IEC 61970-453

Edition 2.0   2014-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour
inside

**Energy management system application program interface (EMS-API) –
Part 453: Diagram layout profile**

**Interface de programmation d'application pour système de gestion d'énergie (EMS-API) –
Partie 453: Profil de disposition de diagramme**

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Part 453: Diagram layout profile

FOREWORD

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International Standard IEC 61970-453 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) The SVG elements and its data model have been replaced by the Diagram Layout Package, which is now an integral part of the IEC 61970-301 (CIM) model.

b) The exchange is in accordance with and is a part of the IEC 61970 profile concept.

c) A glue point object has been introduced to model explicit connections between graphics elements.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/1409/FDIS	57/1430/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61970 series, published under the general title *Energy management system application program interface (EMS-API)*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This standard is part of the IEC 61970 series that define an application program interface (API[1]) for an Energy Management System (EMS[2]).

The IEC 61970-3x series specify a Common Information Model (CIM[3]): a logical view of the physical aspects of EMS information. The IEC 61970-3x series includes IEC 61970-301, *Common Information Model (CIM) Base*.

This standard is one of the IEC 61970-4x series that define utility control centre component interface specifications (CIS[4]). IEC 61970-4x specifies the functional requirements for interfaces that a component (or application) shall implement to exchange information with other components (or applications) and/or to access publicly available data in a standard way. The component interfaces describe the specific message contents and services that can be used by applications for this purpose. The implementation of these messages in a particular technology is described in the IEC 61970-5x series.

Energy Management Systems employ a variety of schematic and quasi-geographic presentations in their user interfaces. These are sometimes generated automatically, but more often are hand-drawn and require considerable labour to create and maintain. Most of this labour goes into the arrangement, or 'layout' of the power system elements within the overall diagram. When network models are exchanged, as defined in IEC 61970-452 and IEC 61968-13 standards, it is desirable to be able to exchange these layouts.

IEC 61970-453 specifies guidelines for the exchange of diagram layout information for schematic data that is encoded using IEC 61970-552.

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1   Footnote 1 applies to the French version only.

2   Footnote 2 applies to the French version only.

3   Footnote 3 applies to the French version only.

4   Footnote 4 applies to the French version only.

ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 453: Diagram layout profile

1 Scope

This part of IEC 61970 is a member of the IEC 61970-450 to 499 series that, taken as a whole, defines, at an abstract level, the content and exchange mechanisms used for data transmitted between control centre components.

Included in this part of IEC 61970 are the general use cases for exchange of diagram layout data, and guidelines for linking the layout definitions with CIM data. Guidelines for management of schematic definitions through multiple revisions are also included.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050, *International electrotechnical vocabulary*

IEC 61970-301, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

IEC 61970-501, *Energy management system application program interface (EMS-API) – Part 501: Common Information Model Resource Description Framework (CIM RDF) schema*

IEC/TR 62541-1, *OPC Unified Architecture – Part 1: Overview and concepts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050, as well as the following, apply.

3.1
domain object[5]
instance of a class that models a Real-World Object[6] with a unique identity

Note 1 to entry: A domain object inherits from a CIM *IdentifiedObject*. A domain object is normally not a diagram object.

3.2
diagram[7]
electronic equivalent of a seamless paper plan

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[5]   Footnote 5 applies only to the French version.

[6]   Footnote 6 applies only to the French version.

[7]   Footnote 7 applies to the French version only.

Note 1 to entry: The diagram is an identified container for the diagram objects. Examples of diagrams include substation schematics, transportation or distribution network orthogonal schematics, or pseudo-geographical schematics. A diagram has a well-defined coordinate space.

3.3
diagram object[8]
representation of domain objects or static background

Note 1 to entry: The diagram is composed of diagram objects.

Note 2 to entry: An example for domain objects includes breakers. An example for static background object includes lakes.

3.4
diagram object style
definition of how to render diagram objects possibly based on the state of domain objects

Note 1 to entry: Typically, the diagram object style is resolved in a very specific way for each system.

4   Use Cases

4.1   General use cases for diagram exchange

Figure 1 shows a high-level view of using diagram layout data exchange with potential systems that can make use of the diagram layout data.

