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Road vehicles — Clock extension peripheral interface (CXPI) —

Part 4: Data link layer and physical layer

Véhicules routiers — Interface du périphérique d'extension d'horloge (CXPI) —

Partie 4: Couches de liaison de données et physique

Reference number
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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).

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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 20794 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.

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Introduction

ISO 20794 (all parts) specifies the application (partly), application layer, transport layer, network layer, data link layer, and physical layer requirements of an in-vehicle network called "clock extension peripheral interface (CXPI)".

CXPI is an automotive low-speed single-wire network. It is an enabler for reducing vehicle weight and fuel consumption by reducing wire counts to simple devices like switches and sensors.

CXPI serves as and is designed for automotive control applications, for example door control group, light switch, and HVAC (Heating Ventilation and Air Conditioning) systems.

The CXPI services, protocols, and their key characteristics are specified in different parts according to the OSI layers.

— Application and application layer

  — application measurement and control data communication to exchange information between applications in different nodes based on message communication;

  — wake-up and sleep functionality;

  — two kinds of communication methods can be selected at system design by each node:

    i) the event-triggered method, which supports application measurement- and control-based (event-driven) slave node communication, and

    ii) the polling method, which supports slave node communication based on a periodic master schedule;

  — performs error detection and reports the result to the application;

  — application error management.

— Transport layer and network layer

  — transforms a message into a single packet;

  — adds protocol control information for diagnostic and node configuration into each packet;

  — adds packet identifier for diagnostic and node configuration into each packet;

  — performs error detection and reports the result to higher OSI layers.

— Data link layer and physical layer

  — provides long and short data frames;

  — adds a frame identifier into the frame;

  — adds frame information into the frame;

  — adds a cyclic redundancy check into the frame;

  — performs byte-wise arbitration and reports the arbitration result to higher OSI layers;

  — performs frame type detection in reception function;

  — performs error detection and reports the result to higher OSI layers.

  — performs Carrier Sense Multiple Access (CSMA);

  — performs Collision Resolution (CR);

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— generates a clock, which is transmitted with each bit to synchronise the connected nodes on the CXPI network;

— supports bit rates up to 20 kbit/s.

To achieve this, it is based on the Open Systems Interconnection (OSI) Basic Reference Model specified in ISO/IEC 7498-1 and ISO/IEC 10731[1], which structures communication systems into seven layers.

Figure 1 illustrates an overview of communication frameworks beyond the scope of this document including related standards:

— vehicle normal communication framework, which is composed of ISO 20794-2, and ISO 20794-5;

— vehicle diagnostic communication framework, which is composed of ISO 14229-1, ISO 14229-2[3], and ISO 14229-8[4];

— presentation layer standards, e.g. vehicle manufacturer specific or ISO 22901-1 ODX[6];

— lower OSI layers framework, which is composed of ISO 20794-3, ISO 20794-4, ISO 20794-6, and ISO 20794-7 conformance testing.

ISO 20794 (all parts) and ISO 14229-8[4] are based on the conventions specified in the OSI Service Conventions (ISO/IEC 10731)[1] as they apply for all layers and the diagnostic services.

