



**International
Standard**

ISO 15118-10

**Road vehicles — Vehicle to grid
communication interface —**

Part 10:

**Physical layer and data link layer
requirements for single-pair
Ethernet**

*Véhicules routiers — Interface de communication entre véhicule
et réseau électrique —*

*Partie 10: Exigences relatives à la couche physique et à la couche
liaison de données pour Ethernet à paire unique*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, SC 31, *Data communication*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 301, *Road vehicles*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 15118 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The looming energy crisis and necessity to reduce greenhouse gas emissions has forced vehicle manufacturers to find ways to scale down how much energy their vehicles consume. The vehicles they are currently developing are propelled either entirely or in part by electric energy. If this energy is generated from renewable sources, this will weaken dependency on oil, improve the global energy efficiency and cut CO₂ emissions. However, a dedicated charging infrastructure is needed to charge the batteries that power these vehicles.

Much of the standardization work on dimensional and electrical specifications of the charging infrastructure and the vehicle interface is already treated in the relevant ISO or IEC groups. However, the question of information transfer between the electric vehicles (EV) and electric vehicle supply equipment (EVSE) has not been treated sufficiently.

This communication is key to optimizing energy resources and energy production systems so vehicles can be charged cheaply and efficiently.

In this document, messages are exchanged between the vehicle and the infrastructure over single-pair Ethernet (which is embedded in the cable assembly).

The relevant information on use-case definitions requirements can be found in ISO 15118-1. Network and application protocol requirements can be found in ISO 15118-20, respectively.

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Road vehicles — Vehicle to grid communication interface —

Part 10:

Physical layer and data link layer requirements for single-pair Ethernet

1 Scope

This document specifies the physical and data link layer of high-level communication (HLC) between electric vehicles (EV) and electric vehicle supply equipment (EVSE) based on single-pair Ethernet communication. Single-pair Ethernet communication uses differential twisted pair wires that are dedicated and balanced. This document applies to 10BASE-T1S only.

This document covers the overall information exchange between all actors involved in electrical energy exchange. The ISO 15118 series applies to charging between EV and EVSE.

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 15118-20:2022, *Road vehicles — Vehicle to grid communication interface — Part 20: 2nd generation network layer and application layer requirements*

IEC 61851-23-3¹⁾, *Electric vehicle conductive charging system — Part 23-3: DC electric vehicle supply equipment for Megawatt charging systems*

IEEE 802.3:2022, *IEEE Standard for Ethernet*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15118-20 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

basic signalling

analogue communication signal loop between the electric vehicle (EV) and the electric vehicle supply equipment (EVSE) to ensure reliable hardware-based information exchange during energy transfer

Note 1 to entry: The basic communication interface is defined in IEC 61851-23-3.

1) Under preparation. Stage at the time of publication: IEC/CCDV 61851-23-3:2025.

3.2

charge enable function

electronic function using an analogue signal loop between the electric vehicle (EV) and the electric vehicle supply equipment (EVSE) to ensure safety during energy transfer and to transmit information about the operational modes of EV and EVSE, in conformity with IEC 61851-23-3

3.3

communication media

physical media carrying the *low-layer communication* (3.7) signal is given by the cable assembly, which connects the charging infrastructure and the electric vehicle

3.4

data link control SAP

service access point which defines the interface between the connection coordination module and the *low-layer communication* (3.7) technology for managing the link status

3.5

data SAP

service access point that defines the interface between layer 2 and layer 3 for exchange of v2g-related payload

3.6

insertion detection function

electronic function using an analogue signal loop between the electric vehicle (EV) and the electric vehicle supply equipment (EVSE) to ensure the detection of an EV coupler inserted in the EV inlet (e.g. to lock the connector in the inlet and allow for the immobilization of the EV), in conformity with IEC 61851-23-3

3.7

low-layer communication

functions managed by the OSI layer 1 and layer 2 of the modem

3.8

low-layer communication module

functional assembly behind each socket outlet or each connector (depending on the type of electric vehicle connection), which includes the communication node and the connection coordination functionality

3.9

physical connection

physical establishment of connection between the electric vehicle (EV) and the electric vehicle supply equipment (EVSE)

Note 1 to entry: This includes mating between the EV and the EVSE and any *basic signalling* (3.1) that acknowledges that a physical connection has been established (e.g. toggling of a switch to indicate connection).

3.10

single-pair Ethernet

Ethernet technology that operates over a single twisted pair cable

4 Abbreviated terms

| | |
|--------|---|
| BIN | bus interface network |
| EMC | electromagnetic compatibility |
| EV | electric vehicle |
| EVCC | electric vehicle communication controller |
| EVSE | electric vehicle supply equipment |
| D-LINK | data link |

| | |
|------|---|
| HLC | high-level communication |
| HLE | high level entity |
| MCS | megawatt charging system |
| OSI | open systems interconnection |
| SAP | service access point |
| SECC | supply equipment communication controller |
| TC | transmission convergence |
| UTP | unshielded twisted pair |
| VAS | value added service |

5 Conventions

5.1 Definition of OSI based services

This document is based on the OSI service conventions as defined in ISO/IEC 10731.

