SVENSK STANDARD SS-EN IEC 61970-456

Fastställd	Utgåva	Sida	Ansvarig kommitté
2022-03-16	3	1 (1+109)	SEK TK 57

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

Gränssnitt för EMS (EMS-API) – Del 456: Lösningsprofiler från tillståndsestimatorer inklusive lastflödesberäkningar

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

Som svensk standard gäller europastandarden EN IEC 61970-456:2022. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 61970-456:2022.

Nationellt förord

Europastandarden EN IEC 61970-456:2022

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 61970-456, Third edition, 2021 - Energy management system application program interface (EMS-API) - Part 456: Solved power system state profiles**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN IEC 61970-456, utgåva 2, 2018, gäller ej fr o m 2025-01-19.

ICS 33.200.00

Denna standard är fastställd av SEK Svensk Elstandard,
som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00.
E-post: sek@elstandard.se. Internet: www.elstandard.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard
Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61970-456

February 2022

ICS 33.200

Supersedes EN IEC 61970-456:2018 and all of its amendments and corrigenda (if any)

English Version

Energy management system application program interface (EMS-API) - Part 456: Solved power system state profiles (IEC 61970-456:2021)

Interface de programmation d'application pour système de gestion d'énergie (EMS-API) - Partie 456: Profils d'état de réseaux électriques résolus (IEC 61970-456:2021)

Schnittstelle für Anwendungsprogramme für Netzführungssysteme (EMS-API) - Teil 456: Gelöste Zustandsprofile des Stromversorgungssystems (IEC 61970-456:2021)

This European Standard was approved by CENELEC on 2022-01-19. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2022 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN IEC 61970-456:2022 E

European foreword

The text of document 57/2406/FDIS, future edition 3 of IEC 61970-456, 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 IEC 61970-456:2022.

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) 2022-10-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-01-19

This document supersedes EN IEC 61970-456:2018 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 61970-456:2021 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 61970-453	NOTE	Harmonized as EN 61970-453
IEC 61970-501	NOTE	Harmonized as EN 61970-501
IEC 61970-552	NOTE	Harmonized as EN 61970-552
IEC 61970-600-1	NOTE	Harmonized as EN IEC 61970-600-1
IEC 61970-600-2	NOTE	Harmonized as EN IEC 61970-600-2

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 61970-301	2020	Energy management system application program interface (EMS-API) - Part 301: Common information model (CIM) base	EN IEC 61970-301	2020
A1[1]	—		A1[2]	—
IEC 61970-452	2021	Energy management system application program interface (EMS-API) - Part 452: CIM static transmission network model profiles	EN IEC 61970-452	2021

[1] Under preparation. Stage at the time of publication: IEC/RPVC 61970-301/AMD1:2021.

[2] Under preparation. Stage at the time of publication: EN IEC 61970-301:2020/FprA1:2021.

IEC 61970-456

Edition 3.0 2021-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Interface de programmation d'application pour système de gestion d'énergie (EMS-API) – Partie 456: Profils d'état de réseaux électriques résolus

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 33.200

ISBN 978-2-8322-1046-1

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

Part 456: Solved power system state profiles

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, access to 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.

IEC 61970-456 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is an International Standard.

This third edition cancels and replaces the second edition published in 2018. This edition constitutes a technical revision. It is based on the IEC 61970 UML version ‘IEC61970CIM17v40’, dated 2020-08-24.

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

a) Updated to support CIM17 (IEC 61970-301:2020+AMD1) and align with IEC 61970-452:ED4.
b) The classes PowerElectronicsConnection, PowerElectronicsUnit and PowerElectronicsWindUnit are added to the Steady State Hypothesis (SSH) profile to match the changes done for Edition 4 of IEC 61970-452, Core Equipment profile.
c) Added relevant terms used in this document.

d) Clarified use of Equipment.inService and Equipment.normallyInService.

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

Draft	Report on voting
57/2406/FDIS	57/2440/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 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 document 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 document is one of several parts of the IEC 61970 series that defines common information model (CIM) datasets exchanged between application programs in energy management systems (EMS).

The IEC 61970-300 series specifies the common information model (CIM). The CIM is an abstract model that represents the objects in an electric utility enterprise typically needed to model the operational aspects of a utility.

This document is one of the IEC 61970-400 series of component interface standards that specify the semantic structure of data exchanged between components (or applications) and/or made publicly available data by a component. This document describes the payload that would be carried if applications are communicating via a messaging system, but the standard does not include the method of exchange, and therefore is applicable to a variety of exchange implementations. The examples in this document are based on the exchanged data formatted specified in IEC 61970-552 CIM XML model exchange standard.

This document specifies three profiles:

- The Steady State Hypothesis (SSH) profile that describes power flow application input variables such as voltage set points, switch statuses etc.
- The topology profile (TP) that describes a bus-branch model. A topology model may be created by a network model builder from a node-breaker model with SSH as inputs using topology processing or by a tool where a user interactively builds a topology model. Therefore, a topology model is defined as an output.
- State variables profile (SV) that describes the solution of a power system case such as is produced by power flow or state estimation applications.

This document describes the inputs and solutions (outputs) with reference to a power system model that conforms to IEC 61970-452 in this series of related standards. The separation of information into profiles also enables separation of data into documents corresponding to the profiles. In this way the profiles defined in this document generate small data documents compared with traditional bus-branch or node-breaker formats that include the network, the initial conditions and the result.

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

Part 456: Solved power system state profiles

1 Scope

This part of IEC 61970 belongs to the IEC 61970-450 to IEC 61970-499 series that, taken as a whole, defines at an abstract level the content and exchange mechanisms used for data transmitted between power system analyses applications, control centres and/or control centre components.

The purpose of this document is to rigorously define the subset of classes, class attributes, and roles from the CIM necessary to describe the result of state estimation, power flow and other similar applications that produce a steady-state solution of a power network, under a set of use cases which are included informatively in this document.

This document is intended for two distinct audiences, data producers and data recipients, and can be read from those two perspectives. From the standpoint of model export software used by a data producer, the document defines how a producer may describe an instance of a network case in order to make it available to some other program. From the standpoint of a consumer, the document defines what that importing software must be able to interpret in order to consume power flow cases.

There are many different use cases for which use of this document is expected and they differ in the way that the document will be applied in each case. Implementers are expected to consider what use cases they wish to cover in order to know the extent of different options they must cover. As an example, the profiles defined in this document will be used in some cases to exchange starting conditions rather than solved conditions, so if this is an important use case, it means that a consumer application needs to be able to handle an unsolved state as well as one which has met some solution criteria.

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.

IEC 61970-301:2020, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*
IEC 61970-301:2020/AMD1:—[1]

IEC 61970-452:2021, *Energy management system application program interface (EMS-API) – Part 452: CIM static transmission network model profiles*

[1] Under preparation. Stage at the time of publication: IEC/RPVC 61970-301/AMD1:2021