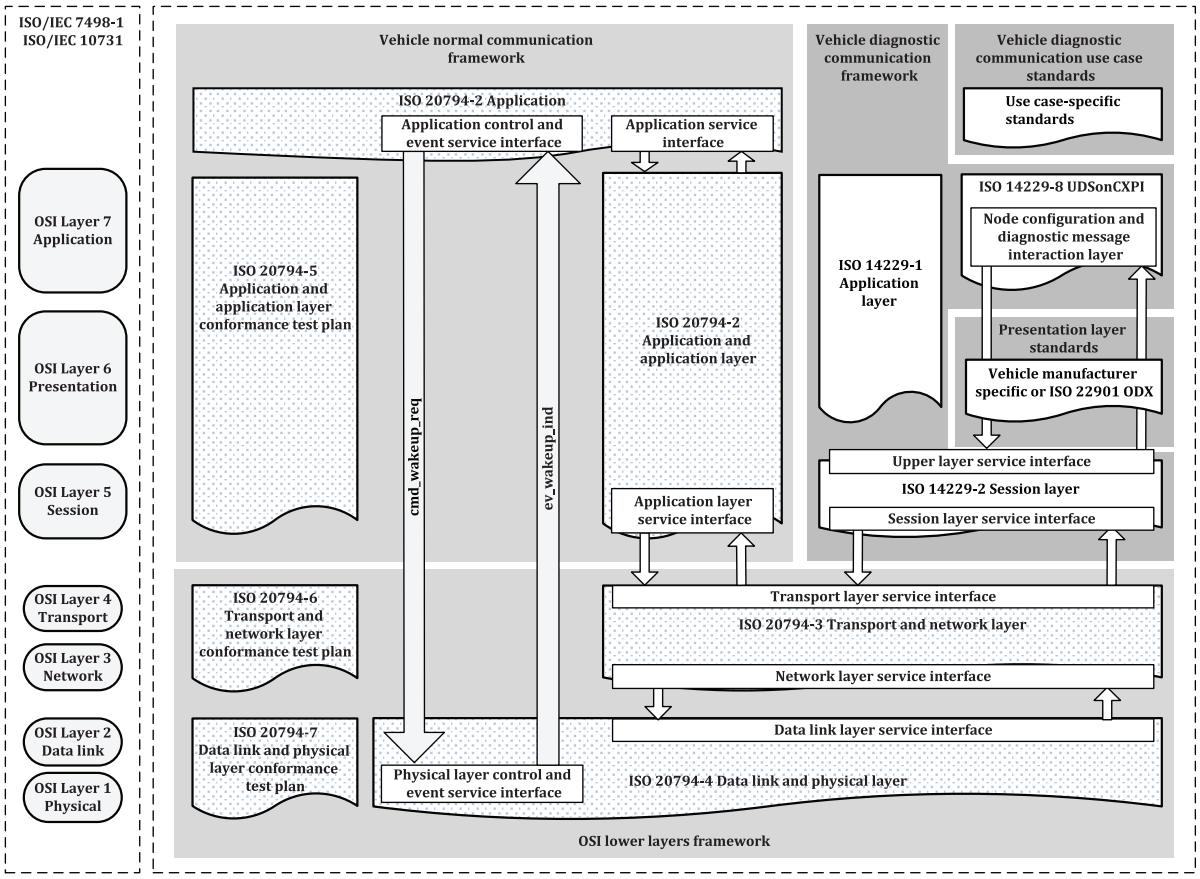


Figure 1 — ISO 20794 documents reference according to OSI model

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Road vehicles — Clock extension peripheral interface (CXPI) —

Part 4: Data link layer and physical layer

1 Scope

This document specifies the CXPI data link layer and the CXPI physical layer.

The DLL is based on:

— priority-based CXPI network access;

— non-destructive content-based arbitration;

— broadcast frame transfer and acceptance filtering; and

— node related error detection and error signalling.

The CXPI physical layer (PHY) requirements comprise of:

— physical signalling (PS) sub-layer, which specifies the requirements of the clock generation function, the encoding and decoding of CXPI frames, and bit-wise collision resolution logic;

— physical media attachment (PMA) sub-layer, which specifies the requirements of the signal shaping waveform logic;

— physical media dependent (PMD) sub-layer, which specifies the requirements of the CXPI network termination, electrostatic discharge protection, etc., and device connector requirements; and

— physical media (PM), which specifies the requirements of the CXPI network cable/wiring harness.

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/IEC 7498-1, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

ISO 20794-2, *Road vehicles — Clock extension peripheral interface (CXPI) — Part 2: Application layer*

ISO 20794-3, *Road vehicles — Clock extension peripheral interface (CXPI) — Part 3: Transport and network layer*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20794-2, ISO 20794-3, and ISO/IEC 7498-1 and the following apply.

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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
bit rate
transmission speed (bit/s) of the protocol within the specification range of transmit frames

3.3
higher OSI layer
OSI layer 3 or more than higher number of layers

3.4
idle state
state of the CXPI network when no frames are exchanged (idle state) and only the clock exists to synchronise the nodes

3.5
inter frame space
IFS
time interval between frames on the CXPI network

4 Symbols and abbreviated terms

4.1 Symbols

C_{BUS}	total bus capacitance
C_{LINE}	capacity of CXPI network
C_{MASTER}	capacity of master node
C_{SLAVE}	capacity of slave node
kbit/s	kilobit per second
LEN_{BUS}	length of CXPI bus wire
R_{BUS}	total bus-resistor including all slave nodes resistors and master node resistor
R_{MASTER}	master node resistor
R_{SLAVE}	slave node resistor
t_{bit}	bit time
t_{bit_ref}	bit time of reference bit rate
$t_{rx_dif_cont}$	difference of the dominant time between logical value '1' and logical value '0'
$t_{rx_wakeup_clk}$	time that the receiving clock master detects the width of dominant level as the wake-up pulse.
t_{rx_wakeup}	time that the receiving node detects each width of dominant level in the wake-up pulse.
$t_{rx_wakeup_space}$	limitation time of acceptance second dominant pulse in the wake-up pulse from first dominant pulse.

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