Applications of digital and analog ISO/IEC-test charts for specifying image reproduction of copiers, printers, scanners and monitors according to ISO/IEC 15775 and ISO/IEC DIS 19839-1 to 4

Klaus RICHTER, Prof. Dr.
Federal Institute of Materials Research and Testing (BAM)
Head of Project Group: Visual Methods and Image Reproduction for NDT
Unter den Eichen 87
D-12200 Berlin, Germany
email: klaus.richter@bam.de
internet: http://www.ps.bam.de or http://o2.ps.bam.de

ABSTRACT

Four ISO/IEC-test charts in different modes (halftone and continuous tone, in reßectance and transmittance mode) have been defined in ISO/IEC 15775 [1] and ISO/IEC DIS 19839-1 to 4 [2] to specify image reproduction properties of colour copiers, printers, scanners and monitors. Corresponding test charts have been defined in DIN 33866-1 to 5 [3].

All colours of all test charts are defined in CIELAB coordinates. Main colour series are equally spaced in CIELAB colour space both in lightness L and chroma C*. Up to now there are productions of DIN and JBMA (Japan Business Machine Makers Association) according to ISO/IEC 15775 which can be used for all applications.*

Keywords: Image reproduction, ISO/IEC-test charts, copiers, printers, scanners, monitors

History of ISO/IEC Standards

The International Standard ISO/IEC 15775 ãInformation technology ‹ Office machines ‹ Machines for colour image reproduction - *Method of specifying image reproduction of colour copying machines by analog test charts ‹ Realisation and application*Ò was prepared by DIN (as DIN 33866-2).

The committees ISO/IEC JTC1/SC28 and DIN-NI-28 ãInformation technology, Office equipmentÒ have worked together to develop the International Standard ISO/IEC 15775. The new Draft International Standards DIS ISO/IEC 19839-1 to 4 [2] and the International Standard ISO/IEC 15775 are based on equivalent colour series and test charts.

All standards use the same colour series both in **digital** and **analog** test charts and the same layout. The application of the new drafts [2] is under test within DIN-NI-28 and ISO/IEC JTC1/SC28 since about two years.

ISO/IEC-test charts

Table 1 shows an overview of the different standards ISO/IEC 15775 and ISO/IEC DIS 19839-1 to 4.

Table 1: Realisation and application of ISO/IEC-test charts for specifying image reproduction

Input	Output	Input and output media and applications			Standard
		Input media	Output media	Application	
−	−	−	−	**Basis**	**ISO/IEC 19839−1**
analog	**analog**	ISO/IEC-test chart (hardcopy)	Hardcopy	**Copier**	**ISO/IEC 15775**
analog	**digital**	ISO/IEC-test chart (hardcopy)	File	**Scanner**	**ISO/IEC 19839−3**
digital	**analog**	ISO/IEC-test chart (file)	Hardcopy Softcopy	**Printer** **Monitor**	**ISO/IEC 19839−2** **ISO/IEC 19839−4**

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Table 1 describes the application and realisation of ISO/IEC-test charts and the methods for the specification of reproduction properties of colour image devices **Òanalog - analogÓ**(copiers), **Òanalog - digitalÒ**(scanners, Photo-CD-systems) and **Òdigital - analogÓ**(printers, monitors) and may therefore be used as a basis for the comparison and the choice of such devices.

The produced **analog** ISO/IEC-test charts are compared visually with the **analog** original. One must reproduce the **analog** ISO/IEC-test charts on copiers or the **digital** ISO/IEC-test charts on printers and monitors. There is also an ISO/IEC colorimetric method for comparison (Examples, see Annex G of ISO/IEC 15775)

For scanners one must use the **analog** ISO/IEC-test charts for input. A colorimetric scanner which produces CIELAB data can use equations to transform the CIELAB data into *cmy**-data or *olv**-data of the default colour space *CMYOLVNW** of the ISO/IEC standards *(compare Fig. 2 to 7).*

ISO/IEC Color Space *CMYOLVNW**

The colour space *CMYOLVNW** is based on colours defined in the International Standard for offset printing using CIE illuminant D65, the CIE 2 degree observer and the CIE 45/0 measurement geometry.