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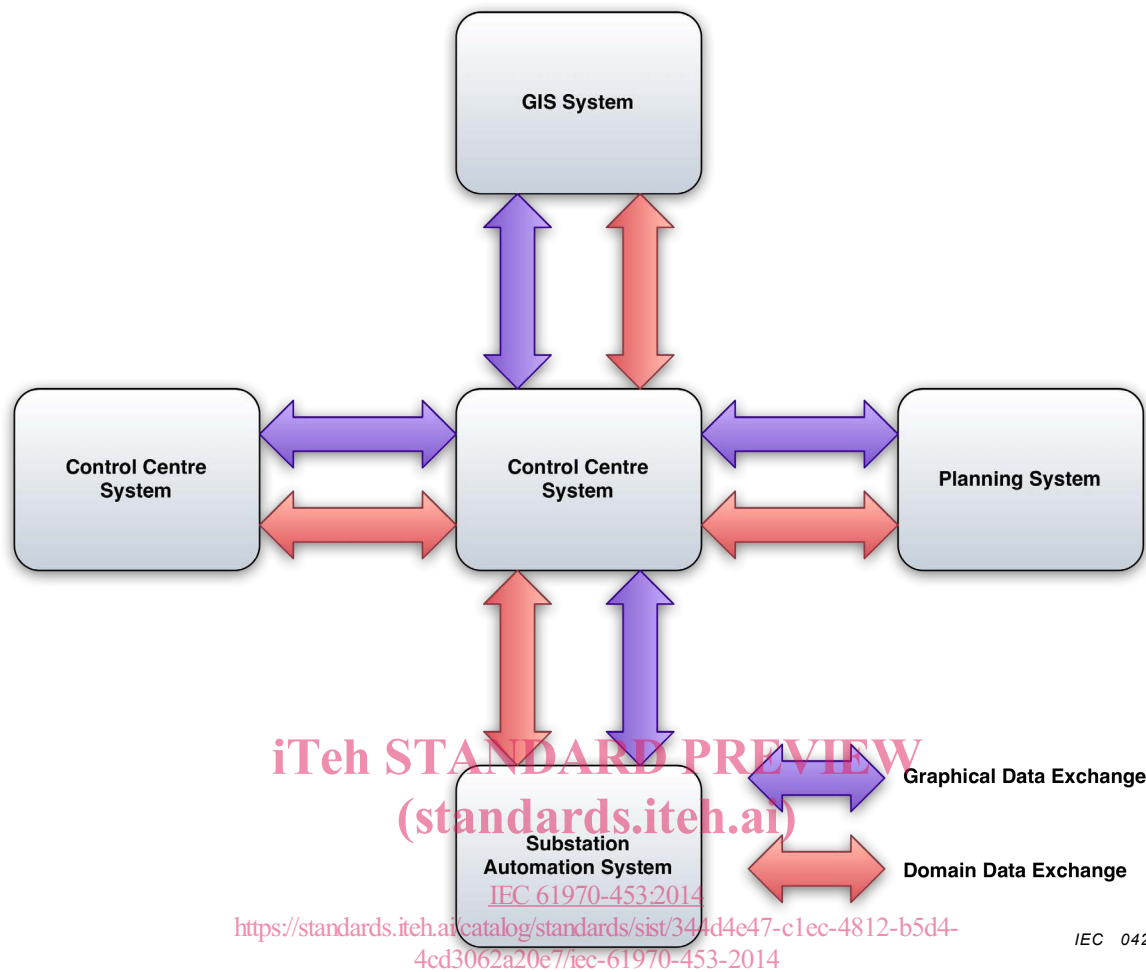8   Footnote 8 applies to the French version only.

Figure 1 – System overview

An examination of the use cases for such exchanges revealed that the diagrams being exchanged are not fixed graphic presentations. Instead the diagrams vary considerably in appearance as attributes of CIM objects change, and they support important user interaction. For example, a SCADA one-line in its creator's system is supporting live control of the power system, while in a receiver's system it is merely used for reference so that a neighbour can understand what the system looks like beyond its own border. These variations are typically not easy or appropriate to map between the source and receiving systems because of the degree of difference in the way those systems are designed.

