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Road vehicles — Clock extension peripheral interface (CXPI) —

Part 7:
Data link and physical layer conformance test plan

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

Partie 7: Plan de test de conformité des couches de liaison de données et physique

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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).

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).

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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

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[2], 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.

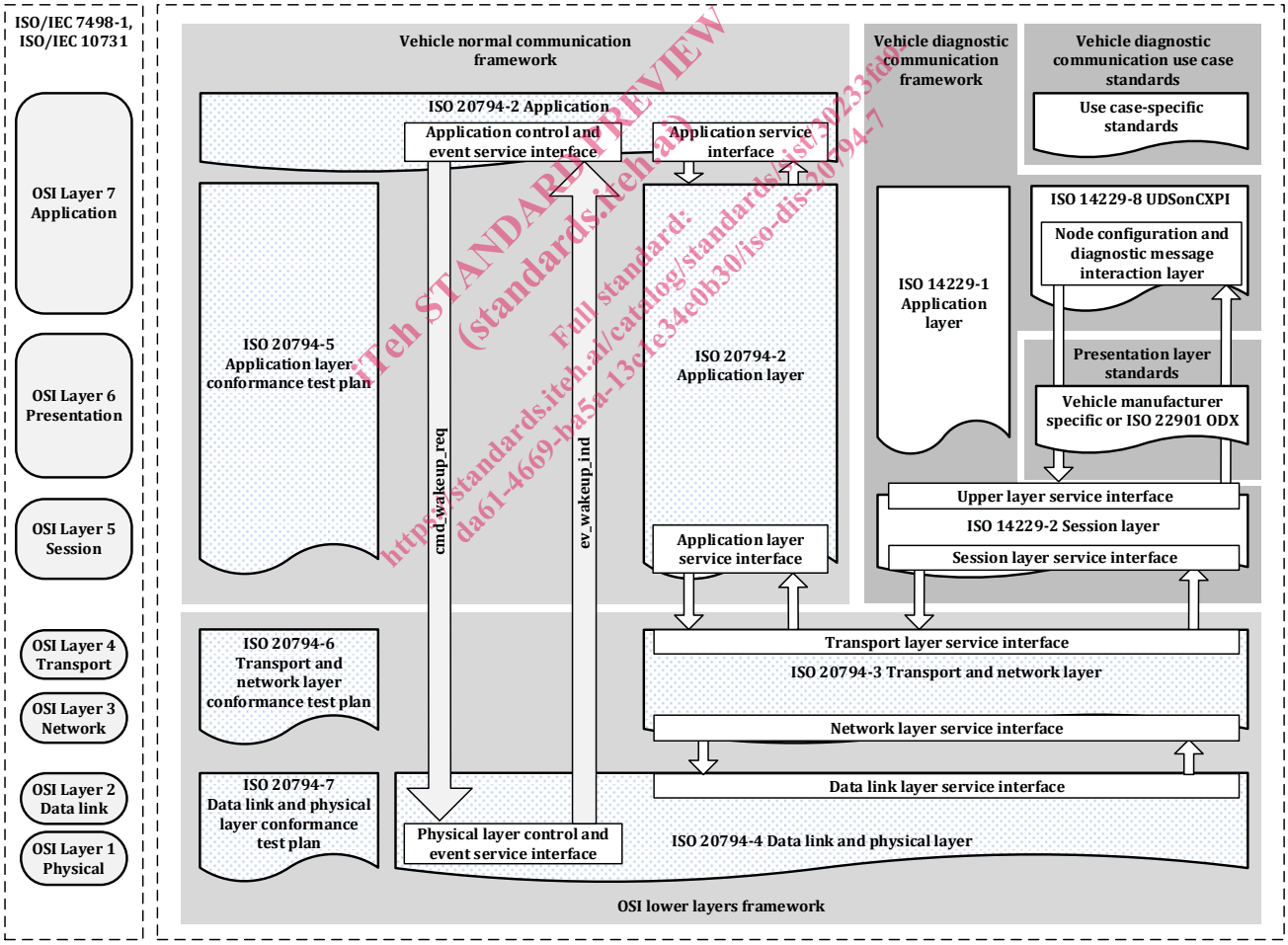

Figure 1 — ISO 20794 documents reference according to OSI model

Road vehicles — Clock extension peripheral interface (CXPI) — Part 7: Data link and physical layer conformance test plan

1 Scope

This document specifies the CXPI data link and physical layers conformance test plan, which tests the data link layer using the service interface parameters reported by the physical layer and submitted to higher OSI layers. The physical layer uses additional test and measurement equipment, which is described in the individual conformance test cases (CTC).

The data link layer and physical layer conformance test plan contains the following descriptions:

— concept of operation conformance test plan;

— data link layer protocol conformance test plan;

— physical layer conformance test plan; and

— error detection conformance test plan.

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.

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/IEC 10731:1994 (Ed. 1), *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 20794-4, ISO/IEC 7498-1 [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

4 Symbols and abbreviated terms

4.1 Symbols

C_{BUS}	total bus capacitance
C_{PG}	capacity of pulse generator/data generator
C_{SLAVE}	capacity of slave node
kbit/s	kilobit per second
R_{MASTER}	master node resistor
R_{SLAVE}	slave node resistor
T_{bit}	bit time
$T_{rx\_dif\_cont}$	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 from first dominant pulse
$T_{rx\_wakeup\_space}$	limitation time of acceptance second dominant pulse in the wake-up pulse from first dominant pulse
T_{tx_wakeup}	time that the transceiver node transmits the dominant voltage of the wake-up pulse
$T_{tx\_wakeup\_space}$	interval time between two of dominant level of transmitting wake-up pulse
$T_{tx\_0\_lo}$	dominant time of logical value 0
$T_{tx\_0\_lo\_dom}$	dominant time of logical value 0 (TH_{tx_dom} = 30 % of V_{SUP})
$T_{tx\_0\_lo\_rec}$	dominant time of logical value 0 (TH_{tx_rec} = 70 % of V_{SUP})
$T_{tx\_0\_pd}$	at the time of logical value 0 outputs, time from the LO level detection of the CXPI network until falling the voltage TH_{tx_dom} = 30 % of V_{SUP}

$T_{tx\_1\_lo}$	dominant time of logical value 1
$T_{tx\_1\_lo\_dom}$	dominant time of logical value 1 (TH_{tx_dom} = 30 % of V_{SUP})
$T_{tx\_1\_lo\_rec}$	dominant time of logical value 1 (TH_{tx_rec} = 70 % of V_{SUP})
TH_{tx_dom}	dominant threshold voltage of the driver node
TH_{tx_rec}	recessive threshold voltage of the driver node
V_{BUS}	voltage of CXPI network
V_{BUS_CNT}	centre recessive threshold voltage of the received node
V_{HYS}	hysteresis voltage between the recessive threshold voltage and the dominant threshold voltage of the received node
V_{th_dom}	measured value of the dominant threshold voltage of the received node
V_{th_rec}	measured value of the recessive threshold voltage of the received node
V_{rec_master}	maximum recessive level of logical value 1

4.2 Abbreviated terms

AC	alternating current
CRC	cyclic redundancy check
DLC	data length code
DLL	data link layer
ECU	electronic control unit
FI	frame information
HI	high
IBS	inter byte space
ID	identifier
IFS	inter frame space
LO	low
N/A	not applicable
NM	network management
OSI	open systems interconnection
PID	protected identifier