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

Part 1003:  
**Application module: Curve appearance**

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

*Partie 1003: Module d'application: Apparence de courbe*



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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to deciding whether it should be confirmed for a further three years, revised to become an International Standard, or withdrawn.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it is reviewed again after six years at which time it has to be either transposed into an International Standard or withdrawn.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 10303-1003 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 curve appearance. It allows for the definition of visual attributes governing how curves shall be presented. These attributes include curve font, colour and curve thickness.

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.



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

Part 1003:

## Application module: Curve appearance

### 1 Scope

This part of ISO 10303 specifies the application module for associating curves with appearance characteristics.

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

- the definition of appearance information for curves.

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

- the specification of semantics associated with the appearance assigned to curves.

### 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 10303-43:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resource: Representation structures*

## **ISO/TS 10303-1003:2001(E)**

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*

ISO/TS 10303-1002:2001, *Industrial automation systems and integration — Product data representation and exchange — Part 1002: Application module: Colour*

ISO/TS 10303-1004:2001, *Industrial automation systems and integration — Product data representation and exchange — Part 1004: Application module: Elemental geometric shape*

## **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
UoF	unit of functionality
URL	uniform resource locator

## 4 Information requirements

This clause specifies the information requirements for curve appearance. 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.

NOTE 1 A graphical representation of the information requirements is given in annex C.

NOTE 2 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 Curve_appearance_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 module definition. This part of ISO 10303 specifies the following unit of functionality:

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- Curve\_appearance.

This part of ISO 10303 uses the following units of functionality:

- Elemental\_geometric\_shape;
- Colour.

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 4.4.

### 4.1.1 Curve\_appearance

The curve\_appearance UoF specifies the presentation of point, vector, and curve geometry with attributes, such as colour, curve thickness, or curve font.

The following application elements are specified in the curve\_appearance UoF:

- Curve\_appearance;
- Curve\_font;
- Curve\_font\_pattern;
- Externally\_defined\_curve\_font;
- Externally\_defined\_marker;
- Externally\_defined\_terminator;
- Marker;
- Point\_appearance;
- Predefined\_curve\_font;
- Predefined\_marker;
- Predefined\_terminator;
- Terminator;
- User\_defined\_curve\_font;
- User\_defined\_marker;
- User\_defined\_terminator;
- Vector\_appearance.

## 4.1.2 Colour

The colour UoF specifies the definitional information for colour. See ISO/TS 10303-1002. The following application element from this UoF are referenced in this part of ISO 10303:

- Colour.

## 4.1.3 Elemental\_geometric\_shape

The elemental\_shape UoF specifies the definitional information for the concept of shape and how it is composed. See ISO/TS 10303-1004. The following application element from this UoF are referenced in this part of ISO 10303:

- Geometric\_model.

## 4.2 Required AM ARMs

The following EXPRESS reference statements specify the application elements imported from the ARMs of other application modules.

EXPRESS specification:

```
*)
USE FROM Colour_arm; -- ISO/TS 10303-1002
USE FROM Elemental_shape_arm; --ISO/TS 10303-1004
(*)
```

## 4.3 ARM type definitions

This subclause specifies the ARM application types defined in this part of ISO 10303. Each application type specifies a data type or selection of data types. The application types and their definitions are given below.

### 4.3.1 Curve\_appearance\_select

A Curve\_appearance\_select identifies the objects which can have appearance.

EXPRESS specification:

```
*)
TYPE curve_appearance_select = SELECT
    (Curve_appearance, Point_appearance, Vector_appearance);
END_TYPE;
(*)
```

## 4.4 ARM entity definitions

This subclause specifies the ARM application entities defined in this part of ISO 10303. Each application entity is an atomic element that embodies a unique application concept and contains

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attributes specifying the data elements of the object. The application entities and their definitions are given below.

### 4.4.1 Curve\_appearance

A Curve\_appearance governs the visual appearance of geometric curves and annotation curves.

