International Standard

ISO 17987-7

Road vehicles — Local Interconnect Network (LIN) —

Part 7: Electrical physical layer (EPL) conformance test specification

Véhicules routiers — Réseau Internet local (LIN) —

Partie 7: Spécification d'essai de conformité de la couche électrique physique (EPL)

Second edition
2025-05

Reference number
ISO 17987-7:2025(en)

© ISO 2025



COPYRIGHT PROTECTED DOCUMENT

© ISO 2025

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

Contents

Page

Foreword ..... **vi**
Introduction ..... **vii**
1 Scope **1**
2 Normative references **1**
3 Terms, definitions, symbols and abbreviated terms **1**
3.1 Terms and definitions 1
3.2 Symbols 2
3.3 Abbreviated terms 4
4 General **5**
4.1 Auto addressing procedures 5
4.2 Conventions 5
5 EPL 12 V LIN class A and class B devices with RX and TX access **6**
5.1 Test specification overview 6
5.1.1 Test case organization 6
5.1.2 Measurement and signal generation requirements 6
5.2 Operational conditions — Calibration 7
5.2.1 Electrical input/output, LIN protocol 7
5.2.2 [EPL–CT 1] Operating voltage range 7
5.2.3 Threshold voltages 9
5.2.4 [EPL–CT 5] Variation of $V_{SUP_NON_OP}$ 14
5.2.5 I_{BUS} under several conditions 15
5.2.6 Slope control 18
5.2.7 Propagation delay 22
5.2.8 Supply voltage offset 23
5.2.9 Failure 28
5.2.10 [EPL–CT 22] Verifying internal capacitance and dynamic interference — IUT as responder 29
5.3 Operation mode termination 31
5.3.1 General 31
5.3.2 [EPL–CT 23] Measuring internal resistor — IUT as responder 32
5.3.3 [EPL–CT 24] Measuring internal resistor — IUT as commander 33
5.4 Static test cases 33
6 EPL 12 V LIN class C devices with RX and TX access **37**
6.1 Test specification overview 37
6.2 Communication scheme 37
6.2.1 General 37
6.2.2 IUT as responder 37
6.2.3 IUT as commander 38
6.2.4 IUT class C device 38
6.3 Test case organization 41
6.4 Measurement and signal generation — Requirements 41
6.4.1 Data generation 41
6.4.2 Various requirements 43
6.5 Operational conditions — Calibration 44
6.5.1 Electrical input/output, LIN protocol 44
6.5.2 [EPL–CT 25] Operating voltage range 44
6.5.3 Threshold voltages 46
6.5.4 [EPL–CT 29] Variation of $V_{SUP_NON_OP}$ ∈ [–0,3 V to 7,0 V], [18 V to 40 V] 50
6.5.5 I_{BUS} under several conditions 51
6.5.6 Slope control 55
6.5.7 Propagation delay 59
6.5.8 Supply voltage offset 65
6.5.9 Failure 74

© ISO 2025 – All rights reserved

6.5.10 [EPL–CT 48] Verifying internal capacitance and dynamic interference — IUT as responder ... 76
6.6 Operation mode termination ... 78
6.6.1 General ... 78
6.6.2 [EPL–CT 49] Measuring internal resistor — IUT as responder ... 79
6.6.3 [EPL–CT 50] Measuring internal resistor — IUT as commander ... 79
6.7 Static test cases ... 79

7 EPL 24 V LIN class A and class B devices with RX and TX access ... 83
7.1 Test specification overview ... 83
7.1.1 Test case organization ... 83
7.1.2 Measurement and signal generation — Requirements ... 84
7.2 Operational conditions — Calibration ... 84
7.2.1 Electrical input/output, LIN protocol ... 84
7.2.2 [EPL–CT 51] Operating voltage range ... 85
7.2.3 Threshold voltages ... 86
7.2.4 [EPL–CT 55] Variation of $V_{SUP_NON_OP}$ ... 91
7.2.5 I_{BUS} under several conditions ... 92
7.2.6 Slope control ... 95
7.2.7 Propagation delay ... 98
7.2.8 Supply voltage offset ... 99
7.2.9 Failure ... 109
7.2.10 [EPL–CT 80] Verifying internal capacitance and dynamic interference — IUT as responder ... 110
7.3 Operation mode termination ... 112
7.3.1 General ... 112
7.3.2 [EPL–CT 81] Measuring internal resistor — IUT as responder ... 113
7.3.3 [EPL–CT 82] Measuring internal resistor — IUT as commander ... 113
7.4 Static test cases ... 114

