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## Road vehicles — In-vehicle Ethernet —

### Part 1: General information and definitions

ICS: 43.040.10

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# Contents

	Page
Foreword.....	iv
Introduction.....	v
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references.....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>1</b>
<b>4 Symbols and abbreviated terms.....</b>	<b>3</b>
<b>5 In-vehicle Ethernet.....</b>	<b>4</b>
5.1 Relationship of in-vehicle Ethernet physical entity to OSI reference model.....	4
5.1.1 General.....	4
5.1.2 Interface of in-vehicle Ethernet physical entity to data link layer.....	4
5.1.3 Interface of in-vehicle Ethernet physical entity to neighbour physical entities.....	4
5.1.4 Wake-up and synchronised link sleep.....	5
5.1.5 PCS, PMA and PMD sub-layer.....	5
5.2 In-vehicle Ethernet physical entity options.....	5
5.3 Component, physical entity, device, and network system requirements.....	6
<b>Bibliography.....</b>	<b>8</b>

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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 documents 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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 22, Road vehicles, Subcommittee SC 31, Data communication.

A list of all parts in the ISO 21111 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](http://www.iso.org/members.html).

## Introduction

In general, the Ethernet physical layer requirements are specified in ISO/IEC/IEEE 8802-3:2017. The ISO 21111 series of standards provides supplemental specifications (e.g. wake-up, I/O functionality), which are required for in-vehicle Ethernet applications. In road vehicles, Ethernet networks are used for different purposes requiring different bit-rates. Currently, this standard series specifies the 1-Gbit/s optical and 100-Mbit/s electrical physical layer.

The documents in the ISO 21111 series contain requirement specifications and test methods related to the in-vehicle Ethernet. This includes requirement specifications for physical layer entity (e.g. connectors, PHY implementations) providers, device (e.g. electronic control units, gateway units) suppliers, and system (e.g. network systems) designers. Additionally, there are test methods specified for conformance testing and for interoperability testing.

The structure of specifications given in this series of documents complies with the Open Systems Interconnection (OSI) reference model specified in ISO/IEC 7498-1[1] and ISO/IEC 10731[2].

ISO 21111-9 specifies the data link layer requirements and conformance test plan. The requirements and test plan for devices and systems that include bridge functionality are specified in this part of the ISO 21111 standard series.

ISO 21111-10 specifies the application to network layer requirements and test plan. The requirements and test plan for devices and systems that include functionality related with OSI layers from 3 to 7 are specified in this document.

Figure 1 shows the parts of the ISO 21111 standard series and the document structure.

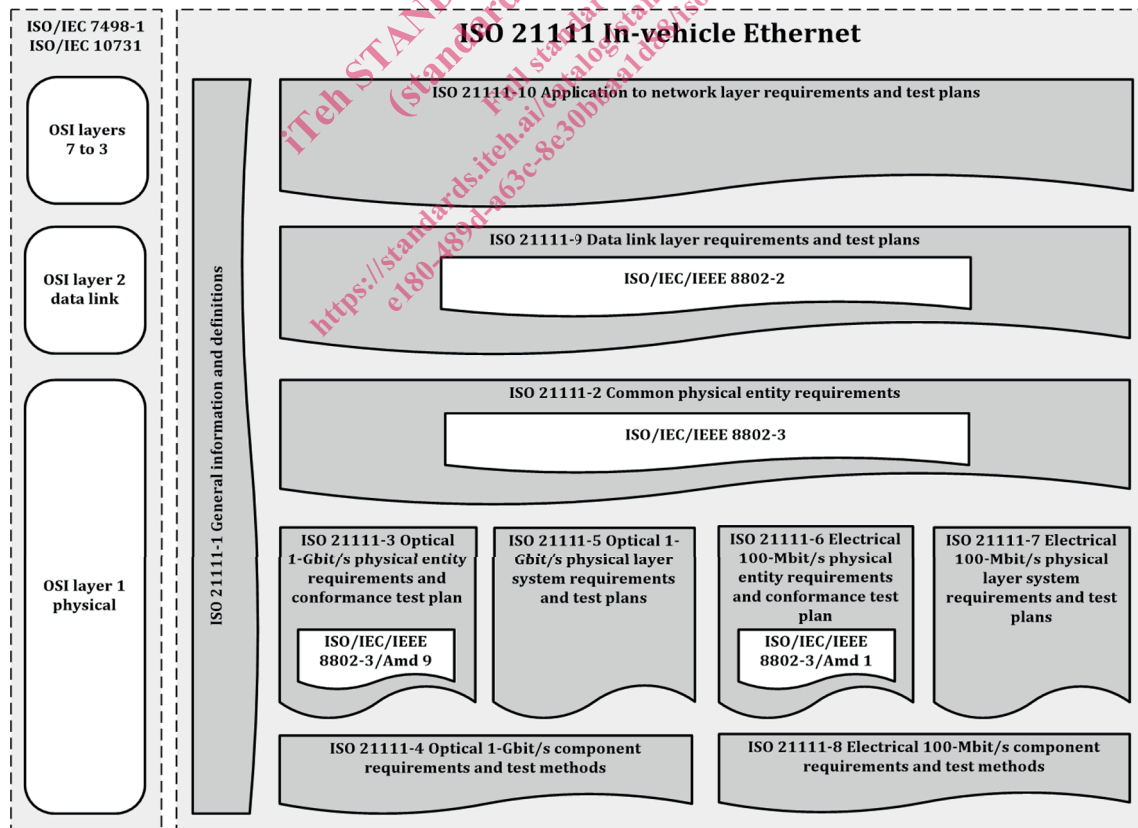


Figure 1 — In-vehicle Ethernet document reference according to OSI model

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# Road vehicles — In-vehicle Ethernet —