EXPRESS specification:

```
*)
ENTITY Curve_appearance;
  width          : REAL;
  font           : Curve_font;
  colour        : Colour;
END_ENTITY; -- Curve_appearance
(*
```

Attribute definitions:

**width:** The width specifies breadth of the rendered curve.

**font:** The font specifies the display pattern of a curve. The font determines the visible and invisible segments of a curve.

**colour:** The colour specifies the colour of the visible segments of a curve.

### 4.4.2 Curve\_font

A Curve\_font is a shape replicated at a fixed pattern used to render a curve.

EXPRESS specification:

```
*)
ENTITY Curve_font
  SUPERTYPE OF (ONEOF (Externally_defined_curve_font,
                       Predefined_curve_font,
                       User_defined_curve_font));
  curve_font_name : STRING;
END_ENTITY; -- Curve_font
(*
```

Attribute definitions:

**curve\_font\_name:** The word or group of words by which the Curve\_font is known.

### 4.4.3 Curve\_font\_pattern

A Curve\_font\_pattern is a semaphore pattern (on-off) in the appearance of a curve.

EXPRESS specification:

```
*)
ENTITY Curve_font_pattern;
  on_segment : REAL;
```

```

    off_segment : REAL;
END_ENTITY; -- Curve_font_pattern
(*)

```

Attribute definitions:

**on\_segment:** The numerical length of the drawn segments. A unit shall be associated with the real number.

**off\_segment:** The numerical length of the blank segments. A unit shall be associated with the real number.

#### 4.4.4 Externally\_defined\_curve\_font

An Externally\_defined\_curve\_font is a Curve\_font whose definition is outside the scope of this application module.

EXPRESS specification:

```

*)
ENTITY Externally_defined_curve_font
  SUBTYPE OF (curve_font);
  curve_font_reference : STRING;
END_ENTITY; -- Externally_defined_curve_font
(*)

```

Attribute definitions:

**curve\_font\_reference:** The identification of the curve font in the external reference.

#### 4.4.5 Externally\_defined\_marker

An Externally\_defined\_marker is a Marker defined by an outside source.

EXPRESS specification:

```

*)
ENTITY Externally_defined_marker
  SUBTYPE OF (Marker);
  marker_reference : STRING;
END_ENTITY; -- Externally_defined_marker
(*)

```

Attribute definitions:

**marker\_reference:** The identification of the Marker in the external reference.

#### 4.4.6 Externally\_defined\_terminator

An Externally\_defined\_terminator is a Terminator with its shape defined by an outside source.

EXPRESS specification:

```

*)

```

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```
ENTITY Externally_defined_terminator
  SUBTYPE OF (Terminator);
  terminator_reference : STRING;
END_ENTITY; -- Externally_defined_terminator
(*
```

Attribute definitions:

**terminator\_reference:** The identification of the Terminator in the external reference.

### 4.4.7 Marker

A Marker is a visual identifier.

EXPRESS specification:

```
*)
ENTITY Marker
  SUPERTYPE OF (ONEOF (Externally_defined_marker,
                       Predefined_marker,
                       User_defined_marker));
  marker_name : STRING;
END_ENTITY; -- Marker
(*
```

Attribute definitions:

**marker\_name:** The word or group of words by which the Marker is known.

### 4.4.8 Point\_appearance

A Point\_appearance governs the visual appearance of a point.

EXPRESS specification:

```
*)
ENTITY Point_appearance;
  marker : Marker;
  colour : Colour;
  size : REAL;
END_ENTITY;
(*
```

Attribute definitions:

**marker:** The marker specifies the point marker that shall be used to present a point.

**colour:** The colour specifies the Colour of a point.

**size:** The size specifies the breadth of the marker.

#### 4.4.9 Predefined\_curve\_font

A Predefined\_curve\_font is a Curve\_font which is defined in this part of ISO 10303. Since its definition is standard, it is interchanged by name.

EXPRESS specification:

```

*)
ENTITY Predefined_curve_font
  SUBTYPE OF (Curve_font);
WHERE
  WR1: SELF.curve_font_name IN ['continuous',
                                'chain',
                                'chain double dash',
                                'dashed',
                                'dotted'];
END_ENTITY; -- Predefined_curve_font
(*)

```

Formal propositions:

**WR1:** The **curve\_font\_name** of the **predefined\_curve\_font** shall be 'continuous', 'chain', 'chain double dash', 'dashed', or 'dotted'.

Table 1 states the lengths of each segment and space in millimetres.

**Table 1 - Predefined curve font segment lengths**

Curve pattern name	Segment (mm)	Space (mm)	Segment (mm)	Space (mm)	Segment (mm)	Space (mm)	Number of segments
Continuous							0
Dashed	4.0	1.5					2
Chain	7.0	1.0	1.0	1.0			4
Chain double dash	7.0	1.0	1.0	1.0	1.0	1.0	6
Dotted	1.0	1.0					2

#### 4.4.10 Predefined\_marker

A Predefined\_marker is a Marker which is defined in this part of ISO 10303. Since its definition is standard, it is interchanged by name.

EXPRESS specification:

```

*)
ENTITY Predefined_marker
  SUBTYPE OF (Marker);
WHERE
  WR1: SELF.marker_name IN ['asterisk',
                              'circle',
                              'dot',
                              'plus',
                              'square',
                              'triangle',

```

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```
        'x' ] ;  
END_ENTITY; -- Predefined_marker  
(*
```

### Formal propositions:

**WR1:** The **marker\_name** of the **predefined\_marker** shall be 'asterisk', 'circle', 'dot', 'plus', 'square', 'triangle', or 'x'.

The predefined\_markers are the following:

**asterisk:** a graphical symbol depicted as three line segments of equal length that intersect at their midpoints forming the origin of the symbol. One of the segments is parallel to the vertical axis of the coordinate system into which the symbol is placed. The other two segments are at angles of 60 and 120 degrees from the first segment, rotated about the origin.

**circle:** a graphical symbol depicted as a circle. The origin of the symbol is the geometric centre of the circle.

**dot:** a graphical symbol depicted as a circle with a fill-pattern applied to it. The origin of the dot symbol is the centre of the circle.

**plus:** a graphical symbol depicted as two perpendicular line segments. The origin of the symbol is the intersection point of the two lines.

**square:** a graphical symbol depicted as an even-sided rectangle. The origin of the symbol is the geometrical centre of the rectangle.

**triangle:** a graphical symbol depicted as three line segments that form an equilateral triangle. The origin of the triangle corresponds to the geometric centre of the triangle. One side of the triangle is parallel to the horizontal axis of the coordinate system into which the symbol is placed.

**x:** a graphical symbol depicted as two line segments of equal length that intersect at their midpoints forming the origin of the symbol. One line segment is at an angle of 45 degrees to the vertical axis of the coordinate system into which the symbol is placed. The other segment is perpendicular to the first.

### **4.4.11 Predefined\_terminator**

A Predefined\_terminator is a Terminator which is defined in this part of ISO 10303. Since its definition is standard, it is interchanged by name.

#### EXPRESS specification:

```
*)  
ENTITY Predefined_terminator  
  SUBTYPE OF (Terminator);  
WHERE  
  WR1: SELF.terminator_name IN ['blanked arrow',  
                                'blanked box',  
                                'dimension origin',  
                                'filled arrow',  
                                'filled box',
```

```

        'filled dot',
        'integral symbol',
        'open arrow',
        'slash',
        'unfilled arrow'];
END_ENTITY; -- Predefined_terminator
(*

```

#### Formal propositions:

**WR1:** The name of the **predefined\_terminator** shall be 'blanked arrow', 'blanked box', 'blanked dot', 'dimension origin', 'filled arrow', 'filled box', 'filled dot', 'integral symbol', 'open arrow', 'slash', or 'unfilled arrow'.

