INTERNATIONAL STANDARD

ISO 17987-8

First edition
2019-10

Road vehicles — Local Interconnect Network (LIN) —

Part 8: Electrical physical layer (EPL) specification: LIN over DC powerline (DC-LIN)

Véhicules routiers — Réseau Internet local (LIN) —

Partie 8: Spécification de couche physique électrique (EPL): LIN sur ligne d'alimentation en courant continu (DC-LIN)

Reference number
ISO 17987-8:2019(E)

© ISO 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

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
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

 © ISO 2019 – All rights reserved

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms, definitions, symbols, and abbreviated terms ... **1**
3.1 Terms and definitions ... 2
3.2 Symbols and abbreviated terms ... 2
4 Electrical physical layer requirements ... **5**
4.1 General ... 5
4.2 Transmitter characteristics ... 6
4.2.1 Transmit signal specification ... 6
4.2.2 Byte field modulation scheme ... 7
4.2.3 Break field modulation scheme ... 14
4.2.4 Wake-up signal modulation scheme ... 15
4.3 Timing requirements ... 18
4.3.1 Bit rate tolerance ... 18
4.3.2 Bit timing ... 19
4.3.3 Bit sample timing ... 19
4.3.4 TXD assert timeout event ... 19
4.3.5 Delay between transmitted byte field (DC-LIN node A) and received byte field (DC-LIN node A) ... 19
4.3.6 Delay between transmitted byte field (DC-LIN node A) and received byte field (DC-LIN node B) ... 19
4.4 Receiver characteristics ... 21
4.5 Electrical parameters ... 21
4.5.1 General configuration — Coupling to the DC powerline ... 21
4.5.2 Signal specification ... 22
4.5.3 Line-out monitoring ... 23
4.5.4 ESD compliance ... 28
4.6 Communication in the presence of faults ... 28
Annex A (informative) **DC-LIN EPL peripheral interface design considerations** ... **30**
Annex B (normative) **DC-LIN EPL conformance test plan** ... **31**
Bibliography ... **56**

© ISO 2019 – 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.

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 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 2019 – All rights reserved

Introduction

ISO 17987 (all parts) specifies the use cases, communication protocol and physical layer requirements of an in-vehicle communication network called Local Interconnect Network (LIN).

The LIN protocol as proposed is an automotive-focused low speed UART-based network (Universal Asynchronous Receiver Transmitter). Some of the key characteristics of the LIN protocol are signal-based communication, schedule table-based frame transfer, master/slave communication with error detection, node configuration and diagnostic service transportation.

The LIN protocol is for low cost automotive control applications, for example door module and air conditioning 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;

— bit rate 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 slave nodes;

— network description file describing behaviour of communication;

— application programmer's interface.

ISO 17987 (all parts) 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 ISO 17987 (all parts).

ISO 17987 (all parts) 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.

ISO 17987 (all parts) provides all documents and references required to support the implementation of the requirements related to the following.

— ISO 17987-1: This part provides an overview of the ISO 17987 (all parts) 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: This part 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: This part 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 2019 – All rights reserved

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

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

— ISO 17987-6: This part 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 part specifies tests to check the conformance of the LIN electrical physical layer implementation (logical level of abstraction) according to ISO 17987-4.

— ISO 17987-8: This part specifies the requirements for implementations of the DC powerline electrical physical layer (EPL) for the LIN communications system as well as a conformance test plan for the EPL.

© ISO 2019 – All rights reserved

Road vehicles — Local Interconnect Network (LIN) —

Part 8:
Electrical physical layer (EPL) specification: LIN over DC powerline (DC-LIN)

1 Scope

This document specifies an additional electrical physical layer (EPL) for the Local Interconnect Network (LIN) of the ISO 17987 series. It specifies the transmission over DC powerline without affecting the LIN higher layers, hereafter named DC-LIN.

The DC-LIN EPL uses a high-frequency modulated carrier to propagate UART bytes (byte-oriented) over the DC powerline.

This document specifies the electrical characteristics, the modulation method of the transmission, and how to impose the carrier signal on the DC powerlines.

The DC-LIN EPL supports bit rates of 9 615 bit/s, 10 417 bit/s, and 19 230 bit/s.

The DC-LIN EPL is applicable for a wide range of DC powerlines including 12-V and 24-V operations, allowing communicating between different DC powerlines via a coupling capacitor. A DC-LIN EPL interface to powerline example is described in Annex A.

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 17987-4:2016, *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*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test*

3 Terms, definitions, symbols, and abbreviated terms

For the purposes of this document, the following terms and definitions 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/

© ISO 2019 – All rights reserved