INTERNATIONAL STANDARD

ISO
28178

Second edition

Graphic technology — Exchange format for colour and process control data using XML or ASCII text

Technologie graphique — Format d'échange pour les données de couleur et de contrôle de procédé en utilisant du texte XML ou ASCII

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Contents

Foreword

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

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

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

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

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

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

This second edition cancels and replaces the first edition (ISO 28178:2009), which has been technically revised.

The main changes are as follows:

— in 4.2.3.21, an additional tag to remove ambiguity with respect to the printing sequence and the sequence of tabulating data in particular to ease the data exchange for multi-colour printing has been added;

— in 4.1.2.1, additional guidance on the use of delimiters, such as point and comma, as well as the plausibility of the sample ID usage have been provided.

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

Introduction

This document is intended to support all existing and future graphic arts standards that require the exchange of measured, computed, or process control data and the associated metadata necessary for its proper interpretation.

The following requirements were identified when reviewing the needs of such a format:

— applications based on the existing ASCII formats must not be made obsolete;

— data must be in a form that is both human-readable (once the digital file has been displayed using standard editors, or file readers) and machine-readable;

— data must be readable by automated programs to extract the necessary information;

— data files must be extensible by end users in such a way as to allow additional information to be included without breaking automated readers of the file;

— data files must be capable of being created by automated programs;

— the format must allow multiple language representation of data.

The file formats chosen to accomplish this task are a combination of XML and extensions of the existing ASCII keyword-value file format, coupled with the necessary tools to allow appropriate conversions to and from XML from ASCII keyword-value files. However, either the XML file format or the ASCII keyword-value file format can be used independently.

These formats make use of predefined XML tags and ASCII keywords. Values are associated with the tags and keywords and remain in effect until another instance of the tag or keyword. Provision is made to allow the use of data tables and to separately define the format within data tables. Multiple occurrences of such data tables within a single file are also permitted. User-defined tags and keywords are also allowed.

NOTE   During the 2021 review process, it was noted that the XML format is not widely used and that its specification in this document is insufficiently precise to ensure reliable exchange of data.

Graphic technology — Exchange format for colour and process control data using XML or ASCII text

1   Scope

This document defines an exchange format for colour and process control data (and the associated metadata necessary for its proper interpretation) in electronic form using either XML or ASCII formatted data files. This exchange format maintains human readability of the data as well as enabling machine readability. It includes a series of predefined tags and keywords, and provides extensibility through provision for the dynamic definition of additional tags and keywords as necessary. It is focused primarily on spectral measurement data, colorimetric data, and densitometric data.

This document is intended to be used in conjunction with other standards that will define the required data, and tags or keywords for specific data exchange applications.

2   Normative references

There are no normative references in this document.

3   Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
data format identifier
predefined set of characters, without intervening spaces, forming a unique word that is used to identify the presence of a defined item of data in a subsequent data table

3.2
keyword
predefined set of characters, without intervening spaces, forming a unique word that is used to identify the presence of a defined item of information

3.3
schema
XML document that, following the rules established by the World Wide Web Consortium, defines the structure of a class of xml documents

3.4
value
information immediately following a *keyword* (3.2) that represents the data content or "value" associated with that keyword

4   Requirements

4.1   General description of a conforming file

4.1.1   XML format

This file format is an XML format that complies with Extensible Markup Language (XML) 1.0.[46] The format makes use of predefined tags that identify information commonly used to describe graphic arts samples. In addition, users of this format are allowed to define tags to tailor the format to their specific needs according to the rules of XML namespace.

The data file is divided into two sections.

The preamble is the first section. This section provides general information and describes the conditions under which data was collected. The preamble tag is iso28178.preamble. Tags used in the preamble are listed in 4.2.

The data section is the second section, which is further divided into two parts. The first part of the data section provides the information that describes the type and location of the table contents; the second section contains the data values.

The schema associated with the XML format defined in this document is contained in file iso28178_data.xsd (available at: https://standards.iso.org/iso/28178/ed-2/en/), which is an essential normative part of this document. This document also provides structural XML tags that are needed for the proper specification of an XML document instance.

NOTE   See Annex A for a discussion on the need and application of the XML data reporting format.

4.1.2   ASCII format

4.1.2.1   General

This file format is an ASCII format keyword-value file. It makes use of predefined keywords and data tables. Values are associated with the keyword that precedes them and remain in effect until another instance of the keyword-value pair. Data values are delimited by the BEGIN_DATA and END_DATA keywords.

Keywords and values, as well as fields within data tables, are separated by white space. Valid white space characters are space (position 2/0 of ISO/IEC 646), carriage return (position 0/13 of ISO/IEC 646), newline (position 0/10 of ISO/IEC 646), and tab (position 0/9 of ISO/IEC 646). Keywords may be separated from values using any valid white space character. Only the space and tab may precede a keyword on a line. Comments are preceded by a single comment character (a single character keyword). The comment character is the "#" (position 2/3 of ISO/IEC 646) symbol. Comments may begin any place on a line, and are terminated by a newline or carriage return character.

NOTE   The default separator for exporting data from spreadsheet applications in many regions is a comma and not a white space character. Conforming files can be created by changing this default to a tab character and by using the full point character as the decimal separator.

4.1.2.2   Exchanged data file structure

A file containing measurement data would normally be structured as shown in Figure 1. This structure allows multiple tables of data within a single exchange file.
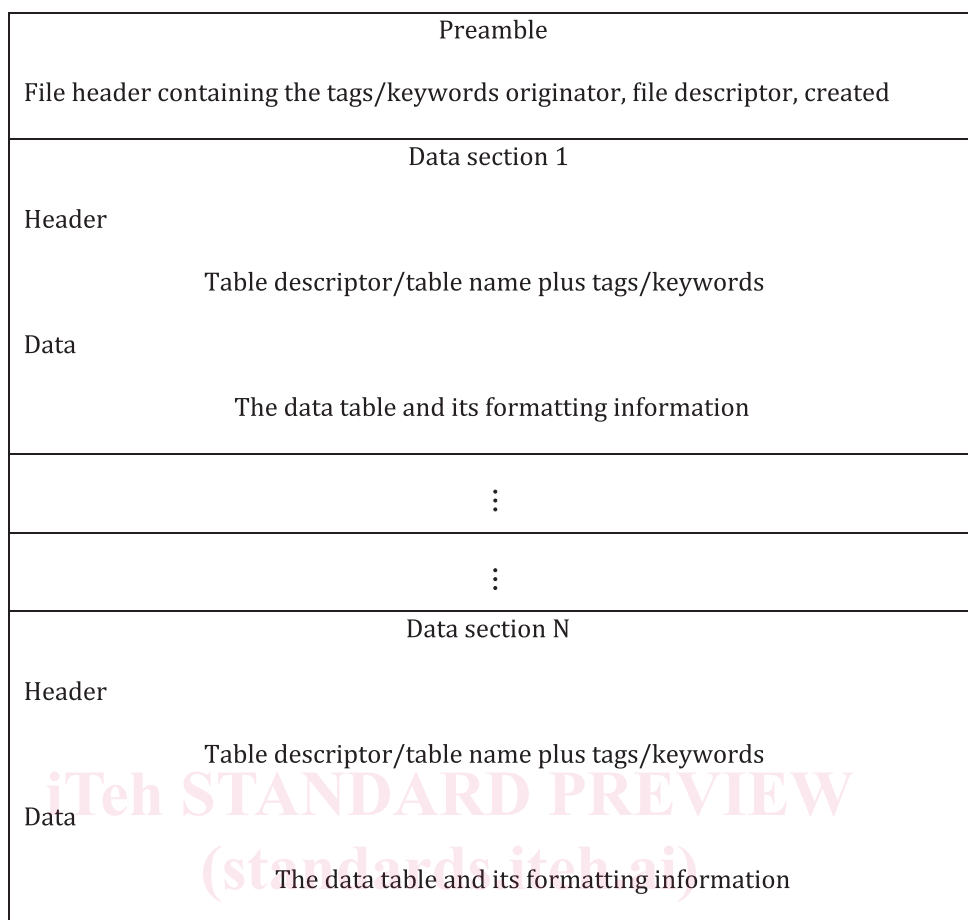
Preamble
File header containing the tags/keywords originator, file descriptor, created
Data section 1   Header   Table descriptor/table name plus tags/keywords   Data   The data table and its formatting information
⋮
⋮
Data section N   Header   Table descriptor/table name plus tags/keywords   Data   The data table and its formatting information

Figure 1 — File structure

4.2 Tags and keywords

4.2.1 General

Most tags and keywords may appear in the file in any order, and may appear multiple times within the file. Values associated with tags and keywords that appear more than once shall be replaced by successive instances except for KEYWORD, COMPUTATIONAL_PARAMETER, and WEIGHTING_ FUNCTION. Tags and keywords that describe data tables, however, shall be defined before the data table. Table 1 lists these tags and keywords. These tags are described in greater detail in this subclause.

Table 1 — XML tags and ASCII keywords that appear in a defined order

Function	XML tag	ASCII keyword
data table width	<number_of_fields>	NUMBER_OF_FIELDS
data format delimiters	<data_format>	BEGIN_DATA_FORMAT END_DATA_FORMAT
data table length	<number_of_sets>	NUMBER_OF_SETS
data table delimiters	<table>	BEGIN_DATA END_DATA

Data format delimiters shall be preceded by a data table width tag or keyword. Data table delimiters shall be preceded by a data table length tag or keyword. In the ASCII format, BEGIN_/END_ keywords begin and end the data format or table data. In the XML format, tags have parameters and/or values and

PROOF/ÉPREUVE

a standard syntax is used; e.g. <data_format> data format identifiers </data_format>. Values for tags and keywords that describe data tables shall be specified for each data table in the file; i.e. inheritance of these values is not permitted.

ASCII tags and keywords may be composed of any combination of the following: upper case letters; digits 0 through 9; and ASCII characters $ (position 2/4 of ISO/IEC 646), % (position 2/5 of ISO/IEC 646), & (position 2/6 of ISO/IEC 646), - (position 2/13 of ISO/IEC 646), / (position 2/15 of ISO/IEC 646), _ (position 5/15 of ISO/IEC 646). By convention all XML tags are lower case.

In the ASCII format, unless used as part of a data format definition, keywords should not be preceded on a line by other than white space. Unless otherwise noted, each keyword has a character string value associated with it. All character string values shall be enclosed in quotes, regardless of whether there is white space contained within the string. Enclosed in quotes means beginning and ending the character string with the " symbol (position 2/2 of ISO/IEC 646). The " symbol itself is represented within a string as "" as in the C language syntax.

NOTE   The default behaviour of applications writing '.csv' files results in additional quotation marks being added to files, for example "FILE_DESCRIPTOR ""12642-3 Target definition""", which means that such files do not conform with this requirement.

For XML tag/keyword entries the form is <xml-tag>value</xml-tag>. If attribute names are provided in the XML section of a definition, the information is represented in the XML-formatted data as XML attribute using the form <xml-tag attribute-name="value" ...>.

The value associated with keywords NUMBER_OF_FIELDS and NUMBER_OF_SETS shall be an integer. These values should not be enclosed in quotes.

Format and table delimiters do not have explicit values associated with them but rather enclose either the data format definition or table data.

The separation between the integer and the fractional part of a given number should be a "full point" for all entries.

See Annex B for examples of the use of each tag and keyword shown in 4.2.2 and 4.2.3.

4.2.2   Required preamble tags and keywords

4.2.2.1   General

Certain tags and keywords are required as part of each file, while others are optional depending upon the data to be included. All keywords shall occur before the BEGIN_DATA_FORMAT keyword and the sequence order for required tags and keywords shall follow the order shown in 4.2.2.2 through 4.2.2.9.

The STANDARD, ORIGINATOR, FILE_DESCRIPTOR and CREATED tags/keywords may occur only once within a file.

The first line in the ASCII format should be ISO 28178. The use of this identifier indicates that the data contained in the file adheres to this document. This information is represented in the XML format with the <standard> tag. See 4.2.2.2.

NOTE   Strings are widely used including "ECI2002", "CGATS17", "CGATS.17", "ISO 12642-2". These files often conform to this document with the exception of this identifier.

4.2.2.2   Standard

The use of this identifier indicates that the data contained in the file adheres to the indicated standard.

Format	Tag/Keyword	Attribute	Data type
XML	<standard>		String

NOTE   There is no ASCII keyword for this because in the ASCII format this information is carried in the first line of the file.

4.2.2.3   Originator

Identifies the specific system, organization or individual that created the data file.

Format	Tag/Keyword	Attribute	Data type
XML	<originator>		String
ASCII	ORIGINATOR		String

4.2.2.4   File descriptor

Describes the purpose or contents of the data file.

Format	Tag/Keyword	Attribute	Data type
XML	<file_descriptor>		String
ASCII	FILE_DESCRIPTOR		String

4.2.2.5   Created

Indicates the creation date of the data file. The recommended form for this date is CCYY-MM-DDThh:mm:ss[Z | +/-hh:mm].

Format	Tag/Keyword	Attribute	Data type
XML	<created>		String
		date	String
ASCII	CREATED		String

4.2.2.6   Number of fields

Number of fields (data format identifiers) that are included in the data format definition that follows.

Format	Tag/Keyword	Attribute	Data type
XML	<number_of_fields>		Integer
ASCII	NUMBER_OF_FIELDS		Integer

4.2.2.7   Data format

Marks the beginning and end of a data format definition. END_DATA_FORMAT shall be preceded by BEGIN_DATA_FORMAT. See 4.3.4 for information on the data that would be included between these tags/keywords.

Format	Tag/Keyword	Attribute	Data type
XML	<data_format>		NA
ASCII	BEGIN_DATA_FORMAT		
	END_DATA_FORMAT		

PROOF/ÉPREUVE

4.2.2.8 Number of sets of data

Number of repetitions or sets of data, i.e. the number of rows in the data table. The associated value is an integer.

Format	Tag/Keyword	Attribute	Data type
XML	\<number_of_sets\>		Integer
ASCII	NUMBER_OF_SETS		Integer

4.2.2.9 Data table

Marks the beginning and end of a data table.

Format	Tag/Keyword	Attribute	Data type
XML	\<table\>		NA
ASCII	BEGIN_DATA		
	END_DATA		

4.2.3 Optional tags and keywords

4.2.3.1 General

Certain additional general tags and keywords are optional and may be used as needed. The currently defined optional tags and keywords are defined in 4.2.3.2 to 4.2.3.19. The optional tags and keywords shall occur after the CREATED tag/keyword and before the NUMBER_OF_FIELDS tag/keyword.

4.2.3.2 Comment

Comments are ignored by automated readers. In the XML syntax, all characters within the \<comment\> \</comment\> tags are ignored. In the ASCII syntax, all characters between the comment keyword and the end of line indicator are ignored. End of line is indicated by either carriage return or newline. Comments indicate to users that the information that follows is of informative interest. Comments need not be enclosed in quotes. Comments may occur anywhere except within a table.

Format	Tag/Keyword	Attribute	Data type
XML	\<comment\>		String
ASCII	#		String

4.2.3.3 Instrumentation

Used to report the specific instrumentation used (e.g. manufacturer, model number and serial number, etc.) to generate the data reported. This data will often provide more information about the particular data collected than an extensive list of specific details. This is particularly important for spectral data or data derived from spectrophotometry.

Format	Tag/Keyword	Attribute	Data type
XML	\<instrumentation\>		String
		manufacturer	String

	model	String
	serial_number	String
ASCII	INSTRUMENTATION	String

4.2.3.4 Measurement geometry

The type of measurement, either reflection or transmission, should be indicated along with details of the geometry and the aperture size and shape. For example, for transmission measurements it is important to identify 0/diffuse, diffuse/0, opal or integrating sphere, etc. For reflection measurements it is important to identify 0/45, 45/0, sphere (specular included or excluded), etc.

Format	Tag/Keyword	Attribute	Data type
XML	<measurement_geometry>		String
ASCII	MEASUREMENT_GEOMETRY		String

4.2.3.5 Measurement source

Illumination (e.g. incandescent, daylight, colour temperature, etc.) used during spectral measurement. This data helps provide a guide to the potential for issues of paper fluorescence, etc.

Format	Tag/Keyword	Attribute	Data type
XML	<measurement_source>		String
ASCII	MEASUREMENT_SOURCE		String

4.2.3.6 Filter

Identifies the use of physical filter(s) during measurement. This is typically used to denote the use of filters such as none, D65, Red, Green or Blue.

Format	Tag/Keyword	Attribute	Data type
XML	<filter>		String
ASCII	FILTER		String

4.2.3.7 Polarization

Identifies the use of a physical polarization filter during measurement. Allowed values are "yes", "none" or "na".

Format	Tag/Keyword	Attribute	Data type
XML	<polarization>		String
ASCII	POLARIZATION		String

4.2.3.8 Weighting function

Indicates such functions as: the CIE standard observer functions used in the calculation of various data parameters (2 degree and 10 degree); CIE standard illuminant functions used in the calculation of various data parameters (e.g. D50, D65, etc.); density status response; etc. If used, there shall be at least one name-value pair following the WEIGHTING_ FUNCTION tag/keyword. The first attribute in the set