8 EPL 24 V LIN class C devices without RX and TX access ... 117
8.1 Test specification overview ... 117
8.2 Communication scheme ... 117
8.2.1 Overview ... 117
8.2.2 IUT as responder ... 117
8.2.3 IUT as commander ... 118
8.2.4 IUT class C device ... 118
8.3 Test case organization ... 121
8.4 Measurement and signal generation — Requirements ... 121
8.4.1 Data generation ... 121
8.4.2 Various requirements ... 123
8.5 Operational conditions — Calibration ... 124
8.5.1 Electrical input/output, LIN protocol ... 124
8.5.2 [EPL–CT 83] Operating voltage range ... 124
8.5.3 Threshold voltages ... 126
8.5.4 [EPL–CT 87] Variation of $V_{SUP_NON_OP} \in$ [–0,3 V to 7,0 V], [18 V to 58 V] ... 131
8.5.5 I_{BUS} under several conditions ... 132
8.5.6 Slope control ... 136
8.5.7 Propagation delay ... 140
8.5.8 Supply voltage offset ... 146
8.5.9 Failure ... 155
8.5.10 [EPL–CT 106] Verifying internal capacitance and dynamic interference — IUT as responder ... 157
8.6 Operation mode termination ... 158
8.6.1 General ... 158
8.6.2 [EPL–CT 107] Measuring internal resistor — IUT as responder ... 159
8.6.3 [EPL–CT 2] Measuring internal resistor — IUT as commander ... 159
8.7 Static test cases ... 160

Annex A (normative) **LIN AA procedure C EPL conformance test plan ... 163**

© ISO 2025 – All rights reserved

Annex B (normative) **LIN AA procedure D EPL conformance test plan** **175**
Annex C (normative) **LIN AA procedure E EPL conformance test plan** **188**
Bibliography **195**

© ISO 2025 – 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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*.

This second edition cancels and replaces the first edition (ISO 17987-7:2016), which has been technically revised.

The main changes are as follows:

— master and slave terms used for the LIN node types in ISO 17987:2016 (all parts) are replaced within this standard with inclusive language terms commander and responder. This also applies for abbreviations and file formats NCF and LDF;

— adoptions based on updates in the corresponding requirement document (ISO 17987-4);

— EPL–CT 35 and EPL–CT 93 withdrawn;

— Electrical parameters for ECU low supply operation voltage range considered in test cases;

— editorial updates and several statements improved to avoid ambiguities.

A list of all parts in the ISO 17987 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.

© ISO 2025 – All rights reserved

Introduction

The LIN protocol as proposed is an automotive focused low-speed universal asynchronous receiver transmitter (UART)-based network. Some of the key characteristics of the Local Interconnect Network (LIN) protocol are signal-based communication, schedule table-based frame transfer, commander/responder communication with error detection, node configuration and diagnostic service transportation.

The LIN protocol is for low-cost automotive control applications as, for example, door module and air condition systems. It serves as a communication infrastructure for low-speed control applications in vehicles by providing

— signal-based communication to exchange information between applications in different nodes,

— bitrate support from 1 kbit/s to 20 kbit/s,

— deterministic schedule table-based frame communication,

— network management that wakes up and puts the LIN cluster into sleep mode in a controlled manner,

— status management that provides error handling and error signalling,

— transport layer that allows large amount of data to be transported (such as diagnostic services),

— specification of how to handle diagnostic services,

— electrical physical layer specifications,

— node description language describing properties of responder nodes,

— network description file describing behaviour of communication, and

— application programming interface.

The ISO 17987 series is based on the open systems interconnection (OSI) basic reference model as specified in ISO/IEC 7498–1 which structures communication systems into seven layers.

The OSI model structures data communication into seven layers called (top down) application layer (layer 7), presentation layer, session layer, transport layer, network layer, data link layer and physical layer (layer 1). A subset of these layers is used in the ISO 17987 series.

The ISO 17987 series distinguishes between the services provided by a layer to the layer above it and the protocol used by the layer to send a message between the peer entities of that layer. The reason for this distinction is to make the services, especially the application layer services and the transport layer services, reusable also for other types of networks than LIN. In this way, the protocol is hidden from the service user and it is possible to change the protocol if special system requirements demand it.

The ISO 17987 series provides all documents and references required to support the implementation of the requirements related to the following:

— ISO 17987–1: provides an overview of the ISO 17987 series and structure along with the use case definitions and a common set of resources (definitions, references) for use by all subsequent parts.

