INTERNATIONAL ELECTROTECHNICAL COMMISSION

Technical Committee No. 3 Documentation and graphical symbols

Data base model description for a Web-based library for graphical symbols

This document contains version 1.2 of the information model produced by the IEC TC3 Task Force for the specification of the information requirements for the graphical symbols data bases, as requested by the IEC TC3 at its meeting in New Delhi.

Comments are kindly requested by email to the following addresses:

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N.B. Some terms used differ among the standards on which the model is based, although the concept as given by the definition is the same. Therefore, if you miss something, look carefully at the definitions - the concept that you miss may still be there.
Data base model description for a Web based library for graphical symbols

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1 Foreword:
During the last meeting of IEC TC 3 at ist meeting in New Delhi in November 1997 it was decided to set up a task force for the specification of the information requirements for the graphical symbols data bases. For further information see 3(New Delhi/Secretariat)12.

2 Deliverables
This Task Force was entrusted to supply the following deliverables:
1. an information model on which the data base design can be founded;
2. at least one screen template allowing input of symbols with associated information;
3. instructions for how to enter information (e.g which information in IEC 60617 shall be put where in the data base.

3 Introduction:
This document provides the deliverable as specified under clause 2.1.
The deliverable covers the requirements having been established during the first meeting of the IEC TC 3 Task force in Frankfort/Main, January 1998. It includes also further requirements originating from ISO TC 10 due to ISO/IEC 14617.
It was unclear whether IEC SC3C and ISO TC 145 would be willed to carry also the motion for a common data base structure. There was no commitment expressed to change in future from the existing data base within SC3C to a common structure.
Therefore the authors of the model focused primarily on the requirements for the use of symbols on diagrams taking into account the requirements established by IEC SC3C and ISO TC 145 for the use of symbols on equipment where appropriate.
Essential contributions were received also by phone from Mr. P.A. Svensson during the meeting in Trondheim, 11-13.March.
This document will be forwarded to the IEC Central Office in Geneva in order to set up the Web prototype.

3.1 Comments
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4 Limitations of the model

4.1 Support of multiple languages

The model provides a multiple language support with respect to the entities functional_description, application_note, symbol_history_relationship, symbol_example_relationship, and common_description. A group is here understood as a group of symbols within e.g. a part, a chapter or a section.

All other occurring strings in the model are single-language-bound, i.e. any other string value is based on defaults. Values occurring in the enumerations shape_class, iso_639(language code), symbol_type, symbol_status, function_class, request_status etc., are defined using the English language.

4.2 Restrictions

The model provides several references to source documents. As those references may differ according to the language the reference is made, the following agreement is made in order to avoid inconsistent referencing throughout the data base. References shall be made as shown below, and if needed, the year of edition should be added:

- source_reference: ISO 14617-21

5 Entity descriptions

5.1 (ABS)Symbol

The (ABS)Symbol is supertype of symbol_definition, symbol_form, symbol_group and symbol_variant. The (ABS)Symbol is a collection of attributes common to all of its subtypes. The entity is associated with the following attributes

- identification
- and;
- status.

5.1.1 identification

Specifies the identifier of the symbol.

Note - This may be e.g. the registration number as in ISO/IEC 14617 or the symbol number as in IEC 60617.

5.1.2 status

Specifies the status of the (ABS)Symbol. The status may contain one of the following text strings:

- proposed, accepted_for_work, rejected, released, withdrawn

5.1.3 date_of_entry

Identifies the day the symbol is originated (YYYY-MM-DD).

5.1.4 date_of_evaluation

Identifies the day of evaluation either resulting in a rejection or acceptance for further work (YYYY-MM-DD).

5.1.5 date_released

Identifies the day when the symbol was released (i.e. released for final publication) (YYYY-MM-DD).
5.1.6 date-withdrawn
Identifies the day of withdrawal of the symbol (YYYY-MM-DD).

