

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

## Kommunikation på energimarknaden – Del 503: Vägledning för användning av CIM-profilen enligt IEC 62323-351

*Framework for energy market communications –  
Part 503: Market data exchanges guidelines for the IEC 62325-351 profile*

Som svensk standard gäller europastandarden EN IEC 62325-503:2018. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 62325-503:2018.

### Nationellt förord

Europastandarden EN IEC 62325-503:2018

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 62325-503, First edition, 2018 - Framework for energy market communications - Part 503: Market data exchanges guidelines for the IEC 62325-351 profile**

utarbetad inom International Electrotechnical Commission, IEC.

---

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](mailto:sek@elstandard.se). Internet: [www.elstandard.se](http://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](http://www.elstandard.se)

ICS 33.200

English Version

**Framework for energy market communications - Part 503:  
Market data exchanges guidelines for the IEC 62325-351 profile  
(IEC 62325-503:2018)**

Cadre pour les communications pour le marché de l'énergie  
- Partie 503: Lignes directrices concernant les échanges de  
données du marché pour le profil défini dans l'IEC 62325-  
351  
(IEC 62325-503:2018)

Kommunikation im Energiemarkt - Teil 503: Richtlinien zum  
Austausch von Marktdaten für das Profil der IEC 62325-351  
(IEC 62325-503:2018)

This European Standard was approved by CENELEC on 2018-08-30. 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**

---

## **European foreword**

The text of document 57/1936/CDV, future edition 1 of IEC 62325-503, 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 62325-503:2018.

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) 2019-05-30
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2021-08-30

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.

## **Endorsement notice**

The text of the International Standard IEC 62325-503:2018 was approved by CENELEC as a European Standard without any modification.

## 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](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC TS 61970-2 -		Energy management system application program interface (EMS-API) - Part 2: Glossary	-	-
ISO/IEC 9594-8	2017	Information technology - Open Systems Interconnection - The Directory - Part 8: Public-key and attribute certificate frameworks	-	-
ISO/IEC 19464:2014	2014	Information technology - Advanced Message Queuing Protocol (AMQP) v1.0 specification	-	-

## CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references .....	10
3 Terms and definitions .....	11
4 High level concepts .....	12
4.1 What is the purpose of MADES? .....	12
4.2 Overview.....	13
4.3 Transparent and reliable message delivery .....	14
4.4 Components of a MADES system.....	15
4.4.1 Endpoint, broker and component-directory.....	15
4.4.2 Delivery routes and acknowledgements .....	16
4.4.3 Sharing configuration data of the system .....	17
4.4.4 Interfaces exposed by the components .....	19
4.4.5 Architecture examples of MADES systems.....	21
4.5 Security and message integrity .....	24
4.5.1 Security goals and security solution.....	24
4.5.2 Transport-layer security .....	25
4.5.3 Message-level security: signing and encryption .....	26
4.5.4 Non-repudiation .....	27
5 Delivering the messages.....	29
5.1 Unique identification of components and messages .....	29
5.2 Message-type of a message .....	29
5.3 Message route towards a recipient endpoint: message-paths.....	29
5.4 Restriction on the routes by a broker .....	31
5.5 Message acceptance by a sender endpoint.....	31
5.6 Tracking the delivery of a message.....	31
5.6.1 Message-status of a message .....	31
5.6.2 Delivery events and acknowledgements.....	32
5.7 Message expiration.....	34
5.8 Reliable transfer of a message.....	35
5.8.1 Rationale .....	35
5.8.2 Transfer between sender application and sender endpoint.....	36
5.8.3 Transfer between components using the AMQP protocol .....	37
5.8.4 Transfer between recipient endpoint and recipient application .....	37
5.9 Storing internal messages in components .....	38
5.10 Message priority .....	38
5.11 Message delivery order.....	38
5.12 Testing a route between two endpoints: tracing-messages.....	38
6 Transferring messages using the AMQP protocol.....	39
6.1 Main principles of the AMQP specification .....	39
6.1.1 Introduction .....	39
6.1.2 Connection Open.....	40
6.1.3 Session begin.....	40
6.1.4 Link attachment.....	41
6.1.5 Message transfer.....	41

