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Relative Colour Image Technology (RCIT) and RLAB *lab** (2005) Colour Image Encoding

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http://www.ps.bam.de/RLABE05.PDF

Foreword

The author is a member of ISO SCIT (Steering Committee of Image Technology) and was a member of the former ISO/IEC JTAG2 (Joint Technical Advisory Group No. 2) since 1998. He has edited, studied and discussed many standard documents in the field of image technology which has been developed during the last 5 years in the committees ISO/IEC JTC1/SC28 “Office Systems”, ISO TC 42 “Photography”, ISO TC 130 “Professional Graphics”, ISO TC 159 SC4/WG2 “Visual Display Requirements”, ISO TC 171 “Document Management”, IEC TC 100 TA2 “Colour Management and Measurement”, CIE Division 1 “Colour”, CIE Division 8 “Image Technology”. All the standard groups have worked hard to specify their needs and to develop appropriate standard documents. However, a long term view for the standards development is missing. This shall be based on CIE colorimetry and on current and future trends of image technology. More cooperation between the different standard groups seems appropriate.

This “Technical Report” is intended for discussion in ISO SCIT and the above different standard groups. This Technical Report shows new possibilities for standardisation on an advanced colorimetric basis and it may therefore lead to improved standard documents which may produce a better connection between the different imaging areas.

Introduction

The Relative Colour Image Technology (RCIT) and the RLAB *lab** (2005) color image encoding and decoding is defined in this Technical Report to meet the demands for colour devices used for input and output at work places. This document has been developed in response to user and industry needs for a specification of the RLAB *lab** (2005) color image encoding.

With the RLAB *lab** (2005) color image encoding, users can represent digital images in color spaces defined for different devices such as CRT monitors, LCD displays, laser printers, inkjet printers, overhead and video projections on screens in different viewing conditions, offset prints and others.

Application of colour in daily life or in Information Technology (IT):

Design, architecture, art, industrial products **Measured for CIE standard illuminant D65**	**Information technology of devices** **Measured for CIE illuminant D65 or D50**
colour order system: name and coordinates	**Device system name and coordinates:**
RAL Design System (CIELAB): ***LCH****, lightness, chroma, hue	**Printer system (illuminant D65 or D50):** ***cmy***, content of "cyan", "magenta", "yellow"
Munsell Colour System: ***VCH****, lightness (Value), Chroma, Hue	**Display system (standard illuminant D65):** ***rgb/sRGB***, content of "red", "green", "blue"
Natural Colour System (NCS): ***nce****: blackness, chromaticness, elementary hue	***IT colour coordinates confuse the users!*** ***Nearly no connection to colour order systems!***

New: Application connection by coordinates *olv*, cmy*, tce, ... und linear relation to *LAB****

CIELAB: ***LAB****: lightness, red-green and yellow-blue chroma; ***LCH****: lightness, chroma, hue

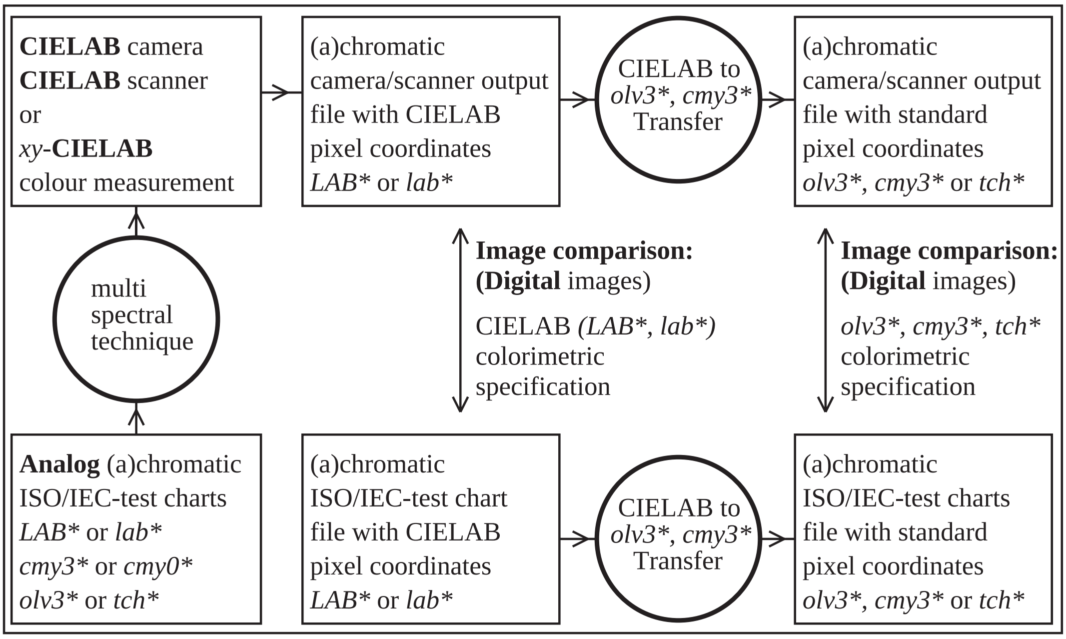
Definition of *relative* CIELAB data *lab , similar to coordinates of colour order system *NCS***

lab*lch: relative lightness ***l**** , chromaticness ***c**** , hue ***h****
lab*lch, lab*tce: triangle lightness ***t**** , chromaticness ***c**** , hue or elementary hue ***h*, e****
lab*nce: blackness ***n****, chromaticness ***c****, elementary hue ***e****
lab*olv = olv* = rgb*: orange-red o^*_3, leaf-green l^*_3, violet-blue v^*_3

LE430−31, Application connection with coordinates *olv**, *cmy**, *tch**, *tce**, *nce**, ... and linear relationship to *LAB**

Fig. 0-1: Colour applications using *standard* CIELAB data *LAB and *relative* CIELAB data *lab****

Figure 0-1 shows the use of colour data in colour order systems and in image technology. There is a barrier between the two applications. *Standard* CIELAB data *LAB** are used to specify the colour order systems RAL (*standard* CIELAB system), Munsell and NCS. Additionally the colour order system NCS is defined by *relative* colour coordinates which are called the *natural* coordinates *nce** (blackness *n**, chromaticness *c**, and elementary hue *e**). These coordinates are based on user requirements and user needs and are easy to understand by every naive user. In contrast to this the coordinates *rgb* or *cmy* used in image technology are hard to understand by most of the naive users and often confuse the naive users.



LE430−7, Transfer from device independent data *LAB** to device dependent data *olv3*, cmy3* and tch**

Fig. 0-2: Transfer from device independent *LAB data to device dependent *lab** data.**

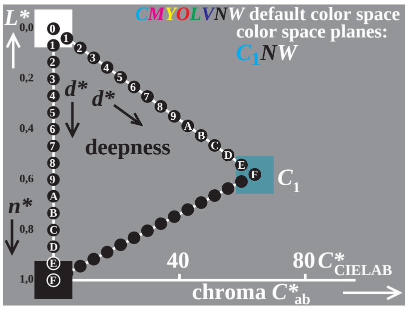
Figure 0-2 shows the transfer from device independent *standard* CIELAB data *LAB** to the device dependent *relative* CIELAB data *lab**, which are called RLAB data *lab** (R = Relative) in this Technical Report. The three data *LAB** are used to plot a colour in the *standard* CIELAB space. Similar the three data *lab** are used to plot the colour in the RLAB space.

New so called CIELAB cameras measure the spectral reflectance of every pixel and calculate the *standard* CIELAB data *LAB** of the original, which may be an ISO/IEC-test chart produced in offset printing. There is a requirement to calculate the original *relative* CIELAB *lab** data of the ISO/IEC-test charts from the *standard* CIELAB data *LAB** and also in the inverse direction.

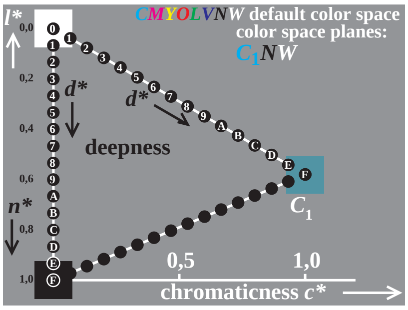
The *relative* CIELAB data *lab** use for the calculation the *standard* CIELAB data *LAB** of both a given colour and of the eight basic colours CMYOLVNW (six chromatic colours CMYOLV and black N and white W, see ISO/IEC 15775:1999, ISO/IEC TR 19797:2004, and ISO/IEC TR 24705:2005) in a given viewing condition. In this case the scan with a CIELAB camera shall produce *lab*olv = olv* = rgb*, lab*cmy = cmy*,* or *lab*tch = tch** data which all are **equivalent** colorimetric data of the *relative* CIELAB space *lab**. Equivalent colorimetric data of the same colour stimuli exist also in the *standard* CIELAB space, for example the rectangular coordinates *L*, a*, b* = LAB** and the cylindric coordinates $L^*, C^*_{ab}, H^* = LCH^*$.

The *relative* CIELAB data *lab** are therefore called the RLAB data *lab** and the *relative* CIELAB colour space is identical to the RLAB colour space (R = Relative) within this Technical Report. The *lab** data are well defined for professional and consumer digital image applications for both input and output.

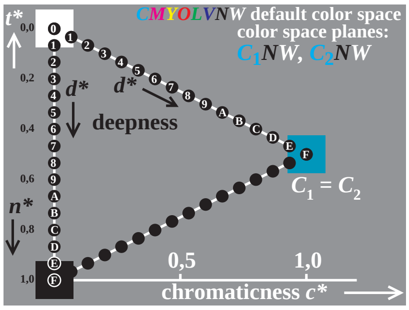
The ideas of the RLAB *lab** (2005) color image encoding are given visually in ISO/IEC 15775:1999 with digital and analog ISO/IEC-test charts which include 16 step equally spaced colour series for example between White and Cyan-blue. In the digital ISO/IEC-test chart files the relative coordinate of cyan-blue c^*_3 changes between 0 and 1 in equal steps 0=0/15, 1/15, 2/15, ..., 14/15, 1=15/15. It is the basic principle of the RLAB *lab** (2005) colour image encoding that the 16 digital steps and similar digital steps (16 step colour series) can be calculated and produced in the *standard* CIELAB colour space between the adjacent eight basic device colours.



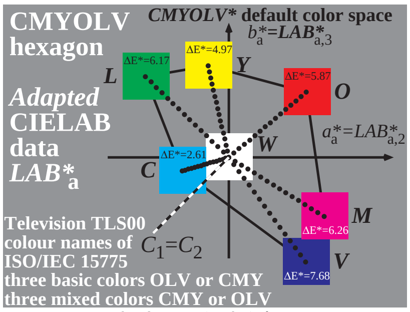
BE090−21, CIE-lightness L^*, chroma C^*_{ab} of C1



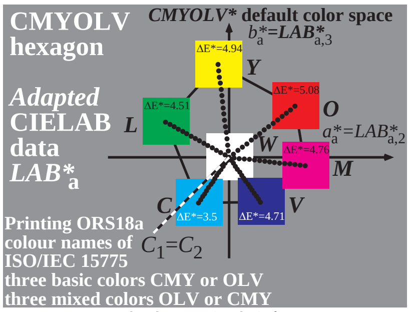
BE090−31, lightness l^*, chromaticness c^*



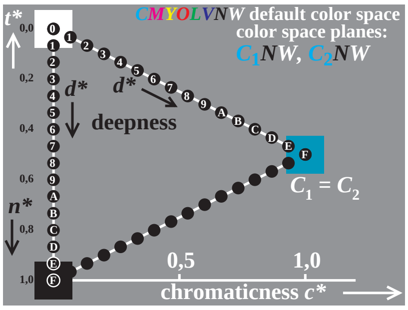
BE090−41, triangle lightness t^*, chromaticness c



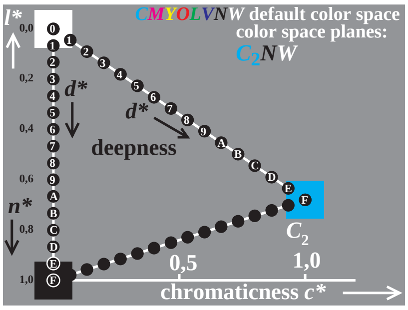
BE390−11, TLS00 in hue diagramm (a^*_a, b^*_a) of LAB^*_a



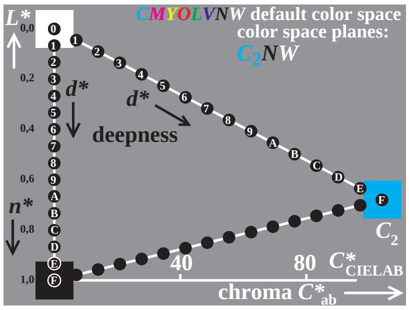
BE370−41, ORS18a in hue diagramm (a^*_a, b^*_a) of LAB^*_a



BE090−41, triangle lightness t^*, chromaticness c



BE090−51, lightness l^*, chromaticness c^*



BE090−61, CIE lightness L^*, chroma C^*_{ab} of C2

Fig. 0-3: Colour workflow between input and output of cyan blue colours

Figure 0-3 shows the colour workflow between input and output which is based on different transformations of the *adapted* CIELAB data LAB^*_a. In the top thee figures the 16 step colour series are shown in a plane of equal CIELAB hue H^*_a = 235 degrees and in diagrams $(C^*_{ab,a}, L^*)$, (c^*, l^*), and (c^*, t^*) of the *adapted* CIELAB data $LCH^*_{a,input}$, the *relative* CIELAB data lab^*lch_{input} and the *relative* CIELAB data lab^*tch_{input}.

At the bottom the Fig. 0-3 shows a similar colour workflow for the output in the opposite direction.

In the middle the Fig. 0-3 shows adapted CIELAB diagrams (a^*_a, b^*_a) of the monitor device system TLS00 and of the printer device system ORS18. The adapted CIELAB chroma $C^*_{ab,a}$ and the CIELAB hue angle H^*_a are different for the six basic colours CMYOLV of the input and output device.

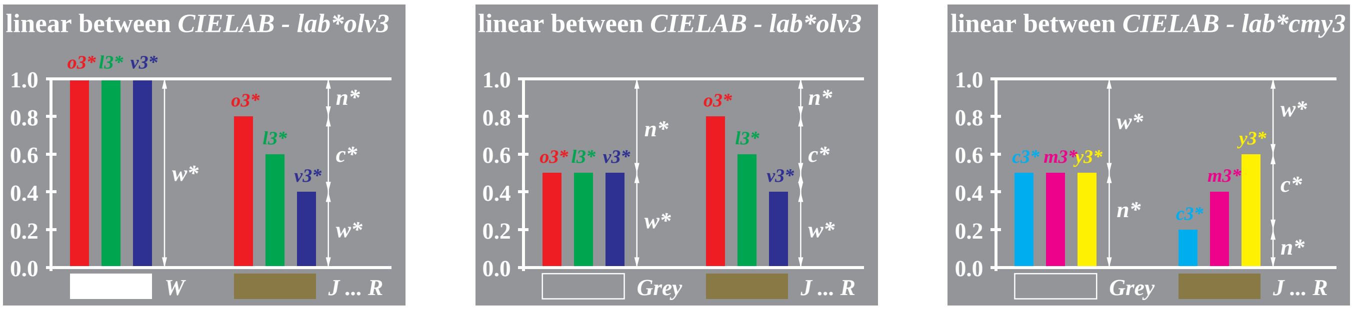
The intended constant hue for the colour $C_1 = C_2$ in the diagram (a^*_a, b^*_a) and the diagram (t^*, c^*) shall be mixed between *cyan blue* and *violet blue* for the input device *(middle left)* and between *cyan blue* and *leaf green* for the output device *(middle right)* . The CIELAB hue angle H^*_a = 235 or the hue value h^* = 0,625 is equal for input and output.

As a result of Fig. 0-3 the intended workflow has the following intended properties between input and output:

1. the CIELAB hue is constant
2. the 16 step spacing is visually equally spaced both for input and output.

Therefore the details of a picture remain for output on any device system. However, CIELAB chroma $C^*_{ab,a}$ and CIELAB lightness L^* change between input and output.

The intended linear relationship between the digital data in the file and the *standard, adapted and relative* CIELAB data lead to some other main properties for the unspecified or specified data *rgb* and *cmy* used in Image Technology. Because of the linear visual relationship between input and output the coordinates are called * (star) coordinates according to ISO/IEC 15775, ISO/IEC TR 19797 and ISO/IEC TR 24705.



ME311−3, *lab*olv3:* linear between *olv3** and *LAB** ME311−4, *lab*olv3:* linear between *olv3** and *LAB** ME311−8, *lab*cmy3:* linear between *cmy3** and *LAB**

Fig. 0-4: *Relative* CIELAB data *lab*olv*$_3$ and *lab*cmy*$_3$ and relation to *adapted* CIELAB data *LAB$_a$**

Fig. 0-4 shows relative CIELAB data *lab*olv*$_3$ and *lab*cmy*$_3$ which have a **linear** relationship to the *adapted* CIELAB data *LAB**$_a$. The linear relationship is one basic intention of this Technical Report. Therefore, if for example the three data *lab*olv = rgb** and *lab*cmy = cmy** are all equal to 0,5 then a mean grey colour is intended which is located in the middle between the colour white W and black N for any device system. Additionally, there are linear colorimetric relationships between the different *lab** data, for example the “1 minus relationship” between the *lab*olv = olv* = rgb** and *lab*cmy = cmy** data.

In applications the *standard* CIELAB data *LAB** of the eight basic colours CMYOLVNW change by the viewing environment for example by the ambient light for luminous colours on a projection screen, see ISO/IEC TR 24705. The eight basic colours change with the CIE illuminant (for example D65 and D50) which may be used to illuminate reflective or transmissive device samples. In each case the equal steps (16 step colour series) can be calculated and produced between the adjacent eight basic colours CMYOLVNW of the “actual device”. There are a number of standard and recommended devices each defined by its own set of eight basic colours CMYOLVNW. Many examples are given in ISO/IEC TR 24705 and in Annex A.

The *standard* CIELAB data *LAB** appear in different modifications, for example as *L*, a*, b*, (LAB*)* or *L*, C**$_{ab}$, *H* (LCH*),* see CIE Publ. 15:2004. There is a mathematical relationship between these coordinate modifications. The users expect the same output if the data are equivalent by the mathematical relationship.

Similar the *relative* CIELAB data *lab** of the RLAB *lab** (2005) colour data appear in many different modifications, for example as *lab*cmy = cmy*, lab*olv = olv* = rgb*, lab*nce = nce** and many others. The small letters *lab** indicate that the data are *relative* CIELAB data *lab** instead of the *standard* CIELAB data *LAB**. The star (*) indicates that the 16 steps are visually and in the *adapted* CIELAB space equidistant between adjacent colours, for example between White and Cyan blue (W – C).

Usually the eight basic colours CMYOLVNW can be produced by using within the digital ISO/IEC-test chart file:

either the *PostScript* operator: *r g b setrgbcolor* and the three parameters which are

[0,1,1; 1,0,1; 1,1,0; 1,0,0; 0,1,0; 0,0,1; 0,0,0; 1,1,1]

or the *PostScript* operator: *c m y k setcmykcolor* and the three parameters (and additionally k=0) which are

[1,0,0; 0,1,0; 0,0,1; 0,1,1; 1,0,1; 1,1,0; 1,1,1; 0,0,0]

The second set of data is the inverse of the first set and defined by the so called “1 minus relation”.

For the relation between *standard, adapted* and *relative* CIELAB data *LAB*, LAB**$_a$ and *lab** for the eight basic colours, a OLV-3x3x3, and a OLV-5x5x5 colour cube, see Annex D and F.

It is both easy to output the colours and to measure them. If the ambient light, for example the daylight in the office, changes the colours, for example produced by the (video) projector on the projection screen, then this must be considered. In this case both the measurement data of the eight basic colours and the 16 step colour series will change by the ambient light.

Recently there was a ballot of the Technical Report CIE 16x:2005 “Criteria for the evaluation of extended-gamut colour encodings”. The following criteria has been studied

- gamut volume characteristics,
- colour quantization characteristics,
- hue constancy when applying non-linear tone scale modifications to RGB colour values,
- complexity of transformation required to and from typical standard spaces (sRGB, ICC PCS, etc.).

A number of other criteria have also been identified that may be important for some applications, although detailed metrics have not been defined at this time. These criteria include:

- perceptual isometry (visual uniformity),
- compressibility,
- compatibility with existing industry practice (e.g., *ICC* colour management, *Adobe Photoshop* software, etc.).

The RLAB *lab** (2005) colour encoding of this Technical Report has especially advantages in the field of

- gamut volume characteristics,
- perceptual isometry (visual uniformity),
- compatibility with existing industry practice

It may be of interest to compare the RLAB *lab** (2005) color image encoding with the encodings studied in the above CIE Report. In the following appropriate remarks on the above last three topics are given.

gamut volume characteristics

The RLAB *lab** (2005) color image encoding has a color gamut that is approximately the same as the colour gamut of the actual device. This property is similar to the image encoding sRGB according to IEC 61966–2.1 and the colour gamut of the standard CRT monitor.

perceptual isometry (visual uniformity)

For the 16 *olv** = *rgb** input data of *achromatic* colours
[0, 0, 0; 1/15, 1/15, 1/15; 2/15, 2/15, 2/15; ... ; 14/15, 14/15, 14/15; 1, 1, 1]
the output is approximately the same, if RLAB or sRGB or Adobe RGB (1998) is used for the *rgb* data interpretation. The technical reason is approximately the same slope (about 2.2) in all three colour spaces.

For the *chromatic* colours for example for the series White – Cyan-blue (W – C) the 16 colours have the *rgb* values
[0, 0, 0; 0, 1/15, 1/15; 0, 2/15, 2/15; ... ; 0, 14/15, 14/15; 0, 1, 1]

For the *rgb* data interpretation in RLAB the output series is visually and in *standard* CIELAB equally spaced. For the *rgb* data interpretation in sRGB the visual and *adapted* CIELAB difference varies by a factor eight for the 16 steps.

Therefore for the *achromatic* colours the perceptual isometry (visual uniformity) is similar for RLAB, sRGB, and Adobe RGB (1998). For the *chromatic* series W – C of printing the perceptual isometry is by *a factor eight better for RLAB* compared to sRGB. For all other colour series of the ISO/IEC-test charts according to ISO/IEC 15775 the perceptual isometry shall be by definition also better for RLAB compared to sRGB.

Compatibility with existing industry practice

Up to 2002 the following properties were often realized for printing and for printers:

1. only one of the three primary colours CMY in the file has produced an output using only this primary colour.
2. two equal amounts of two primary colours MY, YC, and CM have produced the intermediate colours OLV.
3. use of only the black component N (K) has produced the grey series with the black colorant.
4. use of undercolour removal has produced an economical output, using only two chromatic colours and black
5. use of equally spaced digital input data has produced equally spaced output colour series
6. for the six colours in the sequence OYLCVM the hues angles have been roughly 30, 90, 150, 210, 270 and 330.
7. use of *cmy** and *olv** components defined by the “1 minus relation” has produced the same output.

Some of the above properties have been realized only approximately, for example the constant hue angle difference of 60. In an ideal case this forms a regular hexagon. However, Fig. 0-3 shows the real hexagon output of the device system ORS18 *(in the middle and right)* which is not completely regular.

Since about 2002 with the introduction of the “ICC or sRGB colour management” the colour output properties of different PC operating systems (Windows, Mac and Unix) has changed a lot on many device systems. For example for the four 16 step grey series, defined by equivalent colorimetric data and shown later in Fig. 9 of this Technical Report, the output was usually identical and equally spaced before 2002. With “ICC or sRGB colour management” the output is usually different and not any more equally spaced for the four different grey scales.

But up to now there are still a lot of device systems which produce the intended grey series.

For the future this Technical Report supports on one side to use properties of “ICC or sRGB colour management”, for example to use Lookup tables of the ICC color management for a fast colour management. However, the general disadvantage of “ICC colour management” to produce in many cases different output for equivalent colorimetric data of the same colour stimuli shall be changed. If this change is realized in future then usually again backwards compatibility is reached compared to the time before 2002.

In application for any effective colour management method vendors of output devices must linearize the devices in *standard* CIELAB. Therefore the setup state is often a linearized stage. This is compatible with the time before 2002.

If a vendor or user **applies the linearization method** given in ISO/IEC TR 17797:2004 then the data *cmyn* (cmyk)* and *olv* (rgb)* produce approximately the intended relationship *cmyn* – LAB** or *olv* – LAB**.

If a vendor or user **applies a profile** which includes the linear relationship *cmyn* – LAB** or *olv* – LAB**, for example by a three dimensional Look-up Table, then this profile produces the intended relationship *cmyn* – LAB** or *olv* – LAB**.

Then it remains the goal to produce the same output for equivalent colorimetric data of the same stimuli.

There is a **basic difference** between the colour management method of RLAB *lab** (2005) and others used up to now:

The RLAB method is designed to produce for any device the *same relative (lab*)* reproduction data and **not** the same *standard* CIELAB data *LAB**. The RLAB goal of this Technical Report is a **relative** goal and can be reached on any device.The **relative** RLAB goal seems more natural because any visual colour appearance reproduction is to a high degree a **relative** reproduction, e. g. for the 16 step series White – Cyan blue on different devices.

Therefore the RLAB goal is different compared to most of the present colour management methods which favour the reproduction of *standard* CIELAB data *LAB** as the main option.

The usual **absolute** goal of the present colour management methods can often not be reached but there are exceptions: For example a special and expensive wide gamut monitor may be used for a soft-proof of all the standard offset output colours.

Relative Colour Image Technology (RCIT) and RLAB *lab** (2005) Colour Image Encoding

1. Scope

This Technical Report specifies the relation between the family of *standard* CIELAB data *LAB** and both the family of the *adapted* CIELAB data LAB^*_a and the family of the *relative* CIELAB data *lab**. The *relative* CIELAB data *lab** are called the RLAB *lab** (2005) data (R=relative) which are used for input-referred and output-referred encoding methods of colorimetric data. The encoding method shall be used for the digital exchange of RLAB *lab** (2005)-encoded colorimetric data.

The *relative* CIELAB data *lab** shall be calculated from the *adapted* CIELAB data LAB^*_a. The chroma adaptation method of ISO/IEC TR 24704 shall be used for the calculation of the *adapted* CIELAB data LAB^*_a. For any device colour a hue indexed integer table of 8 bit is available or shall be calculated which includes the lightness L^*_{Ma}, the radial chroma $C^*_{ab,Ma}$, and three $lab^*olv_{Ma} = olv^*_{Ma} = rgb^*_{Ma}$ data of the *adapted* Maximum colours M_a of the device. The application of the table produce a fast calculation for many equivalent *relative* CIELAB data *lab** in both directions for any device colour.

NOTE1 ISO/IEC TR 24704 has defined a method to shift both the device system black and white exactly to the achromatic axis which produces *adapted* CIELAB data LAB^*_a which show only very small changes compared to the *standard* CIELAB data *LAB**.

NOTE2 The RLAB *lab** (2005) data may be used for colour management. This Technical report does not specify any method for colour management but creates basic data for colour management, for example in Annex F.

NOTE3 The RLAB *lab** (2005) data used in this Technical Report for integer image encoding are only a subset of many equivalent *lab** data to be defined and calculated in floating point in a new project of ISO/IEC JTC1/SC28.

2. References

The following standards and specifications are referenced in this text.

CIE Publication 15: 2004, Colorimetry

EBU Tech. 3213-E: EBU standard for chromaticity tolerances for studio monitors

ICC Profile Format Specification, Version 3.4,1997

ICC.1:2004-10, File Format for Color Profiles

IEC 61966-2-1, Multimedia systems and equipment - Colour measurement and management - Part 2.1: Colour management in multimedia systems - Default RGB colour space - sRGB

ISO 22028-1:2004, Photography and graphic technology – Extended colour encodings for digital image storage, manipulation and interchange

ISO 3664:2000, Viewing conditions – Graphic technology and photograph

PDF Reference: Adobe Portable Document Format

ISO/DIS 15076-1:2005 “Image Technology - ICC Colour Management - Architecture, profile format, and data structure

DIN 33866-1 to 5:2000, Information technology – Office machines – Machines for colour image reproduction: Method for specifying image reproduction of colour devices by digital and analog test charts (100 pages)

NOTE This standard includes analog DIN-test charts no. 1 to 4 on offset reference paper.

Svensk Standard SS 01 91 00:1982, Colour notation system – SS 01 91 01:1982, CIE tristimulus values and trichromatic co-ordinates for some 16 000 colour notations according to SS 01 91 00 – SS 01 91 02:1982, Colour atlas – SS 01 91 02:1982, CIE tristimulus values and chromaticity co-ordinates for the colour samples in SS 01 91 02

ISO/IEC 15775:1999, Information technology – Office machines – Machines for colour image reproduction - Method of specifying image reproduction of colour copying machines by analog test charts – Realisation and application (50 pages).

NOTE There are 3 analog ISO/IEC-test charts no. 2 to 4 of JMBIA in Japan and similar of DIN.

ISO/IEC TR 19797:2004, Information technology - Device output of 16-step colour scales, output linearization method (LM) and specification of the reproduction properties, ISO/IEC JTC1/SC28 (21pages).

NOTE For an old public version of this document see the URL (21 pages, 280 kByte)

http://www.jbmia.or.jp/sc28/sc28docs/j28n656.zip

ISO/IEC TR 24705:2005, Method of specifying image reproduction of colour devices by digital and analog test charts, (79 pages).

NOTE For an old public version of this document see the URL (79 pages, 1.5 MByte)

http://www.jbmia.or.jp/sc28/sc28docs/j28n689.zip

NOTE see also the two white papers:

Richter, K. (2004), Natural colour connection space (NCCS) between input and output for office systems, International Seminar on Information Office Equipment Standardization, Korean Agency for Technology and Standards, pages 71-92, see the URL (1.4 MByte, 27 pages)

http://www.ps.bam.de/BAMAG1.PDF

Richter, K. (2005), Linear relationship between CIELAB and device coordinates for Colorimetric Image Technology (CIT), see the URL (140 kByte, 6 pages)

http://www.ps.bam.de/CIE05.PDF

3. Terms and definitions

The following terms and definitions are used in this document.

NOTE Most terms are derived from ISO 22028-1, CIE Publ. 17.4, and CIE Publ. 15.

Some preliminary remarks are appropriate about the use of the CIE standard illuminant D65 and the *standard* CIELAB colour space for the office applications of this Technical Report

NOTE The CIE standard illuminant D65 and the *standard* CIELAB colour space is appropriate for all devices in agreement with ISO/IEC 15775, ISO/IEC TR 19797:2004 and ISO/IEC TR 24705:2005

NOTE For a standard CRT monitor the *standard* CIELAB data a^* and b^* of both black and white are $a^*=b^*=0$ and the chromaticity of both black and white has the chromaticity of D65. If in an office the illuminant chromaticity is different from D65 then the ambient light reflection on the monitor surface or on projection screens produces *standard* CIELAB data a^* and b^* which differ from $a^*=b^*=0$ of both black and white much more compared to the tolerance of ISO/IEC 15775 (3 CIELAB).

NOTE For other standard and real devices the *standard* CIELAB data a^* and b^* of both black N and white W usually differ from $a^*_N = b^*_N = a^*_W = b^*_W = 0$. For example for standard offset printing ORS18 the offset reference paper under D65 (x = 0,3127, y = 0,3290) for both black and white serve as medium black and medium white. The *standard* CIELAB data a^* and b^* of both black and white are different from zero (for example $b^*_W = 4$ and $b^*_N = -1$) and the chromaticity of both is different from the chromaticity of D65.

NOTE For real devices usually the *standard* CIELAB data a^* and b^* are different from zero and then a chroma adaptation transform from $a^*\#0$ and $b^*\#0$ to $a^*_a = b^*_a = 0$ is appropriate. Any CIE chromatic adaptation formula can only make either $a^*=b^*=0$ for white or black. Therefore for chromatic adaptation of medium black and medium white and the whole grey series which are all accepted as achromatic the chroma adaptation method of ISO/IEC TR 24705:2005 is recommended in this Technical Report.

NOTE For measured reflective, emissive, transmissive and projection colours the *standard* CIELAB data L^*, a^*, b^* usually has to be adapted. This is indicated by an Index a (=adapted) for the *adapted* CIELAB data a^*_a and b^*_a. Lightness L^* is not changed by the chroma adaptation formula used in this Technical Report. In some application cases the corresponding tristimulus values X_a, $Y_a=Y$, Z_a and the chromaticity (x_a, y_a)are necessary and are calculated.

NOTE For emissive and projection colours the tristimulus value Y is normalized to the tristimulus value Y_W = 88,59 of standard offset paper. A similar normalisation to Y_W = 89.00 is used in ROM RGB (see ISO 22028-2:2005)

NOTE This Technical Report uses relative lightness $l^* = (L^*- L^*_N) / (L^*_W - L^*_N)$ as a basic coordinate with l^* values between 0 and 1. If colorimetry is considered then the similar normalization procedure $Y_{ICC} = (Y - Y_N) / (Y_W - Y_N)$ used in ICC colour management produces wrong results according to colorimetry for many applications. For example for luminous colours on projection screens the tristimulus value of black may be Y_N = 50 according to ISO/IEC TR 24705:2005 (if the normalization Y_W = 88.59 is used for the white screen). If the ICC method with the gamma function (exponent 1/2.2) is then applied to the normalized Y_{ICC} values between 0 and 1 a more then fold discrimination is calculated near Y_N = 50 compared to the real visual discrimination. The normalization of this Technical Report in lightness seems more appropriate compared to the definitions used in ICC colour management. No special ICCXYZ tristimulus values and ICCLAB CIELAB values normalized between 0 and 1 are necessary. In this Technical Report the *standard* or *adapted* CIEXYZ data and the *standard* or *adapted* CIELAB data are used.

3.1 colorimetric data

having an exact and simple relationship to the *standard* CIELAB data *LAB* = L*, a*, b*.*

NOTE1 There is a family of *standard* colorimetric data *LAB**, of *adapted* colorimetric data LAB^*_a, and of *relative* colorimetric data *lab**, compare the list below.

NOTE2 The family of *standard* colorimetric data *LAB** has two equivalent versions *LAB*LAB = L*, a*, b** and $LAB^*LCH = L^*, C_{ab}^*, H^*$

NOTE3 The family of *adapted* colorimetric data LAB^*_a has two equivalent versions $LAB^*LAB_a = L^*_a, a^*_a, b^*_a$ and $LAB^*LCH_a = L^*_a, C_{ab,a}^*, H^*_a$.

NOTE4 The *adapted* colorimetric data LAB^*_a have an exact and simple relationship to the *standard* CIELAB data *LAB**. The *adapted* lightness L^*_a is identical to the *standard* lightness *L**. For red-green, yellow-blue, and radial chroma there may be small differences between *adapted* and *standard* chroma, compare Table 1 and 2 and Annex A.

NOTE5 The family of *relative* colorimetric data *lab** has many equivalent versions, for example $lab^*lab = l^*, a^*_r, b^*_r$, *lab*lch = l*, c*, h**, *lab*nce = n*, c*, e**, and $lab^*cmy = c^*_3, m^*_3, y^*_3$. The *relative* colorimetric data *lab** have an exact and simple relationship to the *adapted* CIELAB data LAB^*_a.

NOTE6 Different colorimetric data *LAB*, LAB*a,* and *lab** including names and abbreviations are given in the following list. There are some more coordinates not used in the list, for example deepness *d**, brilliantness *i**, whiteness *w*,* compare Annex B for the definition and the relationship to LAB^*_a and *LAB**.

Colorimetric *standard* CIELAB data *LAB*, adapted* CIELAB data LAB^*_a, and *relative* CIELAB data *lab**

Name	Family	Family member	Type	Coordinate	Coordinate name
standard CIELAB	*LAB**	*LAB*LAB*	rectangular	*L* = LAB*L*	lightness
				a = LAB*A*	red-green chroma
				b = LAB*B*	yellow-blue chroma
		*LAB*LCH*	cylindric	*L* = LAB*L*	lightness
				$C^*_{ab} = LAB^*C$	radial chroma
				H = LAB*H*	hue angle
adapted (a) CIELAB	LAB^*_a	LAB^*LAB_a	rectangular	$L^*_a = LAB^*L_a$	adapted lightness
				$a^*_a = LAB^*A_a$	adapted red-green chroma
				$b^*_a = LAB^*B_a$	adapted yellow-blue chroma
		LAB^*LCH_a	cylindric	$L^*_a = LAB^*L_a$	adapted lightness
				$C^*_{ab,a} = LAB^*C_a$	adapted radial chroma
				$H^*_a = LAB^*H_a$	adapted hue angle
relative (r) CIELAB	*lab**	*lab*lab*	rectangular	*l* = lab*l*	relative lightness
				$a^*_r = lab^*a$	relative red-green chromaticness
				$b^*_r = lab^*b$	relative yellow-blue chromaticness
		*lab*lch*	cylindric	*l* = lab*l*	relative lightness
				c = lab*c*	relative chromaticness
				h = lab*h*	relative hue = H^*_a / 360
		*lab*tab*	rectangular	*t* = lab*t*	relative triangle lightness
				$a^*_r = lab^*a$	relative red-green chromaticness
				$b^*_r = lab^*b$	relative yellow-blue chromaticness
		*lab*tch*	cylindric	*t* = lab*t*	relative triangle lightness
				c = lab*c*	relative chromaticness
				h = lab*h*	relative hue = H^*_a / 360
		*lab*trj*	rectangular	*t* = lab*t*	relative triangle lightness
				r = lab*r*	relative elementary *rg*-chromaticness
				j = lab*j*	relative elementary *jb*-chromaticness
		*lab*tce*	cylindric	*t* = lab*t*	relative triangle lightness
				c = lab*c*	relative chromaticness

		$e^* = lab^*e$	relative elementary hue
*lab*nce*	triangle	$n^* = lab^*n$	relative blackness
		$c^* = lab^*c$	relative chromaticness
		$e^* = lab^*e$	relative elementary hue
*lab*olv = olv* = rgb**	rectangular	$o^*_3 = lab^*o_3$	relative orange-red (red)
		$l^*_3 = lab^*l_3$	relative leaf-green (green)
		$v^*_3 = lab^*v_3$	relative violet-blue (blue)
*lab*cmy= cmy**	rectangular	$c_3 = lab^*c_3$	relative cyan-blue
		$m^*_3 = lab^*m_3$	relative magenta-red
		$y^*_3 = lab^*y_3$	relative yellow

[see equivalent colorimetric data, isometric colorimetric data, isometric colorimetric space]

3.2 colorimetric data of eight adapted colours CMYOLVNW of a device system

adapted colorimetric data LAB^*_a of eight device system colours CMYOLVNW having an exact and simple relationship to the *standard* CIELAB data $LAB^* = L^*, a^*, b^*$ and the *relative* colorimetric data *lab*.*

NOTE1 For the observer who is *adapted* to the viewing environment and would judge both the device system color black N and the device system colour white W to be perfectly achromatic the *adapted* CIELAB data LAB^*_a of the color stimuli of eight colours CMYOLVNW are most appropriate.

NOTE2 The difference between the *standard* CIELAB data LAB^* and the *adapted* CIELAB data LAB^*_a may be identical or very small (less then 1%). The lightness of LAB^* and LAB^*_a is identical and therefore $L^* = L^*_a$.

NOTE3 The observer *adapted* CIELAB data LAB^*_a and the observer *adapted* tristimulus values $CIEXYZ_a$ are indicated by an index a.

NOTE4 For the eight medium colours CMYOLVNW of the Offset Reference System ORS18 the *adapted* CIELAB data LAB^*_a are given in Section 4.5, Table 1. For the colours of the device system black N and the device system white W the *adapted* CIELAB data are $a^*_{Na} = b^*_{Na} = a^*_{Wa} = b^*_{Wa} = 0$. For the colours of the device system ORS18 the colours black N and white W have the CIE lightness $L^*_N = 18{,}01$ and $L^*_W = 95{,}41$ which corresponds to the CIE tristimulus value $Y_N = 2{,}52$ and $Y_W = 88{,}59$.

NOTE5 For the device system ORS18 the difference between the *standard* colorimetric data and the *adapted* colorimetric data is given in Section 4.5, Table 1 and 2, and Annex A

3.3 colorimetric data of *adapted* Maximum colours M_a of a device system

adapted colorimetric data LAB^*_{Ma} of six chromatic colours of a device system in the sequence OYLCVM and *adapted* colorimetric data LAB^*_{Ma} of the *linear* mixture colours between the six adjacent device colour pairs OY, YL, LC, CV, VM, MO all having an exact and simple relationship to the *standard* CIELAB data $LAB^* = L^*, a^*, b^*$ and the *relative* colorimetric data *lab**

NOTE1 In Section 4.1, Fig. 1 shows for example a *linear* mixture in the *adapted* CIELAB space for the colours O and M and others.

NOTE2 The Maximum colours M_a of a device system form a continuous hue circle, for example of 96 steps if 16 steps are chosen between the six adjacent colour pairs OY, YL, LC, CV, VM, MO. Usually 255 steps (8 bit) are chosen for the hue circle of the Maximum colours M_a, compare Table C.1 in Annex C.

NOTE3 Different colorimetric data LAB^*_{Ma} including names and abbreviations are given in the following list.

Colorimetric *adapted* CIELAB data LAB^*_{Ma} of Maximum colours M_a of a device system

Name	Family	Family member	Type	Coordinate	Coordinate name
adapted (a) CIELAB	LAB^*_{Ma}	LAB^*LAB_{Ma}	rectangular	$L^*_{Ma} = LAB^*L_{Ma}$	adapted lightness
				$a^*_{Ma} = LAB^*A_{Ma}$	adapted red-green chroma
				$b^*_{Ma} = LAB^*B_{Ma}$	adapted yellow-blue chroma
		LAB^*LCH_{Ma}	cylindric	$L^*_{Ma} = LAB^*L_{Ma}$	adapted lightness
				$C^*_{ab,Ma} = LAB^*C_{ab,Ma}$	adapted radial chroma
				$H^*_{Ma} = LAB^*H_{Ma}$	adapted hue angle

NOTE5 Colorimetric data of the Maximum colours M_a of the device systems Television Luminous System TLSxx (xx=00, 06, 11, 18, 27,38, 52, 70) with TLS18 = TRS18 and the Offset Luminous System OLSxx (xx=00, 06, 11, 18, 27,38, 52, 70) with OLS18 = ORS18 are given in Annex A.Table D.1 gives many colorimetric data of the six basic colours of the device system ORS18.

3.4 colorimetric data of the device system surround

area adjacent to the border of an image, which, upon viewing the image in the viewing environment, may affect the local state of adaptation of the observer

NOTE1 The *standard* CIELAB lightness L^*_Z of the device system has a lightness in the middle between the lightness of the *standard* medium white and the *standard* medium black. The formula for the calculation of the standard grey surround lightness is $L^*_Z = L^*_N + 0{,}5\ (L^*_W - L^*_N)$, which gives the surround lightness L^*_z = + 18,01 + 0,5 (95,42 – 18,01) = 56,5 for example for the standard Offset Reflective System ORS18

NOTE2 The *standard* CIELAB chroma a^*_Z and b^*_Z data of the medium surround (Z) are in the middle between the *standard* CIELAB chroma data a^*_W and b^*_W of the medium white and the chroma data a^*_N and b^*_N of the medium black.The formula for the calculation of the medium chroma a^*_Z and b^*_Z of the grey surround are $a^*_Z = 0{,}5\ (a^*_W + a^*_N)$ and $b^*_Z = 0{,}5\ (b^*_W + b^*_N)$, which give for example the surround chroma a^*_z = 0,5 (-0,98 +0,50) = –0,24 and b^*_z = 0.5 (4,76 + (-0,46)) = 2,15 for the standard Offset Reflective System ORS18.

3.5 colorimetric data encoding

digital encoding of three colorimetric data, including the specification of a digital encoding method, and a colorimetric data range

NOTE1 Encoding data are usually the *relative* CIELAB data *lab**, for example *lab*olv = olv* = rgb** or *lab*cmy* = cmy*.* An integer or hex coding of 8 bit for the data range 0 <= *lab*olv = rgb** <=1 shall be used.

NOTE2 If for example the *relative* CIELAB data *lab*olv = rgb** are used for encoding then for the 8/8bit encoding method the black point is at 0, 0, 0 and the white point is at 1, 1, 1. For the 7/8bit encoding method the black point is at 0,25, 0,25, 0,25 and the white point is at 0,75, 0,75, 0,75. In both cases the data range is 0 <= *lab*olv = rgb** <=1.

3.6 colorimetric image encoding

digital encoding using three colorimetric data for a digital image

NOTE1 Usually for colorimetric image encoding the *relative* CIELAB data *lab** shall be used for encoding. Based on the exact and simple relationships between the different families of colorimetric data *LAB**, LAB^*_a and *lab** theoretically any set of data can be used if a software is available to interpret the encoded image data.

NOTE2 *Standard* software applications may use the *standard* CIELAB data *LAB** of the device colours CMYOLVNW (compare Annex A) to interpret the image data *rgb**, *cmy*, tch*, and nce** of the image encoding.

NOTE3 Other software applications may use the *standard* CIELAB data *LAB** of the device colours CMYOLVNW (compare Annex A) which are included as **metadata** in the file to interpret the data *rgb**, *cmy*, tch*, and nce** for the image encoding.

3.7 colorimetric space

geometric representation of colorimetric data in a color space, usually of three dimensions.

[compare CIE Publication 17.4, 845-03-25]

NOTE1: The colorimetric data may be of the type rectangular, for example *LAB*LAB = LAB**, $LAB^*LAB_a = LAB^*_a$, *lab*tab = tab** or of the type cylindric, for example *LAB*LCH = LCH*, $LAB^*LCH_a = LCH^*_a$,* or *lab*tch = tch**.

NOTE2 There is a family of the *standard* colorimetric space *LAB**, of the *adapted* colorimetric space LAB^*_a, and of the *relative* colorimetric space *lab**, compare Section 3.1.

NOTE3 The family of the *standard* colorimetric space *LAB** has a rectangular version *LAB*LAB = L*, a*, b** and a cylindric version $LAB^*LCH = L^*, C_{ab}^*, H^*$

NOTE4 The family of the *adapted* colorimetric space LAB^*_a has a rectangular version $LAB^*LAB_a = L^*_a, a^*_a, b^*_a$ and a cylindric version $LAB^*LCH_a = L^*_a, C_{ab,a}^*, H^*_a$.

NOTE5 The family of the *relative* colorimetric space *lab** has many rectangular versions for example *lab*tab = tab*,* and many cylindric versions, for example *lab*tch = tch**, compare section 3.1.

[see also isometric colorimetric space]

3.8 device dependent ambient flare

ambient light, reflected from an imaging device system, that has not been modulated by the means used to produce the image

[see CIE Publication 122]

NOTE1 Ambient flare lightens all colours, for example luminous colours on a projection screen or on a monitor, and reduces the lightness contrast and the luminance contrast.

NOTE2 See also the different luminous device colours in Annex A, Table A.1 and A.2

3.9 device dependent image state

attribute of a colorimetric data image encoding indicating the rendering state of the colorimetric data of the image using device dependent colorimetric data *lab**.

NOTE1 The rendering state may be input referred, output referred, relative referred, and *rgb* default referred.

NOTE2 The rendering state is **input referred** if the colorimetric data $CMYOLVNW_{input}$ has been used for encoding, for example in $lab^*olv_{input} = olv^*_{input} = rgb^*_{input}$.

NOTE3 The rendering state is **output referred** if the colorimetric data $CMYOLVNW_{output}$ has been used for encoding, for example in $lab^*olv_{output} = olv^*_{output} = rgb^*_{output}$.

NOTE4 The rendering state is ***rgb*** *(NOTE: without star)* **specified,** if for example sRGB or *Adobe* RGB (1998) has been used for encoding. Then three known primary colours has been used for encoding.

NOTE5 The rendering state is ***rgb*** *(NOTE: without star)* **unspecified**, if undefined *rgb* data in the range zero to one are given.

3.10 device dependent image state re-rendering

attribute of a colorimetric data image encoding indicating the intended re-rendering state of the colorimetric data of the image using device dependent colorimetric data *lab**.

NOTE1: For re-rendering for an output device the following options are possible:

1. The rendering state is **input referred** and the colorimetric data $CMYOLVNW_{input}$ has been used for encoding in $lab^*olv_{input} = olv^*_{input} = rgb^*_{input}$. For output on the output device with $CMYOLVNW_{output}$ the following two steps are necessary, compare Section 8, Fig. 6, 7, 8, and 13:

   1.1. a transfer from lab^*olv_{input} to lab^*tch_{input} with $CMYOLVNW_{input}$

   1.2. a transfer from lab^*tch_{output} to lab^*olv_{output} with $CMYOLVNW_{output}$

   By default $lab^*tch_{input} = lab^*tch_{output}$

2. The rendering state is **output referred** and the colorimetric data $CMYOLVNW_{outputx}$ has been used for encoding in $lab^*olv_{outputx} = olv^*_{oupuxt} = rgb^*_{outputx}$. For output on the output device with $CMYOLVNW_{output}$ the following two steps are necessary:

   2.1. a transfer from $lab^*olv_{outputx}$ to $lab^*tch_{outputx}$ with $CMYOLVNW_{outputx}$

   2.2 a transfer from lab^*tch_{output} to lab^*olv_{output} with $CMYOLVNW_{output}$

   By default $lab^*tch_{outputx} = lab^*tch_{output}$

3. The rendering state is ***rgb*** *(NOTE: without star)* **specified,** if for example sRGB or *Adobe* RGB (1998) has been used for encoding. Then three known primary colours *OLV* = *RGB* has been used for encoding. The missing 5 colours CMYNW can be calculated.

   2.1. a transfer from rgb_{input} to lab^*tch_{input} with given or calculated $CMYOLVNW_{input}$

   2.2 a transfer from lab^*tch_{output} to lab^*olv_{output} with $CMYOLVNW_{output}$

   By default $lab^*tch_{input} = lab^*tch_{output}$

4. The rendering state is ***rgb*** *(NOTE: without star)* **unspecified** if no colorimetric data $CMYOLVNW_{input}$ or $CMYOLVNW_{output}$ has been given for encoding for the undefined *rgb* data in the range zero to one. The device system may use the colorimetric $CMYOLVNW_{input} = CMYOLVNW_{output}$ data of its own device as default. Then no change of the *rgb* data is done and they are interpreted as $lab^*olv = rgb^*$. This produces a linearized output according to ISO/IEC TR 19797 with visually equally spaced 16 step colour series, if the device in linearized.

3.11 device system

includes all software and hardware properties for the device output including the viewing environment which may change the luminous colours on projections screens in offices.

3.12 equivalent colorimetric data

of the same colour stimuli having an exact and simple relationship to the same *standard* CIELAB data *LAB* = L*, a*, b**.

NOTE1 For the same colour stimuli the family of *standard* colorimetric data *LAB**, the family of *adapted* colorimetric data LAB^*_a, and the family of *relative* colorimetric data *lab** allows to calculate many equivalent sets of colorimetric data

NOTE2: A user expects that the device output is the same for equivalent colorimetric data. Different compatibility classes allow to deteermin if this intention is reached for the different device systems, see Section 7.2, Fig. 10.

[see also colorimetric data]

3.13 ICC profile

International Color Consortium's file format, used to store transforms from one colorimetric data encoding to another, e.g. from device colorimetric data to the device independent CIEXYZ data of the profile connection space, as part of a color management system.

[see also ISO/DIS 15706-1:2005]

3.14 International Color Consortium profile connection space (ICC PCS)

standard color image encoding defined by the International Color Consortium providing a standard connection point for combining ICC profiles.

[see also ISO/DIS 15706-1:2005]

3.15 isometric colorimetric data

relative CIELAB data *lab*tab* or *lab*tch* for which the calculated colorimetric data differences correlate to a high degree to *relative* visual differences for any device system.

[see colorimetric data, see isometric colorimetric space and gamut]

3.16 isometric colorimetric space

geometric representation of *relative* CIELAB data *lab*tab* or *lab*tch* in a colour space, where the differences in the space correlate to a high degree to the *relative* visual differences for any device system.

NOTE1 This space is to a high degree perceptually isometric and shows a high degree of visual uniformity.

NOTE2 If the coordinates *lab*t, lab*c,* and *lab*h* are used, then the three dimensional visual representation of the 16 step colour series between White W or Black N and the six chromatic colours is a colour double cone called the Natural Colour Connection Space (NCCS).

NOTE3 The colorimetric data *lab*t* in the range 0 to 1 are used for the vertical axis and the colorimetric data *lab*c* in the range 0 to 1 are used for the horizontal axis for any device. For the 16 step colour series equal visual steps correspond to equal geometric steps.

NOTE4 The *standard* CIELAB *LAB** colour space, the *Natural Colour Space* of the *NCS* colour system, and the *relative* CIELAB *lab*tab* or *lab*tch* colour space are more perceptually isometric (visual uniform) compared to the CIEXYZ colour space.

[see colorimetric data, see isometric colorimetric data, and gamut]

3.17 isometric colorimetric device gamut

area in the *relative* CIELAB *lab** colour space defined by the colorimetric data *lab*tab* or *lab*tch* of all device colours.

NOTE1 In the *lab*tch* colour space all colorimetric data of the device form approximately a colour double cone. For some hues there may be some colours outside the mathematical double cone and for other hues there may be some space inside the mathematical double cone.

NOTE2 The isometric colorimetric device gamut is different compared to the isometric colorimetric space which is an exact mathematical double cone

[see colorimetric data, see isometric colorimetric data, and space]

3.18 luminance factor

ratio of the luminance of the surface element in the given direction to that of a perfect reflecting or transmitting diffuser identically illuminated.

[CIE Publication 17.4, 845-04-69]

3.19 metadata

data associated with a digital image aside from the pixel values that comprise the digital image.

NOTE1 Metadata is typically stored as tags in the digital image file.

NOTE2 How to store the colorimetric data of CMYOLVNW, of the 14 CIE-test colours, and of the 4 elementary colours RJGB in an ICC profiles is not specified up to now.

NOTE3 If no metadata are given with the image or the graphics, then for *rgb** data the colorimetric data of the television device system TLS18 and for *cmy** data the colorimetric data of the device system ORS18 may be used.

3.20 Natural Color Connection Space (NCCS)

geometric representation of colorimetric data in a space defined by one set out of many sets of three *relative* CIELAB data *lab*.*

NOTE1 The two sets of colorimetric data *lab*tab* or *lab*tch* are used for a visual view in a double cone.

NOTE2 The two sets of colorimetric data *lab*olv* or *lab*cmy* are used for the encoding of images.

[see also colorimetric data]

3.21 recommended colorimetric image encoding

digital encoding of three colorimetric data used in a digital image, usually one set out of the following five sets of *relative* CIELAB data *lab**: *lab*olv = olv* = rgb*, lab*cmy = cmy*, lab*tch = tch*, *lab*nch = nch*, and lab*nce = nce*.*

NOTE1 In this Technical Report for compatibility reasons most of the software products use a *specified* or *unspecified rgb* encoding. The recommended image encodings of this Technical Report prefer the colorimetric data *lab*olv = olv* = rgb*,* and *lab*cmy = cmy*.*

NOTE2 In this Technical report the recommended image encodings for rendering and re-rendering use the colorimetric data *lab*tch = tch*, *lab*nch = nch*, and lab*nce = nce*,* often as intermediate encodings during the rendering process.

[see also: colorimetric gamut, colorimetric image encoding]

3.22 reference black N and white W

equal to the *adapted* black N and *adapted* white W with the colorimetric data LAB^*_{Na} and LAB^*_{Wa}.

NOTE1 The reference black and white has always the chroma values $a^*_{Na} = b^*_{Na} = a^*_{Wa} = b^*_{Wa} = 0$

NOTE2 For *reflective* colours the medium white and black are measured for CIE standard illuminant D65. The CIE tristimulus values Y_N and Y_W shall be used for the reference Black N and White W.

NOTE3 For *luminous* colours the medium white and black are measured for CIE standard illuminant D65. The CIE tristimulus values $Y_W = 88{,}59$ of the Offset Reflective System ORS18 shall be used for the reference White W. The reference black is usually different compared to the Offset Reflective System ORS18. The tristimulus value must be measured and may be in the range $Y_N = 0.2$ to $Y_N = 50$.

[see colorimetric data of eight adapted colours CMYOLVNW of a device system]

3.23 relative colour management

re-rendering of the relative CIELAB data *lab** of the image state, for example of the relative colorimetric data *lab*olv = rgb** using CMYOLVNW_{input} and/or CMYOLVNV_{output} *adapted* CIELAB data LAB^*_a and intended modifications of the intermediate *relative* CIELAB *lab** data, for example *lab*tch* for constant blackness *lab*n* = ***n**** and an intended increase or decrease of chromaticness *tab*c* = ***c****, and a change of hue *tab*h* = ***h****.*

NOTE1 For constant blackness ***n**** an increase and decrease of chromaticness *tab*c* = ***c**** and a clockwise and a anticlockwise shift of hue *tab*h* = ***h**** is shown in Annex B, Table B.1.

NOTE2 For different re-rendering intents a colorimetric coordinate transfer of *lab*tch* is most appropriate.

3.24 standard colorimetric data

the three rectangular *standard* CIELAB data *L*, a*, b* (= LAB*)* or the cylindric *standard* CIELAB data *L**, C^*_{ab} *H* (= LCH*)*

NOTE1: For the relationship between the *standard,* the *adapted*, and the *relative* CIELAB data *LAB**, LAB^*_a, and *lab** see Annex B.

3.25 *standard* colorimetric data of device system colours CMYOLVNW

standard CIELAB data *LAB** of color stimuli of eight colours CMYOLVNW in the viewing environment including the device system colour black N and the device system colour white W.

NOTE1 The *standard* CIELAB data *LAB** and the *standard* tristimulus values CIEXYZ are measured according to CIE publication 15:2004. Therefore viewing flare is included in the measurements

NOTE2 For the eight medium colours of the Offset Reference System ORS18 the *standard* CIELAB data *LAB** are given in Section 4.5, Table 1 for the colours CMYOLVNW. For the colours of the medium black N and the medium white W the *standard* CIELAB data a^*_N, b^*_N, a^*_W, and b^*_W are usually **not** zero. For the colours of medium black N and medium white W the CIE lightness is L^*_N = 18,01 and L^*_W = 95,41 which corresponds to the CIE tristimulus value Y_N = 2,52 and Y_W = 88,59.

NOTE3 In an office for colour control an illuminance of 1000 lux is recommended according to CIE Publ.XX. This corresponds to a luminance of 284 cd/m^2 (=1000 * 0,8859 / 0,314) of the white paper. Modern CRT and LCD monitors and projection screen have a similar luminance which is usually in the range between 100 and 400 cd/m^2.

NOTE4 It is known that colour discrimination increases only a few percent if the luminance increases from 100 to 400 cd/m^2. Therefore it is appropriate to normalize the tristimulus value Y_W of the luminous white colours for all devices to the same value. This allows to calculate *standard* CIELAB differences between the softcopy output on monitors or screens and the hardcopy output in offset printing or on printers

NOTE5 For the difference of the device independent standard colorimetric data and the device dependent adapted colorimetric data compare Section 4.5, Table 1 and 2, and Annex A.

[see also colorimetric data, colorimetric data of device system colours CMYOLVNW]

3.26 *standard* CIELAB *LAB** space

geometric representation of colors in a three dimensional space defined by the three rectangular *standard* CIELAB data lightness *L**, red-green chroma *a** and yellow-blue chroma *b** or the three cylindric *standard* CIELAB data lightness *L**, radial chroma C^*_{ab} and hue angle *H**

NOTE1 For reflective colours the *standard* CIELAB data shall be L^*_W, a^*_W, b^*_W = 100, 0, 0 for the perfect diffuser and L^*_N, a^*_N, b^*_N = 0, 0, 0 for the perfect absorber.

NOTE2 For a real reflective device system the lightness L^*_W is less than 100 and the lightness L^*_N is larger than zero, for example for the Offset Reflective System ORS18 it is L^*_W = 95,41 and L^*_N = 18,01. All four chroma data a^*_W, b^*_w and a^*_N, b^*_N are usually different from zero and therefore the chroma data shall be adapted by a chroma adaptation formula.

NOTE3 For the Offset Reflective System ORS18 the *standard* and *adapted* CIELAB data *LAB** and LAB^*_a are given in Annex A, Table A.3.

NOTE4 For luminous and emissive colours the standard CIELAB data *LAB** are measured and the *adapted* CIELAB data LAB^*_a shall be normalized for white and black to the data L^*_W, a^*_{Wa}, b^*_{Wa} = 95,41, 0, 0 and L^*_N, a^*_{Na}, b^*_{Na} = X, 0, 0 in the reference condition.

NOTE5 The lightness L^*_N = X =18,01 shall be used if the exact value is unknown. For appropriate applications the tristimulus value Y_N shall be measured and the lightness L^*_N shall be calculated. For luminous colours on projection screens the tristimulus value Y_N may be in the range 0,2 to 50, which corresponds to the lightness L^*_N in the range 2 to 70.

[see also colorimetric data]

3.27 tristimulus value

amounts of the three reference color stimuli, in a given trichromatic system, required to match the color of the stimulus considered

[CIE Publication 17.4, 845-03-22]

[see also colorimetric data]

4. Requirements

4.1 General

The RLAB *lab** (2005) color image encoding is defined as an encoding of the *relative* CIELAB data *lab** of an image.

A *relative* CIELAB data *lab** is calculated using both the *standard* CIELAB data *LAB** of the color and of the eight basic colours CMYOLVNW of a device, all measured in a given viewing environment.

Annex A shows for many device systems the *standard* CIELAB data *LAB** and *adapted* CIELAB data LAB^*_a.

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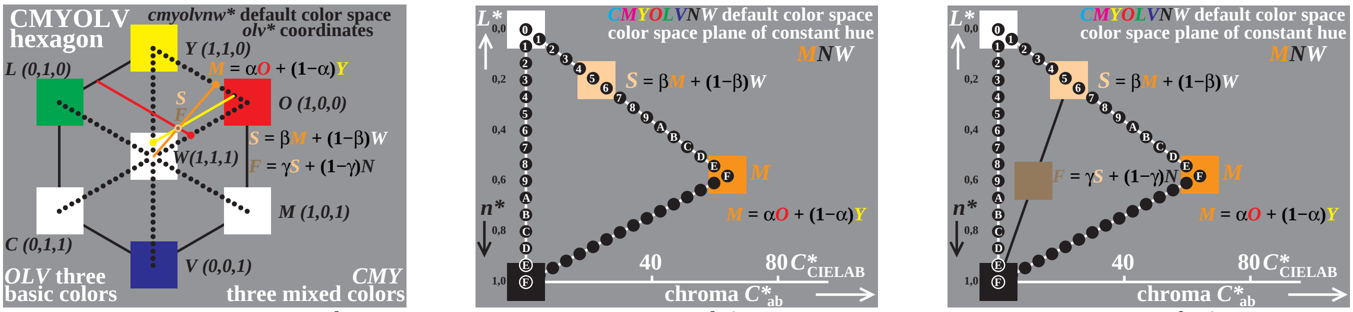


ME310−1, Colorimetric linear hexagon mixture α, β, γ

ME310−2, Hue constant mixture α, β of O-Y, W-M

ME310−3, Hue constant mixture α,β,γ of O-Y, W-M, S-N

Figure 1: Six chromatic colours OYLCVM in a continues hue circle.

