

## Introduction to core Interoperability Conformance Specifications

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### ***Introduction***

ISO 20677-1 defines specifications that provide a platform for defining extended (iccMAX) colour management profiles and systems for various colour workflow domains. It provides a platform for which domain specific specifications can be defined that make use of iccMAX extensions to the existing cross-platform profile format of ISO 15076-1. Thus there is greater flexibility for defining colour transforms and profile connection spaces to meet needs that cannot easily be met with ISO 15076-1. It is not envisioned that all colour management systems that use ISO 20677-1 will implement all the features or capabilities it specifies. Requirements specifying restrictions to iccMAX that apply to a particular workflow are defined in workflow domain specifications known as Interoperability Conformance Specifications. Additionally, for some domain specific workflows it is envisioned that workflows will connect both to profiles defined by ISO 20677-1 (iccMAX) and those defined by ISO 15076-1.

An Interoperability Conformance Specification (ICS) is registered by the International Color Consortium (ICC). It defines minimum structural and operational requirements for writing and reading ICC profiles in order to address a specific problem and/or functionality that cannot readily be handled using the profile format defined by ISO 15076-1. An ICS document essentially defines restrictions to ISO 20677-1 for a specific use case.

An ICS enables all parties to have clarity on the requirements of a conforming profile and the processing elements supported by a conforming colour matching module (CMM). An ICS defines conformance requirements on both profile and CMM.

Generally an ICS defines the application domain to which it applies, one or more profile sub-classes, and the processing scenarios (i.e. workflows through which conforming profiles are expected to connect, including any available user-selectable options). It lists the specific tag elements required to be present, together with any optional tags and the multiProcessingElementTypes that must be supported by a conforming CMM.

Before approval by ICC, an ICS must also have example profiles for the profile sub-classes it defines, and these example profiles must be publicly available. ICC maintains a registry of approved ICSs and associated profiles, and encourages ICS

authors to register their ICS to avoid conflicts. New sub-class signatures must be registered to avoid such conflicts.

Further information on ICS documents can be found in ICC White Paper 54.

### ***Initial core ICSs***

ICC has developed a set of ICSs that meet a wide variety of needs beyond what can be accomplished in ICC.1. Each of these ICSs is published in a multi-part series, in which there is a range of different levels of functionality and complexity. Basic-level ICSs generally support only the standard D50 PCS, while higher-level ICSs also provide for conversion between a custom PCS and the standard PCS. In the highest-level ICSs the calculatorElement is also supported in order to achieve the functionality offered by that ICS.

### **Colorimetric ICS**

The Colorimetric ICS defines a colorSpace class profile (sub-class 'pcc ') in which a non-standard colorimetric PCS is used. The spectralViewingConditions tag shall be used to specify a colorimetric observer and an illuminant, either or both of which may be different from those defined in ICC.1 colorimetry. Transforms shall also be provided to convert between the custom colorimetry and the standard PCS to ensure interoperability.

Part 1 of the Colorimetric ICS defines profiles that perform conversions to and from a custom PCS using an AToB1 and a BTA1 tag. These tags encode a multiProcessElementType which is restricted to matrix, curve, LUT and tint array elements (in any combination). Conversion to and from a custom PCS shall be performed by customToStandardPcc and standardToCustomPcc tags, which shall be restricted to a single 3x3 matrix.

Part 2 of the Colorimetric ICS also defines profiles with AToB1, BTA1 customToStandardPcc and standardToCustomPcc tags, but there are no restrictions on the transform elements used in these tags. Hence a calculatorElement may be included.

### **Extended dynamic range**

An extended dynamic range profile (sub-class 'xrng') shall have a profile class of display or colorSpace. The media white point shall be defined in radiance-based XYZ values, such that the Y of the white is not relative to a reference white but represents the luminance in candelas per sq m. In the media-relative PCS 1.0 represents a diffuse white, while PCS values above 1.0 may be used to represent display luminances above diffuse white. The transform elements in the profile provide a mapping between an HDR display or HDR image and a colorimetric PCS.

Part 1 of the Extended Dynamic Range ICS defines profiles that perform conversions to and from a colorimetric PCS using an AToB1 and a BTA1 tag. These tags encode a multiProcessElementType which is restricted to curveSetElement, matrixElement, CLUTElement, and extendedCLUTElement (in any combination). Other rendering intents may be optionally included. If the PCS is not D50 a v4 'chad' tag may also be included, but as this tag is not present in ICC.2 it shall be considered a private tag for information only and not used in processing.

Part 2 also defines profiles that perform conversions to and from a colorimetric PCS using an AToB1 and a BTA1 tag, restricted as for Part 1. Conversion to and from a custom PCS shall be performed by customToStandardPcc and standardToCustomPcc tags, which shall be restricted to a single 3x3 matrix.

Part 3 defines profiles as in Part 2, except that there are no restrictions on the transform elements that may be included in the customToStandardPcc and standardToCustomPcc tags, thus enabling use of a calculatorElement.

### **Spectral reflectance**

The Spectral Reflectance ICS defines profiles (sub-class 'sref') that convert multi-spectral data to and from a spectral reflectance PCS. It also supports conversion to a colorimetric PCS through a spectralViewingConditions tag, which shall be used to specify a colorimetric observer and an illuminant (either or both of which may be different from those defined in ICC.1 colorimetry).

Part 1 of the Spectral Reflectance ICS defines profiles that perform conversions to and from a spectral PCS using a DToB3 and a BToD3 tag. These tags shall encode a multiProcessElementType which is restricted to curveSetElement, matrixElement, CLUTEElement, extendedCLUTEElement and tintArrayElement (in any combination). Conversion to and from a custom PCS shall be performed by customToStandardPcc and standardToCustomPcc tags, which shall be restricted to a single 3x3 matrix.

Part 2 of the Spectral Reflectance ICS defines profiles as for Part 1, except that there shall be no restrictions on the transform elements that can be included in the DToB3, BToD3, customToStandardPcc and standardToCustomPcc tags, thus enabling use of a calculatorElement.

### **Extended output**

The extendedOutput ICS defines an 'ext' profile that converts to and from a PCS based on custom colorimetry or spectral reflectance.

In Part 1 Custom observer and illuminant information shall be provided in the spectralViewingConditionsTag, along with transforms to convert between standard (D50 for 2 - degree standard observer) and custom observing conditions, via the customToStandardPccTag and the standardToCustomPccTag. multiProcessing elements shall be restricted to curveSetElement, matrixElement, CLUTEElement, and extendedCLUTEElement

Part 2 defines similar workflow scenarios to Part 1, but permits any processing element defined in ISO 20677-1, thus enabling use of a calculatorElement.