5.2 application_note
The application_note is a collection of attributes assigning application oriented notes to either symbol_group, symbol_definition, symbol_form or to symbol_variant. The entity is associated with the following attributes
- identification;
- note;
- source_reference and
- language_code.

5.2.1 identification
Identifies the occurrences of application notes.

5.2.2 note
Specifies an alphanumerical string containing human_interpretable text that gives further details about the referred graphical symbol.

5.2.3 source_reference
Identifies the origin of the referred application note.

5.2.4 language_code
Provides an enumeration of values encoding languages according to the 2-letter code as defined in ISO 639.
The language_code may contain one of the following text strings:
en, fr, de, es

Note - The language code is for prototyping purposes limited to the above values.

5.3 change_request
The change_request is a collection of attributes providing requests for modifications to either a symbol_group, a symbol_definition, a symbol_form or a symbol_variant. The entity is associated with the following attributes
- id;
- date_of_entry;
- proposal;
- reason;
- source_reference;
- category;
- status;
- date_of_evaluation;
- date_resolved and
- date_withdrawn.

5.3.1 id
Identifies all change requests to the referred objects.
5.3.2 **date_of_entry**
Identifies the day of the change request originated (YYYY-MM-DD).

5.3.3 **proposal**
Specifies the intended modification of the referred object.

5.3.4 **reason**
Provides the information causing the requested change.

5.3.5 **source_reference**
Provides the possibility to refer to a document related to the requested change.

5.3.6 **category**
Classifies the different types of change requests.
The category may contain one of the following text strings:
editorial, techn_new, tech_mod

5.3.7 **status**
Provides information about the actual situation of the referred change request.
The status may contain one of the following strings:
submitted, accepted, rejected, resolved, withdrawn.

5.3.8 **date_of_evaluation**
Identifies the day of evaluation either resulting in a rejection or acceptance for further work (YYYY-MM-DD).

5.3.9 **date_resolved**
Identifies the day of closure of the referred change request (YYYY-MM-DD).

5.3.10 **date_withdrawn**
Identifies the day of withdrawal by the organization of the referred change request (YYYY-MM-DD).

5.4 **DET_definition**
The DET_definition is a collection of attributes assigning application-oriented DETs (data element types) to either a symbol_group, a symbol_definition, a symbol_form or a symbol_variant. The entity is associated with the following attributes
- DET_code;
- DET_version;
- revision;
- preferred_name and
- source_reference.

5.4.1 **DET_code**
Identifies a data element type within the defined source (see IEC 61360-1).

5.4.2 **DET_version**
Identifies the version of the data element type within the defined source (see IEC 61360-1).
5.4.3 revision
Identifies the revised version of the data element type referred to (see IEC 61360-1).

5.4.4 preferred_name
Provides the clear text name of the data element type within the defined source (see IEC 61360-1).

5.4.5 source_reference
Identifies the source document the data element type is selected from.

NOTE - In the context of this data base the only related source is IEC 61360-4. Each DET referred to in the data base needs to be made previously known in the IEC Reference collection of IEC 61360-4.

5.5 functional_class
The functional_class is a collection of attributes providing classifying information to a symbol_definition based on a given source. The entity functional_class is associated with the following attributes
- class_code and
- source_reference.

5.5.1 class_code
Classifies the referred object according to a given classification system within a given source.
The class_code may contain one of the following upper-case letters:
- A, ..., Z excluding I and O;

5.5.2 source_reference
Identifies the document where the classification system used is given.

Note - IEC 750 in conjunction with IEC 204-2 provides a two letter classification system, providing about \(25^2\) class values, excluding the letters I and O.

5.6 functional_description
The functional_description is a collection of attributes providing language depending information to a symbol_definition. The entity functional_description is associated with the following attributes
- description;
- synonym_1;
- synonym_2;
- keywords S[0:?];
- product_implementations S[0:?] and
- language_code.

5.6.1 description
Provides the human-readable name of the object.

5.6.2 synonym_1
Provides a human-readable synonym-name for the object.
5.6.3 synonym_2
Provides a human-readable synonym-name for the object.