6.1.6	Link recovery and resends .....	41
6.1.7	Error management .....	41
6.1.8	Message structure .....	41
6.2	AMQP high-level implementation: the client/broker model .....	42
6.3	AMQP implementation in MADES components .....	43
6.4	Management of AMQP connections and attachments by an endpoint .....	45
6.5	Internal message format .....	46
6.5.1	Definitions, design and security checks .....	46
6.5.2	AMQP format for transferring internal messages .....	46
6.5.3	Encryption .....	47
6.5.4	Signing .....	48
6.5.5	Internal message metadata .....	49
6.5.6	XML signature example .....	53
7	Managing configuration data of the system .....	54
7.1	Rationale .....	54
7.2	Directory content and information ownership .....	54
7.3	On the consistency of configuration data .....	56
7.3.1	Component consistency .....	56
7.3.2	System consistency .....	57
7.3.3	Distributed update implementation .....	57
7.3.4	Eventual consistency .....	57
7.4	Connection to a component-directory .....	57
7.5	REST API implementation and available resources .....	58
7.6	Registration process .....	59
7.7	Synchronisation process .....	60
7.7.1	Validity period of replicated data: time-to-live .....	60
7.7.2	Limitation of the synchronisation flow .....	60
7.7.3	Configuration of the synchronisation process .....	61
7.8	XML schemas of the APIs requests and responses .....	61
7.8.1	Shared types .....	61
7.8.2	registrations resource .....	63
7.8.3	endpoints, brokers and components resources .....	65
8	Managing the certificates .....	66
8.1	Definitions and principles .....	66
8.2	Certificates: format and unique ID .....	67
8.3	Used certificates and issuers certificates authorities .....	67
8.3.1	Overview .....	67
8.3.2	Transport-layer security (authorise data exchanges) .....	67
8.3.3	Message-level security (protect message confidentiality and authenticate message issuer) .....	68
8.4	Trusting the certificates of others components .....	68
8.4.1	Authentication .....	68
8.4.2	Signing and encryption .....	68
8.5	Renewing the (nearly) expired certificates .....	68
8.6	Revoking a component .....	69
9	Managing the version of the MADES specification .....	69
9.1	MADES version of this document .....	69
9.2	Issue, version meaning, upgrading recommendations .....	69
9.3	Changing the signature or the encryption algorithms .....	70

10	Administrating and operating the components.....	70
11	Interfaces for the applications.....	71
11.1	Endpoint webservice interface for applications.....	71
11.1.1	Overview .....	71
11.1.2	SendMessage service.....	72
11.1.3	ReceiveMessage service .....	73
11.1.4	ConfirmReceiveMessage service .....	75
11.1.5	CheckMessageStatus service .....	75
11.1.6	ConnectivityTest service.....	77
11.1.7	WSDL for the endpoint webservice interface.....	77
11.2	File System Shared Folders (FSSF).....	84
11.2.1	Overview .....	84
11.2.2	Folders and file naming convention.....	84
11.2.3	Concurrent access to files .....	86
11.2.4	Configuring FSSF .....	86
	Bibliography.....	87
	Figure 1 – MADES overall view.....	12
	Figure 2 – MADES scope in a layered architecture .....	13
	Figure 3 – MADES message delivery .....	14
	Figure 4 – MADES components, interactions and protocols .....	15
	Figure 5 – Possible routes for delivering a message .....	16
	Figure 6 – Communication protocols for delivering a message .....	17
	Figure 7 – Data flows between a component-directory and its registered components.....	18
	Figure 8 – Data flows with several component-directories .....	19
	Figure 9 – Component-directory services and protocols .....	19
	Figure 10 – MADES Interfaces, services and protocols.....	20
	Figure 11 – Minimal MADES system (without broker).....	21
	Figure 12 – Minimal MADES system (with broker).....	21
	Figure 13 – MADES system with a party in a central role .....	22
	Figure 14 – MADES system with several brokers .....	23
	Figure 15 – Using a single endpoint for several business processes .....	24
	Figure 16 – MADES transport security .....	25
	Figure 17 – Security: protected endpoint.....	25
	Figure 18 – Security: exposed endpoint .....	26
	Figure 19 – Message signing and signature verification .....	26
	Figure 20 – Message encryption and decryption .....	27
	Figure 21 – Non-repudiation .....	28
	Figure 22 – Message-status along the delivery .....	32
	Figure 23 – Tracking events while delivering a message.....	33
	Figure 24 – Reliable transfer.....	36
	Figure 25 –Transfer between sender application and sender endpoint .....	36
	Figure 26 – Transfer between recipient endpoint and recipient application.....	37
	Figure 27 – The nine AMQP frames .....	40
	Figure 28 – Structure of an AMQP message .....	42

