INTERNATIONAL STANDARD

ISO 20794-7

First edition
2020-10

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

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233fd9-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

Reference number
ISO 20794-7:2020(E)

© ISO 2020

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233fd9-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

Published in Switzerland

 © ISO 2020 – All rights reserved

Contents

Page

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/sist/a0e35fd9-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

© ISO 2020 – All rights reserved

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233fd9-1c61-4669-bc5e-13e1e34e0b30/iso-20794-7-2020

 © ISO 2020 – All rights reserved

iTeh Standards
(https://standards.iteh.ai)
Document Preview

© ISO 2020 – All rights reserved

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.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

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.

ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233f09-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

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.

 © ISO 2020 – All rights reserved

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 Condition) 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);

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233fd9-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

© ISO 2020 – All rights reserved

— 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[1] and ISO/IEC 10731[2], 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[7];

— vehicle diagnostic communication framework, which is composed of ISO 14229-1[3], ISO 14229-2[4], and ISO 14229-8[5];

— presentation layer standards, e.g. vehicle manufacturer specific or ISO 22901-1 ODX[9];

— lower OSI layers framework, which is composed of ISO 20794-3[6], ISO 20794-4, ISO 20794-5, ISO 20794-6[8] and this document.

ISO 20794 (all parts) and ISO 14229-8[5] are based on the conventions specified in the OSI Service Conventions (ISO/IEC 10731[2]) as they apply for all layers and the diagnostic services.