5.6.4 keywords S[0:?]
Provides a set of zero or many textual descriptors associated with the related object.

5.6.5 product Implementations S[0:?]
Provides a set of zero or many textual product implementations of the referred functional description.

5.6.6 language_code
Provides an enumeration of values encoding languages according to the 2-letter code as defined in ISO 639. See 5.2.4.

5.7 file_reference
The file_reference is a collection of attributes providing the meta-data about a file available in a digital format.

The entity is associated with the following attributes
- file_name;
- syntactical_format;
- date_of_generation;
- module_size and
- scaling_factor.

Notes -
1. The file reference does not replace ISO/IEC 11714-2. The latter specifies how the file is structured.
2. It has been agreed that in the context of this database the following three file types will be supported
   - the PDF-format;
   - the DXF-format and
   - the STEP physical file format (ISO 10303-21), based upon ISO 10303-212.
At the time being the latter needs to cover the requirements established in ISO/IEC 11714-2.
3. That sequence will reflect also the priority of providing data into the database.
4. The following agreements have been taken:
   - the PDF-file will be provided including the grid presenting the used module size the symbol has been constructed within.
5. Neither the DXF nor the STEP-file will contain the presentation of a grid.

5.7.1 file_name
Specifies the information necessary to access the computer interpretable data.

5.7.2 syntactical_format
Specifies the syntax within the file.

   Note - The syntactical format may be RTF, Word Perfect 4.2, C++, FORTRAN77, etc.

5.7.3 date_of_generation
Specifies the information about the date of generation of the computer interpretable data.
5.7.4 module_size
Specifies the size of the X/Y grid used in the design of the graphical symbol. [ISO/IEC 81714-2]

5.7.5 scaling_factor
Specifies the relation by which the coordinates of all defined points of the graphical symbol will be enlarged or reduced in size in relation to the reference point of the symbol. [ISO/IEC 81714-2]

5.8 system_reference
The entity system_reference is a collection of attributes providing the meta-data about the system producing the files. The entity is associated with the following attributes:
- creating_system;
- creating_interface;
- operating_system and
- directory.

5.8.1 creating_system
Specifies the computer system that originated the computer interpretable data.

5.8.2 creating_interface
Specifies the interface of the computer system that originated the computer interpretable data.

5.8.3 operating_system
Specifies the operating system used by the program that originated the computer interpretable data.

5.8.4 directory
Specifies the path the computer interpretable data is located.

5.9 common_description
Provides the possibility assigning language dependent information to a group of symbols. The entity is associated with the following attributes:
- description and
- language_code.

5.9.1 description
Specifies an alphanumerical string containing human_interpretable text that gives further details about the referred object.

5.9.2 language_code
Provides an enumeration of values encoding languages according to the 2-letter code as defined in ISO 639. See 5.2.4.

5.10 organization
The organization is a collection of attributes providing information about the referred person and organization. The entity is associated with the following attributes:
- organization_name;
department;
street;
pob;
postal_code;
location;
last_name;
first_name;
television;
facsimile and
electronic mail.

5.10.1 organization_name
Specifies the organization requesting the change_request.

5.10.2 department
Specifies the department within the organization_name.

5.10.3 street
Specifies the street within the location where the department of the organization is located.

5.10.4 pob
Specifies the post office box used by the referred organization department.

5.10.5 postal_code
Specifies the postal code used by the referred organization department

5.10.6 location
Specifies the name of the location( town, village etc.) where the organization department resides.

5.10.7 last_name
Specifies the last name of the person within the organization responsible for originating the request.

5.10.8 first_name
Specifies the first name of the person within the organization responsible for originating the request.

5.10.9 telephone
Specifies the international telephone number under which the person within the organization can be contacted.

5.10.10 facsimile
Specifies the international fax number under which the person within the organization can be contacted.