In the specification of diagrams, one common element is that the style of displaying an object of a certain kind is usually defined once and then re-used, but the placement of objects must be adjusted whenever new elements are added to the data model. This placement and maintenance of placement is where most of the labour investment takes place that users would like to preserve. As a result, this standard is limited to the exchange of diagram layouts (meaning the arrangement of CIM objects in a display space) rather than a complete exchange of all characteristics of a graphic presentation.

With this proposed standard, instead of maintaining duplicate schematics for different applications, the schematics are exported by one system and imported by the other system. Diagram layout profile is an extension to the CIM power system model exchange IEC 61970-452, and will be orchestrated along with the existing CIM XML model exchange and updates provided using the existing CIM XML Incremental file format as defined in IEC 61970-552. IEC 61970-552 also describes how payload headers provide information as to how payloads fit together.

This process can be applied for initial schematics construction as well as for continuous maintenance.

The importing system can create its graphics displays from the imported data, or the diagram layout data can serve as additional documentation and means of understanding for the domain data exchange.

4.2   Simple bay diagram example

Diagrams are constructed using different approaches. This subclause illustrates this using a simple bay drawing. Figure 2 shows a typical representation of a bay.
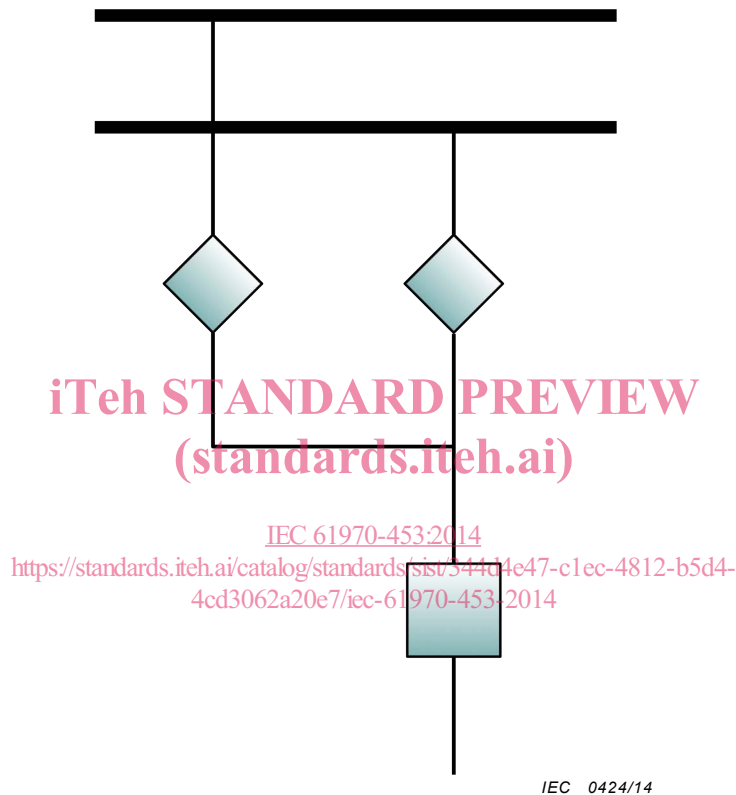
IEC   0424/14

Figure 2 – Bay diagram as rendered

In a GIS system, lines are typically drawn up to the centre point of the symbol. This is shown in Figure 3 (transparent symbol is used for illustration). This construction method is independent if the symbol size, i.e. the drawing looks "pretty" even when the importing system used a smaller symbol size than the original one.
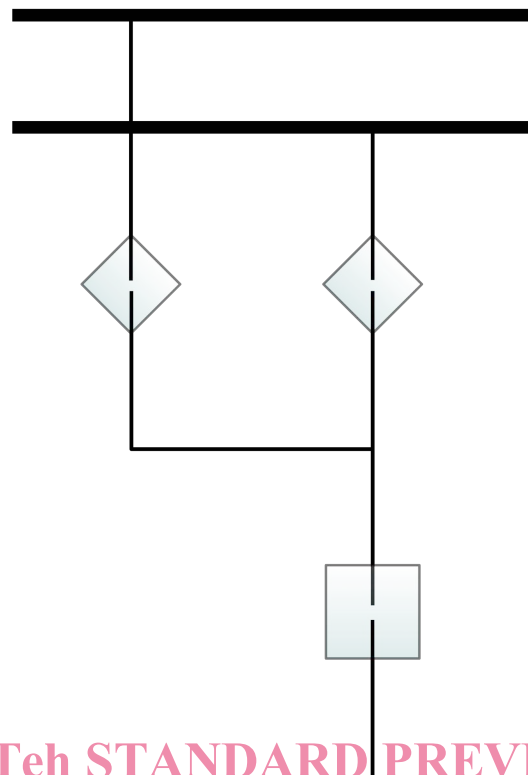
IEC 0425/14

