



**INTERNATIONAL STANDARD ISO 10303-105:1996
TECHNICAL CORRIGENDUM 1**

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**Industrial automation systems and integration — Product data
representation and exchange —
Part 105:
Integrated application resource: Kinematics**

TECHNICAL CORRIGENDUM 1

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

Partie 105: Ressource d'application intégrée: Cinématique

RECTIFICATIF TECHNIQUE 1

Technical Corrigendum 1 to International Standard ISO 10303-105:1996 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*

Introduction

This document corrects ISO 10303-105:1996, Product data representation and exchange — Part 105: Application resource: Kinematics. The corrected document supersedes ISO 10303-105:1996.

The purpose of the modifications to the text of ISO 10303-105:1996 is to correct errors in the EXPRESS definitions likely to cause compilation problems, to include Formal propositions and Informal propositions to support the EXPRESS corrections, to clarify the text for proper usage of the EXPRESS, to replace the annex for the computer-interpretable EXPRESS with a URL reference, and to replace the object identifier for the document and the modified schema.

ICS 25.040.40

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Clause 5.4.4, p. 16

The informal proposition *ground_definition* in 5.4.4 incorrectly stated an informal proposition. Remove the *ground_definition* informal proposition in 5.4.4 and replace with the following:

Informal propositions:

ground_definition: The **kinematic_ground_representation** shall be associated to **property\property_definition_representation.definition-kinematic_property_definition.ground_definition**.

Clause 5.4.12, p. 21

The EXPRESS specification contained logical errors in *kinematic_link_representation*. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
ENTITY kinematic_link_representation
  SUBTYPE OF (representation);
  SELF\representation.context_of_items :
    geometric_representation_context;
DERIVE
  link_frame
    : geometric_representation_context
    := SELF\representation.context_of_items\
      geometric_representation_context;
INVERSE
  link_representation_relation :
    kinematic_link_representation_relation FOR geometric_aspects;
WHERE
  WR1: SIZEOF (QUERY (item <* SELF\representation.items |
    NOT (('KINEMATIC_STRUCTURE_SCHEMA.RIGID_PLACEMENT' IN
      TYPEOF (item))
    OR
    ('GEOMETRY_SCHEMA.CARTESIAN_TRANSFORMATION_OPERATOR_3D' IN
      TYPEOF (item)))) ) = 0;
END_ENTITY;
(*)

```

Clause 5.4.15, p.24

The definition of the entity *kinematic_frame_based_transformation* in 5.4.15 does not provide adequate definition for usage. The subtype shall be changed and additional formal and informal propositions shall be added. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

(*)
ENTITY kinematic_frame_based_transformation
  SUBTYPE OF (geometric_representation_item,
    functionally_defined_transformation);
  transformator : rigid_placement;
WHERE
  WR1: SELF\geometric_representation_item.dim=3;
END_ENTITY;
(*)

```

Add the following Formal proposition and Informal proposition after the Attribute definitions:

Formal propositions:

WR1: The dim shall equal 3.

Informal propositions:

An instance of **kinematic_frame_based_transformation** is equivalent to an instance of **cartesian_transformation_operator_3d** without scaling and mirroring, which is defined in ISO 10303-42, 4.4.17.

If **kinematic_frame_based_transformation.transformer_frame** refers to an instance of **axis2_placement_3d**, the equivalent **cartesian_transformation_operator_3d** can be derived as follows:

The attributes **local_origin** and **u** of the **cartesian_transformation_operator_3d** should be set equal respectively to the attributes **location** and **p** of the **axis2_placement_3d**. The attribute **scale** of the **cartesian_transformation_operator_3d** should be set equal to 1.0.

If **kinematic_frame_based_transformation.transformer_frame** refers to an instance of **su_parameters**, the equivalent **axis2_placement_3d** can be calculated by applying the equations given in 5.4.17 **su_parameters**.

