

# FINAL VERSION

# VERSION FINALE



**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**

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Use Cases.....	8
4.1 General use cases for diagram exchange .....	8
4.2 Simple bay diagram example .....	10
5 Diagram layout exchange profile.....	12
5.1 General.....	12
5.2 Diagram layout profile classes .....	13
5.2.1 General .....	13
5.2.2 Diagram.....	14
5.2.3 DiagramObject.....	14
5.2.4 DiagramObjectGluePoint .....	15
5.2.5 DiagramObjectPoint.....	16
5.2.6 DiagramObjectStyle.....	16
5.2.7 TextDiagramObject.....	16
5.2.8 VisibilityLayer .....	17
5.2.9 Abstract classes – IdentifiedObject.....	18
5.2.10 Enumerations – Orientation and .....	18
6 Graphical rendering.....	19
6.1 General.....	19
6.2 Single point objects.....	19
6.3 Multiple point objects.....	20
6.4 Gluing points.....	21
6.5 Diagram object style .....	22
6.6 Diagram layout exchange process .....	22
7 Examples .....	24
7.1 Data instantiation and encoding.....	24
7.2 Simple bay example use case.....	26
Annex A (informative) Benefits and format conversion from IEC 61970-453 Edition 1 to Edition 2.....	28
Bibliography.....	29
Figure 1 – System overview.....	9
Figure 2 – Bay diagram as rendered .....	10
Figure 3 – Bay diagram drawn in GIS style .....	11
Figure 4 – Bay diagram drawn in SCADA style.....	12
Figure 5 – Diagram layout information model.....	13
Figure 6 – Conventions used for representing object instances and associations .....	19
Figure 7 – Single point diagram objects .....	20
Figure 8 – Multiple point diagram objects.....	21

Figure 9 – Disconnector with glue point .....	21
Figure 10 – Disconnector and breaker with glue points .....	22
Figure 11 – Profiles within IEC standards .....	23
Figure 12 – Disconnector diagram object instantiation .....	24
Figure 13 – IEC 61970-552 Encoding for disconnector diagram data .....	25
Figure 14 – Bay diagram example with objects outlined GIS style .....	26
Figure 15 – Bay diagram example with objects outlined SCADA/EMS style .....	27

Currently in preview, click buy full version

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ENERGY MANAGEMENT SYSTEM APPLICATION  
PROGRAM INTERFACE (EMS-API) –****Part 453: Diagram layout profile**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, accept IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

**DISCLAIMER**

**This Consolidated version is not an official IEC Standard and has been prepared for use convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.**

This Consolidated version of IEC 61970-453 bears the edition number 2.1. It consists of the second edition (2014-02) [documents 57/1409/FDIS and 57/1430/RVD] and its amendment 1 (2018-11) [documents 57/2038/FDIS and 57/2054/RVD]. The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

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

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.

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:

- 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<sup>1</sup>) for an Energy Management System (EMS<sup>2</sup>).

The IEC 61970-3x series specify a Common Information Model (CIM<sup>3</sup>): 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<sup>4</sup>). 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 topo-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.

---

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) class*

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<sup>5</sup>**

instance of a class that models a Real-World Object<sup>6</sup> 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<sup>7</sup>**

electronic equivalent of a seamless paper plan

<sup>5</sup> Footnote 5 applies only to the French version.

<sup>6</sup> Footnote 6 applies only to the French version.

<sup>7</sup> Footnote 7 applies to the French version only.