

Second DFZ-BAM-Workshop: Digital and analog ISO/IEC-test charts for multimedia devices in offices

Definition, production, application and colour management of ISO/IEC-test charts for image reproduction on copiers, printers, scanners, photo-CD-systems, monitors and displays in offices

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Final Program with timetable for oral presentations, poster and working sessions

Background:

Four ISO/IEC- and DIN-test charts have been defined in ISO/IEC 15775:1999-12, DIS ISO/IEC 19839-1 to -4:2000-04, and DIN 33866-1 to 5:2000-08 to specify image reproduction of colour copiers, printers, scanners and monitors. The committees ISO/IEC JTC1/SC28 „Information technique, Office equipment“ and the corresponding German committee have developed these key standards of information technology during the last four years.

New colorimetric technologies of BAM have been used to produce the first set of four DIN-test charts in offset printing (3600 dpi) which are in application for colour devices (for example copiers, printers, scanners and monitors). The first production of (Asian) ISO/IEC-test charts according to ISO/IEC 15775 have been produced in Japan by JBMA (Japan Business Machines Makers Association). In applications the devices including software are used for ISO/IEC-test chart input and output in three different combinations **analog - analog** (copiers), **digital - analog** (printers, monitors) and **analog - digital** (scanners, Photo-CD-systems).

Input	Output	Input and output media and applications		Application	Standard or Draft
		Input media	Output media		
-	-	-	-	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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Figure 1: Figure 1 shows the use of analog and digital ISO/IEC-test charts according to ISO/IEC 15775 and DIS ISO/IEC 19839-1 to -4.

Input	Output	Input and output media and applications		Application	Standard
		Input media	Output media		
-	-	-	-	Basis	DIN 33866-1
analog	analog	DIN-test chart (hardcopy)	Hardcopy	Copier	DIN 33866-2
analog	digital	DIN-test chart (hardcopy)	File	Scanner	DIN 33866-4
digital	analog	DIN-test chart (file)	{ Hardcopy Softcopy	Printer Monitor	DIN 33866-3 DIN 33866-5

INFDE000:DETNK00.PS

Figure 2: Figure 2 shows the use of analog and digital DIN-test charts according to DIN 33866-1 to -5

The method of specifying image reproduction for colour copiers uses the device as a black box and compares mainly visually the input and output (reproduction) of the ISO/IEC-test charts by filling out ISO/IEC-forms depending on the ISO/IEC-test chart number. Transparent ISO/IEC-test charts on a flat area lamp serve as reference monitor. There is no way to calculate in advance this visual assessment for Siemens-stars, Landolt-rings, characters, line screens and other ISO/IEC-test chart elements in different sizes and colours. Using ISO/IEC-test charts for input and output is the only very practical way to specify image reproduction in offices.

Digital ISO/IEC-test charts and production technologies

Now ISO/IEC and DIN are looking for the most promising technologies to produce new ISO/IEC- and DIN-test charts in different modes (reflectance and transmission), on different materials (offset, photographic paper and film) and with different resolution. For production the digital ISO/IEC-test charts are defined in *PostScript (PS)*, *Portable Document File (PDF)* and *equivalent* formats.

Only small colour differences of **analog** test charts compared to the colorimetric definitions in the International Standard ISO/IEC 15775 are intended. The **digital** ISO/IEC- and DIN-test charts for production and applications are available on the Internet and will produce for example an output on any printer or monitor. The digital ISO/IEC-test charts can be used by any manufacturer who decides to produce analog ISO/IEC-test charts. The different requirements of the produced ISO/IEC-test charts are defined in ISO/IEC 15775.

International exchange of knowledge, production methods and applications

The first DFZ-BAM-workshop in Nov. 1999 on this topic has brought together the experts of ISO/IEC, DIN and BAM and manufacturers of the new ISO/IEC-test charts to look at the first production results. The specification of image reproduction both by visual assessment and measurement in comparison with the colorimetric definition within the International Standard ISO/IEC 15775 has allowed discussion and selection of the most promising (and stable and reproducible) methods for the next ISO/IEC-DIN-BAM-test chart productions in different modes, on different materials and in different resolutions

General meeting and paper information for the second DFZ-BAM-Workshop

Date: June 14-15, 2001 (Thursday 10 h to Friday 17 h).

Place: Federal Institute for Materials Research and Testing (BAM), Unter den Eichen 87, D-12200 Berlin, Germany

Remark: This place is in the south west of Berlin, see the URL:

www.bam.de

All program informations and registration:

Deutsches Farbenzentrum (DFZ), Bozener Strasse 11-12

D-10825 Berlin, Germany

Fon and Fax +49-30-854 63 61 (same number, see the URL:)

www.farbenzentrum.net

For registration and more information use DFZ-BAM-Workshop and mail to:

Farbenzentrum@aol.com

Organisation: Deutsches Farbenzentrum (DFZ) and Federal Institute for Materials Research and Testing (BAM)

Workshop fee: DM 300 (approx. 140 US \$, approx. 150 EURO)

NOTE 1 This fee includes a welcome reception, June 14, 17-19 h at BAM

Papers: For the paper abstract and workshop exercises all **related to test charts**

see www.ps.bam.de/NEWSE.html

(see also forms for workshop registration, maps, and recommended hotels)

For further information see the following web addresses (click to go!)

www.ps.bam.de

(Technical information for image reproduction of DIN- and ISO/IEC-test charts)

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

(Digital ISO/IEC-test charts in three resolutions)

www.ps.bam.de/DE13/DE13.HTM

(Digital DIN-test charts in three resolutions)

www.ps.bam.de/DE.HTM

(Many figures of ISO/IEC-test charts as digital files for test reproductions)

<http://www.jbma.or.jp/~isoiec/sc28/testchart/index.html>

(Digital ISO/IEC-test charts of JBMA (Japan Business Makers Association))

www.ps.bam.de/INFBE04/INFBE04.HTM

(Digital test picture B1 of ISO/IEC-test chart for 7 steps of exposure on slide and negative material)

www.ps.bam.de/INFVM03/INFVM03.HTM

(500 digital colour images for colour education purposes in different languages)

www.actech.com.br/sc28

(Home-Page of ISO/IEC JTC1/SC28, see NEWS)

Exhibition in the poster room (Plenum 2)

In a poster room are materials for the production of ISO/IEC-test charts. There are presentations of colour image reproduction devices (colour copiers, printers, monitors and scanners). Colour measuring instruments of leading manufacturers and the BAM staff will guide for the input and output of the DIN- and ISO/IEC-test charts and the comparison with the reference. Within the workshop and the exhibition it is intended to reproduce the test charts on ISO/IEC reference paper by new Input and Output Linearization methods (IL and OL).

Within the workshop the intention is to correct the digital input data of ISO/IEC-test charts - both by visual estimation and colorimetric measurement - to get the output on any colour reproduction device within visual tolerances **identical and independent of hardware and software**. Examples of colour scales and colour images will be produced and shown in the exhibition. Colour image reproduction devices and materials of the following companies are expected: *Apple, Epson, Fuji, Oki, Osram, Tektronix, Xerox*. (Registration and Information only by DFZ).

The new **flat area lamp OSRAM PLANON D65** (10.000 cd/squaremeter) in size A4 and larger will be shown in the colour exhibition. With transparent film material on top this lamp represents the **light colour mode of the ISO/IEC- and DIN-test charts** and serves as **analog reference monitor**.

Presenting technologies within the BAM-conference room:

The BAM-conference room has capabilities for one overhead projection, double slide projection (2 times 4 m x 3 m), PC to video projections ((Mac and Windows, 4 m x 3 m), and 6 distributed microphones for questions and discussions. There are additional possibilities for the presentation of the ISO/IEC-test chart materials in a poster room.