Clause 5.4.17, p.25

*The definition of the entity **su_parameters** in 5.4.17 does not provide adequate definition for the requirements defined in this part of ISO 10303. The **su_parameters** is required to be a subtype of **geometric_representation_item** and have an additional local rule. Remove the EXPRESS definition and replace with the following:*

EXPRESS specification:

```
*)
ENTITY su_parameters
  SUBTYPE OF (geometric_representation_item);
  a      : length_measure;
  alpha  : plane_angle_measure;
  b      : length_measure;
  beta   : plane_angle_measure;
  c      : length_measure;
  gamma  : plane_angle_measure;
WHERE
  WR1: SELF\geometric_representation_item.dim=3;
END_ENTITY;
(*
```

Clause 5.4.73, p.82

*The EXPRESS in WR1 and WR2 of the ENTITY **kinematic_loop** contained logical errors in the body of the function. Remove the EXPRESS specification and replace with the following:*

EXPRESS specification:

```
*)
ENTITY kinematic_loop;
  network : kinematic_network_structure;
WHERE
  WR1 : SIZEOF (USEDIN (SELF,
```

```

'KINEMATIC_STRUCTURE_SCHEMA.JOINT_LOGICAL_RELATIONSHIP.LOOP')) > 0;
WR2 : SIZEOF (QUERY (relation_1 <* USEDIN(SELF,
'KINEMATIC_STRUCTURE_SCHEMA.JOINT_LOGICAL_RELATIONSHIP.LOOP') |
SIZEOF (QUERY (relation_2 <* (USEDIN(SELF,
'KINEMATIC_STRUCTURE_SCHEMA.JOINT_LOGICAL_RELATIONSHIP.LOOP')
- relation_1) |
NOT(connected_in_simple_loop (relation_1, relation_2))
)) > 0
)) = 0;
END_ENTITY;
(*

```

Clause 5.5.1, p.86

The EXPRESS of the FUNCTION *ypr_index* did not return acceptable values in all possible cases in the body of the EXPRESS function. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
FUNCTION ypr_index (ypr : ypr_enumeration) : INTEGER;
CASE ypr OF
    yaw    : RETURN (1);
    pitch  : RETURN (2);
    roll   : RETURN (3);
END_CASE;
RETURN (?);
END_FUNCTION;
(*

```

Clause 5.5.3, p.87

The EXPRESS of the FUNCTION *suitably_based_mechanism* contained logical errors in the body of the EXPRESS function. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
FUNCTION suitably_based_mechanism (mbp : mechanism_base_placement;
                                mech : mechanism) : BOOLEAN;

LOCAL
    kprop : kinematic_property_definition;
    kgrep : kinematic_ground_representation;
    klrep : kinematic_link_representation;
    klnk  : kinematic_link;
    kjnts : BAG OF kinematic_joint;
    nmechs : BAG OF mechanism;
    nmbps : BAG OF mechanism_base_placement;
END_LOCAL;

kprop := mech.containing_property;

IF ('KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_GROUND_REPRESENTATION' IN
TYPEOF (mbp\representation_relationship.rep_1)) THEN
    kgrep := mbp\representation_relationship.rep_1\
            kinematic_ground_representation;

    IF (kgrep.property\property_definition_representation.definition
        := kprop) THEN

```

```

    RETURN (TRUE);
ELSE
    RETURN (FALSE);
END_IF;
ELSE
    klrep := mbp\representation_relationship.rep_1\
            kinematic_link_representation;
    klnk  := klrep.link_representation_relation.topological_aspects;
    kjnts := USEDIN (klnk,
                    'KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_JOINT.FIRST_LINK') +
            USEDIN (klnk,
                    'KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_JOINT.SECOND_LINK');
    nmechs := USEDIN (kjnts[1].structure,
                    'KINEMATIC_STRUCTURE_SCHEMA.MECHANISM.STRUCTURE_DEFINITION');

    IF (nmechs[1] ::= mech) THEN
        RETURN (FALSE);
    ELSE
        IF (nmechs[1].containing_property :<>: kprop) THEN
            RETURN (FALSE);
        ELSE
            nmbps := USEDIN (nmechs[1], 'KINEMATIC_STRUCTURE_SCHEMA.' +
                            'MECHANISM_BASE_PLACEMENT.BASE_OF_MECHANISM');

            IF (SIZEOF (nmbps) = 0) THEN
                RETURN (FALSE);
            ELSE
                RETURN (suitably_based_mechanism (nmbps[1], mech));
            END_IF;
        END_IF;
    END_IF;
END_IF;
END_FUNCTION;
(*