The predefined\_terminators are:

**blanked arrow:** a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is blanked.

**blanked box:** a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area within the symbol is blanked.

**blanked dot:** a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is blanked.

**dimension origin:** a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle.

**filled arrow:** a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is shaded.

**filled box:** a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area that lies within the symbol is shaded.

**filled dot:** a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is shaded.

**integral symbol:** a graphical symbol depicted as one line segment forming two adjacent arcs. The origin of the symbol is the midpoint between the two arcs.

**open arrow:** a graphical symbol depicted as three line segments which form an isosceles triangle where the third side of the triangle is blanked. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

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**slash:** a graphical symbol depicted as a line segment with the midpoint of the segment being the origin and lying on the annotation curve to which it is applied.

**unfilled arrow:** a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

### 4.4.12 Terminator

A Terminator is the shape that denotes the end of a construct.

EXPRESS specification:

```
*)
ENTITY Terminator
  SUPERTYPE OF (ONEOF (Externally_defined_terminator,
                       Predefined_terminator,
                       User_defined_terminator));
  terminator_name : STRING;
END_ENTITY; -- Terminator
(*)
```

Attribute definitions:

**terminator\_name:** The word or group of words by which the Terminator is known.

### 4.4.13 User\_defined\_curve\_font

A User\_defined\_curve\_font is a Curve\_font which is defined without referencing any standard or convention.

EXPRESS specification:

```
*)
ENTITY User_defined_curve_font
  SUBTYPE OF (Curve_font);
  pattern : SET [1:?] OF Curve_font_pattern;
  segment_symbol : Geometric_model;
END_ENTITY; -- User_defined_curve_font
(*)
```

Attribute definitions:

**pattern:** The **pattern** defines the set of semaphore patterns that define the curve font.

**segment\_symbol:** The **segment\_symbol** defines the shape of the drawn portions of the **curve\_font\_pattern**.

### 4.4.14 User\_defined\_marker

A User\_defined\_marker is a Marker which is defined without referencing any standard or convention.

EXPRESS specification:

```

*)
ENTITY User_defined_marker
  SUBTYPE OF (Marker);
  symbol : Geometric_model;
END_ENTITY; -- User_defined_marker
(*)

```

Attribute definitions:

**symbol:** The **symbol** defines the shape of the Marker.

#### 4.4.15 User\_defined\_terminator

A User\_defined\_terminator is a Terminator which is defined without referencing any standard or convention.

EXPRESS specification:

```

*)

ENTITY User_defined_terminator
  SUBTYPE OF (Terminator);
  symbol : Geometric_model;
END_ENTITY; -- User_defined_terminator
(*)

```

Attribute definitions:

**symbol:** The **symbol** defines the shape of the Terminator.

#### 4.4.16 Vector\_appearance

A Vector\_appearance is the definition of the visual appearance of a vector.

EXPRESS specification:

```

*)
ENTITY Vector_appearance;
  terminator_type : Terminator;
  vector_font : Curve_font;
  colour : Colour;
  width : REAL;
END_ENTITY; -- Vector_appearance
(*)

```

Attribute definitions:

**terminator\_type:** The terminator\_type specifies the type of the Terminator.

**vector\_font:** The vector\_font specifies the font of the vector line. The font determines the visible and invisible segments and the shape of the segments of the vector line.

**colour:** The colour specifies the Colour of the visible segments of the vector.

**width:** The **width** specifies the breadth of the vector.

EXPRESS specification:

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

## 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.

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**Table 1 - Mapping table Curve\_appearance UoF**

Application element	MM element	Source	Rules	Reference path
CURVE_APPEARANCE	curve_style	46		curve_style.curve_colour -> colour
colour	PATH			curve_style
font #1 if user defined #2 if predefined #3if externally defined	PATH			curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select #1 (curve_style_font_select = curve_style_font curve_style_font <= user_defined_curve_font) #2 (curve_style_font_select = pre_defined_curve_font pre_defined_curve_font => draughting_pre_defined_curve_font) #3 (curve_style_font_select = externally_defined_curve_font externally_defined_curve_font)
width	curve_style.curve_-- width	46		
CURVE_FONT	curve_style_font	46		
curve_font_name	curve_style_font.name	46		
CURVE_FONT_-- PATTERN	curve_style_font_-- pattern	46		
on_segment	curve_style_font_-- pattern.visible_-- segment_length	46		
off_segment	curve_style_font_-- pattern.invisible_-- segment_length	46		

