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Road vehicles — Clock extension peripheral interface (CXPI) —

Part 5:
Application layer conformance test plan

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

Partie 5: Plan de test de conformité de la couche application

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Foreword

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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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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

This document set specifies the use cases, the application layer, transport and network layer, data link and physical layer requirements of an in-vehicle network called "clock extension peripheral interface (CXPI)".

CXPI is an automotive focused 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, e.g. door control group, light switch and HVAC (Heating Ventilation and Air Condition) systems.

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

— Application layer

  — application measurement and control data communication to exchange information between applications in different nodes based on a deterministic schedule table-based message communication;

  — 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;

  — error management, that provides error detection and reporting to the application.

— Transport 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 transport protocol error detection.

— Data link 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 data link error detection and reports the result to higher OSI layers.
- Physical layer
  - 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 0 and ISO/IEC 10731, 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 [1], and ISO 14229-8 [2];
- presentation layer standards, e.g., vehicle manufacturer specific or ISO 22901 ODX [3];
- 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 [2] are based on the conventions specified in the OSI Service Conventions (ISO/IEC 10731) as they apply for all layers and the diagnostic services.

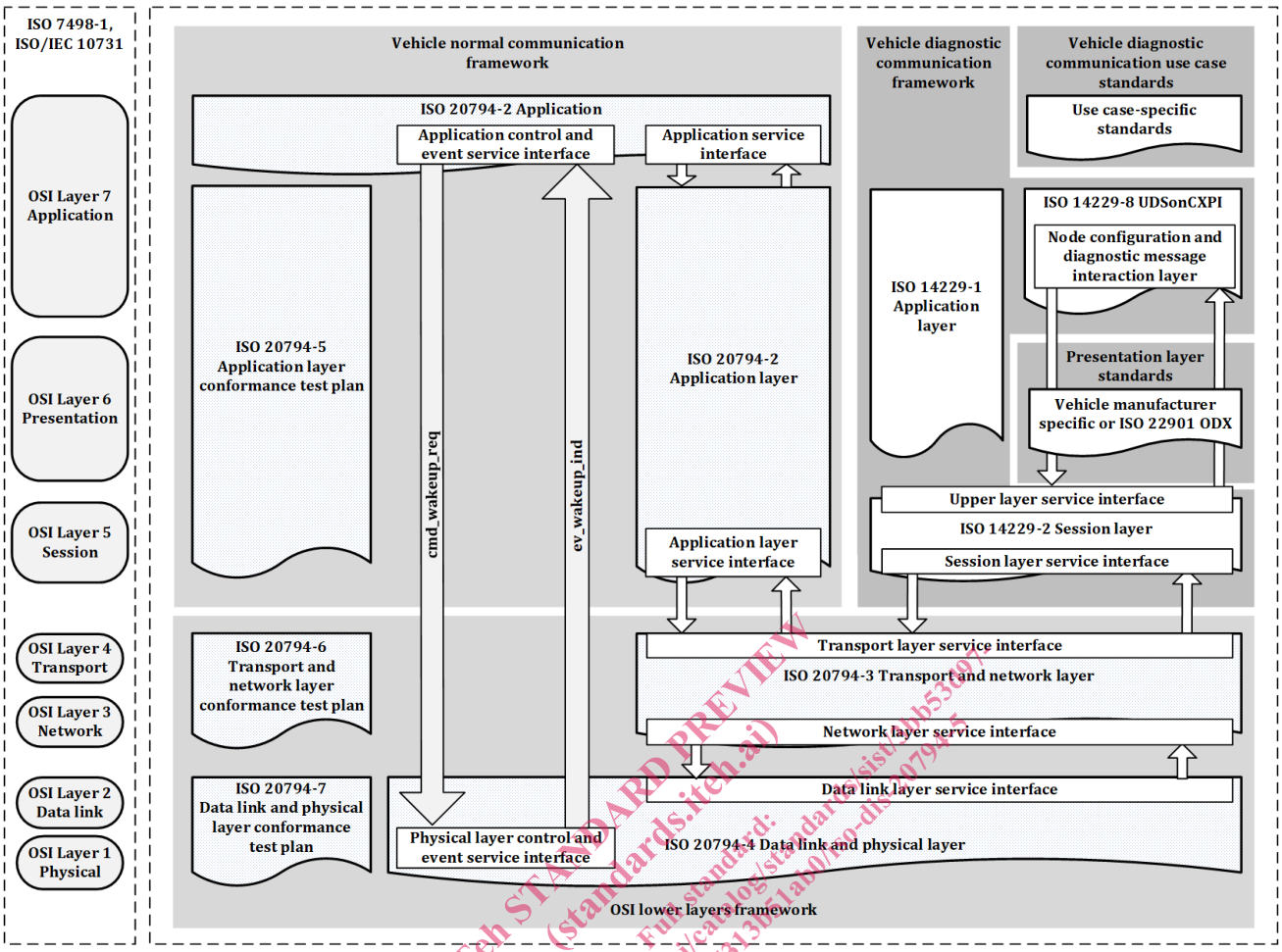

Figure 1 — ISO 20794 documents reference according to OSI model

Road vehicles — Clock extension peripheral interface (CXPI) — Part 5: Application layer conformance test plan

1 Scope

This document shall provide all necessary technical information to ensure that test results will be identical even on different test systems, provided that the particular test suite and the test system are compliant to the content of this document.

The application layer conformance test plan contains the following descriptions:

— concept of operation conformance test plan;

— network management conformance test plan;

— transfer management conformance test plan; and

— error management conformance test plan.

2 Normative references