Figure 3 – Bay diagram drawn in GIS style

In a SCADA system, lines are typically drawn to align with the terminals of the object represented by the symbol. This is shown in Figure 4 (transparent symbol is used for illustration). This construction method gives a closer representation of the electrical topology, but depends on a certain symbol size.
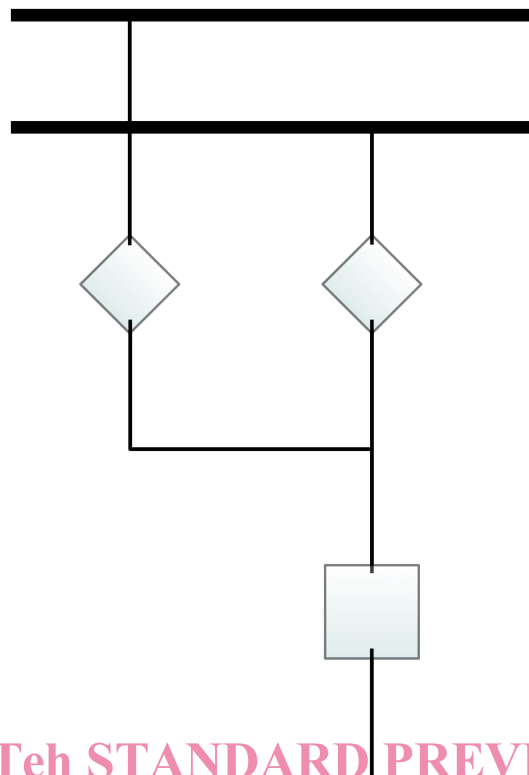
IEC   0426/14

Figure 4 – Bay diagram drawn in SCADA style

5   Diagram layout exchange profile

5.1   General

Profile namespace: http://iec.ch/TC57/61970-453/DiagramLayout/2#

This standard specifies an exchange profile for schematics with the following characteristics.

- A generic method for linking the diagram object to the domain data. Domain data and diagram layout data can be exchanged together with the domain data, or separately from each other with the assumption that domain data will have already been imported should diagram layout data be imported separately.

- It does not require or imply a specific domain data format. Therefore, it supports domain data modelled according to the IEC 61970-301 Common information model (CIM) that is exchanged in the IEC 61970-501 format (CIM RDF schema). Diagram layout data references domain data in compliance with IEC/TR 62541-1, *OPC Unified Architecture*).

- The intended usage of this standard is that the source of a diagram will use the standard to encode the layout of their diagram as they created it. It is then incumbent upon any receiver to supply the means of using that diagram layout in their system.

  - In the simplest situation, if the source uses Switch object placements, the receiver creates a generic Switch template in the receiver's system that will be used to render Switches (i.e. there is no exchange of Switch templates).

  - In more complex situations, a 1:1 correspondence may not be desirable, and receivers may have to create generic transformations in order to use exchanges.

  - However, in both situations, it is expected that once an investment is made in a strategy for rendering, repeated imports may be carried out automatically.

- Supports the exchange of diagram objects that have no relationship to domain data, i.e., pure static background objects.

- Supports multiple representations of the same domain object in the same or different diagrams.

- Allows the diagram to be used as the unit of exchange, providing a straightforward approach to partial exchange, or an exchange between systems that have a separate model and repository for diagram layout data.

- Supports assignment of diagram objects to layers or other means, for showing or hiding information based on zoom level and/or user interest.

- A generic method for proprietary extensions to enable full round tripping (export and import back into the same system) without information loss within a system, and without breaking the standard exchange format.

