TECHNICAL SPECIFICATION

ISO/TS 10303-1002

First edition
2001-09-01

Industrial automation systems and integration — Product data representation and exchange —

Part 1002: Application module: Colour

Systèmes d'automatisation industrielle et intégration — Représentation et échange de données de produits —

Partie 1002: Module d'application: Couleur

Reference number
ISO/TS 10303-1002:2002(E)

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Printed in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years with a view to deciding whether it should be confirmed for a further three years, revised to become an International Standard, or withdrawn. In the case of a confirmed ISO/PAS or ISO/TS, it is reviewed again after six years at which time it has to be either transposed into an International Standard or withdrawn.

Attention is drawn to the possibility that some of the elements of this part of ISO 10303 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 10303-1002 was prepared by Technical Committee ISO/TC 184, *Industrial automation system and integration*, Subcommittee SC 4, *Industrial data*.

ISO 10303 is organized as a series of parts, each published separately. The structure of ISO 10303 is described in ISO 10303-1.

Each part of ISO 10303 is a member of one of the following series: description methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated applications resources, application protocols, abstract test suites, application interpreted constructs, and application modules. This part is a member of the application modules series.

A complete list of parts of ISO 10303 is available from the Internet

<http://www.nist.gov/sc4/editing/step/titles/>

Annexes A and B form a normative part of this part of ISO 10303. Annexes C, D and E are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, application modules, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the application module series.

This part of ISO 10303 specifies an application module for the definition of colour information. It does not provide specifications associated with the use of colours. Colours can be externally-defined, pre-defined or user-defined.

A set of application modules can be combined to provide the capability to assign shape elements to layers and visual attributes, such as colours and curve fonts, to geometric and topological elements. For additional information, see Annex F of ISO/TS 10303-1009.

NOTE The scope of this part of ISO 10303 overlaps with ISO 10303-517, and therefore this part of ISO 10303 should not be used in conjunction in an application protocol or other application module. There are name conflicts for the interpreted model EXPRESS entity draughting_pre_defined_colour.

Industrial automation systems and integration — Product data representation and exchange —

Part 1002: Application module: Colour

1 Scope

This part of ISO 10303 specifies the application module for colour.

The following is within scope of this part of ISO 10303:

— the definition of colour information.

The following is outside the scope of this part of ISO 10303:

— the specification of semantics associated with the use of colours;

— use of this part of ISO 10303 in conjunction with ISO 10303-517 due to scope overlap and name conflicts for the interpreted model EXPRESS entity draughting_pre_defined_colour.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 8824-1:1998, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO 10303-41:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resource: Fundamentals of product description and support*

ISO 10303-46:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation*

ISO 10303-202:1996, *Industrial automation systems and integration — Product data representation and exchange — Part 202: Application protocol: Associative draughting*

ISO/TS 10303-1001:2001, *Industrial automation systems and integration — Product data representation and exchange — Part 1001: Application module: Appearance assignment*

3 Terms, definitions, and abbreviations

3.1 Terms defined in ISO 10303-1

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-1 apply:

— application;

— application object;

— application protocol;

— application reference model;

— data;

— information;

— integrated resource;

— product;

— product data;

— unit of functionality.

3.2 Terms defined in ISO 10303-202

For the purposes of this part of ISO 10303, the following term defined in ISO 10303-202 applies:

— application interpreted construct.

3.3 Terms defined in ISO/TS 10303-1001

For the purposes of this part of ISO 10303, the following terms defined in ISO/TS 10303-1001 apply:

— application module,

— module interpreted model.

3.4 Abbreviations

For the purposes of this part of ISO 10303, the following abbreviations apply:

AM	application module
ARM	application reference model
MIM	module interpreted model
RGB	red green blue
UoF	unit of functionality
URL	uniform resource locator

4 Information requirements

This clause specifies the information requirements for colour.

The information requirements are specified as a set of units of functionality and application objects. The information requirements are defined using the terminology of the subject area of this application module.