Fig. 1 shows for a special regular device the six chromatic colours OYLCVM in a continues hue circle. A linear mixture by parameters α, β, γ is assumed in the *adapted* CIELAB space with the *adapted* CIELAB data LCH^*_a. Then the *relative* CIELAB data *lab** can be calculated. There is a linear mixture of the colours O (orange-red) and Yellow Y (left) by the parameter α and of M and W (middle) by the parameters β, and of S and N (right) by the parameter γ. The hue is assumed to be constant and between orange-red and yellow.

The *relative* CIELAB data *lab** are calculated from the *standard* CIELAB data *LAB**. Special *relative* CIELAB data *lab*olv = olv* = rgb** or *lab*cmy = cmy** produce a high efficiency for encoding, visual uniformity and compression.

The following user requirements are realized

1. to maintain equal spacing of the equally spaced 16 step colour series, see ISO/IEC TR 24705, on any device
2. to maintain relative hue
3. to maintain relative chromaticness of the equally spaced 16 step colour series
4. to maintain relative lightness of the equally spaced 16 step colour series

Appropriate relative colorimetric data are the *relative* CIELAB data *lab*tch* with the three colorimetric data

t = lab*t* triangle lightness

c = lab*c* relative chromaticness

h = lab*h* relative hue

Therefore the basic requirement between input and output is

$lab^*tch_{input} = lab^*tch_{output}$

A solution of the requirement is possible if the *standard* CIELAB data *LAB** of the eight basic colours CMYOLVNW of both for input ant output are known.

NOTE1 The *standard* CIELAB data *LAB** can be reproduced exactly only if no change occurs between input and output of both the physical device and the given viewing environment. However there are so many physical devices and viewing environments that the reproduction of the *standard* CIELAB data *LAB** is usually not possible. There are so many strategies, compromises and approximations which therefore often produce confusion and unacceptable results.

4.2 Reference Viewing Environment

4.2.1 Luminance range and CIE tristimulus value *Y*

The actual viewing conditions for reflective and transmissive colours, for colour monitors and for example luminous colours on a projection screen in an office are all in a similar luminance range. This luminance range is specified by CIE publication XX. The luminance of outdoor scenes may be also in this range but often it may be outside this range. In any case the CIE methods for normalisation with the CIE tristimulus values Y = 100 for the perfect diffuser will be used in this Technical Report.

NOTE1 For office work places CIE Publication XX recommends 500 lux and in case of colour control 1000 lux. The illuminance of 500 lux corresponds to a luminance of 160 (= 500/3,14) cd/m^2 and 1000 lux corresponds to 320 cd/m^2 for the perfect diffuser. For the reference standard offset paper with the CIE tristimulus value Y = 89,59 and the *standard* CIELAB lightness L^* = 95,41 both luminance correspond to 142 cd/m^2 to 284 cd/m^2.

NOTE2 If for example the white projection screen has the luminance of 160 cd/m^2 in a dark room and (in a worst case which is allowed by ergonomic requirements) the luminance of 160 cd/m^2 is added by daylight in the office, then the luminance of black and white are 160cd/m^2 and 320cd/m^2. If the chromaticity of the projector and the office daylight is D65 then the chromaticity is for both D65 and the CIE tristimulus values for white and black are Y_W = 88,59 and Y_N = 44,29 (=88,59/2). This corresponds to the CIE lightness L^*_W = 95.41 and L^*_N = 7X.XX.

4.2.2 CIE standard illuminant D65 and CIE chromaticity *(x, y)* of D65

In different applications one can find recommendations for both the CIE standard illuminant D65 and the CIE illuminant D50. For monitors and projectors the CIE standard illuminant D65 and the chromaticity of D65 is used for both the white and black medium colour. Photography (ISO TC 142) and professional graphics (ISO TC 130) prefer D50 and ISO/IEC JTC1/SC28 has accepted D65 in ISO/IEC 15775 for colour copiers and D65 for all devices in ISO/IEC TR 24705.

Within this Technical Report D65 is recommended but the methods can be applied also for D50. There are many scientific reason to use D65:

1. The CIE standard illuminant is D65. D50 is not a CIE standard illuminant.
2. Colorimetric colour order systems are defined for D65 and not for D50
3. CIE studies on colour difference formulas are nearly all for D65 and not for D50
4. In offices a D65 projector and a D50 illuminant produce large chromaticity differences for white and black
5. In offices a D65 monitor and a D50 reflection test chart are hard to compare.
6. There are no CIE recommendations to how to handle chromatic adaptation for the very different black and white chromaticity in the above cases

4.2.3 Device dependent reference black and white

The device dependent reference black and white shall be equal to the device dependent *adapted* black and white of the Offset Reflective System ORS18a, with the chromaticity *(x, y)* of CIE standard illuminant D65 and the CIE tristimulus values Y_N = 2.52 for black N and Y_W = 89.59 for white W.

For the black and white reference colour the chromaticity data shall be x = 0,3127, y = 0,3290.

The adapted white is equal to the reference white. The adapted black may be different compared to the reference black. For office applications the luminance factor of adapted black may be in the range Y_N = 0.2 to Y_N = 50.

The luminance level of a perfect diffuser is in the range 160 cd/m^2 to 320 cd/m^2 for the office illuminance range between 500 lux and 1000 lux. Both illuminance values are specified in CIE Publication XX and the higher value is intended for color control.

The luminance level of the white standard offset reference paper with the CIE tristimulus value Y = 88,59 is then in the range 142 cd/m^2 to 284 cd/m^2

The luminance level of the black standard offset reference paper with the CIE tristimulus value Y = 2,52 is then in the range 4 cd/m^2 to 8 cd/m^2.

The CIE lightness of reference black and white is L^*_N = 18,01 and L^*_N = 95,41 and these are calculated from the CIE tristimulus values Y_N = 2.52 for black N and Y_W = 89.59 for white W.

Usually for luminous colours the luminance ratio of the black and white colour

$$c_Y = L_N / L_W$$

is used to calculate the CIE tristimulus value of black which is

$$Y_N = c_Y Y_W$$

Most monitors have the property to reflect between 2% and 4% of all wavelengths of the incident light. This reflection property is similar to the reflection property of paper which reflects about 2% for glossy and 4% for mate paper. In the office the luminance of the incident light is in the same range compared to the monitor luminance (160 cd/m^2 to 320 cd/m^2). Therefore it is appropriate to use the CIE tristimulus value of the standard offset reference paper Y_N = 2,52 as reference for the calculations in the case when the exact value is not known.

In an office with daylight and for luminous colours on projection screens the CIE tristimulus value may be in the range $Y_N = 0.2$ to $Y_N = 50$. In the case when the exact value is not known the value $Y_N = 2{,}52$ shall be used as reference.

4.2.4 CIE luminance and CIE lightness contrast ratio

The luminance contrast ratio c_Y shall be the ratio of the tristimulus values of the reference white and black

$$c_Y = Y_W / Y_N = 35$$

The lightness contrast ratio c_{L^*} shall be the ratio of the CIE lightness values of the reference white and black

$$c_{L^*} = L^*_W / L^*_N = 3.5$$

NOTE1 In an office with daylight and for luminous colours on projection screens the luminous contrast ratio may be in the range $c_Y = 200$ to $c_Y = 2$.

NOTE2 The luminous ratio $c_Y = 380$ used in graphic arts and in ICC colour management is far outside the office application range. The use of this luminance ratio may produce problems if applied to office applications, for example a specific color re-rendering may be necessary to avoid scaling problems near the black colour.

4.2.5 Adapted colorimetric black and white

For the colours of the device dependent black N and white W the *standard* CIELAB data a^*_N, b^*_N, a^*_W, and b^*_W are usually **not** zero. The *standard* CIELAB data a^*_{Na}, b^*_{Na}, a^*_{Wa}, and b^*_{Wa} of the device dependent adapted colorimetric black and white data shall be all zero.

The equations for the transfer between the *standard* CIELAB data LAB^* and the *adapted* CIELAB data LAB^*_a in both directions of Annex A shall be used

4.2.6 Ambient Illumination and reference surround

The ambient illuminance shall be in the range 500 lux to 1000 lux with the chromaticity of CIE standard illuminant D65. A mean grey colour with a CIE tristimulus value $Y_Z = 20$ shall be used as reference surround.

NOTE The ICC specifications ISO DIS 15706-1 recommend for display output in graphic applications:

"when measured, with the monitor turned off, at the monitor surface,
the ambient illumination level shall be equal to 32 lux".

This is not appropriate for the office application. With an illuminance of 32 lux instead of 500 lux it is not possible to produce the mean grey reference surround with a CIE tristimulus value $Y_Z = 20$. With 32 lux illumination the surround near the image needs to be emissive. The illuminance must be near 500 lux and not 15 times less to produce visually the intended mean grey reference surround. The specification of ICC DIS 15706-1 needs an expensive technology for viewing.

NOTE For luminous colours on projection screens the reference surround is defined by the reflection of the daylight on the wider screen in the office. If this wider screen has the same white colour as the screen, then the office daylight will simulate a 20% reflection if the final luminance contrast is $c_Y = 5$. Then the luminance of the daylight on the screen shall be four times less compared to the luminance produced by the projector.

4.2.7 Image Size and Viewing Distance

For displays the normal to the center of the display surface shall be the viewer's direction of gaze. The viewing distance shall be equal to the image diagonal, or longest chord.

NOTE From the viewer's position, the image extends 27 degrees from the normal to the display surface.

For reflective ISO/IEC-test charts, which are produced in A4 size, the viewing distance shall be 50 cm. This is similar to the viewing distance of most displays and facilitate comparisons.

4.2.8 Glare

The ambient flare in the reference viewing environment shall be included in all reflective, display and projection colours. If for displays the measurement is done from the viewer position in the reference viewing environment then no problem is expected.

NOTE When positioning a display in a viewing environment, it is important to arrange the ambient lighting so that direct reflections off the display surface, as seen from the viewer position, are avoided. This can usually be achieved by placing ambient light sources at an angle of at least 45 degrees relative to the normal to the display surface, which is assumed to be the viewer's direction of gaze.

4.2.9 Measurements

For measurement of reflective and transmissive colours the appropriate CIE procedure according to CIE Publication

15:2004 shall be used.

All illuminance or luminance measurements shall be made with a photometer having the spectral sensitivity of the CIE standard photopic photometric observer, V(λ), and measuring an area having a diameter no greater than 1/20 of the shortest linear dimension of the illuminated surface area.

All chromaticity values shall be based on the CIE 1931 two-degree standard observer. See CIE Publication 15:2004

Display measurements shall be performed in the reference viewing environment.

The use of a telespectroradiometer or a telecolorimeter for display measurement from the viewer position is recommended, as they include allowance for any ambient flare present, and therefore provide an accurate representation of the color as perceived by the viewer. Where such instruments are not available, and measurements are made in contact with the face of the display, the ambient flare should be measured from the viewer position and used to correct the measurement data obtained.

NOTE 1 Care should be taken when making measurements of displays to ensure that the sampling frequency, or integration time, of the instrument used is synchronized with the frequency of scanning of the display. If not, at least 10 measurements should be taken and averaged.

4.3 *Relative* CIELAB data *rgb** and linear relationship to *standard* CIELAB data *LAB**

This Technical Report use *relative* CIELAB data *lab** for encoding and decoding of images.

If *relative* CIELAB data *lab** are used then there is the option to use different equivalent colorimetric data, for example the data *lab*olv = rgb*, lab*cmy = cmy0*, lab*tch = tch*, lab*nce = nce** and others. All these colorimetric data have three components in the range zero to one and they are therefore all appropriate for colour image encoding.

One of the *relative* CIELAB data *lab* lab*olv = rgb** looks in a first step similar to the different *rgb* coordinates used up to now for colour image encoding and in colour management. The *rgb** data of this Technical Report have a well defined relationship to the *standard* CIELAB data *LAB** of colour measurement similar as the *rgb* data of the sRGB colour space or the *rgb* data of the Adobe RGB (1998) colour space.

Therefore a mathematical transformation exits between the colorimetric *rgb** data of this Technical Report and the different other colorimetric *rgb* data. However, there is a **linear relationship of the *rgb** data and the *standard* CIELAB *LAB** data** for visually equally spaced 16 step colour scales of the ISO/IEC-test charts according to ISO/IEC 15775 and ISO/IEC TR 24705.

The **linear relationship is required by many users** and has for example the advantage that a colour with the relative data *rgb** = [0,5, 0,5, 0,5] is located in *standard* CIELAB space and visually in the middle between black with data *rgb** = [0,0, 0,0, 0,0] and white with the data *rgb** = [1,0, 1,0, 1,0]. This is approximately true also for the *rgb* data of the sRGB colour space or the *rgb* data of the Adobe RGB (1998) colour space.

According to this Technical Report this is also true for all 16 step series between White or Black and the six chromatic colours CMYOLV. For example a light Cyan blue with the data *rgb** = [0.5, 1,0, 1,0] is located visually in the middle between White with the data *rgb** = [1,0, 1,0, 1,0] and Cyan blue with the data *rgb** = [0,0, 1,0, 1,0].

In that case the *rgb* data of the sRGB colour space **vary by a factor eight** for the 16 step series White – Cyan blue of the ISO/IEC-test charts. Therefore the *rgb** colour space is **much more isomeric.** This property is of large importance for many image technology application, for example for an effective encoding, decoding, compression, and decompression.

Calculation in rgb* and cmy*, Table X with data.

4.4 Relative colorimetric Colour Management between input and output

In both the *standard* CIEXYZ and *standard* CIELAB color spaces the colour gamut changes for every device to a large amount, for example by a factor 9 in *standard* CIELAB space for images on projection screens in offices, compare Annex C.

In the *lab*tab* color space the colour gamut for every device is approximately the same. The device gamut is a circular based double cone with a vertical axis of unity and a radius of unity. There is a mapping of colours from the *lab*tab* colour space to the device independent *standard CIELAB* colour space in both directions.

Therefore a mapping from any input space via the *lab*tab* space to any output space is possible.

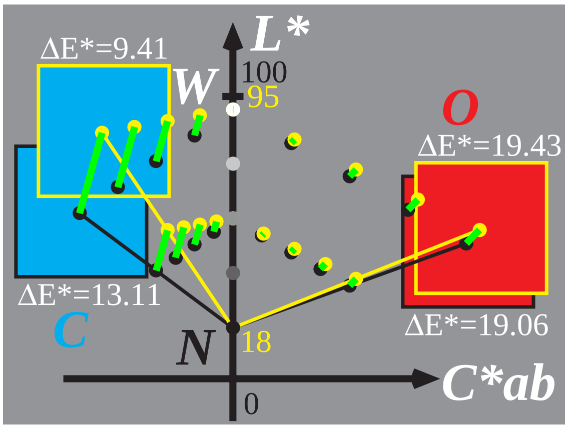
Additionally a mapping from the *lab*tab* space to different output spaces for different viewing conditions is possible

This includes a mapping from the *lab*tab* space to different output illuminants, for example D65 and D50.

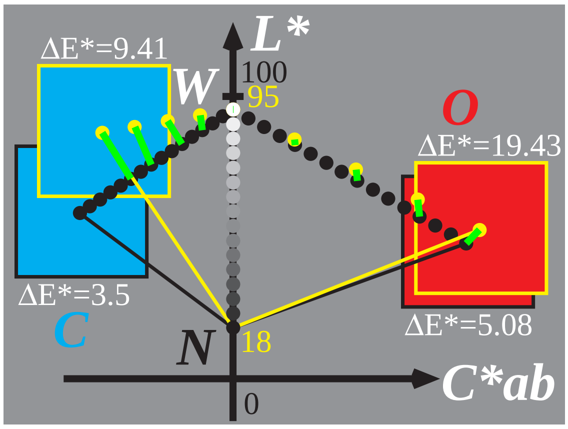
In all cases it is necessary to measure or to calculate the *standard* CIELAB data *LAB** of the eight basic colours CMYOLVNW.

If for example these data come as metadata with the image, then any mapping between any input and any output is possible.

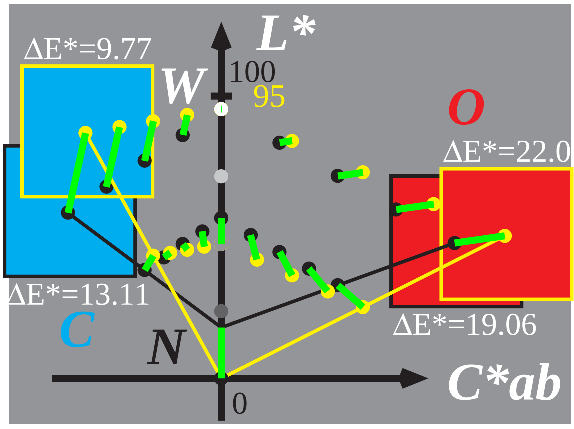
This mapping will remain the *relative* CIELAB data *lab*tab* and will of course change the *standard CIELAB* data *LAB** between input and output which is shown in the following figure.



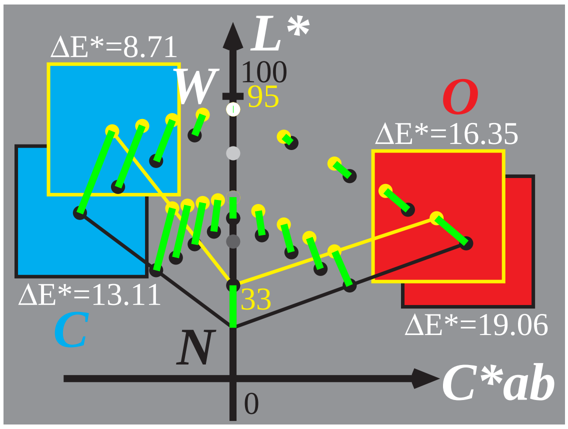
ME321−4, Colour management of hues O-C; TV18 <-> PR18



ME320−6, Colour management of hues O-C; TV18 -> PR18



ME330−4, Colour management of hues O-C; TV00 <-> PR18



ME331−4, Colour management of hues O-C; TV33 <-> PR18

Figure 2: Mapping of 5 step colour series in the *standard* CIELAB colour space

Fig. 2 shows the mapping of 5 step colour series in the *standard* CIELAB colour space from the actual television systems TV18, TV00 and TV33 to the printer system PR18.

The strategy by ICC colour management for the mapping is not defined and proprietary. In more than 50% of the cases the output is like in the upper right figure. The mapping is not only for the “ICC absolute rendering method” but also for the “ICC relative rendering method” in the direction of the lowest colour difference in *standard* CIELAB. Then most of the available output space of the printer is not used and for light cyan colours many different colours produce the same output colours.

The RLAB lab* (2005) colour space uses *relative* CIELAB data *lab** which appear in different modifications, for example as *lab*tab, lab*tch, lab*olv = rgb*.*

In this Technical report there are clear, simple and effective rendering methods shown in Fig. 2, which are based on the colorimetric definition of the *relative* CIELAB data *lab**.

4.5 *Standard* CIELAB data *LAB** of standard device colours CMYOLVNW

The RLAB *lab** (2005) color space is a *relative* CIELAB color space defined by a colour and a set of eight basic device colours. The *standard* CIELAB data *LAB** for the eight standard offset device colours and the eight standard monitor colours are given in the following tables. The colours white and black of this set define the medium white colour and the medium black colour.

The medium white and medium black colours are assumed to appear achromatic in the viewing environment. If at least one of the *standard* CIELAB data *a** and *b** of white or black are different form zero then a chroma adaptation (a = adaptation) formula shall transfer to $a^*_{Na} = b^*_{Na} = a^*_{Wa} = b^*_{Wa} = 0$ before colour image encoding is started.

4.5.1 Colorimetric data for eight basic device colours of offset and television

The *standard* CIELAB data for the eight standard offset device colours and the eight standard monitor colours are given in the following tables.

For the white colour the CIE tristimulus value is Y_W = 88,59 in all cases except in table 3 which shows the normalisation to Y_W = 100 for comparison with other standards and publication. For luminous colours the normalisation to the CIE tristimulus value Y_W = 88,59 is outlined in this Technical Report. The reference white colours and the reference black colours are in all cases included in the tables.

Table 1: CIE data for offset printing according to ISO 2846–1 with Y_W = 88,6 and L^*_W = 18

Basic offset colour or mixture colour for D65 ORS18=OLS18=Standard	chromaticity *x*	*y*	tristimulus values (*Y=88,6 for white D65)* *X*	*Y*	*Z*	*L*a*b**-CIELAB data (*L*=95,4 for white D65)* *L**	*a**	*b**
three subtractive basic colours: printing colours acc. to ISO 2846-1								
C cyan-blue	0,1645	0,2337	18,74	26,62	68,54	58,62	−30,63	−42,75
M magenta-red	0,4594	0,2348	33,06	16,90	22,01	48,13	75,20	−6,80
Y yellow	0,4414	0,5000	68,06	77,10	9,03	90,37	−11,16	96,17
three subtractive mixture colours: # DIN 33866-colours; ISO reference paper								
O orange-red#	0,6080	0,3380	30,13	16,75	2,68	47,94	65,31	52,07
L leaf-green#	0,2523	0,5559	8,71	19,18	6,62	50,90	−62,96	36,71
V violet-blue#	0,2158	0,1400	7,17	4,65	21,41	25,72	31,35	−44,36
achromatic colours: # calculated by linear chroma extrapolation in the CIELAB colour space								
W1 (ideal white#, *D65)*	0,3198	0,3387	94,44	100,00	100,84	100,00	−1,07	5,06
W (ISO paper, *D65)*	0,3197	0,3384	83,69	88,60	89,47	95,41	−0,98	4,76
N (black printing colour)	0,3122	0,3251	2,42	2,52	2,81	18,01	0,50	−0,46
N0 (ideal black#, *D65)*	−	−	0,02	0,00	0,12	0,01	0,84	−1,68

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Table 1 shows the *standard* CIE data for the offset printing colours according to ISO 2846–1:1997 for the CIE standard 45°/0° geometry, the CIE standard illuminant D65 and the CIE standard 2°-observer. The data of Table 2 define the Offset Reflective System ORS18 for lightness L^*_N=18 of Black N. The analog ISO/IEC 15775-test charts have been produced using the CIE data on ISO non-fluorescent standard reference paper.

There may be a few colorimetric calculation problems in applications. In Table 1 the chromaticity of the colours White W and Black N is different and different compared to the chromaticity of D65 (x=0,3127, y=0,3290). The yellow-blue *standard* CIELAB chroma changes for White W from b^*_W = 4,76 to b^*_N = –0,46 for Black N. In applications both colours White W and Black N appear achromatic. Any CIE chromatic adaptation formula can only transform the chromaticity of one colour (either White W or Black N) to the chromaticity of D65, and there is no CIE colorimetric solution for printers and monitors.

The following four equations transform all the *standard* CIELAB data *L*a*b** which are located on a straight line between N and W in the *standard* CIELAB space to the achromatic axis (*a*=b**=0) in the *adapted* CIELAB space. The equations are called the chroma adaptation (a) equations.

$l^* = (L^* - L^*_N) / (L^*_W - L^*_N)$ (0<=*l**<=1 is the *relative* CIELAB lightness between W and N)

$L^*_a = L^*$ (no lightness change by the chroma adaptation (a) equations)

$a^*_a = a^* - a^*_N - (a^*_W - a^*_N)\, l^*$ (a^*_W and a^*_N are CIELAB *a**-chroma of White W and Black N)

$b^*_a = b^* - b^*_N - (b^*_W - b^*_N)\, l^*$ (b^*_W and b^*_N are CIELAB *b**-chroma of White W and Black N)

The chroma adaptation equations and the following inverse equations

$l^* = (L^*_a - L^*_{Na}) / (L^*_{Wa} - L^*_{Na})$ ($L^*_N = L^*_{Na}$, $L^*_W = L^*_{Wa}$)

$L^* = L^*_a$

$a^* = a^*_a + a^*_N + (a^*_W - a^*_N)\, l^*$

$b^* = b^*_a + b^*_N + (b^*_W - b^*_N)\, l^*$

are used for the transform of the achromatic colours in the ISO/IEC-test charts and all other colours.

The chroma adaptation equations are used to extrapolate the *standard* CIELAB data for the achromatic colours Black N0 and White W1 in Table 1 and for the transfer of the chroma adapted colour data of Table 2 which are used to calculate the *standard* CIELAB differences between the printer and the monitor colours. There is no lightness colour difference between the monitor and printer White W and Black N. There may be lightness differences for the two 16 step grey scales if the scaling is different. Equal relative scaling between L^*_N and L^*_W is the reference.

Table 2: CIE data of Offset Reflective System ORS18a with Y_W = 88,6 and L^*_N = 18

Basic offset colour or mixture colour for D65 ORS18a = OLS18a	chromaticity		tristimulus values (Y=88,6 for white D65)			L*a*b*-CIELAB data (L*=95,4 for white D65)		
	x_a	y_a	X_a	Y_a	Z_a	L^*_a	a^*_a	b^*_a
three subtractive basic colours: printing colours acc. to ISO 2846-1								
C cyan-blue	0,1610	0,2280	18,79	26,62	71,32	58,62	−30,34	−45,01
M magenta-red	0,4549	0,2319	33,08	16,90	22,90	48,13	75,28	−8,36
Y yellow	0,4388	0,4941	68,47	77,11	10,48	90,37	−10,26	91,75
three subtractive mixture colours: # DIN 33866-colours; ISO reference paper								
O orange-red#	0,6054	0,3363	30,15	16,75	2,90	47,94	65,39	50,52
L leaf-green#	0,2494	0,5484	8,72	19,18	7,07	50,90	−62,83	34,96
V violet-blue#	0,2148	0,1400	7,14	4,65	21,44	25,72	31,10	−44,40
achromatic colours: # calculated by linear chroma extrapolation in the CIELAB colour space								
W1 (ideal white#, *D65)*	0,3127	0,3290	95,05	100,00	108,92	100,00	0,00	0,00
W (ISO paper, *D65)*	0,3127	0,3290	84,21	88,60	96,48	95,41	0,00	0,00
N (black printing colour)	0,3127	0,3290	2,40	2,52	2,74	18,01	0,00	0,00
N0 (ideal black#, *D65)*	−	−	0,00	0,00	0,00	0,01	0,00	0,00

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Table 2 shows the chroma adapted (a) colour data which are calculated from the offset printing colours according to ISO 2846–1:1997. For the achromatic colours the *adapted* CIELAB chroma data *a** and *b** are equal to zero. This system is called chroma adapted (a) Offset Reflective System ORS18a for the lightness L^*_N=18 of Black N. This System is equal to the Offset Luminous System OLS18a with Y_W=88,6 and Y_r=2.5. Four Offset Luminous Systems OLSxxa with xx=00, 18, 27 and 33 with four different ambient light reflections are given in Annex K of ISO/IEC TR 24705.

Table 3: CIE data of television according to ITU-R BT.709–3 with Y_W = 100,0 and L^*_N = 0

Basic television colour or mixture colour for D65 CIE data for Yw=100	chromaticity		tristimulus values (Y=100,0 for white D65)			L*a*b*-CIELAB data (L*=100,0 for white D65)		
	x	*y*	*X*	*Y*	*Z*	*L**	*a**	*b**
three additive basic colours: television colours acc. to ITU-R BT.709−3								
R red	0,6400	0,3300	41,24	21,26	1,93	53,24	80,08	67,20
G green	0,3000	0,6000	35,76	71,52	11,92	87,74	−86,18	83,18
B blue	0,1500	0,0600	18,05	7,22	95,05	32,30	79,19	−107,85
three additive mixture colours: television colours acc. to ITU-R BT.709−3								
C cyan-blue	0,2246	0,3287	53,81	78,74	106,97	91,11	−48,08	−14,12
M magenta-red	0,3209	0,1542	59,29	28,48	96,99	60,32	98,23	−60,82
Y yellow	0,4193	0,5053	77,00	92,78	13,85	97,14	−21,56	94,48
achromatic colours:								
W (−)	−	−	−	−	−	−	−	−
W1 (white monitor, 100%)	0,3127	0,3290	95,05	100,00	108,90	100,00	0,00	0,00
N (black monitor, 0,00%)	−	−	0,00	0,00	0,00	0,00	0,00	0,00
N0 (ideal black, 0,00%)	−	−	0,00	0,00	0,00	0,00	0,00	0,00

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Table 3 shows the *standard* CIE data for television colours according to ITU-R BT.709–3 for the CIE standard illuminant D65, the CIE standard diffuse/0° geometry, the CIE 2°-observer, and normalized to Y_W = 100. The normalization to Y_W = 100 is the simplest colorimetric method. For colorimetric comparison of monitor and paper colours (of often near the same luminance) the colorimetric normalization to Y_W = 88,6 of the following table is appropriate.

Table 4: CIE data of Television Luminous System TLS00 with Y_W = 88,6 and L^*_N = 0

Basic television colour or mixture colour for D65 TLS00: Yw=88,6 + 0,0	chromaticity *x*	*y*	tristimulus values (Y=88,6 for white D65) *X*	*Y*	*Z*	*L*a*b**-CIELAB data (L*=95,4 for white D65) *L**	*a**	*b**
three additive basic colours: television colours acc. to ITU-R BT.709−3								
R red	0,6400	0,3300	36,54	18,84	1,71	50,50	76,92	64,54
G green	0,3000	0,6000	31,68	63,36	10,56	83,63	−82,77	79,90
B blue	0,1500	0,0600	15,99	6,40	84,22	30,39	76,06	−103,58
three additive mixture colours: television colours acc. to ITU-R BT.709−3								
C cyan-blue	0,2246	0,3287	47,67	69,76	94,78	86,88	−46,17	−13,56
M magenta-red	0,3209	0,1542	52,53	25,24	85,93	57,30	94,35	−58,42
Y yellow	0,4193	0,5053	68,22	82,20	12,27	92,66	−20,70	90,75
achromatic colours:								
W1 (ideal white#, 100%)	0,3127	0,3290	95,05	100,00	108,90	100,00	0,00	0,00
W (white monitor, 88,6%)	0,3127	0,3290	84,21	88,60	96,49	95,41	0,00	0,00
N (black monitor, 0,00%)	−	−	0,00	0,00	0,00	0,00	0,00	0,00
N0 (ideal black, 0,00%)	−	−	0,00	0,00	0,00	0,01	0,00	0,00

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Table 4 shows the *standard* CIE colour data for television according to ITU-R BT.709–3 now normalized to Y_W = 88,6. This system is called Television Luminous System TLS00 for the black lightness L^*_N=0. In Table 1 to 5 except Table 3 the luminance factor is always normalized to Y_W = 88,6 (instead of Y_W = 100,0 in Table 3) for White W. Then in all cases the luminance factor Y_W and the lightness L^*_W of the White W on the monitor and on the paper are equal.

The normalised luminance reflectance Y_W = 88,6 is defined by the white standard reference paper of offset colour printing which is used for the production of the standard **analog** ISO/IEC 15775-test charts no. 2 to 4. In case of different reflections for ambient lighting on the monitor surface the same normalised luminance reflectance Y_W = 88,6 is used. Therefore a transparent (t) normalised luminance reflectance is necessary to calculate the CIE *XYZ* tristimulus values. The normalization changes the *XYZ* tristimulus values and the *standard* CIELAB data of any colour in the application. The luminance reflectance Y_r=2,5 depends on the ambient office lighting and the reflection properties of the monitor surface. For the luminance reflectance Y_r=2,5 the (transparent) normalised luminance reflectance is

$$Y_t = Y_W - Y_r = 88,6 - 2,5 = 86,1$$

The equation is also used for the other luminance reflectance values Y_r=0,0, Y_r=5,0, and Y_r=7,5.

Table 5: CIE data of Television Luminous System TLS18 with Y_W = 88,6 and L^*_N = 18

Basic television colour or mixture colour for D65 TLS18: Yw=86,1 + 2,5	chromaticity *x*	*y*	tristimulus values (Y=88,6 for white D65) *X*	*Y*	*Z*	*L*a*b**-CIELAB data (L*=95,4 for white D65) *L**	*a**	*b**
three additive basic colours: television colours acc. to ITU-R BT.709−3								
R red	0,6003	0,3299	37,89	20,82	4,41	52,76	71,63	49,87
G green	0,3009	0,5812	33,18	64,08	13,00	84,01	−79,02	73,94
B blue	0,1612	0,0785	17,93	8,73	84,57	35,47	64,92	−95,08
three additive mixture colours: television colours acc. to ITU-R BT.709−3								
C cyan-blue	0,2278	0,3287	48,71	70,30	94,79	87,14	−44,44	−13,14
M magenta-red	0,3205	0,1622	53,43	27,04	86,23	59,01	89,33	−55,69
Y yellow	0,4144	0,4971	68,67	82,33	14,67	92,74	−20,06	84,97
achromatic colours:								
W1 (ideal white#, 100%)	0,3127	0,3290	95,05	100,00	108,90	100,00	0,00	0,00
W (white monitor, 88,6%)	0,3127	0,3290	84,21	88,60	96,49	95,41	0,00	0,00
N (black monitor, 2,52%)	0,3127	0,3290	2,40	2,52	2,74	18,01	0,00	0,00
N0 (ideal black, 0,00%)	−	−	0,00	0,00	0,00	0,01	0,00	0,00

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Table 5 shows the CIE colour data for the Television Luminous System TLS18 normalized to Y_W = 88,6 and with the luminance reflectance Y_r = 2,5. The calculations in the Table 5 first need the normalized luminance reflectance Y_t = 86,1 (= 88,6 – 2,5) for White W and all other colours of Table 3. Then an ambient light of the chromaticity D65 with X_r = 2,40, Y_r = 2.52, and Z_r = 2,74 must be added to any *XYZ* monitor colour. There are additional tables for the

Television Luminous System TLS27 and TLS33 in ISO/IEC TR 24705.

Therefore **two** different cases of ambient light reflections are considered in this Technical Report. The two luminance reflectance Y_r are 0,0 and 2,52 which corresponds to the *standard* CIELAB lightness L^* = 0 and 18. Two different Television Luminous Systems (TLS) and two corresponding CIE colour data and example figures are given.

NOTE: A similar Offset Luminous System (OLS) of transparent offset colours printed on transparent overhead sheets is defined in Annex K of ISO/IEC TR 24705.

4.5.2 The forward color transformation

The forward color transformation defines the conversion from the *standard* CIELAB data *LAB** to the *relative* CIELAB data *lab*olv = rgb**.

4.5.3 The inverse color transformation

The inverse color transformation defines the conversion from the relative the *relative* CIELAB data *lab*olv = rgb* to* the *standard* CIELAB data *LAB**

4.5.4 Color Space Encoding 8/8-bit and 7/8-bit

The 8/8-bit and 7/8-bit value range for RLAB *lab** (2005) color space component values shall be [0, 1].

The color component values shall be encoded using integer encodings.

Integer encodings shall be unsigned with 8 bits per component with the same number of bits for all three components.

The *rgb** component value range [0, 1] shall be encoded over the code value range [0, 255].

For 8/8-bit encoding the *rgb** code values of 0, 0, 0 shall represent the color space black point, and *rgb** code values of 1, 1, 1 shall represent the color space white point.

For 7/8-bit encoding the *rgb** code values of 0.25, 0.25, 0.25 shall represent the color space black point, and *rgb** code values of 0.75, 0.75, 0.75 shall represent the color space white point.

For integer encodings, all code values shall be within the color space gamut.

4.5.5 Input referred and output referred image state

The input referred and output referred image state of the RLAB *lab** (2005) color image encoding shall use the data *lab*olv = rgb**

The metadata of the image shall include the *standard* CIELAB data of the eight basic colours used for encoding.

4.5.6 *Standard* CIE tristimulus values *XYZ* and *standard* CIELAB data *LAB**

The *standard* CIE tristimulus values *XYZ* and the *standard* CIELAB data *LAB** shall be those of the image as viewed on the reference device by the reference observer in the reference viewing environment.

The CIE tristimulus values are normalized according to CIE Publication 15. For luminous colours the CIE tristimulus value is normalized to Y_W = 88,59 for the white medium colour.

NOTE Examples for the normalisation of the CIE tristimulus values are shown in Tables 1 to 5. The *standard* CIELAB data *LAB** are calculated according to CIE publication 15 from the *standard* CIE tristimulus values *XYZ*.

NOTE The adaptation of the *standard* CIELAB data *a** and *b** for medium white and black is described in section 4.2.5. Table 2 includes *adapted* CIELAB data $a^*_{Na} = b^*_{Na} = a^*_{Wa} = b^*_{Wa} = 0.$

4.5.7 *Adapted* CIE tristimulus values XYZ_a and *adapted* CIELAB data LAB^*_a

The *adapted* CIE tristimulus values XYZ_a and the *adapted* CIELAB data LAB^*_a shall be those of the image as viewed on the reference device by the reference observer in the reference viewing environment.

An adaptation method in *standard* CIELAB space is necessary, if the device dependent colors Black N and White W have *standard* CIELAB data *a** and *b** different from zero, which is usually the case for real devices.

After adaptation the *adapted* CIELAB data are $a^*_{aN} = b^*_{aN} = a^*_{aW} = b^*_{aW} = 0$ for Black N and White W. There is usually also a small change of the *standard* CIELAB data a* and b* for all other colours including the device colours CMYOLVNW.

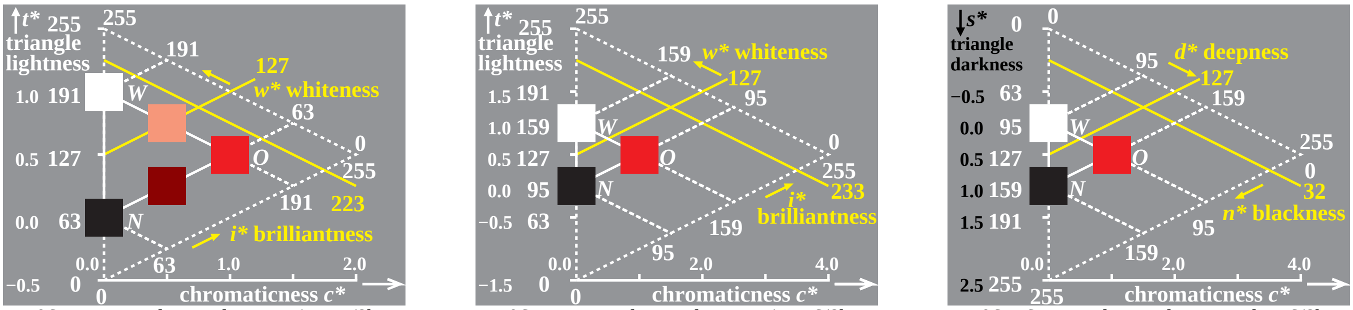
Examples are given for the Offset Reflective System ORS18 and the *adapted* Offset Reflective System ORS18a and others in Annex A.

5. Encoding *standard* CIELAB *LAB** to integer lab^*tch_{k8}, lab^*nce_{k8} or lab^*olv_{3k8}

An image with *standard* CIELAB data *LAB** shall be encoded into an 3x8-bit RLAB lab^*tch_{k8}, lab^*nce_{k8}, lab^*olv_{3k8}, or

lab^*cmy_{3k8} color image for k = 7 and k = 8 in this section.

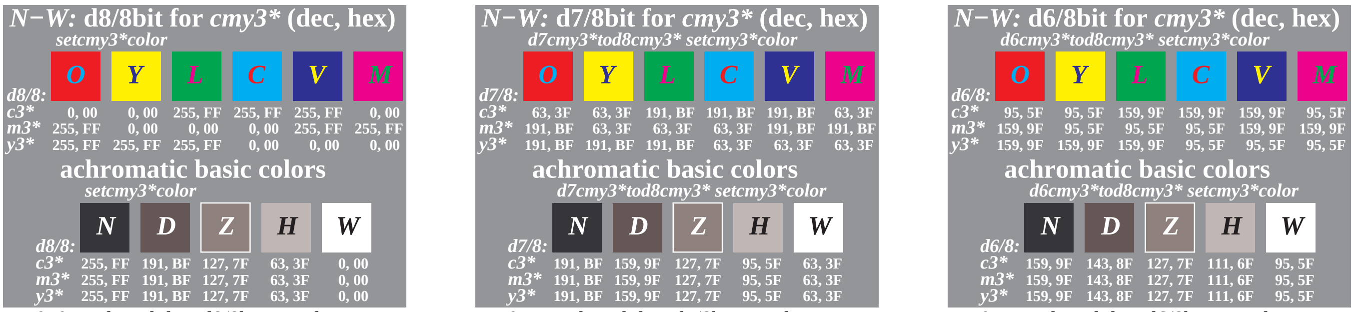
The conversion from *standard* CIELAB data *LAB** to 3x8-bit RLAB lab^*tch_{k8}, lab^*nce_{k8}, lab^*olv_{3k8}, or lab^*cmy_{3k8} color image encoding shall be the inverse of the conversion from 3x8-bit RLAB lab^*tch_{k8}, lab^*nce_{k8}, lab^*olv_{3k8}, or lab^*cmy_{3k8} color image encoding to *standard* CIELAB data *LAB**, which is given in the next section 6.



BE061−1, Triangle coordinates *tciw**: 7/8bit BE061−2, Triangle coordinates *tciw**: 6/8bit BE061−6, Triangle coordinates *scdn**: 6/8bit

Figure 3: Triangle colour with encoding of the grey scale by 7/8bit and 6/8 bit.
Fig. 3 shows examples of the colour encoding by 7/8bit and 6/8 bit for the grey scale instead of the standard encoding 8/8bit. The *relative* CIELAB data triangle lightness ***t**** = *lab*t*, and ***c**** = *lab*c* is given. The encoding of different *relative* CIELAB data *lab*t, lab*w, lab*c, lab*n* and others is shown for 7/8bit and 6/8bit. For the description of the different coordinates, see Annex B.

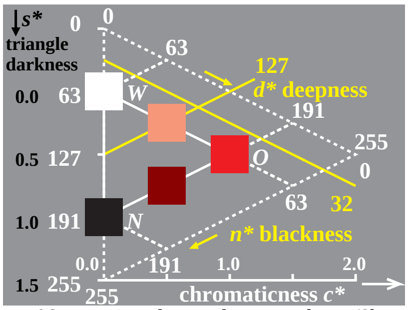
The encoding outside the device colour gamut (colour triangle) may be used for highlight colours, fluorescent colours and very chromatic colours, for example the effect colours used in the automotive industry. One important property of this encoding is that the inverse transformation applied to the colour data will produce back the original colour data. This is often a large disadvantage of many of the present application programs. For many software programs the colorimetric forward and inverse transformations lead to a loss of information (for example in many cases with the software *Adobe Photoshop* depending on the colour space used). Often some (calculated) colour data larger than one or less than zero are clipped and are lost for further transformations.



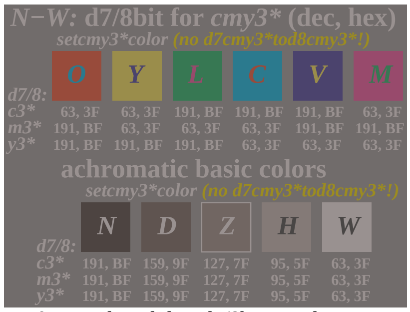
BE050−5, digital data d8/8bit ngcode *cmy3** BE051−1, digital data d7/8bit sgcode *cmy3** BE051−5, digital data d6/8bit wgcode *cmy3**

Figure 4: Colour encoding for basic colours and for a 5 step the grey scale by 7/8bit and 6/8 bit
Fig. 4 shows examples of the colour encoding for basic colours and for a 5 step the grey scale by 8/8bit, 7/8bit and 6/8 bit. The three encodings shall be called ngcode (narrow or normal gamut code), sgcode (standard or extended gamut code) and wgcode (wide gamut code). The standard gamut code allows to code 4 time more colours and the wgcode 16 times more colours compared to the ngcode.

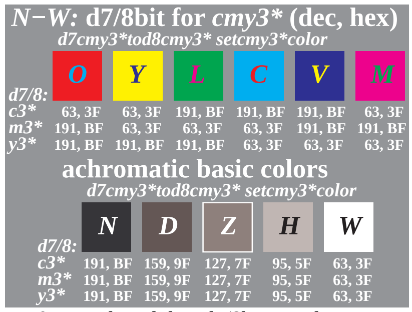
The same output is intended for the different encoding data used in the digital file. Therefore different decoding functions, for example *d6cmy*_to_d8cmy*, shall be applied to the middle and right figure, which transfers data lab^*cmy_{78} or lab^*cmy_{68} to $lab^*cmy^*_{88}$. For example the right figure uses the decoding function *d6cmy*_to_d8cmy*,



BE061−5, Triangle coordinates *scdn**: 7/8bit



BE071−5, digital data d7/8bit sgcode *cmy3**



BE071−4, digital data d7/8bit sgcode *cmy3**

Figure 5: Colour encoding using deepness *d for colours and 7/8bit without and with decoding**

Fig. 5 shows the colour encoding using the deepness *d** direction which is the same as the cmy* direction for the encoding. In the middle figure the 7/8bit decoding is not applied and then the output has a low contrast range (between 0,25 and 0,75). The right figure shows the correct 7/8bit decoding. Only colours between hex values 63 and 191 (between digital 0.25 and 0.75) are used in Fig. 5. The reproduction of the right figure is the same as in Fig. 4 (*left figure*). A naive user will not realize any encoded colour outside the 7/8bit boundary. This colours will be reproduced at the 7/8bit boundary. Experts can make use of the colour encodings outside if there is a wide gamut output device available and if for example an absolute reproduction in CIELAB is intended.

5.1 Encoding *standard* CIELAB data *LAB** to *adapted* CIELAB data LAB^*_a

The *standard* CIELAB data *LAB** shall be converted to *adapted* CIELAB data LAB^*_a as follows:

The following four equations transform all the *standard* CIELAB data *L*, a*, b** which are located on a straight line between N and W in the *standard* CIELAB space to the achromatic axis (*a**=*b**=0) in the *standard* CIELAB space. The equations are called the chroma adaptation (a) equations.

$l^* = (L^* - L^*_N) / (L^*_W - L^*_N)$ (0<=*l**<=1 is the *relative* CIELAB lightness between W and N)

$L^*_a = L^*$ (no lightness change by the chroma adaptation (a) equations)

$a^*_a = a^* - a^*_N - (a^*_W - a^*_N)\, l^*$ (a^*_W and a^*_N are CIELAB *a**-chroma of White W and Black N)

$b^*_a = b^* - b^*_N - (b^*_W - b^*_N)\, l^*$ (b^*_W and b^*_N are CIELAB *b**-chroma of White W and Black N)

The device dependent *standard* CIELAB data of black N and white W shall be used.

NOTE1 For the Offset Reflective System ORS18 the *standard* CIELAB data *LAB** are given in Table 1 and the *adapted* CIELAB data LAB^*_a are given in Table 2.

NOTE2 For the Television Luminous System TLS18 the *standard* CIELAB data *LAB** are given in Table 4. In this case the data *LAB** and LAB^*_a are identical because for TLS18 it is valid $a^*_N = b^*_N = a^*_W = b^*_W = 0$.

The equivalent *standard* CIELAB data *LCH** (lightness, chroma, hue) shall be calculated

$C^*_{ab,a} = (a^{*2}_a + b^{*2}_a)^{1/2}$

$H^*_a = arcos\, (a^*_a / b^*_a)$

$\mathbf{h^*} = H^*_a / 360$

NOTE All relative CIELAB data *lab**, for example *lab*h* = *h** do not need an index a.

5.2 Encoding with 8 bit hue table for *adapted* CIELAB data LAB^*_{Ma} of maximum colors

The floating point number hue ***h**** is in the range [0,1]. The following equations shall be used

$h^*_8 = 255\, \mathbf{h^*}$

The integer value h^*_8 is in the range [0, 255]. Table C.1 of Annex C has 6 columns with the following data:

h^*_8, $C^*_{ab,Ma}$, L^*_{Ma}, lab^*o_{3Ma}, lab^*l_{3Ma}, lab^*v_{3Ma}, ***e****, h^*_{OLV}

The table has 256 entries with the index 0 to 255 (8bit). Therefore for any of the 256 h^*_8 values for example the two values $C^*_{ab,Ma}$ and L^*_{Ma} or the three values lab^*_{olv3Ma} are given.

NOTE: If the *adapted* CIELAB data LAB^*_a are known then it is very easy to calculate at first the CIELAB hue angle H^*_a, then the hue value ***h**** and then the integer hue h^*_8. Finally the table C.1 produces for a given h^*_8 either the two data $C^*_{ab,Ma}$, L^*_M or the three data lab^*_{olv3Ma} or the elementary hue value ***e****. All data sets are necessary and used in the next sections.

The elementary hue value ***e**** allows to express the four elementary hues which are located at the floating points 0,00 (elementary Red = R), 0,25 (elementary Yellow = J), 0,50 (elementary Green = G), 0,75 (elementary Blue = B). This corresponds to the integer elementary hue data e^*_8 = 0 (R), 64 (J), 128 (G), and 192 (B).

5.3 Encoding adapted CIELAB data LAB^*_a to k/8bits integer data lab^*tch_{k8} or lab^*nce_{k8}

Either k = 8 bits or k = 7 bits are used for encoding of the grey scale in this section 5.3.

5.3.1 Encoding *adapted* CIELAB data LAB^*_a to *relative* CIELAB data *lab*tch or lab*nce*

The integer data h^*_8 in the range [0,255] shall be used to determine the two data $C^*_{ab,Ma}$ and L^*_{Ma} of the Table C.1.

The basic equations for *lab*tch* and others to be used are given in Annex B. The above values $C^*_{ab,Ma}$ and L^*_{Ma} are the data for the maximum *adapted* colour M_a compared to a given *adapted* colour F_a of the same hue h^*. For the *adapted* colour F_a the *relative* CIELAB data chromaticness ***c****, lightness ***l****, triangle lightness ***t****, whiteness ***w**** and blackness ***n**** shall be calculated in the following sequence of the equations (1) to (6).

$$\boldsymbol{h^*} = h^*_a \quad (1)$$

$$\boldsymbol{c^*} = C^*_{ab,a} / C^*_{ab,ma} \quad (2)$$

$$\boldsymbol{l^*} = [\, L^* - L^*_N \,] / [\, L^*_W - L^*_N \,] \quad (3)$$

$$\boldsymbol{t^*} = \boldsymbol{l^*} - \boldsymbol{c^*} \{ \, [\, L^*_M - L^*_N \,] / [\, L^*_W - L^*_N \,] - 0.5 \, \} \quad (4)$$

$$\boldsymbol{w^*} = \boldsymbol{t^*} - 0.5\, \boldsymbol{c^*} \quad (5)$$

$$\boldsymbol{n^*} = 1 - \boldsymbol{c^*} - \boldsymbol{w^*} \quad (6)$$

NOTE For the three data CIELAB lightness L^* of the colours Fa, Ma, N, and W it is valid $L^* = L^*_a$.

The *relative* CIELAB data of the new relative device dependent space NCCS (small letters) are given in **bold** and *italics* and the *standard* CIELAB data *LAB** (capital letters) are given only in *italics* for easy identification.

The resulting *lab*tchn* data shall be in floating point and we need for *lab*tch* and *lab*nch* encoding

$lab^*t = \boldsymbol{t^*}$

$lab^*c = \boldsymbol{c^*}$

$lab^*h = \boldsymbol{h^*}$

$lab^*n = \boldsymbol{n^*}$

$lab^*e = \boldsymbol{e^*}$

NOTE for any given integer hue h^*_8 the elementary hue value in given in the Table C.1

Integer encodings lab^*tch_{88} or lab^*nch_{88} for 8bits or lab^*tch_{78} or lab^*nce_{78} for 7bits out of 8bits for the grey scale range are intended.

The *lab*tch* or *lab*nce* values are approximately for all colours of any device in the range [0, 1], only some device colours may be within the twofold larger range [-0,5, 1,5] and in rare cases some colours may be outside. The hue values *lab*h* or elementary hue values *lab*e* are by definition always within the range [0, 1].

NOTE For the calculation of the elementary hue e^* see table C.1

5.3.2 Encoding *relative* CIELAB data *lab*tch* or *lab*nch* to 8/8bits integer data lab^*tch_{88} or lab^*nce_{88}

The three *lab*tch* or *lab*nch* data shall be assumed to be floating point and shall be converted to RLAB *lab** (2005) component values as unsigned integer lab^*tch_{88} or lab^*nch_{88} as follows, if 8 bits for the grey scale range are used:

$lab^*t_{88} = 255\, lab^*t$ *or* $lab^*n_{88} = 255\, lab^*n$

$lab^*c_{88} = 255\, lab^*c$

$lab^*h_{88} = 255\, lab^*h$ *or* $lab^*e_{88} = 255\, lab^*e$

If for the resulting lab^*tch_{88} or lab^*nce_{88} data values less than zero or values larger 255 occur they shall be skipped to zero or skipped to 255. Therefore, all lab^*tch_{88} or lab^*nce_{88} values are in the range [0, 255].

5.3.3 Encoding *relative* CIELAB data *lab*tch* or *lab*nch* to 7/8bits integer data lab^*tch_{78} or lab^*nce_{78}

The three *lab*tch* or *lab*nch* data shall be assumed to be floating point and shall be converted to RLAB *lab** (2005) component values as unsigned integer lab^*tch_{78} or lab^*nch_{88} as follows, if 7 bits for the grey scale range are used:

$lab^*t_{78} = 64 + 127\, lab^*t$ *or* $lab^*n_{78} = 64 + 127\, lab^*n$

$lab^*c_{78} = 64 + 127\, lab^*c$

$lab^*h_{78} = 255\, lab^*h$ *or* $lab^*e_{78} = 255\, lab^*e$

If for the resulting $lab{*}tch_{78}$ or $lab{*}nce_{78}$ data values less than zero or values larger 255 occur they shall be skipped to zero or skipped to 255. Therefore, all $lab{*}tch_{78}$ values are in the range [0, 255].

NOTE The hue values *lab*h* or elementary hue values *lab*e* are by definition always within the range [0, 1].

5.4 Encoding *adapted* CIELAB data $LAB{*}_{a}$ to *relative* CIELAB data $lab{*}olv_{388}$ or $lab{*}olv_{378}$.

The encoding to $lab{*}cmy_{3}$ is very similar compared to $lab{*}olv_{3}$ and is not specified here separately. The "One minus relation" shall be applied to the final encodings of $lab{*}olv_{3k8}$, if this is required.

$lab{*}c_{3k8} = 1 – lab{*}o_{3k8}$

$lab{*}m_{3k8} = 1 – lab{*}l_{3k8}$

$lab{*}y_{3k8} = 1 – lab{*}v_{3k8}$

5.4.1 Encoding *adapted* CIELAB data $LAB{*}_{a}$ to *relative* CIELAB data $lab{*}olv_{3}$

The integer hue data $h{*}_{8}$ in the range [0, 255] shall be used to determine the three data $lab{*}o_{3M}$, $lab{*}l_{3M}$, $lab{*}v_{3M}$ of the Table C.1. Further the following data of section 5.3.1 shall be used

$lab{*}n = \boldsymbol{n*}$

$lab{*}w = \boldsymbol{w*}$

Then the following equations for $lab{*}olv_{3}$ shall be used

$lab{*}o_{3} = [1 – \boldsymbol{n*}]\ [\ lab{*}o_{M} + \boldsymbol{w*}\ (1 – lab{*}o_{M})\ ]$

$lab{*}l_{3} = [1 – \boldsymbol{n*}]\ [\ lab{*}l_{M} + \boldsymbol{w*}\ (1 – lab{*}l_{M})\ ]$

$lab{*}v_{3} = [1 – \boldsymbol{n*}]\ [\ lab{*}v_{M} + \boldsymbol{w*}\ (1 – lab{*}v_{M})\ ]$

The resulting $lab{*}olv_{3}$ data shall be in floating point. Integer encodings $lab{*}olv_{388}$ for 8bits or $ab{*}olv_{378}$ for 7bits out of 8bits for the grey scale range are intended.

The $lab{*}olv_{3}$ values are approximately for all colours of any device in the range [0, 1], only some device colours may be within the twofold larger range [-0,5, 1,5] and in rare cases some colours may be outside.

5.4.2 Encoding *relative* CIELAB data $lab{*}olv_{3}$ to 8/8bits integer data $lab{*}olv_{388}$

The three $lab{*}olv_{3}$ data shall be assumed to be floating point and shall be converted to RLAB *lab** (2005) component values as unsigned integer $lab{*}olv_{388}$ as follows, if 8 bits for the grey scale range are used:

$lab{*}o_{388} = 255\ lab{*}o_{3}$

$lab{*}l_{388} = 255\ lab{*}l_{3}$

$lab{*}v_{388} = 255\ lab{*}v_{3}$

If for the resulting $lab{*}olv_{388}$ data values less than 0 or values larger 255 occur they shall be skipped to zero or skipped to 255. Therefore, all $lab{*}olv_{388}$ values are in the range [0, 255].

5.4.3 Encoding *relative* CIELAB data $lab{*}olv_{3}$ to 7/8bits integer data $lab{*}olv_{378}$

The three $lab{*}olv_{3}$ data shall be assumed to be floating point and shall be converted to RLAB *lab** (2005) component values as unsigned integer $lab{*}olv_{378}$ as follows, if 7 bits for the grey scale range are used:

$lab{*}o_{378} = 64 + 127\ lab{*}o_{3}$

$lab{*}l_{378} = 64 + 127\ lab{*}l_{3}$

$lab{*}v_{378} = 64 + 127\ lab{*}v_{3}$

If for the resulting $lab{*}olv_{378}$ data values less than 0 or values larger 255 occur they shall be skipped to zero or skipped to 1. Therefore, all $lab{*}olv_{378}$ values are in the range [0, 255].

NOTE If by some reason for all the television colours in the TLS18 colour space an encoding in the printing space ORS18 is preferred then all television colours are located within the extended range [-0,5, 1,5] of the printing space. No colour value will be skipped and multiple decoding and encoding will produce the same *relative* CIELAB data $lab{*}olv_{3}$. A similar property is true in the inverse case and therefore the 7/8bit integer data may be very effective for many colour management applications because it is expected that no skipping of integer data occur for re-rendering.

6. Decoding integer *lab*tch*$_{k8,}$ *lab*nce*$_{k8}$ or *lab*olv*$_{3k8}$ to *standard* CIELAB *LAB*.*

An image encoded in *lab*tch*$_{k8}$, *lab*nce*$_{k8}$, *lab*olv*$_{3k8}$, *or lab*cmy*$_{3k8}$ color image encoding shall be decoded into *standard* CIELAB data *LAB** as specified for k =7 or k = 8 in this section.

The conversion from *lab*tch*$_{k8}$, *lab*nce*$_{k8}$, *lab*olv*$_{3k8}$, *or lab*cmy*$_{3k8}$ color image encoding to *standard* CIELAB data *LAB** shall be the inverse of the conversion from *standard* CIELAB data *LAB** to *lab*tch*$_{k8}$, *lab*nce*$_{k8}$, *lab*olv*$_{3k8}$, *or lab*cmy*$_{3k8}$ color image encoding that was given in section 5.

6.1 Decoding integer data *lab*tch*$_{k8}$ or *lab*nce*$_{k8}$ to *adapted* CIELAB data *LAB**$_a$

6.1.1 Decoding 8/8bits integer data *lab*tch*$_{88}$ or *lab*nce*$_{88}$ to *relative* CIELAB data *lab*tch* or *lab*nce*

The three *lab*tch*$_{88}$ 8-bit channel values in 3x8-bit RLAB *lab** (2005) color image encoding and 8 bits for the grey scale shall be assumed to be unsigned integers and shall be converted to RLAB *lab** (2005) component values *lab*tch* as follows:

$lab^*t = lab^*t_{88} / 255$ or $lab^*n = lab^*n_{88} / 255$

$lab^*c = lab^*c_{88} / 255$

$lab^*h = lab^*h_{88} / 255$ or $lab^*e = lab^*e_{88} / 255$

All *lab*tch*$_{88}$ and *lab*nce*$_{88}$values are in the range [0, 255]. The resulting *lab*tch* and *tab*nce* values are then in the range [0,1].

6.1.2 Decoding 7/8bits integer data *lab*tch*$_{78}$ or *lab*nce*$_{78}$ to *relative* CIELAB data *lab*tch* or *lab*nce*

The three *lab*tch*$_{78}$ 8-bit channel values in 3x8-bit RLAB *lab** (2005) color image encoding and 7 bits for the grey scale shall be assumed to be unsigned integers and shall be converted to RLAB *lab** (2005) component values *lab*tch* as follows:

$lab^*t = (lab^*t_{78} - 64) / 127$ or $lab^*n = (lab^*n_{78} - 64) / 127$

$lab^*c = (lab^*c_{78} - 64) / 127$

$lab^*h = lab^*h_{78} / 255$ or $lab^*e = lab^*e_{78} / 255$

All *lab*tch*$_{78}$ and *lab*nce*$_{88}$ values are in the range [0, 255]. The resulting *lab*tch* and *tab*nce* values are then in the range [-0,5, 1,5].

6.1.3 Decoding *relative* CIELAB data *lab*tch* to *adapted* CIELAB data *LAB*$_a$

The integer data $h^*_8 = h^*_{78} = h^*_{88}$ in the range [0,255] shall be used to determine the two data $C^*_{ab,Ma}$ and L^*_{Ma} of the Table C.1.

The starting data are

$\boldsymbol{t^*} = lab^*t$

$\boldsymbol{c^*} = lab^*c$

$\boldsymbol{h^*} = lab^*h$

The basic equations for *lab*tch* and others to be used are given in Annex B. The above values $C^*_{ab,Ma}$ and L^*_M are the data for the maximum *adapted* colour M_a compared to a given *adapted* colour F_a of the same hue h^*. For the *adapted* colour F_a the *relative* CIELAB data lightness $\boldsymbol{l^*}$, whiteness $\boldsymbol{w^*}$ and blackness $\boldsymbol{n^*}$ shall be calculated in the following sequence of the equations (1) to (7).

$$\boldsymbol{l^*} = \boldsymbol{t^*} + \boldsymbol{c^*} \{ [L^*_M - L^*_N] / [L^*_W - L^*_N] - 0.5 \} \quad (1)$$

$$L^* = \boldsymbol{l^*} \; [L^*_W - L^*_N] + L^*_N \quad (2)$$

$$C^*_{ab,a} = \boldsymbol{c^*} \; C^*_{ab,ma} \quad (3)$$

$$h^*_a = \boldsymbol{h^*} \quad (4)$$

$$\boldsymbol{w^*} = \boldsymbol{t^*} - 0.5 \, \boldsymbol{c^*} \quad (5)$$

$$\boldsymbol{n^*} = 1 - \boldsymbol{c^*} - \boldsymbol{w^*} \quad (6)$$

$H^*_a = 360\ \boldsymbol{h^*}$ (7)

$a^*_a = C^*_{ab,a} \cos H^*_a$ (8)

$b^*_a = C^*_{ab,a} \sin H^*_a$ (9)

The *relative* CIELAB data *lab*tch* of the relative device dependent space NCCS (small letters) are given in **bold** and *italics* and the *standard* CIELAB data *LAB** (capital letters, except a^*_a and b^*_a) are given only in *italics* for easy identification.