ISO/IEC 15775 use the following colour terms shown in Fig. 1

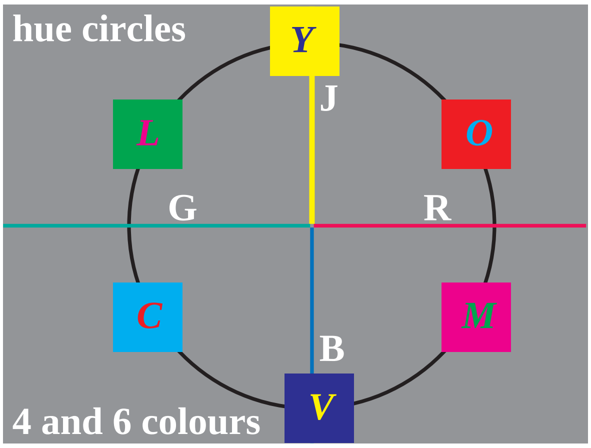


Figure 1: Hue circles with four unitary and six reproduction colors

The four colours *RGBJ* are used for the unitary hues and the six colours *CMYOLV* are used for the reproduction colours. The terms for White and Black are *W* and *N* (french = Noir). The unitary hue yellow is called *J* (french = Jeaune).

The relative coordinates *nru** (Blackness *n**, Radial Chroma *c** and Unique Hue *u**) based on the unitary hues of *Miescher* (see 4) are calculated in Fig. 2 to 7. This system is called Natural Offset Reßective System (ORS) and is very user friendly.

Colour Management

The colour space *CMYOLVNW** is designed for **colour management** mainly for **colours in reßectance mode**. Especially for the **colour reproduction of our natural environment** the colours of the offset printing process are the only standard reßective colours we can use. The full theory for colour management, see [5], can not be discussed. Fig. 2 to 7 show basic calculations.

One must have in mind that the CIELAB colour space is the only one recommended by the CIE and used since many years for colour measurement. The only output of many colour measurement devices are the *LAB** color data of the CIELAB color space.

The basic color measurement space is CIELAB but most of the graphic software can not use this space up to now. Together with the transformations shown in Fig. 2 to 7 there are different possibilities to work with CIELAB color space on all devices with normal graphic software, e.g. using calculated *olv** data.

16-step Colour Series

The 16-step colour series produced in offset printing within the **analog** ISO/IEC-test charts are defined in CIELAB in the International Standard ISO/IEC 15775. The accuracy of production is within the intended 3 CIELAB units. There are colour series changing only in *c** *(Cyanblue)* between 0, 0.063, 0.133, ..., 0.933 1.000 (0/15, 1/15, ... 15/15 corresponding to16 steps) for constant *m**=0 and *y**=0 and similar for the series *m*, y*, o*, l*, v**, and *n**.

The task to calculate the *olv** and *cmy** from *LAB** coordinates has been solved by a *PostScript* (PS) and *Portable Document* (PDF) computer program. This is used here to visualize the colours and to calculate the transformation data in Fig. 2 to 7.

The visualization is based on the *PostScrip*t colour spaces *CIELAB, CMY,* and *RGB* using the *PostScript* parameters *setcolor*, *setcmykcolor* and *setrgbcolor.* One most devices the colours with corresponding *LAB*, olv** and *cmy** coordinates look very different.

The calculations in Fig. 2 to 7 are based on the standard offset printing colours and the standard television colours (see ISO/IEC 15775 for definition and their large differences, e. g. 75 CIELAB units for the two blue in printing and television which is equal to the difference of black *N* and white *W*).

If the output device (the complete offset printing process or the television reproduction process) is linearized in CIELAB then there are **linear equations** describing the output colours in CIELAB color space as function of digital input coordinates in *cmy** or *olv** colour space.

Such 16-step colour series for linearization of the reproduction processes (offset, television and any other) are under the URLs (no. 2 has 8 PDF-pages!)

http://www.ps.bam.de

http://www.ps.bam.de/INFVM03/8810/A4Q8810E.PDF

This allows to reproduce colours within the intended differences of 3 CIELAB units. The method has been used for the production of ISO/IEC test charts in Germany DIN and Japan by JBMA.

In many cases a linearization of only the 16 step gray scale *N‹W* is sufficient. In other cases the three 16-step series of *C‹W, M‹W,* and *Y‹W* are additionally necessary. For ink jet printers with very non linear colorimetric data the 16-step series *olvw*, cmyn*, olvn** may be necessary for the intended accuracy.

For printers, offset printing and CRT monitors the linearization is easy. In many cases there is a visual method which determines the data by visual comparison with the ISO/IEC-test chart. For a colorimetric method the above 16-step colour series are already prepared for automatic measurement. There are measurement devices which use printer equipment. Instead of the printer head a colour measurement device is used. The above 9 x 16 colours on an A4 sheet of paper can be measured within 15 minutes. Input of this data in digital image files or within a *PostScript* printer allow to make the analog output a linear function of the digital input.