— ISO 17987–2: specifies the requirements related to the transport protocol and the network layer requirements to transport the PDU of a message between LIN nodes.

— ISO 17987–3: specifies the requirements for implementations of the LIN protocol on the logical level of abstraction. Hardware related properties are hidden in the defined constraints.

— ISO 17987–4: specifies the requirements for implementations of active hardware components which are necessary to interconnect the protocol implementation.

© ISO 2025 – All rights reserved

— ISO/TR 17987–5: specifies the LIN application programming interface (API) and the node configuration and identification services. The node configuration and identification services are specified in the API and define how a responder node is configured and how a responder node uses the identification service.

— ISO 17987–6: specifies tests to check the conformance of the LIN protocol implementation according to ISO 17987–2 and ISO 17987–3. This comprises tests for the data link layer, the network layer and the transport layer.

— ISO 17987–7 (this document): specifies tests to check the conformance of the LIN electrical physical layer implementation (logical level of abstraction) according to ISO 17987–4.

© ISO 2025 – All rights reserved

Road vehicles — Local Interconnect Network (LIN) —

Part 7:
Electrical physical layer (EPL) conformance test specification

1 Scope

This document specifies the conformance test for the electrical physical layer (EPL) of the LIN communications system.

The purpose of this document is to provide a standardised way to verify whether a LIN bus driver conforms to ISO 17987-4. The primary motivation is to ensure a level of interoperability of LIN bus drivers from different sources in a system environment.

This document provides all the necessary technical information to ensure that test results are consistent even on different test systems, provided that the particular test suite and the test system are conformant to the content of this document.

2 Normative references

The following documents are referred to in 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 17987-4:2025, *Road vehicles — Local Interconnect Network (LIN) — Part 4: Electrical physical layer (EPL) specification 12 V/24 V*

ISO 17987-6, *Road vehicles — Local Interconnect Network (LIN) — Part 6: Protocol conformance test specification*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17987-4 and ISO 17987-6 apply.

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

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

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

© ISO 2025 – All rights reserved

3.2 Symbols

µs	microsecond
$C_{1/2}$	capacitance
C_{COMMON}	capacitance in the communication line
$C`_{LINE}$	line capacitance
C_{BUS}	total bus capacitance
$C_{COMMANDER}$	capacitance of commander node
C_{REF}	reference capacitance
C_{RXD}	RXD capacitance (LIN receiver, RXD capacitive load condition)
$C_{RESPONDER}$	capacitance of responder node
∈	mathematical symbol: replacement for “is an element of”
d^2V/dt^2	second derivative of Voltage (Volt^2 per second^2)
di/dt	instantaneous rate of current change (amps per second)
$D_{1/2/3/4}$	diode
D_{REF}	reference diode according to ISO 17987-4:2025, parameter 21
D_{ser_int}	serial internal diode at transceiver IC
$D_{ser_commander}$	serial commander diode
f	frequency
F_{IUT}	IUT bit rate
F_{TOL}	frequency tolerance to force the maximum propagation delays
F_{TS}	test system bit rate
I_{BUS}	current into the ECU bus line
I_{BUS_LIM}	current limitation for driver dominant state driver on $V_{BUS} = V_{BAT_max}$ into ECU bus line
$I_{BUS_NO_BAT}$	current at ECU bus line when V_{BAT} is disconnected
$I_{BUS_NO_GND}$	current at ECU bus line when V_{GND_ECU} is disconnected
$I_{BUS_PAS_dom}$	current at ECU bus line when driver off (passive) at dominant LIN-bus-level (12 V LIN devices: V_{BUS} = 0 V and V_{BAT} = 12 V; 24 V LIN devices: V_{BUS} = 0 V and V_{BAT} = 24 V)
$I_{BUS_PAS_rec}$	current at ECU bus line when driver off (passive) at recessive LIN-bus-level (12 V LIN devices: 8 V < V_{BAT} < 18 V; 8 V < V_{BUS} < 18 V; $V_{BUS} \geq V_{BAT}$; 24 V LIN devices: 16 V < V_{BAT} < 36 V; 16 V < V_{BUS} < 36 V; $V_{BUS} \geq V_{BAT}$)
I_{Lincs}	Current of current source, $I_{Lincs} = -I_{PU,AA,SEL}$ in ISO 17987-4:2025, Table C.1
GND_{Device}	GND of ECU
kΩ	kilo ohm

© ISO 2025 – All rights reserved