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Table 1 - Mapping table Curve\_appearance UoF (continued)

Application_element	MM element	Source	Rules	Reference path
EXTERNALLY_DEFINED_CURVE_FONT	externally_defined_curve_font	46		curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select curve_style_font_select = externally_defined_curve_font
curve_font_name	externally_defined_curve_font.item_id	46		curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select curve_style_font_select = externally_defined_curve_font externally_defined_curve_font.item_id
curve_font_reference	PATH			curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select curve_style_font_select = externally_defined_curve_font externally_defined_curve_font.source
EXTERNALLY_DEFINED_MARKER	externally_defined_marker	1003		externally_defined_marker <= [pre_defined_marker] [externally_defined_symbol]

Table 1 - Mapping table Curve\_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
marker_name	externally_defined_- marker.item_id	1003		externally_defined_marker <= externally_defined_symbol <= externally_defined_item.item_id
marker_reference	PATH			externally_defined_marker <= externally_defined_symbol <= externally_defined_item.source-> external_source.source_id
EXTERNALLY_- DEFINED_- TERMINATOR	externally_defined_- terminator_symbol	1003		externally_defined_terminator_symbol <= externally_defined_symbol
terminator_name	externally_defined_- terminator_- symbol.item_id	1003		externally_defined_terminator_symbol <= externally_defined_symbol <= externally_defined_item.item_id
terminator_reference	PATH			externally_defined_terminator_symbol <= externally_defined_symbol <= externally_defined_item.source-> external_source.source_id
MARKER	marker_select	1003		point_style.marker -> marker_select
marker_name	NO MAPPING	1003		
POINT_-APPEARANCE	point_style	46		
size	point_style.marker_size			
colour	point_style.marker_- colour	46		point_style point_style.marker_colour -> colour

Table 1 - Mapping table Curve\_appearance UoF (continued)

Application_element	MM element	Source	Rules	Reference path
marker #1 if predefined #2 if externally defined #3 if user defined	point_style.marker	1003		point_style.marker -> marker_select  #1(marker_select = marker_type) #2(marker_select = pre_defined_marker pre_defined_marker => externally_defined_marker) #3(marker_select = pre_defined_marker pre_defined_marker => user_defined_marker)
PREDEFINED_- CURVE_FONT	draughting_pre_- defined_curve_font	1003		
curve_font_name	draughting_pre_- defined_curve_- font.name	1003		
PREDEFINED_- MARKER	marker_type	1003		point_style.marker -> marker_select marker_select = marker_type
marker_name	NO MAPPING	1003		
PREDEFINED_- TERMINATOR	pre_defined_- terminator_symbol	1003		pre_defined_terminator_symbol<= pre_defined_symbol
terminator_name	pre_defined_- terminator_- symbol.name	1003		pre_defined_terminator_symbol<= pre_defined_symbol
TERMINATOR	terminator_select	1003		
terminator_name	NO MAPPING	1003		
USER_DEFINED_- CURVE_FONT	user_defined_curve_- font	1003		user_defined_curve_font<= [curve_style.font] [mapped_item]
Curve_font_name	user_defined_curve_- font.name	1003		user_defined_curve_font<= curve_style_font_name

