This document is a preview generated by EVS

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

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 61970-456:2018 sisaldab Euroopa standardi EN IEC 61970-456:2018 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 61970-456:2018 consists of the English text of the European standard EN IEC 61970-456:2018.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 18.05.2018.	Date of Availability of the European standard is 18.05.2018.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

This document is a preview generated by EVS

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 33.200

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61970-456

May 2018

ICS 33.200

Supersedes EN 61970-456:2013

English Version

Energy management system application program interface (EMS-API) - Part 456: Solved power system state profiles (IEC 61970-456:2018)

Interface de programmation d'application pour système de gestion d'énergie (EMS-API) - Partie 456: Profils d'état de réseaux électriques résolus (IEC 61970-456:2018)

Schnittstelle für Anwendungsprogramme für Netzführungssysteme (EMS-API) - Teil 456: Globale Stabilitätsbeurteilung (IEC 61970-456:2018)

This European Standard was approved by CENELEC on 2018-04-23. 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, 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

© 2018 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

This document is a preview generated by EVS

European foreword

The text of document 57/1951/FDIS, future edition 2 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 61970-456:2018.

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)	2019-01-23
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2021-04-23

This document supersedes EN 61970-456:2013.

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 mandate given to CENELEC by the European Commission and the European Free Trade Association.

Endorsement notice

The text of the International Standard IEC 61970-456:2018 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 61790-2	NOTE	Harmonized as CLC/TS 61790-2.
IEC 61790-301	NOTE	Harmonized as EN 61790-301.
IEC 61790-501	NOTE	Harmonized as EN 61790-501.

This document is a preview generated by EVS

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 61970-452	2017	Energy management system application program interface (EMS-API) - Part 452: CIM static transmission network model profiles	EN 61970-452	2017
IEC 61970-453	2014	Energy Management System Application Program Interface (EMS-API) -- Part 453: Diagram Layout Profile	EN 61970-453	2014
IEC 61970-552	2016	Energy management system application program interface (EMS-API) - Part 552: CIMXML Model exchange format	EN 61970-552	2016

This document is a preview generated by EVS

CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 7
2 Normative references 7
3 Terms and definitions 7
4 Profile information 8
5 Overview 8
6 Use cases 13
6.1 Overview 13
6.2 EMS network analysis integration 15
6.3 Power flow based network analysis 16
7 Data model with CIMXML examples 21
7.1 Use of the interfaces 21
7.1.1 Overview 21
7.1.2 Network model boundaries 21
7.1.3 Bus-branch and node-breaker models 24
7.2 Topology (TP) interface 27
7.3 State Variables (SV) interface 29
7.4 Steady State Hypothesis (SSH) interface 31
8 Profiles 31
8.1 Comments and notes 31
8.2 SteadyStateHypothesis profile 32
8.2.1 General 32
8.2.2 Concrete Classes 33
8.2.3 Abstract Classes 46
8.2.4 Data Types 53
8.3 Topology profile 55
8.3.1 General 55
8.3.2 Concrete Classes 55
8.3.3 Abstract Classes 57
8.4 StateVariables profile 58
8.4.1 General 58
8.4.2 Concrete Classes 58
8.4.3 Abstract Classes 64
8.4.4 Data Types 65
Bibliography 67

Figure 1 – Relations between MAS, profile and dataset 9
Figure 2 – Profile relationships 11
Figure 3 – Connectivity model example 12
Figure 4 – The European power system with regions 14
Figure 5 – Information exchange in power flow and sharing of results 15
Figure 6 – EMS datasets to an external client 16
Figure 7 – Node-breaker power flow Integration architecture 17

This document is a preview generated by EVS

Figure 8 – Bus-branch power flow Integration architecture 17
Figure 9 – Boundary injection model 18
Figure 10 – Alternate boundary modelling 19
Figure 11 – Assembled model alternatives 20
Figure 12 – Line boundary dataset example 22
Figure 13 – Substation boundary dataset example 22
Figure 14 – Power Flow on an assembledd model 23
Figure 15 – Power Flow on a regional network part 24
Figure 16 – CIM relation between ConnectivityNode and TopologicalNode 25
Figure 17 – Bus-branch modeling of bus coupler and line transfer 26
Figure 18 – CIM topology model 27
Figure 19 – Topology solution interface 28
Figure 20 – CIM state variable solution model 29
Figure 21 – State solution interface example 30

Table 1 – Profiles defined in this document 8

This document is a preview generated by EVS

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. This document assumes and recommends that the exchanged data is formatted in XML based on the resource description framework (RDF) schema as specified in IEC 61970-552 CIM XML model exchange standard.

IEC 61970-456 specifies three profiles:

- The Steady State Hypothesis (SSH) profile that describe power flow application input variables such as voltage set points, switch statuses etc..
- The topology profile that describe a bus-branch model. A topology model may be created by a network model builder from a node-breaker model and SSH inputs or by a tool where a user interactively builds a topology model. A topology model is input to power flow applications.
- State variables solution from a power system case such as is produced by power flow or state estimation applications.

IEC 61970-456 describes the dynamic value inputs and solutions 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.

This document is a preview generated by EVS