5.10.11 electronic mail
Specifies the electronic mail number under which the person within the organization can be contacted.
5.11 paper_publication

The paper_publication is a collection of attributes providing information about the International Standard the symbol is published in. The entity is associated with the following attributes
- publication and
- edition.

5.11.1 publication

Identifies the international standard which includes the referred symbol.

5.11.2 edition

Identifies month and year of the publication of the referred document (YYYY-MM).

5.12 symbol_in_paper_publication

The symbol_in_paper_publication is a collection of attributes providing information about the International Standard the symbol is published in. The entity is associated with the following attributes
- location_reference.

5.12.1 location_reference

Provides the identification of the symbol within the referred edition of the publication.

5.13 symbol_definition

The symbol_definition is a subtype of the (ABS)Symbol. The symbol_definition is a collection of attributes providing information about the related symbol. The entity is associated with the following attributes
- symbol_type and
- source_reference.

5.13.1 symbol_type

Classifies the different kind of symbols based on its possible use on drawings or in an a composition of symbols.

The symbol_type may contain one of the following text strings:
qualifying; basic; parametric.

5.13.2 source_reference

Identifies the origin of the referred symbol definition.

5.14 symbol_example_relationship

The symbol_example_relationship is a collection of attributes providing information about examples of and to symbol forms. The entity is associated with the following attributes
- has example,
- is example_of and
- description.

5.14.1 has example

Provides information about the set of symbol forms being examples of the referred symbol form.
5.14.2 is example_of
Provides information about the symbol form, the referred symbol form is an example from.

5.14.3 description
Specifies an alphanumerical string containing human-interpretable text that gives further details about the data specified by the symbol_example_relationship.

5.15 symbol_form
The symbol_form is a collection of attributes providing information about the different symbol forms of a symbol definition. The entity is associated with the following attributes
- shape.

5.15.1 shape
Classifies the symbol_form based on its shape. The shape may contain one of the following text strings:
Circle; Square; Rectangle; Ellipse; Parallelogram; Oval; Equilateral triangle; right angled triangle; Trapezoid; Octagon; Hexagon;

5.16 symbol_group
The symbol_group is a subtype of the (ABS)Symbol. The symbol_group provides information about the symbols contained within a defined group. The entity is associated with the following attributes
- has S[1:?].

5.16.1 has S[1:?]
Specifies a language-bound alphanumerical string containing human-interpretable text that is a common description about the data specified by the symbol_group.

5.17 symbol_history_relationship
The entity symbol_history_relationship is a collection of attributes providing information about the preceding and following symbol forms. The entity is associated with the following attributes
- replacing;
- replaced_by and
description.

5.17.1 replacing
Provides information about the preceding symbol form in relation to the referred symbol form.

5.17.2 replaced_by
Provides information about the succeeding symbol form in relation to the referred symbol form.

5.17.3 description
Specifies an alphanumerical string containing human-interpretable text that gives further details about the data specified by the symbol_history_relationship.
5.18 symbol_variant

The entity symbol_variant is a subtype of the (ABS)Symbol. The entity is associated with
the following attributes
- available as S[1:?].

5.18.1 available as S[1:?]

Provides the information about the availability of the symbol_variant to the file_reference.

5.19 assembled_variant_to_symbol_variant_relationship

The entity dissolves the n:m relation between the entities symbol_variant and
assembled_variant. The assembled_variant_to_symbol_variant_relationship provides the
information about a symbol variant which is a part of an assembled variant (synonym: composite symbols), and the information about an assembled variant containing symbol
variants.

5.20 assembled_variant

The entity assembled_variant provides the possibility to form assemblies containing symbol
variants.

5.21 symbol_definition_to_symbol_form_relationship

The entity dissolves the n:m relation between the entities symbol_form and
symbol_definition. The symbol_definition_to_symbol_form_relationship provides the
information that a symbol_form may be associated with one or many symbol_definitions, and the information that a symbol_definition may be associated with symbol_forms.