Final program: Second DFZ-BAM-Workshop: Digital and analog ISO/IEC-test charts for multimedia devices in offices

Timetable for oral presentations, poster and working sessions

Thursday, June 14, 2001, 10.00-13.00h

10.00-13.00h: Opening Session (Plenum 1), Chair: Prof. Klaus Palm

Prof. Dr. H. Czichos, President of Federal Institute for Material Research and Testing (BAM), Berlin

Prof. Dr. Klaus Palm, President of Deutsches Farbenzentrum e.V., Berlin

Welcome and introduction

Prof. Dr. Klaus Richter, BAM, Berlin

Development of analog and digital test charts for ISO/IEC- and DIN-standards for specifying image reproduction and for Colour Management in offices

Thomas Schmelzer, SWS Software Support, Goepingen

Colour security from input to output

Dr. Alexander Rosemann, TU, Berlin

Psychophysical determination of the amount of grey samples which can be distinguished on a visual scale

Dr. Klaus Witt, BAM, Berlin

The problem of fluorescence in colorimetric measurements of photographic prints

13.00-14.30h Lunch break

14.30-15.30h: Output linearization (OL) method for the achromatic ISO/IEC-test chart no. 3 with a 16 step grey scale (Plenum 1), Chair: T. Schmelzer

Remark 1: During the working sections a notebook, a video display and a black and white printer and a colour printer are used. Digital standard files are freely available on the Internet with many figures of the digital ISO/IEC-test charts. A low cost (\$500) colour measurement equipment serves for the colour measurement technique. Participants can use their own notebooks and the standard ISO/IEC-test chart files (see www.ps.bam.de/DE.HTM) to optimize visually the output on

their notebooks and/or their printers.

Remark 2: *Adobe PostScript* (PS) is basic file format for all ISO/IEC-test charts and figures. The PS format is e. g. compatible to *Adobe Illustrator* and *Adobe Photoshop*. All the tools of these programs can be used to convert to the other file formats, e. g. BMP, GIF, TIF and to change the content of figures. Changes of the PS code will change the output of the PS files and the other file formats.

Remark 3: Based on the ISO/IEC-test charts a combined Input and Output Linearization (IL and OL) can be used to optimize the output of the original scene. There are at least four possibilities (F, S, D, P) to include some standard PS code and the 16 visual or colorimetric grey scale data (or the 8 times 16 colour data for higher accuracy) in the File (F), the Startup (S) directory of the software *Adobe Acrobat Distiller*, the *PostScript Device* (D) or the Printer driver (P). **The user expects a linear relationship between digital data and visual output.** But often there is no Output Linearization by the Printer driver (OLP) or the software-device system. The ISO/IEC-test charts are a new basis for the Input and Output Linearization. The test charts help both users and manufacturers to specify the reproduction properties between input (e. g. original scene or file) and output.

1.00 First working section: Klaus Richter and T. Schmelzer

Output Linearization (OL) of 16 ISO/IEC-grey steps equidistant according to CIELAB. The method uses the files in

www.ps.bam.de/DE09/DE09.HTM

1.10 The BAM-video projector (BVP) and the ISO/IEC-test chart no. 3

- 1.11 Visual estimation of the relative lightness I^* of the video output
- 1.12 Measurement of the 16 grey steps of the video output by a lux meter
- 1.13 Output Linearization of the File (F) and Startup (S) method (OLF, OLS) for the ISO/IEC-test chart no. 3 on the BAM video projector (BVP)
- 1.14 Comparison of the outputs with the reference

1.20 The achromatic laser printer (ALP) and the ISO/IEC-test chart no. 3

- 1.21 Visual comparison of the lightness L^* of the printer output and the ISO/IEC- or DIN-test chart no. 3
- 1.22 Measurement of the lightness L^* of the printer output by a colorimeter
- 1.23 Output Linearization of the File (F) and Startup (S) method (OLF, OLS) for the ISO/IEC-test chart no. 3 on the achromatic laser printer (ALP)
- 1.14 Comparison of the outputs with the reference

15.30-17.00h Poster session and coffee break (Plenum 2)

Remark: In the poster sessions participants can use computers, copiers, printers (photographic and halftone mode) and measurement equipment of different companies. For the test with analog and digital ISO/IEC- and DIN-test charts the digital Workshop example files are available on the Internet or on floppy disks.

