

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

Protokoll för styrning av laddnings- och urladdningsinfrastruktur hos elfordon – Del 1: Definitioner, användningsfall och uppbyggnad

*Protocol for management of electric vehicles charging and discharging infrastructures –
Part 1: Basic definitions, use cases and architectures*

Som svensk standard gäller europastandarden EN IEC 63110-1:2022. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 63110-1:2022.

Nationellt förord

Europastandarden EN IEC 63110-1:2022

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 63110-1, First edition, 2022 - Protocol for management of electric vehicles charging and discharging infrastructures – Part 1: Basic definitions, use cases and architectures**

utarbetad inom International Electrotechnical Commission, IEC.

ICS 43.120.00; 03.100.70

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

ICS 43.120; 03.100.70

English Version

Protocol for management of electric vehicles charging and
discharging infrastructures - Part 1: Basic definitions, use cases
and architectures
(IEC 63110-1:2022)

Protocole de gestion des infrastructures de charge et de
décharge des véhicules électriques - Partie 1: Définitions de
base, cas d'utilisation et architectures
(IEC 63110-1:2022)

Protokoll zum Management von Lade- und
Entladeinfrastruktur für Elektrofahrzeuge - Teil 1:
Grundlegende Begriffe, Anwendungsfälle und Architektur
(IEC 63110-1:2022)

This European Standard was approved by CENELEC on 2022-09-02. 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, Türkiye 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 69/837/FDIS, future edition 1 of IEC 63110-1, prepared by IEC/TC 69 "Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 63110-1:2022.

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) 2023-06-02
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-09-02

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.

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 63110-1:2022 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 61850-7-420 NOTE Harmonized as EN IEC 61850-7-420

IEC 61851-1:2017 NOTE Harmonized as EN IEC 61851-1:2019 (not modified)

IEC 61851-23 NOTE Harmonized as EN 61851-23

IEC 61851-25 NOTE Harmonized as EN IEC 61851-25

IEC 61970 (series) NOTE Harmonized as EN IEC 61970 (series)

IEC 62559-2:2015 NOTE Harmonized as EN 62559-2:2015 (not modified)

IEC 63119 (series) NOTE Harmonized as EN IEC 63119 (series)

ISO 15118-1:2019 NOTE Harmonized as EN ISO 15118-1:2019 (not modified)

ISO 15118-20 NOTE Harmonized as EN ISO 15118-20

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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 15118	series	Road vehicles - Vehicle to grid communication interface	EN ISO 15118	series
-	2013	INTERNET ENGINEERING TASK FORCE - (IETF). RFC 6960: X.509 Internet Public Key Infrastructure Online Certificate Status Protocol – OCSP [online]. S. Santesson et al. June 2013 [viewed 2022-01-26].		-

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Protocol for management of electric vehicles charging and discharging
infrastructures –
Part 1: Basic definitions, use cases and architectures**

**Protocole de gestion des infrastructures de charge et de décharge des
véhicules électriques –
Partie 1: Définitions de base, cas d'utilisation et architectures**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 03.100.70; 43.120

ISBN 978-2-8322-3868-4

**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.**

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms, definitions, and abbreviated terms	10
3.1 Terms and definitions.....	10
3.1.14 Constraints	11
3.1.40 Session	15
3.1.41 Transaction	16
3.2 Abbreviated terms.....	17
4 Actors and architecture model	18
4.1 Actors	18
4.2 Architecture model.....	18
4.3 IEC 63110 metamodel.....	19
4.4 Actors and system view	21
4.5 Implementation examples	23
5 Roles, actors, domains descriptions	23
5.1 General.....	23
5.2 Uses cases type descriptions.....	23
5.3 Description of the business roles	24
5.4 Description of the system actors	24
5.5 Domain description	24
5.5.1 General	24
5.5.2 Deliver energy transfer services	25
5.5.3 Deliver e-mobility services.....	26
5.5.4 Manage charging station.....	26
6 Events, loops and sessions	27
6.1 General.....	27
6.2 Sessions and transactions description	28
7 General requirements	29
7.1 Generalities	29
7.2 Communication protocol requirements	29
7.2.1 General	29
7.2.2 Data transfer	29
7.3 Communication architecture requirements	30
7.4 User specific requirements.....	30
7.5 CSMS implementation requirements	30
7.6 Interface requirements between CEM, RM and CSMS.....	30
7.7 Grid specific requirements	31
7.8 DSO requirements	31
7.9 Cybersecurity requirements	31
7.9.1 General	31
7.9.2 Security considerations for information	31
7.9.3 Threat analysis.....	35
7.9.4 Security requirements.....	36
7.9.5 Relation with use cases	37