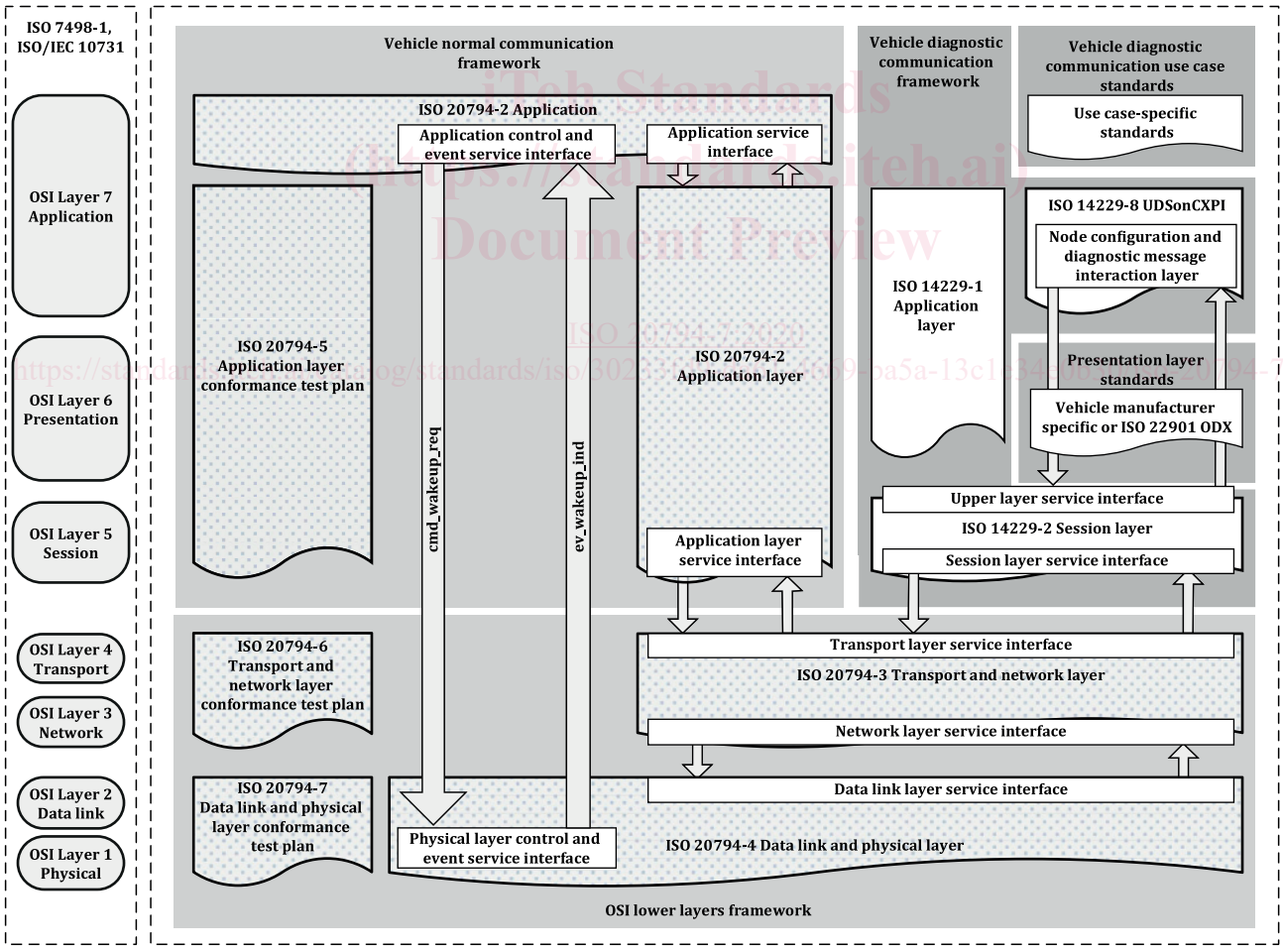


Figure 1 — ISO 20794 documents reference according to OSI model

iTeh Standards (https://standards.iteh.ai) Document Preview
ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/302...-5a5a-13c1...-20794-7-2020

© ISO 2020 – All rights reserved

Road vehicles — Clock extension peripheral interface (CXPI) —

Part 7: Data link and physical layer conformance test plan

1 Scope

This document specifies the conformance test plans for the CXPI data link layer and the CXPI physical layer. It also specifies the conformance test plan for error detection.

Additionally, this document describes the concept of conformance test plan operation.

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 7498-1:1994, *Information processing systems — Open systems interconnection — Basic reference model*

ISO 20794-2:2020, *Road vehicles — Clock extension peripheral interface (CXPI) — Part 2: Application layer*

ISO 20794-4:2020, *Road vehicles — Clock extension peripheral interface (CXPI) — Part 4: Data link layer and physical layer*

iTeh Standards (https://standards.iteh.ai) Document Preview
ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233fd9-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20794-2, ISO 20794-4 and ISO/IEC 7498-1 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/

4 Symbols and abbreviated terms

4.1 Symbols

---	empty cell/undefined
C_{BUS}	total bus capacitance
C_{PG}	capacity of pulse generator/data generator
C_{SLAVE}	capacity of slave node
kbit/s	kilobit per second

© ISO 2020 – All rights reserved

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

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/92233f9e-1c51-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

4.2 Abbreviated terms

AC	alternating current
CRC	cyclic redundancy check
DLC	data length code

© ISO 2020 – All rights reserved

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
PHY	physical layer
PMA	physical media attachment
PMD	physical media dependent
PS	physical signalling
PWM	pulse width modulation
RX_{PWM}	PMA receiver interface signal
SUT	system under test
TH	threshold
TX_{PWM}	PMA transmits interface signal
TYPE	frame type

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233fd9-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

5 Conventions

This document is based on OSI service conventions as specified in ISO/IEC 10731[2] and ISO/IEC 9646-1[1] for conformance test system set-up.

6 General test specification considerations

6.1 General

This document covers the conformance test cases (CTC) to verify the requirements described in ISO 20794-4:2020 data link layer and physical layer document.

© ISO 2020 – All rights reserved

6.2 Test conditions

Tests can be performed at room temperature, if the temperature is in the range of 15° C to 35° C. Also, the tests shall be performed under room EMI (electro-magnetic interference) conditions.

6.3 IUT requirements

The occurrence of the error specified in ISO 20794-2:2020, 9.6.8 shall be notified to the other nodes. IUT shall be initialised in the test case respectively.

6.4 CTC definition

The definition of each test case specifies, whether the IUT is a master or slave node. Each CTC is defined in the structure as defined in Table 1.