The following calculations in Fig. 2 to 7 are based on the assumption of linearisation. Deviation of a device will not inßuence the calculations. The calculations give the intended values and the difference of any linearized device may be different. A well done linearisation show by experience differences often less then the intended 3 CIELAB units.

Fig. 2 to 7 show example calculations for standard offset colours and CIE-test colours used in ISO/IEC 15775 and DIS ISO/IEC 19839-1 to 4 in the standard offset color space.

Fig. 6 shows example calculations for standard television colours in the standard television color space.

Fig. 7 shows example calculations for standard offset colours in the standard television color space. The calculated *olv** data will reproduce the standard offset colours on the standard television monitor. One can not reproduce many bluegreen colors with negative *o** data on the screen.

In the daylight office environment the lightness L^*_N=8 of black *N* of a monitor may change to L^*_N=18 by surface illumination of the screen. For simplicity of the calculations L^*_N=18 is used for both the monitor and the offset black.

Figure 2: Standard offset colours in standard offset system

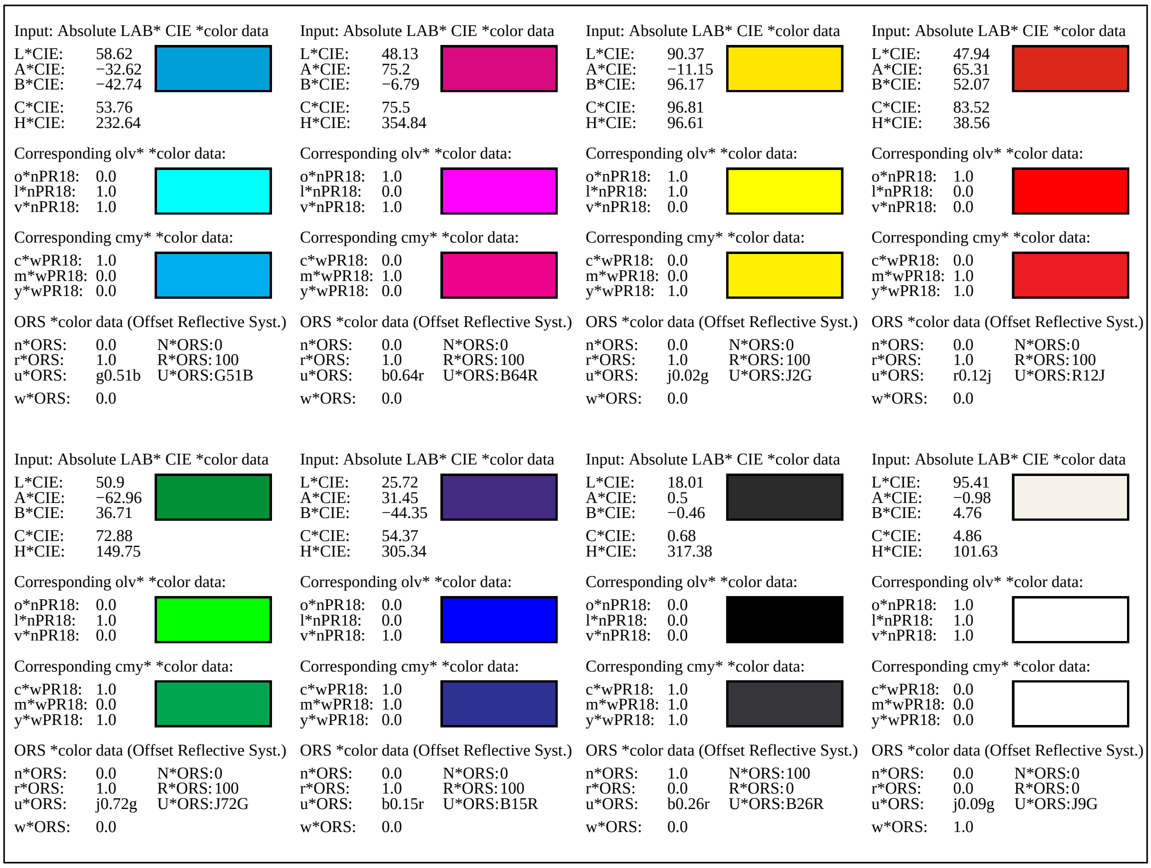


Figure 3: Standard offset colours (*n**=0.25) in the standard offset system

Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data
L*CIE: 48.46	L*CIE: 40.6	L*CIE: 72.28	L*CIE: 40.45
A*CIE: −24.34	A*CIE: 56.52	A*CIE: −8.24	A*CIE: 49.1
B*CIE: −32.17	B*CIE: −5.21	B*CIE: 72.01	B*CIE: 38.93
C*CIE: 40.34	C*CIE: 56.76	C*CIE: 72.48	C*CIE: 62.66
H*CIE: 232.88	H*CIE: 354.73	H*CIE: 96.52	H*CIE: 38.41
Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:
o*nPR18: 0.0	o*nPR18: 0.75	o*nPR18: 0.75	o*nPR18: 0.75
