

# Color Mixer Kit

(Order Code CM-OEK)

Experiments in additive and subtractive color mixing can be easily and conveniently carried out using a simple accessory set with parts from the Vernier Optics Expansion Kit. The accessory consists of a three-color LED illuminator, a screen, and a converging lens.



The three-color LED illuminator contains a high output RGB LED whose three single-color components are separately regulated by three potentiometers mounted on the back of the housing.



The Color Mixer Kit requires the track from the Vernier Dynamics System (order code: VDS). The track can also be purchased separately (order code: TRACK).

## Setups.

For additive color mixing, the illuminator, lens, and screen are set up for real image formation, but with the screen a little way from the image focus point, so that the three colored images overlap only partially. Typical suitable values for the supplied 20 cm focal length would be 20 cm between the lens and the light source and 60 cm to the screen.



Example of the additive image:

**NOTES:** *The color rendering of the images is only approximate. It is distorted by the sensor characteristics of the camera and the computer screen, and even more by the printer's color profile & paper if printed. In practice, the red, green, and blue potentiometers are adjusted until the best white is observed in the center of the pattern. Different operators will have slightly differing opinions about which white is best.*



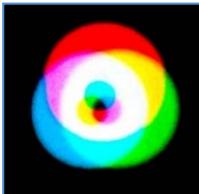
For subtractive color mixing, a diverging cone of light is produced and the screen adjusted until it is evenly illuminated with white. Typical positions have the lens 5 cm from the light source and the screen 30 cm from the lens.

To create a subtractive color pattern, hold a pencil in the light path between the lens and the screen.



Example of the subtractive image:

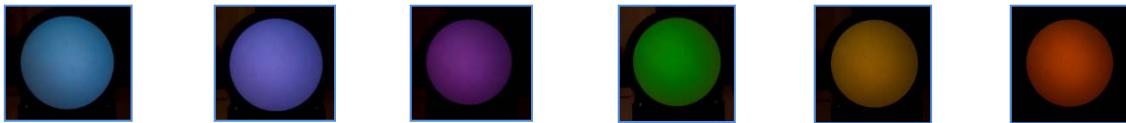
This setup also uniquely allows a combination image to be created where the additive and subtractive patterns are both produced in the same image. Set up the kit for additive color mixing, and then hold an opaque object in the light path in front of the screen:



This pattern is particularly interesting, because on proceeding from the edge to the center, the colors are progressively built up to white and then reduced to black again. At every position, the luminous primaries appear opposite the printer's secondaries and the luminous secondaries appear opposite the printer's primaries.

### Other possibilities.

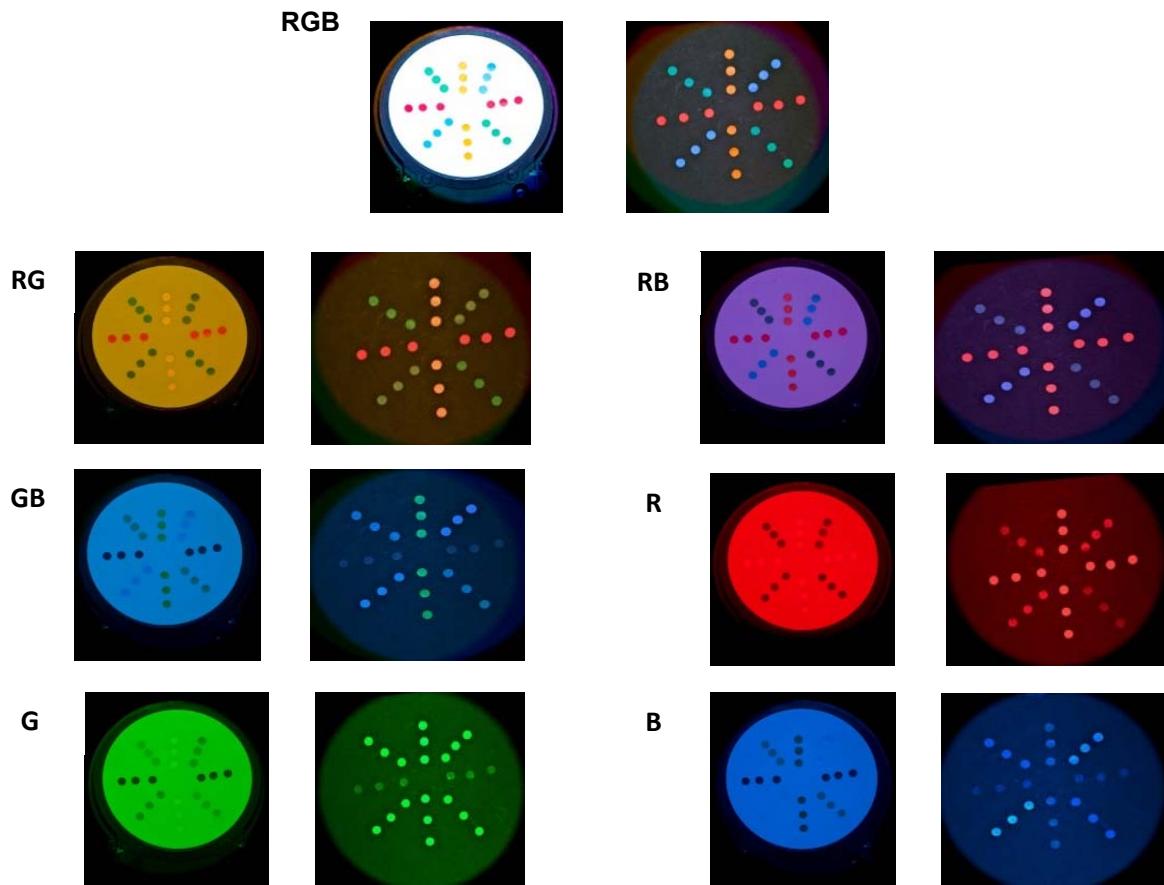
The three independent controls for the red, green, and blue color components allow the creation of different shades of color to be demonstrated by varying the intensities of the components. The screen is first uniformly illuminated white, and then the controls are adjusted to produce various shades:



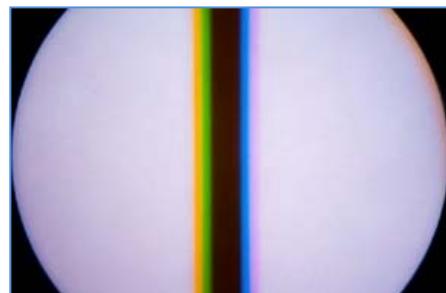
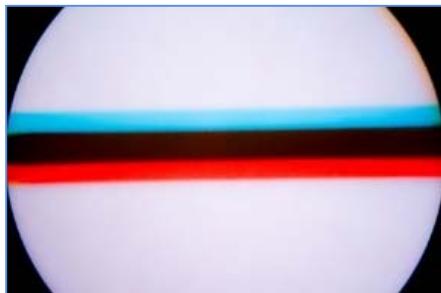
While the gamut is well short of the millions of colors produced by the average computer monitor or TV, there are enough possibilities to be convincing.

Another rich field for investigation is the appearance of colored objects when illuminated by differently-colored lights, and the contrasts in perception resulting from different background colors.

Colored marking dots are stuck onto the white screen and a piece of black card and both are viewed in seven different lights created by different combinations of the LED's: RGB (= "white"), RG, RB, GB, R, G, and B. The results are dramatic:



A further possibility is the production of “colored shadows” using the subtractive color technique with a bar-shaped obstruction, such as a pencil. Because of the orientation of the three light sources, the results for a horizontal bar and a vertical one are different:



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