Table 1 — CTC definition example

Item	Content
CTC # – Title	[OSI layer #].CTC_[number_name] E.g. 2.CTC_2.6 – L_FI_DLC ≠ 1111_2 and frame data verification 2 if DLC is 1101_2 or 1110_2
Purpose	This CTC verifies that the DLC field for the frame of L_FI_DLC ≠ 1111_2 complies with the CXPI specification.
Reference	ISO 20794-4:2020: — REQ 2.10 DLL – L_FI_DLC (data length code); — REQ 2.30 DLL – Function models – DLL – Transmission logic; — REQ 2.31 DLL – Function models – DLL – Reception logic.
Prerequisite	The test system set-up shall be in accordance with Figure 2.
Set-up	— The IUT shall be configured as a master node or a slave node. — The IUT shall be configured to L_ErrDet1 (see 6.6.4) and in addition support TST_FRM_01_REQ_PID, TST_FRM_11_RESP_12, TST_FRM_05_REQ_PID_ERRBIT, and TST_FRM_18_RESP_ERRBIT_0-12. — The bit rate shall be set to the default value (see 6.6.2). — The SUT shall be initialised to default (see 6.7).
Step	1. The LT shall transmit TST_FRM_01_REQ_PID and TST_FRM_11_RESP_12 changing the DLC value as specified in Table 22. 2. The IUT does not detect any error and reports the result to higher OSI layers. 3. The LT shall transmit TST_FRM_05_REQ_PID_ERRBIT (refer to remark 1). 4. The IUT transmits TST_FRM_05_REQ_PID_ERRBIT (refer to remark 2) and TST_FRM_18_RESP_ERRBIT_0-12. 5. The LT shall observe TST_FRM_18_RESP_ERRBIT_0-12 with the result of detect error bit on the CXPI network.
Iteration	Steps are executed for each test case specified in Table 22; REPEAT step 1 to step 5, 2 times; The LT shall set L_FI_DLC as specified in Table 22; REPEAT END.
Expected response	After step 1: The IUT receives TST_FRM_11_RESP_12 as 12 data bytes regardless of L_FI_DLC value. After step 4: The IUT transmits TST_FRM_18_RESP_ERRBIT_0-12 with the error bit = FALSE.

iTeh Standards (https://standards.iteh.ai) Document Preview ISO 20794-7:2020 https://standards.iteh.ai/catalog/standards/sist/...-iso-20794-7-2020

© ISO 2020 – All rights reserved

Table 1 *(continued)*

Item	Content
	After step 5: The LT shall receive TST_FRM_18_RESP_ERRBIT_0-12 with the error bit = FALSE.
Remark	1. If the IUT transmits the TST_FRM_18_RESP_ERRBIT_0-12 then the LT is expected to transmit this TST_FRM_05_REQ_PID_ERRBIT message. 2. Step 4 can be skipped if step 3 is required.