7.10	Safety requirements	37
8	Use cases	37
8.1	Generalities	37
8.2	Energy domain use cases	38
8.2.1	General	38
8.2.2	Use case list of the energy domain	38
8.2.3	Smart charging management	39
8.2.4	Charging with demand response	43
8.2.5	CSMS – RM exchange of information at the initiative of the CSMS	46
8.2.6	CSMS – RM exchange of information at the initiative of the RM	49
8.2.7	Power variation triggered by DSO	51
8.2.8	Actors' relations during a V2G session	54
8.2.9	Information exchange required to ensure a dynamic energy transfer control	56
8.2.10	Providing frequency regulation service by means of decentralized frequency measurements	58
8.3	Manage CS domain use cases	62
8.3.1	General	62
8.3.2	Use case list of the manage CS domain	62
8.3.3	Discover CS configuration	63
8.3.4	Update a CS component properties	66
8.3.5	Monitor a CS	69
8.3.6	Update the firmware of a CS	71
8.3.7	Reboot a CS	75
8.3.8	The CSMS sets the information to be presented to the user	78
8.3.9	The CSMS sets log criteria	80
8.3.10	Retrieve log information from the CS	82
8.3.11	Fault-code provisioning	85
8.3.12	Information deletion triggered to CSMS by an SA	87
8.3.13	CS deregistration	90
8.3.14	Migration of the CS	93
8.3.15	Onboarding the CS	95
8.3.16	CA certificate provisioning	97
8.3.17	ISO 15118 OCSP response messages	101
8.3.18	Install CS certificate	104
8.3.19	Install the certificate of the local CSMS	107
8.3.20	Install CS certificate with key pairs created outside	110
8.3.21	Certificate revocation	113
8.4	Deliver e-mobility services domain use cases	115
8.4.1	General	115
8.4.2	Use case list for deliver e-mobility service domain	116
8.4.3	Reservation of an EVSE	116
8.4.4	Authorization with locally presented credentials	120
8.4.5	Authorization by external means	122
8.4.6	Inform EVU about tariff during charging session	124
8.4.7	Inform EVU about tariff during operation	126
8.4.8	SDR information production	128
8.4.9	ISO 15118 contract certificate installation/update	129
Annex A (informative)	Implementation examples	134

A.1	General.....	134
A.2	A simple home example or a single EVSE at kerbside.....	134
A.3	A more complex home with one or more CSs	134
A.4	Parking lots or high-power CS example.....	136
A.5	A CS with local production and storage.....	136
Annex B	(informative) Requirements used for selecting the transport technology	138
B.1	Message specific timeouts shall be supported.....	138
B.2	Transport foundation shall be IP based – with IPv4 and IPv6 support.....	138
B.3	It shall be possible to transport encrypted and/or signed message payload sub-elements	138
B.4	The communication between a CSC and a CSMS shall be encrypted (transport layer)	139
B.5	Bidirectional communication shall be possible.....	139
B.6	Long messages shall not block urgent messages.....	139
B.7	Message payload encoding shall be memory and CPU efficient	139
B.8	Message priority shall be under the control of the application layer	139
B.9	Asynchronous message transfer shall be supported.....	140
B.10	Authentication with related session mechanism shall be supported	140
B.11	Multicast messages should be supported	140
B.12	Addressing scheme needs to be supported	140
B.13	Coordinated time at CS level shall be supported	140
B.14	Message encoding shall support non-standard payload elements	141
B.15	Message encoding shall support versioning	141
B.16	Communication shall be delay tolerant.....	141
B.17	The communication technology should have a high reliability in payload delivery.....	141
B.18	The selected communication technology should not have a single point of failure	142
B.19	Technology shall have proven implementations	142
B.20	Technology shall not have intellectual property restrictions	142
B.21	The communication technology shall be stable	142
B.22	Fine grained authorization shall be supported	143
B.23	Communication layer shall be supported by at least two operating systems and embedded platforms for CS and CSMS	143
B.24	Interoperability with conventional information models used in power industry.....	143
B.25	Communication layer shall support IEC 63110's multi-level architecture for CSMS	144
B.26	Efficient support for binary payload.....	145
B.27	Communication layer shall support request/response and publish/subscribe patterns	145
Annex C	(informative) Example of a complex service session	146
C.1	Visual representation	146
C.2	Description	146
Annex D	(informative) Classification of use cases impacts.....	148
Annex E	(informative) Security use case sequence.....	150
Bibliography	151
Figure 1	– Actor's interactions.....	18
Figure 2	– Architecture model of the component layer.....	19

Figure 3 – IEC 63110 metamodel.....	20
Figure 4 – IEC 63110 top-level architecture	21
Figure 5 – Actors	21
Figure 6 – Generic communication architecture – System view	22
Figure 7 – Charging site with two charging site zones controlled by a CSMS	23
Figure 8 – Example of service session	28
Figure 9 – Example of simultaneous service sessions.....	29
Figure 10 – Smart charging sequence diagram	43
Figure A.1 – A simple home with one CS	134
Figure A.2 – Complex home with one CS	135
Figure A.3 – Complex home with two charging stations.....	135
Figure A.4 – Parking lot example	136
Figure A.5 – CS with local production and battery storage	137
Figure C.1 – Example of a complex service session.....	146
Figure E.1 – Security use case sequence	150
Table 1 – Business roles of the e-mobility domain	24
Table 2 – System actors of the e-mobility domain	24
Table 3 – Security considerations by information	32
Table 4 – List of use cases of the energy domain	39
Table 5 – List of use cases of the manage CS domain	62
Table 6 – List of use cases of the e-mobility domain	116
Table D.1 – Use case classification of the energy domain.....	148
Table D.2 – Use case classification for the manage CS domain	149
Table D.3 – Use case classification of the deliver e-mobility services domain	149

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PROTOCOL FOR MANAGEMENT OF ELECTRIC VEHICLES
CHARGING AND DISCHARGING INFRASTRUCTURES –**
Part 1: Basic definitions, use cases and architectures**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 63110-1 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is an International Standard.

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

Draft	Report on voting
69/837/FDIS	69/843/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 63110 series, published under the general title *Protocol for management of electric vehicles charging and discharging infrastructures*, 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 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

In recent years, the necessity of reducing greenhouse gas emissions has led the automotive industry to develop vehicles propelled by electric energy. Among them, the success of vehicles with electric rechargeable batteries has marked the beginning of the deployment of electric charging infrastructures.

During the first years, solutions for management of charging infrastructures were based on industry alliance specifications or proprietary protocols. They greatly contributed to education and involvement of early EV adopters. However, with the coming mass development of e-mobility required by the latest energy policies in most countries, it is necessary to standardize the communication protocol between charging infrastructures and charging stations operators in order to establish an international, safe, secure, interoperable and grid friendly e-mobility eco-system.

This standardized protocol is beneficial to all actors belonging to the e-mobility environment such as EV manufacturers, charging station manufacturers and operators, e-mobility service providers, grid network operators, distribution system operators (DSO) and transmission system operators (TSO), flexibility operators (FO), balance responsible parties and of course the EV users.

Special attention is paid to the security and traceability of the transactions with respect to identification and payment, but also to privacy regulations in force in many countries in order to avoid malicious or criminal use of the charging station.

The general requirements and definitions of this document form the basic framework for all use case descriptions and related documents in IEC 63110 (all parts). This document is the result of a large consensus among all the actors of e-mobility and should be considered as a guideline for implementers of IEC 63110 (all parts).

Technical specifications and requirements of the IEC 63110 protocol will be defined in a future part of IEC 63110.

PROTOCOL FOR MANAGEMENT OF ELECTRIC VEHICLES CHARGING AND DISCHARGING INFRASTRUCTURES –

Part 1: Basic definitions, use cases and architectures

1 Scope

This part of IEC 63110, as a basis for the other parts of IEC 63110, covers the definitions, use cases and architecture for the management of electric vehicle charging and discharging infrastructures.

It addresses the general requirements for the establishment of an e-mobility eco-system, therefore covering the communication flows between different e-mobility actors as well as data flows with the electric power system.

This document covers the following features:

- management of energy transfer (e.g., charging session), reporting, including information exchanges related to the required energy, grid usage, contractual data, and metering data;
- asset management of EVSE, including controlling, monitoring, maintaining, provisioning, firmware update and configuration (profiles) of EVSE;
- authentication/authorization/payment of charging and discharging sessions, including roaming, pricing, and metering information;
- the provision of other e-mobility services;
- cybersecurity.

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.

ISO 15118 (all parts), *Road vehicles – Vehicle to grid communication interface*

INTERNET ENGINEERING TASK FORCE (IETF). RFC 6960: *X.509 Internet Public Key Infrastructure Online Certificate Status Protocol – OCSP* [online]. S. Santesson et al. June 2013 [viewed 2022-01-26]. Available at: <https://www.ietf.org/rfc/rfc6960.txt>