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Colour Space Conversion
Part 1

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Can Linear RGB be used to drive the monitor?
No, because the characteristics of real monitors (Phosphor CRT's and LED's), are nonlinear. *(That is, the intensity of light reproduced at the screen of a CRT monitor is a nonlinear function of its voltage input.)*

If we applied linearly-coded colour components to a display, equal increments of each component would NOT result in perceived equal increments of colour.

Linear RGB values are transformed with another 3x3 matrix multiply to produce a set of primaries that are nonlinear in nature, but which closely match and compensate for the non-linearity of the target monitor. This is known as "gamma correction", and the gamma-corrected RGB primaries are denoted with a prime symbol (i.e., R'G'B').

In video systems, gamma correction is applied at the camera; it is usual for these signals to be available as the analogue outputs R'G'B'.

Can R'G'B' be used to drive the monitor?
Yes. These signals are industry-accepted analogue components and are often found on the interface of most video equipment.

Component Analogue RGB Signals

Gamma corrected R'G'B' components are available as analogue signals that require high-stability interfaces with respect to amplitude, level, and timing between the signals.

Ideally, all signals carry a sync pulse that assists timing and amplitude monitoring, but the gamma-corrected R'G'B' format is also implemented with sync on Green only, or on a fourth channel dedicated to sync pulses.

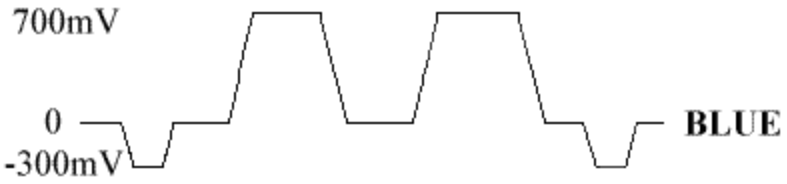

Figure 2

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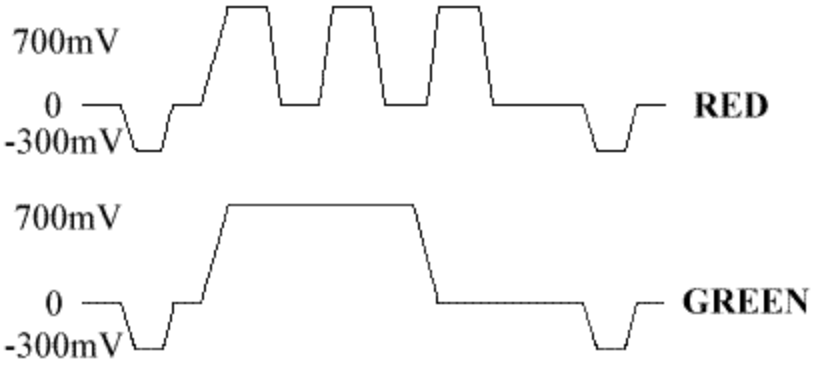

Unity Colour Space

The elements that now define our colour space are three signals with a range of 0->700mV, as shown below. These axes define a colour space cube often referred to as “unity colour space,” as the axes are normalised to a magnitude of 1, and any space within the cube can be located as a vector in the form (Red, Green, Blue).

i.e. pure red = (1,0,0)
pure green = (0,1,0)
pure blue = (0,0,1)

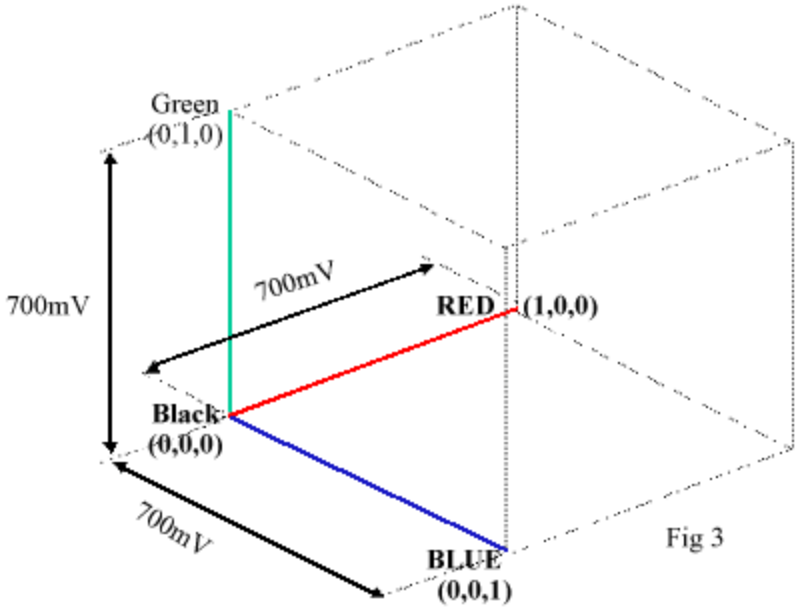

Fig 3

Coding “Yellow”

Yellow is defined as the Maximum excursion of Red + Maximum excursion of Green + NO excursion of Blue (i.e., coordinate [1,1,0]).

The term **excursion** is used because the reference is metric-independent. In the analogue domain, **max excursion** is 700mv. In the colour space domain, a **max excursion** is “1” (and anything less is a fraction). In the digital domain, max excursion depends on the coding system.

Considerations"
(10/30/00 - 11/13/00)

- Ken Chapman's **Cost Savings Using the SRL16E** series:
  Part 1
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"8x12 Does NOT Equal 12x8"
(1/29/07 - 2/12/01)

- Austin Lesea:
  "Signal Integrity Tips and Tricks"
  (1/1/01 - 1/14/01)

- Andy Miller:
  "Colour Space Conversion"
  (3/8/01 -3/26/01)

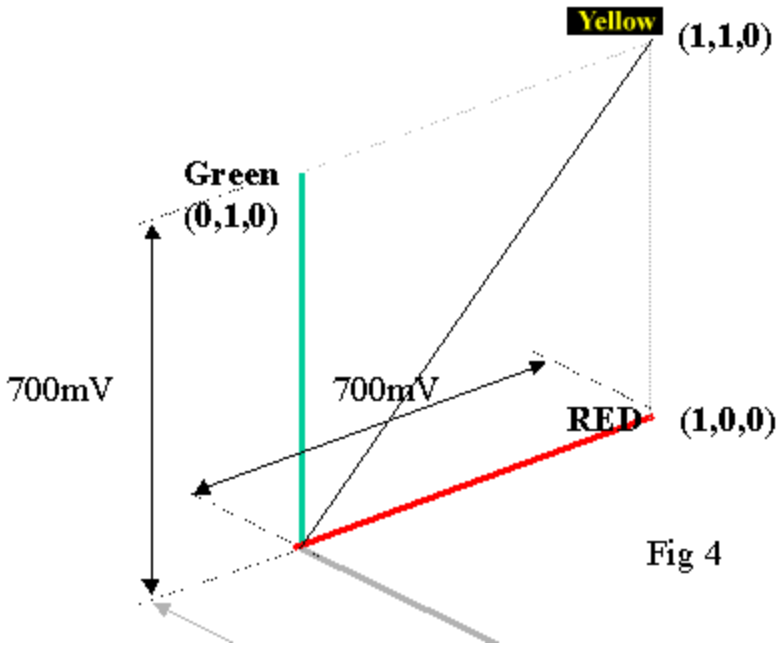

Fig 4

It is useful to be aware of something called “ITU Recommendation 601” (often abbreviated to *Rec-601*), because this defines how the colour coordinates of the “Luma and Colour Difference channel” colour space is digitally coded for 8- and 10-bit words.

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