6.5 Test system set-up

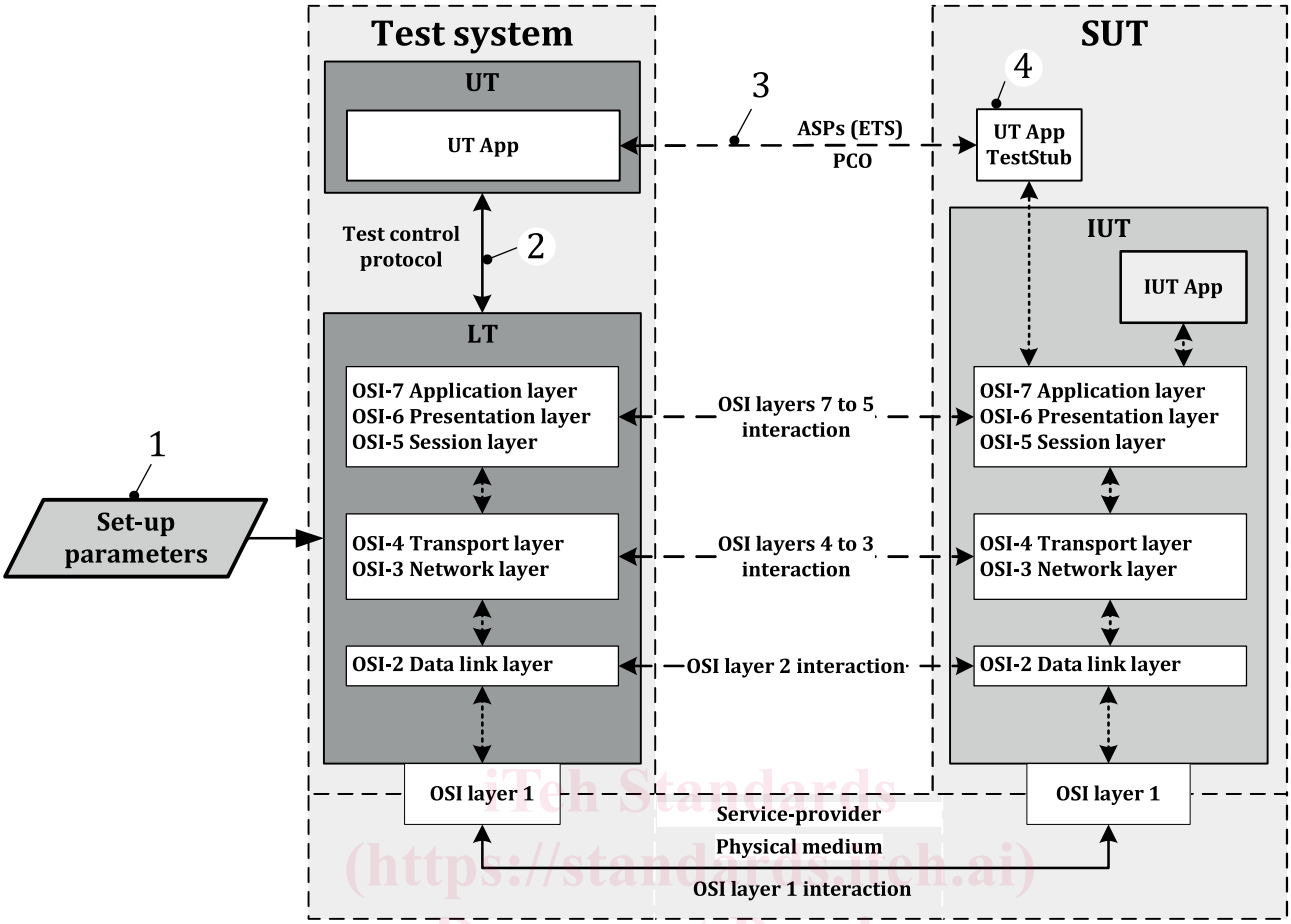
The test system set-up follows the ISO/IEC 9646-1 and consists of a test system and a system under test (SUT) connected via the physical medium. The test system implements an UT and a LT. The UT uses the test control protocol (see Figure 2, key 2) to control the LT. The LT supports the functionality required to test the OSI layers (see Figure 2, key 4) of the IUT. The test system uses the IUT-specific set-up parameters (see Figure 2, key 1) for testing the communication with the IUT.

The control and measurement functionality is provided by direct access to the service interface (see Figure 2, key 3) and the associated parameters of the OSI layers as specified in the ISO 20794 series. The conformance test controller manipulates the service interface parameters of the OSI layers to fulfil the purpose of each conformance test case (CTC). The test system ensures the precision of the bit time and bit synchronisation of the master node as specified in ISO 20794-4:2020, 9.3.7. If the IUT is a master node then the LT functions as a slave node. If the IUT is a slave node then the LT functions as a master node.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO 20794-7:2020
https://standards.iteh.ai/catalog/standards/iso/30233fd9-da61-4669-ba5a-13c1e34e0b30/iso-20794-7-2020

© ISO 2020 – All rights reserved



Key

1 set-up parameters (CXPI node's electronic data sheet)

2 test control protocol

3 abstract service primitives (ASPs) based on enhanced testability services (ETS) and points of control and observation (PCO)

4 upper tester application test stub

Figure 2 — Test system set-up

6.6 Configuration of test system and IUT

6.6.1 General

The test system requires set-up parameters (see Figure 2 key 1), which specify data link layer and physical layer properties of the IUT. The IUT-specific data sheet (see Figure 2, key 1) includes set-up parameters, which the test system requires to perform the CTCs.

Table 2 specifies the configuration of test system and the IUT in the CTCs. In each CTC description, configuration is specified in the 'configuration' column.

iTeh Standards (https://standards.iteh.ai) Document Preview
ISO 20794-7:2020

 © ISO 2020 – All rights reserved