SLOVENSKI STANDARD
SIST EN 61970-452:2018

01-januar-2018

Nadomešča:
SIST EN 61970-452:2015

Aplikacijski programski vmesnik za sistem upravljanja z energijo (EMS-API) - 452. del: Profili CIM za statični model prenosnega omrežja

Energy management system application program interface (EMS-API) - Part 452: CIM static transmission network model profiles

Ta slovenski standard je istoveten z: EN 61970-452:2017

ICS:

03.100.70	Sistemi vodenja	Management systems
29.240.30	Krmilna oprema za elektroenergetske sisteme	Control equipment for electric power systems
35.200	Vmesniška in povezovalna oprema	Interface and interconnection equipment

SIST EN 61970-452:2018 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61970-452

November 2017

ICS 33.200

Supersedes EN 61970-452:2015

English Version

Energy management system application program interface (EMS-API) - Part 452: CIM static transmission network model profiles (IEC 61970-452:2017)

Interface de programmation d'application pour système de gestion d'énergie (EMS-API) - Partie 452: Profils du modèle de réseau de transport statique CIM (IEC 61970-452:2017)

Schnittstelle für Anwendungsprogramme für Netzführungssysteme (EMS-API) - Teil 452: CIM-Statische-Übertragungsnetzwerk-Modell-Profile (IEC 61970-452:2017)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 57/1868/FDIS, future edition 3 of IEC 61970-452, prepared by IEC/TC 57 "Power systems management and associated information exchange" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61970-452:2017.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2018-05-30
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-08-30

This document supersedes EN 61970-452:2015.

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Endorsement notice

The text of the International Standard IEC 61970-452:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61970-1	NOTE	Harmonized as EN 61970-1.
IEC/TS 61970-2	NOTE	Harmonized as CLC/TS 61970-2.
IEC 61970-552	NOTE	Harmonized as EN 61970-552.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 61968-13	-	Application integration at electric utilities - System interfaces for distribution management - Part 13: CIM RDF Model exchange format for distribution	EN 61968-13	-
IEC 61970-301	2016	Energy Management System Application Program Interface (EMS-API) - Part 301: Common information model (CIM) base	EN 61970-301	2017
IEC 61970-456	-	Energy management system application program interface (EMS-API) - Part 456: Solved power system state profiles	EN 61970-456	-
IEC 61970-501	-	Energy management system application program interface (EMS-API) - Part 501: Common Information Model Resource Description Framework (CIM RDF) schema	EN 61970-501	-
IEC 61970-552	-	Energy management system application program interface (EMS-API) - Part 552: CIMXML Model exchange format	EN 61970-552	-

IEC 61970-452

Edition 3.0 2017-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Interface de programmation d'application pour système de gestion d'énergie (EMS-API) – Partie 452: Profils du modèle de réseau de transport statique CIM

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 33.200

ISBN 978-2-8322-4506-4

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

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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.
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International Standard IEC 61970-452 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

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

a) The Equipment profile has been split into three separate profiles, CoreEquipment, Operation and ShortCircuit.
b) The HVDC model has been replaced with the new model defined in Edition 6 of 61970-301.
c) Added attribute IdentifiedObject.mRID.

d) Added class BusNameMarker.

e) Added attribute HydroPowerPlant.hydroPlantType.

f) Removed attribute HydroGeneratingUnit.energyConversionCapability.

g) Added classes related to grounding (PetersenCoil, GroundImpedance, GroundDisconnector, GroundSwitch, and Ground).

h) A number of changes have been made to whether specific attributes and associations are required or optional.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
57/1868/FDIS	57/1892/RVD

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

This document 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document 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 part of IEC 61970 is part of the IEC 61970 series that define an application program interface (API) for an energy management system (EMS).

The IEC 61970-3x series specifies a Common Information Model (CIM). The CIM is an abstract model that represents all of the major objects in an electric utility enterprise typically needed to model the operational aspects of a utility. It provides the semantics for the IEC 61970 APIs specified in the IEC 61970-4x series of Component Interface Standards (CIS). The IEC 61970-3x series includes IEC 61970-301, *Common Information Model (CIM) base* and draft standard IEC 61970-302[1], *Common Information Model (CIM) for Dynamics*.

This document is one of the IEC 61970-4x series of Compoment Interface Standards that specify 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.

This document specifies the specific profiles (or subsets) of the CIM for exchange of static power system data between utilities, security coordinators and other entities participating in a interconnected power system, such that all parties have access to the modeling of their neighbor's systems that is necessary to execute state estimation or power flow applications. Currently three profiles, the CoreEquipment Profile, the Operation Profile and the Short Circuit Profile, have been defined. A companion standard, IEC 61970-552, defines the CIM XML Model Exchange Format based on the Resource Description Framework (RDF) Schema specification language. IEC 61970-552 is the common industry approach and is recommended to be used to transfer power system model data for the IEC 61970-452 profile.

1 Under preparation. Stage at the time of publication: IEC/AFDIS 61970-302:2017.

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

Part 452: CIM static transmission network model profiles

1 Scope

This IEC document is one 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 centers and/or control center components, such as power systems applications.

The purpose of this document is to define the subset of classes, class attributes, and roles from the CIM necessary to execute state estimation and power flow applications. The North American Electric Reliability Council (NERC) Data Exchange Working Group (DEWG) Common Power System Modeling group (CPSM) produced the original data requirements, which are shown in Annex E. These requirements are based on prior industry practices for exchanging power system model data for use primarily in planning studies. However, the list of required data has been extended to facilitate a model exchange that includes parameters common to breaker-oriented applications. Where necessary this document establishes conventions, shown in Clause 6, with which an XML data file must comply in order to be considered valid for exchange of models.

This document is intended for two distinct audiences, data producers and data recipients, and may be read from two perspectives.