```

Clause 5.5.6, p.90

The EXPRESS in the FUNCTION frame associated_to_background contained logical errors in the body of the function. The initialization of the variable rep_bag was incorrect. The references in the USEDIN were in correct. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
FUNCTION frame_associated_to_background
    (frame      : rigid_placement;
     background : kinematic_frame_background) : BOOLEAN;
LOCAL
    rep_bag : BAG OF kinematic_frame_background_representation;
    trf_bag : BAG OF kinematic_frame_based_transformation;
    trm_bag : BAG OF kinematic_frame_based_transformation;
    ass_bag : BAG OF
                kinematic_frame_background_representation_association;
    rep     : kinematic_frame_background_representation;
    ass     : kinematic_frame_background_representation_association;
END_LOCAL;

    rep_bag := USEDIN (background\representation_item,
                    'KINEMATIC_STRUCTURE_SCHEMA.' +

```

```

'REPRESENTATION.ITEMS');

IF SIZEOF (rep_bag) = 0 THEN
  RETURN (FALSE);
END_IF;

trf_bag := USEDIN (frame,
                  'KINEMATIC_STRUCTURE_SCHEMA.' +
                  'KINEMATIC_FRAME_BASED_TRANSFORMATION.' +
                  'TRANSFORMATOR');

IF SIZEOF (trf_bag) = 0 THEN
  RETURN (FALSE);
END_IF;

REPEAT i := 1 TO HIINDEX (rep_bag);
  rep := rep_bag[i];

  ass_bag := USEDIN (rep\representation,
                    'KINEMATIC_STRUCTURE_SCHEMA.' +
                    'REPRESENTATION_RELATIONSHIP.REP-2');

  IF SIZEOF (ass_bag) > 0 THEN
    REPEAT j:= 1 TO HIINDEX (ass_bag);
      ass := ass_bag[j];

      trm_bag := QUERY (trm <* trf_bag |
                        (trm\functionally_defined_transformation :=
                         ass\representation_relationship_with_transformation.
                         transformation_operator));

      IF SIZEOF (trm_bag) > 0 THEN
        RETURN (TRUE);
      END_IF;

    END_REPEAT;
  END_IF;
END_REPEAT;

RETURN (FALSE);

END_FUNCTION;
(*)

```

Clause 5.5.11, p.101

The EXPRESS in the FUNCTION connected_in_simple_loop contained logical errors in the body of the function. The ELSE clause was incorrect and the role names in the USEDIN statements have to be written in uppercase. The bag_to_set function have to be added in the ELSE clause. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
FUNCTION connected_in_simple_loop
  (relation_1 : joint_logical_relationship;
   relation_2 : joint_logical_relationship) : BOOLEAN;
LOCAL
  next_jlr_in_loop_set : SET [1:?] OF joint_logical_relationship;
END_LOCAL;