5.2 Diagram layout profile classes

5.2.1 General

The diagram layout classes are a part of IEC 61970-301 and as such are associated to the domain data using the standard UML association relationship. A new sub-package in IEC 61970-301 contains the classes required for expressing schematic data for domain objects as illustrated in Figure 5.
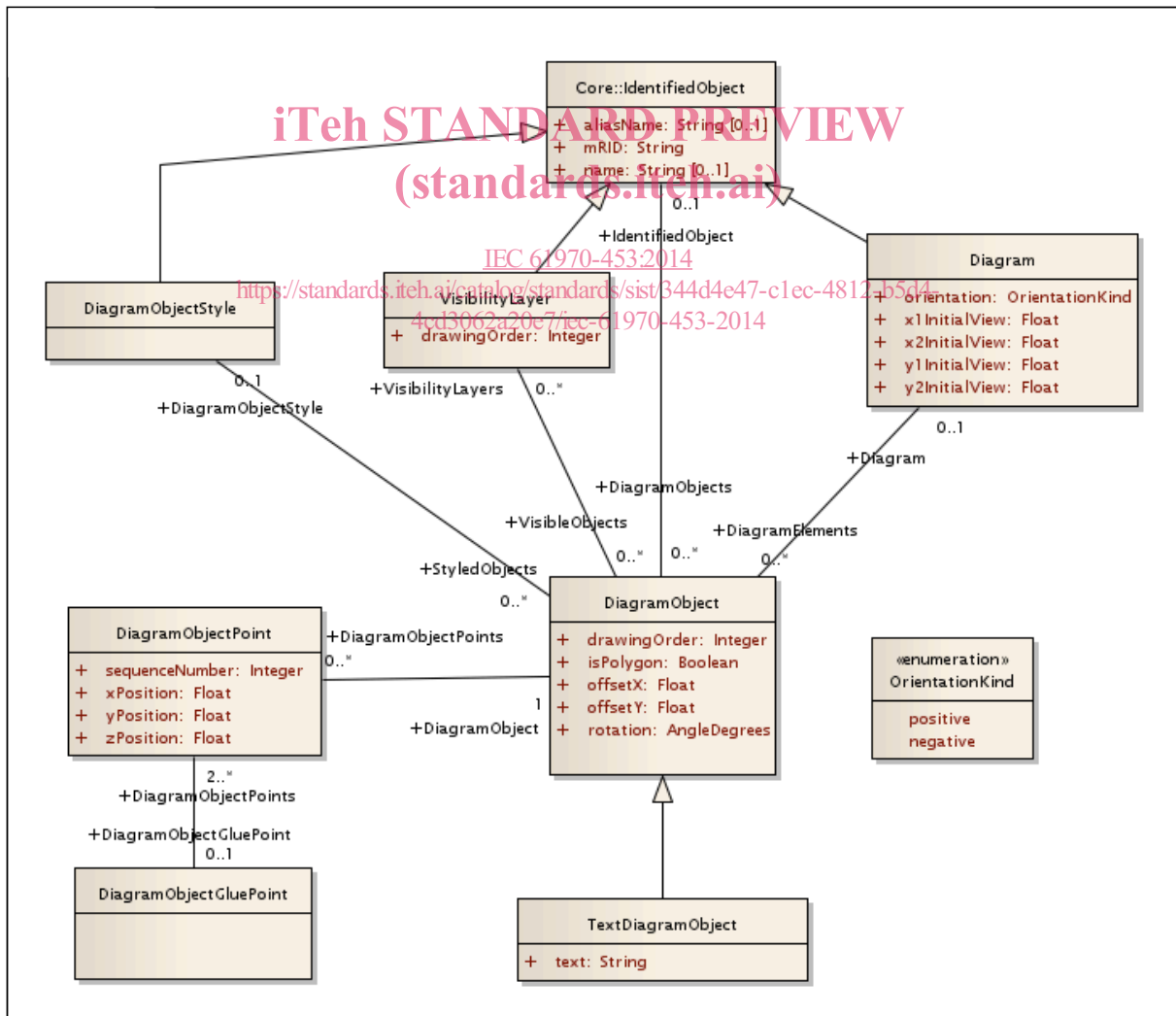

IEC   0427/14

Figure 5 – Diagram layout information model