l*nPR18: 0.75	l*nPR18: 0.0	l*nPR18: 0.75	l*nPR18: 0.0
v*nPR18: 0.75	v*nPR18: 0.75	v*nPR18: 0.0	v*nPR18: 0.0
Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:
c*wPR18: 1.0	c*wPR18: 0.25	c*wPR18: 0.25	c*wPR18: 0.25
m*wPR18: 0.25	m*wPR18: 1.0	m*wPR18: 0.25	m*wPR18: 1.0
y*wPR18: 0.25	y*wPR18: 0.25	y*wPR18: 1.0	y*wPR18: 1.0
ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)
n*ORS: 0.25 N*ORS:25	n*ORS: 0.25 N*ORS:25	n*ORS: 0.25 N*ORS:25	n*ORS: 0.25 N*ORS:25
r*ORS: 0.75 R*ORS:75	r*ORS: 0.75 R*ORS:75	r*ORS: 0.75 R*ORS:75	r*ORS: 0.75 R*ORS:75
u*ORS: g0.52b U*ORS:G52B	u*ORS: b0.64r U*ORS:B64R	u*ORS: j0.02g U*ORS:J2G	u*ORS: r0.11j U*ORS:R11J
w*ORS: 0.0	w*ORS: 0.0	w*ORS: 0.0	w*ORS: 0.0

Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data
L*CIE: 42.67	L*CIE: 23.79	L*CIE: 18.01	L*CIE: 76.06
A*CIE: −47.1	A*CIE: 23.71	A*CIE: 0.5	A*CIE: −0.61
B*CIE: 27.41	B*CIE: −33.38	B*CIE: −0.46	B*CIE: 3.45
C*CIE: 54.49	C*CIE: 40.94	C*CIE: 0.68	C*CIE: 3.5
H*CIE: 149.8	H*CIE: 305.38	H*CIE: 317.38	H*CIE: 100.02
Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:
o*nPR18: 0.0	o*nPR18: 0.0	o*nPR18: 0.0	o*nPR18: 0.75
l*nPR18: 0.75	l*nPR18: 0.0	l*nPR18: 0.0	l*nPR18: 0.75
v*nPR18: 0.0	v*nPR18: 0.75	v*nPR18: 0.0	v*nPR18: 0.75
Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:
c*wPR18: 1.0	c*wPR18: 1.0	c*wPR18: 1.0	c*wPR18: 0.25
m*wPR18: 0.25	m*wPR18: 1.0	m*wPR18: 1.0	m*wPR18: 0.25
y*wPR18: 1.0	y*wPR18: 0.25	y*wPR18: 1.0	y*wPR18: 0.25
ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)
n*ORS: 0.25 N*ORS:25	n*ORS: 0.25 N*ORS:25	n*ORS: 1.0 N*ORS:100	n*ORS: 0.25 N*ORS:25
r*ORS: 0.75 R*ORS:75	r*ORS: 0.75 R*ORS:75	r*ORS: 0.0 R*ORS:0	r*ORS: 0.0 R*ORS:0
u*ORS: j0.72g U*ORS:J72G	u*ORS: b0.15r U*ORS:B15R	u*ORS: b0.26r U*ORS:B26R	u*ORS: j0.07g U*ORS:J7G
w*ORS: 0.0	w*ORS: 0.0	w*ORS: 0.0	w*ORS: 0.75