Table 1 - Mapping table Curve\_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
pattern	PATH			user_defined_curve_font<= curve_style_font.pattern_list-> curve_style_font_pattern
segment_symbol	PATH			user_defined_curve_font<= mapped_item.mapping_source-> representation_map.mapped_representation-> representation-> shape_representation
USER_DEFINED_- MARKER	user_defined_marker	1003		user_defined_marker<= [pre_defined_marker] [mapped_item]
marker_name	user_defined_marker	1003		user_defined_marker<= pre_defined_marker.name
symbol	PATH			user_defined_curve_font<= mapped_item.mapping_source-> representation_map.mapped_representation-> representation-> shape_representation
USER_DEFINED_- TERMINATOR	user_defined_terminator_symbol	1003		user_defined_terminator_symbol<= [pre_defined_symbol] [mapped_item]
terminator_name	pre_defined_symbol.name	46		user_defined_terminator_symbol<= pre_defined_symbol.name
symbol	PATH	46		user_defined_terminator_symbol<= mapped_item.mapping_source-> representation_map.mapped_representation-> representation-> shape_representation

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Table 1 - Mapping table Curve\_appearance UoF (concluded)

Application_element	MIMelement	Source	Rules	Reference_path
VECTOR_- APPEARANCE	vector_style	1003		vector_style <= [pre_defined_symbol] [curve_style]
Width	vector_style.curve_ width	46		vector_style <= curve_style.curve_width
terminator_type	PATH			vector_style <= pre_defined_terminator_symbol <= pre_defined_symbol
Colour	PATH			vector_style <= curve_style curve_style.curve_colour -> colour
vector_font #1 if user defined #2 if predefined #3 if externally defined	PATH			vector_style <= curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select = curve_font_or_scaled_curve_font_select = curve_style_font_select #1 (curve_style_font_select = curve_style_font curve_style_font <= user_defined_curve_font) #2 (curve_style_font_select = pre_defined_curve_font pre_defined_curve_font => draughting_pre_defined_curve_font) #3 (curve_style_font_select = externally_defined_curve_font)

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## 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 Curve_appearance_mim;
  USE FROM representation_schema -- ISO 10303-43
    (mapped_item);
  USE FROM presentation_appearance_schema -- ISO 10303-46
    (curve_style,
     curve_style_font,
     curve_style_font_pattern,
     draughting_pre_defined_curve_font,
     externally_defined_curve_font,
     marker_select,
     marker_type,
     pre_defined_curve_font,
     pre_defined_marker,
     point_style);
  USE FROM presentation_definition_schema -- ISO 10303-46
    (pre_defined_symbol,
     externally_defined_symbol);
  USE FROM Colour_mim; -- ISO/TS 10303-1002
  USE FROM Elemental_geometric_shape_mim; -- ISO/TS 10303-1004
(*)

```

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:

presentation_appearance_schema	ISO 10303-46
presentation_definition_schema	ISO 10303-46
presentation_resource_schema	ISO 10303-46
Colour_mim	ISO/TS 10303-1002
Elemental_shape_mim	ISO/TS 10303-1004

### 5.2.1 Application module type definitions

This subclause contains the EXPRESS type definitions in the application module.

### 5.2.1.1 Terminator

A **terminator** selects a type of symbol to end a construct.

EXPRESS specification:

```
*)
TYPE terminator = SELECT
  (externally_defined_terminator_symbol,
   pre_defined_terminator_symbol,
   user_defined_terminator_symbol);
END_TYPE;
(*
```

### 5.2.2 Application module entity definitions

This subclause contains the EXPRESS entity definitions in the application module.

#### 5.2.2.1 Externally\_defined\_marker

An **externally\_defined\_marker** is a type of **externally\_defined\_symbol** which is a **predefined\_marker**.

EXPRESS specification:

```
*)
ENTITY externally_defined_marker
  SUBTYPE OF (externally_defined_symbol pre_defined_marker);
END_ENTITY;
(*
```

#### 5.2.2.2 Externally\_defined\_terminator\_symbol

An **externally\_defined\_terminator\_symbol** is a type of **externally\_defined\_symbol**.

EXPRESS specification:

```
*)
ENTITY externally_defined_terminator_symbol
  SUBTYPE OF (externally_defined_symbol);
END_ENTITY;
(*
```

#### 5.2.2.3 Pre\_defined\_terminator\_symbol

A **pre\_defined\_terminator\_symbol** is a type of **pre\_defined\_symbol** that presents a terminator and is identified by name.

EXPRESS specification:

```
*)
ENTITY pre_defined_terminator_symbol
  SUBTYPE OF (pre_defined_symbol);
WHERE
  WR1: SELF.name IN ['blanked arrow', 'blanked box',
                    'blanked dot', 'dimension origin', 'filled arrow',
```

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```
'filled box', 'filled dot', 'integral symbol',  
'open arrow', 'slash', 'unfilled arrow'];  
END_ENTITY;  
(*
```

### Formal propositions:

**WR1:** The **name** of the **pre\_defined\_terminator\_symbol** shall be 'blanked arrow', 'blanked box', 'blanked dot', 'dimension origin', 'filled arrow', 'filled box', 'filled dot', 'integral symbol', 'open arrow', 'slash', or 'unfilled arrow'.

The **pre\_defined\_terminator\_symbols** are:

**blanked arrow:** a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is blanked.

**blanked box:** a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area within the symbol is blanked.

**blanked dot:** a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is blanked.

**dimension origin:** a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle.

**filled arrow:** a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is shaded.

**filled box:** a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area that lies within the symbol is shaded.

**filled dot:** a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is shaded.

**integral symbol:** a graphical symbol depicted as one line segment forming two adjacent arcs. The origin of the symbol is the midpoint between the two arcs.

**open arrow:** a graphical symbol depicted as three line segments which form an isosceles triangle where the third side of the triangle is blanked. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

**slash:** a graphical symbol depicted as a line segment with the midpoint of the segment being the origin and lying on the annotation curve to which it is applied.

**unfilled arrow**: a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

#### 5.2.2.4 User\_defined\_curve\_font

A **user\_defined\_curve\_font** is a curve font defined without referencing any standard or convention.

EXPRESS specification:

```
*)
ENTITY user_defined_curve_font
  SUBTYPE OF (curve_style_font, mapped_item);
END_ENTITY;
(*
```

#### 5.2.2.5 User\_defined\_marker

A **user\_defined\_marker** is a **pre\_defined\_marker** defined independently of any standard or convention.

EXPRESS specification:

```
*)
ENTITY user_defined_marker
  SUBTYPE OF (pre_defined_marker, mapped_item);
END_ENTITY;
(*
```

#### 5.2.2.6 User\_defined\_terminator\_symbol

A **user\_defined\_terminator\_symbol** is a **pre\_defined\_terminator** defined independently of any standard or convention.

EXPRESS specification:

```
*)
ENTITY user_defined_terminator_symbol
  SUBTYPE OF (pre_defined_symbol, mapped_item);
END_ENTITY;
(*
```

#### 5.2.2.7 Vector\_style

A **vector\_style** is a type of **curve\_style** and **pre\_defined\_terminator\_symbol** that defines the visual appearance of a vector.

EXPRESS specification:

```
*)
ENTITY vector_style
  SUBTYPE OF (curve_style, pre_defined_terminator_symbol);
END_ENTITY;
(*
```

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EXPRESS specification :

```
*)  
END_SCHEMA; -- Curve_appearance_mim  
(*
```

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**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**

<b>Entity name</b>	<b>Short name</b>
EXTERNALLY_DEFINED_MARKER	EXDFMR
EXTERNALLY_DEFINED_TERMINATOR_SYMBOL	EDT0
PRE_DEFINED_TERMINATOR_SYMBOL	PDT
USER_DEFINED_CURVE_FONT	UDCF
USER_DEFINED_MARKER	USDFMR
USER_DEFINED_TERMINATOR_SYMBOL	UDTS
VECTOR_STYLE	VCTSTY

**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(1003) 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 curve\_appearance\_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(1003) version(1) object(1) curve-appearance-arm-schema(1) }

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

**B.2.2 curve\_appearance\_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(1003) version(1) object(1) curve-appearance-mim-schema(2) }

is assigned to the curve\_appearance\_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.

