PM 5639 Industrial CRT Color Analyzer

Conversion of measured XYZ color coordinates to corresponding RGB coordinates for CRT gun excitation levels.

The PM 5639 Color Sensor basically measure (X,Y,Z) coordinates as defined by the CIE 1931 standard which is based on a human *standard observer*.

When adjusting CRT monitors the natural adjustment parameters are the CRT RGB gun levels.

To ease the adjustment it is most convenient to have access to the measurement results in the same form and domain as the monitor control parameters. Both manual and automatic alignment will converge the quickest possible way if this is the case.

While the PTV Color Analyzer display systems have a selectable build in transformation from the measured XYZ data into RGB the user will have to calculate the RGB values himself if he is using the XYZ sensor data directly as an input for his own display and/or control software.

The transformation is slightly dependent of the CRT phosphor type, therefore it is recommended that the actual phosphor type is taken into consideration.

For a specific type of CRT phosphor a set of constants (3*3 matrix) can be derived from a simple 3 step measurement. The constants form a phosphor matrix that can be used for transformation between the measured XYZ values and the wanted RGB phosphor excitation levels on the CRT.

How to obtain the phosphor dependent constants

Feed the monitor with a stable white window signal and use a luminance level of for instance 80 cd/m2.

Allow the monitor to reach normal working temperature.

Measure the XYZ values XrYrZr with just the reed gun on

Measure the XYZ values XgYgZg with just the green gun on

Measure the XYZ values XbYbZb with just the blue gun on

The rest is plain calculation, a_{xx} are the phosphor dependent constants (diagonal elements are all 1)

a12 = (-Xg - Zg*a13) / Yg

a13 = (-Xb*Yg + Xg*Yb) / (Yg*Zb – Xb*Zg)

a21 = (-Yr – Zr*a23) / Xr

a23 = (-Xr*Yb + Xb*Yr) / (Xr*Zb – Xb*Zr)

a31 = (-Zr - Yr*a32) / Xr

a32 = (-Xr*Zg + Xg*Zr) / (Xr*Yg – Xg*Yr)

Final calculation of RGB values from XYZ

R = (X + Y*a12 + Z*a13) / Nr

G = (X*a21 + Y + Z*a23) / Ng

B = (X*a31 + Y*a32 + Z) / Nb

where

Nr = Xr + Yr*a12 + Zr*a13

Ng = Xg*a21 + Yg + Zg*a23

Nb = Xb*a31 + Yb*a32 + Zb