ANSI®
CGATS.9-2007
Revision of
CGATS.9-2005

AMERICAN NATIONAL STANDARD

Graphic technology — Graphic arts transmission densitometry measurements —Terminology, equations, image elements and procedures

SECRETARIAT
NPES THE ASSOCIATION FOR SUPPLIERS OF PRINTING, PUBLISHING AND CONVERTING TECHNOLOGIES

APPROVED FEBRUARY 21, 2007
AMERICAN NATIONAL STANDARDS INSTITUTE, INC.

CGATS

1899 PRESTON WHITE DRIVE ● RESTON, VIRGINIA 20191-4367 ● TEL: 703/264-7200 ● FAX: 703/620-0994 ● www.npes.org

AMERICAN NATIONAL STANDARD

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat whose name appears on the title pate of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard periodically.

Contents

Foreword

This standard defines terms, equations, image elements and procedures for measurement and communication of data when using transmission densitometer instrumentation for graphic arts.

The Committee for Graphic Arts Technologies Standards (CGATS) was accredited by the American National Standards Institute in 1989 to serve as the coordinator of graphic arts standards activities. CGATS identifies areas in which standards are needed and desired, respecting the established activities of existing accredited standards committees and industry standards developers. CGATS writes standards only where need exists and no other committee is undertaking the writing.

This edition of CGATS.9 updates and replaces the 2005 version of this document. Changes from the 2005 version include, but are not limited to:

— removal of Annex C on sampling aperture and inclusion of a pointer to CGATS.5 for information on this topic;

— addition of information to be included when communicating data;

— removal of Annex E on instrument calibration, and revision on the procedures for measurement to include instrument standardization.

Requests for interpretation must be sent in writing to the CGATS Secretariat. This request will be forwarded to the appropriate committee, which will respond in writing. A statement, written or oral, that is not processed in accordance with the procedures noted above will not be considered the official position of CGATS, and should not be relied upon as a Formal Interpretation.

Suggestions for improving this standard are welcomed. They should be sent to the CGATS Secretariat, NPES The Association for Suppliers of Printing, Publishing and Converting Technologies, 1899 Preston White Drive, Reston, Virginia 20191-4367, USA; Fax: 703-620-0994; E-mail: standards@npes.org.

This standard was prepared by CGATS Subcommittee 3, which had the following membership:

Chair: Raymond Cheydleur
Vice Chair: Lawrence Warter
Secretary: Mary Abbott

Subcommittee members:

Organization	Representative	Organization	Representative
Alliance Group	Tom Cooper	Newspaper Association of America	John Iobst
Arizona State University	Howard Nelson	NPES The Association for and Suppliers of Printing, Publishing and Converting Technologies	David McDowell
Flexographic Technical Association	John Anderson Steve Smiley		
Fujifilm Graphic Systems	Lawrence Warter	Quad/Graphics	Tom Collins
Global Graphics Software	Kenneth Elsman	QuadTech	John Seymour
Graphics Microsystems	Steven Headley	RGB Metrology	Lawrence Steele
Hewlett Packard	Charles Jia	RIT/College of Imaging Arts & Sciences	Robert Chung
IDEAlliance	Lawrence Warter	R.R. Donnelley & Sons	Michael Rodriguez
Individual Expert	Walter Zawacki	Society for Imaging Science & Technology	David McDowell
Kodak Graphic Communications	Richard Goodman	Sun Chemical Corporation	Danny Rich
Latran Technologies	Andy DiDonato	Time Inc.	Heath Luetkens
Lexmark International	Ann McCarthy	Vertis	Steve Smiley
National Association of Printing Ink Manufacturers	Danny Rich	X-Rite	Raymond Cheydleur
		Zwang & Company	David Zwang

This standard was processed and approved for submission to ANSI by Accredited Standards Committee CGATS. Committee approval of the standard does not imply that all committee members voted for its approval. At the time this standard was approved CGATS had the following members:

Chairman: Martin Bailey
Vice Chairman: Walter Zawacki
Secretary: Mary Abbott

Organization	Representative
Adobe Systems Incorporated	Dov Isaacs
Arizona Statue University	Howard Nelson
	Thomas Schildgen (Alt.)
City University of New York – College of Technology	Lloyd Carr
Dainippon Screen Engineering of America	Setsuo Ohara
	Tom Yang (Alt.)
Electronics for Imaging	Margaret Motamed
	Richard Falk (Alt.)
Enfocus Software NV	Andy Den Tandt
Esko-Graphics	Hans De Stecker
	Hans Dewitte (Alt.)
Flexographic Technical Association	John Anderson
	Mark Cisternino (Alt.)
Fujifilm Graphic Systems	Lawrence Warter
Global Graphics	Martin Bailey
	Ken Elsman (Alt.)
Graphics Microsystems Inc.	Steve Headley
	Mark O'Connell (Alt.)
Gravure Association of America	William Sunter
	Sofia Khatkin (Alt.)
GTI Graphic Technology Inc.	Frederic McCurdy
	Robert McCurdy (Alt.)
Heidelberg U.S.A.	Charles Koehler
Hewlett Packard	Mary Nielsen
	Kevin Currans (Alt.)
IDEAlliance	David Steinhardt
	Lawrence Warter (Alt.)
Individual Expert	Walter Zawacki
Integrated Color Solutions	Jo Kirkenaer

Organization	Representative
International Association of Diecutting & Diemaking	Cynthia Crouse
International Prepress Association	Lee Webster
	Scott Tully (Alt.)
Integrated Color Solutions	Jo Kirkenaer
Kodak Graphic Communications Canada	David Kauffman
Kodak Versamark	Terry Wozniak
	John Desautels
Latran Technologies	Andy DiDonato
Mitsubishi Imaging (MPM), Inc.	Catherine Cartolano
National Association of Printing Ink Manufacturers	Danny Rich
	James Coleman (Alt.)
Newspaper Association of America	John Iobst
	Tom Croteau (Alt.)
NPES The Association for Suppliers of Printing, Publishing and Converting Technologies	David McDowell
Quebecor World, Inc.	Johnny Sutton
	Jean-Francois Cuillerier (Alt.)
RGB Metrology	Lawrence Steele
RIT/College of Imaging Arts & Sciences	Robert Chung
	Frank Cost (Alt.)
R. R. Donnelley & Sons Company	Michael Rodriguez
Society for Imaging Science & Technology	David McDowell
St. Petersburg Times	Alvin Nesmith
	Tom Frick (Alt.)
Sun Chemical Corporation	Danny Rich
X-Rite, Inc.	Raymond Cheydleur
Xerox Corporation	Brian Rooney
Zwang & Company	David Zwang

Introduction

Densitometer instrumentation is widely used for quality and process control within the graphic arts industry. The intent of this standard is to define terms and establish a standard method for the use and application of transmission densitometry and measurements of graphic arts halftone images. It does not address issues of photographic process control. This document is a complement to CGATS.4, *Graphic technology — Graphic arts reflection densitometry measurements — Terminology, equations, image elements and procedures*.

Transmission densitometers for photographic materials, including graphic arts, are discussed in ISO 5-2 and ISO 5-3.

Through use of this standard, characterization of photomechanical graphic arts images and associated processes can be achieved in a more consistent manner. Furthermore, the communication of data with conformance to a measurement standard will enhance the control of image reproduction across an industry becoming global in nature.

It should be noted that the basic scheme used in transmission densitometers, as with other measuring systems (such as spectrophotometers), is to measure transmittance. This transmittance is a function of the various components, including filters, of the optical system and its geometry. One important difference between densitometers and other transmittance measuring instruments is the densitometer's immediate calculation and reporting of density (negative log of transmittance) rather than the transmittance. This practice has yielded some confusion about what the unit "measures" and what it "reports", but it differentiates densitometers from other instruments. Most densitometers also report other derived data.

A colorimeter is designed to take into account the human visual response as defined by the CIE Standard Observer. Densitometers may have a number of spectral responses, but these do not typically bear any simple linear relationship to colorimeter responses. These spectral characteristics are generally chosen to suit the process and materials being measured. For this reason it is inappropriate to use densitometers for color measurement as defined by the human visual response. Densitometric "color" characteristics should be used in a relative sense only and are useful for process control for graphic arts materials.

NOTE Because the printing and publishing industry uses many binary printing patterns in addition to the traditional center-weighted halftone dot, this standard uses the term tone value instead of dot area to better address this issue.

Graphic technology — Graphic arts transmission densitometry measurements — Terminology, equations, image elements and procedures

1 Scope and field of application

This standard defines terminology, equations, process control elements, and procedures for measurement and communication of transmission densitometry data for graphic arts halftone images. Graphic arts includes, but is not limited to, the preparation of material for, and volume production by, production printing processes which include offset lithography, letterpress, flexography, gravure, and screen printing.

Although this standard addresses halftone applications, there are situations where non-traditional halftones and/or continuous tone materials are used for which these computations are also appropriate.

2 References

The following standards contain provisions that, through reference in this text, constitute provisions of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5-2, *Photography — Density measurements — Part 2: Geometric conditions for transmission density*

ISO 5-3, *Photography — Density measurements — Part 3: Spectral conditions*

3 Terms and definitions

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

3.1
absorption (light)
process by which light (radiant energy) is captured by a material and converted into another form of energy, usually heat; light that is neither transmitted nor reflected is absorbed

3.2
aperture, illumination
area of the sample illuminated by the instrument's light source

3.3
aperture, mechanical
aperture created by an opaque mask used to position the densitometer on the specimen

3.4
aperture, sampling
reading aperture
area actually measured by the instrument