

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



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2022 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

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>