
**Road vehicles — Clock extension
peripheral interface (CXPI) —**

**Part 3:
Transport and network layer**

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

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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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).

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).

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.

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.

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);

- 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^[7];
- 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.

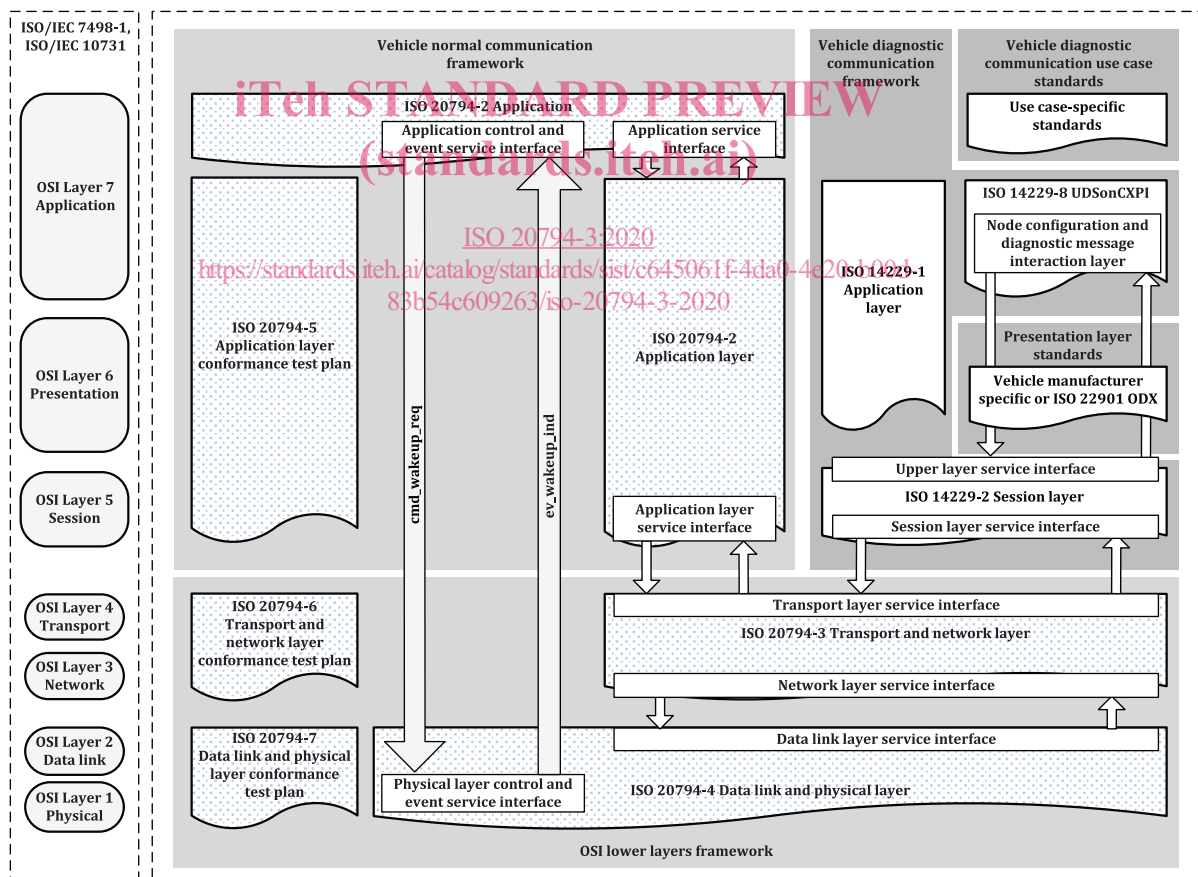


Figure 1 — ISO 20794 documents reference according to OSI model

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Road vehicles — Clock extension peripheral interface (CXPI) —

Part 3: Transport and network layer

1 Scope

This document specifies the OSI transport layer and network layer by means of services and protocols. They can be used by different applications.

The transport 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; and
- performs transport protocol error detection.

The transport layer protocol is not used for normal communication except to map the service interface parameters between lower and upper OSI layers.

The network layer:

- adds a node address for diagnostic and node configuration into each segment; and
- observes timing for diagnostic and node configuration of each segment.

