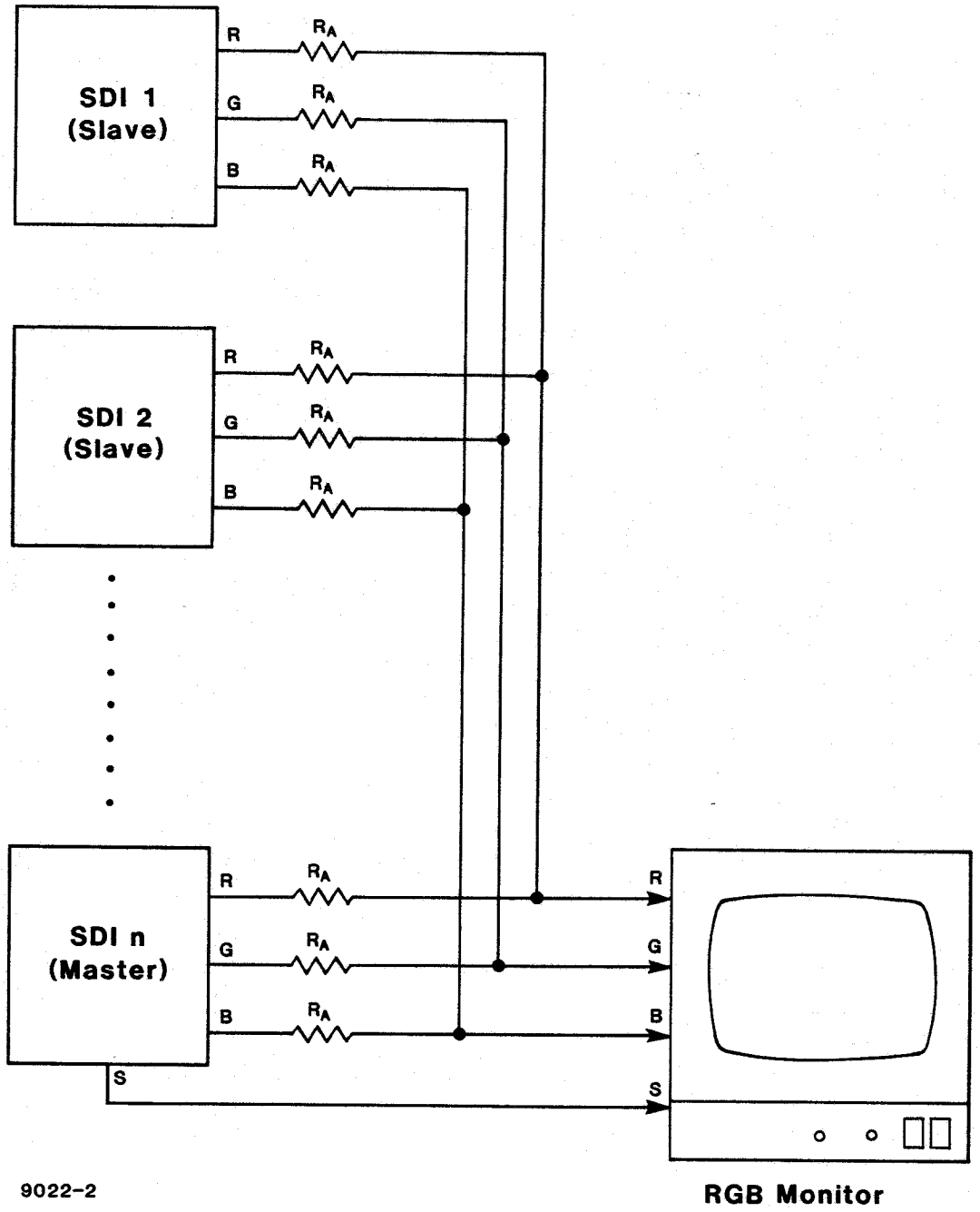

Figure 2: COLOR MIXING APPROACH

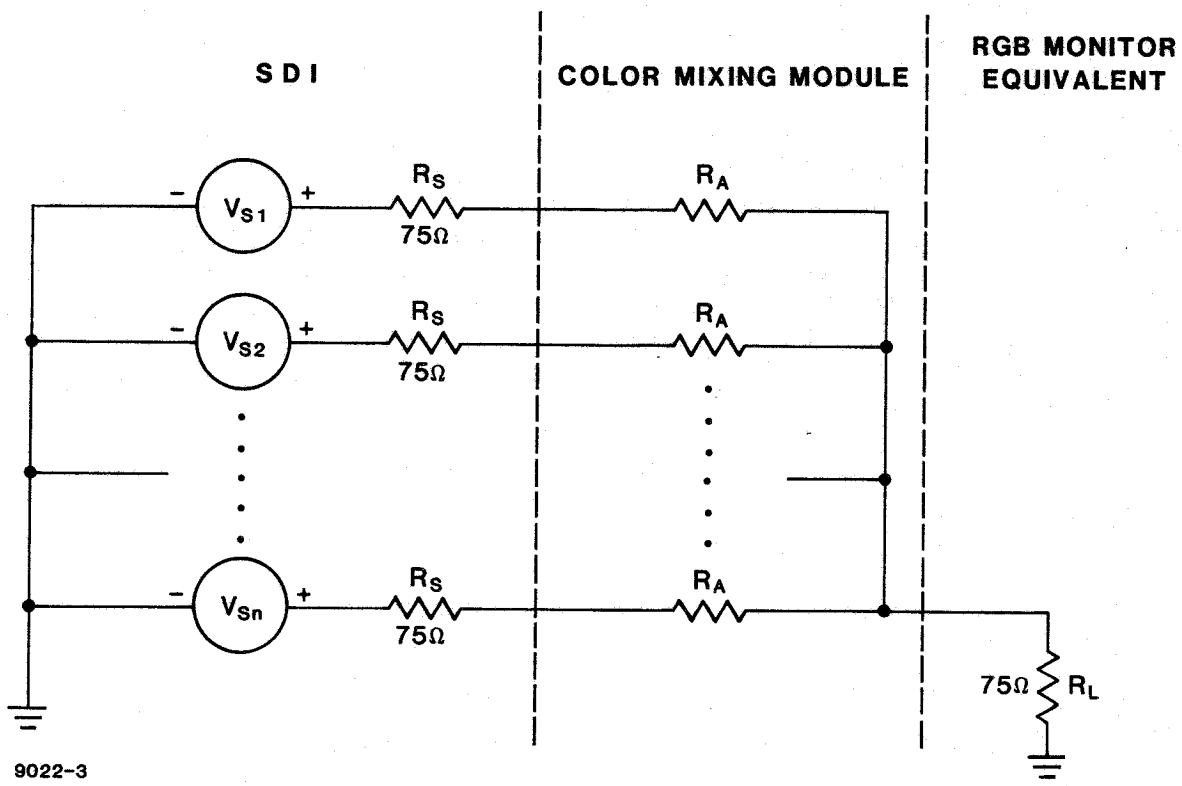

Figure 3: EQUIVALENT CIRCUIT OF COLOR MIXING MODEL

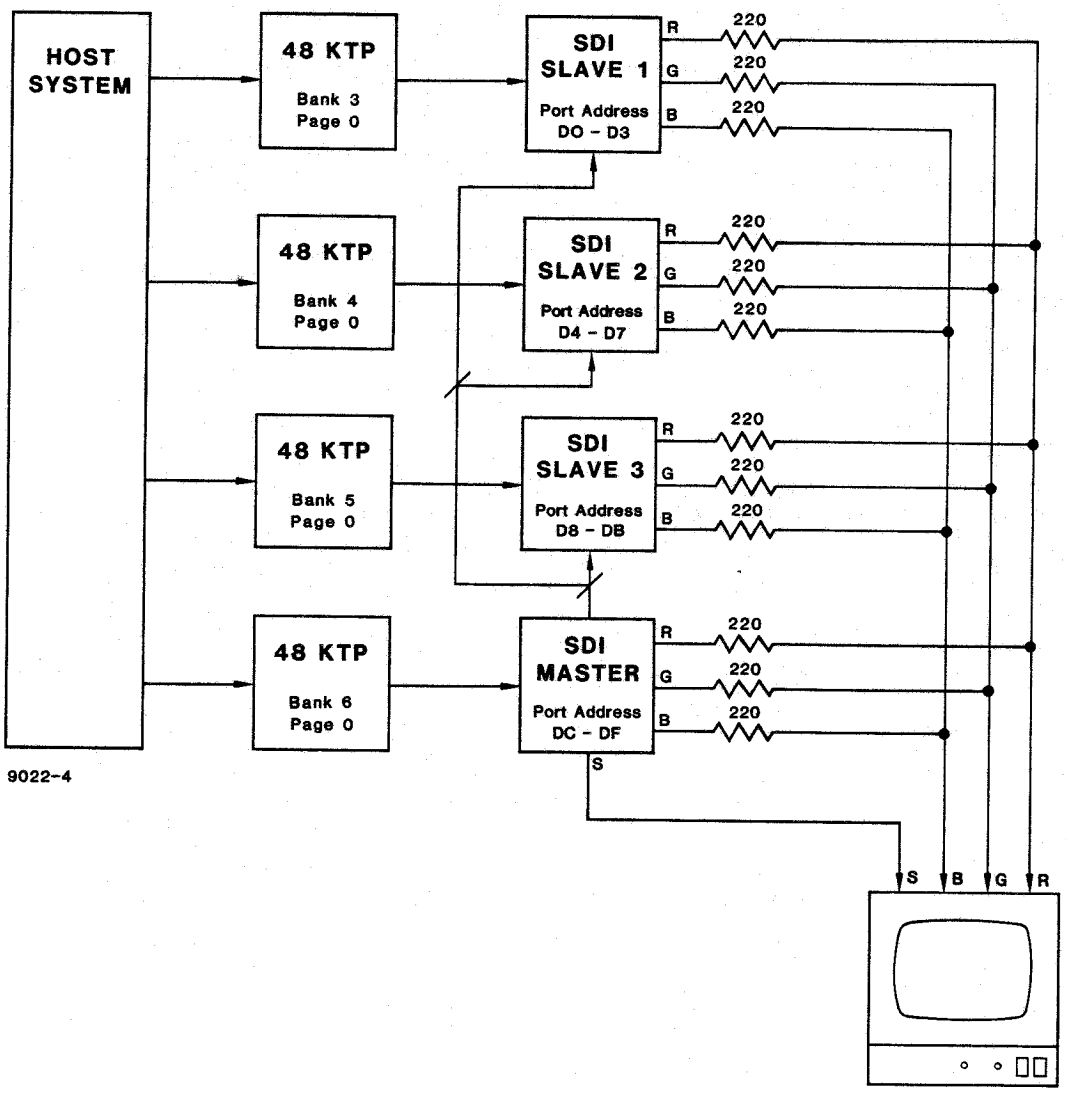

Figure 4: 16 COLOR HIGH RESOLUTION SYSTEM
WITH COLOR MIXING

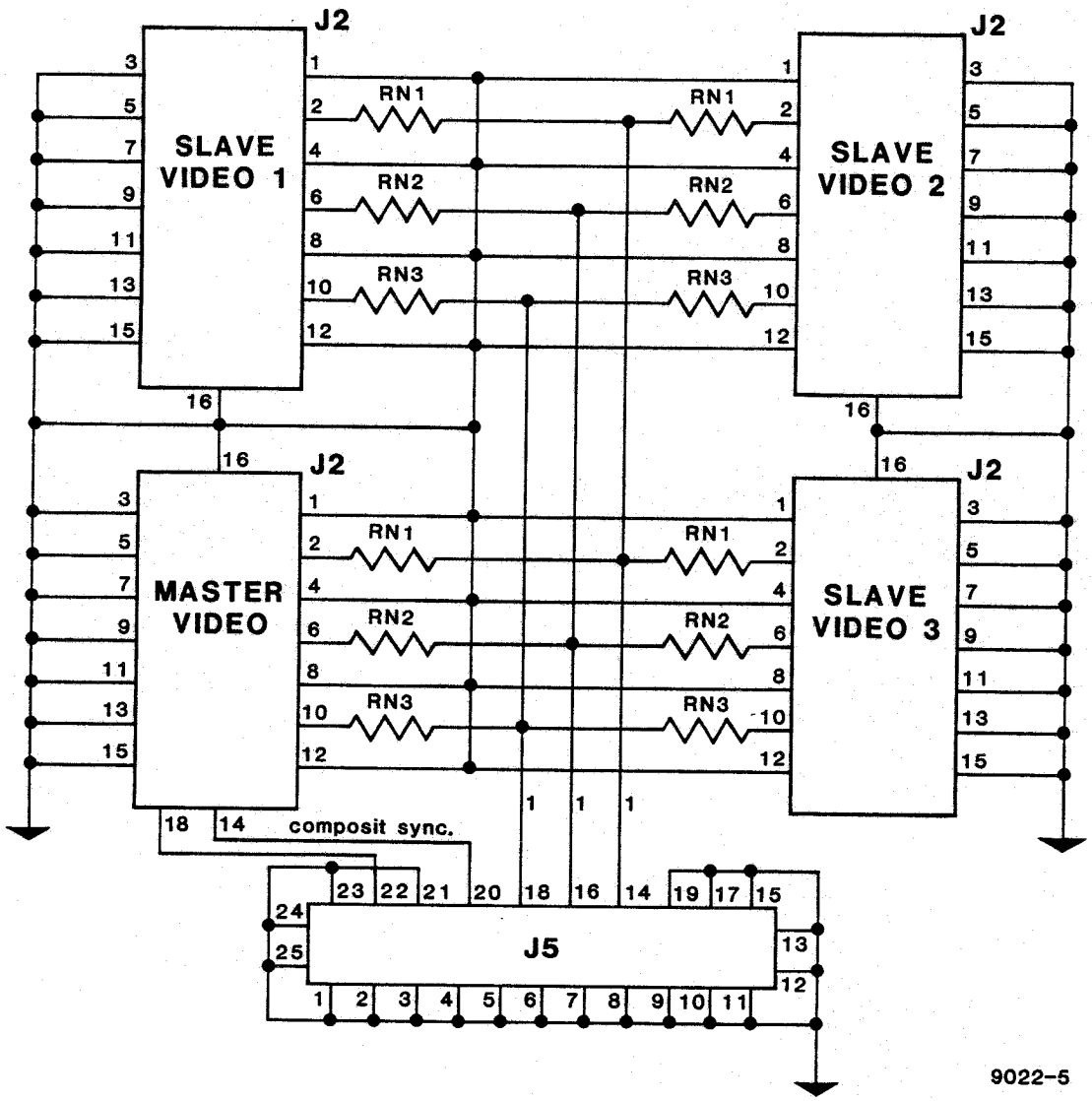

Figure 5: SDI COLOR MIXING MODULE