The following referenced documents are indispensable for the application 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 7498-1:1994 (Ed. 1), *Information processing systems — Open systems interconnection — Basic reference model*

ISO/IEC 10731:1994, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services*

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

ISO 14229-1, *Road vehicles — unified diagnostic services (UDS) — Part 1: Application layer*

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
clock master
node that transmits clock to the lower OSI layers

3.2
lower OSI layers
OSI layers lower than application layer

3.3
master node
node that provides the schedule master management (include ReqTypeId transmission), the primary clock, and optionally the sleep message transmission management

3.4
clock
function that synchronises all nodes on the CXPI network

3.5
initiator
node that transmit messages

3.6
passive
node that receive messages

3.7
primary clock
clock that is provided by the master node

3.8
schedule
origin of periodic frame transmission

3.9
secondary clock
clock that is provided by one dedicated slave node

3.10
sequence
transmission and reception procedure of messages among two or more nodes

211 **3.11**
212 **slave node**
213 node other than master node connected to the CXPI network

214 **3.12**
215 **slave initiator node**
216 node that wakes up from the slave node itself

217 **3.13**
218 **slave passive node**
219 node that is wake-up from another slave node

220 **3.14**
221 **wake-up pulse**
222 stimulus initiated by a node used for wake-up of other nodes on the CXPI network

223

4 Symbols and abbreviated terms

4.1 Symbols

kbit/s	kilobit per second
$T_{clock\_start\_m}$	time that the master node transmits the clock on the CXPI network at the latest
$T_{clock\_stop\_m}$	time that the master node stops to transmit the clock after master node receives the sleep message
T_{sleep_s}	time that each slave node transits to sleep state after the node receives the sleep message
T_{wakeup_m}	minimum time that master node starts the transmission of any Request field (ReqId) or Request field (ReqTypeId) first for the wakeup sequence
$T_{wakeup\_recovery\_s}$	time that slave node starts the transmission of the second wakeup pulse after transmits the first wakeup pulse
T_{wakeup_s}	maximum time until the slave node wakes up by the wakeup sequence
$T_{wakeup\_schedule\_m}$	maximum time until master node starts the transmission of any Request field (ReqId) or Request field (ReqTypeId) first for the wakeup sequence

4.2 Abbreviated terms

AL	application layer
APP	application
CRC	cyclic redundancy check
DID	diagnostic data identifier
DLC	data length code
ECU	electronic control unit
EMI	electro-magnetic interference
IUT	Implementation under test
OSI	open systems interconnection
PDU	protocol data unit
PID	protected identifier
ReqId	request identifier
ReqTypeId	request type identifier
SCT	sequence count

254 SUT system under test

255 # 5 Conventions

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