Figure 4: Standard CIE-test colours (*i*=1 to 8) in the standard offset system

Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data
L*CIE: 56.8	L*CIE: 55.0	L*CIE: 56.74	L*CIE: 60.9
A*CIE: 12.93	A*CIE: −2.41	A*CIE: −24.6	A*CIE: −48.13
B*CIE: 19.6	B*CIE: 35.85	B*CIE: 42.51	B*CIE: 23.62
C*CIE: 23.48	C*CIE: 35.93	C*CIE: 49.11	C*CIE: 53.61
H*CIE: 56.58	H*CIE: 93.84	H*CIE: 120.05	H*CIE: 153.86
Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:
o*nPR18: 0.63	o*nPR18: 0.51	o*nPR18: 0.37	o*nPR18: 0.2
l*nPR18: 0.42	l*nPR18: 0.49	l*nPR18: 0.71	l*nPR18: 1.0
v*nPR18: 0.35	v*nPR18: 0.13	v*nPR18: 0.06	v*nPR18: 0.29
Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:
c*wPR18: 0.37	c*wPR18: 0.49	c*wPR18: 0.63	c*wPR18: 0.8
m*wPR18: 0.58	m*wPR18: 0.51	m*wPR18: 0.29	m*wPR18: 0.0
y*wPR18: 0.65	y*wPR18: 0.87	y*wPR18: 0.94	y*wPR18: 0.71
ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)
n*ORS: 0.36 N*ORS:36	n*ORS: 0.48 N*ORS:48	n*ORS: 0.28 N*ORS:28	n*ORS: 0.0 N*ORS:0
r*ORS: 0.28 R*ORS:28	r*ORS: 0.37 R*ORS:37	r*ORS: 0.64 R*ORS:64	r*ORS: 0.8 R*ORS:80
U*ORS:R40J	U*ORS:R99J	U*ORS:J33G	U*ORS:J77G
w*ORS: 0.35	w*ORS: 0.13	w*ORS: 0.06	w*ORS: 0.2

Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data	Input: Absolute LAB* CIE *color data
L*CIE: 58.17	L*CIE: 57.44	L*CIE: 56.85	L*CIE: 57.87
A*CIE: −19.97	A*CIE: 0.1	A*CIE: 18.29	A*CIE: 27.63
B*CIE: −13.3	B*CIE: −31.82	B*CIE: −25.85	B*CIE: −21.74
C*CIE: 23.99	C*CIE: 31.82	C*CIE: 31.66	C*CIE: 35.15
H*CIE: 213.66	H*CIE: 270.18	H*CIE: 305.28	H*CIE: 321.8
Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:	Corresponding olv* *color data:
o*nPR18: 0.25	o*nPR18: 0.27	o*nPR18: 0.43	o*nPR18: 0.56
l*nPR18: 0.77	l*nPR18: 0.64	l*nPR18: 0.44	l*nPR18: 0.4
v*nPR18: 0.67	v*nPR18: 1.03	v*nPR18: 1.06	v*nPR18: 1.07
Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:	Corresponding cmy* *color data:
c*wPR18: 0.75	c*wPR18: 0.73	c*wPR18: 0.57	c*wPR18: 0.44
m*wPR18: 0.23	m*wPR18: 0.36	m*wPR18: 0.56	m*wPR18: 0.6
y*wPR18: 0.33	y*wPR18: −0.02	y*wPR18: −0.05	y*wPR18: −0.06
ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)	ORS *color data (Offset Reflective Syst.)
n*ORS: 0.22 N*ORS:22	n*ORS: −0.03 N*ORS:−3	n*ORS: −0.06 N*ORS:−6	n*ORS: −0.07 N*ORS:−7
r*ORS: 0.51 R*ORS:51	r*ORS: 0.76 R*ORS:76	r*ORS: 0.63 R*ORS:63	r*ORS: 0.67 R*ORS:67
U*ORS:G36B	U*ORS:G83B	U*ORS:B15R	U*ORS:B31R
w*ORS: 0.25	w*ORS: 0.27	w*ORS: 0.43	w*ORS: 0.4

Figure 5: Standard CIE-test colours (*i*=9 to 16) in the standard offset system

Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data	
L*CIE:	41.87	L*CIE:	75.56	L*CIE:	47.15	L*CIE:	34.8
A*CIE:	38.7	A*CIE:	4.2	A*CIE:	−47.27	A*CIE:	1.37
B*CIE:	33.37	B*CIE:	74.01	B*CIE:	18.53	B*CIE:	−28.59
C*CIE:	51.1	C*CIE:	74.13	C*CIE:	50.77	C*CIE:	28.62
H*CIE:	40.77	H*CIE:	86.75	H*CIE:	158.59	H*CIE:	272.74
Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:	
o*nPR18:	0.67	o*nPR18:	0.89	o*nPR18:	0.01	o*nPR18:	0.02
l*nPR18:	0.08	l*nPR18:	0.71	l*nPR18:	0.83	l*nPR18:	0.32
v*nPR18:	0.05	v*nPR18:	0.04	v*nPR18:	0.15	v*nPR18:	0.67
Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:	
c*wPR18:	0.33	c*wPR18:	0.11	c*wPR18:	0.99	c*wPR18:	0.98
m*wPR18:	0.92	m*wPR18:	0.29	m*wPR18:	0.17	m*wPR18:	0.68
y*wPR18:	0.95	y*wPR18:	0.96	y*wPR18:	0.85	y*wPR18:	0.33
ORS *color data (Offset Reflective Syst.)		ORS *color data (Offset Reflective Syst.)		ORS *color data (Offset Reflective Syst.)		ORS *color data (Offset Reflective Syst.)	
n*ORS:	0.32 N*ORS:32	n*ORS:	0.1 N*ORS:10	n*ORS:	0.16 N*ORS:16	n*ORS:	0.32 N*ORS:32
r*ORS:	0.61 R*ORS:61	r*ORS:	0.85 R*ORS:85	r*ORS:	0.82 R*ORS:82	r*ORS:	0.65 R*ORS:65
u*ORS:	r0.15j U*ORS:R15J	u*ORS:	r0.87j U*ORS:R87J	u*ORS:	j0.83g U*ORS:J83G	u*ORS:	g0.85b U*ORS:G85B
w*ORS:	0.05	w*ORS:	0.04	w*ORS:	0.01	w*ORS:	0.02