Figure 29 – AMQP in MADES components.....	44
Figure 30 – Certificates and certification authorities (CAs) of a MADES system .....	67
Figure 31 – WSDL 1.1 definitions.....	78
Table 1 – Characteristics of the tracking events .....	34
Table 2 – Final state of a message in an endpoint .....	38
Table 3 – Services of the client / broker model.....	43
Table 4 – Rules for setting up connection/attachment and for message transfer .....	45
Table 5 – Internal message – AMQP format: header section .....	46
Table 6 – Internal message – AMQP format: properties section .....	46
Table 7 – Internal message – AMQP format: application-properties section .....	47
Table 8 – Internal message – AMQP format: application-data section .....	47
Table 9 – Encryption – Processing metadata attributes for the "AES-256" cipher .....	48
Table 10 – Signing – Processing metadata attributes for the "SHA-512" Algorithm.....	49
Table 11 – MessageMetadata (type) .....	50
Table 12 – InternalMessageType (type: string enumeration) .....	51
Table 13 – ProcessingMetadata (type).....	51
Table 14 – MessageProcessor (type).....	51
Table 15 – Map (type).....	51
Table 16 – MapEntry (type).....	51
Table 17 – ValueType (type: string enumeration) .....	52
Table 18 – Component-directory – content of an entry .....	55
Table 19 – Certificate (type).....	55
Table 20 – MakesImplementation (type) .....	56
Table 21 – MessagePath (type) .....	56
Table 22 – BrokerRestriction (type).....	56
Table 23 – HTTP operations .....	58
Table 24 – HTTP return codes .....	58
Table 25 – Component-directory API .....	59
Table 26 – Endpoint interface – Generic error.....	72
Table 27 – Endpoint interface – Value for errorCode.....	72
Table 28 – SendMessage – Request elements.....	72
Table 29 – SentMessage (type) .....	73
Table 30 – SendMessage – Response elements .....	73
Table 31 – SendMessage – Additional error elements.....	73
Table 32 – ReceiveMessage – Request elements .....	74
Table 33 – ReceiveMessage – Response elements.....	74
Table 34 – ReceivedMessage (type) .....	74
Table 35 – ReceiveMessage – Additional error elements .....	74
Table 36 – ConfirmReceiveMessage – Request elements .....	75
Table 37 – ConfirmReceiveMessage – Response elements .....	75
Table 38 – ConfirmReceiveMessage – Additional error elements .....	75
Table 39 – CheckMessageStatus – Request elements .....	75

Table 40 – CheckMessageStatus – Response elements ..... 76

Table 41 – MessageStatus (type)..... 76

Table 42 – MessageTraceItem (type) ..... 76

Table 43 – MessageState or MessageTraceState (Type: string enumeration) ..... 76

Table 44 – CheckMessageStatus – Additional error elements ..... 77

Table 45 – ConnectivityTest – Request elements ..... 77

Table 46 – ConnectivityTest – Response elements ..... 77

Table 47 – ConnectivityTest – Additional error elements ..... 77

Table 48 – FSSF – Folders and filename format ..... 85

Table 49 – FSSF – Tokens used to generate the filenames..... 85

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FRAMEWORK FOR ENERGY MARKET COMMUNICATIONS –****Part 503: Market data exchanges guidelines for the IEC 62325-351 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, 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.