Dr. Alexander Rosemann, TU, Berlin

Psychophysical determination of the amount of grey samples which can be distinguished on a visual scale

Thomas Schmelzer, SWS Software Support, Goepingen

Colour security from input to output (using *D2P* monitor and a colour printer)

17.00-18.00h: Output Linearization of 128 standard colours according to ISO/IEC 15775 (Plenum 1), Chair: Thomas Schmelzer

2.00 Second working section: Klaus Richter and T. Schmelzer

The Figures **B4** and **D4** of the ISO/IEC-test charts no. 2 and 4 include 8 different 16 step colour series between white and the seven colours CMYOLVN (96 whitish colours on the surface of the colour space and 2 times 16 grey colours). The output of the 16 step series should be equidistant in relative CIELAB colour space for the 8 series. The Output Linearization (OL) uses the files in

www.ps.bam.de/DE14/DE14.HTM

www.ps.bam.de/DE15/DE15.HTM

2.10 The BAM-video projector (BVP) and the 128 standard colours

- 2.11 Visual estimation of relative distance d^* of the 16 grey colours in the video output (compare 1.1)

- 2.12 Output Linearization (OL) by File (F) and Startup (S) (OLF, OLS) for 128 standard colours on the BAM video projection (BVP) using 16 greys.
- 2.13 Comparison of the outputs with the reference

2.20 A colour (chromatic) laser printer (CLP) and the 128 standard colours

- 2.21 Visual comparison of the colour difference d^* of 16 grey colours in the printer output
- 2.22 Measurement of the CIELAB data of the 8 times 16 colours in the printer output by a colorimeter
- 2.23 Output Linearization (OL) by File (F) and Startup (S) (OLF, OLS) for the 8 times 16 colours of the printer output
- 2.24 Comparison of the outputs with the reference

Thursday, 14. June 2001, 18.00-20.00h, Welcome reception at Plenum 2

Friday, 15. June 2001, 9.00-18.00h

9.00-10.00h: Applications of the ISO/IEC-test charts (Plenum 1), Chair: Klaus Richter

Dr. Klaus Ziemssen, OSRAM, Muenchen

Mercury free flat panel light source with high homogeneity and in the application as reference monitor

Thomas Schmelzer, SWS Software Support, Goepingen

National standards in relation to International Standards in the field of colour image technology

10.00-11.30 Poster session and coffee break (Plenum 2)

Klaus Richter, BAM, Berlin

Report and presentation of the different productions of the ISO/IEC-test charts by the Japan Business Machines Makers Association (JBMA)

Dr. Klaus Ziemssen, OSRAM, Muenchen

Mercury free flat panel light source with high homogeneity and in the application as reference monitor

11.30-13.00h: Output Linearization (OL) for the chromatic ISO/IEC-test charts no. 2 and 4 (Plenum 1), Chair: Thomas Schmelzer, SWS, Goepingen

3.00 Third working section:

All Figures B4 to B7 and D4 to D7 of the ISO/IEC-test charts no. 2 and 4 will be reproduced on one page. The measurement data of the second working section and the Output Linearization (OL) will optimize the video and printer output. The Output Linearization (OL) uses the files in

www.ps.bam.de/DE23/DE23.HTM

3.10 The BAM-video projector (BVP)

- 3.11 Output Linearization (OL) by File (F) and Startup (S) (OLF, OLS) of all Fig. B4 to B7 and D4 to D7 of the ISO/IEC-test charts no. 2 and 4 on the BVP
- 3.12 Comparison of the outputs with the reference

3.20 A colour laser printer (CLP)

- 3.21 Output Linearization (OL) by File (F) and Startup (S) (OLF, OLS) of all Fig. B4 to B7 and D4 to D7 of the ISO/IEC-test charts no. 2 and 4 on the CLP
- 3.22 Comparison of the outputs with the reference

13.00-14.30h Lunch break

14.30-15.30h: Combined Input and Output Linearization (IL and OL) of 32 ISO/IEC-test colours of the ISO/IEC-picture image B1 (Plenum 1), Chair: Thomas Schmelzer, SWS, Goepingen