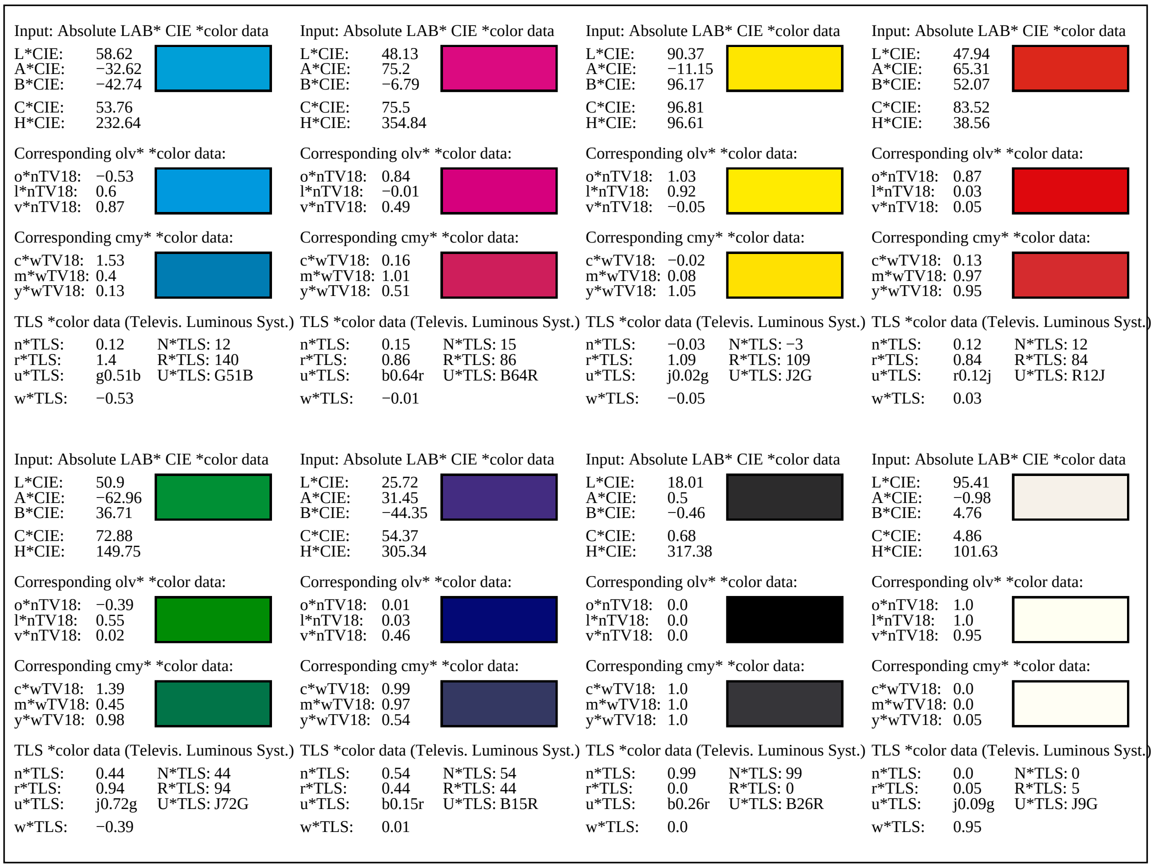
Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data	
L*CIE:	77.59	L*CIE:	36.07	L*CIE:	17.16	L*CIE:	94.98
A*CIE:	15.62	A*CIE:	−18.22	A*CIE:	−0.06	A*CIE:	−0.58
B*CIE:	29.57	B*CIE:	23.81	B*CIE:	−2.71	B*CIE:	3.28
C*CIE:	33.44	C*CIE:	29.98	C*CIE:	2.71	C*CIE:	3.33
H*CIE:	62.15	H*CIE:	127.42	H*CIE:	268.73	H*CIE:	100.02
Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:	
o*nPR18:	0.94	o*nPR18:	0.13	o*nPR18:	−0.02	o*nPR18:	0.99
l*nPR18:	0.67	l*nPR18:	0.39	l*nPR18:	0.0	l*nPR18:	0.99
v*nPR18:	0.54	v*nPR18:	−0.01	v*nPR18:	0.01	v*nPR18:	1.01
Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:	
c*wPR18:	0.06	c*wPR18:	0.87	c*wPR18:	1.02	c*wPR18:	0.01
m*wPR18:	0.33	m*wPR18:	0.61	m*wPR18:	1.0	m*wPR18:	0.01
y*wPR18:	0.46	y*wPR18:	1.01	y*wPR18:	0.99	y*wPR18:	0.0
ORS *color data (Offset Reflective Syst.)		ORS *color data (Offset Reflective Syst.)		ORS *color data (Offset Reflective Syst.)		ORS *color data (Offset Reflective Syst.)	
n*ORS:	0.05 N*ORS:5	n*ORS:	0.6 N*ORS:60	n*ORS:	0.98 N*ORS:98	n*ORS:	0.0 N*ORS:0
r*ORS:	0.4 R*ORS:40	r*ORS:	0.41 R*ORS:41	r*ORS:	0.04 R*ORS:4	r*ORS:	−0.01 R*ORS:−1
u*ORS:	r0.49j U*ORS:R49J	u*ORS:	j0.43g U*ORS:J43G	u*ORS:	g0.82b U*ORS:G82B	u*ORS:	j0.07g U*ORS:J7G
w*ORS:	0.54	w*ORS:	−0.01	w*ORS:	−0.02	w*ORS:	1.01