From the standpoint of model export software used by a data producer, the document describes a minimum subset of CIM classes, attributes, and associations which must be present in an XML formatted data file for model exchange. This standard does not dictate how the network is modelled, however. It only dictates what classes, attributes, and associations are to be used to describe the source model as it exists.

Optional and required classes, attributes and associations must be imported if they are in the model file prior to import. If an optional attribute does not exist in the imported file, it does not have to be exported in case exactly the same data set is exported, i.e. the tool is not obliged to automatically provide this attribute. If any mandatory attribute or association is missing, the exchanged data is considered invalid. Specific business processes may relax restrictions of the profile, but such exchanges would not be considered to be compliant with the standard. Business processes governing different exchanges can also require mandatory exchange of certain optional attributes or associations.

Furthermore, an exporter may, at his or her discretion, produce an XML data file containing additional class data described by the CIM RDF Schema but not required by this document provided these data adhere to the conventions established in Clause 6.

From the standpoint of the model import used by a data recipient, the document describes a subset of the CIM that importing software must be able to interpret in order to import exported models. As mentioned above, data providers are free to exceed the minimum requirements described herein as long as their resulting data files are compliant with the CIM RDF Schema and the conventions established in Clause 6. The document, therefore, describes additional classes and class data that, although not required, exporters will, in all likelihood, choose to include in their data files. The additional classes and data are labeled as required (cardinality 1..1) or as optional (cardinality 0..1) to distinguish them from their required counterparts. Please note, however, that data importers could potentially receive data containing instances of any and all classes described by the CIM RDF Schema.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE For general glossary definitions, see IEC 60059, *International Electrotechnical Vocabulary*.

IEC 61968-13, *Application integration at electric utilities – System interfaces for distribution management – Part 13: CIM RDF Model exchange format for distribution*

IEC 61970-301:2016, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

IEC 61970-456, *Energy management system application program interface (EMS-API) – Part 456: Solved power system state profiles*

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

IEC 61970-552, *Energy management system application program interface (EMS-API) – Part 552: CIMXML Model exchange format*

Extensible Markup Language (XML) 1.0 (Second Edition), http://www.w3.org/TR/REC-xml

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Overview of data requirements

4.1 Overview

An extensive discussion of the model exchange use cases can be found in Annex A. In all cases, the purposes of this document are:

- To improve the accuracy of power system models used in critical systems, particularly the representation of parts of the network outside the primary domain of the system in question.
- To achieve consistency among the models used by the various systems that play a role in operating or planning the interconnection.
- To reduce the overall cost of maintaining critical models used in operating or planning an interconnection.

The classes, attributes, and associations identified in this document and specified in IEC 61970-456 represent the minimum subset of the full CIM model necessary to exchange sufficient power system data to support state estimation and power flow for HV(high voltage) and MV (medium voltage) networks. IEC 61968-13 describes the profiles used to exchange distribution MV/LV (low voltage) network models.

4.2 General requirements

The following requirements are general in nature or involve multiple classes. Additional requirements are defined in Subclauses 5.2.1 and 5.2.2 for the individual classes.

- The cardinality defined in the CIM model shall be followed, unless a different cardinality is explicitly defined in this document. For instance, the cardinality on the association between VoltageLevel and BaseVoltage indicates that a VoltageLevel shall be associated with one and only one BaseVoltage, but a BaseVoltage can be associated with zero to many VoltageLevels.
- Associations between classes referenced in this document and classes not referenced here are not required regardless of cardinality.
- The attribute “name” inherited by many classes from the abstract class IdentifiedObject is not required to be unique. The RDF ID defined in the data exchange format is the only unique and persistent identifier used for this data exchange. The attribute IdentifiedObject.name is, however, always required. The additional attribute of IdentifiedObject, aliasName, is not required.
- The IdentifiedObject.mRID attribute should be used as the RDF ID. The RDF ID can not begin with a number. An underscore should be added as the first character if necessary. The RDF ID shall be globally unique. A prefix may be added, if necessary, to ensure global uniqueness, but the RDF ID including the prefix shall be within the maximum character limit specified below.
- The maximum character length of names and identifiers are listed below.
  - rdf:ID – 60 characters maximum
  - IdentifiedObject.name – 32 characters maximum
  - IdentifiedObject.aliasname – 40 characters maximum
- To maintain a consistent naming hierarchy, each Substation shall be contained by a SubGeographicalRegion and each SubGeographicalRegion shall be contained by one and only one GeographicalRegion.
- Equipment defined without connectivity, because the associated Terminal(s) are not connected to ConnectivityNodes is allowed, for instance a ShuntCompensator whose Terminal is not associated to a ConnectivityNode.
- UTF-8 is the standard for file encoding. UTF-16 is not supported.
- Instance data to be exchanged shall make use of the most detailed class possible. The classes GeneratingUnit, Switch, and EnergyConsumer should only be used if the information to determine the more detailed class (ThermalGeneratingUnit, HydroGeneratingUnit, Breaker, Disconnector, etc.) is not available.
- All Equipment must be within a VoltageLevel except PowerTransformer, GeneratingUnit, HydroPump, Conductor, Switch and DCConductingEquipment. A PowerTransformer, GeneratingUnit or HydroPump should be contained in a substation; a Switch may be in a VoltageLevel or a Bay; and Conductor should be contained in a Line. For networks with HVDC the ACDCConverter will be in a DCConverterUnit and the associated PowerTransformer, Switches and SeriesCompensators will also be contained in a DCConverterUnit.

4.3 Transformer modeling

A two winding PowerTransformer has two PowerTransformerEnds. This gives the option to specify the impedance values for the equivalent pi-model completely at one end or split them between the two ends. The impedances shall be specified at the primary voltage side as shown in Figure 1.