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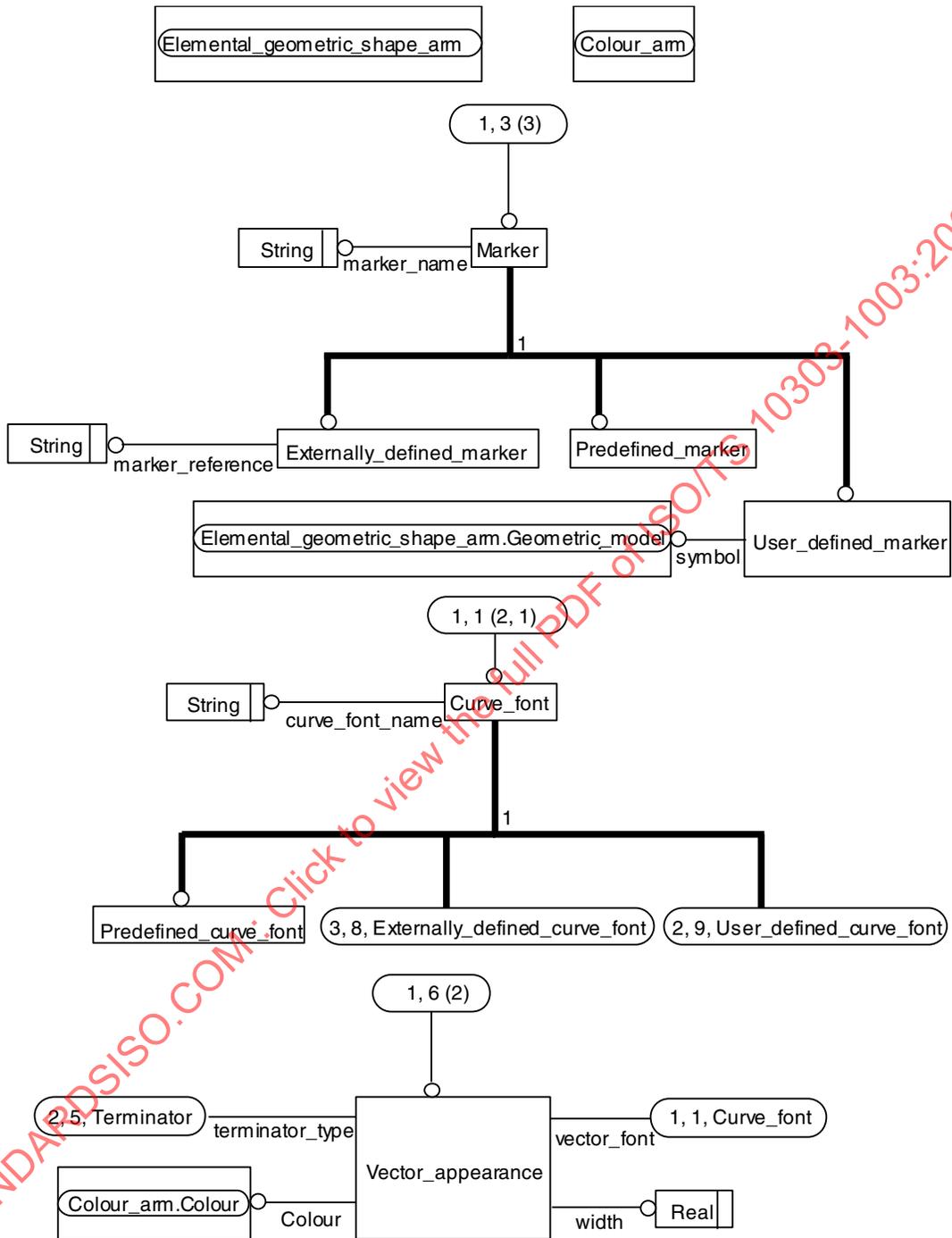


Figure C.1 -ARM EXPRESS-G diagram 1 of 3