Figure 6: Standard television colors *CMYOLVNW** in the standard television system

Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data	
L*CIE:	86.88	L*CIE:	57.5	L*CIE:	92.66	L*CIE:	50.5
A*CIE:	−46.17	A*CIE:	94.35	A*CIE:	−20.7	A*CIE:	76.92
B*CIE:	−13.56	B*CIE:	−58.41	B*CIE:	90.75	B*CIE:	64.55
C*CIE:	48.12	C*CIE:	110.96	C*CIE:	93.08	C*CIE:	100.41
H*CIE:	196.36	H*CIE:	328.24	H*CIE:	102.85	H*CIE:	40.0
Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:	
o*nTV18:	0.0	o*nTV18:	1.0	o*nTV18:	1.0	o*nTV18:	1.0
l*nTV18:	1.0	l*nTV18:	0.0	l*nTV18:	1.0	l*nTV18:	0.0
v*nTV18:	1.0	v*nTV18:	1.0	v*nTV18:	0.0	v*nTV18:	0.0
Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:	
c*wTV18:	1.0	c*wTV18:	0.0	c*wTV18:	0.0	c*wTV18:	0.0
m*wTV18:	0.0	m*wTV18:	1.0	m*wTV18:	0.0	m*wTV18:	1.0
y*wTV18:	0.0	y*wTV18:	0.0	y*wTV18:	1.0	y*wTV18:	1.0
TLS *color data (Televis. Luminous Syst.)		TLS *color data (Televis. Luminous Syst.)		TLS *color data (Televis. Luminous Syst.)		TLS *color data (Televis. Luminous Syst.)	
n*TLS:	0.0 N*TLS: 0	n*TLS:	0.0 N*TLS: 0	n*TLS:	0.0 N*TLS: 0	n*TLS:	0.0 N*TLS: 0
r*TLS:	1.0 R*TLS: 100	r*TLS:	1.0 R*TLS: 100	r*TLS:	1.0 R*TLS: 100	r*TLS:	1.0 R*TLS: 100
u*TLS:	g0.21b U*TLS: G21B	u*TLS:	b0.38r U*TLS: B38R	u*TLS:	j0.11g U*TLS: J11G	u*TLS:	r0.14j U*TLS: R14J
w*TLS:	0.0	w*TLS:	0.0	w*TLS:	0.0	w*TLS:	0.0

Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data		Input: Absolute LAB* CIE *color data	
L*CIE:	83.63	L*CIE:	30.39	L*CIE:	18.01	L*CIE:	95.41
A*CIE:	−82.76	A*CIE:	76.06	A*CIE:	0.01	A*CIE:	0.01
B*CIE:	79.9	B*CIE:	−103.59	B*CIE:	0.01	B*CIE:	0.01
C*CIE:	115.03	C*CIE:	128.51	C*CIE:	0.01	C*CIE:	0.01
H*CIE:	136.0	H*CIE:	306.28	H*CIE:	45.0	H*CIE:	45.0
Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:		Corresponding olv* *color data:	
o*nTV18:	0.0	o*nTV18:	0.0	o*nTV18:	0.0	o*nTV18:	1.0
l*nTV18:	1.0	l*nTV18:	0.0	l*nTV18:	0.0	l*nTV18:	1.0
v*nTV18:	0.0	v*nTV18:	1.0	v*nTV18:	0.0	v*nTV18:	1.0
Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:		Corresponding cmy* *color data:	
c*wTV18:	1.0	c*wTV18:	1.0	c*wTV18:	1.0	c*wTV18:	0.0
m*wTV18:	0.0	m*wTV18:	1.0	m*wTV18:	1.0	m*wTV18:	0.0
y*wTV18:	1.0	y*wTV18:	0.0	y*wTV18:	1.0	y*wTV18:	0.0
TLS *color data (Televis. Luminous Syst.)		TLS *color data (Televis. Luminous Syst.)		TLS *color data (Televis. Luminous Syst.)		TLS *color data (Televis. Luminous Syst.)	
n*TLS:	0.0 N*TLS: 0	n*TLS:	0.0 N*TLS: 0	n*TLS:	1.0 N*TLS: 100	n*TLS:	0.0 N*TLS: 0
r*TLS:	1.0 R*TLS: 100	r*TLS:	1.0 R*TLS: 100	r*TLS:	0.0 R*TLS: 0	r*TLS:	0.0 R*TLS: 0
u*TLS:	j0.54g U*TLS: J54G	u*TLS:	b0.16r U*TLS: B16R	u*TLS:	r0.22j U*TLS: R22J	u*TLS:	r0.22j U*TLS: R22J
w*TLS:	0.0	w*TLS:	0.0	w*TLS:	0.0	w*TLS:	1.0

Figure 7: Standard offset colours *CMYOLVNW** in the standard television system



Digital ISO/IEC-test charts

One can find the **digital** ISO/IEC-test charts by using the following URLs (click to go!):

www.ps.bam.de

www.ps.bam.de/INFIE13/INFIE13.HTM

www.din.de/33866

One can use this files to produce an **analog** output on monitors and printers. Some more information about ISO/IEC JTC1/SC28 is on the home page and drafts of ISO/IEC standards are under the following URLs (click to go!):

www.actech.com.br/sc28

www.actech.com.br/sc28/15775.html

References

[1] ISO/IEC 15775: 1999-12 ãnformation technology ‹ Office machines ‹ Machines for colour image reproduction - *Method of specifying image reproduction of colour copying machines by analog test charts ‹ Realisation and application* Ò

[2] ISO/IEC DIS 19839-1 to 4: 2000-04 ãnformation technology ‹ Office machines ‹ Machines for colour image reproductionÓ

Part 1: *Method of specifying image reproduction by **digital** and **analog** DIN-test charts ‹ Classification and principles*

Part 2: *Method of specifying image reproduction with **digital** input and **analog** output as **hardcopy** of colour image devices: **Òdigital**‹ **analogÓ**(printers) ‹ Realisation and application*

Part 3: *Method of specifying image reproduction with **analog** input and **digital** output of colour image devices: **Òanalog**‹ **digitalÓ**(scanners) ‹ Realisation and application*

Part 4: *Method of specifying image reproduction with **digital** input and **analog** output as **softcopy** of colour image devices: **Òdigital**‹ **analogÓ**(monitors) ‹ Realisation and application*

[3] DIN 33866-1 to 5: 2000-07 ãnformation technology ‹ Office machines ‹ Machines for colour image reproductionÓ Part 2 corresponds to ISO/IEC 15775; Part 1, 3, 4 and 5 corresponds to ISO/IEC DIS 19839-1 to 4.

[4] Klaus Richter, Computergrafik und Farbmetrik, VDE-Verlag, Berlin, 1996, with 500 colour figures in PS and PDF on CD-ROM, ISBN 3-8007-1775-1

[5] Klaus Richter, Automatic colour management for variable processes between original and reproduction using 16 colours of ISO/IEC 15775, CIS2000, Uni Derby, England, p. 197-204, 321-328