```

```

IF ((relation_1.loop:<>: relation_2.loop) OR
    (relation_1 :=: relation_2)) THEN
    RETURN (FALSE);
ELSE
    IF (relation_1.next_joint_logical_structure :=:
        relation_2.previous_joint_logical_structure) THEN
        RETURN (TRUE);
    ELSE
        next_jlr_in_loop_set :=
            QUERY (relation <*
                bag_to_set (USEDIN (relation_1.next_joint_logical_structure,
                    'KINEMATIC_STRUCTURE_SCHEMA.JOINT_LOGICAL_RELATIONSHIP.' +
                    'PREVIOUS_JOINT_LOGICAL_STRUCTURE'))
                    | relation.loop :=: relation_1.loop);
        IF (SIZEOF(next_jlr_in_loop_set) <> 1) THEN
            RETURN (FALSE);
        ELSE
            RETURN (connected_in_simple_loop(next_jlr_in_loop_set [1],
                relation_2));
        END_IF;
    END_IF;
END_IF;
END_FUNCTION;
(*

```

Clause 7.4.3, p. 115

The EXPRESS in the ENTITY founded_kinematic_path contained logical errors in the DERIVE for founding. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
ENTITY founded_kinematic_path
  SUBTYPE OF (representation);
  SELF\representation.items : SET [1 : ?] OF kinematic_path;
  SELF\representation.context_of_items :
    geometric_representation_context;
DERIVE
  paths : SET [1 : ?] OF kinematic_path := SELF\representation.items;
  founding : geometric_representation_context
    := SELF\representation.context_of_items\
      geometric_representation_context;
END_ENTITY;
(*

```

Clause 7.4.4, p.116

The EXPRESS in the ENTITY motion_link_relationship contained logical errors in the DERIVE for motion and frame_link. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
ENTITY motion_link_relationship
  SUPERTYPE OF (ONEOF (prescribed_path, resulting_path))
  SUBTYPE OF (representation_relationship);
  SELF\representation_relationship.rep_1 : founded_kinematic_path;
  SELF\representation_relationship.rep_2 :
    kinematic_link_representation;

```

```

related_frame          : rigid_placement;
DERIVE
motion                 : founded_kinematic_path
                       := SELF\representation_relationship.rep_1\
                           founded_kinematic_path;
frame_link             : kinematic_link_representation
                       := SELF\representation_relationship.rep_2\
                           kinematic_link_representation;
WHERE
WR1: related_frame IN frame_link\representation.items;
END_ENTITY;
(*)

```

Clause 7.4.8, p.118

The EXPRESS in the ENTITY *kinematic_analysis_result* contained logical errors in the EXPRESS for WR1. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```

*)
ENTITY kinematic_analysis_result;
  analysed_mechanism      : mechanism;
  contained_kinematic_results : SET [1 : ?] OF kinematic_result;
WHERE
WR1: (SIZEOF (QUERY (result <* contained_kinematic_results |
  'KINEMATIC_ANALYSIS_CONTROL_AND_RESULT_SCHEMA.RESULTING_PATH'
  IN TYPEOF (result)))
  > 0)
XOR
  (SIZEOF (QUERY (result <* contained_kinematic_results |
  (('KINEMATIC_ANALYSIS_CONTROL_AND_RESULT_SCHEMA.'+
  'INTERPOLATED_CONFIGURATION_SEQUENCE' IN TYPEOF (result))
  AND
  (SIZEOF (QUERY (sequence <* result\
  interpolated_configuration_sequence.interpolation |
  (sequence.interpolation <> undefined ))) > 0)))) = 0);
END_ENTITY;

```

Annex B.1, p. 123

With the changes identified in this Technical Corrigendum, the object identifier for this part of ISO 10303 has changed. Remove the object identifier for the document and replace with the following:

{ iso standard 10303 part (105) version (2) }

Annex B.2.1, p. 123

With the changes identified in this Technical Corrigendum, the object identifier for the *kinematic_structure_schema* has changed. Remove the object identifier for *kinematic_structure_schema* and replace with the following:

{ iso standard 10303 part (105) version (2) object (1) kinematic-structure-schema (1) }

Annex B.2.3, p. 123

With the changes identified in this Technical Corrigendum, the object identifier for the *kinematic_analysis_control_and_result_schema* has changed. Remove the object identifier for *kinematic_analysis_control_and_result_schema* and replace with the following: