Specification of opRGB.

(Specified in IEC 61966-2-5:2007)

Chromaticity co-ordinates of primaries:
R: x=0.64, y=0.33, z=0.03;
G: x=0.21, y=0.71, z=0.08;
B: x=0.15, y=0.06, z=0.79.
Note: these are the same as Adobe RGB (1998).

'Gamma': 2.2.

The reference white for sRGB is specified as D65 (i.e. chromaticity co-ordinates of x=0.3127, y=0.3290; z=0.3583).

Conversion from XYZ (D65) to sRGB:

$$\begin{bmatrix} R_{opRGB} \\ G_{opRGB} \\ B_{opRGB} \end{bmatrix} = \begin{bmatrix} 2.0416 & -0.5650 & -0.3447 \\ -0.9692 & 1.8760 & 0.0416 \\ 0.0134 & -0.1184 & 1.0152 \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

where XYZ are normalised such that Y=1 and values of RGB outside of 0-1 are clipped.

opRGB values are then transformed to non-linear opR′G′B′ values as follows

$$R'_{opRGB} = R_{opRGB}^{(1.0/2.2)}$$
$$G'_{opRGB} = G_{opRGB}^{(1.0/2.2)}$$
$$B'_{opRGB} = B_{opRGB}^{(1.0/2.2)}$$

Hints for Profile makers:

1) D50 referenced characterisation data

When chromatically adapted to the D50 white point, using the recommended ‘Bradford’ chromatic adaptation matrix published on the ICC web site, and normalised such that Y=1 for white, the tristimulus values of the primaries and white are:

R: X=0.60973, Y=0.31112, Z=0.01947;
G: X=0.20528, Y=0.62566, Z=0.06087;
B: X=0.14920, Y=0.06322, Z=0.74457
White: X=0.9642, Y=1.00, Z=0.8249

Please note: When the white is calculated from the chromaticity co-ordinates defined above it introduces an error of 0.0001 in X and Z compared to that defined in the specification. All the above values have been normalised to correct that and produce the correct white values.

For D50 data the matrix to convert XYZ to linear opRGB (i.e. prior to applying the non-linear function) is the matrix multiplication of the inverse of the chad tag given on the web site and the matrix above which (with slight modifications to produce 1,1,1 for the D50 white defined in the specification) is:

$$\begin{bmatrix} R_{opRGB} \\ G_{opRGB} \\ B_{opRGB} \end{bmatrix} = \begin{bmatrix} 1.9625 & -0.6107 & -0.3413 \\ -0.9787 & 1.9160 & 0.0335 \\ 0.0287 & -0.1407 & 1.3493 \end{bmatrix} \begin{bmatrix} X_{(50)} \\ Y_{(50)} \\ Z_{(50)} \end{bmatrix}$$

2) Measurement 'correction'

The above transformation produces 1 and 0 in each of RGB when XYZ is set to 0.9642, 1, 0.8249 and 0, 0, 0 respectively. However, in practice some degree of flare will be present if opRGB is intended to represent a real viewing situation. IEC 61966-2-5:2007 specifies the white to have a luminance of 160cd/m^2 and a black point of 0.4 cd/m^2. Annex C of that specification suggests that a reference viewer-observed black would have a luminance of 0.5557 cd/m^2, implying a veiling glare of 0.1557 cd/m^2. In this case the correction required is very small, but if profile makers wish to utilise this information when producing profiles they should assume the black point has a Y value of 0.003473 when the white is 1, and correct the opRGB values prior to applying the non-linear functions as follows:

opRGB′ = 0.003473 + 0.996527*(opRGB)^2.2