5.22 symbol_note_relationship

The entity dissolves the n:m relation between the entities (ABS)Symbol and
application_note. The symbol_note_relationship provides the information that a
(ABS)Symbol may be associated with one or many application_notes, and the information
that an application_note may be associated with one or many (ABS)Symbols.

5.23 variant_to_assembled_variant_association

The entity dissolves the n:m relation between the entities symbol_variant and
assembled_variant. The variant_to_assembled_variant_association provides the
information that an assembled_variant may be contain one or many symbol_variants, and
the information that a symbol_variant may be part of one or many assembled_variants.

6 Constraints

This document version does not yet provide explicit constraints.

For the prototype implementation of the data base, the following shall however be taken
into account:

- a symbol_example_relationship instance shall not point to itself;
- a symbol_history_relationship instance shall not point to itself;
- a symbol_definition having several functional_descriptions shall not have the same
  language_code;
- date_withdrawn > date_resolved > date_of_evaluation > date_of_entry;
- an (ABS)Symbol can not be part of a symbol_group that is the (ABS)Symbol itself;
• an assembled_variant_to_symbol_variant_relationship shall not point to a symbol_variant that is an assembled_variant.

7 EXPRESS-Source

This clause specifies the data model based on the EXPRESS Language specified by ISO 10303-21. An EXPRESS-G file is available also.

SCHEMA SYMBOL_LIBRARY;

TYPE request_status = ENUMERATION OF (SUBMITTED,
                                   ACCEPTED,
                                   REJECTED,
                                   RESOLVED,
                                   WITHDRAWN);
END_TYPE;

TYPE function_class = ENUMERATION OF (A,
                                   B,
                                   C,
                                   D,
                                   E,
                                   F,
                                   G,
                                   H,
                                   J,
                                   K,
                                   L,
                                   M,
                                   N,
                                   P,
                                   Q,
                                   R,
                                   S,
                                   T,
                                   U,
                                   V,
                                   W,
                                   X,
                                   Y,
                                   Z);
END_TYPE;

TYPE shape_class = ENUMERATION OF (CIRCLE,
                                   ELLIPSIS,
                                   SQUARE,
                                   PARALLELOGRAM,
                                   TRIANGLE,
                                   HEXAGON,
                                   OCTAGON,
                                   OVAL,
                                   EQUILATERAL TRIANGLE,
RIGHT ANGLED TRIANGLE,
TRAPEZOID,
RECTANGLE);
END_TYPE;

TYPE symbol_status = ENUMERATION OF
(PROPOSED,
ACCEPTED_FOR_WORK,
REJECTED,
RELEASED,
WITHDRAWN);
END_TYPE;

TYPE symbol_type = ENUMERATION OF
(QUALIFYING,
BASIC,
PARAMETRIC);
END_TYPE;

TYPE iso_639 = ENUMERATION OF
(EN,
FR,
DE,
ES);
END_TYPE;

TYPE request_category = ENUMERATION OF
(EDITORIAL,
TECHN_NEW,
TECH_MOD);
END_TYPE;

ENTITY organization;
  organization_name : STRING;
  last_name         : STRING;
  first_name        : STRING;
  street            : STRING;
  postal_code       : STRING;
  pob               : STRING;
  location          : STRING;
  telephone         : STRING;
  facsimile         : STRING;
  email             : STRING;
  requests          : SET [1:?] OF change_request;
  department        : STRING;
UNIQUE
  ur1 : organization_name, department, last_name, first_name;
END_ENTITY;

ENTITY change_request;
  id             : INTEGER;
  date_of_entry  : STRING;
  proposal       : STRING;
  reason         : STRING;
  source_reference : OPTIONAL STRING;
  status         : request_status;
  refers_to      : symbol;

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ENTITY symbol
    ABSTRACT SUPERTYPE OF (ONEOF(symbol_group, symbol_definition, symbol_form, symbol_variant));
    status          : symbol_status;
    refers_to       : SET OF det_definition;
    is_a_part_of    : OPTIONAL symbol_group;
    identification  : STRING;
    date_of_entry   : STRING;
    date_of_evaluation : OPTIONAL STRING;
    date_released   : OPTIONAL STRING;
    date_withdrawn  : OPTIONAL STRING;
    UNIQUE
        ur1 : id;
    END_ENTITY;