International Standard IEC 62325-503 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This edition cancels and replaces IEC TS 62325-503 published in 2014.

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

- a) Use of ISO/IEC 19464:2014, Advanced Message Queuing Protocol (AMQP) v1.0 specification;
- b) Splitting of the node described in the IEC TS 62325-503:2014 into a broker that implements the messaging function and a directory;
- c) Increase of operability and resilience of the communication system with the ability for an endpoint to send and receive messages through several brokers;
- d) Benefits of standardisation, performance and scalability of the AMQP protocol for transferring messages.

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

CDV	Report on voting
57/1936/CDV	57/1983/RVC

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.

In this document, the following print types are used:

*Help the visibility of information in table and diagram: in italic type*

A list of all parts in the IEC 62325 series, published under the general title *Framework for energy market communications*, 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 useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

This document is part of the IEC 62325 series for deregulated energy market communications.

The principal objective of the IEC 62325 series is to produce documents which facilitate the integration of market application software developed independently by different vendors into a market management system, between market management systems and market participant systems. This is accomplished by defining message exchanges to enable these applications or systems access to public data and exchange information independent of how such information is represented internally.

The common information model (CIM) specifies the basis for the semantics for the message exchange. The European style market profile specifications that support the European style design electricity markets are defined in IEC 62325-351. These electricity markets are based on the European regulations, and on the concepts of third party access and zonal markets. The IEC 62325-451-n International documents specify the content of the messages exchanged.

The purpose of this document is to provide the guidelines to exchange the above-mentioned messages. A European market participant (trader, distribution utilities, etc.) could benefit from a single, common, harmonised, secure platform for message exchange with the European Transmission System Operators (TSOs); thus reducing the cost of building different IT platforms to interface with all the parties involved.

This document represents an important step in facilitating parties entering into electricity markets other than their national ones; they could use the same or similar information exchange system to participate in more than one market all over Europe.

This document was originally based upon the work of the European Network of Transmission System Operators (ENTSO-E) Working Group EDI.

## FRAMEWORK FOR ENERGY MARKET COMMUNICATIONS –

### Part 503: Market data exchanges guidelines for the IEC 62325-351 profile

#### 1 Scope

This part of IEC 62325 is for European electricity markets.

This document specifies a standard for a communication platform which every Transmission System Operator (TSO) in Europe can use to exchange reliably and securely documents for the energy market. Consequently a European market participant (TSO, regional supervision centre, distribution utility, power exchange, etc.) could benefit from a single, common, harmonised and secure platform for message exchange with other participants; thus, reducing the cost of building different information technology (IT) platforms to interface with all the parties involved.

“MADES” (Market Data Exchange Standard) is the acronym to designate this standard.

MADES is a specification for a decentralised common communication platform based on international IT standards:

- From an application program perspective, MADES specifies the software interfaces to exchange electronic documents with peer applications. Such interfaces mainly provide means to send and receive documents using a so-called “MADES communication system” (or “MADES system” or simply “system”). The sender can request about the status of the delivery of a document and the recipient issues a message back, the acknowledgement, when receiving the document. This makes a MADES system usable for exchanging documents in business processes requiring a reliable delivery.
- MADES also specifies services hidden to the applications such as recipient localisation, recipient connection status, message routing and security. Services include directory, authentication, signing, encryption, message tracking, message logging and message temporary storage.

The purpose of MADES is to create a secured message exchange standard based on standard communication protocols and utilising IT best practices for exchanging data over any TCP/IP communication network, in order to facilitate business-to-business (B2B) information exchanges as described in IEC 62325-351 and the IEC 62325-451 series.

A MADES system acts as a post-office organisation: the transported object is a “message” in which the document of the sender is securely packaged in an envelope containing metadata, which is necessary information for transportation, tracking and delivery.

#### 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 TS 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

ISO/IEC 19464:2014, *Information technology – Advanced Message Queuing Protocol (AMQP) v1.0 specification*, <https://www.amqp.org/> (developed by the OASIS open standards consortium)

ISO/IEC 9594-8:2017, *Information technology – Open systems interconnection – The Directory – Part 8: Public-key and attribute certificate frameworks*