5.2 Requirement structure

Each individual requirement included in this document has a unique code, as follows:

“[V2G10-XXX] requirement text”

where

- “V2G10” represents this document;
- “XXX” represents the individual requirement number;
- “requirement text” includes the actual text of the requirement.

See [Table 1](#) for an example of the requirement structure.

Table 1 — Example

| | |
|-------------|--------------------------------|
| [V2G10-001] | Description of the requirement |
|-------------|--------------------------------|

6 System architecture

6.1 Communication layers

6.1.1 Architecture

This document defines requirements applicable to layers 1 and 2, including V2G standardized service primitive interface, according to the OSI layered architecture. Layers 3 to 7 are specified in ISO 15118-20. For a diagram, see ISO 15118-20:2022, Figure 2.

In addition to HLC to the upper layers, additional communication (basic signalling) allows for reliable hardware control.

NOTE This document only applies to DC power transfer, not AC.

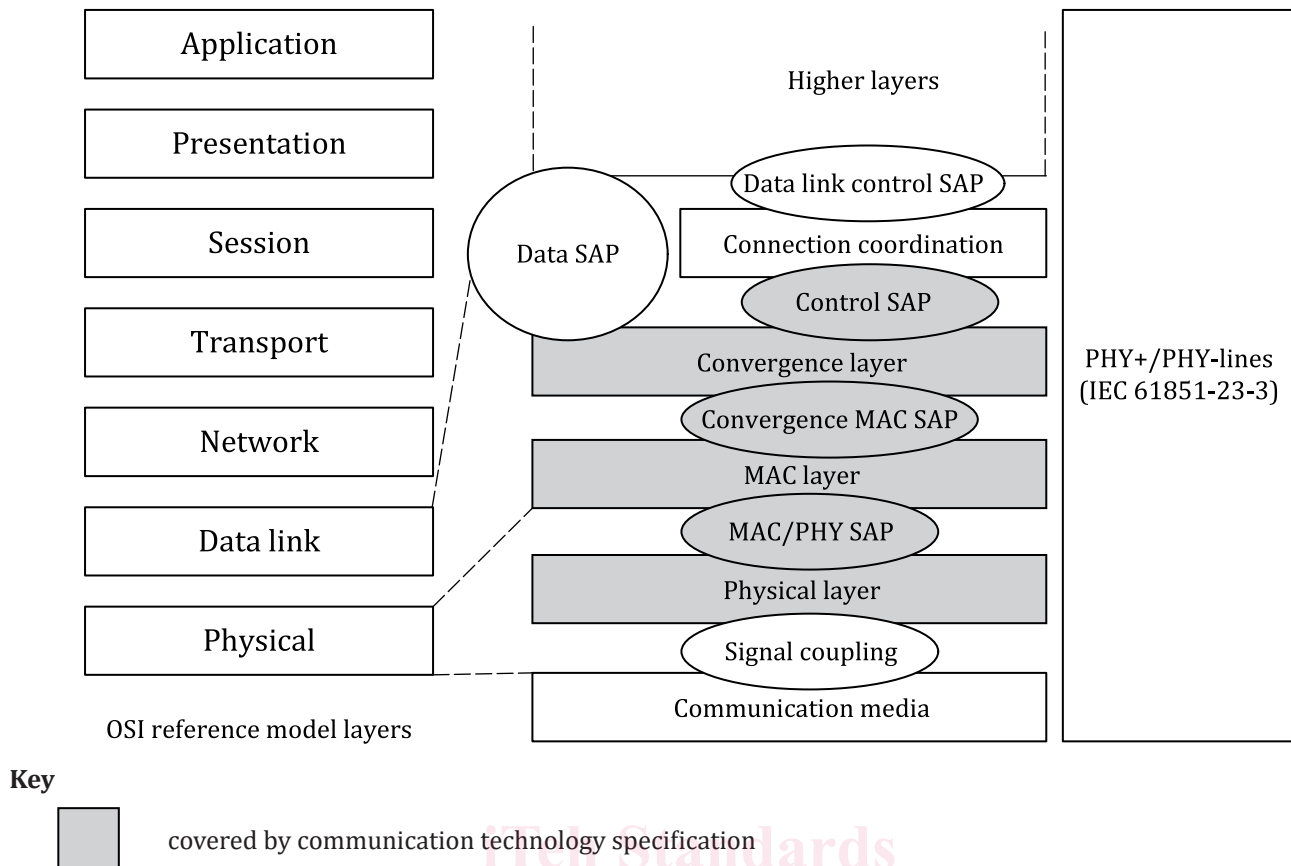


Figure 1 — Relationship to the ISO/IEC OSI reference model

6.1.2 Layer 2 interfaces

This clause describes the terminology primitives used in this document. It explains and defines a unique terminology. This terminology is implementation specific.

As shown in [Figure 1](#), the definition of the data link layer provides two interfaces to higher layers:

- data SAP is the interface between the communication technology (layer 2) and the network layer (layer 3);
- data link control SAP provides link status information, error information and control functionality and is located between layers 2 and 3.

6.1.3 Communication media

Communication media block, as shown in [Figure 1](#), are the PHY+ and PHY- lines (according to IEC TS 63379).

6.1.4 Data SAP

6.1.4.1 General

The network layer/logical link control sublayer data service primitives are defined in ISO/IEC 8802-2.