The resulting *relative CIELAB data* LCH^*_a and LAB^*_a shall be in floating point.

6.1.4 Decoding *relative* CIELAB data *lab*nce* to *adapted* CIELAB data LAB_a

The integer data $e^*_8 = e^*_{78} = e^*_{88}$ in the range [0,255] shall be used to determine the two data $C^*_{ab,Ma}$ and L^*_{Ma} and the hue value h^* of the Table C.7, which is the inverse table of table C.1.

The starting data are

$\boldsymbol{n^*} = lab^*n$

$\boldsymbol{c^*} = lab^*c$

$\boldsymbol{e^*} = lab^*e$

The basic equations for *lab*nce* and others to be used are given in Annex B. The above values $C^*_{ab,Ma}$ and L^*_{Ma} are the data for the maximum *adapted* colour M_a compared to a given *adapted* colour F_a of the same elementary hue e^*. For the *adapted* colour F_a the *relative* CIELAB data whiteness $\boldsymbol{w^*}$, blackness $\boldsymbol{n^*}$, and lightness $\boldsymbol{l^*}$ shall be calculated in the following sequence of the equations (1) to (7).

$\boldsymbol{w^*} = 1 - \boldsymbol{c^*} - \boldsymbol{n^*}$ (1)

$\boldsymbol{t^*} = \boldsymbol{w^*} + 0.5\ \boldsymbol{c^*}$ (2)

$\boldsymbol{l^*} = \boldsymbol{t^*} + \boldsymbol{c^*} \{ [L^*_M - L^*_N] / [L^*_W - L^*_N] - 0.5 \}$ (3)

$L^* = \boldsymbol{l^*}\ [L^*_W - L^*_N] + L^*_N$ (4)

$C^*_{ab,a} = \boldsymbol{c^*}\ C^*_{ab,ma}$ (5)

$h^*_a = \boldsymbol{h^*}$ see Table C.7

$H^*_a = 360\ \boldsymbol{h^*}$ (7)

$a^*_a = C^*_{ab,a} \cos H^*_a$ (8)

$b^*_a = C^*_{ab,a} \sin H^*_a$ (9)

The *relative* CIELAB data *lab*nce* of the relative device dependent space NCCS (small letters) are given in **bold** and *italics* and the *standard* CIELAB data *LAB** (capital letters, except a^*_a and b^*_a) are given only in *italics* for easy identification.

The resulting *relative CIELAB data* LCH^*_a and LAB^*_a shall be in floating point.

6.2 Decoding integer data lab^*olv_{388} or lab^*olv_{378} to *adapted* CIELAB data LAB^*_a

6.2.1 Decoding 8/8bits integer data lab^*olv_{388} to *relative* CIELAB data lab^*olv_3

The three lab^*olv_{388} 8-bit channel values in 3x8-bit RLAB *lab** (2005) color image encoding and 8 bits for the grey scale shall be assumed to be unsigned integers and shall be converted to RLAB *lab** (2005) component values lab^*olv_3 as follows:

$lab^*o_3 = lab^*o_{388} / 255$

$lab^*l_3 = lab^*l_{388} / 255$

$lab^*v_3 = lab^*v_{388} / 255$

All lab^*olv_{388} values are in the range [0, 255]. The resulting lab^*olv_3 values are then in the range [0,1].

6.2.2 Decoding 7/8bits integer data lab^*olv_{378} to *relative* CIELAB data lab^*olv_3

The three lab^*olv_{378} 8-bit channel values in 3x8-bit RLAB *lab** (2005) color image encoding and 7 bits for the grey scale shall be assumed to be unsigned integers and shall be converted to RLAB *lab** (2005) component values lab^*olv_3 as follows:

$lab^*o_3 = (lab^*o_{378} - 64) / 127$

$lab^*l_3 = (lab^*l_{378} - 64) / 127$

$lab^*v_3 = (lab^*v_{378} - 64) / 127$

All lab^*olv_{378} values are in the range [0, 255]. The resulting lab^*olv_3 values are then in the range [-0,5, 1,5].

6.2.3 Decoding *relative* CIELAB data lab^*olv_3 to *adapted* CIELAB data LAB_a

The minimum, difference and maximum of the three values lab^*olv_3 determine blackness ***n****, chromaticness ***c**** and whiteness ***w****

$$\boldsymbol{n^*} = \min(lab^*o_3, lab^*l_3, lab^*v_3)$$

$$\boldsymbol{w^*} = 1 - \max(lab^*o_3, lab^*l_3, lab^*v_3)$$

$$\boldsymbol{c^*} = 1 - \boldsymbol{n^*} - \boldsymbol{w^*}$$

The hue is to be decided depending on the six sector of the six chromatic colours in a regular hexagon.

$$x = lab^*o_3 \cos 30 - lab^*l_3 \cos 30$$

$$y = -lab^*v_3 + lab^*o_3 \sin 30 + lab^*l_3 \sin 30$$

$$h^*_{olv3Ma} = \text{atan}(x / y) / 360$$

Table D.1 uses the integer data h^*_{olv3Ma} as index in the range [0,255]. Table C.8 shall be used to determine the two data $C^*_{ab,Ma}$ and L^*_{Ma}.

The starting data are

$$\boldsymbol{n^*} = lab^*n$$

$$\boldsymbol{c^*} = lab^*c$$

$$\boldsymbol{w^*} = lab^*w$$

The above values $C^*_{ab,Ma}$ and L^*_{Ma} are the data for the maximum *adapted* colour M_a compared to a given *adapted* colour F_a of the same hue h^*_{olv3Ma}. For the *adapted* colour F_a the *relative* CIELAB data triangle lightness ***t****, lightness ***l**** and hue ***h**** shall be calculated in the following sequence of the equations (1) to (7).

$$\boldsymbol{t^*} = \boldsymbol{w^*} + 0.5\,\boldsymbol{c^*} \quad (1)$$

$$\boldsymbol{l^*} = \boldsymbol{t^*} + \boldsymbol{c^*}\,\{\,[L^*_{Ma} - L^*_N] / [L^*_W - L^*_N] - 0.5\,\} \quad (2)$$

$$L^* = \boldsymbol{l^*}\,[L^*_W - L^*_N] + L^*_N \quad (3)$$

$$C^*_{ab,a} = \boldsymbol{c^*}\,C^*_{ab,Ma} \quad (4)$$

$$h^*_a = \boldsymbol{h^*} \quad (5)$$

$$H^*_a = 360\,\boldsymbol{h^*} \quad (6)$$

$$a^*_a = C^*_{ab,a} \cos H^*_a \quad (7)$$

$$b^*_a = C^*_{ab,a} \sin H^*_a \quad (8)$$

The *relative* CIELAB data of the relative device dependent space NCCS (small letters) are given in **bold** and *italics* and the *standard* CIELAB data *LAB** (capital letters) are given only in *italics* for easy identification.

The resulting *relative CIELAB data* LCH^*_a and LAB^*_a shall be in floating point.

6.3 Decoding *adapted* CIELAB data LAB_a to *standard* CIELAB data *LAB**

The *adapted* CIELAB data LAB^*_a shall be converted to *standard* CIELAB data *LAB** as follows:

The following four equations transform all the *adapted* CIELAB data LAB^*_a which are located on the achromatic axis ($a^*=b^*=0$) between N and W in the *adapted* CIELAB space into the *standard* CIELAB space. The equations are called the chroma adaptation (a) equations.

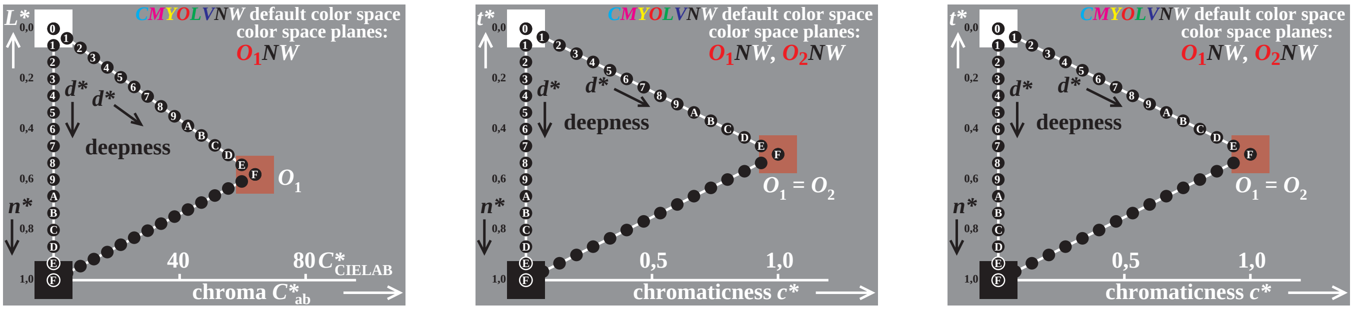
$l^* = (L^*_a - L^*_{Na}) / (L^*_{Wa} - L^*_{Na})$	($0<=l^*<=1$ is the *relative* CIELAB lightness between W and N)
$L^* = L^*_a$	(no lightness change by the chroma adaptation (a) equations)
$a^* = a^*_a + a^*_N + (a^*_W - a^*_N)\,l^*$	(a^*_W and a^*_N are CIELAB a^*-chroma of White W and Black N)
$b^* = b^*_a + b^*_N + (b^*_W - b^*_N)\,l^*$	(b^*_W and b^*_N are CIELAB b^*-chroma of White W and Black N)

NOTE1 For the Offset Reflective System ORS18 the *standard* CIELAB data *LAB** of black N and white W are given in Table 1 and the *adapted* CIELAB data LAB^*_a are given in Table 2.

NOTE2 For the Television Luminous System TLS18 the *standard* CIELAB data *LAB** of black N and white W are given in Table 4. In this case the data *LAB** and LAB^*_a are identical because for TLS18 it is valid $a^*_N = b^*_N = a^*_W = b^*_W = 0$.

7. Colour input, rendering and output based on RLAB *lab** (2005)

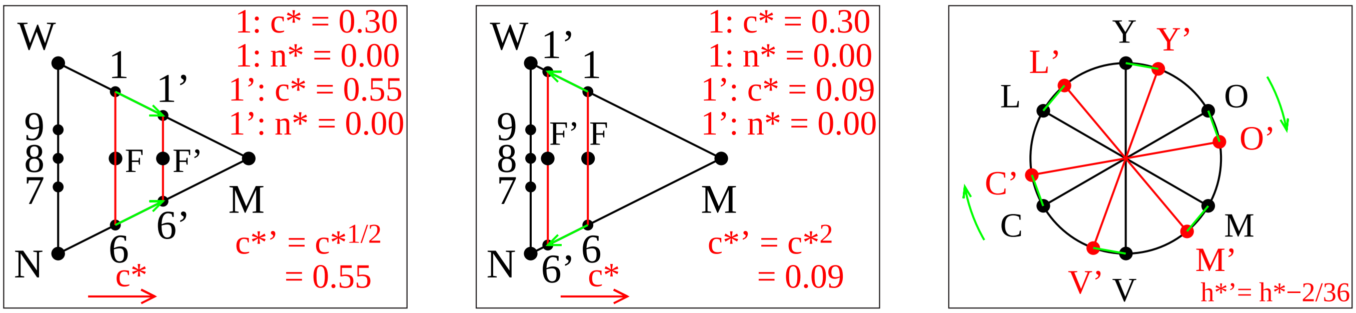
7.1 Colour management and colour rendering based on RLAB *lab** (2005)



BE090−2, lightness L^*, chroma C^*_{ab} of O1 BE090−4, lightness t^*, chromaticness c^* BE090−4, lightness t^*, chromaticness c^*

Figure 6: From *adapted* CIELAB data LCH^*_a via *relative CIELAB* data *lab*lch* to *lab*tch*

Fig. 6 shows the transfer from *adapted* CIELAB data LCH^*_a to *relative* CIELAB data *lab*lch* and *lab*tch.* Hue is constant and the right figure shows the 16 step series within the Natural Colour Connections Space (NCCS). This space has high perceptual isometry (visual uniformity) which is of large importance for effective communication and compression.



LE571−3, Colorimetric chromaticness c^* increase LE571−4, Colorimetric chromaticness c^* decrease LE571−6, Colorimetric hue h^* decrease

Figure 7: Rendering to larger or smaller chromaticness *c or a clockwise hue shift *h****

Fig. 7 shows examples for colour rendering in the NCCS which produces larger *(left)* or smaller *(middle)* chromaticness *c** or a clockwise *(right)* hue shift *h*.* The chromaticness change can be done only if the blackness data *lab*n* are kept constant during the chromaticness transformation. An example rendering transformation is

$$c^{*\prime} = c^{*1/2} \quad \text{and} \quad n^{*\prime} = n^*$$

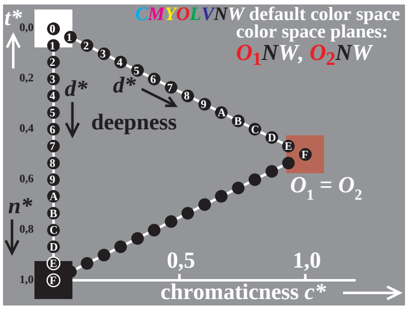
Then the chromaticness $c^* = 0$ and $c^* = 1$ will not change and $c^*= 0{,}3$ will change to $c^{*\prime} = 0{,}55$, which is more chromatic.

Another example transformation is a clockwise hue shift by 20 degrees *(right)*

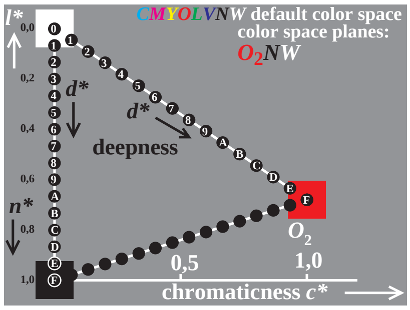
$$h^{*\prime} = h^* – 2/36$$

One or both of the above changes may be included before the image data *lab*tch* are encoded, compare section 5.3.2 and 5.3.3. If the image data are already encoded in lab^*olv_{378} then at first a decoding to *lab*tch* is necessary to make the intended changes and then to encode again to lab^*olv_{378}.

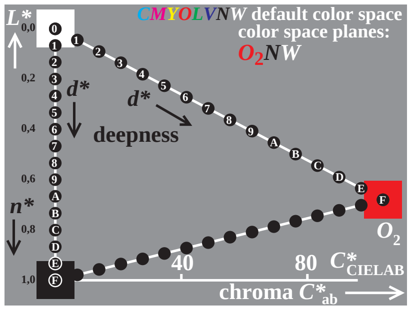
It is a large advantage of this Technical Report that methods for simple and effective visual changes are defined using effective *relative* device coordinates similar to the Natural Colour System NCS. Such simple changes seem not possible if only *lab*olv* = *rgb** coordinates or other *rgb* coordinates of sRGB or *Adobe* RGB (1998) are used.



BE090−4, lightness *t**, chromaticness *c**



BE090−5, lightness *l**, chromaticness *c**



BE090−6, lightness *L**, chroma C^*_{ab} of O2

Figure 8: From *relative* CIELAB data *lab*tch* via *lab*lch* to *adapted* CIELAB data *LCH$_a$**

Fig.8 shows the transfer from the Natural Colour Connections Space (NCCS) with *relative* CIELAB data *lab*tch* via the *relative* CIELAB data *lab*lch* to the *adapted* CIELAB data LCH^*_a for a constant hue *h*.*

One must realize for the relative reproduction of this Technical Report that in the CIELAB space and the hue plane O – W – N the radial chroma $C^*_{ab,a}$ and the lightness L^*_a is different for input (O_1) and output (O_2). The intention and a large advantage is the equal relative spacing of the 16 steps for both input and output.

There are possibilities to increase (or decrease) the chromaticness, compare Fig. 7. The chromaticness increase will not maintain the spacing but make the grass and the sky more chromatic. This may produce a more pleasant picture

If for both the input and output device the CIELAB data *LAB** of the eight colours CMYOLVNW are known then not only a *relative* reproduction in *lab** but also an *absolute* reproduction in *LAB** is possible and may be useful. The methods of this Technical Report allow to design appropriate rendering methods which produce this “softproof” within the common colour gamut of both the input and the output device. But in this case the colours outside the comment colour gamut are clipped and some information is lost.

7.2 Equivalent colorimetric data based on RLAB *lab** (2005)

Equivalent colorimetric data have an exact and simple relationship to the **same** *standard* CIELAB data *LAB**. For the same colour stimuli the *adapted* CIELAB data LAB^*_a and LCH^*_a are equivalent colorimetric data. For the same colour stimuli the *relative* CIELAB data *lab*tab = tab*, lab*tch = tch*, lab*lab = lab*, lab*lch = lch*, lab*nch = nch*, lab*nce = nce** are equivalent colorimetric data.

Table 6: Equivalent colorimetric data which belong to the same colour stimuli

5 steps of grey series black - white (N - W)	Colour space, colour space coordinates and PostScript operator calculations according to ISO/IEC 15775:1999-12			
Linear mixture between black and white in CIELAB colour space	***L** CIE* ***w* = l**** ***setgray***	**CMYN (CMYK)** ***000n**** ***setcmykcolor***	**CMYN (CMYK)** ***cmy0**** ***setcmykcolor***	**OLV (RGB)** ***www**** ***setrgbcolor***
1,00 N + 0,00 W (black N)	0,00	0,00 0,00 0,00 1,00	1,00 1,00 1,00 0,00	0,00 0,00 0,00
0,75 N + 0,25 W	0,25	0,00 0,00 0,00 0,75	0,75 0,75 0,75 0,00	0,25 0,25 0,25
0,50 N + 0,50 W	0,50	0,00 0,00 0,00 0,50	0,50 0,50 0,50 0,00	0,50 0,50 0,50
0,25 N + 0,75 W	0,75	0,00 0,00 0,00 0,25	0,25 0,25 0,25 0,00	0,75 0,75 0,75
0,00 N + 1,00 W (white W)	1,00	0,00 0,00 0,00 0,00	0,00 0,00 0,00 0,00	1,00 1,00 1,00

LE420−1, colorimetric relationship of *w*, 000n*, cmy0*, www** for a 5 step scale: black − white

5 steps of colour series black - white (N - W)	Colour space, colour space coordinates and PostScript operator calculations according to ISO/IEC 15775:1999-12		
Linear mixture between black and white in CIELAB colour space	**CIELAB adapted** ***LAB*a (adapted)*** ***LAB*a setcolor***	**CIELAB relative** ***lab*tch = tch**** ***tch* setcolor***	**CIELAB relative** ***lab*ncE = ncE**** ***ncE* setcolor***
1,00 N + 0,00 W (black N)	18.01 0.00 0.00	0,00 0,00 −	1,00 0,00 −
0,75 N + 0,25 W	37.35 0.00 0.00	0,25 0,00 −	0,75 0,00 −
0,50 N + 0,50 W	56.70 0.00 0.00	0,50 0,00 −	0,50 0,00 −
0,25 N + 0,75 W	76.05 0.00 0.00	0,75 0,00 −	0,25 0,00 −
0,00 N + 1,00 W (white W)	95.41 0.00 0.00	1,00 0,00 −	0,00 0,00 −

LE420−7, colorimetric relationship of *LAB*a, tch*, ncE** for a 5 step scale: black − white

Table 6 shows equivalent colorimetric data which belong to the same colour stimuli. A device system may produce the same output, if the PS operators *w* setgray, 000n* setcmykcolor, cmyn* setcmykcolor*, and *www*setrgbcolor* are used or not.

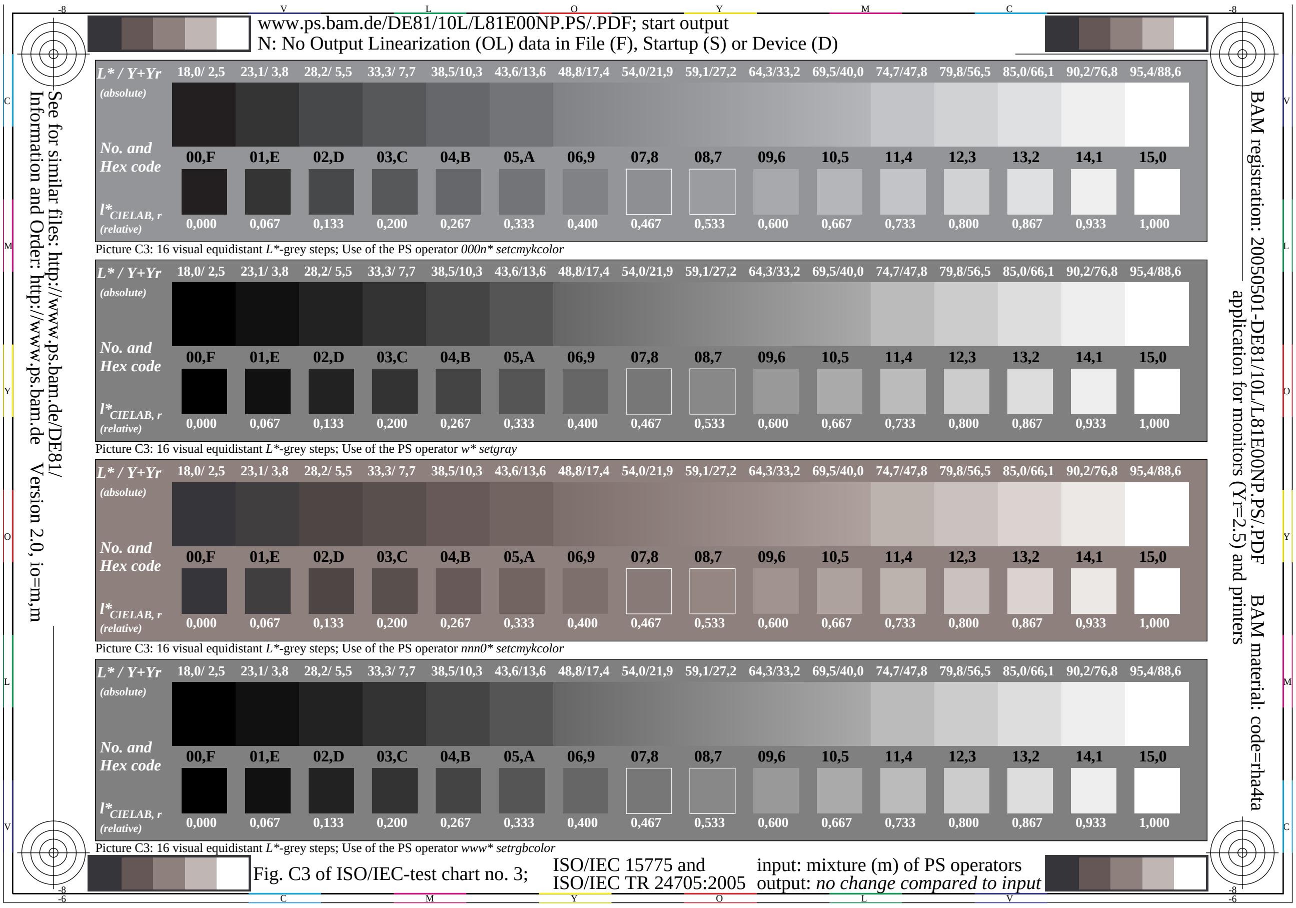


Figure 9: ISO/IEC-test chart for output of colour stimuli with equivalent colorimetric data.
Fig. 9 shows an ISO/IEC test chart for output of colour stimuli with equivalent colorimetric data. Different PS operators are used for output.

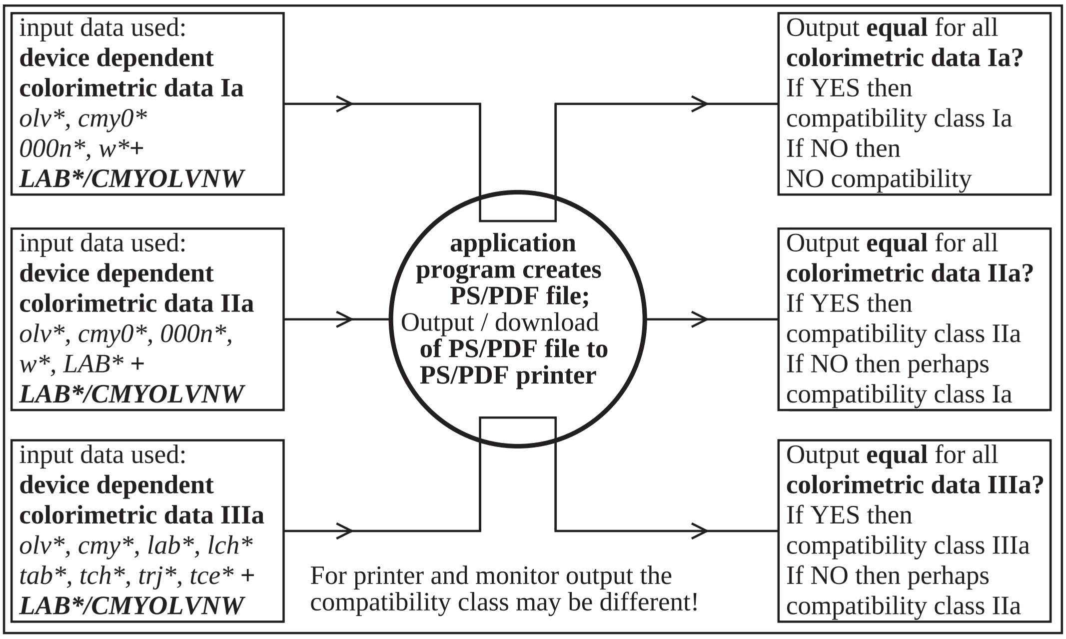
The colorimetric relationship between the different *standard* and *relative* CIELAB data *LAB** and *LCH*, lab*tch* and *lab*olv* and others raise the question if it is possible to produce the same output for all the different equivalent coordinates which belong to the same colour stimuli.

In colour image encoding technology there is a similar intention: the same output shall be produced if the encoding is done by *rgb* data of either RLAB *lab** (2005) of this Technical Report, sRGB or *Adobe* RGB (1998).

The intention of equal output for both equivalent colours and for different colour image encoding shall lead to test methods, which test the compatibility. The above ISO/IEC-test chart is one possibility.

Table 6 shows four different colorimetric colour coordinates of a five step grey scale. The coordinates of the 5 step grey scale can be described by at least 4 different simple coordinates. Some printers show the same output and others show between 2 and 4 different grey scales. In some cases the output on the displays is different and the output on printers is the same and vice versa.

.



LE440−7, Test of the compatibility class of application program which creates PDF/PS files and/or download to printer

Figure 10: Test of compatibility class for application program which creates PDF/PS files

Fig. 10 shows the test for the compatibility class of an application program which creates PDF/PS files or for the download of PDF/PS files to a printer or display system. There are many application programs which produce the compatibility class I, for example the PDF/PS Reader and Output software *GostScript / GostView* which is in the internet freely available for the computer operating systems Windows, Mac, and Unix.

For the software default settings the present software versions of *Adobe Acrobat, Adobe Reader, Adobe Photoshop, Adobe Illustrator* show NO compatibility. However, for the different colorimetric coordinates there seem to be some solutions after a change of the present default settings. Older versions for example *Adobe Photoshop 3.5 on Unix* and *Adobe Display PostScript* and *Display PostScript* on *Silicon Graphics, Mac OS X Server (Software Yap)* and *Compac Open VMS (software Decwrite)* show the compatibility to class I.

According to this Technical Report the three values 0.5 of either *cmy0** or *olv** and the one value *n*=w*=0.5* of *000n** and *w** shall produce

1. the same grey colour
2. a grey colour which is visually in the middle between black and white

If at least the first property is true then the application program agrees to compatibility class I. If NOT there is NO compatibility.

Table 7: Colorimetric colour coordinates for a five step scale between white and cyan blue

5 steps of colour series cyan blue - white (C - W)	Colour space, colour space coordinates and PostScript operator calculations according to ISO/IEC 15775:1999-12		
Linear mixture between cyan blue and white in CIELAB colour space	**CIELAB absolute** ***LAB*LAB = LAB**** ***LAB* setcolor***	**CIELAB relative** ***lab*cmy0 = cmy0**** ***cmy0* setcmykcolor***	**CIELAB relative** ***lab*olv = olv**** ***olv* setrgbcolor***
1,00 C + 0,00 W (cyan blue C)	58.62 -30.62 -42.74	1,00 0,00 0,00 0,00	0,00 1,00 1,00
0,75 C + 0,25 W	67.82 -23.21 -30.86	0,75 0,00 0,00 0,00	0,25 1,00 1,00
0,50 C + 0,50 W	77.02 -15.80 -18.98	0,50 0,00 0,00 0,00	0,50 1,00 1,00
0,25 C + 0,75 W	86.21 -8.39 -7.11	0,25 0,00 0,00 0,00	0,75 1,00 1,00
0,00 C + 1,00 W (white W)	95.41 -0.98 4.76	0,00 0,00 0,00 0,00	1,00 1,00 1,00

LE421−1, colorimetric relationship of *LAB*a, cmy0*, olv** for a 5 step scale: cyan blue − white

Table 7 shows the colorimetric colour coordinates for a five step scale between white and cyan blue. If all the coordinates are used in one PDF file and the output of the three colour series is the same, then this is an indication for compatibility class II. For an example test file which uses the *LAB** data see the URL (200 kByte)

http://www.ps.bam.de/DE92/

The MTL code version 2.0 of ISO/IEC TR 19797 shows the compatibility class II and the next version 3.0 of the MTL code is intended to show the compatibility class III.

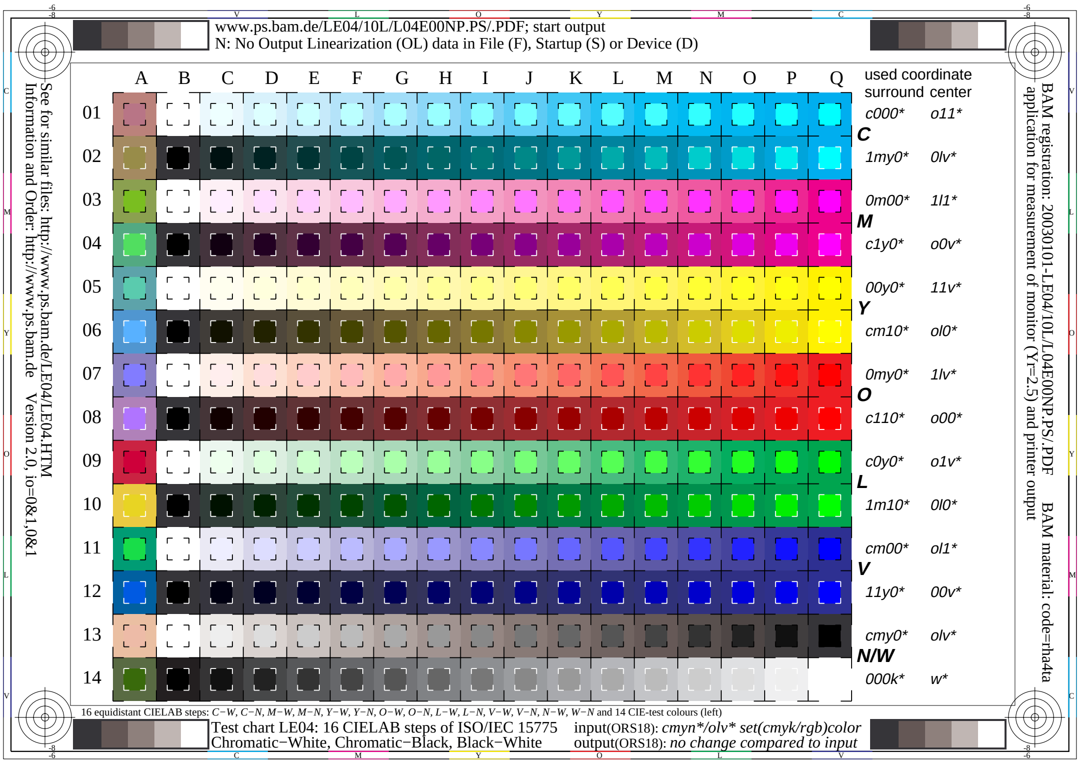


Figure 11: Test chart with image data *(cmy0*, olv*, 000n*, w*)* for the compatibility class I test

Fig. 11 shows a test chart with the colour coordinates *(cmy0*, olv*, 000n*, w*)* for the compatibility class I test. The outer squares are defined by the coordinates *cmy0** and the inner squares by the coordinates *olv** (using the 1 minus relation). It depends on the PDF *Reader*, the PDF *Viewer* or the PDF/PS *printer* if the output is equal (compatibility class I) or not.

The version 2 of the MTL code used in ISO/IEC TR 19797 allows to use additionally the *LAB** (CIELAB) data for the production of the same output which is the property of class II. The version 3 of the MTL code will allow that the user may take a triple of data out of the many colorimetric data *lab*, lch* tab*, tch* trj*, tce*, nce**. The PDF files will for any triple of data lead to the same output (compatibility to class III).

The question if a grey colour with the three values 0.5 of the colorimetric coordinates *olv** is visually in the middle between black and white is not answered by the test of Fig. 11. But after linearization of the 16 step output according to ISO/IEC TR 19797 this additional goal will be reached.

7.3 Device dependent colorimetric data and ambient flare based on RLAB *lab** (2005)

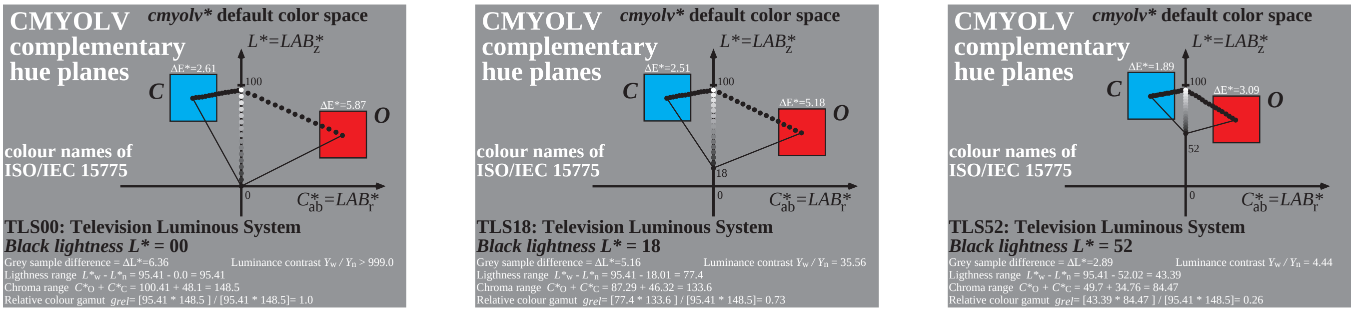
Device dependent ambient flare is ambient light, reflected from an imaging device system, that has not been modulated by the means used to produce the image, compare also CIE Publication 122. Ambient flare lightens all colours, for example on a projection screen or on a monitor and reduces the lightness and luminance contrast, see also Annex A with colorimetric data for eight different lightness and luminance contrast ratios

The standard lightness contrast between medium white and medium black is c_{L*} = 5.29 (=$L*_W$: $L*_N$ = 95.41: 18.01). The corresponding luminance contrast value is c_Y = 35.29 (=$L*_W$: $L*_N$ = 88.59 : 2.51). In ISO 22018-1, the ambient flare is called veiling glare.

Ambient flare shall be always included in the measurement data. If a telespectroradiometer is used at the position of the observer then the ambient flare is included in the measurement data of a monitor or a projection screen. In offices the above standard luminance contrast value c_Y = 35.29 is only in rare cases less compared to this value.

The standard luminance contrast c_Y = 379 of ICC colour management for graphic arts applications is not recommended because it produces may problems if applied to office applications.

The ambient flare changes the standard CIELAB data $LAB*_a$ of monitors and of projected colors to a high degree. Colour differences of up to 20 CIELAB for monitors and up 60 CIELAB for projected colours may occur. In a worse case the lightness range and chroma range of projected images shrinks to 1/3 (for $L*_N$ = 70) and then the colour gamut may decrease to 1/9. In the next figure for the right (a worse) case ($L*_N$ = 52) is selected.

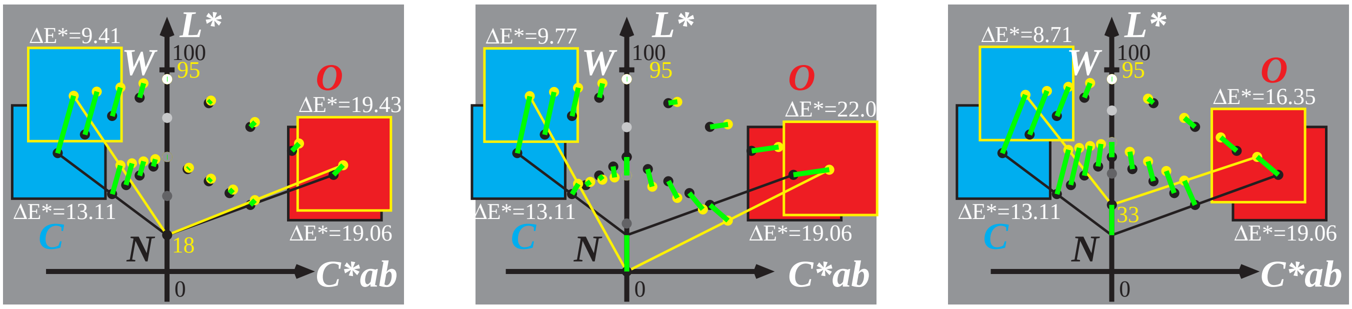


BE391−1, TLS00 in hue plane C−O of LAB* BE391−4, TRS18 in hue plane C−O of LAB* BE391−7, TLS52 in hue plane C−O of LAB*

Figure 12: Change of chroma and lightness for projected colours by the ambient light

Fig. 12 shows the change of chroma and lightness for projected colours by the ambient light. The colour gamut decreases between the dark room condition (left) to the standard condition (L^*_N = 18, middle) by a factor 0.79 and to the condition (L^*_N = 52, right) by a factor 0.26.

The intention of this Technical Report is to produce visually equally space 16 step colour series for the different ambient light conditions.



ME321−4, Colour management of hues O-C; TV18 <-> PR18 ME330−4, Colour management of hues O-C; TV00 <-> PR18 ME331−4, Colour management of hues O-C; TV33 <-> PR18

Figure 13: Rendering between input spaces TLS00, TLS18, TLS33 and output space ORS18

Fig. 13 shows the colorimetric rendering of this Technical Report between three input spaces of television TLS00, TLS18, TLS33 in three ambient light conditions and the offset printing output space ORS18.

It is an advantage of this Technical Report that there is a well defined and effective colorimetric solution for every viewing condition. The result can be studied visually, see for example the test file

http://www.ps.bam.de/ME15/10L/L15E00FP.PDF

This test chart with 16 pages is intended to produce 16 step grey scales for luminous colours on projection screens with eight different ambient flare. The luminance contrast changes between larger 200:1 and 2;1 between white and black.

8. RLAB *lab** (2005) color image encoding and ICC colour management

This section is not completed at the moment and open for discussion.

NOTE Annex F include tables with the connection between the *relative* CIELAB data *lab*olv* and the intended *adapted* CIELAB data LAB^*_a for a 5x5x5, 8x8x8, and 16x16x16 olv-cube. The data shall be used to produce the ICC lookup tables *olv** – LAB^*_a

For compliance with this specification the use of the RLAB *lab** (2005) color image encoding shall be specified by using the RLAB *lab** (2005) ICC profile.

Many image file formats include means to indicate the method used for encoding an image. The RLAB *lab** (2005) ICC profile, specified in section 8 and Annex F, shall be used to indicate the use of the RLAB *lab** (2005) color image encoding.

For this purpose, the RLAB *lab** (2005) ICC profile shall be embedded in PDF, PICT, EPS, TIFF, JFIF, JPEG, and GIF files. ICC.1:2004-10 specifies how to embed ICC profiles in PICT, EPS, TIFF, JFIF (and JPEG) and GIF files.

The PDF Reference, version 1.3 or later, specifies how to use ICCBased Color Spaces to embed ICC profiles. In addition, when the Output Intent of a PDF file is the RLAB *lab** (2005) color image encoding, the OutputConditionIdentifier shall be RLAB *lab** (2005) including spaces and parentheses.

CalRGB Color Spaces should not be used for RLAB *lab** (2005) color image encodings in PDF files, as CalRGB cannot store a name for the color image encoding

Annex A: Tables with *different* CIE data of standard devices

In this Annex A for the standard colours CMYOLVNW the *standard* CIELAB data, the *standard* CIEXYZ data, and the CIE chromaticity *(x, y)* data are given for eight standard devices:

1. Television Luminous System TLSxx (xx=00, 06, 11, 18, 27,38, 52, 70) with TLS18 = TRS18
2. Offset Luminous System OLSxx (xx=00, 06, 11, 18, 27,38, 52, 70) with OLS18 = ORS18

The eight colours CMYOLVNW appear on the different devices in different viewing situations.

The data of the system Television Reflective System TRS18 and of the Television Luminous System TLS18 are identical. The data of the system Offset Reflective System ORS18 and of the Offset Luminous System OLS18 are identical.

In application colour management software needs a solution for the colorimetric transfer from TLS18 to ORS18 and vice versa. In this Technical Report in any case the *standard* CIELAB data of one device system are transferred to the *standard* CIELAB data of the other device system. The *standard* CIELAB data *LAB** are in any case different but the *relative* CIELAB data *lab** are equal.

According to the figures in 3.18 the colorimetric gamut between input and output may change by a factor 9. Therefore a reproduction with the same *standard* CIELAB data in input and output is usually not appropriate. The reproduction intent of this Technical Report maintains the *standard* CIELAB hue, the *standard* CIELAB relative chroma and lightness, compare section 4.3.

The Offset Reflective and Luminous Systems have *standard* CIELAB data a^*_N #0, a^*_W # 0, b^*_N # 0, b^*_W #0. The white paper and the printed black is visually accepted as achromatic. Therefore it is appropriate to transfer all *standard* CIELAB data to $a^*_N = a^*_W = b^*_N = b^*_W = 0$ for white and black and all grey colours on a line between black and white in the *standard* CIELAB space.

The following four equations transform all the *standard* CIELAB data L^*, a^*, b^* which are located on a straight line between N and W in the *standard* CIELAB space to the achromatic axis ($a^*=b^*=0$) in the *adapted* CIELAB space. The equations are called the chroma adaptation (a) equations.

$l^* = (L^* - L^*_N) / (L^*_W - L^*_N)$	($0<=l^*<=1$ is the *relative* CIELAB lightness between W and N)
$L^*_a = L^*$	(no lightness change by the chroma adaptation (a) equations)
$a^*_a = a^* - a^*_N - (a^*_W - a^*_N)\, l^*$	(a^*_W and a^*_N are CIELAB a^*-chroma of White W and Black N)
$b^*_a = b^* - b^*_N - (b^*_W - b^*_N)\, l^*$	(b^*_W and b^*_N are CIELAB b^*-chroma of White W and Black N)

The chroma adaptation equations and the following inverse equations

$l^* = (L^*_a - L^*_{Na}) / (L^*_{Wa} - L^*_{Na})$	($L^*_N = L^*_{Na}$, $L^*_W = L^*_{Wa}$)
$L^* = L^*_a$	
$a^* = a^*_a + a^*_N + (a^*_W - a^*_N)\, l^*$	
$b^* = b^*_a + b^*_N + (b^*_W - b^*_N)\, l^*$	

are used for the transform of the achromatic colours in the ISO/IEC-test charts.

The chroma adaptation equations are used to extrapolate the *standard* CIELAB data for the achromatic colours Black N0 and White W1 in Table 1 and for the transfer of the chroma adapted colour data of Table 2 which are used to calculate the *standard* CIELAB differences between the printer and the monitor colours. There is no lightness colour difference between the monitor and printer White W and Black N. There may be lightness differences for the two 16 step grey scales if the scaling is different. Equal relative scaling between L^*_N and L^*_W is the reference.

NOTE Up to now the CIE has defined equations for chromatic adaptation based on chromaticity *(x, y)* which allow to transfer only one colour from the device chromaticity to the chromaticity of D65. This colour is usually white but in application the chromaticity of both is different from the chromaticity of D65 and therefore the above “chroma adaptation equations” are an appropriate solution.

Table A.1: CIE data of Television Systems TRS18 and TLSxx (xx = 00, 06, 11, 18)

BAM registration: 20040901-LE49/10L/L49E00NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer or monitor systems

/LE49/ Form: 1/2, Serie: 1/1, Page: 1 Page count: 1

www.ps.bam.de/LE49/10L/L49E00NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

Colorimetric data of "Standard Original": Television Reflective System TRS18 for CIE lightness L*=18 of black

System TRS18 (Reflective CIE, Y_N=2.52 and CIELAB cero point) (CIELAB according to ISO/IEC 15775)

Color	L*=LAB*$_1$	a*=LAB*$_2$	b*=LAB*$_3$	C*$_{ab}$=LAB*$_r$	X=XYZ$_1$	Y=XYZ$_2$	Z=XYZ$_3$	x	y	Y/88.59
C	87.14	−44.42	−13.12	46.33	48.72	70.29	94.79	0.2279	0.3288	0.7934
V (B)	31.9	24.46	−37.38	44.68	9.36	7.04	23.51	0.2346	0.1764	0.0795
M	59.01	89.33	−19.43	91.42	53.43	27.04	44.82	0.4265	0.2158	0.3052
O (R)	52.76	71.63	49.88	87.29	37.9	20.83	4.41	0.6003	0.3299	0.2351
Y	92.74	−20.03	84.97	87.3	68.68	82.37	14.66	0.4144	0.4971	0.9298
L (G)	84.0	−78.99	73.94	108.2	33.17	64.07	13.0	0.3009	0.5812	0.7231
N	18.01	0.0	0.0	0.01	2.4	2.52	2.74	0.3127	0.329	0.0284
W	95.41	0.0	0.0	0.01	84.21	88.59	96.48	0.3127	0.329	1.0
N0	0.01	0.0	0.0	0.01	0.0	0.0	0.0	0.3127	0.329	0.0
W1	100.0	0.0	0.0	0.01	95.05	100.0	108.9	0.3127	0.329	1.1288

Calculated colorimetric data: Television Luminous Systeme (TLSxx) for CIE lightness L*=xx=00, 06, 11, 18 of black

System TLS00 (Display reflection Yr=0.0)

Color	L*=LAB*$_1$	a*=LAB*$_2$	b*=LAB*$_3$	C*$_r$=LAB*$_r$	X=XYZ$_1$	Y=XYZ$_2$	Z=XYZ$_3$	x	y	Y/88.59
C	86.88	−46.15	−13.54	48.11	47.68 (=47.68+0.0)	69.76 (=69.76+0.0)	94.74 (=94.74+0.0)	0.2247	0.3288	0.7874
V (B)	25.72	31.45	−44.28	54.32	7.17 (=7.17+0.0)	4.65 (=4.65+0.0)	21.37 (=21.37+0.0)	0.2161	0.1402	0.0525
M	57.31	94.35	−20.68	96.59	52.53 (=52.53+0.0)	25.24 (=25.24+0.0)	43.31 (=43.31+0.0)	0.4339	0.2084	0.2849
O (R)	50.5	76.91	64.55	100.41	36.54 (=36.54+0.0)	18.84 (=18.84+0.0)	1.71 (=1.71+0.0)	0.64	0.33	0.2127
Y	92.66	−20.68	90.75	93.08	68.22 (=68.22+0.0)	82.19 (=82.19+0.0)	12.27 (=12.27+0.0)	0.4194	0.5052	0.9278
L (G)	83.62	−82.74	79.9	115.03	31.68 (=31.68+0.0)	63.35 (=63.35+0.0)	10.55 (=10.55+0.0)	0.3	0.6	0.715
N	0.0	0.0	0.0	0.0	0.0 (=0.0+0.0)	0.0 (=0.0+0.0)	0.0 (=0.0+0.0)	0.2789	0.2934	0.0
W	95.41	0.0	0.0	0.0	84.21 (=84.21+0.0)	88.59 (=88.59+0.0)	96.48 (=96.48+0.0)	0.3127	0.329	1.0
N0	0.0	0.0	0.0	0.0	−2.45 (=−2.45+0.0)	−2.58 (=−2.58+0.0)	−2.81 (=−2.81+0.0)	0.3127	0.329	−0.0292
W1	100.13	0.0	0.0	0.0	95.37 (=95.37+0.0)	100.33 (=100.33+0.0)	109.26 (=109.26+0.0)	0.3127	0.329	1.1325

System TLS06 (Display reflection Yr=0.63)

Color	L*=LAB*$_1$	a*=LAB*$_2$	b*=LAB*$_3$	C*$_r$=LAB*$_r$	X=XYZ$_1$	Y=XYZ$_2$	Z=XYZ$_3$	x	y	Y/88.59
C	86.94	−45.72	−13.43	47.66	47.94 (=47.34+0.6)	69.89 (=69.26+0.63)	94.75 (=94.06+0.69)	0.2255	0.3288	0.7889
V (B)	27.44	29.31	−42.29	51.46	7.72 (=7.12+0.6)	5.25 (=4.62+0.63)	21.91 (=21.22+0.69)	0.2214	0.1505	0.0593
M	57.74	93.06	−20.36	95.26	52.75 (=52.16+0.6)	25.69 (=25.06+0.63)	43.68 (=43.0+0.69)	0.432	0.2103	0.2899
O (R)	51.08	75.54	59.69	96.28	36.88 (=36.28+0.6)	19.34 (=18.71+0.63)	2.39 (=1.7+0.69)	0.6293	0.33	0.2183
Y	92.68	−20.51	89.24	91.57	68.34 (=67.74+0.6)	82.24 (=81.61+0.63)	12.87 (=12.18+0.69)	0.4181	0.5032	0.9283
L (G)	83.72	−81.79	78.32	113.25	32.05 (=31.45+0.6)	63.53 (=62.9+0.63)	11.17 (=10.48+0.69)	0.3003	0.5951	0.7171
N	5.69	0.0	0.0	0.0	0.6 (=0.0+0.6)	0.63 (=0.0+0.63)	0.69 (=0.0+0.69)	0.3127	0.329	0.0071
W	95.41	0.0	0.0	0.0	84.21 (=83.61+0.6)	88.59 (=87.96+0.63)	96.48 (=95.79+0.69)	0.3127	0.329	1.0
N0	0.0	0.0	0.0	0.0	−1.84 (=−2.44+0.6)	−1.93 (=−2.56+0.63)	−2.11 (=−2.79+0.69)	0.3127	0.329	−0.0218
W1	100.1	0.0	0.0	0.0	95.29 (=94.69+0.6)	100.25 (=99.62+0.63)	109.17 (=108.49+0.69)	0.3127	0.329	1.1316

System TLS11 (Display reflection Yr=1.26)

Color	L*=LAB*$_1$	a*=LAB*$_2$	b*=LAB*$_3$	C*$_r$=LAB*$_r$	X=XYZ$_1$	Y=XYZ$_2$	Z=XYZ$_3$	x	y	Y/88.59
C	87.01	−45.28	−13.33	47.22	48.2 (=47.0+1.2)	70.02 (=68.76+1.26)	94.76 (=93.39+1.37)	0.2263	0.3288	0.7904
V (B)	29.02	27.48	−40.49	48.94	8.27 (=7.07+1.2)	5.85 (=4.59+1.26)	22.44 (=21.07+1.37)	0.2262	0.16	0.066
M	58.17	91.8	−20.04	93.96	52.98 (=51.78+1.2)	26.14 (=24.88+1.26)	44.06 (=42.69+1.37)	0.4301	0.2122	0.295
O (R)	51.65	74.2	55.83	92.86	37.22 (=36.02+1.2)	19.84 (=18.58+1.26)	3.06 (=1.69+1.37)	0.6191	0.3299	0.2239
Y	92.7	−20.35	87.77	90.1	68.45 (=67.25+1.2)	82.28 (=81.02+1.26)	13.47 (=12.09+1.37)	0.4169	0.5011	0.9288
L (G)	83.81	−80.85	76.81	111.52	32.43 (=31.23+1.2)	63.71 (=62.45+1.26)	11.78 (=10.4+1.37)	0.3005	0.5904	0.7191
N	10.99	0.0	0.0	0.0	1.2 (=0.0+1.2)	1.26 (=0.0+1.26)	1.37 (=0.0+1.37)	0.3127	0.329	0.0142
W	95.41	0.0	0.0	0.0	84.21 (=83.01+1.2)	88.59 (=87.33+1.26)	96.48 (=95.11+1.37)	0.3127	0.329	1.0
N0	0.0	0.0	0.0	0.0	−1.22 (=−2.42+1.2)	−1.29 (=−2.55+1.26)	−1.4 (=−2.77+1.37)	0.3127	0.329	−0.0145
W1	100.06	0.0	0.0	0.0	95.21 (=94.01+1.2)	100.17 (=98.91+1.26)	109.08 (=107.71+1.37)	0.3127	0.329	1.1306

System TLS18 (Display reflection Yr=2.52)

Color	L*=LAB*$_1$	a*=LAB*$_2$	b*=LAB*$_3$	C*$_r$=LAB*$_r$	X=XYZ$_1$	Y=XYZ$_2$	Z=XYZ$_3$	x	y	Y/88.59
C	87.14	−44.42	−13.12	46.33	48.72 (=46.32+2.4)	70.29 (=67.77+2.52)	94.79 (=92.04+2.74)	0.2279	0.3288	0.7934
V (B)	31.9	24.46	−37.38	44.68	9.36 (=6.97+2.4)	7.04 (=4.52+2.52)	23.51 (=20.76+2.74)	0.2346	0.1764	0.0795
M	59.01	89.33	−19.43	91.42	53.43 (=51.03+2.4)	27.04 (=24.52+2.52)	44.82 (=42.07+2.74)	0.4265	0.2158	0.3052
O (R)	52.76	71.63	49.88	87.29	37.9 (=35.5+2.4)	20.83 (=18.31+2.52)	4.41 (=1.66+2.74)	0.6003	0.3299	0.2351
Y	92.74	−20.03	84.97	87.3	68.68 (=66.28+2.4)	82.37 (=79.85+2.52)	14.66 (=11.92+2.74)	0.4144	0.4971	0.9298
L (G)	84.0	−78.99	73.94	108.2	33.17 (=30.78+2.4)	64.07 (=61.55+2.52)	13.0 (=10.25+2.74)	0.3009	0.5812	0.7231
N	18.01	0.0	0.0	0.0	2.4 (=0.0+2.4)	2.52 (=0.0+2.52)	2.74 (=0.0+2.74)	0.3127	0.329	0.0284
W	95.41	0.0	0.0	0.0	84.21 (=81.81+2.4)	88.59 (=86.07+2.52)	96.48 (=93.73+2.74)	0.3127	0.329	1.0
N0	0.01	0.0	0.0	0.0	0.0 (=−2.38+2.4)	0.0 (=−2.51+2.52)	0.0 (=−2.73+2.74)	0.3037	0.3196	0.0
W1	100.0	0.0	0.0	0.0	95.05 (=92.65+2.4)	100.0 (=97.48+2.52)	108.9 (=106.16+2.74)	0.3127	0.329	1.1288

LE490−7N, Colorimetric data of Television Reflective System TRS18 and of Television Luminous Systems TLS00/06/11/18

BAM-test chart no. LE49; colorimetric coordinates
TRS18 and Television Luminous Systems TLS=00, 06, 11, 18

input: *cmy0* setcmykcolor*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/LE49/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table A.1 shows the *standard* CIELAB data, the *standard* CIEXYZ data, and the CIE chromaticity *(x, y)* data for the *standard* Television Reflective System TRS18 and the Television Luminous Systems TLSxx (xx = 00, 06, 11, 18)

www.ps.bam.de/LE49/10L/L49E01NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

Colorimetric data of "Standard Original": Television Reflective System TRS18 for CIE lightness L*=18 of black

System TRS18	Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_{ab}=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
(Reflective CIE, Y_N=2.52	C	87.14	−44.42	−13.12	46.33	48.72	70.29	94.79	0.2279	0.3288	0.7934
and CIELAB cero point)	V (B)	31.9	24.46	−37.38	44.68	9.36	7.04	23.51	0.2346	0.1764	0.0795
(CIELAB according	M	59.01	89.33	−19.43	91.42	53.43	27.04	44.82	0.4265	0.2158	0.3052
to ISO/IEC 15775)	O (R)	52.76	71.63	49.88	87.29	37.9	20.83	4.41	0.6003	0.3299	0.2351
	Y	92.74	−20.03	84.97	87.3	68.68	82.37	14.66	0.4144	0.4971	0.9298
	L (G)	84.0	−78.99	73.94	108.2	33.17	64.07	13.0	0.3009	0.5812	0.7231
	N	18.01	0.0	0.0	0.01	2.4	2.52	2.74	0.3127	0.329	0.0284
	W	95.41	0.0	0.0	0.01	84.21	88.59	96.48	0.3127	0.329	1.0
	N0	0.01	0.0	0.0	0.01	0.0	0.0	0.0	0.3127	0.329	0.0
	W1	100.0	0.0	0.0	0.01	95.05	100.0	108.9	0.3127	0.329	1.1288

Calculated colorimetric data: Television Luminous Systeme (TLSxx) for CIE lightness L*=xx=27, 33, 52, 70 of black

System TLS27	Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
(Display reflection	C	87.4	−42.72	−12.7	44.58	49.76 (=44.96+4.79)	70.83 (=65.79+5.04)	94.84 (=89.35+5.49)	0.231	0.3288	0.7995
Yr=5.04)	V (B)	36.8	20.12	−32.47	38.2	11.56 (=6.76+4.79)	9.43 (=4.39+5.04)	25.64 (=20.16+5.49)	0.2478	0.2022	0.1064
	M	60.64	84.61	−18.27	86.56	54.33 (=49.54+4.79)	28.84 (=23.8+5.04)	46.33 (=40.84+5.49)	0.4195	0.2227	0.3255
	O (R)	54.88	66.84	41.69	78.78	39.25 (=34.46+4.79)	22.81 (=17.77+5.04)	7.1 (=1.62+5.49)	0.5675	0.3298	0.2575
	Y	92.82	−19.39	79.81	82.13	69.13 (=64.34+4.79)	82.56 (=77.52+5.04)	17.06 (=11.57+5.49)	0.4097	0.4892	0.9319
	L (G)	84.37	−75.39	68.76	102.04	34.67 (=29.88+4.79)	64.78 (=59.74+5.04)	15.44 (=9.95+5.49)	0.3017	0.5639	0.7313
	N	26.85	0.0	0.0	0.0	4.79 (=0.0+4.79)	5.04 (=0.0+5.04)	5.49 (=0.0+5.49)	0.3127	0.329	0.0569
	W	95.41	0.0	0.0	0.0	84.21 (=79.42+4.79)	88.59 (=83.55+5.04)	96.48 (=90.99+5.49)	0.3127	0.329	1.0
	N0	18.34	0.0	0.0	0.0	2.47 (=−2.31+4.79)	2.59 (=−2.44+5.04)	2.83 (=−2.65+5.49)	0.3127	0.329	0.0293
	W1	99.87	0.0	0.0	0.0	94.73 (=89.94+4.79)	99.67 (=94.63+5.04)	108.54 (=103.05+5.49)	0.3127	0.329	1.125

System TLS38	Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
(Display reflection	C	87.92	−39.42	−11.87	41.19	51.83 (=42.25+9.58)	71.9 (=61.82+10.08)	94.94 (=83.96+10.98)	0.237	0.3288	0.8116
Yr=10.08)	V (B)	44.52	14.84	−25.65	29.64	15.94 (=6.36+9.58)	14.2 (=4.12+10.08)	29.92 (=18.94+10.98)	0.2654	0.2365	0.1603
	M	63.71	75.92	−16.19	77.63	56.13 (=46.55+9.58)	32.45 (=22.37+10.08)	49.36 (=38.38+10.98)	0.407	0.2352	0.3662
	O (R)	58.77	58.45	31.73	66.5	41.97 (=32.38+9.58)	26.78 (=16.7+10.08)	12.49 (=1.52+10.98)	0.5166	0.3296	0.3023
	Y	92.98	−18.11	70.81	73.09	70.04 (=60.46+9.58)	82.92 (=72.84+10.08)	21.85 (=10.87+10.98)	0.4007	0.4743	0.936
	L (G)	85.11	−68.58	60.02	91.14	37.66 (=28.08+9.58)	66.22 (=56.14+10.08)	20.33 (=9.35+10.98)	0.3032	0.5331	0.7475
	N	37.99	0.0	0.0	0.0	9.58 (=0.0+9.58)	10.08 (=0.0+10.08)	10.98 (=0.0+10.98)	0.3127	0.329	0.1138
	W	95.41	0.0	0.0	0.0	84.21 (=74.63+9.58)	88.59 (=78.51+10.08)	96.48 (=85.5+10.98)	0.3127	0.329	1.0
	N0	33.53	0.0	0.0	0.0	7.4 (=−2.17+9.58)	7.78 (=−2.29+10.08)	8.47 (=−2.49+10.98)	0.3127	0.329	0.0878
	W1	99.61	0.0	0.0	0.0	94.1 (=84.52+9.58)	99.0 (=88.92+10.08)	107.81 (=96.83+10.98)	0.3127	0.329	1.1174

System TLS52	Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
(Display reflection	C	88.94	−33.19	−10.24	34.75	55.99 (=36.83+19.16)	74.04 (=53.88+20.16)	95.13 (=73.18+21.95)	0.2487	0.3288	0.8358
Yr=20.16)	V (B)	55.84	9.42	−17.5	19.88	24.7 (=5.54+19.16)	23.75 (=3.59+20.16)	38.46 (=16.51+21.95)	0.2842	0.2733	0.2681
	M	69.22	60.95	−12.72	62.27	59.74 (=40.58+19.16)	39.65 (=19.49+20.16)	55.41 (=33.45+21.95)	0.3859	0.2562	0.4476
	O (R)	65.53	45.06	20.98	49.71	47.39 (=28.23+19.16)	34.72 (=14.56+20.16)	23.28 (=1.32+21.95)	0.4497	0.3294	0.3919
	Y	93.3	−15.61	56.27	58.4	71.86 (=52.7+19.16)	83.65 (=63.49+20.16)	31.43 (=9.48+21.95)	0.3844	0.4475	0.9442
	L (G)	86.55	−56.31	46.52	73.05	43.63 (=24.47+19.16)	69.09 (=48.93+20.16)	30.11 (=8.15+21.95)	0.3055	0.4837	0.7799
	N	52.02	0.0	0.0	0.0	19.16 (=0.0+19.16)	20.16 (=0.0+20.16)	21.95 (=0.0+21.95)	0.3127	0.329	0.2276
	W	95.41	0.0	0.0	0.0	84.21 (=65.05+19.16)	88.59 (=68.43+20.16)	96.48 (=74.52+21.95)	0.3127	0.329	1.0
	N0	49.69	0.0	0.0	0.0	17.26 (=−1.89+19.16)	18.16 (=−1.99+20.16)	19.77 (=−2.17+21.95)	0.3127	0.329	0.205
	W1	99.09	0.0	0.0	0.0	92.83 (=73.67+19.16)	97.66 (=77.5+20.16)	106.35 (=84.4+21.95)	0.3127	0.329	1.1024