The network layer is not used for normal communication except to map the service interface parameters between lower and upper OSI layers.

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 7498-1 and the following 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
normal communication
NormalCom

measurement and control data

3.2
higher OSI layers

application, presentation, session, transport, and network layers according to ISO/IEC 7498-1:1994

3.3
lower OSI layers

data link and physical layers according to ISO/IEC 7498-1:1994

4 Symbols and abbreviated terms

4.1 Symbols

ms millisecond

| vertical bar indicates choice; either the left-hand side or the right-hand side of the vertical bar appears

4.2 Abbreviated terms

A_ prefix for application layer

AL application layer

DiagNodeCfg diagnostic and node configuration

Mtype message type

N_ prefix for network layer

NAD node address

NormalCom normal communication

NL network layer

OSI open systems interconnection

PDU protocol data unit

Ptype packet type

ReqId request identifier

SA source address

SAP service access point

SF single frame

SIP service interface parameter

T_ prefix for transport layer

T_Data transport data service primitive

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TA	target address
TL	transport layer
w/	with
w/o	without

5 Conventions

This document is based on the conventions discussed in the OSI Service Conventions as specified in ISO/IEC 10731.

6 Overview of transport layer and network layer

6.1 Properties

The transport layer and network layer have the following properties:

- addition (transmission) and elimination (reception) of transport- and network-specific header information to A_PDU;
- creation of T_PDU and N_PDU;
- mapping of service interface parameters between application and transport layer;
- mapping of service interface parameters between transport and network layer;
- determination of packet types to identify normal communication measurement and/or control data, diagnostic and node configuration data; and
- target address type and address handling of packet transmission and reception.

6.2 Packet types

The transport layer only supports single packets (no segmentation of application layer messages).

6.3 Error detection and indication

For detecting errors, the following measures are specified:

- transport layer packet type error;
- transport protocol control information single frame data length error;
- transport protocol control information single frame data length extension error; and
- node related error detection and error signalling.

To confirm an error occurrence during data transmission and reception, higher OSI layers are notified by an error indication.

7 Service interface parameters (SIP)

7.1 SIP — General

The following subclauses specify the service interface parameters and data types, which are used by the transport and network layer services.

7.2 SIP — Data type definitions

This requirement specifies the data type definitions of the CXPI service interface parameters.

REQ	0.1 SIP — Data type definitions
	<p>The data types shall be in accordance to:</p> <ul style="list-style-type: none"> — Enum = 8-bit enumeration — Unsigned Byte = 8-bit unsigned numeric value — Unsigned Word = 16-bit unsigned numeric value — Byte Array = sequence of 8-bit aligned data — 2-bit Bit String = 2-bit binary coded — 8-bit Bit String = 8-bit binary coded — 16-bit Bit String = 16-bit binary coded

7.3 SIP — TA, target address

This requirement specifies the target address parameter values of the CXPI service interface.

REQ	0.2 SIP — TA, target address
	<p>The TA parameter shall be of data type <code>Unsigned Byte</code> and shall be used to identify the target address of the information to be transmitted.</p> <p>Range: [01₁₆ to FF₁₆]</p>

7.4 SIP — SA, source address

This requirement specifies the source address parameter values of the CXPI service interface.

REQ	0.3 SIP — SA, source address
	<p>The SA parameter shall be of data type <code>Unsigned Byte</code> and shall be used to identify the source address of the received information.</p> <p>Range: [01₁₆ to FF₁₆]</p>

7.5 SIP — Ptype, packet type

This requirement specifies the packet type parameter values of the CXPI service interface.

REQ	0.4 SIP — Ptype, packet type
	<p>The Ptype parameter shall be of data type <code>Enum</code> and shall be used to identify the packet type and range of address information included in a service call.</p> <p>Range: [NormalCom, DiagNodeCfg]</p>

7.6 SIP — ReqId, request identifier

This requirement specifies the request identifier parameter values of the CXPI service interface.

REQ	0.5 SIP — ReqId, request identifier
	<p>The ReqId parameter shall be of data type <code>Unsigned Byte</code> and shall contain the request identifier.</p> <p>Range: [01₁₆ to 7F₁₆]</p>