Remark 1: ISO/IEC 15775 defines the properties of an **ISO/IEC-test chart image with 32 ISO/IEC-reference colours**, which include the 16-step ISO/IEC grey scale and the 16 ISO/IEC-CIE-test colours. A photo of real reflective 32 ISO/IEC-test colours on photographic slide or negative material must be taken together with the scene to produce such an image. The standard photo-CD-process will give 5 resolutions of bit images between 192 x 128, 384 x 256, ... 3072 x 2048 pixels. Participants can use own notebooks and the **ISO/IEC-test chart image file B1**. This is available on standard 1.4 MB disks in the workshop or during the

poster sessions in lowest resolution 192 x 128. There are working PS-files with only 2 x 16 colours in two lines, different e. g. for slide and negative film material between under exposure (of 2 stops) and over exposure (of 4 stops).

Remark 2: The **ISO/IEC-test chart image B1** may be taken as a first picture on slide or negative material. Then the **Input Linearization (IL)** allows to a high degree to get the same output **independent** of exposure, taking illuminant, film material, developing process, scanning process, software, hardware etc.

Remark 3: Most picture images are based on photographic material and most other Input Linearization (IL) methods fail to handle this standard application. The other methods are dependent on stable input processes but the method used here is to a high degree independent of variations of the input process.

There are **two steps, the Input and Output Linearization (IM and OM)**. The first step is to change the scanning data to equidistant data between 0 and 1 in steps of 1/15 similar as in the original. This leads to standard data in the image file. Then the Output Linearization (OL) of the first working section is used.

4.00 Fourth Working section: Klaus Richter and T. Schmelzer Combined Input and Output Linearization (IL and OL) for all colours in the ISO/IEC-test chart image B1 using the **16 grey steps** and **7 steps of exposure for slide and negative film material**. The method uses the files in

www.ps.bam.de/DE36/DE36.HTM

www.ps.bam.de/DE12/DE12.HTM

4.10 Original scene and the scan data file of the Photo-CD process

- 4.12 Use of the Software *Adobe Photoshop* to compare the digital scan file data with the reference file data
- 4.11 Input Linearization (IL) to change of the scan data to the equidistant data for the grey scale

4.20 The BAM-video projector (BVP)

- 4.21 Input and Output Linearization (IL and OL) by File (F) and Startup (S) (OLF, OLS) of the **32 ISO/IEC-test colours** by 16 grey colours on the BVP
- 4.22 Comparison of the outputs with the reference

4.30 A colour laser printer (CLP)

- 4.31 Input and Output Linearization (IL and OL) by File (F) and Startup (S) (OLF, OLS) of the **32 ISO/IEC-test colours** by 16 grey colours on the CLP
- 4.32 Comparison of the outputs with the reference

4.40 A PostScript document file of a layout program and output on the CLP

- Output Linearization (OL) by File (F) for the foreign PS document
- 4.31 File which includes Fig. B4 of the ISO/IEC-test charts no. 2 on the CLP
- 4.32 Comparison of the output with the reference

15.30-16.00h: Poster session and coffee break (Plenum 2)

Klaus Richter, BAM, Berlin

Display PostScript (DPS) and Output Linearization (OL) of the ISO/IEC- and DIN-test charts on *Mac OS X Server*

16.00-17.00h: General discussion: Application of ISO/IEC-test and DIN-test charts (Plenum 1), Chair: Thomas Schmelzer, SWS, Goepingen

1. Halftone and photographic technology, reflectance and transparent mode
3. Accuracy and measurement problems (fluorescent paper)
4. Developing of images B1 for the ISO/IEC-test charts no. 2 and 4 with ISO/IEC- and CIE-reference colours
5. Trend: Taking pictures on slide or negative film with reference colours (ISO/IEC-test chart as reference), using the Photo-CD-process, and the photographic output and the Input and Output Linearization methods on the Internet
6. Linearization methods as a tool for device and ISO/IEC-test chart production
7. ISO/IEC-test chart files for production on BAM-, DIN- and ISO/IEC-web server
8. Database of produced ISO/IEC-test charts in different technologies