ENTITY symbol_group
    SUBTYPE OF(symbol);
    has         : SET [1:?] OF common_description;
    INVERSE
        consists_of : SET [1:?] OF symbol FOR is_a_part_of;
    END_ENTITY;

ENTITY common_description;
    description   : STRING;
    language_code : iso_639;
END_ENTITY;

ENTITY symbol_definition
    SUBTYPE OF(symbol);
    source_reference : STRING;
    symbol_type      : symbol_type;
    associated_with  : SET [1:?] OF functional_description;
    is_of            : SET [1:?] OF functional_class;
    INVERSE
        forms        : SET [1:?] OF symbol_definition_to_symbol_form_relationship FOR symbol_definition;
    END_ENTITY;

ENTITY functional_description;
    description             : STRING;
    synonym_1               : STRING;
    synonym_2               : STRING;
    keywords                : SET OF STRING;
    product_implementations : SET OF STRING;
    language_code           : iso_639;
END_ENTITY;

ENTITY functional_class;
    class_code       : function_class;
END_ENTITY;
ENTITY symbol_definition_to_symbol_form_relationship;
  symbol_definition : symbol_definition;
  symbol_form : symbol_form;
END_ENTITY;

ENTITY symbol_form
  SUBTYPE OF(symbol);
  shape : shape_class;
  has : SET [1:8] OF symbol_variant;
INVERSE
  definitions : SET [1:?] OF symbol_definition_to_symbol_form_relationship FOR symbol_form;
END_ENTITY;

ENTITY symbol_variant
  SUBTYPE OF(symbol);
  available_as : SET [1:?] OF file_reference;
INVERSE
  used_as : SET OF assembled_variant_to_symbol_variant_relationship FOR contain;
END_ENTITY;

ENTITY assembled_variant
  SUBTYPE OF(symbol_variant);
INVERSE
  contains : SET [2:?] OF assembled_variant_to_symbol_variant_relationship FOR is_a_part_of;
END_ENTITY;

ENTITY assembled_variant_to_symbol_variant_relationship;
  contain : symbol_variant;
  is_a_part_of : assembled_variant;
END_ENTITY;

ENTITY file_reference;
  file_name : STRING;
  syntactical_format : STRING;
  date_of_generation : STRING;
  created_by : system_reference;
  module_size : REAL;
  scaling_factor : REAL;
UNIQUE
  ur1 : file_name, syntactical_format;
END_ENTITY;

ENTITY system_reference;
  creating_system : STRING;
  creating_interface : STRING;
  directory : STRING;
UNIQUE
  ur1 : creating_system, creating_interface, directory;
END_ENTITY;

ENTITY det_definition;
  det_code : STRING;

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ENTITY application_note;
    note             : STRING;
    source_reference : STRING;
    identification   : STRING;
    language_code    : iso_639;
    UNIQUE
    ur1 : identification;
END_ENTITY;

ENTITY symbol_history_relationship;
    replaced_by : symbol_form;
    replacing   : symbol_form;
    description : OPTIONAL common_description;
END_ENTITY;

ENTITY symbol_example_relationship;
    is_example_of : symbol_form;
    has_example   : symbol_form;
    description   : OPTIONAL common_description;
END_ENTITY;

ENTITY symbol_note_relationship;
    symbol           : symbol;
    application_note : application_note;
    note_no          : INTEGER;
END_ENTITY;

ENTITY paper_publication;
    publication : STRING;
    edition     : STRING;
    UNIQUE
    ur1 : publication, edition;
END_ENTITY;

ENTITY symbol_in_paper_publication;
    contains           : symbol;
    published          : paper_publication;
    location_reference : STRING;
END_ENTITY;

END_SCHEMA;