System TLS70	Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
(Display reflection	C	90.93	−21.96	−7.08	23.09	64.3 (=25.98+38.32)	78.33 (=38.01+40.32)	95.53 (=51.62+43.91)	0.27	0.3289	0.8841
Yr=40.32)	V (B)	71.46	4.57	−9.01	10.11	42.23 (=3.91+38.32)	42.86 (=2.54+40.32)	55.55 (=11.65+43.91)	0.3003	0.3047	0.4837
	M	78.5	37.52	−7.58	38.28	66.95 (=28.62+38.32)	54.07 (=13.75+40.32)	67.51 (=23.6+43.91)	0.3551	0.2868	0.6103
	O (R)	76.43	26.27	10.57	28.31	58.24 (=19.91+38.32)	50.59 (=10.27+40.32)	44.84 (=0.93+43.91)	0.379	0.3292	0.571
	Y	93.93	−10.77	34.63	36.27	75.5 (=37.17+38.32)	85.11 (=44.79+40.32)	50.59 (=6.69+43.91)	0.3575	0.403	0.9606
	L (G)	89.32	−35.81	27.64	45.25	55.59 (=17.26+38.32)	74.84 (=34.52+40.32)	49.66 (=5.75+43.91)	0.3087	0.4156	0.8447
	N	69.7	0.0	0.0	0.0	38.32 (=0.0+38.32)	40.32 (=0.0+40.32)	43.91 (=0.0+43.91)	0.3127	0.329	0.4551
	W	95.41	0.0	0.0	0.0	84.21 (=45.88+38.32)	88.59 (=48.27+40.32)	96.48 (=52.57+43.91)	0.3127	0.329	1.0
	N0	68.68	0.0	0.0	0.0	36.98 (=−1.33+38.32)	38.91 (=−1.4+40.32)	42.37 (=−1.53+43.91)	0.3127	0.329	0.4392
	W1	98.03	0.0	0.0	0.0	90.29 (=51.96+38.32)	94.99 (=54.67+40.32)	103.44 (=59.54+43.91)	0.3127	0.329	1.0722

LE490−7N, Colorimetric data of Television Reflective System TRS18 and of Television Luminous Systems TLS18/27/38/52/70

BAM-test chart no. LE49; colorimetric coordinates
TRS18 and Television Luminous Systems TLS=27, 38, 52, 70

input: *cmy0* setcmykcolor*
output: *no change compared to input*

BAM registration: 20040901-LE49/10L/L49E01NP.PS/.PDF
application for measurement of printer or monitor systems

BAM material: code=rha4ta

/LE49/ Form: 2/2, Serie: 1/1, Page: 2 Page count: 2

See for similar files: http://www.ps.bam.de/LE49/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table A.2 shows the *standard* CIELAB data, the *standard* CIEXYZ data, and the CIE chromaticity (*x*, *y*) data for the *standard* Television Reflective System TRS18 and the Television Luminous Systems TLSxx (xx = 27, 38, 52, 70)

Table A.3: CIE data of Offset Systems ORS18a and OLSxxa (xx=00, 06, 11, 18)

www.ps.bam.de/LE48/10L/L48E00NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

See for similar files: http://www.ps.bam.de/LE48/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

BAM registration: 20040901-LE48/10L/L48E00NP.PS/.PDF
application for measurement of printer or monitor systems

BAM material: code=rha4ta

/LE48/ Form: 1/4, Serie: 1/1, Page: 1 Page count: 1

Colorimetric data of "Standard Original": Offset Reflective System ORS18 for CIE lightness L*=18 of black

System ORS18 (Reflective CIE, Y_N=2.52 and CIELAB cero point) (CIELAB according to ISO/IEC 15775)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_{ab}=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	58.62	−30.62	−42.74	52.59	18.74	26.62	68.55	0.1645	0.2337	0.3005
V	25.72	31.45	−44.35	54.38	7.17	4.65	21.41	0.2158	0.14	0.0525
M	48.13	75.2	−6.79	75.51	33.06	16.9	22.01	0.4594	0.2348	0.1907
O	47.94	65.31	52.07	83.53	30.13	16.75	2.68	0.608	0.338	0.189
Y	90.37	−11.15	96.17	96.82	68.07	77.11	9.03	0.4414	0.5	0.8703
L	50.9	−62.96	36.71	72.89	8.71	19.18	6.62	0.2523	0.5559	0.2165
N	18.01	0.5	−0.46	0.69	2.42	2.52	2.81	0.3122	0.3251	0.0284
W	95.41	−0.98	4.76	4.86	83.69	88.59	89.48	0.3197	0.3384	1.0
N0	0.01	0.84	−1.68	1.89	0.02	0.0	0.12	0.1518	0.0078	0.0
W1	100.0	−1.07	5.06	5.17	94.44	100.0	100.84	0.3198	0.3387	1.1288

Calculated colorimetric data: Offset Luminous Systems OLSxxa for CIE lightness L*=xx=00, 06, 11, 18 of black, chroma adapted (a)

System OLS00a (Display reflection Yr=0.0)

Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
C	56.88	−33.11	−47.41	57.84	16.88 (=16.88+0.0)	24.8 (=24.8+0.0)	70.58 (=70.58+0.0)	0.1504	0.221	0.28
V	16.48	45.84	−56.22	72.54	4.88 (=4.88+0.0)	2.19 (=2.19+0.0)	19.24 (=19.24+0.0)	0.1854	0.0834	0.0248
M	45.36	81.85	−9.29	82.38	31.58 (=31.58+0.0)	14.8 (=14.8+0.0)	20.75 (=20.75+0.0)	0.4705	0.2204	0.167
O	45.14	71.37	75.54	103.92	28.57 (=28.57+0.0)	14.64 (=14.64+0.0)	0.16 (=0.16+0.0)	0.6587	0.3376	0.1653
Y	90.22	−10.6	99.51	100.07	68.01 (=68.01+0.0)	76.77 (=76.77+0.0)	7.96 (=7.96+0.0)	0.4453	0.5026	0.8665
L	48.45	−73.19	42.21	84.5	6.51 (=6.51+0.0)	17.15 (=17.15+0.0)	4.45 (=4.45+0.0)	0.2316	0.61	0.1936
N	0.0	0.0	0.0	0.0	0.0 (=0.0+0.0)	0.0 (=0.0+0.0)	0.0 (=0.0+0.0)	0.2789	0.2934	0.0
W	95.41	0.0	0.0	0.0	84.21 (=84.21+0.0)	88.59 (=88.59+0.0)	96.48 (=96.48+0.0)	0.3127	0.329	1.0
N0	0.0	0.0	0.0	0.0	−2.45 (=−2.45+0.0)	−2.58 (=−2.58+0.0)	−2.81 (=−2.81+0.0)	0.3127	0.329	−0.0292
W1	100.13	0.0	0.0	0.01	95.37 (=95.37+0.0)	100.33 (=100.33+0.0)	109.28 (=109.28+0.0)	0.3127	0.329	1.1325

System OLS06a (Display reflection Yr=0.63)

Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
C	57.33	−32.38	−46.8	56.92	17.36 (=16.76+0.6)	25.26 (=24.63+0.63)	70.76 (=70.08+0.69)	0.1531	0.2228	0.2851
V	19.26	40.73	−52.47	66.44	5.44 (=4.84+0.6)	2.81 (=2.18+0.63)	19.79 (=19.1+0.69)	0.1941	0.1002	0.0317
M	46.07	80.12	−9.04	80.63	31.96 (=31.36+0.6)	15.32 (=14.69+0.63)	21.29 (=20.6+0.69)	0.4661	0.2235	0.173
O	45.87	69.79	66.99	96.74	28.96 (=28.36+0.6)	15.17 (=14.54+0.63)	0.85 (=0.16+0.69)	0.6439	0.3373	0.1712
Y	90.25	−10.51	97.42	97.99	68.13 (=67.53+0.6)	76.85 (=76.22+0.63)	8.59 (=7.9+0.69)	0.4436	0.5004	0.8675
L	49.08	−70.28	40.08	80.91	7.06 (=6.47+0.6)	17.66 (=17.03+0.63)	5.11 (=4.42+0.69)	0.2368	0.5919	0.1993
N	5.69	0.0	0.0	0.0	0.6 (=0.0+0.6)	0.63 (=0.0+0.63)	0.69 (=0.0+0.69)	0.3127	0.329	0.0071
W	95.41	0.0	0.0	0.0	84.21 (=83.61+0.6)	88.59 (=87.96+0.63)	96.48 (=95.79+0.69)	0.3127	0.329	1.0
N0	0.0	0.0	0.0	0.0	−1.84 (=−2.44+0.6)	−1.93 (=−2.56+0.63)	−2.11 (=−2.79+0.69)	0.3128	0.329	−0.0218
W1	100.1	0.0	0.0	0.01	95.29 (=94.69+0.6)	100.25 (=99.62+0.63)	109.19 (=108.5+0.69)	0.3127	0.329	1.1316

System OLS11a (Display reflection Yr=1.26)

Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
C	57.76	−31.68	−46.19	56.02	17.84 (=16.64+1.2)	25.71 (=24.45+1.26)	70.95 (=69.57+1.37)	0.1558	0.2246	0.2902
V	21.67	36.81	−49.37	61.59	6.01 (=4.81+1.2)	3.42 (=2.16+1.26)	20.34 (=18.97+1.37)	0.2018	0.115	0.0386
M	46.77	78.45	−8.8	78.95	32.33 (=31.13+1.2)	15.85 (=14.59+1.26)	21.82 (=20.45+1.37)	0.4619	0.2264	0.1789
O	46.57	68.27	59.62	90.64	29.36 (=28.16+1.2)	15.7 (=14.44+1.26)	1.53 (=0.16+1.37)	0.6302	0.3369	0.1772
Y	90.29	−10.43	95.45	96.01	68.24 (=67.05+1.2)	76.94 (=75.68+1.26)	9.22 (=7.85+1.37)	0.442	0.4983	0.8684
L	49.7	−67.6	38.19	77.65	7.62 (=6.42+1.2)	18.17 (=16.91+1.26)	5.76 (=4.39+1.37)	0.2415	0.5759	0.2051
N	10.99	0.0	0.0	0.0	1.2 (=0.0+1.2)	1.26 (=0.0+1.26)	1.37 (=0.0+1.37)	0.3127	0.329	0.0142
W	95.41	0.0	0.0	0.0	84.21 (=83.01+1.2)	88.59 (=87.33+1.26)	96.48 (=95.11+1.37)	0.3127	0.329	1.0
N0	0.0	0.0	0.0	0.0	−1.22 (=−2.42+1.2)	−1.29 (=−2.55+1.26)	−1.4 (=−2.77+1.37)	0.3128	0.329	−0.0145
W1	100.06	0.0	0.0	0.01	95.21 (=94.01+1.2)	100.17 (=98.91+1.26)	109.1 (=107.73+1.37)	0.3127	0.329	1.1306

System OLS18a (Display reflection Yr=2.52)

Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
C	58.62	−30.34	−45.01	54.3	18.79 (=16.4+2.4)	26.62 (=24.1+2.52)	71.32 (=68.57+2.74)	0.161	0.228	0.3005
V	25.72	31.1	−44.4	54.22	7.14 (=4.74+2.4)	4.65 (=2.13+2.52)	21.44 (=18.69+2.74)	0.2148	0.14	0.0525
M	48.13	75.28	−8.36	75.74	33.08 (=30.68+2.4)	16.9 (=14.38+2.52)	22.9 (=20.16+2.74)	0.4539	0.2319	0.1907
O	47.94	65.39	50.52	82.63	30.15 (=27.75+2.4)	16.75 (=14.23+2.52)	2.9 (=0.16+2.74)	0.6054	0.3363	0.189
Y	90.37	−10.26	91.75	92.32	68.47 (=66.08+2.4)	77.11 (=74.59+2.52)	10.48 (=7.73+2.74)	0.4388	0.4941	0.8703
L	50.9	−62.83	34.96	71.91	8.72 (=6.33+2.4)	19.18 (=16.66+2.52)	7.07 (=4.33+2.74)	0.2494	0.5484	0.2165
N	18.01	0.0	0.0	0.0	2.4 (=0.0+2.4)	2.52 (=0.0+2.52)	2.74 (=0.0+2.74)	0.3127	0.329	0.0284
W	95.41	0.0	0.0	0.0	84.21 (=81.81+2.4)	88.59 (=86.07+2.52)	96.48 (=93.73+2.74)	0.3127	0.329	1.0
N0	0.01	0.0	0.0	0.01	0.0 (=−2.38+2.4)	0.0 (=−2.51+2.52)	0.0 (=−2.73+2.74)	0.2505	0.3105	0.0
W1	100.0	0.0	0.0	0.01	95.05 (=92.65+2.4)	100.0 (=97.48+2.52)	108.92 (=106.17+2.74)	0.3127	0.329	1.1288

LE480−7N, Colorimetric data of standard Offset Reflective System ORS18 and of Offset Luminous Systems OLS00/06/11/18a, chroma adapted (a)

BAM-test chart no. LE48; colorimetric coordinates
ORS18 and Offset Luminous Systems OLS00a, 06a, 11a, 18a

input: *cmy0* setcmykcolor*
output: *no change compared to input*

Table A.3 shows the *adapted* CIELAB data, the CIEXYZ data, and the CIE chromaticity (*x*, *y*) data for the *adapted* Offset Reflective System ORS18a and the Offset Luminous Systems TLSxxa (xx = 00, 06, 11, 18), (a=adapted).

BAM registration: 20040901-LE48/10L/L48E01NP.PS/.PDF
application for measurement of printer or monitor systems

BAM material: code=rha4ta

/LE48/ Form: 2/4, Serie: 1/1, Page: 2 Page count: 2

www.ps.bam.de/LE48/10L/L48E01NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

Colorimetric data of "Standard Original": Offset Reflective System ORS18 for CIE lightness L*=18 of black

System ORS18	Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_{ab}=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
(Reflective CIE, Y_N=2.52	C	58.62	−30.62	−42.74	52.59	18.74	26.62	68.55	0.1645	0.2337	0.3005
and CIELAB cero point)	V	25.72	31.45	−44.35	54.38	7.17	4.65	21.41	0.2158	0.14	0.0525
(CIELAB according	M	48.13	75.2	−6.79	75.51	33.06	16.9	22.01	0.4594	0.2348	0.1907
to ISO/IEC 15775)	O	47.94	65.31	52.07	83.53	30.13	16.75	2.68	0.608	0.338	0.189
	Y	90.37	−11.15	96.17	96.82	68.07	77.11	9.03	0.4414	0.5	0.8703
	L	50.9	−62.96	36.71	72.89	8.71	19.18	6.62	0.2523	0.5559	0.2165
	N	18.01	0.5	−0.46	0.69	2.42	2.52	2.81	0.3122	0.3251	0.0284
	W	95.41	−0.98	4.76	4.86	83.69	88.59	89.48	0.3197	0.3384	1.0
	N0	0.01	0.84	−1.68	1.89	0.02	0.0	0.12	0.1518	0.0078	0.0
	W1	100.0	−1.07	5.06	5.17	94.44	100.0	100.84	0.3198	0.3387	1.1288

Calculated colorimetric data: Offset Luminous Systems OLSxxa for CIE lightness L*=xx=27, 33, 52, 70 of black, chroma adapted (a)

System OLS27a	Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
(Display reflection	C	60.28	−27.91	−42.75	51.07	20.71 (=15.92+4.79)	28.43 (=23.39+5.04)	72.05 (=66.56+5.49)	0.1709	0.2346	0.3209
Yr=5.04)	V	32.06	24.02	−37.32	44.39	9.39 (=4.6+4.79)	7.11 (=2.07+5.04)	23.63 (=18.14+5.49)	0.234	0.1771	0.0803
	M	50.68	69.5	−7.57	69.92	34.58 (=29.79+4.79)	19.0 (=13.96+5.04)	25.06 (=19.57+5.49)	0.4398	0.2416	0.2144
	O	50.51	60.17	40.13	72.32	31.73 (=26.94+4.79)	18.85 (=13.81+5.04)	5.64 (=0.15+5.49)	0.5644	0.3353	0.2128
	Y	90.52	−9.92	85.2	85.77	68.94 (=64.14+4.79)	77.44 (=72.4+5.04)	13.0 (=7.51+5.49)	0.4325	0.4859	0.8741
	L	53.18	−55.04	30.0	62.69	10.93 (=6.14+4.79)	21.21 (=16.17+5.04)	9.69 (=4.2+5.49)	0.2613	0.5071	0.2395
	N	26.85	0.0	0.0	0.0	4.79 (=0.0+4.79)	5.04 (=0.0+5.04)	5.49 (=0.0+5.49)	0.3127	0.329	0.0569
	W	95.41	0.0	0.0	0.0	84.21 (=79.42+4.79)	88.59 (=83.55+5.04)	96.48 (=90.99+5.49)	0.3127	0.329	1.0
	N0	18.34	0.0	0.0	0.0	2.47 (=−2.31+4.79)	2.59 (=−2.44+5.04)	2.83 (=−2.65+5.49)	0.3127	0.329	0.0293
	W1	99.87	0.0	0.0	0.01	94.73 (=89.94+4.79)	99.67 (=94.63+5.04)	108.55 (=103.06+5.49)	0.3127	0.329	1.125

System OLS38a	Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
(Display reflection	C	63.39	−23.83	−38.56	45.34	24.54 (=14.96+9.58)	32.06 (=21.98+10.08)	73.53 (=62.55+10.98)	0.1886	0.2464	0.3619
Yr=10.08)	V	41.26	16.67	−28.49	33.02	13.91 (=4.32+9.58)	12.02 (=1.94+10.08)	28.03 (=17.05+10.98)	0.2577	0.2229	0.1357
	M	55.27	59.74	−6.32	60.07	37.57 (=27.99+9.58)	23.19 (=13.11+10.08)	29.36 (=18.39+10.98)	0.4169	0.2573	0.2618
	O	55.13	51.42	29.16	59.12	34.9 (=25.32+9.58)	23.06 (=12.98+10.08)	11.12 (=0.14+10.98)	0.5052	0.3338	0.2603
	Y	90.83	−9.25	74.37	74.94	69.86 (=60.28+9.58)	78.11 (=68.03+10.08)	18.03 (=7.05+10.98)	0.4208	0.4706	0.8817
	L	57.35	−43.84	23.35	49.68	15.35 (=5.77+9.58)	25.28 (=15.2+10.08)	14.92 (=3.95+10.98)	0.2763	0.455	0.2853
	N	37.99	0.0	0.0	0.0	9.58 (=0.0+9.58)	10.08 (=0.0+10.08)	10.98 (=0.0+10.98)	0.3127	0.329	0.1138
	W	95.41	0.0	0.0	0.0	84.21 (=74.63+9.58)	88.59 (=78.51+10.08)	96.48 (=85.5+10.98)	0.3127	0.329	1.0
	N0	33.53	0.0	0.0	0.0	7.4 (=−2.17+9.58)	7.78 (=−2.29+10.08)	8.48 (=−2.49+10.98)	0.3127	0.329	0.0878
	W1	99.61	0.0	0.0	0.01	94.1 (=84.52+9.58)	99.0 (=88.92+10.08)	107.82 (=96.85+10.98)	0.3127	0.329	1.1174

System OLS52a	Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
(Display reflection	C	68.98	−17.74	−31.24	35.94	32.2 (=13.04+19.16)	39.32 (=19.16+20.16)	76.47 (=54.52+21.95)	0.2176	0.2657	0.4438
Yr=20.16)	V	53.87	10.09	−18.84	21.38	22.93 (=3.77+19.16)	21.86 (=1.7+20.16)	36.82 (=14.86+21.95)	0.281	0.2678	0.2467
	M	63.0	44.96	−4.56	45.19	43.56 (=24.4+19.16)	31.59 (=11.43+20.16)	37.98 (=16.03+21.95)	0.385	0.2792	0.3566
	O	62.9	38.38	18.55	42.63	41.23 (=22.07+19.16)	31.47 (=11.31+20.16)	22.08 (=0.12+21.95)	0.435	0.3321	0.3552
	Y	91.44	−7.95	57.91	58.46	71.7 (=52.54+19.16)	79.46 (=59.3+20.16)	28.1 (=6.15+21.95)	0.4	0.4433	0.8969
	L	64.49	−30.06	15.67	33.91	24.19 (=5.03+19.16)	33.41 (=13.25+20.16)	25.39 (=3.44+21.95)	0.2915	0.4025	0.3771
	N	52.02	0.0	0.0	0.0	19.16 (=0.0+19.16)	20.16 (=0.0+20.16)	21.95 (=0.0+21.95)	0.3127	0.329	0.2276
	W	95.41	0.0	0.0	0.0	84.21 (=65.05+19.16)	88.59 (=68.43+20.16)	96.48 (=74.52+21.95)	0.3127	0.329	1.0
	N0	49.69	0.0	0.0	0.0	17.26 (=−1.89+19.16)	18.16 (=−1.99+20.16)	19.77 (=−2.17+21.95)	0.3127	0.329	0.205
	W1	99.09	0.0	0.0	0.01	92.83 (=73.67+19.16)	97.66 (=77.5+20.16)	106.37 (=84.41+21.95)	0.3127	0.329	1.1024

System OLS70a	Color	$L^*_a=LAB^*_{a1}$	$a^*_a=LAB^*_{a2}$	$b^*_a=LAB^*_{a3}$	$C^*_{ar}=LAB^*_{ar}$	$X_a=XYZ_{a1}$	$Y_a=XYZ_{a2}$	$Z_a=XYZ_{a3}$	x_a	y_a	Y_a/88.59
(Display reflection	C	78.37	−9.9	−19.51	21.89	47.52 (=9.2+38.32)	53.84 (=13.52+40.32)	82.37 (=38.46+43.91)	0.2587	0.293	0.6077
Yr=40.32)	V	70.54	4.74	−9.47	10.6	40.98 (=2.66+38.32)	41.52 (=1.2+40.32)	54.39 (=10.48+43.91)	0.2994	0.3033	0.4686
	M	75.07	25.47	−2.46	25.59	55.53 (=17.21+38.32)	48.38 (=8.06+40.32)	55.21 (=11.3+43.91)	0.349	0.304	0.5461
	O	75.01	21.53	9.07	23.36	53.89 (=15.57+38.32)	48.3 (=7.98+40.32)	44.0 (=0.09+43.91)	0.3686	0.3304	0.5452
	Y	92.64	−5.45	34.85	35.27	75.38 (=37.06+38.32)	82.15 (=41.83+40.32)	48.25 (=4.34+43.91)	0.3663	0.3992	0.9273
	L	75.86	−15.5	7.96	17.44	41.87 (=3.55+38.32)	49.66 (=9.34+40.32)	46.34 (=2.43+43.91)	0.3037	0.3602	0.5606
	N	69.7	0.0	0.0	0.0	38.32 (=0.0+38.32)	40.32 (=0.0+40.32)	43.91 (=0.0+43.91)	0.3127	0.329	0.4551
	W	95.41	0.0	0.0	0.0	84.21 (=45.88+38.32)	88.59 (=48.27+40.32)	96.48 (=52.57+43.91)	0.3127	0.329	1.0
	N0	68.68	0.0	0.0	0.0	36.98 (=−1.33+38.32)	38.91 (=−1.4+40.32)	42.37 (=−1.53+43.91)	0.3127	0.329	0.4392
	W1	98.03	0.0	0.0	0.01	90.29 (=51.96+38.32)	94.99 (=54.67+40.32)	103.45 (=59.55+43.91)	0.3127	0.329	1.0722

LE480−7N, Colorimetric data of standard Offset Reflective System ORS18 and of Offset Luminous Systems OLS27/38/52/70a, chroma adapted (a)

BAM-test chart no. LE48; colorimetric coordinates
ORS18 and Offset Luminous Systems OLS27a, 38a, 52a, 70a

input: *cmy0* setcmykcolor*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/LE48/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table A.4 shows the *adapted* CIELAB data, the CIEXYZ data, and the CIE chromaticity (*x*, *y*) data for the adapted Offset Reflective System ORS18a and the Offset Luminous Systems TLSxxa (xx = 27, 33, 52, 70), (a=adapted).

Table A.5: CIE data of Offset Systems ORS18a and OLSxxa (xx = 27, 33, 52, 70)

www.ps.bam.de/LE48/10L/L48E02NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

Colorimetric data of "Standard Original": Offset Reflective System ORS18 for CIE lightness L*=18 of black

System ORS18 (Reflective CIE, Y_N=2.52 and CIELAB cero point) (CIELAB according to ISO/IEC 15775)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_{ab}=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	58.62	−30.62	−42.74	52.59	18.74	26.62	68.55	0.1645	0.2337	0.3005
V	25.72	31.45	−44.35	54.38	7.17	4.65	21.41	0.2158	0.14	0.0525
M	48.13	75.2	−6.79	75.51	33.06	16.9	22.01	0.4594	0.2348	0.1907
O	47.94	65.31	52.07	83.53	30.13	16.75	2.68	0.608	0.338	0.189
Y	90.37	−11.15	96.17	96.82	68.07	77.11	9.03	0.4414	0.5	0.8703
L	50.9	−62.96	36.71	72.89	8.71	19.18	6.62	0.2523	0.5559	0.2165
N	18.01	0.5	−0.46	0.69	2.42	2.52	2.81	0.3122	0.3251	0.0284
W	95.41	−0.98	4.76	4.86	83.69	88.59	89.48	0.3197	0.3384	1.0
N0	0.01	0.84	−1.68	1.89	0.02	0.0	0.12	0.1518	0.0078	0.0
W1	100.0	−1.07	5.06	5.17	94.44	100.0	100.84	0.3198	0.3387	1.1288

Calculated colorimetric data: Offset Luminous Systems OLSxx for CIE lightness L*=xx=00, 06, 11, 18 of black

System OLS00 (Display reflection Yr=0.0)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	56.88	−33.36	−45.25	56.23	16.83 (=16.83+0.0)	24.8 (=24.8+0.0)	67.97 (=67.97+0.0)	0.1536	0.2263	0.28
V	16.48	46.37	−56.79	73.32	4.92 (=4.92+0.0)	2.19 (=2.19+0.0)	19.54 (=19.54+0.0)	0.1846	0.0823	0.0248
M	45.36	81.82	−7.91	82.2	31.58 (=31.58+0.0)	14.8 (=14.8+0.0)	20.01 (=20.01+0.0)	0.4757	0.2229	0.167
O	45.14	71.35	76.9	104.9	28.56 (=28.56+0.0)	14.64 (=14.64+0.0)	0.06 (=0.06+0.0)	0.6601	0.3384	0.1653
Y	90.22	−11.49	103.92	104.55	67.61 (=67.61+0.0)	76.77 (=76.77+0.0)	6.77 (=6.77+0.0)	0.4473	0.5079	0.8665
L	48.45	−73.28	43.8	85.38	6.5 (=6.5+0.0)	17.15 (=17.15+0.0)	4.15 (=4.15+0.0)	0.2339	0.6168	0.1936
N	0.0	0.85	−1.68	1.89	0.02 (=0.02+0.0)	0.0 (=0.0+0.0)	0.12 (=0.12+0.0)	0.15	0.0019	0.0
W	95.41	−0.98	4.76	4.86	83.69 (=83.69+0.0)	88.59 (=88.59+0.0)	89.48 (=89.48+0.0)	0.3197	0.3384	1.0
N0	0.0	0.85	−1.68	1.89	0.02 (=0.02+0.0)	0.0 (=0.0+0.0)	0.12 (=0.12+0.0)	0.149	0.0	0.0
W1	100.13	−1.07	5.07	5.18	94.75 (=94.75+0.0)	100.33 (=100.33+0.0)	101.17 (=101.17+0.0)	0.3198	0.3387	1.1325

System OLS06 (Display reflection Yr=0.63)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	57.33	−32.64	−44.61	55.29	17.31 (=16.71+0.6)	25.26 (=24.63+0.63)	68.12 (=67.43+0.69)	0.1564	0.2282	0.2851
V	19.26	41.21	−52.86	67.03	5.48 (=4.88+0.6)	2.81 (=2.18+0.63)	19.99 (=19.31+0.69)	0.1939	0.0993	0.0317
M	46.07	80.08	−7.61	80.44	31.95 (=31.35+0.6)	15.32 (=14.69+0.63)	20.51 (=19.82+0.69)	0.4713	0.2261	0.173
O	45.87	69.76	68.41	97.7	28.95 (=28.35+0.6)	15.17 (=14.54+0.63)	0.75 (=0.06+0.69)	0.6453	0.3381	0.1712
Y	90.25	−11.4	101.84	102.47	67.72 (=67.12+0.6)	76.85 (=76.22+0.63)	7.33 (=6.65+0.69)	0.4458	0.5059	0.8675
L	49.08	−70.38	41.71	81.81	7.05 (=6.46+0.6)	17.66 (=17.03+0.63)	4.77 (=4.08+0.69)	0.2393	0.5989	0.1993
N	5.69	0.74	−1.29	1.5	0.62 (=0.02+0.6)	0.63 (=0.0+0.63)	0.78 (=0.09+0.69)	0.3047	0.3113	0.0071
W	95.41	−0.98	4.76	4.86	83.69 (=83.09+0.6)	88.59 (=87.96+0.63)	89.48 (=88.8+0.69)	0.3197	0.3384	1.0
N0	0.0	0.85	−1.68	1.89	0.02 (=−0.57+0.6)	0.0 (=−0.62+0.63)	0.12 (=−0.56+0.69)	0.149	0.0	0.0
W1	100.1	−1.07	5.07	5.18	94.67 (=94.07+0.6)	100.25 (=99.62+0.63)	101.09 (=100.41+0.69)	0.3198	0.3387	1.1316

System OLS11 (Display reflection Yr=1.26)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	57.76	−31.94	−43.98	54.37	17.79 (=16.59+1.2)	25.71 (=24.45+1.26)	68.26 (=66.89+1.37)	0.1592	0.2301	0.2902
V	21.67	37.24	−49.59	62.03	6.05 (=4.85+1.2)	3.42 (=2.16+1.26)	20.46 (=19.08+1.37)	0.202	0.1144	0.0386
M	46.77	78.4	−7.33	78.74	32.32 (=31.12+1.2)	15.85 (=14.59+1.26)	21.01 (=19.64+1.37)	0.4672	0.2291	0.1789
O	46.57	68.22	61.08	91.57	29.34 (=28.15+1.2)	15.7 (=14.44+1.26)	1.4 (=0.02+1.37)	0.6319	0.338	0.1772
Y	90.29	−11.32	99.86	100.5	67.84 (=66.64+1.2)	76.94 (=75.68+1.26)	7.9 (=6.53+1.37)	0.4443	0.5039	0.8684
L	49.7	−67.71	39.86	78.58	7.61 (=6.41+1.2)	18.17 (=16.91+1.26)	5.39 (=4.01+1.37)	0.2441	0.583	0.2051
N	10.99	0.64	−0.93	1.14	1.22 (=0.02+1.2)	1.26 (=0.0+1.26)	1.46 (=0.09+1.37)	0.3094	0.3202	0.0142
W	95.41	−0.98	4.76	4.86	83.69 (=82.49+1.2)	88.59 (=87.33+1.26)	89.48 (=88.11+1.37)	0.3197	0.3384	1.0
N0	0.0	0.85	−1.68	1.89	0.02 (=−1.17+1.2)	0.0 (=−1.25+1.26)	0.12 (=−1.24+1.37)	0.149	0.0	0.0
W1	100.06	−1.07	5.06	5.18	94.59 (=93.4+1.2)	100.17 (=98.91+1.26)	101.01 (=99.64+1.37)	0.3198	0.3387	1.1306

System OLS18 (Display reflection Yr=2.52)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	58.62	−30.62	−42.74	52.59	18.74 (=16.34+2.4)	26.62 (=24.1+2.52)	68.55 (=65.81+2.74)	0.1645	0.2337	0.3005
V	25.72	31.45	−44.35	54.38	7.17 (=4.78+2.4)	4.65 (=2.13+2.52)	21.41 (=18.66+2.74)	0.2158	0.14	0.0525
M	48.13	75.2	−6.79	75.51	33.06 (=30.66+2.4)	16.9 (=14.38+2.52)	22.01 (=19.26+2.74)	0.4594	0.2348	0.1907
O	47.94	65.31	52.07	83.53	30.13 (=27.73+2.4)	16.75 (=14.23+2.52)	2.68 (=−0.05+2.74)	0.608	0.338	0.189
Y	90.37	−11.15	96.17	96.82	68.07 (=65.67+2.4)	77.11 (=74.59+2.52)	9.03 (=6.29+2.74)	0.4414	0.5	0.8703
L	50.9	−62.96	36.71	72.89	8.71 (=6.31+2.4)	19.18 (=16.66+2.52)	6.62 (=3.87+2.74)	0.2523	0.5559	0.2165
N	18.01	0.5	−0.46	0.69	2.42 (=0.02+2.4)	2.52 (=0.0+2.52)	2.81 (=0.07+2.74)	0.3122	0.3251	0.0284
W	95.41	−0.98	4.76	4.86	83.69 (=81.29+2.4)	88.59 (=86.07+2.52)	89.48 (=86.74+2.74)	0.3197	0.3384	1.0
N0	0.01	0.84	−1.68	1.89	0.02 (=−2.36+2.4)	0.0 (=−2.51+2.52)	0.12 (=−2.61+2.74)	0.1517	0.0078	0.0
W1	100.0	−1.07	5.06	5.17	94.44 (=92.04+2.4)	100.0 (=97.48+2.52)	100.84 (=98.1+2.74)	0.3198	0.3387	1.1288

LE480−7N, Colorimetric data of standard Offset Reflective System ORS18 and of Offset Luminous Systems OLS00/06/11/18

BAM-test chart no. LE48; colorimetric coordinates
ORS18 and Offset Luminous Systems OLS00, 06, 11, 18

input: *cmy0* setcmykcolor*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/LE48/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

BAM registration: 20040901-LE48/10L/L48E02NP.PS/.PDF
application for measurement of printer or monitor systems

BAM material: code=rha4ta

/LE48/ Form: 3/4, Serie: 1/1, Page: 3 Page count: 3

Table A.5 shows the *standard* CIELAB data, the CIEXYZ data, and the CIE chromaticity (x, y) data for the standard Offset Reflective System ORS18 and the Offset Luminous Systems TLSxx (xx = 00, 06, 11, 18).

BAM registration: 20040901-LE48/10L/L48E03NP.PS/.PDF application for measurement of printer or monitor systems

BAM material: code=rha4ta

/LE48/ Form: 4/4, Serie: 1/1, Page: 4 Page count: 4

See for similar files: http://www.ps.bam.de/LE48/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

www.ps.bam.de/LE48/10L/L48E03NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

Colorimetric data of "Standard Original": Offset Reflective System ORS18 for CIE lightness L*=18 of black

System ORS18 (Reflective CIE, Y_N=2.52 and CIELAB cero point) (CIELAB according to ISO/IEC 15775)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_{ab}=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	58.62	−30.62	−42.74	52.59	18.74	26.62	68.55	0.1645	0.2337	0.3005
V	25.72	31.45	−44.35	54.38	7.17	4.65	21.41	0.2158	0.14	0.0525
M	48.13	75.2	−6.79	75.51	33.06	16.9	22.01	0.4594	0.2348	0.1907
O	47.94	65.31	52.07	83.53	30.13	16.75	2.68	0.608	0.338	0.189
Y	90.37	−11.15	96.17	96.82	68.07	77.11	9.03	0.4414	0.5	0.8703
L	50.9	−62.96	36.71	72.89	8.71	19.18	6.62	0.2523	0.5559	0.2165
N	18.01	0.5	−0.46	0.69	2.42	2.52	2.81	0.3122	0.3251	0.0284
W	95.41	−0.98	4.76	4.86	83.69	88.59	89.48	0.3197	0.3384	1.0
N0	0.01	0.84	−1.68	1.89	0.02	0.0	0.12	0.1518	0.0078	0.0
W1	100.0	−1.07	5.06	5.17	94.44	100.0	100.84	0.3198	0.3387	1.1288

Calculated colorimetric data: Offset Luminous Systems OLSxx for CIE lightness L*=xx=27, 33, 52, 70 of black

System OLS27 (Display reflection Yr=5.04)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	60.28	−28.22	−40.36	49.27	20.64 (=15.85+4.79)	28.43 (=23.39+5.04)	69.13 (=63.64+5.49)	0.1746	0.2405	0.3209
V	32.06	24.25	−36.84	44.12	9.42 (=4.63+4.79)	7.11 (=2.07+5.04)	23.35 (=17.86+5.49)	0.2362	0.1783	0.0803
M	50.68	69.37	−5.83	69.62	34.54 (=29.75+4.79)	19.0 (=13.96+5.04)	24.0 (=18.52+5.49)	0.4454	0.245	0.2144
O	50.51	60.04	41.85	73.19	31.7 (=26.91+4.79)	18.85 (=13.81+5.04)	5.26 (=−0.22+5.49)	0.568	0.3378	0.2128
Y	90.52	−10.82	89.63	90.28	68.52 (=63.73+4.79)	77.44 (=72.4+5.04)	11.32 (=5.83+5.49)	0.4357	0.4924	0.8741
L	53.18	−55.21	31.9	63.78	10.91 (=6.12+4.79)	21.21 (=16.17+5.04)	9.08 (=3.59+5.49)	0.2647	0.5149	0.2395
N	26.85	0.33	0.13	0.35	4.82 (=0.03+4.79)	5.04 (=0.0+5.04)	5.46 (=−0.02+5.49)	0.3144	0.3291	0.0569
W	95.41	−0.98	4.76	4.86	83.69 (=78.9+4.79)	88.59 (=83.55+5.04)	89.48 (=83.99+5.49)	0.3197	0.3384	1.0
N0	18.34	0.49	−0.44	0.67	2.49 (=−2.29+4.79)	2.59 (=−2.44+5.04)	2.89 (=−2.59+5.49)	0.3123	0.3253	0.0293
W1	99.87	−1.07	5.05	5.17	94.12 (=89.33+4.79)	99.67 (=94.63+5.04)	100.51 (=95.02+5.49)	0.3198	0.3387	1.125

System OLS38 (Display reflection Yr=10.08)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	63.39	−24.2	−35.96	43.36	24.45 (=14.87+9.58)	32.06 (=21.98+10.08)	70.31 (=59.33+10.98)	0.1928	0.2528	0.3619
V	41.26	16.72	−27.39	32.1	13.91 (=4.33+9.58)	12.02 (=1.94+10.08)	27.31 (=16.33+10.98)	0.2613	0.2258	0.1357
M	55.27	59.52	−4.27	59.68	37.5 (=27.92+9.58)	23.19 (=13.11+10.08)	27.99 (=17.01+10.98)	0.4229	0.2615	0.2618
O	55.13	51.21	31.2	59.97	34.83 (=25.25+9.58)	23.06 (=12.98+10.08)	10.41 (=−0.56+10.98)	0.51	0.3376	0.2603
Y	90.83	−10.16	78.82	79.47	69.44 (=59.86+9.58)	78.11 (=68.03+10.08)	15.93 (=4.95+10.98)	0.4248	0.4778	0.8817
L	57.35	−44.1	25.53	50.96	15.31 (=5.73+9.58)	25.28 (=15.2+10.08)	13.99 (=3.02+10.98)	0.2805	0.4631	0.2853
N	37.99	0.12	0.88	0.89	9.6 (=0.01+9.58)	10.08 (=0.0+10.08)	10.67 (=−0.3+10.98)	0.3162	0.3322	0.1138
W	95.41	−0.98	4.76	4.86	83.69 (=74.11+9.58)	88.59 (=78.51+10.08)	89.48 (=78.5+10.98)	0.3197	0.3384	1.0
N0	33.53	0.2	0.58	0.61	7.42 (=−2.15+9.58)	7.78 (=−2.29+10.08)	8.3 (=−2.66+10.98)	0.3156	0.3311	0.0878
W1	99.61	−1.06	5.03	5.15	93.49 (=83.91+9.58)	99.0 (=88.92+10.08)	99.84 (=88.87+10.98)	0.3198	0.3386	1.1174

System OLS52 (Display reflection Yr=20.16)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	68.98	−18.22	−28.26	33.64	32.07 (=12.9+19.16)	39.32 (=19.16+20.16)	72.7 (=50.74+21.95)	0.2226	0.2729	0.4438
V	53.87	9.9	−16.89	19.58	22.89 (=3.73+19.16)	21.86 (=1.7+20.16)	35.29 (=13.33+21.95)	0.286	0.2731	0.2467
M	63.0	44.59	−1.99	44.64	43.43 (=24.27+19.16)	31.59 (=11.43+20.16)	35.94 (=13.98+21.95)	0.3914	0.2847	0.3566
O	62.9	38.02	21.11	43.49	41.11 (=21.95+19.16)	31.47 (=11.31+20.16)	20.66 (=−1.28+21.95)	0.4409	0.3375	0.3552
Y	91.44	−8.86	62.4	63.03	71.27 (=52.11+19.16)	79.46 (=59.3+20.16)	25.23 (=3.28+21.95)	0.405	0.4516	0.8969
L	64.49	−30.45	18.34	35.56	24.1 (=4.94+19.16)	33.41 (=13.25+20.16)	23.78 (=1.82+21.95)	0.2965	0.411	0.3771
N	52.02	−0.14	1.83	1.83	19.13 (=−0.02+19.16)	20.16 (=0.0+20.16)	20.94 (=−1.0+21.95)	0.3176	0.3347	0.2276
W	95.41	−0.98	4.76	4.86	83.69 (=64.53+19.16)	88.59 (=68.43+20.16)	89.48 (=67.53+21.95)	0.3197	0.3384	1.0
N0	49.69	−0.1	1.67	1.67	17.24 (=−1.91+19.16)	18.16 (=−1.99+20.16)	18.91 (=−3.03+21.95)	0.3174	0.3343	0.205
W1	99.09	−1.05	5.0	5.11	92.23 (=73.07+19.16)	97.66 (=77.5+20.16)	98.51 (=76.56+21.95)	0.3198	0.3386	1.1024

System OLS70 (Display reflection Yr=40.32)

Color	$L^*=LAB^*_1$	$a^*=LAB^*_2$	$b^*=LAB^*_3$	$C^*_r=LAB^*_r$	$X=XYZ_1$	$Y=XYZ_2$	$Z=XYZ_3$	x	y	Y/88.59
C	78.37	−10.56	−15.9	19.11	47.28 (=8.96+38.32)	53.84 (=13.52+40.32)	77.57 (=33.66+43.91)	0.2646	0.3013	0.6077
V	70.54	4.22	−6.39	7.67	40.82 (=2.49+38.32)	41.52 (=1.2+40.32)	51.29 (=7.38+43.91)	0.3055	0.3107	0.4686
M	75.07	24.87	0.92	24.89	55.3 (=16.97+38.32)	48.38 (=8.06+40.32)	51.77 (=7.86+43.91)	0.3557	0.3112	0.5461
O	75.01	20.93	12.45	24.35	53.66 (=15.33+38.32)	48.3 (=7.98+40.32)	41.05 (=−2.85+43.91)	0.3752	0.3378	0.5452
Y	92.64	−6.39	39.42	39.93	74.93 (=36.6+38.32)	82.15 (=41.83+40.32)	44.03 (=0.13+43.91)	0.3726	0.4085	0.9273
L	75.86	−16.12	11.4	19.75	41.67 (=3.35+38.32)	49.66 (=9.34+40.32)	43.23 (=−0.67+43.91)	0.3097	0.3691	0.5606
N	69.7	−0.49	3.02	3.06	38.17 (=−0.14+38.32)	40.32 (=0.0+40.32)	41.27 (=−2.63+43.91)	0.3187	0.3367	0.4551
W	95.41	−0.98	4.76	4.86	83.69 (=45.36+38.32)	88.59 (=48.27+40.32)	89.48 (=45.57+43.91)	0.3197	0.3384	1.0
N0	68.68	−0.47	2.95	2.99	36.84 (=−1.48+38.32)	38.91 (=−1.4+40.32)	39.85 (=−4.05+43.91)	0.3187	0.3366	0.4392
W1	98.03	−1.03	4.93	5.04	89.72 (=51.39+38.32)	94.99 (=54.67+40.32)	95.85 (=51.95+43.91)	0.3198	0.3386	1.0722

LE480−7N, Colorimetric data of standard Offset Reflective System ORS18 and of Offset Luminous Systems OLS27/38/52/70

BAM-test chart no. LE48; colorimetric coordinates ORS18 and Offset Luminous Systems OLS27, 38, 52, 70

input: *cmy0* setcmykcolor
output: *no change compared to input*

Table A.6 shows the *standard* CIELAB data, the CIEXYZ data, and the CIE chromaticity (*x*, *y*) data for the standard Offset Reflective System ORS18 and the Offset Luminous Systems TLSxx (xx = 27, 33, 52, 70)

Annex B:
Device dependent *relative* colorimetric data

The three *relative* colorimetric data *lab*t, lab*a, lab*b (= lab*tab = tab*)* or *lab*t, lab*c, lab*h (= tab*tch = tch*)* have an exact and simple relationship to the *adapted* CIELAB data LAB^*_a. The three *relative* colorimetric data are defined as ratio of three *adapted* CIELAB data L^*, $C^*_{ab,a}$ H^*_a (LCH^*_a) of a colour stimuli and of the appropriate *adapted* CIELAB data L^*_{Ma}, $C^*_{ab,Ma}$ H^*_{Ma} (LCH^*_{Ma}) of six maximum (M_a) colour stimuli CMYOLV of a device or the linear mixtures of adjacent colours of the hue circle OYLCVMO.

There are many *relative* colorimetric data which have an exact and simple relationship to the *adapted* CIELAB data LAB^*_a or the *relative* CIELAB data *lab*.*

Table B.1: Definition and change of *relative* colorimetric data *n*, c*, w*, d*, i*, t*, s*, q*, h*, e**

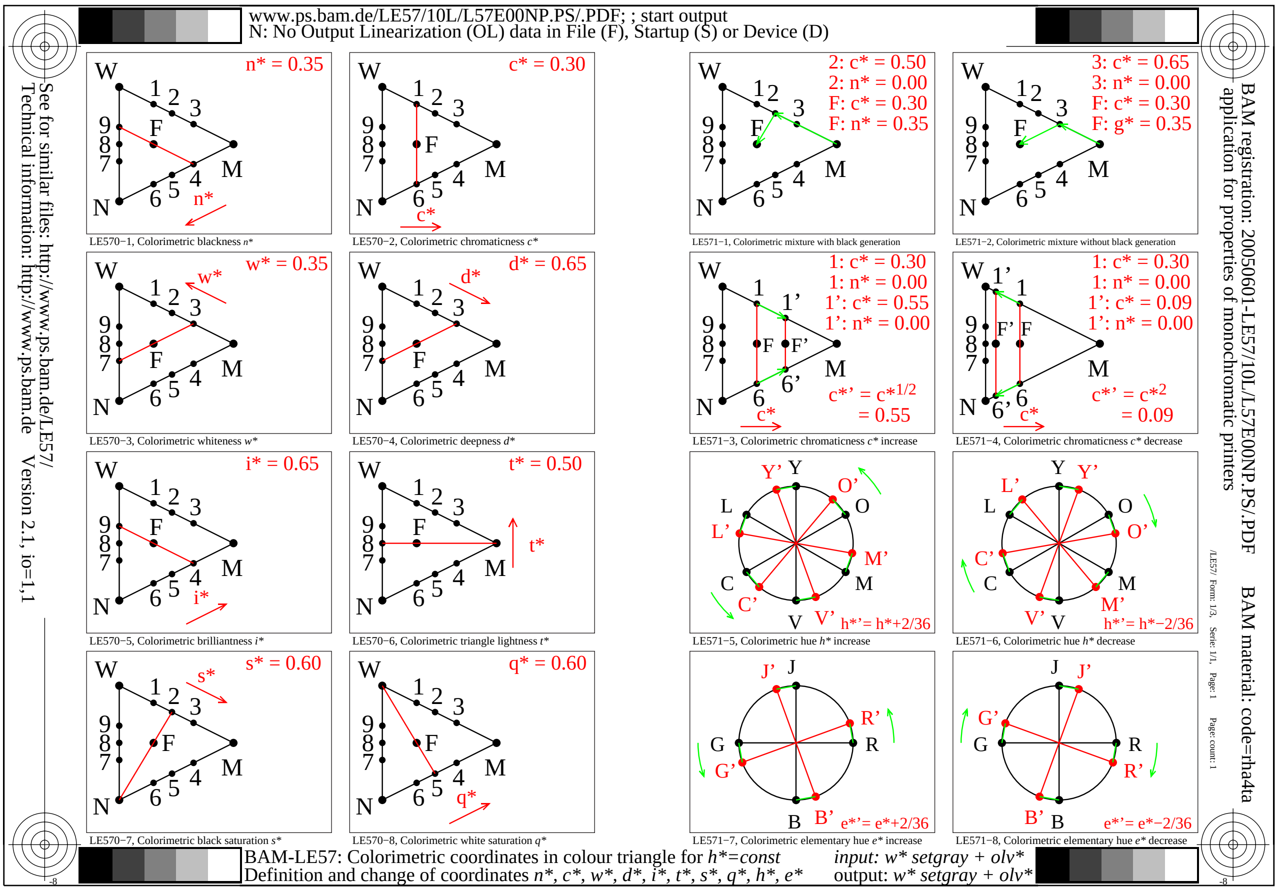


Table B.1 shows the definition and change of *relative* colorimetric data *n*, c*, w*, d*, i*, t*, s*, q*, h*, e** in the colour triangle and colour circle. The triangle colours are the colours black N, white W, and the maximum colour M. The colour F within any triangle is specified to have different relative colour attributes, such as blackness *n*, chromaticness c*, whiteness w*, deepness d*, brilliantness i*, triangle lightness t*, black saturation s*, white saturation q*, hue h*, elementary hue e**. The elementary hue is defined in relation to the four elementary hues *R, J, G, B,* see right side. Some possible changes of chromaticness *c** and hue *h** or elementary hue *e** are also given on the right side.

Within a hue triangle (*adapted* CIELAB hue angle H^*_a = constant) there is the classical Ostwald equation: relative blackness + relative chromaticness + relative whiteness equals 1 or

or $\quad \boldsymbol{n^*} + \boldsymbol{c^*} + \boldsymbol{w^*} = 1 \qquad (0 <= \boldsymbol{n^*, c^*, w^*} <= 1) \qquad (1)$

A hue triangle in the *adapted* CIELAB space is defined by the *adapted* CIELAB data LAB^*_a of the given colour (F_a), the colours Black (N_a), White (W_a) and the colour of maximum chroma (M_a). For the colour F_a (a=adapted) the *relative* CIELAB data chromaticness ***c****, lightness ***l****, triangle lightness ***t****, whiteness ***w**** and blackness ***n**** shall be calculated in the following sequence of the equations (2) to (6).

$$\boldsymbol{c^*}(F_a) = C^*_{ab}(F_a) / C^*_{ab}(M_a) \qquad (2)$$

$$\boldsymbol{l^*}(F_a) = [\, L^*(F_a) - L^*(N_a)\,] / [\, L^*(W_a) - L^*(N_a)\,] \qquad (3)$$

$$\boldsymbol{t^*} (F_a) = \boldsymbol{l^*} (F_a) - \boldsymbol{c^*} \{ [L^* (M_a) - L^* (N_a)] / [L^* (W_a) - L^* (N_a)] - 0.5 \} \quad (4)$$

$$\boldsymbol{w^*} (F_a) = \boldsymbol{t^*} (F_a) - 0.5\, \boldsymbol{c^*} (F_a) \quad (5)$$

$$\boldsymbol{n^*} (F_a) = 1 - \boldsymbol{c^*} (F_a) - \boldsymbol{w^*} (F_a) \quad (6)$$

The *relative* CIELAB data of the new relative device dependent space NCCS (small letters) are given in **bold** and *italics* and the *standard* CIELAB data (capital letters) are given only in *italics* for easy identification.The coordinates are completed by the relative hue (0 <= ***h**** <=1) and two rectangular components –1 <= $\boldsymbol{a^*_r}$, $\boldsymbol{b^*_r}$ <= 1 (r = relative and different to *a**, *b** of *standard* CIELAB data *LAB**)

$$\boldsymbol{h^*} (F_a) = H^* (F_a) / 360 \quad (7)$$

$$\boldsymbol{a^*_r} (F_a) = \boldsymbol{c^*} (F_a) \cos (H^* (F_a)) \quad (8)$$

$$\boldsymbol{b^*_r} (F_a) = \boldsymbol{c^*} (F_a) \sin (H^* (F_a)) \quad (9)$$

The values of the device dependent data are usually between 0 and 1 for equations (2) to (7) and different compared to *standard* CIELAB data (usually between 0 and 100). Exceptions may appear for luminous and fluorescent colours. In image technology for different applications (printers and displays) the complementary data are used for example blackness ***n**** for printers and whiteness ***w**** = 1 – ***n**** for displays.

There are other *relative* colorimetric data used in image technology, for example $\boldsymbol{lab^*cmy_3 = cmy_3^* = cmy^*}$ and $\boldsymbol{lab^*olv_3 = olv_3^* (= rgb_3^* = olv^* = rgb^*)}$. The index 3 is necessary here to separate the three relative colorimetric data for example from the chromaticness ***c**** and the relative lightness ***l****. Therefore for printers the three data $\boldsymbol{lab^*c_3 = c_3^*}$, $\boldsymbol{lab^*m_3 = m_3^*}$, and $\boldsymbol{lab^*y_3 = y_3^*}$ are used and similar for displays $\boldsymbol{o_3^*} = 1 - \boldsymbol{c_3^*}$, $\boldsymbol{l_3^*} = 1 - \boldsymbol{m_3^*}$, $\boldsymbol{v_3^*} = 1 - \boldsymbol{y_3^*}$. The letters ***olv*** with O = orange red, L = leaf green, and V = violet blue are used in this Technical Report instead of *rgb.* The letters *rgb* are used for three of the four elementary colours in *rjgb*; compare ISO/IEC 15775:1999 and ISO/IEC TR 24705:2005.

For the calculation of these data (compare $\boldsymbol{cmyn_3^*}$, $\boldsymbol{cmyn_4^*}$ and $\boldsymbol{olvi_3^*}$, $\boldsymbol{olvi_4^*}$ in Annex D with *three* and *four* components) additionally the *adapted* CIELAB data of the **six** colours *CMY* and *OLV* are necessary. The CIELAB data of the six colours allow to calculate the Maximum colours M_a of maximum chroma for every hue ***h****, compare ISO/IEC TR 19797:2004-09

For basic colours the data ***cmy**** or ***olv**** are either zero or one. The next figure shows the so called “1 minus relationship” between both data.

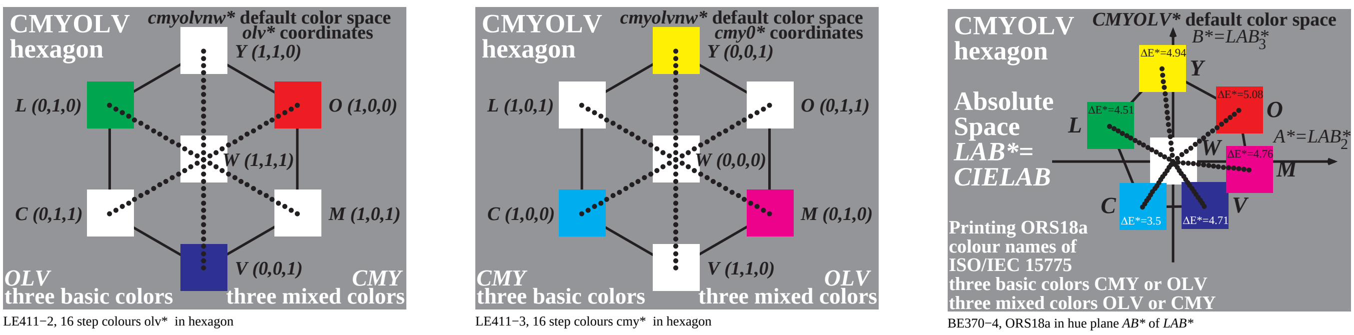
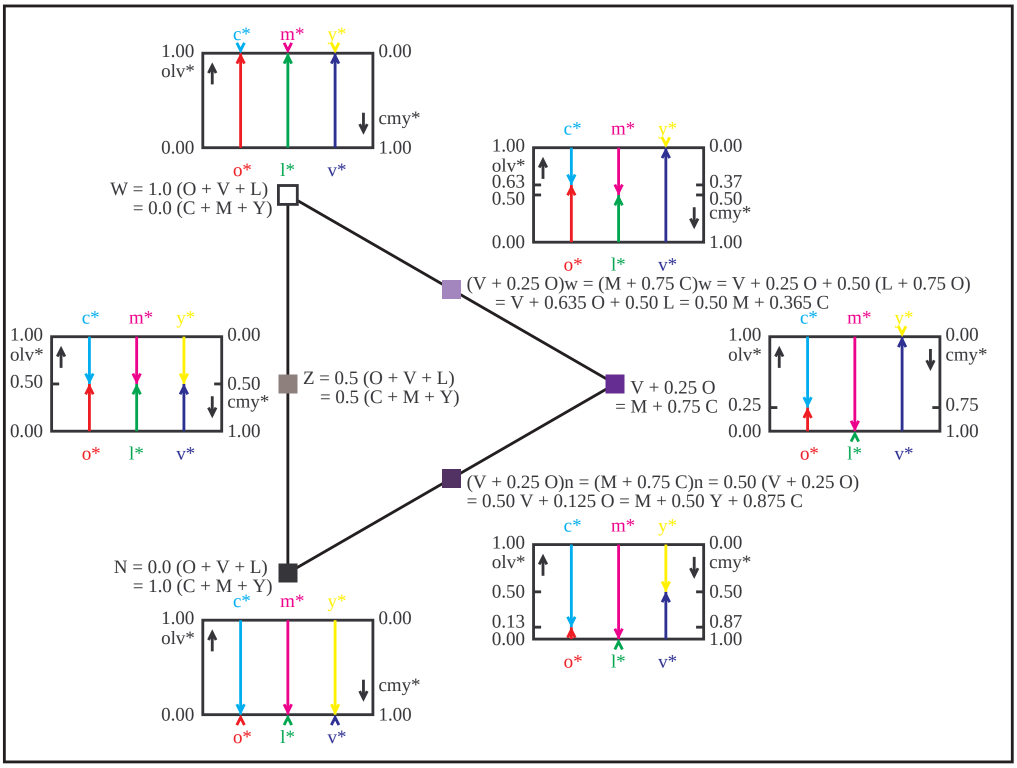


Fig. B.1: Three *relative* CIELAB data *olv and *cmy** and the “1 minus relationship**

Fig. B.1 shows three *relative* CIELAB data *olv** (left) and *cmy** (middle) which are connected by the inverse “1 minus relationship”. For the Offset Reference System ORS18 the colorimetric data (a^*_a, b^*_a) of the colours are shown (right). The hue angles are not so regular as in the left figures with constant hue angle differences of 60 degrees. However, in any case the three data are either one or zero for the six chromatic colours.

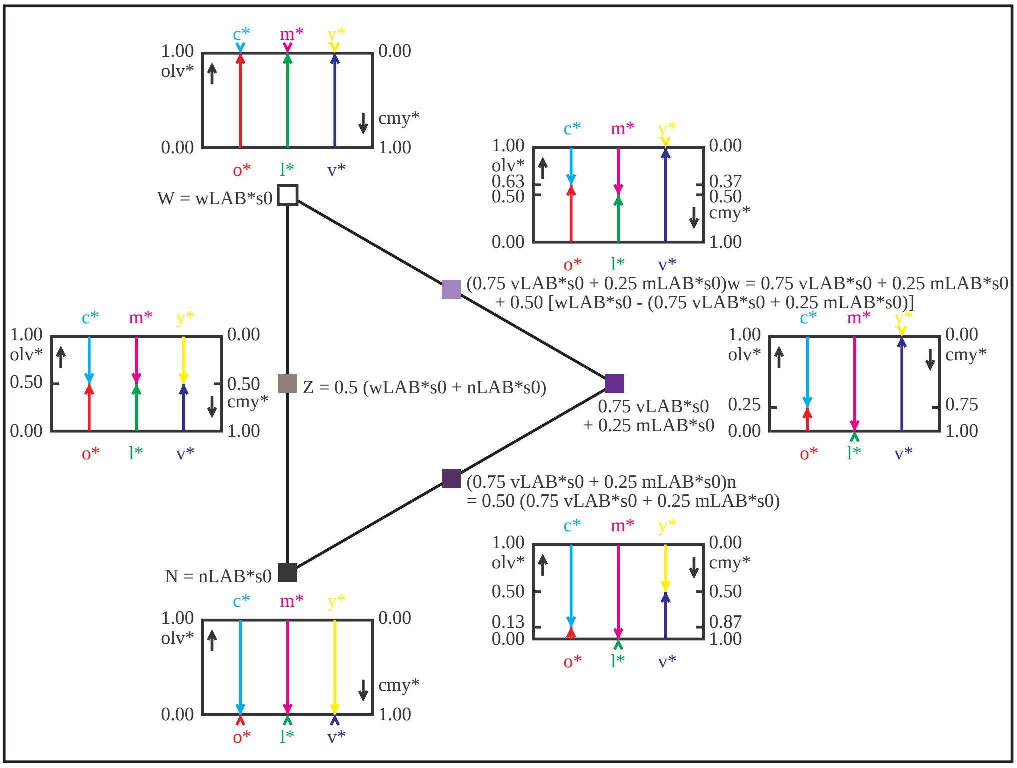
For the colours within a hue triangle the relationship is shown in Fig. B.2.



TR19797/E6320-2N

Fig. B.2 “1 minus relationship” between *olv and *cmy** colorimetric data for constant hue**

Fig. B.2 shows the connection between the *relative olv** and *cmy** colorimetric data. The relation to the *adapted CIELAB* data *LAB**$_a$ is given in the next Fig. B.2.



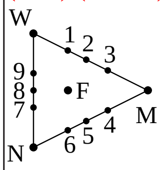
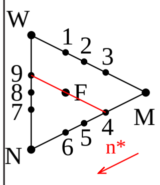
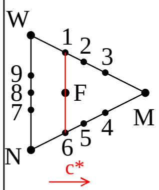
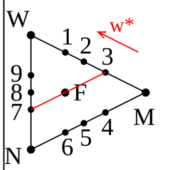
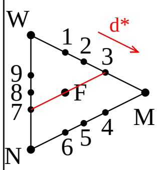
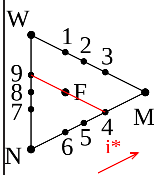
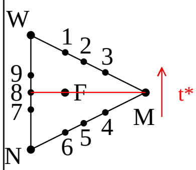
TR19797/E6321-2N

Figure B.3: Relationship between *adapted LAB$_a$ and *cmy** or *olv** colorimetric data**

Fig. B.3 shows the relationship between *adapted LAB**$_a$ and *cmy** or *olv** colorimetric data for the hue 1,00 M + 0,75 C. A *linear* mixture is assumed for all the intermediate colours. For the calculations the *adapted* colorimetric data

LAB$_a$* are usually transferred with the medium black colour as origin (index 0). Therefore the transformation *LAB*$_a$* to *LAB*$_{a0}$* is done first and then the *adapted* CIELAB data *LAB*$_{a0}$* with the origin at black N may be used if appropriate for some rendering or re-rendering applications.

Table B.2: Colours defined by the colorimetric data blackness *n and chromaticness *c***

Colour F and 9 others	Relation of colorimetric coordinates in colour triangle of hue h*=const Formula are based on given data of chromaticness c* and blackness n*					
(c*,n*)=(0.3, 0.35) 	*blackness n** n* = 0.35 	*chromatic-ness c** c* = 0.30 	*whiteness w* = 1 − n* − c** w* = 0.35 	*deepness d* = 1 − w* = n* + c** d* = 0.65 	*brilliantness i* = 1 − n** i* = 0.70 	*triangle lightness t* = 1 − n* − 0.5 c** t* = 0.50 
Colour 1 *Colour 2=S* *Colour 3*	0 0 0	c* c*/(1−n*) n*+c*	1−c* 1−c*/(1−n*) 1−n*−c*	c* c*/(1−n*) n*+c*	1 1 1	1−0.5c* 1−0.5c*/(1−n*) 1−0.5(n*+c*)
Colour 4 *Colour 5=Q* *Colour 6*	n* n*/(n*+c*) 1−c*	1−n* c*/(n*+c*) c*	0 0 0	1 1 1	1−n* c*/(n*+c*) c*	0.5(1−n*) 0.5c*/(n*+c*) 0.5c*
Colour 7 *Colour 8* *Colour 9*	1−n* 1−n*−0.5c* 1−n*−c*	0 0 0	n* n*+0.5c* n*+c*	1−n* 1−n*−0.5c* 1−n*−c*	n* n*+0.5c* n*+c*	n* n*+0.5c* n*+c*

LE540−7, colorimetric relationship of colour triangle points *N, W, M and others*

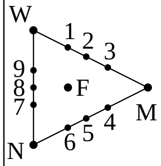
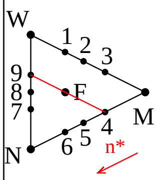
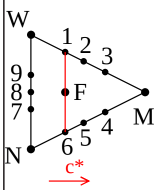
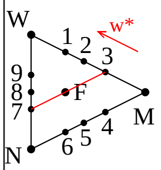
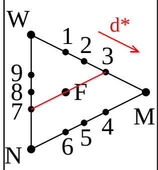
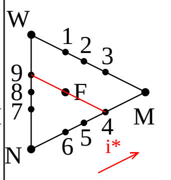
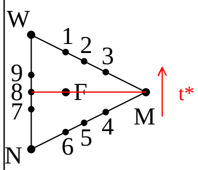
Table B.2 shows colours defined by the two colorimetric coordinates blackness ***n**** and chromaticness ***c**** (column 2 and 3), In column 4 to 7 equations for the calculation of whiteness ***w****, deepness ***d****, brilliantness ***i****, and triangle lightness ***t**** as function of ***n**** and ***c**** are given. Any pair of the six relative coordinates may be used to specify a colour F. In the *Natural Colour System NCS* the two coordinates blackness ***n**** and chromaticness ***c**** are used together with the elementary hue ***e**** to specify a three dimensional colour stimuli, compare Annex G.

For any device the *relative* colorimetric data, the *relative* triangle lightness *lab*t* = ***t*****,** the *relative* chromaticness *lab*c* = ***c**** and the *relative* hue *lab*h* = ***h**** are in the range

0 <= ***t**** <= 1
0 <= ***c**** <= 1
0 <= ***h**** <= 1

The three reference *relative* CIELAB data *lab*tab (=* ***t*, a***$_r$*,* ***b***$_r$*) or lab*tch (=* ***t*, c*, h****)* form in three dimensions the three-dimensional Natural Colour Connection Space

Table B.3: Colours defined by the colorimetric data chromaticness *c and triangle lightness *t***

Colour F and 9 others	**Relation of colorimetric coordinates in colour triangle of hue h*=const Formula are based on given data of chromaticness c* and triangle lightness t***					
(c*,t*)=(0.3, 0.5) 	***blackness n* = 1 − t* − 0.5 c**** n* = 0.35 	***chromatic-ness c**** c* = 0.30 	***whiteness w* = t* − 0.5 c**** w* = 0.35 	***deepness d* = 1 − t + 0.5 c**** d* = 0.65 	***brilliantness i* = t* + 0.5 c**** i* = 0.70 	***triangle lightness t**** t* = 0.50 
Colour 1 *Colour 2=S* *Colour 3*	0 0 0	c* c*/(t*+0.5c*) 1−t*+0.5c*	1−c* 1−c*/(t*+0.5c*) t*−0.5c	c* c*/(t*+0.5c*) 1−t*+0.5c*	1 1 1	1−0.5c* 1−0.5c*/(t*+0.5c*) 1−0.5(1−t*+0.5c*)
Colour 4 *Colour 5=Q* *Colour 6*	1−t*−0.5c* 1+c*/(1−t*+0.5c*) 1−c*	t*+0.5c* c*/(1−t*+0.5c*) c*	0 0 0	1 1 1	t*+0.5c* c*/(1−t*+0.5c*) c*	0.5(t*+0.5c*) 0.5c*/(1−t*+0.5c*) 0.5c*
Colour 7 *Colour 8* *Colour 9*	t*+0.5c* t* t*−0.5c*	0 0 0	1−t*−0.5c* 1−t* 1−t*+0.5c*	t*+0.5c* t* t*−0.5c*	1−t*−0.5c* 1−t* 1−t*+0.5c*	1−t*−0.5c* 1−t* 1−t*+0.5c*

LE541−7, colorimetric relationship of colour triangle points *N, W, M and others*

Table B.3 shows colours defined by the two colorimetric coordinates chromaticness ***c**** and triangle lightness ***t**** (column 2 and 7), In column 2 and 4 to 6 equations for the calculation of blackness ***n****, whiteness ***w****, deepness ***d****, and brilliantness ***i**** as function of ***c**** and ***t**** are given.

The three relative colorimetric data *lab*cmy*$_3$ or *lab*olv*$_3$ are used for colour encoding. The colorimetric relationship of *lab*cmy*$_3$ or *lab*olv*$_3$ to the three *lab*tch* data is only dependent on the hue angle of the six chromatic colours OYLCVM. This hue angle is the same in the *adapted* and the *relative* CIELAB for any device.

There is a standard reference device with a constant hue angle difference of 60 for the six chromatic colours, compare Fig. B.1. The hue angles of OYLCVM of this standard reference device are 30 degrees for O, 90 degrees for Y, 150 degrees for L, 210 degrees for C, 270 degrees for V, and 330 degrees for M. Therefore for this standard reference device with yellow at the top of the hue circle the encoding in *lab*cmy*$_3$ or *lab*olv*$_3$ and the profiling (in the NCCS) has advantages for teaching.

The possible double use of the different equivalent *relative* CIELAB data *lab** for both encoding and profiling is completely different compared to the ICC colour management method. The ICC method uses two different data sets both the three data of standard CIEXYZ (or standard CIELAB) for the profiling and the data RGB for encoding. The encoding data RGB are different for any device.

Annex C:
Transformation from LAB^*_a to olv^* (rgb^*) data for M_a-colors

Annex C shows a hue h^*_8 indexed table for the *adapted* CIELAB data $C^*_{ab,Ma}$ and L^*_{Ma}, the *relative* CIELAB data lab^*olv_{3Ma}, the elementary hue e^*, and the olv-hue h^*_o of devices ORS18a, TLS00, DRSXX, TRS18, SLS00, SRS18.

Table C.1: Integer CIELAB hue h^*_8, LAB^*_{Ma} and lab^*olv_{3Ma}, e^*, h^*_o for the system ORS18a

BAM registration: 20040901-ME28/10L/L28E00NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME28/ Form: 1/6, Serie: 1/1, Page: 1 Page: count: 1

www.ps.bam.de/ME28/10L/L28E00NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
0	73.9	48.1	1.0	0.0	0.858	0.944	0.938
1	73.6	48.1	1.0	0.0	0.827	0.947	0.942
2	73.4	48.1	1.0	0.0	0.797	0.95	0.947
3	73.2	48.1	1.0	0.0	0.767	0.953	0.952
4	73.0	48.1	1.0	0.0	0.736	0.956	0.958
5	72.9	48.1	1.0	0.0	0.706	0.959	0.963
6	72.9	48.1	1.0	0.0	0.676	0.963	0.968
7	72.9	48.1	1.0	0.0	0.646	0.966	0.973
8	72.9	48.1	1.0	0.0	0.616	0.969	0.979
9	73.0	48.1	1.0	0.0	0.586	0.972	0.984
10	73.1	48.0	1.0	0.0	0.556	0.975	0.99
11	73.2	48.0	1.0	0.0	0.526	0.978	0.995
12	73.5	48.0	1.0	0.0	0.496	0.981	0.001
13	73.7	48.0	1.0	0.0	0.465	0.984	0.006
14	74.0	48.0	1.0	0.0	0.434	0.987	0.012
15	74.4	48.0	1.0	0.0	0.403	0.99	0.018
16	74.8	48.0	1.0	0.0	0.372	0.993	0.023
17	75.2	48.0	1.0	0.0	0.34	0.997	0.029
18	75.7	48.0	1.0	0.0	0.308	1.0	0.035
19	76.3	48.0	1.0	0.0	0.276	0.005	0.04
20	76.9	48.0	1.0	0.0	0.243	0.01	0.046
21	77.5	48.0	1.0	0.0	0.209	0.015	0.052
22	78.2	48.0	1.0	0.0	0.175	0.02	0.057
23	79.0	48.0	1.0	0.0	0.14	0.026	0.063
24	79.9	48.0	1.0	0.0	0.104	0.031	0.068
25	80.8	48.0	1.0	0.0	0.068	0.036	0.074
26	81.8	47.9	1.0	0.0	0.031	0.041	0.079
27	82.5	48.2	1.0	0.005	0.0	0.047	0.084
28	81.6	49.2	1.0	0.03	0.0	0.052	0.088
29	80.8	50.3	1.0	0.055	0.0	0.057	0.091
30	80.1	51.3	1.0	0.08	0.0	0.063	0.095
31	79.5	52.3	1.0	0.104	0.0	0.068	0.098
32	78.9	53.3	1.0	0.127	0.0	0.073	0.102
33	78.3	54.3	1.0	0.15	0.0	0.078	0.106
34	77.8	55.3	1.0	0.173	0.0	0.084	0.109
35	77.4	56.3	1.0	0.196	0.0	0.089	0.113
36	77.0	57.2	1.0	0.219	0.0	0.094	0.117
37	76.7	58.2	1.0	0.241	0.0	0.099	0.12
38	76.4	59.1	1.0	0.263	0.0	0.105	0.124
39	76.1	60.0	1.0	0.285	0.0	0.11	0.128
40	76.0	60.9	1.0	0.306	0.0	0.115	0.132
41	75.8	61.9	1.0	0.328	0.0	0.12	0.135
42	75.7	62.8	1.0	0.35	0.0	0.126	0.139
43	75.7	63.7	1.0	0.371	0.0	0.131	0.143
44	75.7	64.6	1.0	0.393	0.0	0.136	0.147
45	75.7	65.5	1.0	0.414	0.0	0.141	0.151
46	75.8	66.4	1.0	0.436	0.0	0.147	0.155
47	75.9	67.4	1.0	0.458	0.0	0.152	0.159
48	76.1	68.3	1.0	0.479	0.0	0.157	0.163
49	76.3	69.2	1.0	0.501	0.0	0.162	0.167
50	76.6	70.1	1.0	0.523	0.0	0.168	0.171
51	76.9	71.1	1.0	0.545	0.0	0.173	0.175
52	77.3	72.0	1.0	0.568	0.0	0.178	0.179
53	77.7	73.0	1.0	0.59	0.0	0.183	0.183
54	78.1	74.0	1.0	0.613	0.0	0.189	0.187
55	78.7	74.9	1.0	0.636	0.0	0.194	0.192
56	79.3	75.9	1.0	0.66	0.0	0.199	0.196
57	79.9	77.0	1.0	0.684	0.0	0.205	0.2
58	80.6	78.0	1.0	0.708	0.0	0.21	0.204
59	81.3	79.0	1.0	0.733	0.0	0.215	0.208
60	82.2	80.1	1.0	0.758	0.0	0.22	0.213
61	83.0	81.2	1.0	0.784	0.0	0.226	0.217
62	84.0	82.3	1.0	0.81	0.0	0.231	0.221
63	85.0	83.4	1.0	0.837	0.0	0.236	0.226

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
64	86.2	84.6	1.0	0.864	0.0	0.241	0.23
65	87.3	85.8	1.0	0.893	0.0	0.247	0.234
66	88.6	87.1	1.0	0.922	0.0	0.252	0.239
67	90.0	88.3	1.0	0.952	0.0	0.257	0.243
68	91.5	89.6	1.0	0.983	0.0	0.262	0.248
69	91.4	89.7	0.982	1.0	0.0	0.267	0.252
70	89.6	88.2	0.945	1.0	0.0	0.272	0.258
71	87.9	86.8	0.909	1.0	0.0	0.277	0.263
72	86.3	85.4	0.875	1.0	0.0	0.282	0.268
73	84.8	84.1	0.842	1.0	0.0	0.287	0.274
74	83.4	82.9	0.81	1.0	0.0	0.292	0.279
75	82.1	81.6	0.779	1.0	0.0	0.297	0.284
76	80.9	80.4	0.748	1.0	0.0	0.302	0.289
77	79.8	79.3	0.719	1.0	0.0	0.307	0.294
78	78.8	78.2	0.69	1.0	0.0	0.312	0.299
79	77.8	77.1	0.663	1.0	0.0	0.317	0.304
80	76.9	76.0	0.635	1.0	0.0	0.322	0.309
81	76.1	74.9	0.609	1.0	0.0	0.327	0.313
82	75.3	73.9	0.583	1.0	0.0	0.332	0.318
83	74.6	72.9	0.557	1.0	0.0	0.337	0.323
84	73.9	71.9	0.532	1.0	0.0	0.342	0.327
85	73.3	70.9	0.508	1.0	0.0	0.347	0.332
86	72.8	70.0	0.484	1.0	0.0	0.352	0.336
87	72.3	69.0	0.46	1.0	0.0	0.357	0.341
88	71.8	68.1	0.436	1.0	0.0	0.362	0.345
89	71.4	67.2	0.413	1.0	0.0	0.367	0.349
90	71.1	66.3	0.39	1.0	0.0	0.372	0.353
91	70.8	65.4	0.367	1.0	0.0	0.378	0.358
92	70.5	64.5	0.344	1.0	0.0	0.383	0.362
93	70.3	63.6	0.322	1.0	0.0	0.388	0.366
94	70.1	62.7	0.299	1.0	0.0	0.393	0.37
95	70.0	61.8	0.277	1.0	0.0	0.398	0.373
96	69.9	61.0	0.255	1.0	0.0	0.403	0.377
97	69.9	60.1	0.233	1.0	0.0	0.408	0.381
98	69.9	59.2	0.211	1.0	0.0	0.413	0.385
99	69.9	58.3	0.188	1.0	0.0	0.418	0.388
100	70.0	57.5	0.166	1.0	0.0	0.423	0.392
101	70.1	56.6	0.144	1.0	0.0	0.428	0.395
102	70.3	55.7	0.122	1.0	0.0	0.433	0.399
103	70.5	54.8	0.099	1.0	0.0	0.438	0.402
104	70.7	53.9	0.076	1.0	0.0	0.443	0.406
105	71.0	53.0	0.054	1.0	0.0	0.448	0.409
106	71.4	52.1	0.031	1.0	0.0	0.453	0.412
107	72.6	50.8	0.0	1.0	−0.009	0.458	0.415
108	70.4	51.1	0.0	1.0	0.022	0.463	0.42
109	68.4	51.3	0.0	1.0	0.052	0.468	0.424
110	66.6	51.5	0.0	1.0	0.081	0.473	0.428
111	64.9	51.7	0.0	1.0	0.108	0.478	0.432
112	63.3	51.9	0.0	1.0	0.134	0.483	0.436
113	61.8	52.1	0.0	1.0	0.159	0.488	0.44
114	60.4	52.3	0.0	1.0	0.182	0.493	0.444
115	59.2	52.5	0.0	1.0	0.205	0.498	0.448
116	58.0	52.6	0.0	1.0	0.227	0.502	0.451
117	56.9	52.8	0.0	1.0	0.247	0.505	0.455
118	55.8	53.0	0.0	1.0	0.267	0.508	0.458
119	54.9	53.1	0.0	1.0	0.287	0.512	0.462
120	53.9	53.3	0.0	1.0	0.305	0.515	0.465
121	53.1	53.4	0.0	1.0	0.324	0.518	0.468
122	52.3	53.5	0.0	1.0	0.341	0.521	0.471
123	51.6	53.7	0.0	1.0	0.358	0.525	0.474
124	50.9	53.8	0.0	1.0	0.375	0.528	0.477
125	50.3	53.9	0.0	1.0	0.391	0.531	0.48
126	49.7	54.0	0.0	1.0	0.407	0.534	0.483
127	49.1	54.2	0.0	1.0	0.422	0.537	0.486

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
128	48.6	54.3	0.0	1.0	0.437	0.541	0.488
129	48.2	54.4	0.0	1.0	0.452	0.544	0.491
130	47.7	54.5	0.0	1.0	0.466	0.547	0.494
131	47.4	54.6	0.0	1.0	0.481	0.55	0.496
132	47.0	54.7	0.0	1.0	0.495	0.553	0.499
133	46.7	54.8	0.0	1.0	0.508	0.557	0.502
134	46.4	54.9	0.0	1.0	0.522	0.56	0.504
135	46.1	55.0	0.0	1.0	0.536	0.563	0.507
136	45.9	55.1	0.0	1.0	0.549	0.566	0.509
137	45.7	55.2	0.0	1.0	0.562	0.569	0.511
138	45.5	55.3	0.0	1.0	0.575	0.573	0.514
139	45.4	55.4	0.0	1.0	0.588	0.576	0.516
140	45.2	55.5	0.0	1.0	0.601	0.579	0.519
141	45.2	55.6	0.0	1.0	0.614	0.582	0.521
142	45.1	55.7	0.0	1.0	0.627	0.586	0.523
143	45.1	55.8	0.0	1.0	0.64	0.589	0.525
144	45.1	55.9	0.0	1.0	0.653	0.592	0.528
145	45.1	56.0	0.0	1.0	0.665	0.595	0.53
146	45.1	56.1	0.0	1.0	0.678	0.598	0.532
147	45.2	56.2	0.0	1.0	0.691	0.602	0.535
148	45.3	56.3	0.0	1.0	0.704	0.605	0.537
149	45.4	56.4	0.0	1.0	0.717	0.608	0.539
150	45.6	56.5	0.0	1.0	0.73	0.611	0.541
151	45.8	56.6	0.0	1.0	0.743	0.614	0.544
152	46.0	56.7	0.0	1.0	0.757	0.618	0.546
153	46.3	56.8	0.0	1.0	0.77	0.621	0.548
154	46.5	56.9	0.0	1.0	0.784	0.624	0.55
155	46.8	57.1	0.0	1.0	0.797	0.627	0.553
156	47.2	57.2	0.0	1.0	0.811	0.63	0.555
157	47.6	57.3	0.0	1.0	0.826	0.634	0.557
158	48.0	57.4	0.0	1.0	0.84	0.637	0.56
159	48.4	57.5	0.0	1.0	0.855	0.64	0.562
160	48.9	57.6	0.0	1.0	0.87	0.643	0.564
161	49.4	57.7	0.0	1.0	0.885	0.647	0.567
162	50.0	57.9	0.0	1.0	0.9	0.65	0.569
163	50.6	58.0	0.0	1.0	0.916	0.653	0.571
164	51.3	58.1	0.0	1.0	0.933	0.656	0.574
165	52.0	58.2	0.0	1.0	0.95	0.659	0.576
166	52.8	58.4	0.0	1.0	0.967	0.663	0.579
167	53.6	58.5	0.0	1.0	0.985	0.666	0.581
168	54.4	58.6	0.0	1.0	1.003	0.669	0.584
169	53.3	57.6	0.0	0.97	1.0	0.672	0.588
170	52.5	56.8	0.0	0.945	1.0	0.675	0.591
171	51.7	56.0	0.0	0.921	1.0	0.679	0.595
172	51.0	55.2	0.0	0.897	1.0	0.682	0.598
173	50.3	54.5	0.0	0.874	1.0	0.685	0.602
174	49.7	53.7	0.0	0.852	1.0	0.688	0.605
175	49.1	53.0	0.0	0.83	1.0	0.691	0.609
176	48.6	52.3	0.0	0.809	1.0	0.695	0.612
177	48.1	51.6	0.0	0.788	1.0	0.698	0.616
178	47.7	51.0	0.0	0.767	1.0	0.701	0.619
179	47.3	50.3	0.0	0.747	1.0	0.704	0.622
180	46.9	49.7	0.0	0.728	1.0	0.708	0.626
181	46.5	49.0	0.0	0.708	1.0	0.711	0.629
182	46.2	48.4	0.0	0.689	1.0	0.714	0.632
183	45.9	47.8	0.0	0.67	1.0	0.717	0.636
184	45.7	47.1	0.0	0.651	1.0	0.72	0.639
185	45.5	46.5	0.0	0.633	1.0	0.724	0.642
186	45.3	45.9	0.0	0.614	1.0	0.727	0.646
187	45.1	45.3	0.0	0.596	1.0	0.73	0.649
188	45.0	44.7	0.0	0.578	1.0	0.733	0.652
189	44.9	44.1	0.0	0.56	1.0	0.736	0.656
190	44.8	43.5	0.0	0.542	1.0	0.74	0.659
191	44.7	43.0	0.0	0.524	1.0	0.743	0.662

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
192	44.7	42.4	0.0	0.506	1.0	0.746	0.666
193	44.7	41.8	0.0	0.488	1.0	0.749	0.669
194	44.8	41.2	0.0	0.47	1.0	0.752	0.672
195	44.8	40.6	0.0	0.452	1.0	0.755	0.675
196	44.9	40.0	0.0	0.434	1.0	0.759	0.679
197	45.0	39.4	0.0	0.416	1.0	0.762	0.682
198	45.1	38.8	0.0	0.398	1.0	0.765	0.685
199	45.3	38.2	0.0	0.38	1.0	0.768	0.689
200	45.5	37.6	0.0	0.362	1.0	0.771	0.692
201	45.7	37.0	0.0	0.343	1.0	0.774	0.695
202	46.0	36.4	0.0	0.324	1.0	0.777	0.699
203	46.3	35.8	0.0	0.305	1.0	0.78	0.702
204	46.6	35.1	0.0	0.286	1.0	0.783	0.705
205	46.9	34.5	0.0	0.266	1.0	0.786	0.709
206	47.3	33.8	0.0	0.247	1.0	0.789	0.712
207	47.7	33.2	0.0	0.226	1.0	0.793	0.715
208	48.2	32.5	0.0	0.206	1.0	0.796	0.719
209	48.7	31.8	0.0	0.185	1.0	0.799	0.722
210	49.2	31.1	0.0	0.163	1.0	0.802	0.726
211	49.8	30.4	0.0	0.142	1.0	0.805	0.729
212	50.4	29.6	0.0	0.119	1.0	0.808	0.733
213	51.1	28.9	0.0	0.096	1.0	0.811	0.736
214	51.8	28.1	0.0	0.072	1.0	0.814	0.74
215	52.6	27.3	0.0	0.048	1.0	0.817	0.743
216	53.4	26.5	0.0	0.023	1.0	0.82	0.747
217	54.2	25.8	0.003	0.0	1.0	0.823	0.75
218	54.1	26.3	0.026	0.0	1.0	0.827	0.754
219	54.1	26.8	0.049	0.0	1.0	0.83	0.757
220	54.1	27.3	0.073	0.0	1.0	0.833	0.76
221	54.1	27.9	0.096	0.0	1.0	0.836	0.764
222	54.1	28.4	0.119	0.0	1.0	0.839	0.767
223	54.2	28.9	0.142	0.0	1.0	0.842	0.771
224	54.3	29.4	0.166	0.0	1.0	0.845	0.775
225	54.5	30.0	0.19	0.0	1.0	0.848	0.779
226	54.7	30.5	0.213	0.0	1.0	0.851	0.782
227	54.9	31.0	0.237	0.0	1.0	0.854	0.786
228	55.2	31.6	0.261	0.0	1.0	0.857	0.791
229	55.5	32.1	0.286	0.0	1.0	0.861	0.795
230	55.8	32.7	0.31	0.0	1.0	0.864	0.799
231	56.1	33.2	0.335	0.0	1.0	0.867	0.803
232	56.6	33.8	0.36	0.0	1.0	0.87	0.808
233	57.0	34.4	0.386	0.0	1.0	0.873	0.813
234	57.5	35.0	0.412	0.0	1.0	0.876	0.817
235	58.0	35.6	0.439	0.0	1.0	0.879	0.822
236	58.6	36.2	0.466	0.0	1.0	0.882	0.827
237	59.2	36.8	0.493	0.0	1.0	0.885	0.832
238	59.9	37.4	0.522	0.0	1.0	0.888	0.837
239	60.6	38.1	0.551	0.0	1.0	0.891	0.843
240	61.4	38.7	0.58	0.0	1.0	0.895	0.848
241	62.2	39.4	0.611	0.0	1.0	0.898	0.854
242	63.1	40.1	0.642	0.0	1.0	0.901	0.859
243	64.1	40.8	0.674	0.0	1.0	0.904	0.865
244	65.2	41.6	0.707	0.0	1.0	0.907	0.871
245	66.3	42.3	0.742	0.0	1.0	0.91	0.877
246	67.5	43.1	0.777	0.0	1.0	0.913	0.883
247	68.7	44.0	0.814	0.0	1.0	0.916	0.889
248	70.1	44.8	0.853	0.0	1.0	0.919	0.895
249	71.6	45.7	0.893	0.0	1.0	0.922	0.901
250	73.2	46.7	0.934	0.0	1.0	0.925	0.907
251	76.0	48.1	1.0	0.0	1.016	0.929	0.914
252	75.5	48.1	1.0	0.0	0.984	0.932	0.919
253	75.0	48.1	1.0	0.0	0.952	0.935	0.923
254	74.6	48.1	1.0	0.0	0.92	0.938	0.928
255	74.2	48.1	1.0	0.0	0.889	0.941	0.933

ME280−7N1, Integer CIELAB hue h^*_8, *adapted* CIELAB data LAB^*_{Ma}, *relative* CIELAB data lab^*olv_{3Ma} of Ma-colours, elementary hue e^*, standard olv-hue, h^*_o of device ORS18a

BAM-reference table no. ME28 for Ma colours
Table h*8 − LAB*Ma, lab*olvMa, e*, h*o; System: ORS18a

input: *w* setgray*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME28/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table C.1 shows a CIELAB integer hue h^*_8 indexed table to determine either the adapted CIELAB data $C^*_{ab,Ma}$ or L^*_{Ma}, the *relative* CIELAB data lab^*olv_{3Ma}, the elementary hue e^*, and the olv-hue h^*_o for the standard device system

OSR18a. The next Table C.2 shows many possibilities to describe the hue of the Maximum colour M_a.

Table C.2: CIELAB, elementary, and olv-hue, for example h^*_8, H^*, and h^* for the system ORS18a

BAM registration: 20040901-ME29/10L/L29E00NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME29/ Form: 1/6, Serie: 1/1, Page: 1 Page: count: 1

www.ps.bam.de/ME29/10L/L29E00NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

h^*_8	H^*	h^*	e^*_8	E^*	e^*	h^*_{o8}	H^*_o	h^*_o
0	0	0.0	242	340	0.944	240	338	0.938
1	1	0.004	242	341	0.947	241	339	0.942
2	3	0.008	243	342	0.95	243	341	0.947
3	4	0.012	244	343	0.953	244	343	0.952
4	6	0.016	245	344	0.956	245	345	0.958
5	7	0.02	246	345	0.959	246	347	0.963
6	8	0.023	246	347	0.963	248	348	0.968
7	10	0.027	247	348	0.966	249	350	0.973
8	11	0.031	248	349	0.969	251	352	0.979
9	13	0.035	249	350	0.972	252	354	0.984
10	14	0.039	250	351	0.975	253	356	0.99
11	15	0.043	250	352	0.978	255	358	0.995
12	17	0.047	251	353	0.981	0	0	0.001
13	18	0.051	252	354	0.984	2	2	0.006
14	20	0.055	253	355	0.987	3	4	0.012
15	21	0.059	254	357	0.99	5	6	0.018
16	23	0.063	254	358	0.993	6	8	0.023
17	24	0.066	255	359	0.997	7	10	0.029
18	25	0.07	256	360	1.0	9	12	0.035
19	27	0.074	1	2	0.005	10	15	0.04
20	28	0.078	3	4	0.01	12	17	0.046
21	30	0.082	4	5	0.015	13	19	0.052
22	31	0.086	5	7	0.02	15	21	0.057
23	32	0.09	7	9	0.026	16	23	0.063
24	34	0.094	8	11	0.031	17	25	0.068
25	35	0.098	9	13	0.036	19	27	0.074
26	37	0.102	11	15	0.041	20	28	0.079
27	38	0.105	12	17	0.047	22	30	0.084
28	39	0.109	13	19	0.052	22	32	0.088
29	41	0.113	15	21	0.057	23	33	0.091
30	42	0.117	16	23	0.063	24	34	0.095
31	44	0.121	17	24	0.068	25	35	0.098
32	45	0.125	19	26	0.073	26	37	0.102
33	46	0.129	20	28	0.078	27	38	0.106
34	48	0.133	21	30	0.084	28	39	0.109
35	49	0.137	23	32	0.089	29	41	0.113
36	51	0.141	24	34	0.094	30	42	0.117
37	52	0.145	25	36	0.099	31	43	0.12
38	53	0.148	27	38	0.105	32	45	0.124
39	55	0.152	28	40	0.11	33	46	0.128
40	56	0.156	29	41	0.115	34	47	0.132
41	58	0.16	31	43	0.12	35	49	0.135
42	59	0.164	32	45	0.126	36	50	0.139
43	60	0.168	34	47	0.131	37	52	0.143
44	62	0.172	35	49	0.136	38	53	0.147
45	63	0.176	36	51	0.141	39	54	0.151
46	65	0.18	38	53	0.147	40	56	0.155
47	66	0.184	39	55	0.152	41	57	0.159
48	68	0.188	40	57	0.157	42	59	0.163
49	69	0.191	42	58	0.162	43	60	0.167
50	70	0.195	43	60	0.168	44	62	0.171
51	72	0.199	44	62	0.173	45	63	0.175
52	73	0.203	46	64	0.178	46	64	0.179
53	75	0.207	47	66	0.183	47	66	0.183
54	76	0.211	48	68	0.189	48	67	0.187
55	77	0.215	50	70	0.194	49	69	0.192
56	79	0.219	51	72	0.199	50	70	0.196
57	80	0.223	52	74	0.205	51	72	0.2
58	82	0.227	54	76	0.21	52	74	0.204
59	83	0.23	55	77	0.215	53	75	0.208
60	84	0.234	56	79	0.22	54	77	0.213
61	86	0.238	58	81	0.226	56	78	0.217
62	87	0.242	59	83	0.231	57	80	0.221
63	89	0.246	60	85	0.236	58	81	0.226
64	90	0.25	62	87	0.241	59	83	0.23
65	91	0.254	63	89	0.247	60	84	0.234
66	93	0.258	64	91	0.252	61	86	0.239
67	94	0.262	66	92	0.257	62	88	0.243
68	96	0.266	67	94	0.262	63	89	0.248
69	97	0.27	68	96	0.267	65	91	0.252
70	98	0.273	70	98	0.272	66	93	0.258
71	100	0.277	71	100	0.277	67	95	0.263
72	101	0.281	72	102	0.282	69	97	0.268
73	103	0.285	73	103	0.287	70	98	0.274
74	104	0.289	75	105	0.292	71	100	0.279
75	105	0.293	76	107	0.297	73	102	0.284
76	107	0.297	77	109	0.302	74	104	0.289
77	108	0.301	79	111	0.307	75	106	0.294
78	110	0.305	80	112	0.312	77	108	0.299
79	111	0.309	81	114	0.317	78	109	0.304
80	113	0.313	82	116	0.322	79	111	0.309
81	114	0.316	84	118	0.327	80	113	0.313
82	115	0.32	85	120	0.332	81	115	0.318
83	117	0.324	86	121	0.337	83	116	0.323
84	118	0.328	88	123	0.342	84	118	0.327
85	120	0.332	89	125	0.347	85	119	0.332
86	121	0.336	90	127	0.352	86	121	0.336
87	122	0.34	91	129	0.357	87	123	0.341
88	124	0.344	93	130	0.362	88	124	0.345
89	125	0.348	94	132	0.367	89	126	0.349
90	127	0.352	95	134	0.372	90	127	0.353
91	128	0.355	97	136	0.378	92	129	0.358
92	129	0.359	98	138	0.383	93	130	0.362
93	131	0.363	99	140	0.388	94	132	0.366
94	132	0.367	101	141	0.393	95	133	0.37
95	134	0.371	102	143	0.398	96	134	0.373
96	135	0.375	103	145	0.403	97	136	0.377
97	136	0.379	104	147	0.408	98	137	0.381
98	138	0.383	106	149	0.413	98	138	0.385
99	139	0.387	107	150	0.418	99	140	0.388
100	141	0.391	108	152	0.423	100	141	0.392
101	142	0.395	110	154	0.428	101	142	0.395
102	143	0.398	111	156	0.433	102	144	0.399
103	145	0.402	112	158	0.438	103	145	0.402
104	146	0.406	113	159	0.443	104	146	0.406
105	148	0.41	115	161	0.448	105	147	0.409
106	149	0.414	116	163	0.453	106	148	0.412
107	150	0.418	117	165	0.458	106	149	0.415
108	152	0.422	119	167	0.463	107	151	0.42
109	153	0.426	120	168	0.468	109	153	0.424
110	155	0.43	121	170	0.473	110	154	0.428
111	156	0.434	122	172	0.478	111	156	0.432
112	158	0.438	124	174	0.483	112	157	0.436
113	159	0.441	125	176	0.488	113	159	0.44
114	160	0.445	126	178	0.493	114	160	0.444
115	162	0.449	128	179	0.498	115	161	0.448
116	163	0.453	129	181	0.502	116	162	0.451
117	165	0.457	129	182	0.505	116	164	0.455
118	166	0.461	130	183	0.508	117	165	0.458
119	167	0.465	131	184	0.512	118	166	0.462
120	169	0.469	132	185	0.515	119	167	0.465
121	170	0.473	133	187	0.518	120	168	0.468
122	172	0.477	133	188	0.521	121	170	0.471
123	173	0.48	134	189	0.525	121	171	0.474
124	174	0.484	135	190	0.528	122	172	0.477
125	176	0.488	136	191	0.531	123	173	0.48
126	177	0.492	137	192	0.534	124	174	0.483
127	179	0.496	138	193	0.537	124	175	0.486
128	180	0.5	138	195	0.541	125	176	0.488
129	181	0.504	139	196	0.544	126	177	0.491
130	183	0.508	140	197	0.547	126	178	0.494
131	184	0.512	141	198	0.55	127	179	0.496
132	186	0.516	142	199	0.553	128	180	0.499
133	187	0.52	142	200	0.557	128	181	0.502
134	188	0.523	143	202	0.56	129	181	0.504
135	190	0.527	144	203	0.563	130	182	0.507
136	191	0.531	145	204	0.566	130	183	0.509
137	193	0.535	146	205	0.569	131	184	0.511
138	194	0.539	147	206	0.573	132	185	0.514
139	195	0.543	147	207	0.576	132	186	0.516
140	197	0.547	148	208	0.579	133	187	0.519
141	198	0.551	149	210	0.582	133	188	0.521
142	200	0.555	150	211	0.586	134	188	0.523
143	201	0.559	151	212	0.589	135	189	0.525
144	203	0.563	152	213	0.592	135	190	0.528
145	204	0.566	152	214	0.595	136	191	0.53
146	205	0.57	153	215	0.598	136	192	0.532
147	207	0.574	154	217	0.602	137	192	0.535
148	208	0.578	155	218	0.605	137	193	0.537
149	210	0.582	156	219	0.608	138	194	0.539
150	211	0.586	156	220	0.611	139	195	0.541
151	212	0.59	157	221	0.614	139	196	0.544
152	214	0.594	158	222	0.618	140	197	0.546
153	215	0.598	159	224	0.621	140	197	0.548
154	217	0.602	160	225	0.624	141	198	0.55
155	218	0.605	161	226	0.627	141	199	0.553
156	219	0.609	161	227	0.63	142	200	0.555
157	221	0.613	162	228	0.634	143	201	0.557
158	222	0.617	163	229	0.637	143	201	0.56
159	224	0.621	164	230	0.64	144	202	0.562
160	225	0.625	165	232	0.643	144	203	0.564
161	226	0.629	166	233	0.647	145	204	0.567
162	228	0.633	166	234	0.65	146	205	0.569
163	229	0.637	167	235	0.653	146	206	0.571
164	231	0.641	168	236	0.656	147	207	0.574
165	232	0.645	169	237	0.659	148	207	0.576
166	233	0.648	170	239	0.663	148	208	0.579
167	235	0.652	170	240	0.666	149	209	0.581
168	236	0.656	171	241	0.669	149	210	0.584
169	238	0.66	172	242	0.672	150	212	0.588
170	239	0.664	173	243	0.675	151	213	0.591
171	240	0.668	174	244	0.679	152	214	0.595
172	242	0.672	175	245	0.682	153	215	0.598
173	243	0.676	175	247	0.685	154	217	0.602
174	245	0.68	176	248	0.688	155	218	0.605
175	246	0.684	177	249	0.691	156	219	0.609
176	248	0.688	178	250	0.695	157	220	0.612
177	249	0.691	179	251	0.698	158	222	0.616
178	250	0.695	179	252	0.701	158	223	0.619
179	252	0.699	180	254	0.704	159	224	0.622
180	253	0.703	181	255	0.708	160	225	0.626
181	255	0.707	182	256	0.711	161	226	0.629
182	256	0.711	183	257	0.714	162	228	0.632
183	257	0.715	184	258	0.717	163	229	0.636
184	259	0.719	184	259	0.72	164	230	0.639
185	260	0.723	185	260	0.724	164	231	0.642
186	262	0.727	186	262	0.727	165	232	0.646
187	263	0.73	187	263	0.73	166	234	0.649
188	264	0.734	188	264	0.733	167	235	0.652
189	266	0.738	189	265	0.736	168	236	0.656
190	267	0.742	189	266	0.74	169	237	0.659
191	269	0.746	190	267	0.743	170	238	0.662
192	270	0.75	191	269	0.746	170	240	0.666
193	271	0.754	192	270	0.749	171	241	0.669
194	273	0.758	193	271	0.752	172	242	0.672
195	274	0.762	193	272	0.755	173	243	0.675
196	276	0.766	194	273	0.759	174	244	0.679
197	277	0.77	195	274	0.762	175	246	0.682
198	278	0.773	196	275	0.765	175	247	0.685
199	280	0.777	197	276	0.768	176	248	0.689
200	281	0.781	197	278	0.771	177	249	0.692
201	283	0.785	198	279	0.774	178	250	0.695
202	284	0.789	199	280	0.777	179	251	0.699
203	285	0.793	200	281	0.78	180	253	0.702
204	287	0.797	201	282	0.783	181	254	0.705
205	288	0.801	201	283	0.786	181	255	0.709
206	290	0.805	202	284	0.789	182	256	0.712
207	291	0.809	203	285	0.793	183	258	0.715
208	293	0.813	204	286	0.796	184	259	0.719
209	294	0.816	204	288	0.799	185	260	0.722
210	295	0.82	205	289	0.802	186	261	0.726
211	297	0.824	206	290	0.805	187	262	0.729
212	298	0.828	207	291	0.808	188	264	0.733
213	300	0.832	208	292	0.811	188	265	0.736
214	301	0.836	208	293	0.814	189	266	0.74
215	302	0.84	209	294	0.817	190	268	0.743
216	304	0.844	210	295	0.82	191	269	0.747
217	305	0.848	211	296	0.823	192	270	0.75
218	307	0.852	212	298	0.827	193	271	0.754
219	308	0.855	212	299	0.83	194	273	0.757
220	309	0.859	213	300	0.833	195	274	0.76
221	311	0.863	214	301	0.836	196	275	0.764
222	312	0.867	215	302	0.839	196	276	0.767
223	314	0.871	216	303	0.842	197	278	0.771
224	315	0.875	216	304	0.845	198	279	0.775
225	316	0.879	217	305	0.848	199	280	0.779
226	318	0.883	218	306	0.851	200	282	0.782
227	319	0.887	219	308	0.854	201	283	0.786
228	321	0.891	220	309	0.857	202	285	0.791
229	322	0.895	220	310	0.861	203	286	0.795
230	323	0.898	221	311	0.864	205	288	0.799
231	325	0.902	222	312	0.867	206	289	0.803
232	326	0.906	223	313	0.87	207	291	0.808
233	328	0.91	223	314	0.873	208	293	0.813
234	329	0.914	224	315	0.876	209	294	0.817
235	330	0.918	225	316	0.879	210	296	0.822
236	332	0.922	226	318	0.882	212	298	0.827
237	333	0.926	227	319	0.885	213	300	0.832
238	335	0.93	227	320	0.888	214	301	0.837
239	336	0.934	228	321	0.891	216	303	0.843
240	338	0.938	229	322	0.895	217	305	0.848
241	339	0.941	230	323	0.898	219	307	0.854
242	340	0.945	231	324	0.901	220	309	0.859
243	342	0.949	231	325	0.904	221	311	0.865
244	343	0.953	232	326	0.907	223	313	0.871
245	345	0.957	233	328	0.91	224	316	0.877
246	346	0.961	234	329	0.913	226	318	0.883
247	347	0.965	235	330	0.916	228	320	0.889
248	349	0.969	235	331	0.919	229	322	0.895
249	350	0.973	236	332	0.922	231	324	0.901
250	352	0.977	237	333	0.925	232	327	0.907
251	353	0.98	238	334	0.929	234	329	0.914
252	354	0.984	238	335	0.932	235	331	0.919
253	356	0.988	239	337	0.935	236	332	0.923
254	357	0.992	240	338	0.938	238	334	0.928
255	359	0.996	241	339	0.941	239	336	0.933

ME470−441, CIELAB hue: integer h^*_8, angle H^*, and value h^*; elementary hue: integer e^*_8, angle E^*, and value e^*; standard olv-hue: integer h^*_{o8}, angle H^*_o, and value h^*_o of device ORS18a

BAM-reference table no. ME29 for Ma colours
h*8 − H*a, h*, e*8, E*, e*, h*o8, H*o, h*o; System: ORS18a

input: *w* setgray*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME29/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table C.2 shows the CIELAB, the elementary, and the olv-hue for the device ORS18a. The CIELAB hue is shown as an integer hue h^*_8 in the range [0, 255], as hue angle H^* in the range [0, 360], and as hue value h^* in the range [0, 1]. The elementary hue and olv-hue is shown in the same three ranges. However, the CIELAB, the elementary, and the olv-hue is different. The olv-hue has hue angles of 30, 150 and 270 degrees in the CIELAB diagram *(a*, b*)* for OLV.

Together with the hues of CMY a regular hue hexagon is formed.

Table C.3: Integer CIELAB hue h^*_8, LAB^*_{Ma} and lab^*olv_{3Ma}, e^*, h^*_o for the system SRS18

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N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
0	86.6	56.7	1.0	0.0	0.5	0.944	0.0
1	86.6	56.7	1.0	0.0	0.479	0.947	0.004
2	86.7	56.7	1.0	0.0	0.457	0.95	0.008
3	86.8	56.7	1.0	0.0	0.436	0.953	0.012
4	87.0	56.7	1.0	0.0	0.415	0.956	0.016
5	87.3	56.7	1.0	0.0	0.393	0.959	0.02
6	87.5	56.7	1.0	0.0	0.372	0.963	0.023
7	87.9	56.7	1.0	0.0	0.35	0.966	0.027
8	88.3	56.7	1.0	0.0	0.328	0.969	0.031
9	88.8	56.7	1.0	0.0	0.306	0.972	0.035
10	89.3	56.7	1.0	0.0	0.283	0.975	0.039
11	89.9	56.7	1.0	0.0	0.26	0.978	0.043
12	90.5	56.7	1.0	0.0	0.237	0.981	0.047
13	91.2	56.7	1.0	0.0	0.214	0.984	0.051
14	92.0	56.7	1.0	0.0	0.19	0.987	0.055
15	92.8	56.7	1.0	0.0	0.166	0.99	0.059
16	93.7	56.7	1.0	0.0	0.141	0.993	0.062
17	94.7	56.7	1.0	0.0	0.116	0.997	0.066
18	95.8	56.7	1.0	0.0	0.09	1.0	0.07
19	97.0	56.7	1.0	0.0	0.064	0.005	0.074
20	98.2	56.7	1.0	0.0	0.037	0.01	0.078
21	100.5	56.7	1.0	0.0	0.0	0.015	0.083
22	99.1	56.7	1.0	0.019	0.0	0.02	0.086
23	97.8	56.7	1.0	0.046	0.0	0.026	0.09
24	96.6	56.7	1.0	0.073	0.0	0.031	0.094
25	95.4	56.7	1.0	0.099	0.0	0.036	0.098
26	94.4	56.7	1.0	0.125	0.0	0.041	0.102
27	93.4	56.7	1.0	0.15	0.0	0.047	0.105
28	92.5	56.7	1.0	0.174	0.0	0.052	0.109
29	91.7	56.7	1.0	0.198	0.0	0.057	0.113
30	91.0	56.7	1.0	0.222	0.0	0.063	0.117
31	90.3	56.7	1.0	0.245	0.0	0.068	0.121
32	89.7	56.7	1.0	0.268	0.0	0.073	0.125
33	89.1	56.7	1.0	0.291	0.0	0.078	0.129
34	88.6	56.7	1.0	0.313	0.0	0.084	0.133
35	88.2	56.7	1.0	0.335	0.0	0.089	0.137
36	87.8	56.7	1.0	0.357	0.0	0.094	0.141
37	87.4	56.7	1.0	0.379	0.0	0.099	0.145
38	87.2	56.7	1.0	0.4	0.0	0.105	0.148
39	87.0	56.7	1.0	0.422	0.0	0.11	0.152
40	86.8	56.7	1.0	0.443	0.0	0.115	0.156
41	86.7	56.7	1.0	0.465	0.0	0.12	0.16
42	86.6	56.7	1.0	0.486	0.0	0.126	0.164
43	86.6	56.7	1.0	0.507	0.0	0.131	0.168
44	86.6	56.7	1.0	0.528	0.0	0.136	0.172
45	86.7	56.7	1.0	0.55	0.0	0.141	0.176
46	86.9	56.7	1.0	0.571	0.0	0.147	0.18
47	87.1	56.7	1.0	0.592	0.0	0.152	0.184
48	87.3	56.7	1.0	0.614	0.0	0.157	0.187
49	87.7	56.7	1.0	0.636	0.0	0.162	0.191
50	88.0	56.7	1.0	0.658	0.0	0.168	0.195
51	88.4	56.7	1.0	0.68	0.0	0.173	0.199
52	88.9	56.7	1.0	0.702	0.0	0.178	0.203
53	89.5	56.7	1.0	0.724	0.0	0.183	0.207
54	90.1	56.7	1.0	0.747	0.0	0.189	0.211
55	90.7	56.7	1.0	0.77	0.0	0.194	0.215
56	91.5	56.7	1.0	0.794	0.0	0.199	0.219
57	92.3	56.7	1.0	0.818	0.0	0.205	0.223
58	93.1	56.7	1.0	0.842	0.0	0.21	0.227
59	94.1	56.7	1.0	0.867	0.0	0.215	0.23
60	95.1	56.7	1.0	0.892	0.0	0.22	0.234
61	96.2	56.7	1.0	0.918	0.0	0.226	0.238
62	97.4	56.7	1.0	0.945	0.0	0.231	0.242
63	98.6	56.7	1.0	0.972	0.0	0.236	0.246

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
64	100.0	56.7	1.0	1.0	0.0	0.241	0.25
65	98.6	56.7	0.972	1.0	0.0	0.247	0.254
66	97.4	56.7	0.945	1.0	0.0	0.252	0.258
67	96.2	56.7	0.918	1.0	0.0	0.257	0.262
68	95.1	56.7	0.892	1.0	0.0	0.262	0.266
69	94.1	56.7	0.867	1.0	0.0	0.267	0.27
70	93.1	56.7	0.842	1.0	0.0	0.272	0.273
71	92.3	56.7	0.818	1.0	0.0	0.277	0.277
72	91.5	56.7	0.794	1.0	0.0	0.282	0.281
73	90.7	56.7	0.77	1.0	0.0	0.287	0.285
74	90.1	56.7	0.747	1.0	0.0	0.292	0.289
75	89.5	56.7	0.724	1.0	0.0	0.297	0.293
76	88.9	56.7	0.702	1.0	0.0	0.302	0.297
77	88.4	56.7	0.68	1.0	0.0	0.307	0.301
78	88.0	56.7	0.658	1.0	0.0	0.312	0.305
79	87.7	56.7	0.636	1.0	0.0	0.317	0.309
80	87.3	56.7	0.614	1.0	0.0	0.322	0.313
81	87.1	56.7	0.592	1.0	0.0	0.327	0.316
82	86.9	56.7	0.571	1.0	0.0	0.332	0.32
83	86.7	56.7	0.55	1.0	0.0	0.337	0.324
84	86.6	56.7	0.528	1.0	0.0	0.342	0.328
85	86.6	56.7	0.507	1.0	0.0	0.347	0.332
86	86.6	56.7	0.486	1.0	0.0	0.352	0.336
87	86.7	56.7	0.465	1.0	0.0	0.357	0.34
88	86.8	56.7	0.443	1.0	0.0	0.362	0.344
89	87.0	56.7	0.422	1.0	0.0	0.367	0.348
90	87.2	56.7	0.4	1.0	0.0	0.372	0.352
91	87.4	56.7	0.379	1.0	0.0	0.378	0.355
92	87.8	56.7	0.357	1.0	0.0	0.383	0.359
93	88.2	56.7	0.335	1.0	0.0	0.388	0.363
94	88.6	56.7	0.313	1.0	0.0	0.393	0.367
95	89.1	56.7	0.291	1.0	0.0	0.398	0.371
96	89.7	56.7	0.268	1.0	0.0	0.403	0.375
97	90.3	56.7	0.245	1.0	0.0	0.408	0.379
98	91.0	56.7	0.222	1.0	0.0	0.413	0.383
99	91.7	56.7	0.198	1.0	0.0	0.418	0.387
100	92.5	56.7	0.174	1.0	0.0	0.423	0.391
101	93.4	56.7	0.15	1.0	0.0	0.428	0.395
102	94.4	56.7	0.125	1.0	0.0	0.433	0.398
103	95.4	56.7	0.099	1.0	0.0	0.438	0.402
104	96.6	56.7	0.073	1.0	0.0	0.443	0.406
105	97.8	56.7	0.046	1.0	0.0	0.448	0.41
106	99.1	56.7	0.019	1.0	0.0	0.453	0.414
107	99.5	56.7	0.0	1.0	0.009	0.458	0.418
108	98.2	56.7	0.0	1.0	0.037	0.463	0.422
109	97.0	56.7	0.0	1.0	0.064	0.468	0.426
110	95.8	56.7	0.0	1.0	0.09	0.473	0.43
111	94.7	56.7	0.0	1.0	0.116	0.478	0.434
112	93.7	56.7	0.0	1.0	0.141	0.483	0.438
113	92.8	56.7	0.0	1.0	0.166	0.488	0.441
114	92.0	56.7	0.0	1.0	0.19	0.493	0.445
115	91.2	56.7	0.0	1.0	0.214	0.498	0.449
116	90.5	56.7	0.0	1.0	0.237	0.502	0.453
117	89.9	56.7	0.0	1.0	0.26	0.505	0.457
118	89.3	56.7	0.0	1.0	0.283	0.508	0.461
119	88.8	56.7	0.0	1.0	0.306	0.512	0.465
120	88.3	56.7	0.0	1.0	0.328	0.515	0.469
121	87.9	56.7	0.0	1.0	0.35	0.518	0.473
122	87.5	56.7	0.0	1.0	0.372	0.521	0.477
123	87.3	56.7	0.0	1.0	0.393	0.525	0.48
124	87.0	56.7	0.0	1.0	0.415	0.528	0.484
125	86.8	56.7	0.0	1.0	0.436	0.531	0.488
126	86.7	56.7	0.0	1.0	0.457	0.534	0.492
127	86.6	56.7	0.0	1.0	0.479	0.537	0.496

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
128	86.6	56.7	0.0	1.0	0.5	0.541	0.5
129	86.6	56.7	0.0	1.0	0.521	0.544	0.504
130	86.7	56.7	0.0	1.0	0.543	0.547	0.508
131	86.8	56.7	0.0	1.0	0.564	0.55	0.512
132	87.0	56.7	0.0	1.0	0.585	0.553	0.516
133	87.3	56.7	0.0	1.0	0.607	0.557	0.52
134	87.5	56.7	0.0	1.0	0.628	0.56	0.523
135	87.9	56.7	0.0	1.0	0.65	0.563	0.527
136	88.3	56.7	0.0	1.0	0.672	0.566	0.531
137	88.8	56.7	0.0	1.0	0.694	0.569	0.535
138	89.3	56.7	0.0	1.0	0.717	0.573	0.539
139	89.9	56.7	0.0	1.0	0.74	0.576	0.543
140	90.5	56.7	0.0	1.0	0.763	0.579	0.547
141	91.2	56.7	0.0	1.0	0.786	0.582	0.551
142	92.0	56.7	0.0	1.0	0.81	0.586	0.555
143	92.8	56.7	0.0	1.0	0.834	0.589	0.559
144	93.7	56.7	0.0	1.0	0.859	0.592	0.562
145	94.7	56.7	0.0	1.0	0.884	0.595	0.566
146	95.8	56.7	0.0	1.0	0.91	0.598	0.57
147	97.0	56.7	0.0	1.0	0.936	0.602	0.574
148	98.2	56.7	0.0	1.0	0.963	0.605	0.578
149	99.5	56.7	0.0	1.0	0.991	0.608	0.582
150	99.1	56.7	0.0	0.981	1.0	0.611	0.586
151	97.8	56.7	0.0	0.954	1.0	0.614	0.59
152	96.6	56.7	0.0	0.927	1.0	0.618	0.594
153	95.4	56.7	0.0	0.901	1.0	0.621	0.598
154	94.4	56.7	0.0	0.875	1.0	0.624	0.602
155	93.4	56.7	0.0	0.85	1.0	0.627	0.605
156	92.5	56.7	0.0	0.826	1.0	0.63	0.609
157	91.7	56.7	0.0	0.802	1.0	0.634	0.613
158	91.0	56.7	0.0	0.778	1.0	0.637	0.617
159	90.3	56.7	0.0	0.755	1.0	0.64	0.621
160	89.7	56.7	0.0	0.732	1.0	0.643	0.625
161	89.1	56.7	0.0	0.709	1.0	0.647	0.629
162	88.6	56.7	0.0	0.687	1.0	0.65	0.633
163	88.2	56.7	0.0	0.665	1.0	0.653	0.637
164	87.8	56.7	0.0	0.643	1.0	0.656	0.641
165	87.4	56.7	0.0	0.621	1.0	0.659	0.645
166	87.2	56.7	0.0	0.6	1.0	0.663	0.648
167	87.0	56.7	0.0	0.578	1.0	0.666	0.652
168	86.8	56.7	0.0	0.557	1.0	0.669	0.656
169	86.7	56.7	0.0	0.535	1.0	0.672	0.66
170	86.6	56.7	0.0	0.514	1.0	0.675	0.664
171	86.6	56.7	0.0	0.493	1.0	0.679	0.668
172	86.6	56.7	0.0	0.472	1.0	0.682	0.672
173	86.7	56.7	0.0	0.45	1.0	0.685	0.676
174	86.9	56.7	0.0	0.429	1.0	0.688	0.68
175	87.1	56.7	0.0	0.408	1.0	0.691	0.684
176	87.3	56.7	0.0	0.386	1.0	0.695	0.687
177	87.7	56.7	0.0	0.364	1.0	0.698	0.691
178	88.0	56.7	0.0	0.342	1.0	0.701	0.695
179	88.4	56.7	0.0	0.32	1.0	0.704	0.699
180	88.9	56.7	0.0	0.298	1.0	0.708	0.703
181	89.5	56.7	0.0	0.276	1.0	0.711	0.707
182	90.1	56.7	0.0	0.253	1.0	0.714	0.711
183	90.7	56.7	0.0	0.23	1.0	0.717	0.715
184	91.5	56.7	0.0	0.206	1.0	0.72	0.719
185	92.3	56.7	0.0	0.182	1.0	0.724	0.723
186	93.1	56.7	0.0	0.158	1.0	0.727	0.727
187	94.1	56.7	0.0	0.133	1.0	0.73	0.73
188	95.1	56.7	0.0	0.108	1.0	0.733	0.734
189	96.2	56.7	0.0	0.082	1.0	0.736	0.738
190	97.4	56.7	0.0	0.055	1.0	0.74	0.742
191	98.6	56.7	0.0	0.028	1.0	0.743	0.746

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
192	100.0	56.7	0.0	0.0	1.0	0.746	0.75
193	98.6	56.7	0.028	0.0	1.0	0.749	0.754
194	97.4	56.7	0.055	0.0	1.0	0.752	0.758
195	96.2	56.7	0.082	0.0	1.0	0.755	0.762
196	95.1	56.7	0.108	0.0	1.0	0.759	0.766
197	94.1	56.7	0.133	0.0	1.0	0.762	0.77
198	93.1	56.7	0.158	0.0	1.0	0.765	0.773
199	92.3	56.7	0.182	0.0	1.0	0.768	0.777
200	91.5	56.7	0.206	0.0	1.0	0.771	0.781
201	90.7	56.7	0.23	0.0	1.0	0.774	0.785
202	90.1	56.7	0.253	0.0	1.0	0.777	0.789
203	89.5	56.7	0.276	0.0	1.0	0.78	0.793
204	88.9	56.7	0.298	0.0	1.0	0.783	0.797
205	88.4	56.7	0.32	0.0	1.0	0.786	0.801
206	88.0	56.7	0.342	0.0	1.0	0.789	0.805
207	87.7	56.7	0.364	0.0	1.0	0.793	0.809
208	87.3	56.7	0.386	0.0	1.0	0.796	0.813
209	87.1	56.7	0.408	0.0	1.0	0.799	0.816
210	86.9	56.7	0.429	0.0	1.0	0.802	0.82
211	86.7	56.7	0.45	0.0	1.0	0.805	0.824
212	86.6	56.7	0.472	0.0	1.0	0.808	0.828
213	86.6	56.7	0.493	0.0	1.0	0.811	0.832
214	86.6	56.7	0.514	0.0	1.0	0.814	0.836
215	86.7	56.7	0.535	0.0	1.0	0.817	0.84
216	86.8	56.7	0.557	0.0	1.0	0.82	0.844
217	87.0	56.7	0.578	0.0	1.0	0.823	0.848
218	87.2	56.7	0.6	0.0	1.0	0.827	0.852
219	87.4	56.7	0.621	0.0	1.0	0.83	0.855
220	87.8	56.7	0.643	0.0	1.0	0.833	0.859
221	88.2	56.7	0.665	0.0	1.0	0.836	0.863
222	88.6	56.7	0.687	0.0	1.0	0.839	0.867
223	89.1	56.7	0.709	0.0	1.0	0.842	0.871
224	89.7	56.7	0.732	0.0	1.0	0.845	0.875
225	90.3	56.7	0.755	0.0	1.0	0.848	0.879
226	91.0	56.7	0.778	0.0	1.0	0.851	0.883
227	91.7	56.7	0.802	0.0	1.0	0.854	0.887
228	92.5	56.7	0.826	0.0	1.0	0.857	0.891
229	93.4	56.7	0.85	0.0	1.0	0.861	0.895
230	94.4	56.7	0.875	0.0	1.0	0.864	0.898
231	95.4	56.7	0.901	0.0	1.0	0.867	0.902
232	96.6	56.7	0.927	0.0	1.0	0.87	0.906
233	97.8	56.7	0.954	0.0	1.0	0.873	0.91
234	99.1	56.7	0.981	0.0	1.0	0.876	0.914
235	99.5	56.7	1.0	0.0	0.991	0.879	0.918
236	98.2	56.7	1.0	0.0	0.963	0.882	0.922
237	97.0	56.7	1.0	0.0	0.936	0.885	0.926
238	95.8	56.7	1.0	0.0	0.91	0.888	0.93
239	94.7	56.7	1.0	0.0	0.884	0.891	0.934
240	93.7	56.7	1.0	0.0	0.859	0.895	0.938
241	92.8	56.7	1.0	0.0	0.834	0.898	0.941
242	92.0	56.7	1.0	0.0	0.81	0.901	0.945
243	91.2	56.7	1.0	0.0	0.786	0.904	0.949
244	90.5	56.7	1.0	0.0	0.763	0.907	0.953
245	89.9	56.7	1.0	0.0	0.74	0.91	0.957
246	89.3	56.7	1.0	0.0	0.717	0.913	0.961
247	88.8	56.7	1.0	0.0	0.694	0.916	0.965
248	88.3	56.7	1.0	0.0	0.672	0.919	0.969
249	87.9	56.7	1.0	0.0	0.65	0.922	0.973
250	87.5	56.7	1.0	0.0	0.628	0.925	0.977
251	87.3	56.7	1.0	0.0	0.607	0.929	0.98
252	87.0	56.7	1.0	0.0	0.585	0.932	0.984
253	86.8	56.7	1.0	0.0	0.564	0.935	0.988
254	86.7	56.7	1.0	0.0	0.543	0.938	0.992
255	86.6	56.7	1.0	0.0	0.521	0.941	0.996

ME280−7N6, Integer CIELAB hue h^*_8, *adapted* CIELAB data LAB^*_{Ma}, *relative* CIELAB data lab^*olv_{3Ma} of Ma-colours, elementary hue e^*, standard olv-hue, h^*_o of device SRS18

BAM-reference table no. ME28 for Ma colours input: *w* setgray*
Table h*8 − LAB*Ma, lab*olvMa, e*, h*o; System: SRS18 output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME28/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table C.3 shows a CIELAB integer hue h^*_8 indexed table to determine either the adapted CIELAB data $C^*_{ab,Ma}$ and L^*_{Ma}, or the *relative* CIELAB data lab^*olv_{3Ma}, the elementary hue value e^*, and the olv-hue h^*_o for the device system SRS18. The device SRS18 is a theoretical (standard) device system with $L^*_{Ma} = 56.7$ and $C^*_{ab,Ma} = 100$ for all six basic colours CMYOLV which are located at the regular hue angles 30, 90, 150, 210, 270, and 330 degrees in the sequence OYLCVM. A plot of the CIELAB data in the diagram ($C^*_{ab,Ma}$, H^*_{Ma}) forms a regular hexagon.

Table C.4: CIELAB, elementary, and olv-hue, for example h^*_8, H^*, and h^* for the system SRS18

BAM registration: 20040901-ME29/10L/L29E05NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME29/ Form: 6/6, Serie: 1/1, Page: 6 Page: count: 6

www.ps.bam.de/ME29/10L/L29E05NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

h^*_8	H^*	h^*	e^*_8	E^*	e^*	h^*_{o8}	H^*_o	h^*_o
0	0	0.0	242	340	0.944	0	0	0.0
1	1	0.004	242	341	0.947	1	1	0.004
2	3	0.008	243	342	0.95	2	3	0.008
3	4	0.012	244	343	0.953	3	4	0.012
4	6	0.016	245	344	0.956	4	6	0.016
5	7	0.02	246	345	0.959	5	7	0.02
6	8	0.023	246	347	0.963	6	8	0.023
7	10	0.027	247	348	0.966	7	10	0.027
8	11	0.031	248	349	0.969	8	11	0.031
9	13	0.035	249	350	0.972	9	13	0.035
10	14	0.039	250	351	0.975	10	14	0.039
11	15	0.043	250	352	0.978	11	15	0.043
12	17	0.047	251	353	0.981	12	17	0.047
13	18	0.051	252	354	0.984	13	18	0.051
14	20	0.055	253	355	0.987	14	20	0.055
15	21	0.059	254	357	0.99	15	21	0.059
16	23	0.063	254	358	0.993	16	22	0.062
17	24	0.066	255	359	0.997	17	24	0.066
18	25	0.07	256	360	1.0	18	25	0.07
19	27	0.074	1	2	0.005	19	27	0.074
20	28	0.078	3	4	0.01	20	28	0.078
21	30	0.082	4	5	0.015	21	30	0.083
22	31	0.086	5	7	0.02	22	31	0.086
23	32	0.09	7	9	0.026	23	32	0.09
24	34	0.094	8	11	0.031	24	34	0.094
25	35	0.098	9	13	0.036	25	35	0.098
26	37	0.102	11	15	0.041	26	37	0.102
27	38	0.105	12	17	0.047	27	38	0.105
28	39	0.109	13	19	0.052	28	39	0.109
29	41	0.113	15	21	0.057	29	41	0.113
30	42	0.117	16	23	0.063	30	42	0.117
31	44	0.121	17	24	0.068	31	44	0.121
32	45	0.125	19	26	0.073	32	45	0.125
33	46	0.129	20	28	0.078	33	46	0.129
34	48	0.133	21	30	0.084	34	48	0.133
35	49	0.137	23	32	0.089	35	49	0.137
36	51	0.141	24	34	0.094	36	51	0.141
37	52	0.145	25	36	0.099	37	52	0.145
38	53	0.148	27	38	0.105	38	53	0.148
39	55	0.152	28	40	0.11	39	55	0.152
40	56	0.156	29	41	0.115	40	56	0.156
41	58	0.16	31	43	0.12	41	58	0.16
42	59	0.164	32	45	0.126	42	59	0.164
43	60	0.168	34	47	0.131	43	60	0.168
44	62	0.172	35	49	0.136	44	62	0.172
45	63	0.176	36	51	0.141	45	63	0.176
46	65	0.18	38	53	0.147	46	65	0.18
47	66	0.184	39	55	0.152	47	66	0.184
48	68	0.188	40	57	0.157	48	67	0.187
49	69	0.191	42	58	0.162	49	69	0.191
50	70	0.195	43	60	0.168	50	70	0.195
51	72	0.199	44	62	0.173	51	72	0.199
52	73	0.203	46	64	0.178	52	73	0.203
53	75	0.207	47	66	0.183	53	75	0.207
54	76	0.211	48	68	0.189	54	76	0.211
55	77	0.215	50	70	0.194	55	77	0.215
56	79	0.219	51	72	0.199	56	79	0.219
57	80	0.223	52	74	0.205	57	80	0.223
58	82	0.227	54	76	0.21	58	82	0.227
59	83	0.23	55	77	0.215	59	83	0.23
60	84	0.234	56	79	0.22	60	84	0.234
61	86	0.238	58	81	0.226	61	86	0.238
62	87	0.242	59	83	0.231	62	87	0.242
63	89	0.246	60	85	0.236	63	89	0.246

h^*_8	H^*	h^*	e^*_8	E^*	e^*	h^*_{o8}	H^*_o	h^*_o
64	90	0.25	62	87	0.241	64	90	0.25
65	91	0.254	63	89	0.247	65	91	0.254
66	93	0.258	64	91	0.252	66	93	0.258
67	94	0.262	66	92	0.257	67	94	0.262
68	96	0.266	67	94	0.262	68	96	0.266
69	97	0.27	68	96	0.267	69	97	0.27
70	98	0.273	70	98	0.272	70	98	0.273
71	100	0.277	71	100	0.277	71	100	0.277
72	101	0.281	72	102	0.282	72	101	0.281
73	103	0.285	73	103	0.287	73	103	0.285
74	104	0.289	75	105	0.292	74	104	0.289
75	105	0.293	76	107	0.297	75	105	0.293
76	107	0.297	77	109	0.302	76	107	0.297
77	108	0.301	79	111	0.307	77	108	0.301
78	110	0.305	80	112	0.312	78	110	0.305
79	111	0.309	81	114	0.317	79	111	0.309
80	113	0.313	82	116	0.322	80	113	0.313
81	114	0.316	84	118	0.327	81	114	0.316
82	115	0.32	85	120	0.332	82	115	0.32
83	117	0.324	86	121	0.337	83	117	0.324
84	118	0.328	88	123	0.342	84	118	0.328
85	120	0.332	89	125	0.347	85	120	0.332
86	121	0.336	90	127	0.352	86	121	0.336
87	122	0.34	91	129	0.357	87	122	0.34
88	124	0.344	93	130	0.362	88	124	0.344
89	125	0.348	94	132	0.367	89	125	0.348
90	127	0.352	95	134	0.372	90	127	0.352
91	128	0.355	97	136	0.378	91	128	0.355
92	129	0.359	98	138	0.383	92	129	0.359
93	131	0.363	99	140	0.388	93	131	0.363
94	132	0.367	101	141	0.393	94	132	0.367
95	134	0.371	102	143	0.398	95	134	0.371
96	135	0.375	103	145	0.403	96	135	0.375
97	136	0.379	104	147	0.408	97	136	0.379
98	138	0.383	106	149	0.413	98	138	0.383
99	139	0.387	107	150	0.418	99	139	0.387
100	141	0.391	108	152	0.423	100	141	0.391
101	142	0.395	110	154	0.428	101	142	0.395
102	143	0.398	111	156	0.433	102	143	0.398
103	145	0.402	112	158	0.438	103	145	0.402
104	146	0.406	113	159	0.443	104	146	0.406
105	148	0.41	115	161	0.448	105	148	0.41
106	149	0.414	116	163	0.453	106	149	0.414
107	150	0.418	117	165	0.458	107	150	0.418
108	152	0.422	119	167	0.463	108	152	0.422
109	153	0.426	120	168	0.468	109	153	0.426
110	155	0.43	121	170	0.473	110	155	0.43
111	156	0.434	122	172	0.478	111	156	0.434
112	158	0.438	124	174	0.483	112	158	0.438
113	159	0.441	125	176	0.488	113	159	0.441
114	160	0.445	126	178	0.493	114	160	0.445
115	162	0.449	128	179	0.498	115	162	0.449
116	163	0.453	129	181	0.502	116	163	0.453
117	165	0.457	129	182	0.505	117	165	0.457
118	166	0.461	130	183	0.508	118	166	0.461
119	167	0.465	131	184	0.512	119	167	0.465
120	169	0.469	132	185	0.515	120	169	0.469
121	170	0.473	133	187	0.518	121	170	0.473
122	172	0.477	133	188	0.521	122	172	0.477
123	173	0.48	134	189	0.525	123	173	0.48
124	174	0.484	135	190	0.528	124	174	0.484
125	176	0.488	136	191	0.531	125	176	0.488
126	177	0.492	137	192	0.534	126	177	0.492
127	179	0.496	138	193	0.537	127	179	0.496

h^*_8	H^*	h^*	e^*_8	E^*	e^*	h^*_{o8}	H^*_o	h^*_o
128	180	0.5	138	195	0.541	128	180	0.5
129	181	0.504	139	196	0.544	129	181	0.504
130	183	0.508	140	197	0.547	130	183	0.508
131	184	0.512	141	198	0.55	131	184	0.512
132	186	0.516	142	199	0.553	132	186	0.516
133	187	0.52	142	200	0.557	133	187	0.52
134	188	0.523	143	202	0.56	134	188	0.523
135	190	0.527	144	203	0.563	135	190	0.527
136	191	0.531	145	204	0.566	136	191	0.531
137	193	0.535	146	205	0.569	137	193	0.535
138	194	0.539	147	206	0.573	138	194	0.539
139	195	0.543	147	207	0.576	139	195	0.543
140	197	0.547	148	208	0.579	140	197	0.547
141	198	0.551	149	210	0.582	141	198	0.551
142	200	0.555	150	211	0.586	142	200	0.555
143	201	0.559	151	212	0.589	143	201	0.559
144	203	0.563	152	213	0.592	144	202	0.562
145	204	0.566	152	214	0.595	145	204	0.566
146	205	0.57	153	215	0.598	146	205	0.57
147	207	0.574	154	217	0.602	147	207	0.574
148	208	0.578	155	218	0.605	148	208	0.578
149	210	0.582	156	219	0.608	149	210	0.582
150	211	0.586	156	220	0.611	150	211	0.586
151	212	0.59	157	221	0.614	151	212	0.59
152	214	0.594	158	222	0.618	152	214	0.594
153	215	0.598	159	224	0.621	153	215	0.598
154	217	0.602	160	225	0.624	154	217	0.602
155	218	0.605	161	226	0.627	155	218	0.605
156	219	0.609	161	227	0.63	156	219	0.609
157	221	0.613	162	228	0.634	157	221	0.613
158	222	0.617	163	229	0.637	158	222	0.617
159	224	0.621	164	230	0.64	159	224	0.621
160	225	0.625	165	232	0.643	160	225	0.625
161	226	0.629	166	233	0.647	161	226	0.629
162	228	0.633	166	234	0.65	162	228	0.633
163	229	0.637	167	235	0.653	163	229	0.637
164	231	0.641	168	236	0.656	164	231	0.641
165	232	0.645	169	237	0.659	165	232	0.645
166	233	0.648	170	239	0.663	166	233	0.648
167	235	0.652	170	240	0.666	167	235	0.652
168	236	0.656	171	241	0.669	168	236	0.656
169	238	0.66	172	242	0.672	169	238	0.66
170	239	0.664	173	243	0.675	170	239	0.664
171	240	0.668	174	244	0.679	171	240	0.668
172	242	0.672	175	245	0.682	172	242	0.672
173	243	0.676	175	247	0.685	173	243	0.676
174	245	0.68	176	248	0.688	174	245	0.68
175	246	0.684	177	249	0.691	175	246	0.684
176	248	0.688	178	250	0.695	176	247	0.687
177	249	0.691	179	251	0.698	177	249	0.691
178	250	0.695	179	252	0.701	178	250	0.695
179	252	0.699	180	254	0.704	179	252	0.699
180	253	0.703	181	255	0.708	180	253	0.703
181	255	0.707	182	256	0.711	181	255	0.707
182	256	0.711	183	257	0.714	182	256	0.711
183	257	0.715	184	258	0.717	183	257	0.715
184	259	0.719	184	259	0.72	184	259	0.719
185	260	0.723	185	260	0.724	185	260	0.723
186	262	0.727	186	262	0.727	186	262	0.727
187	263	0.73	187	263	0.73	187	263	0.73
188	264	0.734	188	264	0.733	188	264	0.734
189	266	0.738	189	265	0.736	189	266	0.738
190	267	0.742	189	266	0.74	190	267	0.742
191	269	0.746	190	267	0.743	191	269	0.746

h^*_8	H^*	h^*	e^*_8	E^*	e^*	h^*_{o8}	H^*_o	h^*_o
192	270	0.75	191	269	0.746	192	270	0.75
193	271	0.754	192	270	0.749	193	271	0.754
194	273	0.758	193	271	0.752	194	273	0.758
195	274	0.762	193	272	0.755	195	274	0.762
196	276	0.766	194	273	0.759	196	276	0.766
197	277	0.77	195	274	0.762	197	277	0.77
198	278	0.773	196	275	0.765	198	278	0.773
199	280	0.777	197	276	0.768	199	280	0.777
200	281	0.781	197	278	0.771	200	281	0.781
201	283	0.785	198	279	0.774	201	283	0.785
202	284	0.789	199	280	0.777	202	284	0.789
203	285	0.793	200	281	0.78	203	285	0.793
204	287	0.797	201	282	0.783	204	287	0.797
205	288	0.801	201	283	0.786	205	288	0.801
206	290	0.805	202	284	0.789	206	290	0.805
207	291	0.809	203	285	0.793	207	291	0.809
208	293	0.813	204	286	0.796	208	293	0.813
209	294	0.816	204	288	0.799	209	294	0.816
210	295	0.82	205	289	0.802	210	295	0.82
211	297	0.824	206	290	0.805	211	297	0.824
212	298	0.828	207	291	0.808	212	298	0.828
213	300	0.832	208	292	0.811	213	300	0.832
214	301	0.836	208	293	0.814	214	301	0.836
215	302	0.84	209	294	0.817	215	302	0.84
216	304	0.844	210	295	0.82	216	304	0.844
217	305	0.848	211	296	0.823	217	305	0.848
218	307	0.852	212	298	0.827	218	307	0.852
219	308	0.855	212	299	0.83	219	308	0.855
220	309	0.859	213	300	0.833	220	309	0.859
221	311	0.863	214	301	0.836	221	311	0.863
222	312	0.867	215	302	0.839	222	312	0.867
223	314	0.871	216	303	0.842	223	314	0.871
224	315	0.875	216	304	0.845	224	315	0.875
225	316	0.879	217	305	0.848	225	316	0.879
226	318	0.883	218	306	0.851	226	318	0.883
227	319	0.887	219	308	0.854	227	319	0.887
228	321	0.891	220	309	0.857	228	321	0.891
229	322	0.895	220	310	0.861	229	322	0.895
230	323	0.898	221	311	0.864	230	323	0.898
231	325	0.902	222	312	0.867	231	325	0.902
232	326	0.906	223	313	0.87	232	326	0.906
233	328	0.91	223	314	0.873	233	328	0.91
234	329	0.914	224	315	0.876	234	329	0.914
235	330	0.918	225	316	0.879	235	330	0.918
236	332	0.922	226	318	0.882	236	332	0.922
237	333	0.926	227	319	0.885	237	333	0.926
238	335	0.93	227	320	0.888	238	335	0.93
239	336	0.934	228	321	0.891	239	336	0.934
240	338	0.938	229	322	0.895	240	338	0.938
241	339	0.941	230	323	0.898	241	339	0.941
242	340	0.945	231	324	0.901	242	340	0.945
243	342	0.949	231	325	0.904	243	342	0.949
244	343	0.953	232	326	0.907	244	343	0.953
245	345	0.957	233	328	0.91	245	345	0.957
246	346	0.961	234	329	0.913	246	346	0.961
247	347	0.965	235	330	0.916	247	347	0.965
248	349	0.969	235	331	0.919	248	349	0.969
249	350	0.973	236	332	0.922	249	350	0.973
250	352	0.977	237	333	0.925	250	352	0.977
251	353	0.98	238	334	0.929	251	353	0.98
252	354	0.984	238	335	0.932	252	354	0.984
253	356	0.988	239	337	0.935	253	356	0.988
254	357	0.992	240	338	0.938	254	357	0.992
255	359	0.996	241	339	0.941	255	359	0.996

ME470−446, CIELAB hue: integer h^*_8, angle H^*, and value h^*; elementary hue: integer e^*_8, angle E^*, and value e^*; standard olv-hue: integer h^*_{o8}, angle H^*_o, and value h^*_o of device SRS18

BAM-reference table no. ME29 for Ma colours   input: *w* setgray*
h*8 − H*a, h*, e*8, E*, e*, h*o8, H*o, h*o; System: SRS18   output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME29/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table C.4 shows the CIELAB, the elementary, and the olv-hue for the device SRS18. The CIELAB hue is shown as integer hue h^*_8 in the range [0, 255], as hue angle H^* in the range [0, 360], and as hue value in the range [0, 1]. The elementary hue and olv-hue is shown in the same three ranges. The CIELAB and the elementary hues are different, but the CIELAB and the olv-hue is equal. For the six device systems the tables are at the URL (6 pages, 220 kbyte) http://www.ps.bam.de/ME29/10L/L29E00NP.PDF

Table C.5: Integer CIELAB hue h^*_8, LAB^*_{Ma} and lab^*olv_{3Ma}, e^*, h^*_o for the system TLS00

www.ps.bam.de/ME28/10L/L28E01NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

BAM registration: 20040901-ME28/10L/L28E01NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME28/ Form: 2/6, Serie: 1/1, Page: 2 Page: count: 2

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
0	86.1	54.1	1.0	0.0	0.525	0.944	0.995
1	85.8	54.0	1.0	0.0	0.508	0.947	0.999
2	85.6	53.8	1.0	0.0	0.491	0.95	0.002
3	85.4	53.7	1.0	0.0	0.474	0.953	0.005
4	85.3	53.6	1.0	0.0	0.457	0.956	0.008
5	85.2	53.5	1.0	0.0	0.44	0.959	0.011
6	85.2	53.4	1.0	0.0	0.423	0.963	0.014
7	85.3	53.3	1.0	0.0	0.406	0.966	0.017
8	85.3	53.1	1.0	0.0	0.39	0.969	0.02
9	85.5	53.0	1.0	0.0	0.373	0.972	0.023
10	85.7	52.9	1.0	0.0	0.356	0.975	0.026
11	85.9	52.8	1.0	0.0	0.339	0.978	0.029
12	86.2	52.7	1.0	0.0	0.321	0.981	0.032
13	86.6	52.6	1.0	0.0	0.304	0.984	0.035
14	87.0	52.4	1.0	0.0	0.287	0.987	0.038
15	87.5	52.3	1.0	0.0	0.269	0.99	0.041
16	88.0	52.2	1.0	0.0	0.251	0.993	0.045
17	88.6	52.1	1.0	0.0	0.233	0.997	0.048
18	89.2	52.0	1.0	0.0	0.215	1.0	0.051
19	89.9	51.8	1.0	0.0	0.196	0.005	0.054
20	90.7	51.7	1.0	0.0	0.177	0.01	0.057
21	91.6	51.6	1.0	0.0	0.158	0.015	0.06
22	92.5	51.4	1.0	0.0	0.138	0.02	0.063
23	93.5	51.3	1.0	0.0	0.118	0.026	0.066
24	94.6	51.2	1.0	0.0	0.098	0.031	0.069
25	95.7	51.0	1.0	0.0	0.077	0.036	0.072
26	97.0	50.9	1.0	0.0	0.055	0.041	0.076
27	98.3	50.7	1.0	0.0	0.033	0.047	0.079
28	101.2	49.9	1.0	0.0	0.0	0.052	0.083
29	99.5	51.2	1.0	0.016	0.0	0.057	0.086
30	97.9	52.4	1.0	0.045	0.0	0.063	0.09
31	96.4	53.6	1.0	0.073	0.0	0.068	0.094
32	95.0	54.7	1.0	0.1	0.0	0.073	0.098
33	93.7	55.8	1.0	0.126	0.0	0.078	0.102
34	92.5	56.9	1.0	0.152	0.0	0.084	0.106
35	91.4	57.9	1.0	0.177	0.0	0.089	0.11
36	90.3	59.0	1.0	0.201	0.0	0.094	0.114
37	89.4	60.0	1.0	0.225	0.0	0.099	0.118
38	88.5	61.0	1.0	0.248	0.0	0.105	0.122
39	87.6	61.9	1.0	0.271	0.0	0.11	0.126
40	86.9	62.9	1.0	0.293	0.0	0.115	0.129
41	86.2	63.8	1.0	0.316	0.0	0.12	0.133
42	85.6	64.7	1.0	0.337	0.0	0.126	0.137
43	85.0	65.6	1.0	0.359	0.0	0.131	0.141
44	84.5	66.5	1.0	0.38	0.0	0.136	0.145
45	84.0	67.4	1.0	0.401	0.0	0.141	0.149
46	83.6	68.3	1.0	0.422	0.0	0.147	0.152
47	83.3	69.1	1.0	0.442	0.0	0.152	0.156
48	83.0	70.0	1.0	0.463	0.0	0.157	0.16
49	82.7	70.9	1.0	0.483	0.0	0.162	0.164
50	82.6	71.7	1.0	0.503	0.0	0.168	0.167
51	82.4	72.6	1.0	0.523	0.0	0.173	0.171
52	82.3	73.4	1.0	0.543	0.0	0.178	0.175
53	82.3	74.2	1.0	0.563	0.0	0.183	0.178
54	82.3	75.1	1.0	0.583	0.0	0.189	0.182
55	82.4	75.9	1.0	0.603	0.0	0.194	0.186
56	82.5	76.8	1.0	0.623	0.0	0.199	0.189
57	82.6	77.6	1.0	0.643	0.0	0.205	0.193
58	82.8	78.5	1.0	0.663	0.0	0.21	0.196
59	83.1	79.3	1.0	0.684	0.0	0.215	0.2
60	83.4	80.2	1.0	0.704	0.0	0.22	0.204
61	83.8	81.1	1.0	0.725	0.0	0.226	0.207
62	84.2	81.9	1.0	0.746	0.0	0.231	0.211
63	84.7	82.8	1.0	0.767	0.0	0.236	0.214
64	85.2	83.7	1.0	0.788	0.0	0.241	0.218
65	85.8	84.6	1.0	0.81	0.0	0.247	0.221
66	86.4	85.6	1.0	0.831	0.0	0.252	0.225
67	87.2	86.5	1.0	0.854	0.0	0.257	0.228
68	87.9	87.4	1.0	0.876	0.0	0.262	0.232
69	88.8	88.4	1.0	0.899	0.0	0.267	0.235
70	89.7	89.4	1.0	0.923	0.0	0.272	0.239
71	90.7	90.4	1.0	0.947	0.0	0.277	0.242
72	91.8	91.5	1.0	0.971	0.0	0.282	0.246
73	93.1	92.7	1.0	1.0	0.0	0.287	0.25
74	93.2	92.4	0.969	1.0	0.0	0.292	0.254
75	93.4	92.0	0.932	1.0	0.0	0.297	0.26
76	93.6	91.7	0.896	1.0	0.0	0.302	0.265
77	94.0	91.4	0.859	1.0	0.0	0.307	0.271
78	94.3	91.0	0.821	1.0	0.0	0.312	0.277
79	94.8	90.7	0.784	1.0	0.0	0.317	0.283
80	95.2	90.4	0.746	1.0	0.0	0.322	0.289
81	95.8	90.0	0.708	1.0	0.0	0.327	0.296
82	96.4	89.7	0.669	1.0	0.0	0.332	0.303
83	97.1	89.3	0.63	1.0	0.0	0.337	0.31
84	97.9	89.0	0.59	1.0	0.0	0.342	0.317
85	98.7	88.6	0.55	1.0	0.0	0.347	0.324
86	99.6	88.2	0.509	1.0	0.0	0.352	0.332
87	100.6	87.8	0.467	1.0	0.0	0.357	0.339
88	101.6	87.5	0.424	1.0	0.0	0.362	0.347
89	102.8	87.1	0.38	1.0	0.0	0.367	0.355
90	104.0	86.7	0.335	1.0	0.0	0.372	0.363
91	105.3	86.2	0.289	1.0	0.0	0.378	0.371
92	106.8	85.8	0.242	1.0	0.0	0.383	0.379
93	108.3	85.4	0.194	1.0	0.0	0.388	0.387
94	109.9	84.9	0.144	1.0	0.0	0.393	0.395
95	111.7	84.5	0.092	1.0	0.0	0.398	0.403
96	113.6	84.0	0.039	1.0	0.0	0.403	0.411
97	113.3	83.7	0.0	1.0	0.019	0.408	0.419
98	107.7	83.9	0.0	1.0	0.081	0.413	0.428
99	102.7	84.1	0.0	1.0	0.137	0.418	0.437
100	98.1	84.2	0.0	1.0	0.189	0.423	0.445
101	94.0	84.4	0.0	1.0	0.236	0.428	0.453
102	90.3	84.5	0.0	1.0	0.279	0.433	0.46
103	86.9	84.7	0.0	1.0	0.319	0.438	0.467
104	83.8	84.8	0.0	1.0	0.356	0.443	0.474
105	81.0	84.9	0.0	1.0	0.391	0.448	0.48
106	78.4	85.0	0.0	1.0	0.424	0.453	0.486
107	76.0	85.1	0.0	1.0	0.454	0.458	0.492
108	73.8	85.2	0.0	1.0	0.483	0.463	0.497
109	71.8	85.3	0.0	1.0	0.51	0.468	0.502
110	69.9	85.4	0.0	1.0	0.535	0.473	0.506
111	68.1	85.4	0.0	1.0	0.559	0.478	0.511
112	66.5	85.5	0.0	1.0	0.583	0.483	0.515
113	65.0	85.6	0.0	1.0	0.605	0.488	0.519
114	63.6	85.7	0.0	1.0	0.626	0.493	0.523
115	62.3	85.7	0.0	1.0	0.646	0.498	0.527
116	61.0	85.8	0.0	1.0	0.665	0.502	0.53
117	59.9	85.9	0.0	1.0	0.684	0.505	0.533
118	58.8	85.9	0.0	1.0	0.702	0.508	0.536
119	57.8	86.0	0.0	1.0	0.719	0.512	0.539
120	56.9	86.0	0.0	1.0	0.736	0.515	0.542
121	56.1	86.1	0.0	1.0	0.752	0.518	0.545
122	55.3	86.1	0.0	1.0	0.768	0.521	0.548
123	54.5	86.2	0.0	1.0	0.784	0.525	0.55
124	53.8	86.2	0.0	1.0	0.798	0.528	0.553
125	53.2	86.3	0.0	1.0	0.813	0.531	0.555
126	52.6	86.3	0.0	1.0	0.827	0.534	0.558
127	52.0	86.4	0.0	1.0	0.841	0.537	0.56
128	51.5	86.4	0.0	1.0	0.855	0.541	0.562
129	51.0	86.5	0.0	1.0	0.868	0.544	0.564
130	50.6	86.5	0.0	1.0	0.881	0.547	0.566
131	50.2	86.5	0.0	1.0	0.894	0.55	0.568
132	49.8	86.6	0.0	1.0	0.907	0.553	0.57
133	49.5	86.6	0.0	1.0	0.92	0.557	0.572
134	49.2	86.7	0.0	1.0	0.932	0.56	0.574
135	48.9	86.7	0.0	1.0	0.944	0.563	0.575
136	48.7	86.7	0.0	1.0	0.957	0.566	0.577
137	48.5	86.8	0.0	1.0	0.969	0.569	0.579
138	48.3	86.8	0.0	1.0	0.981	0.573	0.581
139	48.2	86.9	0.0	1.0	0.992	0.576	0.582
140	48.1	86.9	0.0	1.0	1.004	0.579	0.584
141	47.0	86.1	0.0	0.987	1.0	0.582	0.585
142	46.2	85.6	0.0	0.978	1.0	0.586	0.586
143	45.4	85.1	0.0	0.969	1.0	0.589	0.588
144	44.7	84.6	0.0	0.96	1.0	0.592	0.589
145	44.1	84.2	0.0	0.952	1.0	0.595	0.59
146	43.5	83.7	0.0	0.944	1.0	0.598	0.591
147	42.9	83.3	0.0	0.936	1.0	0.602	0.592
148	42.4	82.8	0.0	0.928	1.0	0.605	0.594
149	42.0	82.4	0.0	0.921	1.0	0.608	0.595
150	41.5	82.0	0.0	0.914	1.0	0.611	0.596
151	41.1	81.6	0.0	0.906	1.0	0.614	0.597
152	40.7	81.2	0.0	0.899	1.0	0.618	0.598
153	40.4	80.8	0.0	0.892	1.0	0.621	0.599
154	40.1	80.4	0.0	0.886	1.0	0.624	0.6
155	39.8	80.0	0.0	0.879	1.0	0.627	0.601
156	39.5	79.7	0.0	0.872	1.0	0.63	0.602
157	39.3	79.3	0.0	0.866	1.0	0.634	0.603
158	39.1	78.9	0.0	0.859	1.0	0.637	0.604
159	38.9	78.6	0.0	0.853	1.0	0.64	0.605
160	38.7	78.2	0.0	0.846	1.0	0.643	0.606
161	38.6	77.8	0.0	0.84	1.0	0.647	0.607
162	38.5	77.5	0.0	0.834	1.0	0.65	0.608
163	38.4	77.1	0.0	0.828	1.0	0.653	0.609
164	38.4	76.8	0.0	0.821	1.0	0.656	0.61
165	38.3	76.4	0.0	0.815	1.0	0.659	0.611
166	38.3	76.1	0.0	0.809	1.0	0.663	0.612
167	38.3	75.7	0.0	0.803	1.0	0.666	0.613
168	38.3	75.4	0.0	0.797	1.0	0.669	0.614
169	38.4	75.0	0.0	0.79	1.0	0.672	0.615
170	38.5	74.7	0.0	0.784	1.0	0.675	0.616
171	38.6	74.3	0.0	0.778	1.0	0.679	0.617
172	38.7	74.0	0.0	0.772	1.0	0.682	0.618
173	38.8	73.6	0.0	0.765	1.0	0.685	0.619
174	39.0	73.3	0.0	0.759	1.0	0.688	0.62
175	39.2	72.9	0.0	0.752	1.0	0.691	0.622
176	39.4	72.5	0.0	0.746	1.0	0.695	0.623
177	39.7	72.1	0.0	0.739	1.0	0.698	0.624
178	40.0	71.8	0.0	0.732	1.0	0.701	0.625
179	40.3	71.4	0.0	0.726	1.0	0.704	0.626
180	40.6	71.0	0.0	0.719	1.0	0.708	0.627
181	41.0	70.6	0.0	0.712	1.0	0.711	0.629
182	41.4	70.2	0.0	0.705	1.0	0.714	0.63
183	41.8	69.8	0.0	0.697	1.0	0.717	0.631
184	42.3	69.4	0.0	0.69	1.0	0.72	0.632
185	42.8	68.9	0.0	0.682	1.0	0.724	0.634
186	43.3	68.5	0.0	0.674	1.0	0.727	0.635
187	43.9	68.0	0.0	0.666	1.0	0.73	0.636
188	44.6	67.6	0.0	0.658	1.0	0.733	0.638
189	45.2	67.1	0.0	0.649	1.0	0.736	0.639
190	46.0	66.6	0.0	0.641	1.0	0.74	0.641
191	46.7	66.1	0.0	0.632	1.0	0.743	0.643
192	47.6	65.5	0.0	0.622	1.0	0.746	0.644
193	48.5	65.0	0.0	0.613	1.0	0.749	0.646
194	49.4	64.4	0.0	0.602	1.0	0.752	0.648
195	50.4	63.8	0.0	0.592	1.0	0.755	0.65
196	51.5	63.2	0.0	0.581	1.0	0.759	0.652
197	52.7	62.6	0.0	0.569	1.0	0.762	0.654
198	54.0	61.9	0.0	0.557	1.0	0.765	0.656
199	55.3	61.2	0.0	0.545	1.0	0.768	0.658
200	56.8	60.4	0.0	0.532	1.0	0.771	0.661
201	58.4	59.6	0.0	0.518	1.0	0.774	0.663
202	60.1	58.8	0.0	0.503	1.0	0.777	0.666
203	62.0	57.9	0.0	0.487	1.0	0.78	0.669
204	64.0	57.0	0.0	0.47	1.0	0.783	0.672
205	66.2	55.9	0.0	0.452	1.0	0.786	0.675
206	68.6	54.9	0.0	0.433	1.0	0.789	0.679
207	71.2	53.7	0.0	0.413	1.0	0.793	0.683
208	74.1	52.4	0.0	0.39	1.0	0.796	0.687
209	77.2	51.1	0.0	0.366	1.0	0.799	0.691
210	80.7	49.6	0.0	0.34	1.0	0.802	0.696
211	84.6	48.0	0.0	0.311	1.0	0.805	0.701
212	88.9	46.2	0.0	0.279	1.0	0.808	0.706
213	93.8	44.2	0.0	0.244	1.0	0.811	0.712
214	99.3	42.0	0.0	0.205	1.0	0.814	0.719
215	105.5	39.5	0.0	0.16	1.0	0.817	0.726
216	112.6	36.6	0.0	0.11	1.0	0.82	0.734
217	120.9	33.4	0.0	0.053	1.0	0.823	0.743
218	128.1	30.8	0.015	0.0	1.0	0.827	0.752
219	126.3	32.8	0.089	0.0	1.0	0.83	0.763
220	124.6	34.7	0.162	0.0	1.0	0.833	0.774
221	122.9	36.6	0.232	0.0	1.0	0.836	0.786
222	121.5	38.5	0.301	0.0	1.0	0.839	0.797
223	120.1	40.3	0.368	0.0	1.0	0.842	0.809
224	118.8	42.1	0.434	0.0	1.0	0.845	0.821
225	117.6	43.8	0.498	0.0	1.0	0.848	0.833
226	116.5	45.5	0.561	0.0	1.0	0.851	0.845
227	115.5	47.2	0.623	0.0	1.0	0.854	0.856
228	114.6	48.8	0.684	0.0	1.0	0.857	0.867
229	113.7	50.4	0.744	0.0	1.0	0.861	0.877
230	113.0	52.0	0.803	0.0	1.0	0.864	0.887
231	112.3	53.6	0.862	0.0	1.0	0.867	0.896
232	111.7	55.1	0.919	0.0	1.0	0.87	0.905
233	111.9	57.4	1.0	0.0	1.012	0.873	0.915
234	109.7	57.2	1.0	0.0	0.983	0.876	0.919
235	107.6	57.0	1.0	0.0	0.956	0.879	0.923
236	105.6	56.8	1.0	0.0	0.93	0.882	0.927
237	103.8	56.6	1.0	0.0	0.904	0.885	0.93
238	102.1	56.5	1.0	0.0	0.88	0.888	0.934
239	100.5	56.3	1.0	0.0	0.856	0.891	0.938
240	99.0	56.2	1.0	0.0	0.833	0.895	0.942
241	97.6	56.0	1.0	0.0	0.811	0.898	0.945
242	96.3	55.9	1.0	0.0	0.789	0.901	0.949
243	95.1	55.7	1.0	0.0	0.768	0.904	0.952
244	94.0	55.6	1.0	0.0	0.747	0.907	0.956
245	93.0	55.4	1.0	0.0	0.727	0.91	0.959
246	92.0	55.3	1.0	0.0	0.707	0.913	0.963
247	91.1	55.2	1.0	0.0	0.687	0.916	0.966
248	90.3	55.0	1.0	0.0	0.668	0.919	0.969
249	89.6	54.9	1.0	0.0	0.649	0.922	0.973
250	88.9	54.8	1.0	0.0	0.631	0.925	0.976
251	88.3	54.7	1.0	0.0	0.613	0.929	0.979
252	87.7	54.5	1.0	0.0	0.595	0.932	0.983
253	87.2	54.4	1.0	0.0	0.577	0.935	0.986
254	86.8	54.3	1.0	0.0	0.56	0.938	0.989
255	86.4	54.2	1.0	0.0	0.542	0.941	0.992

See for similar files: http://www.ps.bam.de/ME28/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

ME280−7N2, Integer CIELAB hue h^*_8, *adapted* CIELAB data LAB^*_{Ma}, *relative* CIELAB data lab^*olv_{3Ma} of Ma-colours, elementary hue e^*, standard olv-hue, h^*_o of device TLS00

BAM-reference table no. ME28 for Ma colours
Table h*8 − LAB*Ma, lab*olvMa, e*, h*o; System: TLS00

input: *w* setgray*
output: *no change compared to input*

Table C.5 shows a CIELAB integer hue h^*_8 indexed table to determine either the adapted CIELAB data $C^*_{ab,Ma}$ and L^*_{Ma}, or the *relative* CIELAB data lab^*olv_{3Ma}, or the elementary hue e^*, or the olv-hue h^*_o for the standard device system TLS00.

Table C.6: Integer CIELAB hue h^*_8, LAB^*_{Ma} and lab^*olv_{3Ma}, e^*, h^*_o for the system TLS18

BAM registration: 20040901-ME28/10L/L28E03NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME28/ Form: 4/6, Serie: 1/1, Page: 4 Page: count: 4

www.ps.bam.de/ME28/10L/L28E03NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

h^*_8	$C^*_{ab,Ma}$	L^*_{Ma}	o^*_{3Ma}	l^*_{3Ma}	v^*_{3Ma}	e^*	h^*_o
0	84.5	57.2	1.0	0.0	0.72	0.944	0.96
1	84.0	57.0	1.0	0.0	0.691	0.947	0.965
2	83.6	56.8	1.0	0.0	0.662	0.95	0.971
3	83.2	56.7	1.0	0.0	0.633	0.953	0.976
4	82.9	56.5	1.0	0.0	0.604	0.956	0.981
5	82.6	56.3	1.0	0.0	0.575	0.959	0.986
6	82.4	56.1	1.0	0.0	0.547	0.963	0.991
7	82.2	55.9	1.0	0.0	0.519	0.966	0.997
8	82.0	55.8	1.0	0.0	0.491	0.969	0.002
9	82.0	55.6	1.0	0.0	0.463	0.972	0.007
10	81.9	55.4	1.0	0.0	0.435	0.975	0.012
11	82.0	55.2	1.0	0.0	0.407	0.978	0.017
12	82.0	55.1	1.0	0.0	0.379	0.981	0.022
13	82.1	54.9	1.0	0.0	0.351	0.984	0.027
14	82.3	54.7	1.0	0.0	0.322	0.987	0.032
15	82.5	54.5	1.0	0.0	0.294	0.99	0.037
16	82.8	54.4	1.0	0.0	0.266	0.993	0.042
17	83.1	54.2	1.0	0.0	0.237	0.997	0.047
18	83.5	54.0	1.0	0.0	0.208	1.0	0.052
19	83.9	53.8	1.0	0.0	0.179	0.005	0.057
20	84.4	53.6	1.0	0.0	0.149	0.01	0.061
21	84.9	53.4	1.0	0.0	0.119	0.015	0.066
22	85.5	53.3	1.0	0.0	0.089	0.02	0.071
23	86.2	53.1	1.0	0.0	0.058	0.026	0.075
24	86.9	52.9	1.0	0.0	0.027	0.031	0.08
25	87.4	52.9	1.0	0.004	0.0	0.036	0.084
26	86.0	53.9	1.0	0.03	0.0	0.041	0.087
27	84.7	54.9	1.0	0.055	0.0	0.047	0.091
28	83.5	55.9	1.0	0.079	0.0	0.052	0.095
29	82.3	56.8	1.0	0.103	0.0	0.057	0.098
30	81.3	57.7	1.0	0.126	0.0	0.063	0.102
31	80.3	58.6	1.0	0.148	0.0	0.068	0.105
32	79.4	59.5	1.0	0.17	0.0	0.073	0.109
33	78.5	60.4	1.0	0.192	0.0	0.078	0.112
34	77.8	61.2	1.0	0.213	0.0	0.084	0.116
35	77.1	62.1	1.0	0.234	0.0	0.089	0.119
36	76.4	62.9	1.0	0.254	0.0	0.094	0.123
37	75.8	63.7	1.0	0.274	0.0	0.099	0.126
38	75.2	64.5	1.0	0.294	0.0	0.105	0.129
39	74.8	65.2	1.0	0.313	0.0	0.11	0.133
40	74.3	66.0	1.0	0.332	0.0	0.115	0.136
41	73.9	66.8	1.0	0.351	0.0	0.12	0.14
42	73.6	67.5	1.0	0.37	0.0	0.126	0.143
43	73.3	68.3	1.0	0.388	0.0	0.131	0.146
44	73.0	69.0	1.0	0.407	0.0	0.136	0.15
45	72.8	69.7	1.0	0.425	0.0	0.141	0.153
46	72.7	70.5	1.0	0.443	0.0	0.147	0.156
47	72.5	71.2	1.0	0.462	0.0	0.152	0.16
48	72.5	71.9	1.0	0.48	0.0	0.157	0.163
49	72.4	72.6	1.0	0.498	0.0	0.162	0.166
50	72.4	73.4	1.0	0.516	0.0	0.168	0.17
51	72.5	74.1	1.0	0.534	0.0	0.173	0.173
52	72.6	74.8	1.0	0.552	0.0	0.178	0.176
53	72.8	75.5	1.0	0.57	0.0	0.183	0.18
54	72.9	76.3	1.0	0.589	0.0	0.189	0.183
55	73.2	77.0	1.0	0.607	0.0	0.194	0.186
56	73.5	77.8	1.0	0.626	0.0	0.199	0.19
57	73.8	78.5	1.0	0.644	0.0	0.205	0.193
58	74.2	79.3	1.0	0.663	0.0	0.21	0.196
59	74.6	80.0	1.0	0.682	0.0	0.215	0.2
60	75.1	80.8	1.0	0.702	0.0	0.22	0.203
61	75.6	81.6	1.0	0.721	0.0	0.226	0.206
62	76.2	82.4	1.0	0.741	0.0	0.231	0.21
63	76.8	83.2	1.0	0.761	0.0	0.236	0.213
64	77.5	84.0	1.0	0.782	0.0	0.241	0.217
65	78.3	84.8	1.0	0.803	0.0	0.247	0.22
66	79.1	85.7	1.0	0.824	0.0	0.252	0.224
67	80.0	86.6	1.0	0.846	0.0	0.257	0.227
68	80.9	87.5	1.0	0.868	0.0	0.262	0.231
69	81.9	88.4	1.0	0.891	0.0	0.267	0.234
70	83.0	89.3	1.0	0.914	0.0	0.272	0.238
71	84.2	90.3	1.0	0.938	0.0	0.277	0.241
72	85.5	91.3	1.0	0.963	0.0	0.282	0.245
73	87.4	92.9	1.0	1.0	0.0	0.287	0.25
74	87.5	92.6	0.979	1.0	0.0	0.292	0.253
75	87.7	92.2	0.943	1.0	0.0	0.297	0.258
76	87.9	91.9	0.907	1.0	0.0	0.302	0.263
77	88.2	91.6	0.871	1.0	0.0	0.307	0.269
78	88.5	91.3	0.835	1.0	0.0	0.312	0.275
79	88.9	91.0	0.798	1.0	0.0	0.317	0.281
80	89.3	90.6	0.761	1.0	0.0	0.322	0.287
81	89.8	90.3	0.723	1.0	0.0	0.327	0.293
82	90.3	90.0	0.685	1.0	0.0	0.332	0.3
83	91.0	89.7	0.647	1.0	0.0	0.337	0.307
84	91.6	89.3	0.608	1.0	0.0	0.342	0.314
85	92.4	89.0	0.568	1.0	0.0	0.347	0.321
86	93.2	88.6	0.528	1.0	0.0	0.352	0.328
87	94.1	88.3	0.487	1.0	0.0	0.357	0.336
88	95.0	87.9	0.445	1.0	0.0	0.362	0.343
89	96.1	87.5	0.403	1.0	0.0	0.367	0.351
90	97.2	87.1	0.359	1.0	0.0	0.372	0.359
91	98.4	86.7	0.314	1.0	0.0	0.378	0.367
92	99.7	86.3	0.268	1.0	0.0	0.383	0.375
93	101.1	85.9	0.221	1.0	0.0	0.388	0.383
94	102.6	85.5	0.173	1.0	0.0	0.393	0.391
95	104.2	85.1	0.123	1.0	0.0	0.398	0.399
96	105.9	84.6	0.071	1.0	0.0	0.403	0.407
97	110.2	83.9	0.0	1.0	−0.02	0.408	0.414
98	104.7	84.1	0.0	1.0	0.044	0.413	0.423
99	99.7	84.3	0.0	1.0	0.103	0.418	0.432
100	95.3	84.5	0.0	1.0	0.157	0.423	0.44
101	91.3	84.6	0.0	1.0	0.206	0.428	0.448
102	87.6	84.8	0.0	1.0	0.251	0.433	0.455
103	84.3	84.9	0.0	1.0	0.293	0.438	0.463
104	81.3	85.0	0.0	1.0	0.332	0.443	0.469
105	78.5	85.1	0.0	1.0	0.368	0.448	0.476
106	76.0	85.3	0.0	1.0	0.402	0.453	0.482
107	73.6	85.4	0.0	1.0	0.433	0.458	0.488
108	71.5	85.4	0.0	1.0	0.463	0.463	0.493
109	69.5	85.5	0.0	1.0	0.491	0.468	0.498
110	67.6	85.6	0.0	1.0	0.518	0.473	0.503
111	65.9	85.7	0.0	1.0	0.543	0.478	0.508
112	64.3	85.8	0.0	1.0	0.567	0.483	0.512
113	62.9	85.8	0.0	1.0	0.59	0.488	0.516
114	61.5	85.9	0.0	1.0	0.612	0.493	0.52
115	60.2	86.0	0.0	1.0	0.633	0.498	0.524
116	59.0	86.0	0.0	1.0	0.653	0.502	0.528
117	57.9	86.1	0.0	1.0	0.672	0.505	0.531
118	56.9	86.2	0.0	1.0	0.691	0.508	0.535
119	55.9	86.2	0.0	1.0	0.709	0.512	0.538
120	55.0	86.3	0.0	1.0	0.726	0.515	0.541
121	54.1	86.3	0.0	1.0	0.743	0.518	0.544
122	53.4	86.4	0.0	1.0	0.76	0.521	0.546
123	52.6	86.4	0.0	1.0	0.776	0.525	0.549
124	51.9	86.5	0.0	1.0	0.791	0.528	0.552
125	51.3	86.5	0.0	1.0	0.806	0.531	0.554
126	50.7	86.6	0.0	1.0	0.821	0.534	0.556
127	50.2	86.6	0.0	1.0	0.835	0.537	0.559
128	49.7	86.7	0.0	1.0	0.849	0.541	0.561
129	49.2	86.7	0.0	1.0	0.863	0.544	0.563
130	48.8	86.7	0.0	1.0	0.877	0.547	0.565
131	48.4	86.8	0.0	1.0	0.89	0.55	0.567
132	48.0	86.8	0.0	1.0	0.903	0.553	0.569
133	47.7	86.9	0.0	1.0	0.916	0.557	0.571
134	47.4	86.9	0.0	1.0	0.929	0.56	0.573
135	47.2	86.9	0.0	1.0	0.942	0.563	0.575
136	46.9	87.0	0.0	1.0	0.954	0.566	0.577
137	46.7	87.0	0.0	1.0	0.967	0.569	0.579
138	46.6	87.1	0.0	1.0	0.979	0.573	0.58
139	46.4	87.1	0.0	1.0	0.991	0.576	0.582
140	46.3	87.1	0.0	1.0	1.004	0.579	0.584
141	44.4	85.3	0.0	0.967	1.0	0.582	0.588
142	43.1	84.0	0.0	0.944	1.0	0.586	0.591
143	41.8	82.8	0.0	0.921	1.0	0.589	0.595
144	40.7	81.6	0.0	0.901	1.0	0.592	0.598
145	39.6	80.5	0.0	0.881	1.0	0.595	0.601
146	38.6	79.5	0.0	0.862	1.0	0.598	0.604
147	37.7	78.5	0.0	0.844	1.0	0.602	0.607
148	36.8	77.5	0.0	0.827	1.0	0.605	0.609
149	36.0	76.6	0.0	0.81	1.0	0.608	0.612
150	35.3	75.8	0.0	0.795	1.0	0.611	0.614
151	34.6	74.9	0.0	0.78	1.0	0.614	0.617
152	34.0	74.1	0.0	0.765	1.0	0.618	0.619
153	33.4	73.4	0.0	0.751	1.0	0.621	0.622
154	32.8	72.6	0.0	0.738	1.0	0.624	0.624
155	32.3	71.9	0.0	0.725	1.0	0.627	0.626
156	31.8	71.2	0.0	0.712	1.0	0.63	0.628
157	31.3	70.5	0.0	0.7	1.0	0.634	0.631
158	30.9	69.9	0.0	0.688	1.0	0.637	0.633
159	30.5	69.2	0.0	0.676	1.0	0.64	0.635
160	30.1	68.6	0.0	0.665	1.0	0.643	0.637
161	29.8	68.0	0.0	0.654	1.0	0.647	0.639
162	29.5	67.4	0.0	0.643	1.0	0.65	0.641
163	29.2	66.8	0.0	0.633	1.0	0.653	0.642
164	28.9	66.2	0.0	0.622	1.0	0.656	0.644
165	28.7	65.6	0.0	0.612	1.0	0.659	0.646
166	28.5	65.1	0.0	0.602	1.0	0.663	0.648
167	28.2	64.5	0.0	0.592	1.0	0.666	0.65
168	28.1	64.0	0.0	0.582	1.0	0.669	0.652
169	27.9	63.5	0.0	0.573	1.0	0.672	0.653
170	27.7	62.9	0.0	0.563	1.0	0.675	0.655
171	27.6	62.4	0.0	0.554	1.0	0.679	0.657
172	27.5	61.9	0.0	0.544	1.0	0.682	0.659
173	27.4	61.4	0.0	0.535	1.0	0.685	0.66
174	27.3	60.9	0.0	0.526	1.0	0.688	0.662
175	27.3	60.4	0.0	0.517	1.0	0.691	0.664
176	27.2	59.9	0.0	0.507	1.0	0.695	0.665
177	27.2	59.3	0.0	0.498	1.0	0.698	0.667
178	27.2	58.8	0.0	0.489	1.0	0.701	0.669
179	27.2	58.3	0.0	0.48	1.0	0.704	0.67
180	27.2	57.8	0.0	0.471	1.0	0.708	0.672
181	27.3	57.3	0.0	0.462	1.0	0.711	0.674
182	27.3	56.8	0.0	0.453	1.0	0.714	0.675
183	27.4	56.3	0.0	0.443	1.0	0.717	0.677
184	27.5	55.8	0.0	0.434	1.0	0.72	0.679
185	27.6	55.3	0.0	0.425	1.0	0.724	0.68
186	27.7	54.8	0.0	0.415	1.0	0.727	0.682
187	27.8	54.2	0.0	0.406	1.0	0.73	0.684
188	28.0	53.7	0.0	0.396	1.0	0.733	0.686
189	28.2	53.2	0.0	0.387	1.0	0.736	0.687
190	28.4	52.6	0.0	0.377	1.0	0.74	0.689
191	28.6	52.1	0.0	0.367	1.0	0.743	0.691
192	28.8	51.5	0.0	0.357	1.0	0.746	0.693
193	29.1	50.9	0.0	0.346	1.0	0.749	0.695
194	29.4	50.3	0.0	0.336	1.0	0.752	0.696
195	29.7	49.8	0.0	0.325	1.0	0.755	0.698
196	30.0	49.1	0.0	0.314	1.0	0.759	0.7
197	30.4	48.5	0.0	0.303	1.0	0.762	0.702
198	30.8	47.9	0.0	0.291	1.0	0.765	0.704
199	31.2	47.2	0.0	0.28	1.0	0.768	0.706
200	31.6	46.6	0.0	0.267	1.0	0.771	0.708
201	32.1	45.9	0.0	0.255	1.0	0.774	0.711
202	32.6	45.2	0.0	0.242	1.0	0.777	0.713
203	33.2	44.4	0.0	0.229	1.0	0.78	0.715
204	33.7	43.7	0.0	0.215	1.0	0.783	0.717
205	34.4	42.9	0.0	0.201	1.0	0.786	0.72
206	35.1	42.0	0.0	0.186	1.0	0.789	0.722
207	35.8	41.2	0.0	0.17	1.0	0.793	0.725
208	36.6	40.3	0.0	0.154	1.0	0.796	0.727
209	37.4	39.4	0.0	0.137	1.0	0.799	0.73
210	38.3	38.4	0.0	0.12	1.0	0.802	0.733
211	39.3	37.4	0.0	0.101	1.0	0.805	0.735
212	40.3	36.3	0.0	0.082	1.0	0.808	0.738
213	41.4	35.1	0.0	0.061	1.0	0.811	0.741
214	42.6	33.9	0.0	0.039	1.0	0.814	0.744
215	44.0	32.7	0.0	0.016	1.0	0.817	0.748
216	45.0	31.9	0.006	0.0	1.0	0.82	0.751
217	45.4	32.4	0.023	0.0	1.0	0.823	0.753
218	45.8	32.9	0.041	0.0	1.0	0.827	0.756
219	46.3	33.4	0.059	0.0	1.0	0.83	0.758
220	46.8	33.9	0.077	0.0	1.0	0.833	0.761
221	47.3	34.4	0.096	0.0	1.0	0.836	0.764
222	47.8	34.9	0.115	0.0	1.0	0.839	0.767
223	48.5	35.4	0.135	0.0	1.0	0.842	0.77
224	49.1	36.0	0.155	0.0	1.0	0.845	0.773
225	49.8	36.5	0.176	0.0	1.0	0.848	0.776
226	50.6	37.1	0.198	0.0	1.0	0.851	0.78
227	51.4	37.7	0.22	0.0	1.0	0.854	0.784
228	52.3	38.4	0.243	0.0	1.0	0.857	0.787
229	53.2	39.0	0.267	0.0	1.0	0.861	0.791
230	54.2	39.7	0.291	0.0	1.0	0.864	0.796
231	55.3	40.4	0.317	0.0	1.0	0.867	0.8
232	56.4	41.1	0.343	0.0	1.0	0.87	0.805
233	57.6	41.8	0.371	0.0	1.0	0.873	0.81
234	59.0	42.6	0.4	0.0	1.0	0.876	0.815
235	60.4	43.5	0.43	0.0	1.0	0.879	0.821
236	61.9	44.3	0.462	0.0	1.0	0.882	0.826
237	63.6	45.2	0.496	0.0	1.0	0.885	0.833
238	65.4	46.2	0.531	0.0	1.0	0.888	0.839
239	67.3	47.2	0.569	0.0	1.0	0.891	0.846
240	69.4	48.3	0.608	0.0	1.0	0.895	0.853
241	71.6	49.5	0.651	0.0	1.0	0.898	0.861
242	74.1	50.7	0.696	0.0	1.0	0.901	0.869
243	76.8	52.0	0.744	0.0	1.0	0.904	0.877
244	79.7	53.4	0.797	0.0	1.0	0.907	0.886
245	83.0	55.0	0.853	0.0	1.0	0.91	0.895
246	86.5	56.6	0.914	0.0	1.0	0.913	0.904
247	91.9	59.0	1.0	0.0	1.009	0.916	0.915
248	90.8	58.8	1.0	0.0	0.975	0.919	0.92
249	89.8	58.6	1.0	0.0	0.941	0.922	0.925
250	88.8	58.4	1.0	0.0	0.908	0.925	0.93
251	87.9	58.2	1.0	0.0	0.875	0.929	0.935
252	87.1	58.0	1.0	0.0	0.843	0.932	0.94
253	86.4	57.8	1.0	0.0	0.812	0.935	0.945
254	85.7	57.6	1.0	0.0	0.781	0.938	0.95
255	85.1	57.4	1.0	0.0	0.75	0.941	0.955

ME280−7N4, Integer CIELAB hue h^*_8, *adapted* CIELAB data LAB^*_{Ma}, *relative* CIELAB data lab^*olv_{3Ma} of Ma-colours, elementary hue e^*, standard olv-hue, h^*_o of device TLS18

BAM-reference table no. ME28 for Ma colours input: *w* setgray*
Table h*8 − LAB*Ma, lab*olvMa, e*, h*o; System: TLS18 output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME28/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table C.6 shows a CIELAB integer hue h^*_8 indexed table to determine either the adapted CIELAB data $C^*_{ab,Ma}$ and L^*_{Ma}, or the *relative* CIELAB data lab^*olv_{3Ma}, or the elementary hue e^*, or the olv-hue h^*_o for the standard device system TLS18. For the six device systems the tables are at the URL (6 pages, 220 kbyte)

http://www.ps.bam.de/ME28/10L/L28E00NP.PDF

Annex D:
Equivalent colorimetric data for basic and 3x3x3 colours of OSR18

Annex D shows equivalent colorimetric data of the basic colours CMYOLV, for a 3x3x3, and a 5x5x5 olv-cube of the device system OSR18. The four basic hue colours OYLV are approximations of the elementary hue colours RJGB.

Table D.1: Equivalent colorimetric data of six basic and two intermediate colours of OSR18.

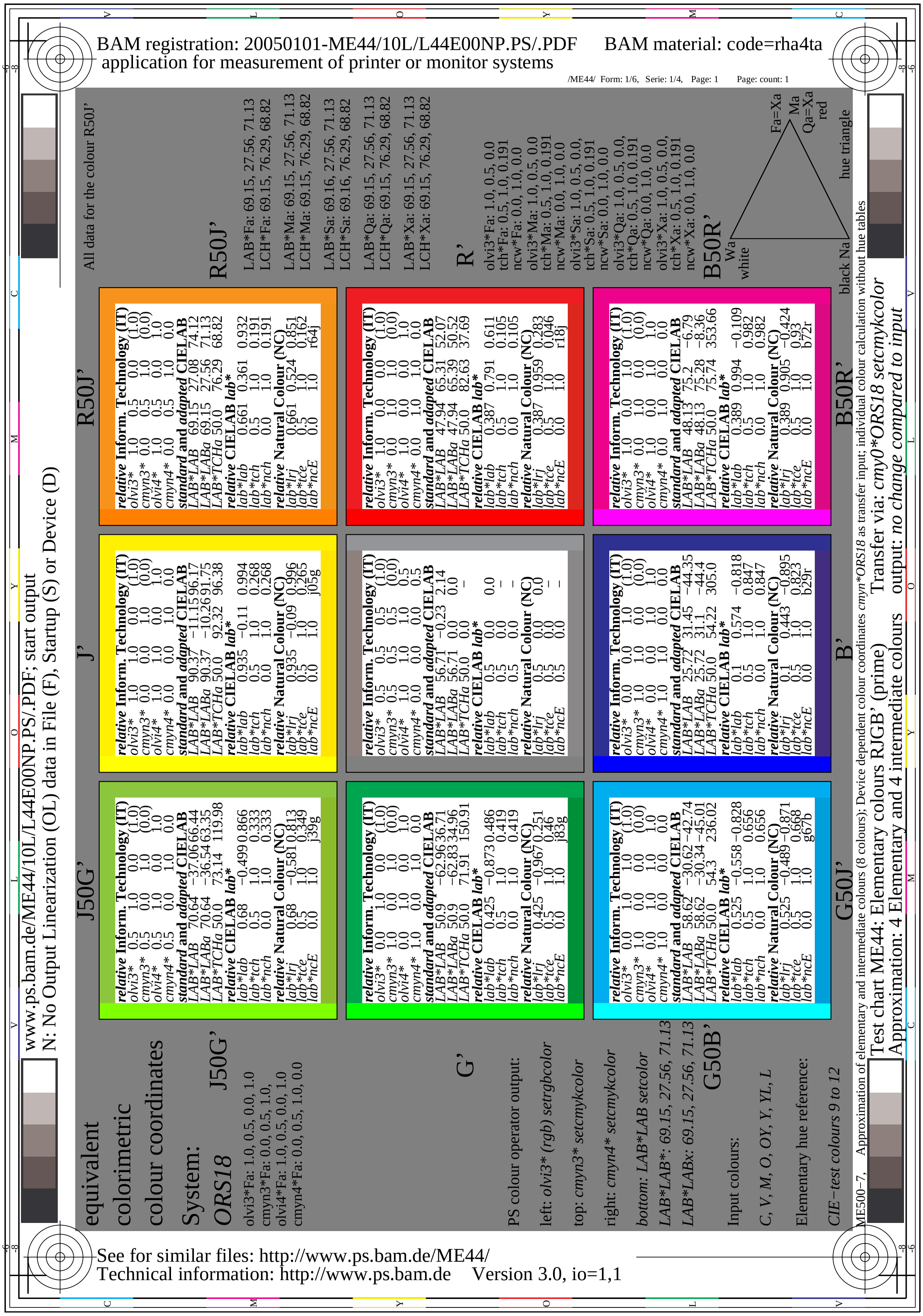

Table D.1 shows 13 equivalent colorimetric data of six basic and two intermediate (O–J, J–L) colours of the device system OSR18. The four basic colours O, Y, L, V are approximately the elementary colours R', J', G', B'.

Table D.2: Equivalent colorimetric data for 9 colours for *olv*$_3$* = *rgb = (0, *l*$_3$*, *v*$_3$*) of OSR18**

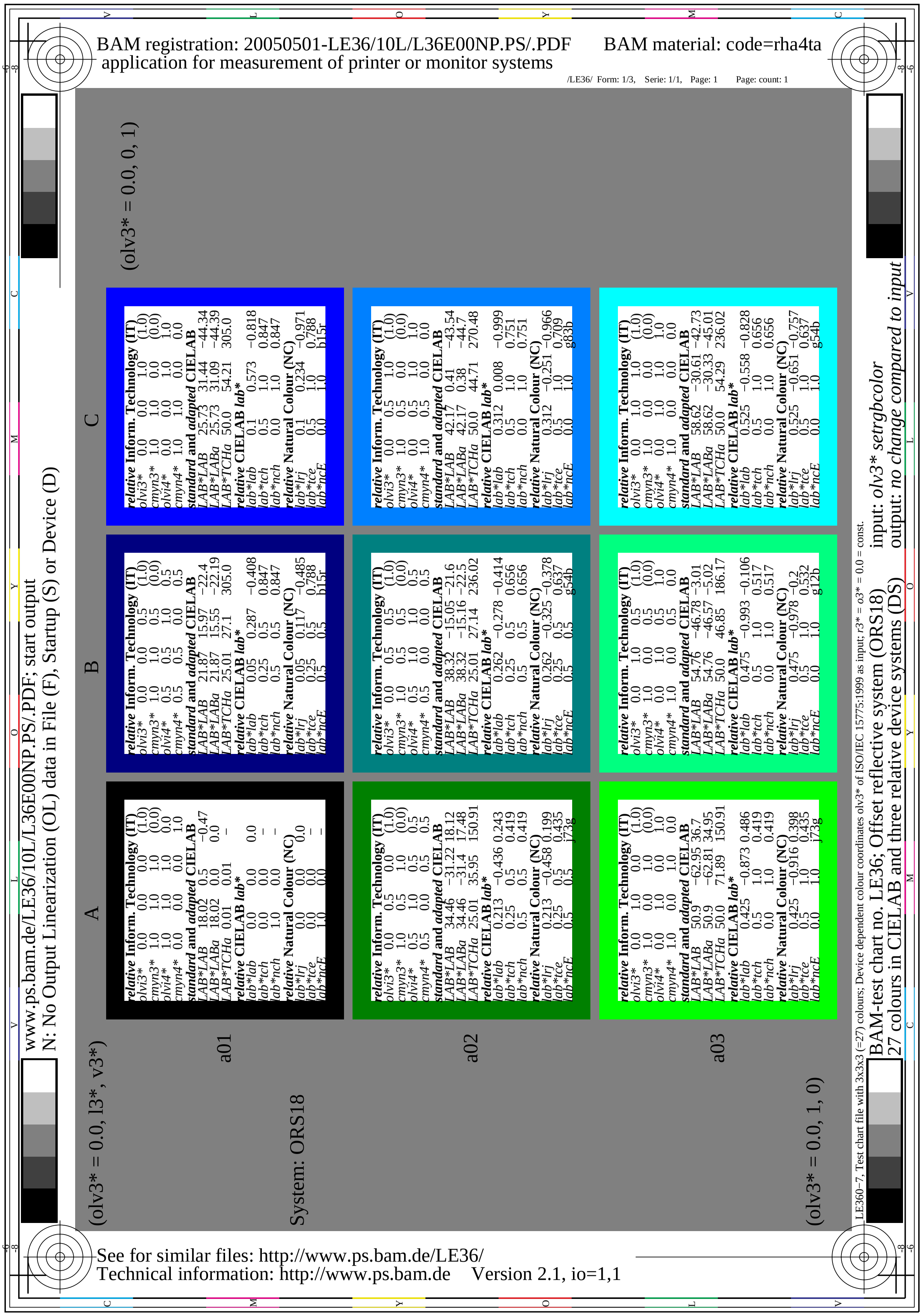

Table D.2 shows 13 equivalent colorimetric data for 9 colours for *olv*$_3$* = *rgb** = (0,0, *l*$_3$*, *v*$_3$*) of the device system OSR18.

Table D.3: Equivalent colorimetric data for 9 colours for olv_3* = *rgb = (0,5, l_3*, v_3*) of OSR18**

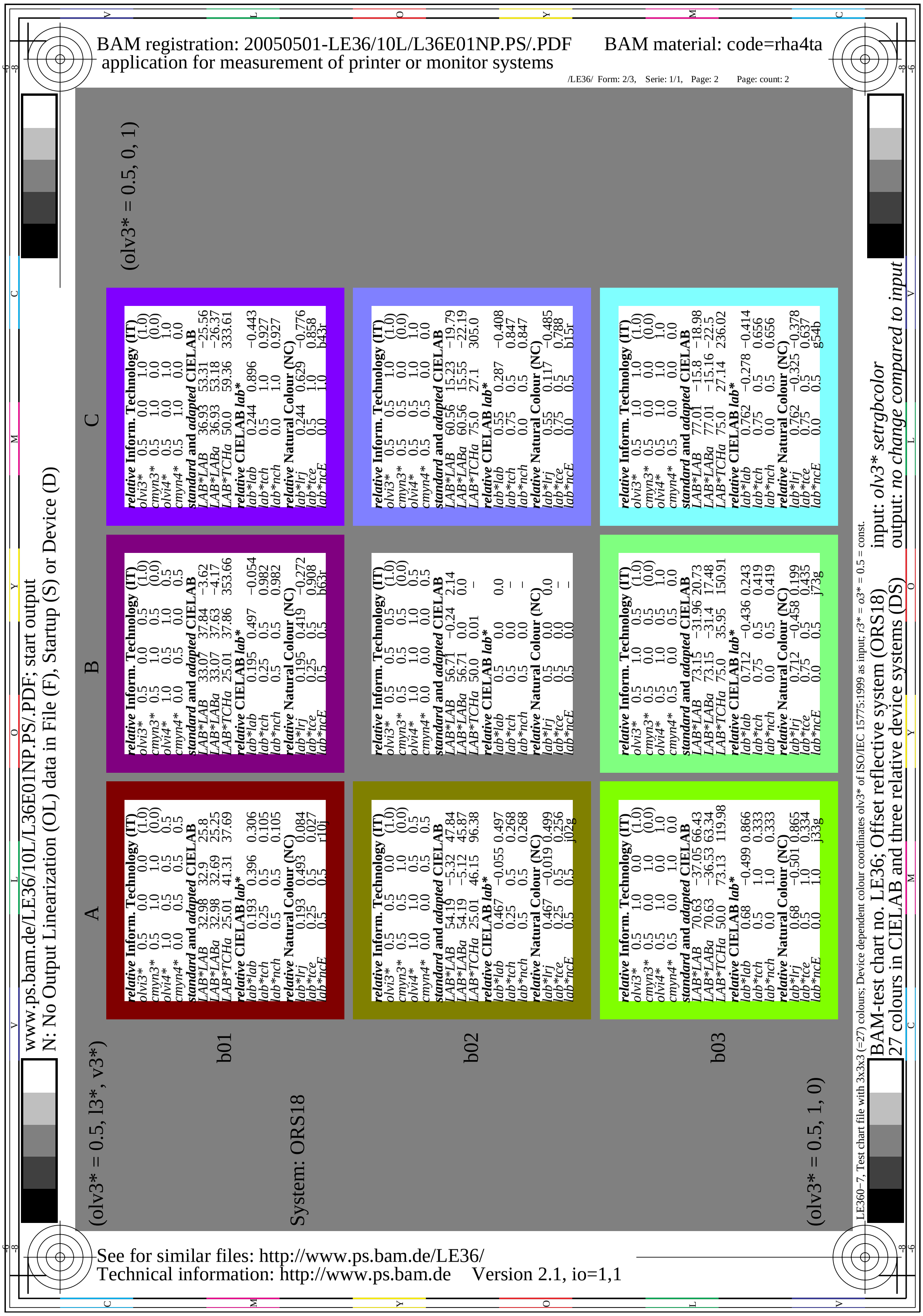

Table D.3 shows 13 equivalent colorimetric data for 9 colours for olv_3* = *rgb** = (0,5, l_3*, v_3*) of the device system OSR18

Table D.4: Equivalent colorimetric data for 9 colours for $olv_3^* = rgb^* = (1,0, l_3^*, v_3^*)$ of OSR18

BAM registration: 20050501-LE36/10L/L36E02NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer or monitor systems
/LE36/ Form: 3/3, Serie: 1/1, Page: 3 Page: count: 3

www.ps.bam.de/LE36/10L/L36E02NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

(olv3* = 1.0, l3*, v3*) (olv3* = 1.0, 0, 1) (olv3* = 1.0, 1, 0)

System: ORS18

c01 A

relative **Inform. Technology (IT)**				
*olvi3**	1.0	0.0	0.0	(1.0)
*cmyn3**	0.0	1.0	1.0	(0.0)
*olvi4**	1.0	0.0	0.0	1.0
*cmyn4**	0.0	1.0	1.0	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	47.94	65.3	52.06	
*LAB*LABa*	47.94	65.37	50.51	
*LAB*TCHa*	50.0	82.61	37.69	
relative **CIELAB *lab****				
*lab*lab*	0.387	0.791	0.611	
*lab*tch*	0.5	1.0	0.105	
*lab*nch*	0.0	1.0	0.105	
relative **Natural Colour (NC)**				
*lab*lrj*	0.387	0.986	0.167	
*lab*tce*	0.5	1.0	0.027	
*lab*ncE*	0.0	1.0	r10j	

c01 B

relative **Inform. Technology (IT)**				
*olvi3**	1.0	0.0	0.5	(1.0)
*cmyn3**	0.0	1.0	0.5	(0.0)
*olvi4**	1.0	0.0	0.5	1.0
*cmyn4**	0.0	1.0	0.5	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	48.04	70.24	22.63	
*LAB*LABa*	48.04	70.32	21.07	
*LAB*TCHa*	50.0	73.41	16.68	
relative **CIELAB *lab****				
*lab*lab*	0.388	0.958	0.287	
*lab*tch*	0.5	1.0	0.046	
*lab*nch*	0.0	1.0	0.046	
relative **Natural Colour (NC)**				
*lab*lrj*	0.388	0.976	−0.218	
*lab*tce*	0.5	1.0	0.965	
*lab*ncE*	0.0	1.0	b85r	

c01 C

relative **Inform. Technology (IT)**				
*olvi3**	1.0	0.0	1.0	(1.0)
*cmyn3**	0.0	1.0	0.0	(0.0)
*olvi4**	1.0	0.0	1.0	1.0
*cmyn4**	0.0	1.0	0.0	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	48.13	75.18	−6.79	
*LAB*LABa*	48.13	75.26	−8.35	
*LAB*TCHa*	50.0	75.73	353.66	
relative **CIELAB *lab****				
*lab*lab*	0.389	0.994	−0.109	
*lab*tch*	0.5	1.0	0.982	
*lab*nch*	0.0	1.0	0.982	
relative **Natural Colour (NC)**				
*lab*lrj*	0.389	0.837	−0.546	
*lab*tce*	0.5	1.0	0.908	
*lab*ncE*	0.0	1.0	b63r	

c02 A

relative **Inform. Technology (IT)**				
*olvi3**	1.0	0.5	0.0	(1.0)
*cmyn3**	0.0	0.5	1.0	(0.0)
*olvi4**	1.0	0.5	0.0	1.0
*cmyn4**	0.0	0.5	1.0	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	69.15	27.07	74.11	
*LAB*LABa*	69.15	27.55	71.12	
*LAB*TCHa*	50.0	76.27	68.82	
relative **CIELAB *lab****				
*lab*lab*	0.661	0.361	0.932	
*lab*tch*	0.5	1.0	0.191	
*lab*nch*	0.0	1.0	0.191	
relative **Natural Colour (NC)**				
*lab*lrj*	0.661	0.591	0.806	
*lab*tce*	0.5	1.0	0.149	
*lab*ncE*	0.0	1.0	r59j	

c02 B

relative **Inform. Technology (IT)**				
*olvi3**	1.0	0.5	0.5	(1.0)
*cmyn3**	0.0	0.5	0.5	(0.0)
*olvi4**	1.0	0.5	0.5	1.0
*cmyn4**	0.0	0.5	0.5	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	71.67	32.15	28.41	
*LAB*LABa*	71.67	32.69	25.25	
*LAB*TCHa*	75.0	41.31	37.69	
relative **CIELAB *lab****				
*lab*lab*	0.693	0.396	0.306	
*lab*tch*	0.75	0.5	0.105	
*lab*nch*	0.0	0.5	0.105	
relative **Natural Colour (NC)**				
*lab*lrj*	0.693	0.493	0.084	
*lab*tce*	0.75	0.5	0.027	
*lab*ncE*	0.0	0.5	r10j	

c02 C

relative **Inform. Technology (IT)**				
*olvi3**	1.0	0.5	1.0	(1.0)
*cmyn3**	0.0	0.5	0.0	(0.0)
*olvi4**	1.0	0.5	1.0	1.0
*cmyn4**	0.0	0.5	0.0	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	71.77	37.1	−1.01	
*LAB*LABa*	71.77	37.63	−4.17	
*LAB*TCHa*	75.0	37.86	353.66	
relative **CIELAB *lab****				
*lab*lab*	0.695	0.497	−0.054	
*lab*tch*	0.75	0.5	0.982	
*lab*nch*	0.0	0.5	0.982	
relative **Natural Colour (NC)**				
*lab*lrj*	0.695	0.419	−0.272	
*lab*tce*	0.75	0.5	0.908	
*lab*ncE*	0.0	0.5	b63r	

c03 A

relative **Inform. Technology (IT)**				
*olvi3**	1.0	1.0	0.0	(1.0)
*cmyn3**	0.0	0.0	1.0	(0.0)
*olvi4**	1.0	1.0	0.0	1.0
*cmyn4**	0.0	0.0	1.0	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	90.36	−11.15	96.15	
*LAB*LABa*	90.36	−10.25	91.73	
*LAB*TCHa*	50.0	92.3	96.38	
relative **CIELAB *lab****				
*lab*lab*	0.935	−0.11	0.994	
*lab*tch*	0.5	1.0	0.268	
*lab*nch*	0.0	1.0	0.268	
relative **Natural Colour (NC)**				
*lab*lrj*	0.935	−0.04	0.999	
*lab*tce*	0.5	1.0	0.256	
*lab*ncE*	0.0	1.0	j02g	

c03 B

relative **Inform. Technology (IT)**				
*olvi3**	1.0	1.0	0.5	(1.0)
*cmyn3**	0.0	0.0	0.5	(0.0)
*olvi4**	1.0	1.0	0.5	1.0
*cmyn4**	0.0	0.0	0.5	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	92.88	−6.06	50.46	
*LAB*LABa*	92.88	−5.12	45.87	
*LAB*TCHa*	75.0	46.15	96.38	
relative **CIELAB *lab****				
*lab*lab*	0.967	−0.055	0.497	
*lab*tch*	0.75	0.5	0.268	
*lab*nch*	0.0	0.5	0.268	
relative **Natural Colour (NC)**				
*lab*lrj*	0.967	−0.019	0.499	
*lab*tce*	0.75	0.5	0.256	
*lab*ncE*	0.0	0.5	j02g	

c03 C

relative **Inform. Technology (IT)**				
*olvi3**	1.0	1.0	1.0	(1.0)
*cmyn3**	0.0	0.0	0.0	(0.0)
*olvi4**	1.0	1.0	1.0	1.0
*cmyn4**	0.0	0.0	0.0	0.0
standard and *adapted* CIELAB				
*LAB*LAB*	95.41	−0.98	4.75	
*LAB*LABa*	95.41	0.0	0.0	
*LAB*TCHa*	99.99	0.01	−	
relative **CIELAB *lab****				
*lab*lab*	1.0	0.0	0.0	
*lab*tch*	1.0	0.0	−	
*lab*nch*	0.0	0.0	−	
relative **Natural Colour (NC)**				
*lab*lrj*	1.0	0.0	0.0	
*lab*tce*	1.0	0.0	−	
*lab*ncE*	0.0	0.0	−	

LE360−7, Test chart file with 3x3x3 (=27) colours; Device dependent colour coordinates olv3* of ISO/IEC 15775:1999 as input; $r3^* = o3^* = 1.0$ = const.

BAM-test chart no. LE36; Offset reflective system (ORS18) input: *olv3* setrgbcolor*
27 colours in CIELAB and three relative device systems (DS) output: *no change compared to input*

See for similar files: http://www.ps.bam.de/LE36/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table D.4 shows 13 equivalent colorimetric data for 9 colours for $olv_3^* = rgb^* = (1,0, l_3^*, v_3^*)$ of the device system OSR18

For the colorimetric data of 3x3x3 = 27 colours of the device systems ORS18, TLS00, DRSXX, TRS18, SLS00, and SRS18, see the URL (3 pages, 84 kByte)

http://www.ps.bam.de/LE36/10L/L36E00NP.PDF

Table D.5: Equivalent colorimetric data for 25 colours for olv_3* = rgb* = (0,0, l_3*, v_3*) of OSR18

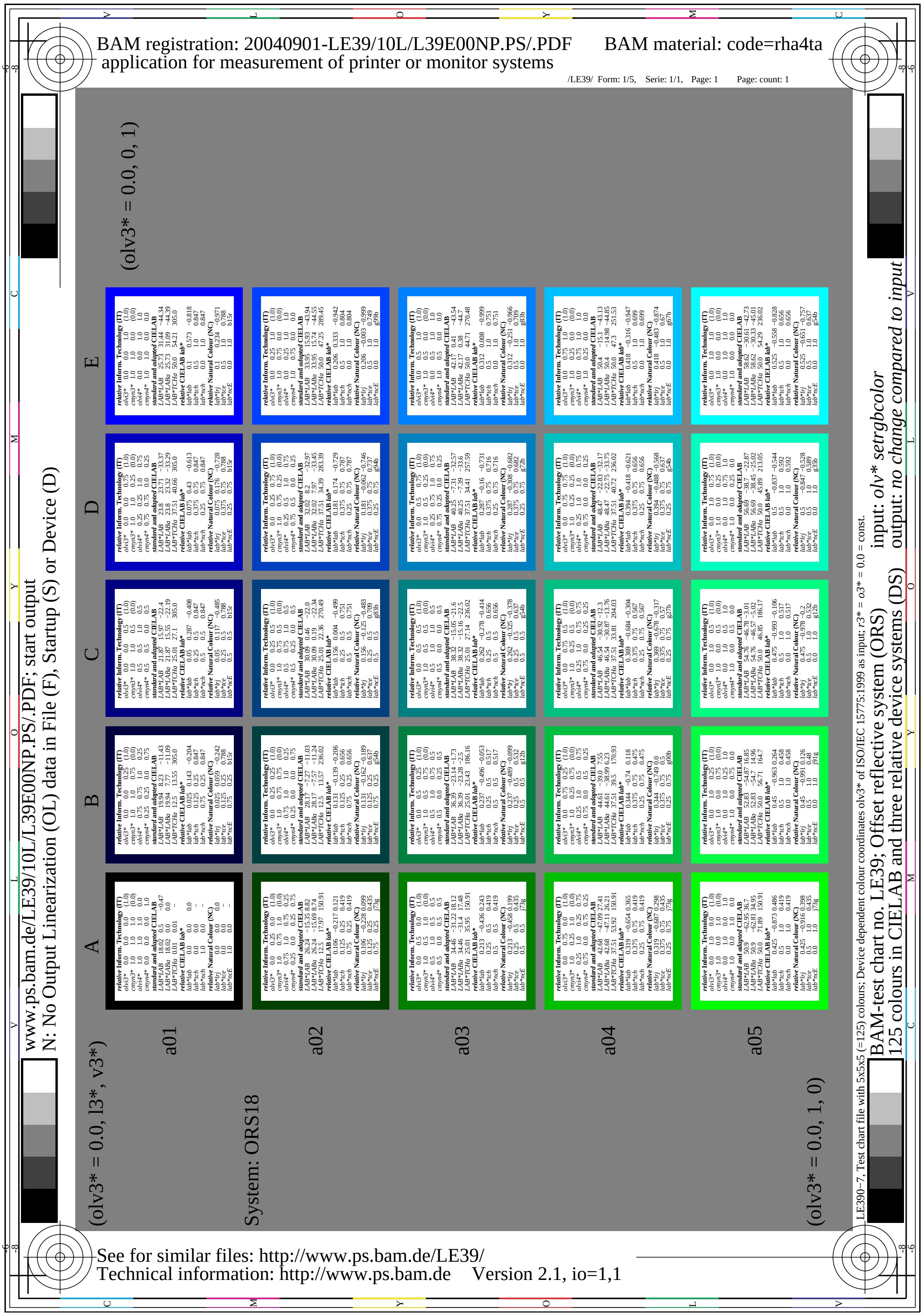

Table D.5 shows 13 equivalent colorimetric data for 25 colours for olv_3* = rgb* = (0,0, l_3*, v_3*) of the device system OSR18.

For the colorimetric data of 5x5x5 = 125 colours of the device systems ORS18, see the URL (5 pages, 270 kByte)
http://www.ps.bam.de/LE39/10L/L39E00NP.PDF

Annex E: Transformation from *lab*olv* = *olv3** to LAB^*_{Ma} data

Annex E shows hue h^*_{o8} indexed tables for the transformation from *lab*olv* = *olv3** = *rgb** to the *adapted* CIELAB data LAB^*LCH_{Ma}. The tables are the inverse of the tables in Annex C. In Annex C for a CIELAB integer hue h^*_8 in the range [0,255] the *olv*-hue value h^*_o in the range [0, 1] is calculated.

The tables of this Annex E will allow to determine for an integer olv-hue h^*_{o8} in the range [0, 255] the CIELAB hue value *h** in the range [0, 1].

Similar tables of this Annex E will allow to determine for an integer elementary hue e^*_8 in the range [0, 255] the CIELAB hue value *h** in the range [0, 1].

In application for an integer olv-hue h^*_{o8} in the range [0, 255] the *adapted* CIELAB data LAB^*LCH_{Ma} and the lab^*olv_{Ma} data of the Maximum colour M_a are given by the Table E.1.

Table E.1: Integer CIELAB hue h^*_{o8}, LAB^*_{Ma} and lab^*olv_{3Ma}, *e, *h** for the system ORS18a**

to be calculated

Table E.1 is an integer *olv*-hue h^*_{o8} indexed table in the range [0, 255] and one inverse table of Table C.1.

Table E.2: Integer CIELAB hue e^*_8, LAB^*_{Ma} and lab^*olv_{3Ma}, *h, h^*_o for the system ORS18a**

to be calculated

Table E.2 is an integer elementary hue e^*_8 indexed table in the range [0, 255] and another inverse table of Table C.1.

For any given three data *lab*olv3* = *olv3** = *rgb** of a given colour F_a the three corresponding data for the Maximum colour M_a must be calculated. Therefore in a first step the *olv*-hue h^*_o must be calculated for the given colour F_a. The colours F_a and M_a have the same olv-hue h^*_o and the same integer *olv*-hue h^*_{o8}.

$$x_{Fa} = lab^*o_{3Fa} \cos 30 - lab^*l_{3Fa} \cos 30$$

$$y_{Fa} = - lab^*v_{3Fa} + lab^*o_{3Fa} \sin 30 + lab^*l_{3Fa} \sin 30$$

$$h^*_{oFa} = \operatorname{atan} (x_{Fa} / y_{Fa}) / 360$$

$$h^*_o = h^*_{oFa} = h^*_{oMa}$$

$$h^*_{o8} = 255\, h^*_o$$

The integer *olv*-hue h^*_{o8} indexed Table E.1 shall be used to determine for any integer hue h^*_{o8} the *adapted* CIELAB data LAB^*LCH_{Ma} and the lab^*olv_{Ma} data of the Maximum colour M_a. This is the basis for the calculation of for example the chromaticness ***c**** and blackness ***n****.

The integer elementary hue e^*_8 indexed Table E.2 shall be used to determine for any integer elementary hue e^*_8 the *adapted* CIELAB data LAB^*LCH_{Ma} and the lab^*olv_{Ma} data of the Maximum colour $M_{a.}$ This is the basis for the calculation of for example the chromaticness ***c**** and blackness ***n****.

Annex F:
RLAB *lab** (2005) and ICC profile

NOTE: A method to produce ICC profiles for the RLAB *lab** (2005) image encoding shall use the following table data.

Table F.1: *OLV*-5x5x5 cube calculated for linear relation *lab*olv - LAB*LCH*$_a$ of ORS18a.

www.ps.bam.de/ME39/10L/L39E00NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

BAM registration: 20040901-ME39/10L/L39E00NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME39/ Form: 1/6, Serie: 1/1, Page: 1 Page: count: 1

n	o^*_3	l^*_3	v^*_3	H^*_o	L^*_a	$C^*_{ab,a}$	H^*_a
0	0.0	0.0	0.0	0.0	18.02	0.01	–
1	0.0	0.0	0.25	270.0	19.94	13.55	305.0
2	0.0	0.0	0.5	270.0	21.87	27.1	305.0
3	0.0	0.0	0.75	270.0	23.8	40.66	305.0
4	0.0	0.0	1.0	270.0	25.73	54.21	305.0
5	0.0	0.25	0.0	150.0	26.24	17.97	150.9
6	0.0	0.25	0.25	210.0	28.17	13.57	236.0
7	0.0	0.25	0.5	240.0	30.09	22.36	270.5
8	0.0	0.25	0.75	250.9	32.02	34.39	283.4
9	0.0	0.25	1.0	256.1	33.95	47.25	289.5
10	0.0	0.5	0.0	150.0	34.46	35.95	150.9
11	0.0	0.5	0.25	180.0	36.39	23.43	186.2
12	0.0	0.5	0.5	210.0	38.32	27.14	236.0
13	0.0	0.5	0.75	229.1	40.25	34.41	257.6
14	0.0	0.5	1.0	240.0	42.17	44.71	270.5
15	0.0	0.75	0.0	150.0	42.68	53.92	150.9
16	0.0	0.75	0.25	169.1	44.61	39.5	170.9
17	0.0	0.75	0.5	190.9	46.54	33.81	204.0
18	0.0	0.75	0.75	210.0	48.47	40.72	236.0
19	0.0	0.75	1.0	223.9	50.4	47.3	251.5
20	0.0	1.0	0.0	150.0	50.9	71.89	150.9
21	0.0	1.0	0.25	163.9	52.83	56.71	164.7
22	0.0	1.0	0.5	180.0	54.76	46.85	186.2
23	0.0	1.0	0.75	196.1	56.69	45.89	213.1
24	0.0	1.0	1.0	210.0	58.62	54.29	236.0
25	0.25	0.0	0.0	30.0	25.5	20.65	37.7
26	0.25	0.0	0.25	330.0	25.54	18.93	353.7
27	0.25	0.0	0.5	300.0	27.47	29.68	333.6
28	0.25	0.0	0.75	289.1	29.4	42.08	324.7
29	0.25	0.0	1.0	283.9	31.33	55.03	320.0
30	0.25	0.25	0.0	90.0	36.1	23.07	96.4
31	0.25	0.25	0.25	0.0	37.36	0.01	–
32	0.25	0.25	0.5	270.0	39.29	13.55	305.0
33	0.25	0.25	0.75	270.0	41.22	27.11	305.0
34	0.25	0.25	1.0	270.0	43.14	40.66	305.0
35	0.25	0.5	0.0	120.0	44.32	36.56	120.0
36	0.25	0.5	0.25	150.0	45.58	17.98	150.9
37	0.25	0.5	0.5	210.0	47.51	13.57	236.0
38	0.25	0.5	0.75	240.0	49.44	22.36	270.5
39	0.25	0.5	1.0	250.9	51.37	34.39	283.4
40	0.25	0.75	0.0	130.9	52.55	52.8	130.1
41	0.25	0.75	0.25	150.0	53.81	35.95	150.9
42	0.25	0.75	0.5	180.0	55.74	23.43	186.2
43	0.25	0.75	0.75	210.0	57.67	27.15	236.0
44	0.25	0.75	1.0	229.1	59.59	34.42	257.6
45	0.25	1.0	0.0	136.1	60.76	69.88	135.3
46	0.25	1.0	0.25	150.0	62.02	53.92	150.9
47	0.25	1.0	0.5	169.1	63.95	39.49	170.9
48	0.25	1.0	0.75	190.9	65.88	33.81	204.0
49	0.25	1.0	1.0	210.0	67.81	40.72	236.0
50	0.5	0.0	0.0	30.0	32.98	41.31	37.7
51	0.5	0.0	0.25	0.0	33.03	36.7	16.7
52	0.5	0.0	0.5	330.0	33.07	37.86	353.7
53	0.5	0.0	0.75	310.9	35.0	47.91	341.4
54	0.5	0.0	1.0	300.0	36.93	59.36	333.6
55	0.5	0.25	0.0	60.0	43.58	38.13	68.8
56	0.5	0.25	0.25	30.0	44.84	20.66	37.7
57	0.5	0.25	0.5	330.0	44.89	18.94	353.7
58	0.5	0.25	0.75	300.0	46.82	29.69	333.6
59	0.5	0.25	1.0	289.1	48.74	42.08	324.7
60	0.5	0.5	0.0	90.0	54.19	46.15	96.4
61	0.5	0.5	0.25	90.0	55.45	23.08	96.4
62	0.5	0.5	0.5	0.0	56.71	0.01	–
63	0.5	0.5	0.75	270.0	58.64	13.55	305.0
64	0.5	0.5	1.0	270.0	60.56	27.1	305.0
65	0.5	0.75	0.0	109.1	62.41	58.45	110.9
66	0.5	0.75	0.25	120.0	63.67	36.57	120.0
67	0.5	0.75	0.5	150.0	64.93	17.98	150.9
68	0.5	0.75	0.75	210.0	66.86	13.57	236.0
69	0.5	0.75	1.0	240.0	68.79	22.36	270.5
70	0.5	1.0	0.0	120.0	70.63	73.13	120.0
71	0.5	1.0	0.25	130.9	71.89	52.8	130.1
72	0.5	1.0	0.5	150.0	73.15	35.95	150.9
73	0.5	1.0	0.75	180.0	75.08	23.43	186.2
74	0.5	1.0	1.0	210.0	77.01	27.14	236.0
75	0.75	0.0	0.0	30.0	40.46	61.96	37.7
76	0.75	0.0	0.25	10.9	40.51	56.48	24.2
77	0.75	0.0	0.5	349.1	40.56	54.64	8.9
78	0.75	0.0	0.75	330.0	40.6	56.8	353.7
79	0.75	0.0	1.0	316.1	42.53	66.53	344.9
80	0.75	0.25	0.0	49.1	51.07	56.83	58.0
81	0.75	0.25	0.25	30.0	52.33	41.31	37.7
82	0.75	0.25	0.5	0.0	52.37	36.71	16.7
83	0.75	0.25	0.75	330.0	52.42	37.87	353.7
84	0.75	0.25	1.0	310.9	54.35	47.91	341.4
85	0.75	0.5	0.0	70.9	61.67	59.56	79.1
86	0.75	0.5	0.25	60.0	62.93	38.14	68.8
87	0.75	0.5	0.5	30.0	64.19	20.66	37.7
88	0.75	0.5	0.75	330.0	64.24	18.94	353.7
89	0.75	0.5	1.0	300.0	66.17	29.68	333.6
90	0.75	0.75	0.0	90.0	72.28	69.23	96.4
91	0.75	0.75	0.25	90.0	73.54	46.16	96.4
92	0.75	0.75	0.5	90.0	74.8	23.08	96.4
93	0.75	0.75	0.75	0.0	76.06	0.01	–
94	0.75	0.75	1.0	270.0	77.99	13.55	305.0
95	0.75	1.0	0.0	103.9	80.5	80.99	106.8
96	0.75	1.0	0.25	109.1	81.76	58.45	110.9
97	0.75	1.0	0.5	120.0	83.02	36.56	120.0
98	0.75	1.0	0.75	150.0	84.28	17.97	150.9
99	0.75	1.0	1.0	210.0	86.21	13.57	236.0
100	1.0	0.0	0.0	30.0	47.94	82.61	37.7
101	1.0	0.0	0.25	16.1	47.99	76.71	27.8
102	1.0	0.0	0.5	0.0	48.04	73.41	16.7
103	1.0	0.0	0.75	343.9	48.08	73.07	5.0
104	1.0	0.0	1.0	330.0	48.13	75.73	353.7
105	1.0	0.25	0.0	43.9	58.55	76.53	52.6
106	1.0	0.25	0.25	30.0	59.8	61.96	37.7
107	1.0	0.25	0.5	10.9	59.85	56.47	24.2
108	1.0	0.25	0.75	349.1	59.9	54.64	8.9
109	1.0	0.25	1.0	330.0	59.95	56.8	353.7
110	1.0	0.5	0.0	60.0	69.15	76.27	68.8
111	1.0	0.5	0.25	49.1	70.41	56.83	58.0
112	1.0	0.5	0.5	30.0	71.67	41.31	37.7
113	1.0	0.5	0.75	0.0	71.72	36.7	16.7
114	1.0	0.5	1.0	330.0	71.77	37.86	353.7
115	1.0	0.75	0.0	76.1	79.76	81.89	83.9
116	1.0	0.75	0.25	70.9	81.02	59.56	79.2
117	1.0	0.75	0.5	60.0	82.28	38.14	68.8
118	1.0	0.75	0.75	30.0	83.54	20.65	37.7
119	1.0	0.75	1.0	330.0	83.59	18.93	353.7
120	1.0	1.0	0.0	90.0	90.36	92.3	96.4
121	1.0	1.0	0.25	90.0	91.62	69.23	96.4
122	1.0	1.0	0.5	90.0	92.88	46.15	96.4
123	1.0	1.0	0.75	90.0	94.14	23.07	96.4
124	1.0	1.0	1.0	0.0	95.41	0.01	–

ME390−70, Table olv3* − LCH*a with 5x5x5 (=125) colours; Device dependent colour coordinates olv3* of ISO/IEC 15775:1999 as input; Page 1, System: ORS18a

BAM-reference table no. ME39 for OLV-5x5x5 colours
Table lab*olv − H*o, LAB*LCHa; System: ORS18a

input: *w* setgray*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME39/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table F.1 shows the *olv*-5x5x5 cube calculated for the linear relation *lab*olv - LAB*LCH*$_a$ of the device system ORS18a. The three olv*$_3$ values change in steps of 0,25 = 1/4 in the sequence v^*_3, l^*_3, and o^*_3. The *olv*-hue angle

H^*_o and the *adapted* CIELAB data LCH^*_a are given in the Table F.1. The three rectangular data olv^*_3 form a rectangular OLV-5x5x5 cube. Similar data for a OLV-8x8x8 and a OLV-16x16x16 cube are given in Tables F.2 to F.5

Table F.2: *OLV*-8x8x8 cube calculated for linear relation *lab*olv - LAB*LCH*$_a$ of ORS18a.

www.ps.bam.de/ME40/10L/L40E00NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

BAM registration: 20040901-ME40/10L/L40E00NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME40/ Form: 1/12, Serie: 1/1, Page: 1 Page count: 1

n	o^*_3	l^*_3	v^*_3	H^*_o	L^*_a	$C^*_{ab,a}$	H^*_a
0	0.0	0.0	0.0	0.0	18.02	0.01	−
1	0.0	0.0	0.143	270.0	19.12	7.74	305.0
2	0.0	0.0	0.286	270.0	20.22	15.49	305.0
3	0.0	0.0	0.429	270.0	21.32	23.23	305.0
4	0.0	0.0	0.571	270.0	22.42	30.98	305.0
5	0.0	0.0	0.714	270.0	23.52	38.72	305.0
6	0.0	0.0	0.857	270.0	24.63	46.47	305.0
7	0.0	0.0	1.0	270.0	25.73	54.21	305.0
8	0.0	0.143	0.0	150.0	22.71	10.27	150.9
9	0.0	0.143	0.143	210.0	23.82	7.75	236.0
10	0.0	0.143	0.286	240.0	24.92	12.77	270.5
11	0.0	0.143	0.429	250.9	26.02	19.65	283.4
12	0.0	0.143	0.571	256.1	27.12	27.0	289.5
13	0.0	0.143	0.714	259.1	28.22	34.53	292.9
14	0.0	0.143	0.857	261.1	29.32	42.13	295.1
15	0.0	0.143	1.0	262.4	30.42	49.77	296.6
16	0.0	0.286	0.0	150.0	27.41	20.54	150.9
17	0.0	0.286	0.143	180.0	28.51	13.39	186.1
18	0.0	0.286	0.286	210.0	29.62	15.51	236.0
19	0.0	0.286	0.429	229.1	30.72	19.66	257.6
20	0.0	0.286	0.571	240.0	31.82	25.55	270.5
21	0.0	0.286	0.714	246.6	32.92	32.23	278.3
22	0.0	0.286	0.857	250.9	34.02	39.31	283.4
23	0.0	0.286	1.0	253.9	35.12	46.59	286.9
24	0.0	0.429	0.0	150.0	32.11	30.81	150.9
25	0.0	0.429	0.143	169.1	33.21	22.57	170.9
26	0.0	0.429	0.286	190.9	34.32	19.32	204.0
27	0.0	0.429	0.429	210.0	35.42	23.26	236.0
28	0.0	0.429	0.571	223.9	36.52	27.03	251.5
29	0.0	0.429	0.714	233.4	37.62	32.24	262.7
30	0.0	0.429	0.857	240.0	38.72	38.33	270.5
31	0.0	0.429	1.0	244.7	39.82	44.92	276.1
32	0.0	0.571	0.0	150.0	36.81	41.08	150.9
33	0.0	0.571	0.143	163.9	37.91	32.41	164.7
34	0.0	0.571	0.286	180.0	39.01	26.78	186.2
35	0.0	0.571	0.429	196.1	40.12	26.22	213.0
36	0.0	0.571	0.571	210.0	41.22	31.02	236.0
37	0.0	0.571	0.714	220.9	42.32	34.56	248.1
38	0.0	0.571	0.857	229.1	43.42	39.33	257.6
39	0.0	0.571	1.0	235.3	44.52	44.93	264.9
40	0.0	0.714	0.0	150.0	41.51	51.35	150.9
41	0.0	0.714	0.143	160.9	42.61	42.46	161.4
42	0.0	0.714	0.286	173.4	43.71	35.66	176.6
43	0.0	0.714	0.429	186.6	44.82	32.32	196.7
44	0.0	0.714	0.571	199.1	45.92	33.5	218.2
45	0.0	0.714	0.714	210.0	47.02	38.78	236.0
46	0.0	0.714	0.857	219.0	48.12	42.18	245.9
47	0.0	0.714	1.0	226.1	49.22	46.63	254.1
48	0.0	0.857	0.0	150.0	46.21	61.63	150.9
49	0.0	0.857	0.143	158.9	47.31	52.59	159.4
50	0.0	0.857	0.286	169.1	48.41	45.14	170.9
51	0.0	0.857	0.429	180.0	49.51	40.17	186.2
52	0.0	0.857	0.571	190.9	50.62	38.64	204.0
53	0.0	0.857	0.714	201.1	51.72	40.95	221.5
54	0.0	0.857	0.857	210.0	52.82	46.53	236.0
55	0.0	0.857	1.0	217.6	53.92	49.84	244.4
56	0.0	1.0	0.0	150.0	50.9	71.89	150.9
57	0.0	1.0	0.143	157.6	52.0	62.76	158.0
58	0.0	1.0	0.286	166.1	53.11	54.9	167.3
59	0.0	1.0	0.429	175.3	54.21	48.91	179.2
60	0.0	1.0	0.571	184.7	55.31	45.55	193.6
61	0.0	1.0	0.714	193.9	56.41	45.4	209.2
62	0.0	1.0	0.857	202.4	57.52	48.5	223.8
63	0.0	1.0	1.0	210.0	58.62	54.29	236.0

n	o^*_3	l^*_3	v^*_3	H^*_o	L^*_a	$C^*_{ab,a}$	H^*_a
64	0.143	0.0	0.0	30.0	22.29	11.8	37.7
65	0.143	0.0	0.143	330.0	22.32	10.81	353.7
66	0.143	0.0	0.286	300.0	23.42	16.96	333.6
67	0.143	0.0	0.429	289.1	24.52	24.04	324.7
68	0.143	0.0	0.571	283.9	25.62	31.44	320.0
69	0.143	0.0	0.714	280.9	26.72	38.98	317.0
70	0.143	0.0	0.857	279.0	27.82	46.58	315.0
71	0.143	0.0	1.0	277.6	28.93	54.22	313.6
72	0.143	0.143	0.0	90.0	28.35	13.18	96.4
73	0.143	0.143	0.143	0.0	29.07	0.01	−
74	0.143	0.143	0.286	270.0	30.17	7.75	305.0
75	0.143	0.143	0.429	270.0	31.27	15.49	305.0
76	0.143	0.143	0.571	270.0	32.37	23.24	305.0
77	0.143	0.143	0.714	270.0	33.47	30.98	305.0
78	0.143	0.143	0.857	270.0	34.57	38.73	305.0
79	0.143	0.143	1.0	270.0	35.67	46.47	305.0
80	0.143	0.286	0.0	120.0	33.05	20.89	120.0
81	0.143	0.286	0.143	150.0	33.77	10.27	150.9
82	0.143	0.286	0.286	210.0	34.87	7.76	236.0
83	0.143	0.286	0.429	240.0	35.97	12.78	270.5
84	0.143	0.286	0.571	250.9	37.07	19.65	283.4
85	0.143	0.286	0.714	256.1	38.17	27.01	289.4
86	0.143	0.286	0.857	259.1	39.27	34.53	292.9
87	0.143	0.286	1.0	261.1	40.37	42.13	295.1
88	0.143	0.429	0.0	130.9	37.74	30.17	130.1
89	0.143	0.429	0.143	150.0	38.46	20.54	150.9
90	0.143	0.429	0.286	180.0	39.57	13.39	186.2
91	0.143	0.429	0.429	210.0	40.67	15.51	236.0
92	0.143	0.429	0.571	229.1	41.77	19.67	257.6
93	0.143	0.429	0.714	240.0	42.87	25.55	270.5
94	0.143	0.429	0.857	246.6	43.97	32.24	278.3
95	0.143	0.429	1.0	250.9	45.07	39.3	283.4
96	0.143	0.571	0.0	136.1	42.44	39.93	135.3
97	0.143	0.571	0.143	150.0	43.16	30.82	150.9
98	0.143	0.571	0.286	169.1	44.27	22.57	170.9
99	0.143	0.571	0.429	190.9	45.37	19.32	204.0
100	0.143	0.571	0.571	210.0	46.47	23.27	236.0
101	0.143	0.571	0.714	223.9	47.57	27.03	251.5
102	0.143	0.571	0.857	233.4	48.67	32.25	262.7
103	0.143	0.571	1.0	240.0	49.77	38.33	270.5
104	0.143	0.714	0.0	139.1	47.14	49.91	138.5
105	0.143	0.714	0.143	150.0	47.86	41.09	150.9
106	0.143	0.714	0.286	163.9	48.96	32.41	164.7
107	0.143	0.714	0.429	180.0	50.07	26.78	186.2
108	0.143	0.714	0.571	196.1	51.17	26.23	213.0
109	0.143	0.714	0.714	210.0	52.27	31.03	236.0
110	0.143	0.714	0.857	220.9	53.37	34.57	248.1
111	0.143	0.714	1.0	229.1	54.47	39.33	257.6
112	0.143	0.857	0.0	141.0	51.84	59.98	140.6
113	0.143	0.857	0.143	150.0	52.56	51.36	150.9
114	0.143	0.857	0.286	160.9	53.66	42.46	161.4
115	0.143	0.857	0.429	173.4	54.77	35.66	176.6
116	0.143	0.857	0.571	186.6	55.87	32.33	196.7
117	0.143	0.857	0.714	199.1	56.97	33.5	218.2
118	0.143	0.857	0.857	210.0	58.07	38.78	236.0
119	0.143	0.857	1.0	219.0	59.17	42.18	245.9
120	0.143	1.0	0.0	142.4	56.54	70.1	142.1
121	0.143	1.0	0.143	150.0	57.26	61.63	150.9
122	0.143	1.0	0.286	158.9	58.36	52.59	159.4
123	0.143	1.0	0.429	169.1	59.46	45.13	170.9
124	0.143	1.0	0.571	180.0	60.56	40.16	186.2
125	0.143	1.0	0.714	190.9	61.67	38.64	204.0
126	0.143	1.0	0.857	201.1	62.77	40.96	221.6
127	0.143	1.0	1.0	210.0	63.87	46.53	236.0

n	o^*_3	l^*_3	v^*_3	H^*_o	L^*_a	$C^*_{ab,a}$	H^*_a
128	0.286	0.0	0.0	30.0	26.57	23.6	37.7
129	0.286	0.0	0.143	0.0	26.59	20.97	16.7
130	0.286	0.0	0.286	330.0	26.62	21.63	353.7
131	0.286	0.0	0.429	310.9	27.72	27.37	341.4
132	0.286	0.0	0.571	300.0	28.82	33.92	333.6
133	0.286	0.0	0.714	293.4	29.92	40.89	328.4
134	0.286	0.0	0.857	289.1	31.03	48.1	324.7
135	0.286	0.0	1.0	286.1	32.13	55.44	322.0
136	0.286	0.143	0.0	60.0	32.62	21.79	68.8
137	0.286	0.143	0.143	30.0	33.34	11.8	37.7
138	0.286	0.143	0.286	330.0	33.37	10.82	353.7
139	0.286	0.143	0.429	300.0	34.47	16.96	333.6
140	0.286	0.143	0.571	289.1	35.57	24.05	324.7
141	0.286	0.143	0.714	283.9	36.67	31.45	320.0
142	0.286	0.143	0.857	280.9	37.78	38.98	317.0
143	0.286	0.143	1.0	279.0	38.88	46.58	315.0
144	0.286	0.286	0.0	90.0	38.68	26.37	96.4
145	0.286	0.286	0.143	90.0	39.4	13.19	96.4
146	0.286	0.286	0.286	0.0	40.13	0.01	−
147	0.286	0.286	0.429	270.0	41.23	7.75	305.0
148	0.286	0.286	0.571	270.0	42.33	15.49	305.0
149	0.286	0.286	0.714	270.0	43.43	23.24	305.0
150	0.286	0.286	0.857	270.0	44.53	30.98	305.0
151	0.286	0.286	1.0	270.0	45.63	38.72	305.0
152	0.286	0.429	0.0	109.1	43.38	33.39	110.9
153	0.286	0.429	0.143	120.0	44.1	20.9	120.0
154	0.286	0.429	0.286	150.0	44.82	10.27	150.9
155	0.286	0.429	0.429	210.0	45.93	7.76	236.0
156	0.286	0.429	0.571	240.0	47.03	12.78	270.5
157	0.286	0.429	0.714	250.9	48.13	19.65	283.4
158	0.286	0.429	0.857	256.1	49.23	27.01	289.4
159	0.286	0.429	1.0	259.1	50.33	34.53	292.9
160	0.286	0.571	0.0	120.0	48.08	41.79	120.0
161	0.286	0.571	0.143	130.9	48.8	30.17	130.1
162	0.286	0.571	0.286	150.0	49.52	20.54	150.9
163	0.286	0.571	0.429	180.0	50.62	13.39	186.2
164	0.286	0.571	0.571	210.0	51.73	15.51	236.0
165	0.286	0.571	0.714	229.1	52.83	19.67	257.6
166	0.286	0.571	0.857	240.0	53.93	25.55	270.5
167	0.286	0.571	1.0	246.6	55.03	32.23	278.3
168	0.286	0.714	0.0	126.6	52.78	50.87	125.9
169	0.286	0.714	0.143	136.1	53.5	39.94	135.3
170	0.286	0.714	0.286	150.0	54.22	30.82	150.9
171	0.286	0.714	0.429	169.1	55.32	22.57	170.9
172	0.286	0.714	0.571	190.9	56.43	19.32	204.0
173	0.286	0.714	0.714	210.0	57.53	23.27	236.0
174	0.286	0.714	0.857	223.9	58.63	27.03	251.5
175	0.286	0.714	1.0	233.4	59.73	32.25	262.7
176	0.286	0.857	0.0	130.9	57.48	60.34	130.1
177	0.286	0.857	0.143	139.1	58.2	49.91	138.5
178	0.286	0.857	0.286	150.0	58.92	41.09	150.9
179	0.286	0.857	0.429	163.9	60.02	32.41	164.7
180	0.286	0.857	0.571	180.0	61.12	26.78	186.2
181	0.286	0.857	0.714	196.1	62.23	26.23	213.0
182	0.286	0.857	0.857	210.0	63.33	31.03	236.0
183	0.286	0.857	1.0	220.9	64.43	34.57	248.1
184	0.286	1.0	0.0	133.9	62.17	70.03	133.1
185	0.286	1.0	0.143	141.0	62.89	59.98	140.6
186	0.286	1.0	0.286	150.0	63.61	51.35	150.9
187	0.286	1.0	0.429	160.9	64.72	42.45	161.4
188	0.286	1.0	0.571	173.4	65.82	35.66	176.6
189	0.286	1.0	0.714	186.6	66.92	32.32	196.7
190	0.286	1.0	0.857	199.1	68.03	33.5	218.2
191	0.286	1.0	1.0	210.0	69.13	38.78	236.0

n	o^*_3	l^*_3	v^*_3	H^*_o	L^*_a	$C^*_{ab,a}$	H^*_a
192	0.429	0.0	0.0	30.0	30.84	35.4	37.7
193	0.429	0.0	0.143	10.9	30.87	32.27	24.2
194	0.429	0.0	0.286	349.1	30.9	31.22	8.9
195	0.429	0.0	0.429	330.0	30.92	32.45	353.7
196	0.429	0.0	0.571	316.1	32.02	38.02	344.9
197	0.429	0.0	0.714	306.6	33.13	44.24	338.4
198	0.429	0.0	0.857	300.0	34.23	50.89	333.6
199	0.429	0.0	1.0	295.3	35.33	57.8	329.9
200	0.429	0.143	0.0	49.1	36.9	32.47	58.0
201	0.429	0.143	0.143	30.0	37.62	23.61	37.7
202	0.429	0.143	0.286	0.0	37.65	20.98	16.7
203	0.429	0.143	0.429	330.0	37.67	21.64	353.7
204	0.429	0.143	0.571	310.9	38.77	27.38	341.4
205	0.429	0.143	0.714	300.0	39.88	33.93	333.6
206	0.429	0.143	0.857	293.4	40.98	40.9	328.4
207	0.429	0.143	1.0	289.1	42.08	48.1	324.7
208	0.429	0.286	0.0	70.9	42.96	34.03	79.1
209	0.429	0.286	0.143	60.0	43.68	21.8	68.8
210	0.429	0.286	0.286	30.0	44.4	11.8	37.7
211	0.429	0.286	0.429	330.0	44.43	10.82	353.7
212	0.429	0.286	0.571	300.0	45.53	16.96	333.6
213	0.429	0.286	0.714	289.1	46.63	24.05	324.7
214	0.429	0.286	0.857	283.9	47.73	31.45	320.0
215	0.429	0.286	1.0	280.9	48.83	38.98	317.0
216	0.429	0.429	0.0	90.0	49.02	39.56	96.4
217	0.429	0.429	0.143	90.0	49.74	26.38	96.4
218	0.429	0.429	0.286	90.0	50.46	13.19	96.4
219	0.429	0.429	0.429	0.0	51.19	0.01	−
220	0.429	0.429	0.571	270.0	52.28	7.75	305.0
221	0.429	0.429	0.714	270.0	53.38	15.49	305.0
222	0.429	0.429	0.857	270.0	54.49	23.24	305.0
223	0.429	0.429	1.0	270.0	55.59	30.98	305.0
224	0.429	0.571	0.0	103.9	53.72	46.28	106.8
225	0.429	0.571	0.143	109.1	54.44	33.4	110.9
226	0.429	0.571	0.286	120.0	55.16	20.9	120.0
227	0.429	0.571	0.429	150.0	55.88	10.27	150.9
228	0.429	0.571	0.571	210.0	56.98	7.76	236.0
229	0.429	0.571	0.714	240.0	58.08	12.78	270.5
230	0.429	0.571	0.857	250.9	59.19	19.65	283.4
231	0.429	0.571	1.0	256.1	60.29	27.0	289.4
232	0.429	0.714	0.0	113.4	58.42	54.13	114.4
233	0.429	0.714	0.143	120.0	59.14	41.8	120.0
234	0.429	0.714	0.286	130.9	59.86	30.17	130.1
235	0.429	0.714	0.429	150.0	60.58	20.54	150.9
236	0.429	0.714	0.571	180.0	61.68	13.39	186.2
237	0.429	0.714	0.714	210.0	62.78	15.51	236.0
238	0.429	0.714	0.857	229.1	63.89	19.67	257.6
239	0.429	0.714	1.0	240.0	64.99	25.55	270.5
240	0.429	0.857	0.0	120.0	63.12	62.68	120.0
241	0.429	0.857	0.143	126.6	63.84	50.88	125.9
242	0.429	0.857	0.286	136.1	64.56	39.94	135.3
243	0.429	0.857	0.429	150.0	65.28	30.82	150.9
244	0.429	0.857	0.571	169.1	66.38	22.57	170.9
245	0.429	0.857	0.714	190.9	67.48	19.32	204.0
246	0.429	0.857	0.857	210.0	68.59	23.27	236.0
247	0.429	0.857	1.0	223.9	69.69	27.03	251.5
248	0.429	1.0	0.0	124.7	67.81	71.69	124.2
249	0.429	1.0	0.143	130.9	68.53	60.34	130.1
250	0.429	1.0	0.286	139.1	69.25	49.91	138.5
251	0.429	1.0	0.429	150.0	69.97	41.08	150.9
252	0.429	1.0	0.571	163.9	71.08	32.41	164.7
253	0.429	1.0	0.714	180.0	72.18	26.77	186.2
254	0.429	1.0	0.857	196.1	73.28	26.22	213.1
255	0.429	1.0	1.0	210.0	74.38	31.02	236.0

ME400−70, Table olv3* − LCH*a with 8x8x8 (=512) colours; Device dependent colour coordinates olv3* of ISO/IEC 15775:1999 as input; Page 1, System: ORS18a

BAM-reference table no. ME39 for OLV-8x8x8 colours
Table lab*olv − H*o, LAB*LCHa; System: ORS18a

input: *w* setgray*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME40/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table F.2 shows the *olv*-8x8x8 cube calculated for the linear relation *lab*olv - LAB*LCH*$_a$ of the device system ORS18a. The three olv^*_3 values change in steps of 0,143 = 1/7 in the sequence v^*_3, l^*_3, and o^*_3 for the colours n = 0 to 127. The *olv*-hue angle H^*_o and the adapted CIELAB data LCH^*_a are given in the table.The three rectangular data olv^*_3 form a rectangular OLV-8x8x8 cube. For the six device systems ORS18a, TLS00, DRSXX, TRS18, SLS00,

SRS18 and an *olv*-8x8x8 cube the tables are at the URL (6 pages, 160 kbyte)
http://www.ps.bam.de/ME39/10L/L39E00NP.PDF

Table F.3: *OLV*-8x8x8 cube calculated for the relation *lab*olv* - *LAB*LCH*$_a$ of ORS18a.

BAM registration: 20040901-ME40/10L/L40E01NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME40/ Form: 2/12, Serie: 1/1, Page: 2 Page: count: 2

www.ps.bam.de/ME40/10L/L40E01NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
256	0.571	0.0	0.0	30.0	35.12	47.21	37.7
257	0.571	0.0	0.143	16.1	35.14	43.84	27.8
258	0.571	0.0	0.286	0.0	35.17	41.95	16.7
259	0.571	0.0	0.429	343.9	35.2	41.75	5.0
260	0.571	0.0	0.571	330.0	35.23	43.27	353.7
261	0.571	0.0	0.714	319.1	36.33	48.74	346.8
262	0.571	0.0	0.857	310.9	37.43	54.76	341.4
263	0.571	0.0	1.0	304.7	38.53	61.16	337.1
264	0.571	0.143	0.0	43.9	41.17	43.73	52.6
265	0.571	0.143	0.143	30.0	41.89	35.41	37.7
266	0.571	0.143	0.286	10.9	41.92	32.28	24.2
267	0.571	0.143	0.429	349.1	41.95	31.22	8.9
268	0.571	0.143	0.571	330.0	41.98	32.46	353.7
269	0.571	0.143	0.714	316.1	43.08	38.02	344.9
270	0.571	0.143	0.857	306.6	44.18	44.25	338.4
271	0.571	0.143	1.0	300.0	45.28	50.89	333.6
272	0.571	0.286	0.0	60.0	47.24	43.58	68.8
273	0.571	0.286	0.143	49.1	47.96	32.48	58.0
274	0.571	0.286	0.286	30.0	48.68	23.61	37.7
275	0.571	0.286	0.429	0.0	48.7	20.98	16.7
276	0.571	0.286	0.571	330.0	48.73	21.64	353.7
277	0.571	0.286	0.714	310.9	49.83	27.38	341.4
278	0.571	0.286	0.857	300.0	50.93	33.93	333.6
279	0.571	0.286	1.0	293.4	52.03	40.89	328.4
280	0.571	0.429	0.0	76.1	53.3	46.79	83.9
281	0.571	0.429	0.143	70.9	54.02	34.04	79.2
282	0.571	0.429	0.286	60.0	54.74	21.8	68.8
283	0.571	0.429	0.429	30.0	55.46	11.8	37.7
284	0.571	0.429	0.571	330.0	55.48	10.82	353.7
285	0.571	0.429	0.714	300.0	56.59	16.96	333.6
286	0.571	0.429	0.857	289.1	57.69	24.05	324.7
287	0.571	0.429	1.0	283.9	58.79	31.45	320.0
288	0.571	0.571	0.0	90.0	59.36	52.75	96.4
289	0.571	0.571	0.143	90.0	60.08	39.57	96.4
290	0.571	0.571	0.286	90.0	60.8	26.38	96.4
291	0.571	0.571	0.429	90.0	61.52	13.19	96.4
292	0.571	0.571	0.571	0.0	62.24	0.01	–
293	0.571	0.571	0.714	270.0	63.34	7.75	305.0
294	0.571	0.571	0.857	270.0	64.44	15.49	305.0
295	0.571	0.571	1.0	270.0	65.54	23.23	305.0
296	0.571	0.714	0.0	100.9	64.06	59.3	104.5
297	0.571	0.714	0.143	103.9	64.78	46.29	106.8
298	0.571	0.714	0.286	109.1	65.5	33.4	110.9
299	0.571	0.714	0.429	120.0	66.22	20.9	120.0
300	0.571	0.714	0.571	150.0	66.94	10.27	150.9
301	0.571	0.714	0.714	210.0	68.04	7.76	236.0
302	0.571	0.714	0.857	240.0	69.14	12.78	270.5
303	0.571	0.714	1.0	250.9	70.24	19.65	283.4
304	0.571	0.857	0.0	109.1	68.76	66.8	110.9
305	0.571	0.857	0.143	113.4	69.48	54.14	114.4
306	0.571	0.857	0.286	120.0	70.2	41.8	120.0
307	0.571	0.857	0.429	130.9	70.92	30.17	130.1
308	0.571	0.857	0.571	150.0	71.64	20.54	150.9
309	0.571	0.857	0.714	180.0	72.74	13.39	186.2
310	0.571	0.857	0.857	210.0	73.84	15.51	236.0
311	0.571	0.857	1.0	229.1	74.94	19.66	257.6
312	0.571	1.0	0.0	115.3	73.45	74.95	115.9
313	0.571	1.0	0.143	120.0	74.17	62.69	120.0
314	0.571	1.0	0.286	126.6	74.89	50.88	125.9
315	0.571	1.0	0.429	136.1	75.61	39.94	135.3
316	0.571	1.0	0.571	150.0	76.33	30.81	150.9
317	0.571	1.0	0.714	169.1	77.43	22.56	170.9
318	0.571	1.0	0.857	190.9	78.54	19.32	204.1
319	0.571	1.0	1.0	210.0	79.64	23.26	236.0

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
320	0.714	0.0	0.0	30.0	39.39	59.01	37.7
321	0.714	0.0	0.143	19.1	39.42	55.5	29.9
322	0.714	0.0	0.286	6.6	39.45	53.14	21.3
323	0.714	0.0	0.429	353.4	39.47	52.08	12.0
324	0.714	0.0	0.571	340.9	39.5	52.41	2.7
325	0.714	0.0	0.714	330.0	39.53	54.09	353.7
326	0.714	0.0	0.857	321.1	40.63	59.5	348.1
327	0.714	0.0	1.0	313.9	41.73	65.37	343.4
328	0.714	0.143	0.0	40.9	45.45	55.22	49.5
329	0.714	0.143	0.143	30.0	46.17	47.22	37.7
330	0.714	0.143	0.286	16.1	46.2	43.84	27.8
331	0.714	0.143	0.429	0.0	46.22	41.96	16.7
332	0.714	0.143	0.571	343.9	46.25	41.76	5.0
333	0.714	0.143	0.714	330.0	46.28	43.28	353.7
334	0.714	0.143	0.857	319.1	47.38	48.75	346.8
335	0.714	0.143	1.0	310.9	48.48	54.76	341.4
336	0.714	0.286	0.0	53.4	51.51	54.03	62.3
337	0.714	0.286	0.143	43.9	52.23	43.74	52.6
338	0.714	0.286	0.286	30.0	52.95	35.41	37.7
339	0.714	0.286	0.429	10.9	52.98	32.28	24.2
340	0.714	0.286	0.571	349.1	53.01	31.22	8.9
341	0.714	0.286	0.714	330.0	53.03	32.46	353.7
342	0.714	0.286	0.857	316.1	54.13	38.02	344.9
343	0.714	0.286	1.0	306.6	55.23	44.24	338.4
344	0.714	0.429	0.0	66.6	57.57	55.61	75.1
345	0.714	0.429	0.143	60.0	58.29	43.59	68.8
346	0.714	0.429	0.286	49.1	59.01	32.48	58.0
347	0.714	0.429	0.429	30.0	59.73	23.61	37.7
348	0.714	0.429	0.571	0.0	59.76	20.98	16.7
349	0.714	0.429	0.714	330.0	59.79	21.64	353.7
350	0.714	0.429	0.857	310.9	60.89	27.38	341.4
351	0.714	0.429	1.0	300.0	61.99	33.92	333.6
352	0.714	0.571	0.0	79.1	63.63	59.74	86.7
353	0.714	0.571	0.143	76.1	64.35	46.8	83.9
354	0.714	0.571	0.286	70.9	65.07	34.04	79.2
355	0.714	0.571	0.429	60.0	65.79	21.8	68.8
356	0.714	0.571	0.571	30.0	66.51	11.8	37.7
357	0.714	0.571	0.714	330.0	66.54	10.82	353.7
358	0.714	0.571	0.857	300.0	67.64	16.96	333.6
359	0.714	0.571	1.0	289.1	68.74	24.05	324.7
360	0.714	0.714	0.0	90.0	69.7	65.94	96.4
361	0.714	0.714	0.143	90.0	70.42	52.76	96.4
362	0.714	0.714	0.286	90.0	71.14	39.57	96.4
363	0.714	0.714	0.429	90.0	71.86	26.38	96.4
364	0.714	0.714	0.571	90.0	72.58	13.19	96.4
365	0.714	0.714	0.714	0.0	73.3	0.01	–
366	0.714	0.714	0.857	270.0	74.4	7.75	305.0
367	0.714	0.714	1.0	270.0	75.5	15.49	305.0
368	0.714	0.857	0.0	98.9	74.39	72.38	103.0
369	0.714	0.857	0.143	100.9	75.11	59.31	104.5
370	0.714	0.857	0.286	103.9	75.83	46.29	106.8
371	0.714	0.857	0.429	109.1	76.55	33.4	110.9
372	0.714	0.857	0.571	120.0	77.27	20.9	120.0
373	0.714	0.857	0.714	150.0	77.99	10.27	150.9
374	0.714	0.857	0.857	210.0	79.1	7.76	236.0
375	0.714	0.857	1.0	240.0	80.2	12.77	270.5
376	0.714	1.0	0.0	106.1	79.09	79.63	108.5
377	0.714	1.0	0.143	109.1	79.81	66.8	110.9
378	0.714	1.0	0.286	113.4	80.53	54.13	114.4
379	0.714	1.0	0.429	120.0	81.25	41.79	120.0
380	0.714	1.0	0.571	130.9	81.97	30.17	130.1
381	0.714	1.0	0.714	150.0	82.69	20.54	150.9
382	0.714	1.0	0.857	180.0	83.79	13.38	186.2
383	0.714	1.0	1.0	210.0	84.89	15.51	236.0

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
384	0.857	0.0	0.0	30.0	43.67	70.82	37.7
385	0.857	0.0	0.143	21.0	43.7	67.22	31.3
386	0.857	0.0	0.286	10.9	43.72	64.55	24.2
387	0.857	0.0	0.429	0.0	43.75	62.93	16.7
388	0.857	0.0	0.571	349.1	43.78	62.44	8.9
389	0.857	0.0	0.714	339.0	43.8	63.12	1.1
390	0.857	0.0	0.857	330.0	43.83	64.92	353.7
391	0.857	0.0	1.0	322.4	44.93	70.27	348.9
392	0.857	0.143	0.0	38.9	49.73	66.82	47.4
393	0.857	0.143	0.143	30.0	50.45	59.02	37.7
394	0.857	0.143	0.286	19.1	50.47	55.51	29.9
395	0.857	0.143	0.429	6.6	50.5	53.14	21.2
396	0.857	0.143	0.571	353.4	50.53	52.09	12.0
397	0.857	0.143	0.714	340.9	50.55	52.41	2.7
398	0.857	0.143	0.857	330.0	50.58	54.1	353.7
399	0.857	0.143	1.0	321.1	51.68	59.5	348.1
400	0.857	0.286	0.0	49.1	55.79	64.95	58.0
401	0.857	0.286	0.143	40.9	56.51	55.23	49.5
402	0.857	0.286	0.286	30.0	57.23	47.22	37.7
403	0.857	0.286	0.429	16.1	57.25	43.84	27.8
404	0.857	0.286	0.571	0.0	57.28	41.96	16.7
405	0.857	0.286	0.714	343.9	57.31	41.76	5.0
406	0.857	0.286	0.857	330.0	57.34	43.28	353.7
407	0.857	0.286	1.0	319.1	58.44	48.74	346.8
408	0.857	0.429	0.0	60.0	61.85	65.38	68.8
409	0.857	0.429	0.143	53.4	62.57	54.04	62.3
410	0.857	0.429	0.286	43.9	63.29	43.74	52.6
411	0.857	0.429	0.429	30.0	64.01	35.41	37.7
412	0.857	0.429	0.571	10.9	64.04	32.28	24.2
413	0.857	0.429	0.714	349.1	64.06	31.22	8.9
414	0.857	0.429	0.857	330.0	64.09	32.46	353.7
415	0.857	0.429	1.0	316.1	65.19	38.02	344.9
416	0.857	0.571	0.0	70.9	67.91	68.07	79.1
417	0.857	0.571	0.143	66.6	68.63	55.62	75.1
418	0.857	0.571	0.286	60.0	69.35	43.59	68.8
419	0.857	0.571	0.429	49.1	70.07	32.48	58.0
420	0.857	0.571	0.571	30.0	70.79	23.61	37.7
421	0.857	0.571	0.714	0.0	70.82	20.98	16.7
422	0.857	0.571	0.857	330.0	70.84	21.64	353.7
423	0.857	0.571	1.0	310.9	71.94	27.38	341.4
424	0.857	0.714	0.0	81.0	73.97	72.77	88.4
425	0.857	0.714	0.143	79.1	74.69	59.75	86.7
426	0.857	0.714	0.286	76.1	75.41	46.8	83.9
427	0.857	0.714	0.429	70.9	76.13	34.04	79.2
428	0.857	0.714	0.571	60.0	76.85	21.8	68.8
429	0.857	0.714	0.714	30.0	77.57	11.8	37.7
430	0.857	0.714	0.857	330.0	77.6	10.82	353.7
431	0.857	0.714	1.0	300.0	78.7	16.96	333.6
432	0.857	0.857	0.0	90.0	80.03	79.12	96.4
433	0.857	0.857	0.143	90.0	80.75	65.95	96.4
434	0.857	0.857	0.286	90.0	81.47	52.76	96.4
435	0.857	0.857	0.429	90.0	82.19	39.57	96.4
436	0.857	0.857	0.571	90.0	82.91	26.38	96.4
437	0.857	0.857	0.714	90.0	83.63	13.19	96.4
438	0.857	0.857	0.857	0.0	84.36	0.01	–
439	0.857	0.857	1.0	270.0	85.45	7.74	305.0
440	0.857	1.0	0.0	97.6	84.73	85.49	102.0
441	0.857	1.0	0.143	98.9	85.45	72.39	103.0
442	0.857	1.0	0.286	100.9	86.17	59.31	104.5
443	0.857	1.0	0.429	103.9	86.89	46.29	106.8
444	0.857	1.0	0.571	109.1	87.61	33.4	110.9
445	0.857	1.0	0.714	120.0	88.33	20.89	120.0
446	0.857	1.0	0.857	150.0	89.05	10.27	150.9
447	0.857	1.0	1.0	210.0	90.15	7.75	236.0

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
448	1.0	0.0	0.0	30.0	47.94	82.61	37.7
449	1.0	0.0	0.143	22.4	47.97	78.95	32.2
450	1.0	0.0	0.286	13.9	48.0	76.07	26.3
451	1.0	0.0	0.429	4.7	48.02	74.06	20.0
452	1.0	0.0	0.571	355.3	48.05	73.0	13.4
453	1.0	0.0	0.714	346.1	48.08	72.93	6.7
454	1.0	0.0	0.857	337.6	48.1	73.85	0.0
455	1.0	0.0	1.0	330.0	48.13	75.73	353.7
456	1.0	0.143	0.0	37.6	54.0	78.48	45.9
457	1.0	0.143	0.143	30.0	54.72	70.82	37.7
458	1.0	0.143	0.286	21.0	54.75	67.21	31.3
459	1.0	0.143	0.429	10.9	54.77	64.54	24.2
460	1.0	0.143	0.571	0.0	54.8	62.93	16.7
461	1.0	0.143	0.714	349.1	54.83	62.44	8.9
462	1.0	0.143	0.857	339.0	54.85	63.12	1.1
463	1.0	0.143	1.0	330.0	54.88	64.92	353.7
464	1.0	0.286	0.0	46.1	60.06	76.12	54.9
465	1.0	0.286	0.143	38.9	60.78	66.82	47.4
466	1.0	0.286	0.286	30.0	61.5	59.01	37.7
467	1.0	0.286	0.429	19.1	61.53	55.5	29.9
468	1.0	0.286	0.571	6.6	61.55	53.14	21.2
469	1.0	0.286	0.714	353.4	61.58	52.08	12.0
470	1.0	0.286	0.857	340.9	61.61	52.41	2.7
471	1.0	0.286	1.0	330.0	61.64	54.09	353.7
472	1.0	0.429	0.0	55.3	66.12	75.72	64.2
473	1.0	0.429	0.143	49.1	66.84	64.95	58.0
474	1.0	0.429	0.286	40.9	67.56	55.22	49.5
475	1.0	0.429	0.429	30.0	68.28	47.21	37.7
476	1.0	0.429	0.571	16.1	68.31	43.83	27.8
477	1.0	0.429	0.714	0.0	68.34	41.95	16.7
478	1.0	0.429	0.857	343.9	68.36	41.75	5.0
479	1.0	0.429	1.0	330.0	68.39	43.27	353.7
480	1.0	0.571	0.0	64.7	72.18	77.31	73.3
481	1.0	0.571	0.143	60.0	72.9	65.38	68.8
482	1.0	0.571	0.286	53.4	73.62	54.03	62.3
483	1.0	0.571	0.429	43.9	74.34	43.73	52.6
484	1.0	0.571	0.571	30.0	75.06	35.4	37.7
485	1.0	0.571	0.714	10.9	75.09	32.27	24.2
486	1.0	0.571	0.857	349.1	75.12	31.22	8.9
487	1.0	0.571	1.0	330.0	75.14	32.45	353.7
488	1.0	0.714	0.0	73.9	78.24	80.76	81.9
489	1.0	0.714	0.143	70.9	78.96	68.07	79.2
490	1.0	0.714	0.286	66.6	79.68	55.61	75.1
491	1.0	0.714	0.429	60.0	80.4	43.59	68.8
492	1.0	0.714	0.571	49.1	81.12	32.47	58.0
493	1.0	0.714	0.714	30.0	81.84	23.6	37.7
494	1.0	0.714	0.857	0.0	81.87	20.97	16.7
495	1.0	0.714	1.0	330.0	81.9	21.63	353.7
496	1.0	0.857	0.0	82.4	84.31	85.85	89.6
497	1.0	0.857	0.143	81.0	85.03	72.78	88.4
498	1.0	0.857	0.286	79.1	85.75	59.74	86.7
499	1.0	0.857	0.429	76.1	86.47	46.79	83.9
500	1.0	0.857	0.571	70.9	87.19	34.03	79.2
501	1.0	0.857	0.714	60.0	87.91	21.79	68.8
502	1.0	0.857	0.857	30.0	88.63	11.8	37.7
503	1.0	0.857	1.0	330.0	88.65	10.81	353.7
504	1.0	1.0	0.0	90.0	90.36	92.3	96.4
505	1.0	1.0	0.143	90.0	91.08	79.12	96.4
506	1.0	1.0	0.286	90.0	91.8	65.94	96.4
507	1.0	1.0	0.429	90.0	92.52	52.75	96.4
508	1.0	1.0	0.571	90.0	93.24	39.56	96.4
509	1.0	1.0	0.714	90.0	93.96	26.37	96.4
510	1.0	1.0	0.857	90.0	94.68	13.18	96.4
511	1.0	1.0	1.0	0.0	95.41	0.01	–

ME400−71, Table olv3* − LCH*a with 8x8x8 (=512) colours; Device dependent colour coordinates olv3* of ISO/IEC 15775:1999 as input; Page 2, System: ORS18a

BAM-reference table no. ME39 for OLV-8x8x8 colours
Table lab*olv − H*o, LAB*LCHa; System: ORS18a

input: *w* setgray*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME40/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table F.3 shows the *olv*-8x8x8 cube calculated for the linear relation *lab*olv* - *LAB*LCH*$_a$ of the device system ORS18a. The three *olv**$_3$ values change in steps of 0,143 = 1/7 in the sequence *v**$_3$, *l**$_3$, and *o**$_3$ for the colours *n* = 128 to 255. The *olv*-hue angle *H**$_o$ and the adapted CIELAB data *LCH**$_a$ are given in the table. For the six device systems ORS18a, TLS00, DRSXX, TRS18, SLS00, SRS18 and an *olv*-8x8x8 cube the tables are at the URL (12

pages, 440 kbyte)
http://www.ps.bam.de/ME40/10L/L40E00NP.PDF

Table F.4: ***OLV*-16x16x16 cube calculated for the relation *lab*olv* - *LAB*LCH*$_a$ of ORS18a.**

www.ps.bam.de/ME41/10L/L41E00NP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

BAM registration: 20040901-ME41/10L/L41E00NP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME41/ Form: 1/96, Serie: 1/1, Page: 1 Page count: 1

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
0	0.0	0.0	0.0	0.0	18.02	0.01	−
1	0.0	0.0	0.067	270.1	18.53	3.61	305.0
2	0.0	0.0	0.133	270.0	19.04	7.22	305.0
3	0.0	0.0	0.2	270.0	19.56	10.84	305.0
4	0.0	0.0	0.267	270.0	20.07	14.45	305.0
5	0.0	0.0	0.333	270.0	20.59	18.07	305.0
6	0.0	0.0	0.4	270.0	21.1	21.68	305.0
7	0.0	0.0	0.467	270.0	21.61	25.3	305.0
8	0.0	0.0	0.533	270.0	22.13	28.91	305.0
9	0.0	0.0	0.6	270.0	22.64	32.52	305.0
10	0.0	0.0	0.667	270.0	23.16	36.14	305.0
11	0.0	0.0	0.733	270.0	23.67	39.75	305.0
12	0.0	0.0	0.8	270.0	24.18	43.37	305.0
13	0.0	0.0	0.867	270.0	24.7	46.98	305.0
14	0.0	0.0	0.933	270.0	25.21	50.6	305.0
15	0.0	0.0	1.0	270.0	25.73	54.21	305.0
16	0.0	0.067	0.0	150.0	20.21	4.79	150.9
17	0.0	0.067	0.067	210.0	20.72	3.61	236.0
18	0.0	0.067	0.133	240.0	21.24	5.96	270.5
19	0.0	0.067	0.2	250.9	21.75	9.17	283.4
20	0.0	0.067	0.267	256.1	22.26	12.6	289.5
21	0.0	0.067	0.333	259.1	22.78	16.11	292.9
22	0.0	0.067	0.4	261.1	23.29	19.66	295.1
23	0.0	0.067	0.467	262.4	23.81	23.23	296.7
24	0.0	0.067	0.533	263.4	24.32	26.81	297.8
25	0.0	0.067	0.6	264.2	24.83	30.4	298.6
26	0.0	0.067	0.667	264.8	25.35	33.99	299.3
27	0.0	0.067	0.733	265.3	25.86	37.59	299.9
28	0.0	0.067	0.8	265.7	26.38	41.19	300.3
29	0.0	0.067	0.867	266.0	26.89	44.8	300.7
30	0.0	0.067	0.933	266.3	27.4	48.4	301.0
31	0.0	0.067	1.0	266.6	27.92	52.0	301.3
32	0.0	0.133	0.0	150.0	22.4	9.58	150.9
33	0.0	0.133	0.067	180.0	22.91	6.24	186.1
34	0.0	0.133	0.133	210.0	23.43	7.23	236.0
35	0.0	0.133	0.2	229.1	23.94	9.17	257.6
36	0.0	0.133	0.267	240.0	24.46	11.92	270.5
37	0.0	0.133	0.333	246.6	24.97	15.04	278.3
38	0.0	0.133	0.4	250.9	25.48	18.34	283.4
39	0.0	0.133	0.467	253.9	26.0	21.74	286.9
40	0.0	0.133	0.533	256.1	26.51	25.2	289.5
41	0.0	0.133	0.6	257.8	27.03	28.7	291.4
42	0.0	0.133	0.667	259.1	27.54	32.23	292.9
43	0.0	0.133	0.733	260.2	28.05	35.77	294.1
44	0.0	0.133	0.8	261.1	28.57	39.32	295.1
45	0.0	0.133	0.867	261.8	29.08	42.89	295.9
46	0.0	0.133	0.933	262.4	29.6	46.46	296.6
47	0.0	0.133	1.0	263.0	30.11	50.03	297.2
48	0.0	0.2	0.0	150.0	24.59	14.37	150.9
49	0.0	0.2	0.067	169.1	25.11	10.53	170.9
50	0.0	0.2	0.133	190.9	25.62	9.01	204.0
51	0.0	0.2	0.2	210.0	26.14	10.85	236.0
52	0.0	0.2	0.267	223.9	26.65	12.61	251.5
53	0.0	0.2	0.333	233.4	27.16	15.04	262.7
54	0.0	0.2	0.4	240.0	27.68	17.88	270.5
55	0.0	0.2	0.467	244.7	28.19	20.96	276.1
56	0.0	0.2	0.533	248.2	28.71	24.19	280.2
57	0.0	0.2	0.6	250.9	29.22	27.51	283.4
58	0.0	0.2	0.667	253.0	29.73	30.9	285.9
59	0.0	0.2	0.733	254.7	30.25	34.34	287.8
60	0.0	0.2	0.8	256.1	30.76	37.81	289.5
61	0.0	0.2	0.867	257.3	31.28	41.3	290.8
62	0.0	0.2	0.933	258.3	31.79	44.81	291.9
63	0.0	0.2	1.0	259.1	32.3	48.33	292.9

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
64	0.0	0.267	0.0	150.0	26.79	19.17	150.9
65	0.0	0.267	0.067	163.9	27.3	15.12	164.7
66	0.0	0.267	0.133	180.0	27.81	12.49	186.1
67	0.0	0.267	0.2	196.1	28.33	12.23	213.0
68	0.0	0.267	0.267	210.0	28.84	14.47	236.0
69	0.0	0.267	0.333	220.9	29.36	16.13	248.1
70	0.0	0.267	0.4	229.1	29.87	18.35	257.6
71	0.0	0.267	0.467	235.3	30.39	20.97	264.9
72	0.0	0.267	0.533	240.0	30.9	23.85	270.5
73	0.0	0.267	0.6	243.7	31.41	26.9	274.9
74	0.0	0.267	0.667	246.6	31.93	30.08	278.3
75	0.0	0.267	0.733	249.0	32.44	33.35	281.1
76	0.0	0.267	0.8	250.9	32.96	36.69	283.4
77	0.0	0.267	0.867	252.5	33.47	40.07	285.3
78	0.0	0.267	0.933	253.9	33.98	43.49	286.9
79	0.0	0.267	1.0	255.1	34.5	46.93	288.3
80	0.0	0.333	0.0	150.0	28.98	23.96	150.9
81	0.0	0.333	0.067	160.9	29.49	19.81	161.4
82	0.0	0.333	0.133	173.4	30.01	16.64	176.6
83	0.0	0.333	0.2	186.6	30.52	15.08	196.7
84	0.0	0.333	0.267	199.1	31.04	15.63	218.2
85	0.0	0.333	0.333	210.0	31.55	18.09	236.0
86	0.0	0.333	0.4	219.0	32.06	19.68	245.9
87	0.0	0.333	0.467	226.1	32.58	21.76	254.1
88	0.0	0.333	0.533	231.8	33.09	24.2	260.7
89	0.0	0.333	0.6	236.3	33.61	26.91	266.1
90	0.0	0.333	0.667	240.0	34.12	29.81	270.5
91	0.0	0.333	0.733	243.0	34.63	32.85	274.1
92	0.0	0.333	0.8	245.5	35.15	36.0	277.0
93	0.0	0.333	0.867	247.6	35.66	39.23	279.5
94	0.0	0.333	0.933	249.4	36.18	42.52	281.6
95	0.0	0.333	1.0	250.9	36.69	45.85	283.4
96	0.0	0.4	0.0	150.0	31.17	28.76	150.9
97	0.0	0.4	0.067	158.9	31.68	24.54	159.3
98	0.0	0.4	0.133	169.1	32.2	21.06	170.9
99	0.0	0.4	0.2	180.0	32.71	18.74	186.2
100	0.0	0.4	0.267	190.9	33.23	18.03	204.0
101	0.0	0.4	0.333	201.1	33.74	19.11	221.5
102	0.0	0.4	0.4	210.0	34.26	21.71	236.0
103	0.0	0.4	0.467	217.6	34.77	23.26	244.4
104	0.0	0.4	0.533	223.9	35.29	25.23	251.5
105	0.0	0.4	0.6	229.1	35.8	27.53	257.6
106	0.0	0.4	0.667	233.4	36.31	30.09	262.7
107	0.0	0.4	0.733	237.0	36.83	32.86	266.9
108	0.0	0.4	0.8	240.0	37.34	35.77	270.5
109	0.0	0.4	0.867	242.5	37.86	38.8	273.5
110	0.0	0.4	0.933	244.7	38.37	41.93	276.1
111	0.0	0.4	1.0	246.6	38.88	45.12	278.3
112	0.0	0.467	0.0	150.0	33.36	33.55	150.9
113	0.0	0.467	0.067	157.6	33.88	29.29	158.0
114	0.0	0.467	0.133	166.1	34.39	25.62	167.3
115	0.0	0.467	0.2	175.3	34.91	22.83	179.2
116	0.0	0.467	0.267	184.7	35.42	21.26	193.6
117	0.0	0.467	0.333	193.9	35.94	21.19	209.2
118	0.0	0.467	0.4	202.4	36.45	22.63	223.8
119	0.0	0.467	0.467	210.0	36.97	25.33	236.0
120	0.0	0.467	0.533	216.6	37.48	26.84	243.2
121	0.0	0.467	0.6	222.2	37.99	28.73	249.6
122	0.0	0.467	0.667	227.0	38.51	30.93	255.1
123	0.0	0.467	0.733	231.1	39.02	33.37	259.9
124	0.0	0.467	0.8	234.5	39.54	36.01	264.0
125	0.0	0.467	0.867	237.5	40.05	38.81	267.5
126	0.0	0.467	0.933	240.0	40.56	41.73	270.5
127	0.0	0.467	1.0	242.2	41.08	44.75	273.1

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
128	0.0	0.533	0.0	150.0	35.56	38.34	150.9
129	0.0	0.533	0.067	156.6	36.07	34.06	157.0
130	0.0	0.533	0.133	163.9	36.58	30.25	164.7
131	0.0	0.533	0.2	171.8	37.1	27.14	174.4
132	0.0	0.533	0.267	180.0	37.61	24.99	186.2
133	0.0	0.533	0.333	188.2	38.13	24.05	199.5
134	0.0	0.533	0.4	196.1	38.64	24.47	213.0
135	0.0	0.533	0.467	203.4	39.16	26.18	225.5
136	0.0	0.533	0.533	210.0	39.67	28.95	236.0
137	0.0	0.533	0.6	215.8	40.19	30.44	242.4
138	0.0	0.533	0.667	220.9	40.7	32.26	248.1
139	0.0	0.533	0.733	225.3	41.21	34.37	253.1
140	0.0	0.533	0.8	229.1	41.73	36.71	257.6
141	0.0	0.533	0.867	232.4	42.24	39.25	261.5
142	0.0	0.533	0.933	235.3	42.76	41.94	264.9
143	0.0	0.533	1.0	237.8	43.27	44.76	267.9
144	0.0	0.6	0.0	150.0	37.75	43.14	150.9
145	0.0	0.6	0.067	155.8	38.26	38.83	156.2
146	0.0	0.6	0.133	162.2	38.78	34.93	162.8
147	0.0	0.6	0.2	169.1	39.29	31.6	170.9
148	0.0	0.6	0.267	176.3	39.81	29.04	180.7
149	0.0	0.6	0.333	183.7	40.32	27.46	191.9
150	0.0	0.6	0.4	190.9	40.84	27.05	204.0
151	0.0	0.6	0.467	197.8	41.35	27.84	216.0
152	0.0	0.6	0.533	204.2	41.87	29.75	226.8
153	0.0	0.6	0.6	210.0	42.38	32.57	236.0
154	0.0	0.6	0.667	215.2	42.89	34.04	241.7
155	0.0	0.6	0.733	219.8	43.41	35.81	246.9
156	0.0	0.6	0.8	223.9	43.92	37.84	251.5
157	0.0	0.6	0.867	227.5	44.44	40.1	255.7
158	0.0	0.6	0.933	230.6	44.95	42.54	259.4
159	0.0	0.6	1.0	233.4	45.46	45.14	262.7
160	0.0	0.667	0.0	150.0	39.94	47.93	150.9
161	0.0	0.667	0.067	155.2	40.46	43.6	155.6
162	0.0	0.667	0.133	160.9	40.97	39.63	161.4
163	0.0	0.667	0.2	167.0	41.48	36.14	168.3
164	0.0	0.667	0.267	173.4	42.0	33.28	176.6
165	0.0	0.667	0.333	180.0	42.51	31.24	186.2
166	0.0	0.667	0.4	186.6	43.03	30.17	196.7
167	0.0	0.667	0.467	193.0	43.54	30.18	207.7
168	0.0	0.667	0.533	199.1	44.06	31.27	218.2
169	0.0	0.667	0.6	204.8	44.57	33.33	227.8
170	0.0	0.667	0.667	210.0	45.09	36.19	236.0
171	0.0	0.667	0.733	214.7	45.6	37.64	241.2
172	0.0	0.667	0.8	219.0	46.12	39.37	245.9
173	0.0	0.667	0.867	222.7	46.63	41.34	250.2
174	0.0	0.667	0.933	226.1	47.14	43.52	254.1
175	0.0	0.667	1.0	229.1	47.66	45.88	257.6
176	0.0	0.733	0.0	150.0	42.13	52.72	150.9
177	0.0	0.733	0.067	154.7	42.65	48.38	155.2
178	0.0	0.733	0.133	159.8	43.16	44.35	160.3
179	0.0	0.733	0.2	165.3	43.68	40.74	166.3
180	0.0	0.733	0.267	171.1	44.19	37.66	173.4
181	0.0	0.733	0.333	177.0	44.71	35.26	181.7
182	0.0	0.733	0.4	183.0	45.22	33.69	190.9
183	0.0	0.733	0.467	188.9	45.74	33.05	200.7
184	0.0	0.733	0.533	194.7	46.25	33.41	210.6
185	0.0	0.733	0.6	200.2	46.77	34.73	220.1
186	0.0	0.733	0.667	205.3	47.28	36.91	228.6
187	0.0	0.733	0.733	210.0	47.79	39.81	236.0
188	0.0	0.733	0.8	214.3	48.31	41.25	240.7
189	0.0	0.733	0.867	218.2	48.82	42.94	245.1
190	0.0	0.733	0.933	221.7	49.34	44.86	249.1
191	0.0	0.733	1.0	224.9	49.85	46.97	252.7

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
192	0.0	0.8	0.0	150.0	44.33	57.52	150.9
193	0.0	0.8	0.067	154.3	44.84	53.16	154.8
194	0.0	0.8	0.133	158.9	45.36	49.09	159.4
195	0.0	0.8	0.2	163.9	45.87	45.38	164.7
196	0.0	0.8	0.267	169.1	46.38	42.13	170.9
197	0.0	0.8	0.333	174.5	46.9	39.46	178.1
198	0.0	0.8	0.4	180.0	47.41	37.49	186.2
199	0.0	0.8	0.467	185.5	47.93	36.33	194.9
200	0.0	0.8	0.533	190.9	48.44	36.06	204.0
201	0.0	0.8	0.6	196.1	48.96	36.71	213.0
202	0.0	0.8	0.667	201.1	49.47	38.22	221.5
203	0.0	0.8	0.733	205.7	49.99	40.5	229.2
204	0.0	0.8	0.8	210.0	50.5	43.43	236.0
205	0.0	0.8	0.867	214.0	51.02	44.86	240.3
206	0.0	0.8	0.933	217.6	51.53	46.52	244.4
207	0.0	0.8	1.0	220.9	52.04	48.39	248.1
208	0.0	0.867	0.0	150.0	46.52	62.31	150.9
209	0.0	0.867	0.067	154.0	47.03	57.95	154.5
210	0.0	0.867	0.133	158.2	47.55	53.83	158.6
211	0.0	0.867	0.2	162.7	48.06	50.05	163.4
212	0.0	0.867	0.267	167.5	48.58	46.66	168.9
213	0.0	0.867	0.333	172.4	49.09	43.78	175.2
214	0.0	0.867	0.4	177.5	49.61	41.49	182.3
215	0.0	0.867	0.467	182.5	50.12	39.92	190.1
216	0.0	0.867	0.533	187.6	50.64	39.13	198.4
217	0.0	0.867	0.6	192.5	51.15	39.18	206.8
218	0.0	0.867	0.667	197.3	51.67	40.07	215.1
219	0.0	0.867	0.733	201.8	52.18	41.74	222.8
220	0.0	0.867	0.8	206.0	52.69	44.1	229.8
221	0.0	0.867	0.867	210.0	53.21	47.05	236.0
222	0.0	0.867	0.933	213.7	53.72	48.47	240.0
223	0.0	0.867	1.0	217.1	54.24	50.1	243.8
224	0.0	0.933	0.0	150.0	48.71	67.11	150.9
225	0.0	0.933	0.067	153.7	49.23	62.73	154.2
226	0.0	0.933	0.133	157.6	49.74	58.59	158.0
227	0.0	0.933	0.2	161.7	50.26	54.74	162.3
228	0.0	0.933	0.267	166.1	50.77	51.24	167.3
229	0.0	0.933	0.333	170.6	51.28	48.19	172.9
230	0.0	0.933	0.4	175.3	51.8	45.65	179.2
231	0.0	0.933	0.467	180.0	52.31	43.74	186.2
232	0.0	0.933	0.533	184.7	52.83	42.52	193.6
233	0.0	0.933	0.6	189.4	53.34	42.06	201.4
234	0.0	0.933	0.667	193.9	53.86	42.38	209.2
235	0.0	0.933	0.733	198.3	54.37	43.47	216.8
236	0.0	0.933	0.8	202.4	54.89	45.27	223.8
237	0.0	0.933	0.867	206.3	55.4	47.7	230.3
238	0.0	0.933	0.933	210.0	55.92	50.67	236.0
239	0.0	0.933	1.0	213.4	56.43	52.08	239.7
240	0.0	1.0	0.0	150.0	50.9	71.89	150.9
241	0.0	1.0	0.067	153.4	51.42	67.51	154.0
242	0.0	1.0	0.133	157.1	51.93	63.34	157.4
243	0.0	1.0	0.2	160.9	52.44	59.44	161.4
244	0.0	1.0	0.267	164.9	52.96	55.85	165.9
245	0.0	1.0	0.333	169.1	53.47	52.66	170.9
246	0.0	1.0	0.4	173.4	53.99	49.92	176.6
247	0.0	1.0	0.467	177.8	54.5	47.72	182.8
248	0.0	1.0	0.533	182.2	55.02	46.15	189.6
249	0.0	1.0	0.6	186.6	55.53	45.25	196.7
250	0.0	1.0	0.667	190.9	56.05	45.08	204.0
251	0.0	1.0	0.733	195.1	56.56	45.64	211.3
252	0.0	1.0	0.8	199.1	57.08	46.9	218.2
253	0.0	1.0	0.867	202.9	57.59	48.81	224.7
254	0.0	1.0	0.933	206.6	58.11	51.3	230.7
255	0.0	1.0	1.0	210.0	58.62	54.29	236.0

ME410−70Table olv3* − LCH*a with 16x16x16 (=4096) colours; Device dependent colour coordinates olv3* of ISO/IEC 15775:1999 as input; Page 1, System: ORS18a

BAM-reference table no. ME39 for OLV-16x16x16 colours
Table lab*olv − H*o, LAB*LCHa; System: ORS18a

input: *w* setgray*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME41/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table F.4 shows the *olv*-16x16x16 cube calculated for the linear relation *lab*olv* - *LAB*LCH*$_a$ of the device system ORS18a. The three *olv**$_3$ values change in steps of 0,067 = 1/15 in the sequence *v**$_3$, *l**$_3$, and *o**$_3$ for the colours *n* = 0 to 127. The *olv*-hue angle *H**$_o$ and the adapted CIELAB data *LCH**$_a$ are given in the table. The three rectangular data *olv**$_3$ form a rectangular OLV-16x16x16 cube. For the six device systems ORS18a, TLS00, DRSXX, TRS18,

SLS00, SRS18 and an *olv*-8x8x8 cube the tables are at the URL (96pages, 3,4 Mbyte)
http://www.ps.bam.de/ME41/10L/L41E00NP.PDF

Table F.5: *OLV*-16x16x16 cube calculated for linear relation *lab*olv* - *LAB*LCH*$_a$ of ORS18a.

BAM registration: 20040901-ME41/10L/L41E0FNP.PS/.PDF BAM material: code=rha4ta
application for measurement of printer systems

/ME41/ Form: 16/96Serie: 1/1, Page: 16 Page: count: 16

www.ps.bam.de/ME41/10L/L41E0FNP.PS/.PDF; start output
N: No Output Linearization (OL) data in File (F), Startup (S) or Device (D)

n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a	n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a	n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a	n	o*3	l*3	v*3	H*o	L*a	C*ab,a	H*a
3840	1.0	0.0	0.0	30.0	47.94	82.61	37.7	3904	1.0	0.267	0.0	44.9	59.25	76.33	53.7	3968	1.0	0.533	0.0	62.2	70.57	76.69	71.0	4032	1.0	0.8	0.0	79.1	81.88	83.63	86.7
3841	1.0	0.0	0.067	26.6	47.95	80.81	35.2	3905	1.0	0.267	0.067	41.7	59.59	71.93	50.4	3969	1.0	0.533	0.067	60.0	70.9	71.19	68.8	4033	1.0	0.8	0.067	78.3	82.22	77.58	85.9
3842	1.0	0.0	0.133	22.9	47.97	79.17	32.6	3906	1.0	0.267	0.133	38.2	59.92	67.8	46.6	3970	1.0	0.533	0.133	57.5	71.24	65.8	66.3	4034	1.0	0.8	0.133	77.3	82.55	71.54	85.0
3843	1.0	0.0	0.2	19.1	47.98	77.7	29.9	3907	1.0	0.267	0.2	34.3	60.26	64.0	42.4	3971	1.0	0.533	0.2	54.5	71.57	60.55	63.4	4035	1.0	0.8	0.2	76.1	82.89	65.51	83.9
3844	1.0	0.0	0.267	15.1	47.99	76.4	27.1	3908	1.0	0.267	0.267	30.0	60.6	60.59	37.7	3972	1.0	0.533	0.267	51.0	71.91	55.49	60.0	4036	1.0	0.8	0.267	74.7	83.23	59.52	82.7
3845	1.0	0.0	0.333	10.9	48.01	75.3	24.2	3909	1.0	0.267	0.333	25.3	60.61	58.81	34.3	3973	1.0	0.533	0.333	47.0	72.25	50.66	55.8	4037	1.0	0.8	0.333	73.0	83.56	53.56	81.1
3846	1.0	0.0	0.4	6.6	48.02	74.39	21.2	3910	1.0	0.267	0.4	20.2	60.62	57.26	30.6	3974	1.0	0.533	0.4	42.2	72.58	46.16	50.9	4038	1.0	0.8	0.4	70.9	83.9	47.65	79.2
3847	1.0	0.0	0.467	2.2	48.03	73.68	18.2	3911	1.0	0.267	0.467	14.7	60.63	55.95	26.8	3975	1.0	0.533	0.467	36.6	72.92	42.08	44.9	4039	1.0	0.8	0.467	68.2	84.23	41.81	76.7
3848	1.0	0.0	0.533	357.8	48.04	73.19	15.1	3912	1.0	0.267	0.533	8.9	60.65	54.9	22.9	3976	1.0	0.533	0.533	30.0	73.25	38.55	37.7	4040	1.0	0.8	0.533	64.7	84.57	36.08	73.4
3849	1.0	0.0	0.6	353.4	48.06	72.91	12.0	3913	1.0	0.267	0.6	3.0	60.66	54.12	18.8	3977	1.0	0.533	0.6	22.4	73.27	36.84	32.2	4041	1.0	0.8	0.6	60.0	84.91	30.51	68.8
3850	1.0	0.0	0.667	349.1	48.07	72.84	8.9	3914	1.0	0.267	0.667	357.0	60.67	53.62	14.6	3978	1.0	0.533	0.667	13.9	73.28	35.5	26.3	4042	1.0	0.8	0.667	53.4	85.24	25.21	62.3
3851	1.0	0.0	0.733	344.9	48.08	73.0	5.8	3915	1.0	0.267	0.733	351.1	60.68	53.42	10.3	3979	1.0	0.533	0.733	4.7	73.29	34.56	20.0	4043	1.0	0.8	0.733	43.9	85.58	20.4	52.6
3852	1.0	0.0	0.8	340.9	48.09	73.37	2.7	3916	1.0	0.267	0.8	345.3	60.7	53.52	6.0	3980	1.0	0.533	0.8	355.3	73.31	34.07	13.4	4044	1.0	0.8	0.8	30.0	85.91	16.52	37.7
3853	1.0	0.0	0.867	337.1	48.11	73.95	359.6	3917	1.0	0.267	0.867	339.8	60.71	53.91	1.8	3981	1.0	0.533	0.867	346.1	73.32	34.03	6.7	4045	1.0	0.8	0.867	10.9	85.93	15.05	24.2
3854	1.0	0.0	0.933	333.4	48.12	74.74	356.6	3918	1.0	0.267	0.933	334.7	60.72	54.58	357.7	3982	1.0	0.533	0.933	337.6	73.33	34.46	0.0	4046	1.0	0.8	0.933	349.1	85.94	14.56	8.9
3855	1.0	0.0	1.0	330.0	48.13	75.73	353.7	3919	1.0	0.267	1.0	330.0	60.73	55.54	353.7	3983	1.0	0.533	1.0	330.0	73.34	35.34	353.7	4047	1.0	0.8	1.0	330.0	85.95	15.14	353.7
3856	1.0	0.067	0.0	33.4	50.77	80.48	41.4	3920	1.0	0.333	0.0	49.1	62.08	75.77	58.0	3984	1.0	0.6	0.0	66.6	73.4	77.85	75.1	4048	1.0	0.867	0.0	82.9	84.71	86.24	90.1
3857	1.0	0.067	0.067	30.0	51.1	77.11	37.7	3921	1.0	0.333	0.067	46.1	62.42	71.05	54.9	3985	1.0	0.6	0.067	64.7	73.73	72.16	73.4	4049	1.0	0.867	0.067	82.4	85.05	80.13	89.6
3858	1.0	0.067	0.133	26.3	51.11	75.31	35.0	3922	1.0	0.333	0.133	42.7	62.75	66.57	51.4	3986	1.0	0.6	0.133	62.5	74.07	66.54	71.3	4050	1.0	0.867	0.133	81.8	85.38	74.02	89.1
3859	1.0	0.067	0.2	22.4	51.13	73.69	32.2	3923	1.0	0.333	0.2	38.9	63.09	62.37	47.4	3987	1.0	0.6	0.2	60.0	74.4	61.02	68.8	4051	1.0	0.867	0.2	81.0	85.72	67.92	88.4
3860	1.0	0.067	0.267	18.3	51.14	72.25	29.3	3924	1.0	0.333	0.267	34.7	63.42	58.51	42.8	3988	1.0	0.6	0.267	57.0	74.74	55.64	65.9	4052	1.0	0.867	0.267	80.2	86.05	61.83	87.6
3861	1.0	0.067	0.333	13.9	51.15	71.0	26.3	3925	1.0	0.333	0.333	30.0	63.76	55.08	37.7	3989	1.0	0.6	0.333	53.4	75.08	50.43	62.3	4053	1.0	0.867	0.333	79.1	86.39	55.76	86.7
3862	1.0	0.067	0.4	9.4	51.17	69.96	23.2	3926	1.0	0.333	0.4	24.8	63.77	53.31	33.9	3990	1.0	0.6	0.4	49.1	75.41	45.46	58.0	4054	1.0	0.867	0.4	77.8	86.73	49.7	85.5
3863	1.0	0.067	0.467	4.7	51.18	69.13	20.0	3927	1.0	0.333	0.467	19.1	63.79	51.8	29.9	3991	1.0	0.6	0.467	43.9	75.75	40.82	52.6	4055	1.0	0.867	0.467	76.1	87.06	43.67	83.9
3864	1.0	0.067	0.533	0.0	51.19	68.52	16.7	3928	1.0	0.333	0.533	13.0	63.8	50.55	25.7	3992	1.0	0.6	0.533	37.6	76.08	36.62	45.9	4056	1.0	0.867	0.533	73.9	87.4	37.69	81.9
3865	1.0	0.067	0.6	355.3	51.2	68.14	13.4	3929	1.0	0.333	0.6	6.6	63.81	49.59	21.2	3993	1.0	0.6	0.6	30.0	76.42	33.04	37.7	4057	1.0	0.867	0.6	70.9	87.73	31.76	79.2
3866	1.0	0.067	0.667	350.6	51.22	67.99	10.0	3930	1.0	0.333	0.667	0.0	63.82	48.94	16.7	3994	1.0	0.6	0.667	21.0	76.43	31.36	31.3	4058	1.0	0.867	0.667	66.6	88.07	25.95	75.1
3867	1.0	0.067	0.733	346.1	51.23	68.08	6.7	3931	1.0	0.333	0.733	353.4	63.84	48.61	12.0	3995	1.0	0.6	0.733	10.9	76.44	30.12	24.2	4059	1.0	0.867	0.733	60.0	88.41	20.34	68.8
3868	1.0	0.067	0.8	341.7	51.24	68.39	3.3	3932	1.0	0.333	0.8	347.0	63.85	48.6	7.3	3996	1.0	0.6	0.8	0.0	76.46	29.36	16.7	4060	1.0	0.867	0.8	49.1	88.74	15.15	58.0
3869	1.0	0.067	0.867	337.6	51.25	68.94	0.0	3933	1.0	0.333	0.867	340.9	63.86	48.91	2.7	3997	1.0	0.6	0.867	349.1	76.47	29.14	8.9	4061	1.0	0.867	0.867	30.0	89.08	11.01	37.7
3870	1.0	0.067	0.933	333.7	51.27	69.7	356.8	3934	1.0	0.333	0.933	335.2	63.87	49.55	358.1	3998	1.0	0.6	0.933	339.0	76.48	29.45	1.1	4062	1.0	0.867	0.933	0.0	89.09	9.78	16.7
3871	1.0	0.067	1.0	330.0	51.28	70.69	353.7	3935	1.0	0.333	1.0	330.0	63.89	50.49	353.7	3999	1.0	0.6	1.0	330.0	76.49	30.29	353.7	4063	1.0	0.867	1.0	330.0	89.1	10.09	353.7
3872	1.0	0.133	0.0	37.0	53.59	78.7	45.4	3936	1.0	0.4	0.0	53.4	64.91	75.64	62.3	4000	1.0	0.667	0.0	70.9	76.22	79.41	79.2	4064	1.0	0.933	0.0	86.6	87.54	89.14	93.4
3873	1.0	0.133	0.067	33.7	53.93	74.99	41.7	3937	1.0	0.4	0.067	50.6	65.25	70.64	59.5	4001	1.0	0.667	0.067	69.4	76.56	73.56	77.7	4065	1.0	0.933	0.067	86.3	87.87	83.0	93.1
3874	1.0	0.133	0.133	30.0	54.27	71.6	37.7	3938	1.0	0.4	0.133	47.5	65.58	65.81	56.3	4002	1.0	0.667	0.133	67.6	76.9	67.76	76.1	4066	1.0	0.933	0.133	86.0	88.21	76.86	92.9
3875	1.0	0.133	0.2	26.0	54.28	69.81	34.8	3939	1.0	0.4	0.2	43.9	65.92	61.23	52.6	4003	1.0	0.667	0.2	65.5	77.23	62.03	74.1	4067	1.0	0.933	0.2	85.7	88.55	70.72	92.6
3876	1.0	0.133	0.267	21.8	54.29	68.21	31.8	3940	1.0	0.4	0.267	39.8	66.25	56.94	48.3	4004	1.0	0.667	0.267	63.0	77.57	56.38	71.7	4068	1.0	0.933	0.267	85.3	88.88	64.58	92.2
3877	1.0	0.133	0.333	17.3	54.3	66.8	28.6	3941	1.0	0.4	0.333	35.2	66.59	53.03	43.4	4005	1.0	0.667	0.333	60.0	77.9	50.85	68.8	4069	1.0	0.933	0.333	84.8	89.22	58.44	91.8
3878	1.0	0.133	0.4	12.5	54.32	65.61	25.3	3942	1.0	0.4	0.4	30.0	66.93	49.57	37.7	4006	1.0	0.667	0.4	56.3	78.24	45.48	65.2	4070	1.0	0.933	0.4	84.2	89.55	52.31	91.2
3879	1.0	0.133	0.467	7.6	54.33	64.64	21.9	3943	1.0	0.4	0.467	24.2	66.94	47.82	33.5	4007	1.0	0.667	0.467	51.8	78.58	40.34	60.7	4071	1.0	0.933	0.467	83.4	89.89	46.18	90.5
3880	1.0	0.133	0.533	2.5	54.34	63.9	18.4	3944	1.0	0.4	0.533	17.8	66.95	46.35	29.0	4008	1.0	0.667	0.533	46.1	78.91	35.52	54.9	4072	1.0	0.933	0.533	82.4	90.23	40.06	89.6
3881	1.0	0.133	0.6	357.5	54.36	63.41	14.9	3945	1.0	0.4	0.6	10.9	66.96	45.18	24.2	4009	1.0	0.667	0.6	38.9	79.25	31.18	47.4	4073	1.0	0.933	0.6	81.0	90.56	33.96	88.4
3882	1.0	0.133	0.667	352.4	54.37	63.16	11.3	3946	1.0	0.4	0.667	3.7	66.98	44.34	19.2	4010	1.0	0.667	0.667	30.0	79.58	27.53	37.7	4074	1.0	0.933	0.667	79.1	90.9	27.88	86.7
3883	1.0	0.133	0.733	347.5	54.38	63.17	7.7	3947	1.0	0.4	0.733	356.3	66.99	43.84	14.1	4011	1.0	0.667	0.733	19.1	79.6	25.9	29.9	4075	1.0	0.933	0.733	76.1	91.23	21.83	84.0
3884	1.0	0.133	0.8	342.7	54.39	63.42	4.1	3948	1.0	0.4	0.8	349.1	67.0	43.71	8.9	4012	1.0	0.667	0.8	6.6	79.61	24.79	21.2	4076	1.0	0.933	0.8	70.9	91.57	15.88	79.2
3885	1.0	0.133	0.867	338.2	54.41	63.92	0.5	3949	1.0	0.4	0.867	342.2	67.01	43.93	3.7	4013	1.0	0.667	0.867	353.4	79.62	24.3	12.0	4077	1.0	0.933	0.867	60.0	91.91	10.16	68.8
3886	1.0	0.133	0.933	334.0	54.42	64.66	357.0	3950	1.0	0.4	0.933	335.8	67.03	44.52	358.6	4014	1.0	0.667	0.933	340.9	79.63	24.45	2.7	4078	1.0	0.933	0.933	30.0	92.24	5.5	37.7
3887	1.0	0.133	1.0	330.0	54.43	65.64	353.7	3951	1.0	0.4	1.0	330.0	67.04	45.44	353.7	4015	1.0	0.667	1.0	330.0	79.65	25.24	353.7	4079	1.0	0.933	1.0	330.0	92.25	5.04	353.7
3888	1.0	0.2	0.0	40.9	56.42	77.31	49.5	3952	1.0	0.467	0.0	57.8	67.74	75.95	66.7	4016	1.0	0.733	0.0	75.1	79.05	81.35	83.0	4080	1.0	1.0	0.0	90.0	90.36	92.3	96.4
3889	1.0	0.2	0.067	37.6	56.76	73.25	45.9	3953	1.0	0.467	0.067	55.3	68.07	70.68	64.2	4017	1.0	0.733	0.067	73.9	79.39	75.38	81.9	4081	1.0	1.0	0.067	90.0	90.7	86.16	96.4
3890	1.0	0.2	0.133	34.0	57.1	69.49	42.0	3954	1.0	0.467	0.133	52.4	68.41	65.55	61.3	4018	1.0	0.733	0.133	72.5	79.72	69.44	80.7	4082	1.0	1.0	0.133	90.0	91.03	80.0	96.4
3891	1.0	0.2	0.2	30.0	57.43	66.09	37.7	3955	1.0	0.467	0.2	49.1	68.75	60.62	58.0	4019	1.0	0.733	0.2	70.9	80.06	63.53	79.2	4083	1.0	1.0	0.2	90.0	91.37	73.85	96.4
3892	1.0	0.2	0.267	25.7	57.44	64.31	34.6	3956	1.0	0.467	0.267	45.3	69.08	55.93	54.1	4020	1.0	0.733	0.267	68.9	80.4	57.68	77.3	4084	1.0	1.0	0.267	90.0	91.71	67.69	96.4
3893	1.0	0.2	0.333	21.0	57.46	62.73	31.3	3957	1.0	0.467	0.333	40.9	69.42	51.54	49.5	4021	1.0	0.733	0.333	66.6	80.73	51.91	75.1	4085	1.0	1.0	0.333	90.0	92.04	61.54	96.4
3894	1.0	0.2	0.4	16.1	57.47	61.37	27.8	3958	1.0	0.467	0.4	35.8	69.75	47.55	44.0	4022	1.0	0.733	0.4	63.7	81.07	46.22	72.4	4086	1.0	1.0	0.4	90.0	92.38	55.38	96.4
3895	1.0	0.2	0.467	10.9	57.48	60.24	24.2	3959	1.0	0.467	0.467	30.0	70.09	44.06	37.7	4023	1.0	0.733	0.467	60.0	81.4	40.68	68.8	4087	1.0	1.0	0.467	90.0	92.71	49.23	96.4
3896	1.0	0.2	0.533	5.5	57.49	59.36	20.5	3960	1.0	0.467	0.533	23.4	70.1	42.33	32.9	4024	1.0	0.733	0.533	55.3	81.74	35.34	64.2	4088	1.0	1.0	0.533	90.0	93.05	43.07	96.4
3897	1.0	0.2	0.6	0.0	57.51	58.73	16.7	3961	1.0	0.467	0.6	16.1	70.12	40.91	27.8	4025	1.0	0.733	0.6	49.1	82.08	30.31	58.0	4089	1.0	1.0	0.6	90.0	93.39	36.92	96.4
3898	1.0	0.2	0.667	354.5	57.52	58.37	12.8	3962	1.0	0.467	0.667	8.2	70.13	39.84	22.4	4026	1.0	0.733	0.667	40.9	82.41	25.77	49.5	4090	1.0	1.0	0.667	90.0	93.72	30.77	96.4
3899	1.0	0.2	0.733	349.1	57.53	58.28	8.9	3963	1.0	0.467	0.733	0.0	70.14	39.15	16.7	4027	1.0	0.733	0.733	30.0	82.75	22.03	37.7	4091	1.0	1.0	0.733	90.0	94.06	24.61	96.4
3900	1.0	0.2	0.8	343.9	57.55	58.46	5.0	3964	1.0	0.467	0.8	351.8	70.15	38.86	10.8	4028	1.0	0.733	0.8	16.1	82.76	20.45	27.8	4092	1.0	1.0	0.8	90.0	94.39	18.46	96.4
3901	1.0	0.2	0.867	339.0	57.56	58.91	1.1	3965	1.0	0.467	0.867	343.9	70.17	38.97	5.0	4029	1.0	0.733	0.867	0.0	82.77	19.57	16.7	4093	1.0	1.0	0.867	90.0	94.73	12.3	96.4
3902	1.0	0.2	0.933	334.3	57.57	59.62	357.3	3966	1.0	0.467	0.933	336.6	70.18	39.49	359.2	4030	1.0	0.733	0.933	343.9	82.79	19.48	5.0	4094	1.0	1.0	0.933	89.9	95.07	6.15	96.4
3903	1.0	0.2	1.0	330.0	57.58	60.59	353.7	3967	1.0	0.467	1.0	330.0	70.19	40.39	353.7	4031	1.0	0.733	1.0	330.0	82.8	20.19	353.7	4095	1.0	1.0	1.0	0.0	95.41	0.01	−

ME410−715Table olv3* − LCH*a with 16x16x16 (=4096) colours; Device dependent colour coordinates olv3* of ISO/IEC 15775:1999 as input; Page 16, System: ORS18a

BAM-reference table no. ME39 for OLV-16x16x16 colours
Table lab*olv − H*o, LAB*LCHa; System: ORS18a

input: *w* setgray*
output: *no change compared to input*

See for similar files: http://www.ps.bam.de/ME41/
Technical information: http://www.ps.bam.de Version 2.1, io=1,1

Table F.5 shows the *olv*-16x16x16 cube calculated for the linear relation *lab*olv* - *LAB*LCH*$_a$ of the device system ORS18a. The three *olv**$_3$ values change in steps of 0,067 = 1/15 in the sequence *v**$_3$, *l**$_3$, and *o**$_3$ for the colours *n* = 3840 to 4095. The *olv*-hue angle *H**$_o$ and the adapted CIELAB data *LCH**$_a$ are given in the table. The three rectangular data *olv**$_3$ form a rectangular OLV-16x16x16 cube. For an input of the *olv*-16x16x16 cube colour data the colour output shall be measured, see a file at the URL (16 pages, 290 kbyte)

http://www.ps.bam.de/LE29/10L/L29E00NP.PDF

This Technical Report and this Annex does not specify how to create the ICC profiles for the different applications. The normal procedures can be taken to make the appropriate Lookup Tables, for example for 16x16x16 colours.

For a linearized device the Tables for 5x5x5 = 125 or 8x8x8 =512 or 16x16x16 =4096 colours give for the device data *lab*olv = rgb** the appropriate *adapted* CIELAB data LAB^*LCH_a, which have a linear relation to the *standard* CIELAB data *LAB*LCH* according to Annex A.

One may use for example the file

If a similar table has been measured for the same device, then **the table data for the eight basic colours are the same** and there are usually deviations for the intermediate colours.

With two Lookup Tables

rgb – LAB**

$rgb – LAB^*_{output}$

one can produce for the same *LAB** data a new Lookup Table

*rgb – rgb**

which linearizes the output device in the CIELAB space if used internally, compare the method for output linearization with relative CIELAB data *lab** according to ISO/IEC TR 19797.

Without using ICC profiles another method **for output linearization** is the use of appropriate *PostScript* code in the *Start-up Directory* of the software *Adobe Acrobat Distiller.* This allows to produce the same output, compare the method for output linearization with relative CIELAB data *lab** according to ISO/IEC TR 19797.

Without using ICC profiles the method of this Technical Report may be used to produce the **same output for equivalent colorimetric data**. The use of appropriate *PostScript* code in the *Start-up Directory* of the software *Adobe Acrobat Distiller* is one possibility to produce the same output, compare the method for output linearization in relative CIELAB according to ISO/IEC TR 19797.

The method of this Technical Report may be used for **rendering or re-rendering** for company or user specific needs without using ICC profiles or in combination with ICC profiles.

The RLAB *lab** (2005) ICC profile according to this Technical Report is an instance of the RLAB *lab** (2005) color image encoding. It may be included in software applications and in ISO/IEC-test chart files.

Example profiles may be downloaded from

http://www.ps.bam.de

The RLAB *lab** (2005) ICC profile is constructed as follows, using the ICC Profile Format:

NOTE: The following section needs a lot of corrections to be specified later. There may be families of ICC data.

Specification, Version 3.4,1997. ???

Specific header fields shall be set as follows:

Preferred CMM = RLAB ???

Specification version = 2.1.0 ???

Profile class = mntr ???

Color space = RGB ???

PCS space = XYZ ???

PCS Illuminant = f6d6, 10000, d32d (all values are hexadecimal) ???

The ASCII part of the desc tag shall be set to RLAB *lab** (2005) ???

The cprt tag shall include Copyright RLAB *lab** (2005)

The rXYZ tag shall be set to 9c18, 348d, 2631 ???

The gXYZ tag shall be set to 4fa5, a02c, 102f ???

The bXYZ tag shall be set to 04fc, 0f95, be9c ???

The wtpt tag shall be set to f351, 10000, 116cc ???

The rTRC, gTRC, bTRC tags shall specify a gamma curve using a gamma value of 0233 ???

Other required fields shall be set according to the ICC profile specification. ???

Annex G:
Practical tolerances for output of RLAB *lab** (2005)-encoded data

This Annex H is preliminary and needs further corrections

Remarks on tolerances in CIELAB and RLAB

No tolerances are specified in RLAB *lab** (2005) Color Image Encoding up to now.

The tolerances may be based on geometric differences in the double cone space NCCS. The three rectangular or circular coordinates RLAB *lab*tab* or *lab*tch* may be used.

ISO/IEC 15775:1999 specifies in Annex G a mean tolerance of 3 CIELAB for the colour difference between the original and a colour copy for the 14 chromatic CIE-test colours and the five achromatic colours.

In section 4 of this Technical Report the reference conditions for RLAB *lab** (2005) are defined. This section may provide tolerances for output on printers and displays.

It is important to make a distinction between the RLAB *lab** (2005) Color Image Encoding as a reference encoding and any physical device approximating this encoding. As a reference encoding, the RLAB *lab** (2005) Color Image Encoding is exact, with no tolerances or variations in color appearance.

However, physical devices will usually exhibit variations from an ideal design specification for a number of reasons. Thus, an RLAB *lab** (2005)-compatible device is one that sufficiently approximates the reference RLAB *lab** (2005) Color Image Encoding within acceptable tolerances so that users may approximate an accurate view of RLAB *lab** (2005) encoded images.

By definition for an RLAB *lab** (2005) encoded image when viewed across a range of devices, all within accepted tolerances, the output may appear very different on each device. Of course, the most accurate color reproduction occurs when devices exactly match the reference. If the output gamut is for all hue larger compared to the input gamut a *absolute* colorimetric reproduction is possible. This kind of reproduction is not intended in this Technical report. This Technical Report likes to fill the available output gamut with for the output colours.

By definition the hue and *relative* chroma remains constant for the *relative* reproduction of this Technical Report. Therefore within a hue triangle the triangle lightness ***t**** does not change but the *relative* CIELAB lightness ***l**** and the standard CIELAB lightness *L** may change a lot.

Parameter Tolerances for viewing RLAB *lab (2005)-encoded data on a calibrated device system:**

Device System White W

The white luminance should be within the range 100 to 400 cd/m^2. It is assumed that additional re-rendering will be required for luminance levels outside this range.

Luminance contrast ratio

The luminance contrast ratio should be within the range 2 : 1 to 200 : 1.

Device System Black

The black colour luminance level is limited only by the above restrictions on the display white point luminance and contrast ratio.

Color space data

The *standard* CIELAB data *LAB* LCH* are used for all *absolute* comparisons.

The 14 CIE-test colours according to CIE Publication 13.3 may be used for the *absolute* comparisons. The comparison method is described in Annex G of ISO/IEC 15775:1999 and in Annex G of ISO/IEC TR 24705:24705

The *relative* CIELAB data *lab*tch* are used for all *relative* comparisons.

The 14 CIE-test colours according to CIE Publication 13.3 may be transferred for the different viewing situations, compare the transfer of basic Colours in Annex A for different viewing situations. The method described in Annex G of ISO/IEC 15775:1999 and ISO/IEC TR 24705:24705 shall be modified for the *relative* comparisons

Ambient illumination level

The ambient illuminance level shall be limited for luminous colours on projection screens to half of the white illuminance level. The large illuminance level variations of the “Black” between 0,2% and 50% of the White illuminance will lead to large changes of luminance contrast level

Ambient Illumination chromaticity

The ambient illumination chromaticity may be D65 to D50.

Device system surround

The luminance of the border can be lower than 20% when this does not measurably affect the viewer’s adapted state.

Annex H: NCS hue circle and *adapted* CIELAB data LAB^*_a for c^*=1 and n^*=0

The Swedish standard series SS 01 91 00 to 03:1982 specifies the CIE tristimulus values *X, Y, Z* of the NCS colour system. The Swedish standard SS 01 91 03 includes the CIE tristimulus values X, Y, Z and CIE chromaticity (x, y) for 40 hues of a elementary hue circle.

In the Swedish standard series the CIE standard illuminant C with the chromaticity (x_C= 0,3127, y_C= 0,3290) was used. This chromaticity is very near to the chromaticity of the CIE standard illuminant D65 with the chromaticity (x_{D65} = 0,3127, y_{D65} = 0,3290). In the Swedish standard series for all the 40 hues the CIE data for the chromaticness ***c**** = 0,9 and the blackness ***n**** = 0 are listed. The blackness ***n**** of this Technical Report is called ***s*** In the Swedish standard series and varies between 0 for white and 1 for black. The data for ***c**** = 1 and ***n**** = 0 are missing.

The four elementary hues RJGB in this Technical Report are called RYGB in the Swedish standard series.

The hue circle is counted in the mathematical (anticlockwise) direction in this Technical Report and counted clockwise in the Swedish standard series. The following list include the both data

Table H.1: NCS and NCCS code for 40 hues and CIE tristimulus values and chromaticities

NCS Code			NCCS Code			CIE tristimulus values			CIE chromaticity	
s	c	ϕ	n*	c*	e*	X	Y	Z	x	y
00	90	Y	0,0	0,9	j	75,67	80,20	5,36	0,4693	0,4974
00	90	Y10R	0,0	0,9	r90j	76,63	75,06	5,06	0,4889	0,4789
...										
00	90	Y90R	0,0	0,9	r10j	40,64	22,79	6,34	0,5825	0,3266
00	90	R	0,0	0,9	r	38,27	20,12	7,97	0,5767	0,3032
00	90	R10B	0,0	0,9	b90r	38,32	19,45	12,08	0,5486	0,27,85
...										
00	90	R90B	0,0	0,9	b10j	22,38	20,47	100,66	0,1559	0,1426
00	90	B	0,0	0,9	b	12,19	13,19	62,34	0,1390	0,1504
00	90	B10G	0,0	0,9	b90g	17,82	24,87	85,90	0,1386	0,1934
...										
00	90	B90G	0,0	0,9	b10g	11,42	34,41	35,90	0,1397	0,4210
00	90	G	0,0	0,9	g	12,16	35,72	22,99	0,1716	0,5040
00	90	G10Y	0,0	0,9	g90j	15,15	37,15	13,63	0,2298	0,5635
...										
00	90	G90Y	0,0	0,9	g10j	69,72	78,71	5,52	0,4529	0,5113

NOTE There is still a possibility to define the notation more in the direction of the NCS system, for example using capital letters for RJGB and to use the clockwise hue definition of NCS.

There seem to be two different ways to get the missing data for ***c**** = 1,0 and ***n**** = 0,0:

1. The Swedish standard SS 01 91 01 91 01 may include the missing data.
2. The data of the Swedish standard SS 01 91 02 for ***c**** = 0,9 and ***n**** = 0 may be used to calculate the data for ***c**** = 1 and ***n**** = 0 using the adapted CIELAB data LAB^*_a of both White and the colour with ***c**** = 0,9 and ***n**** = 0 (see above list) for extrapolation.

There is another problem with the NCS data: The *achromatic* colours are in the range between blackness ***n**** = 0,05 and ***n**** = 0,95 instead of the range between ***n**** = 0 and ***n**** = 1. The CIE tristimulus values for the two samples with this backness are:

Y_W = 87,21 (for ***n**** = 0,05) and Y_N = 1,85 (for ***n**** = 0,95).

Reference: L.Sivik A.Hard and G.Tonnquist: NCS, natural color system--from concept to research and applications. part I and part II, Color Res.Appl., Vol.21, No.3, pp.180-220 (1996).

Annex I: Information on web sites

Organisations with Internet addresses for additional information:

ISO: International Organization for Standardization, 1 Rue de Framable, CH–1211 Geneva, Switzerland

http://www.iso.ch

ISO/IEC JTC1 SC28: Information technology – Japan Business Machine and Information System Industries Association (JBMIA)

http://www.jbmia.or.jp/sc28

Shuuwa Dai-ni Tranomon Bldg., 8th Floor,1-21-19 Tranomon, Minato-ku, Tokyo 105
Tel.No. +81-3-3503-9821, Fax.No. +81-3-3591-3646

Sc28 documents related to this Draft Technical Report are: N607 (first draft ISO/IEC/WD1 24705; 2003-08), N656 (ISO/IEC/PDTR 24705:2004-01)

DIN: Deutsches Institut für Normung e.V., Burggrafenstrasse 6, D–10787 Berlin, Germany

http://www.din.de

DIN NI-28: Information technology – Office systems

http://www.din.de/33866 (digital DIN-test charts according to DIN 33866)

NOTE 1: Four digital DIN-test charts are available as *PostScript-(PS)* and *PDF*-files with text in english and german language and in different resolutions
NOTE 2: Four analog DIN-test charts are available as test patterns.

BAM: Federal Institute for Materials Research and Testing, Unter den Eichen 87, D–12200 Berlin, Germany

http://www.bam.de

BAM VIII.34: Visual methods and image reproduction

http://www.ps.bam.de

NOTE 1: Four digital ISO/IEC-test charts no. 1 to 4 are available as *PostScript-(PS)* and *PDF*-files with colours defined in four device coordinates *cmy0*, w*, olv*, and 000n** and absolute CIELAB coordinates *L*a*b** with text in english or in german language and in different resolutions
NOTE 2: Four analog ISO/IEC-test charts no. 1 to 4 in reflectance mode are available as test pattern from two different manufacturers
NOTE 3: Four analog ISO/IEC-test charts no. 3 are available as transparencies which give equally spaced series for the luminance reflectances Y_r = 0, 2,5, 5,0 and 7,5.

PostScript and the *Portable Document Format* are Trademarks of *Adobe Systems Incorporated*.
For definition see:
Adobe Systems Incorporated, *PostScript* Language Reference Manual, Second edition, Addison-Wesley, 1990, ISBN 0–201–10174–2.
Adobe Systems Incorporated, *Portable Document Format*, Reference Manual, Addison-Wesley, 1993, ISBN 0–201–62628–4.

NOTE: The *PostScript*-Code of many figures used for analog and digital ISO/IEC- and DIN-test charts were taken from a book and a CD-ROM: Klaus Richter, Computergrafik und Farbmetrik, VDE-Verlag GMBH, Berlin, 1996, ISBN 3–8007–1775–1 by agreement of the publisher.

Author of this "white paper" for different standard documents in the field of image technology

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