— A graphical representation of the information requirements is given in annex C.

— The mapping specification is specified in 5.1 which shows how the information requirements are met using the integrated resources of this International Standard. The use of the integrated resources introduces additional requirements which are common to application modules and application protocols.

EXPRESS specification:

```
*)
SCHEMA Colour_arm;
(*
```

4.1 Units of functionality

This subclause specifies the units of functionality (UoF) for this part of ISO 10303 as well as any support elements needed for the application module definition. This part of ISO 10303 specifies the following unit of functionality:

— Colour.

This part of ISO 10303 uses no other unit of functionality.

The units of functionality and a description of the functions that each UoF supports are given below. The application elements included in the UoFs are defined in 4.2.

4.1.1 Colour

The colour UoF specifies the definitional information for colour.

The following application entities are defined in the colour UoF:

— Colour;

— Externally_defined_colour;

— Pre_defined_colour;

— User_defined_colour.

4.2 ARM entity definitions

This subclause specifies the application entities for the colour module. Each application entity is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the entity. The application entities and their definitions are given below.

4.2.1 Colour

A Colour is a name for a property of reflecting light at a particular wavelength.

EXPRESS specification:

```
*)
ENTITY Colour;
  name : STRING;
END_ENTITY;
(*
```

Attribute definitions:

name: The **name** specifies the word or group of words by which the Colour is known.

4.2.2 Externally_defined_colour

An Externally_defined_colour is a Colour that has its definition established and maintained by a source outside of ISO 10303.

EXPRESS specification:

```
*)
ENTITY Externally_defined_colour
  SUBTYPE OF (Colour);
  source : STRING;
END_ENTITY;
(*
```

Attribute definitions:

source: The **source** specifies the identification of the organization responsible for the Colour definition.

4.2.3 Pre_defined_colour

A Pre_defined_colour is a Colour that has its definition established and maintained in the Colour module.

EXPRESS specification:

```
*)
ENTITY Pre_defined_colour
  SUBTYPE OF (Colour);
WHERE
  WR1: SELF.name IN
       ['red',
        'green',
        'blue',
        'yellow',
        'magenta',
        'cyan',
        'black',
        'white'];
END_ENTITY;
(*
```

4.2.4 User_defined_colour

A User_defined_colour is a Colour that has its definition established without referencing any standard.

EXPRESS specification:

```
*)
ENTITY User_defined_colour
  SUBTYPE OF (Colour);
  red   : REAL;
  green : REAL;
  blue  : REAL;
WHERE
  WR1: {0.0 <= red <= 1.0};
  WR2: {0.0 <= green <= 1.0};
  WR3: {0.0 <= blue <= 1.0};
END_ENTITY;

END_SCHEMA;
(*
```

Attribute definitions:

red: the intensity of the red colour component.

green: the intensity of the green colour component.

blue: the intensity of the blue colour component.

Formal propositions:

WR1: The intensity of the red component shall be between 0.0 and 1.0.

WR2: The intensity of the green component shall be between 0.0 and 1.0.

WR3: The intensity of the blue component shall be between 0.0 and 1.0.

5 Module interpreted model

5.1 Mapping specification

This clause contains the mapping table that shows how each UoF and application element of this part of ISO 10303 (see clause 4) maps to one or several MIM resource constructs. The mapping table is organized in five columns. The contents of these five columns are:

Column 1) Application element: Name of an application element as it appears in the application entity definition. Application entity names are written in uppercase. Attribute names are listed after the application entity to which they belong and are written in lower case.

Column 2) MIM element: Name of an MIM element as it appears in the MIM, the term 'IDENTICAL MAPPING', or the term 'PATH'. MIM entities are written in lower case. Attribute names of MIM entities are referred to as <entity name>.<attribute name>. The mapping of an application element may result in several related MIM elements. Each of these MIM elements will require a line of its own in the table. The term 'IDENTICAL MAPPING' indicates that both application entities of an application assertion map to the same MIM element. The term 'PATH' indicates that the application assertion maps to the entire reference path.

Column 3) Source: For those MIM elements that are interpreted from the integrated resources, this is the number of the corresponding part of ISO 10303. For those MIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part.

Column 4) Rules: One or more numbers may be given which refer to rules that apply to the current MIM element or reference path. For rules that are derived from relationships between application entities, the same rule is referred to by the mapping entries of all the involved MIM elements. The expanded names of the rules are listed after the table.

Column 5) Reference path: To describe fully the mapping of an application entity, it may be necessary to specify a reference path through several related MIM elements. The reference path column documents the role of a MIM element relative to the MIM element in the row succeeding it. Two or more such related MIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application entity. For each MIM element that has been created for use within this part of ISO 10303, a reference path up to its supertype from an integrated resource is specified.

For the expression of reference paths and the relationships between MIM elements, the following notational conventions apply:

a) [] : multiple MIM elements or sections of the reference path are required to satisfy an information requirement;

b) () : multiple MIM elements or sections of the reference path are identified as alternatives within the mapping to satisfy an information requirement;

c) {} : enclosed section constrains the reference path to satisfy an information requirement;

d) -> : attribute references the entity or select type given in the following row;

e) <- : entity or select type is referenced by the attribute in the following row;

f) [i] : attribute is an aggregation of which a single member is given in the following row;

g) [n] : attribute is an aggregation of which member n is given in the following row;

h) => : entity is a supertype of the entity given in the following row;

i) <= : entity is a subtype of the entity given in the following row;

j) = : the string, select or enumeration type is constrained to a choice or value;

k) \ : the line continuation for strings that wrap.

Table 1 - Mapping table for Colour UoF

Application_element	MIM element	Source	Rules	Reference path
COLOUR	colour	46		
name	colour_specification.-name	46		colour_specification<=colour
EXTERNALLY_-DEFINED_COLOUR	externally_defined_-colour	1002		externally_defined_colour<=[externally_defined_item][colour_specification]<=colour
name	externally_defined_-colour.name	46		externally_defined_colour<=[externally_defined_item][colour_specification]<=colour
source	external_source.source_-id	41		externally_defined_colour<=externally_defined_itemexternally_defined_item.source->external_sourceexternal_source.source_id
PRE_DEFINED_-COLOUR	draughting_pre_defined_-colour	1002		draughting_pre_defined_colour<=pre_defined_colour<=[pre_defined_item][colour]
name	draughting_pre_defined_-colour.name	1002		draughting_pre_defined_colour<=pre_defined_colour<=[pre_defined_item][colour]
USER_DEFINED_-COLOUR	colour_rgb	46		colour_rgb<=colour_specification<=colour

Table 1 - Mapping table for Colour UoF (concluded)

Application_element	MIM element	Source	Rules	Reference path
name	colour_rgb.name	46		colour_rgb<= colour_specification<= colour
red	colour_rgb.red	46		colour_rgb<= colour_specification<= colour
green	colour_rgb.green	46		colour_rgb<= colour_specification<= colour
blue	colour_rgb.blue	46		colour_rgb<= colour_specification<= colour

5.2 MIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources, application interpreted constructs or application module MIMs and contains the types, entity specializations, rules, and functions that are specific to this part of ISO 10303. This clause also specifies modifications to the textual material for constructs that are imported from the integrated resources. The definitions and EXPRESS provided in the integrated resources or application interpreted constructs for constructs used in the MIM may include select list items and subtypes which are not imported into the MIM. Requirements stated in the integrated resources or application interpreted constructs which refer to such items and subtypes apply exclusively to those items which are imported into the MIM.

EXPRESS Specification:

```
*)
SCHEMA Colour_mim;
  USE FROM external_reference_schema -- ISO 10303-41
      (externally_defined_item);
  USE FROM presentation_resource_schema -- ISO 10303-46
      (colour,
       colour_rgb,
       colour_specification,
       draughting_pre_defined_colour,
       pre_defined_colour);
  USE FROM support_resource_schema -- ISO 10303-41
      (identifier);
(*
```

NOTE 1 See annex D for a graphical presentation of this schema using the EXPRESS-G notation.

NOTE 2 The schema referenced above can be found in the following part of ISO 10303:

external_reference_schema	ISO 10303-41
presentation_resource_schema	ISO 10303-46
support_resource_schema	ISO 10303-41

5.2.1 Application module entity definitions

This subclause contains the EXPRESS entity definitions in the MIM.

5.2.1.1 Externally_defined_colour

An **externally_defined_colour** is a colour that has its definition specified outside of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_colour
  SUBTYPE OF (colour_specification,externally_defined_item);
END_ENTITY; -- externally_defined_colour
(*
```


EXPRESS specification:

```
*)
END_SCHEMA;
(*
```


Annex A
(normative)

MIM short names

Table A.1 provides the short names for entities defined in the MIM of this part of ISO 10303. Requirements on the use of the short names are found in the implementation methods included in ISO 10303.

NOTE The EXPRESS entity names are available from Internet:
<http://www.mel.nist.gov/div826/subject/apde/snr/>.

Table A.1 - MIM short names of entities

Entity name	Short name
EXTERNALLY_DEFINED_COLOUR	EXD1

Annex B
(normative)

Information object registration

B.1 Document identification

To provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard 10303 part(1002) version(1) }

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

B.2 Schema identification

B.2.1 colour_arm schema identification

To provide for unambiguous identification of the schema specifications given in this application module in an open information system, the object identifiers are assigned as follows:

{ iso standard 10303 part(1002) version(1) object(1) colour-arm-schema(1) }

is assigned to the colour_arm schema. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

B.2.2 colour_mim schema identification

To provide for unambiguous identification of the schema specifications given in this application module in an open information system, the object identifiers are assigned as follows:

{ iso standard 10303 part(1002) version(1) object(1) colour-mim-schema(2) }

is assigned to the colour_mim schema. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

Annex C
(informative)

ARM EXPRESS-G

The following diagrams correspond to the ARM EXPRESS listing given in clause 4. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

NOTE The inter-page referencing is to the diagram number and not the figure number.

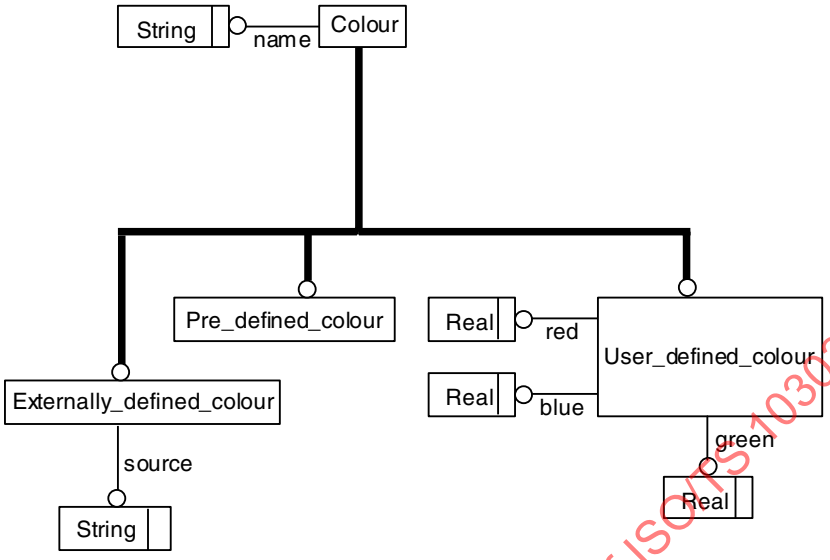

Figure C.1 - ARM EXPRESS-G diagram 1 of 1

Annex D
(informative)
MIM EXPRESS-G

The following diagrams correspond to the MIM EXPRESS expanded listing. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

NOTE The inter-page referencing is to the diagram number and not the figure number.