
**Image technology colour
management — Black point
compensation for n-colour ICC profiles**

Technologie de l'image — BPC pour profil à n couleurs



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The xCLR ICC profiles that are used in digital printing applications are often CMYK ICC profiles extended with red, orange, green, blue and/or violet colourants. Hence there is a need to specify black point compensation (BPC) for a well-defined class of xCLR ICC profiles, where xCLR refers to a device-dependent colour space defined in ISO 15076-1 and ICC.1:2001-04, specified for 3 to 15 device colourants wherein the value of x is a hexadecimal digit within the range 3 to F inclusive. Such xCLR ICC profiles are also commonly referred to as n-colour profiles.

To guarantee continuity of the black point compensation procedure between CMYK devices and printing devices with extended colourant sets, xCLR ICC profiles follow the constraints and calculation of output-capable CMYK ICC profiles wherever possible, as specified in ISO 18619:2015.

Limiting xCLR ICC profiles to CMYK plus combinations from the set of red, orange, green, blue and violet colourants is a logical extension of the CMYK colourant set to enhance the printing gamut as applied in digital print. Some of the key additional assumptions which will likely result in predictive and expected behaviour for black point compensation calculations include:

- in a similar fashion to most CMYK colourants, the colourants chosen for use with the xCLR ICC profiles should result in a colour gamut featuring a large range of neutral colours;
- the physical colourants should be sufficiently transparent with well-saturated CMY primaries in order to keep the gamut shell well-formed and permit the black point compensation algorithm to work correctly;
- a well-behaving forward model can be constructed near the darkest neutral, with a well-defined darkest colour, thus guaranteeing a good approximation using curve-fitting as defined by ISO 18619:2015, 4.2.5.5.

In the case of 4CLR ICC profiles, which are constrained by ISO 15076-1 as well as ICC.1:2001-04 to not refer to CMYK device-dependent colour spaces, the 4CLR colour space should behave similarly to CMYK device-dependent colour spaces, and conforms to the requirements defined by the key assumptions given above for other xCLR ICC profiles.

An additional class of xCLR ICC profiles for consideration by this document are 3CLR and CMY ICC profiles. For 3CLR ICC profiles, the colourants should be CMY-like in the sense of being chromatic colourants with widely-spaced hue angles (as distinct from achromatic colourants such as grey or black). As a result, BPC for 3CLR ICC profiles is defined by this document, and follows the same approach as for CMY ICC profiles.

The BPC method described in this document does not give meaningful results for most 2CLR ICC profiles, hence these types of ICC profiles are excluded from this document.

In addition, this document extends the BPC method for the ICC v4 profile types with the device-dependent colour spaces described above for corresponding ICC v2 profiles as defined by ICC.1:2001-04.

The black point compensation procedure defined in ISO 18619:2015 is specified for ICC profiles with data colour spaces Gray, RGB, CMYK and CIELAB, as identified in 15076-1. As an increasing number of output ICC profiles for digital printing applications are available with more than four colourants, there is a need to extend black point compensation to n-colour ICC profiles, also referred to as xCLR or extended process ICC profiles.

Image technology colour management — Black point compensation for n-colour ICC profiles

1 Scope

This document specifies a procedure, including computation, for extending the method described in ISO 18619:2015 to n-colour ICC profiles specifically for the xCLR cases where the colourants are either CMYK plus combinations from the set of red, orange, green, blue and violet or where, for the 3CLR case, the colourants are CMY-like chromatic colourants with widely-spaced hue angles. Other types of colour spaces which are otherwise permitted by 15076-1, such as 2CLR (two-device colourants), are not addressed by this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 18619:2015, *Image technology colour management — Black point compensation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

output-capable xCLR ICC profile

ICC profile containing a transform from the ICC PCS encoding to the xCLR data colour space encoding, where xCLR refers to one of the ICC profile colour spaces where x is hexadecimal 3 to F

4 Extension of black point compensation to n-colour ICC profiles

4.1 Constraints

In this document the black point compensation procedure is extended to ICC v4 profiles conforming to ISO 15076-1 and ICC v2 profiles conforming to ICC.1:2001-04 with the following characteristics:

- the ICC profile class is one of Input, Display, Output or ColorSpace;
- the ICC profile data colour space is one of Gray, RGB, CMYK, or xCLR;
- the ICC profile includes a lut-based transform from the ICC PCS encoding to the colour space encoding;
- the data colour space xCLR has a minimum of three channels.