## Part 1: General information and definitions

### 1 Scope

This document defines the terms which are used in this series of standards and provides an overview of the standards for in-vehicle Ethernet including the complementary relations to ISO/IEC/IEEE 8802-3:2017 and the amendments, the document structure in accordance with OSI reference model specified in ISO/IEC 7498-1<sup>[1]</sup> and ISO/IEC 10731-1994,<sup>[2]</sup> type of physical entities, in-vehicle Ethernet specific functionalities, and so on.

ISO/TR 23841<sup>1)</sup><sup>[4]</sup> provides the guidelines for the definition of requirements, conformance and interoperability test plan structure and layout.

### 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 26262-1:2011, *Road vehicles – Functional safety – Part 1: Vocabulary*

IEC 60793-2-40:2015, *Optical fibres – Part 2-40: Product specification – Sectional specification for category A4 multimode fibres*

ISO/IEC/IEEE 8802-3, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 3: Standard for Ethernet*

ISO/IEC/IEEE 8802-3, *Amd 1:2017 Physical layer specifications and management parameters for 100 Mb/s operation over a single balanced twisted pair cable (100BASE-T1)*

ISO/IEC/IEEE 8802-3, *Amd 9:2018, Physical layer specifications and management parameters for 1000 Mb/s operation over plastic optical fiber*

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

#### 3.1

##### 100BASE-T1

physical layer for 100-Mbit/s electrical Ethernet over single balanced twisted pair specified in ISO/IEC/IEEE 8802-3:1/Amd 1: 2017

1) Document is currently under drafting.

3.2

**1000BASE-RHC**

physical layer for 1-Gbit/s Ethernet over plastic optical fibre tailored for automotive application requirements specified in ISO/IEC/IEEE 8802-3:2017/Amd 9

3.3

**balanced twisted pair**

twisted pair of 100- $\Omega$  wire, which consist of copper core and dielectric jacket

3.4

**bridge**

layer 2 interconnection device as defined in ISO/IEC/IEEE 8802-3:2017, 1.4

3.5

**device**

"E/E system" as defined in ISO 26262-1

3.6

**electronic control unit**

**ECU**

"E/E system" as defined in ISO 26262-1

3.7

**gigabit Ethernet over plastic optical fibre entity**

**GEPOF entity**

physical layer for 1-Gbit/s Ethernet over plastic optical fibre tailored for automotive application requirements specified in ISO/IEC/IEEE 8802-3:2017/Amd 9 and with this series of documents

3.8

**gigabit media independent interface**

**GMI**

interface between physical entity and data link layer as specified in ISO/IEC/IEEE 8802-3:2017, Clause 35

3.9

**in-vehicle Ethernet**

Ethernet network system optimized for in-vehicle implementation that comply with the specifications in ISO/IEC/IEEE 8802-3:2017 and this series of documents

3.10

**link partners**

two physical entities connected bi-directionally through a physical media

3.11

**local physical entity**

calling physical entity to the remote physical entity as specified in ISO 7498-1:1996

3.12

**media dependent interface**

**MDI**

optical or electrical interface between physical layer entity and physical media as specified in ISO/IEC/IEEE 8802-3:2017

3.13

**media independent interface**

**MII**

interface between physical layer and data link layer as specified in ISO/IEC/IEEE 8802-3:2017, Clause 22

3.14

**neighbour physical entities**

two or more physical entities embedded in the same device



**3.15****OSI reference model**

model to divide the communication function into seven different layers specified in ISO/IEC 7498-1:1997 and ISO/IEC 10731:1994

**3.16****physical coding sublayer****PCS**

sublayer in which transmission data bits are encoded specified in ISO/IEC/IEEE 8802-3:2017

**3.17****physical entity**

in-vehicle Ethernet physical layer that complies with ISO/IEC/IEEE 8802-3 and with this series of documents for certain bit rates and physical media

**3.18****physical media**

media that transfer signal between physical entities as defined in ISO 7498-1

**3.19****physical medium attachment****PMA**

sublayer interfacing with PCS and PMD as specified in ISO/IEC/IEEE 8802-3:2017

**3.20****physical medium dependent****PMD**

sublayer interfacing to the physical media specified in ISO/IEC/IEEE 8802-3

**3.21****plastic optical fibre****POF**

optically transparent wave guide fibre made from polymer material specified in IEC 60793-2-40

**3.22****reduced gigabit media independent interface****RGMII**

modified gigabit media independent interface between physical entity and data link layer to reduce pin counts

**3.23****remote physical entity**

link partner or neighbour of the local physical entity

**3.24****test set-up**

arrangement of test hardware and/or software and the IUT that is used to implement a test method as defined in ISO/IEC 9646-1:1994<sup>[2]</sup>

**3.25****wake-up and synchronized link sleep**

functionality devoted to manage physical entities' power consumption in a network system

**4 Symbols and abbreviated terms**

For the purposes of this document, the following abbreviated terms apply.

IUT implementation under test

OSI open systems interconnections