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Road vehicles — Local Interconnect Network (LIN) —

Part 1: General information and use case definition

Véhicules routiers — Réseau Internet local (LIN) —

Partie 1: Information générale et définition des cas d'usage

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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.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 17987-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Electrical and electronic equipment*.

ISO 17987 consists of the following parts, under the general title *Road vehicles — Local Interconnect Network (LIN)*:

— *Part 1: General information and use case definition*

— *Part 2: Transport protocol and network layer services*

— *Part 3: Protocol specification*

— *Part 4: Electrical Physical Layer (EPL) specification 12 V / 24 V*

— *Part 5: Application Programmers Interface (API)*

— *Part 6: Protocol conformance test specification*

— *Part 7: Electrical Physical Layer (EPL) conformance test specification*

Introduction

This document set specifies the use cases, the 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 Universal Asynchronous Receiver Transmitter (UART) based network. 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 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 state 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 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.

ISO 17987 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.

This document set provides all documents and references required to support the implementation of the requirements related to.

— Part 1: General information and use case definitions
This part provides an overview of the document set and structure along with the use case definitions and a common set of resources (definitions, references) for use by all subsequent parts.

— Part 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.

— Part 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.

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

— Part 5 (published as a non-normative technical report):
This part specifies the LIN API (Application Programmers Interface) 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.

— Part 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.

— Part 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.

Road vehicles — Local Interconnect Network (LIN) — Part 1: General information and use case definition

1 Scope

This part of ISO 17987 gives an overview of the structure and the partitioning of ISO 17987. In addition, it outlines the use case where the ISO 17987 document set will be used. The terminology defined in this part of ISO 17987 is common for all LIN communication systems and is used throughout all parts of ISO 17987.

This part of ISO 17987 has been established in order to define the use cases for LIN.

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 17987 (Part 2, 3, 4, 6 and 7), *Road vehicles – Local Interconnect Network (LIN)*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
break field
entety that consists of a dominant part, the break and a recessive part, the break delimiter

3.1.2
byte field
10 bit entity, which consists of a dominant start bit, 8 bit payload (least significant bit first) and a recessive stop bit.

3.1.3
checksum
frame verification byte

3.1.4
frame
entity that consists of the header and the PDU including payload and a checksum byte at the end

3.1.5
LIN master
unique node in a LIN network that schedules the frames and connected to a back bone network

3.1.6
LIN slave
node that serves the communication requests of a LIN master

3.1.1
master task
task in the LIN master sending all headers on the bus according to schedule table definition

3.1.7
NAD
diagnostic address assigned to each LIN slave node

3.1.8
protected identifier
an 8-bit entity containing the 6 bit frame identifier (least significant bits) together with two parity bits

3.1.2
schedule table
list of frames specifies the frames, their order and time distances to each other used for communication on the LIN bus

3.1.3
slave task
task in a LIN node responsible for listening to all headers on the bus and react accordingly, i.e. either publish a frame response or subscribe to it (or ignore it).

3.1.4
sync byte field
byte with fixed value located between the break field and the protected identifier.

3.2 Abbreviated terms

API	application programmers interface
LDF	LIN description file
NAD	node address for diagnostics
OEM	original equipment manufacturer
OSI	open systems interconnection
PDU	protocol data unit
PID	protected identifier
SAP	service access point
UC	use case
UDS	unified diagnostic services

4 Conventions

ISO 17987 is based on the conventions specified in the OSI Service Conventions (ISO/IEC 10731) [2] as they apply for physical layer, data link layer, network and transport protocol and diagnostic services.

5 Use case overview and principles

5.1 Basic principles for use case definition

Basic principles have been established as a guideline to define the use cases:

— Pointing out features which support usual operating modes of networked systems in OEM's products;

— Pointing out features which support future expected properties of networked systems in OEM's products;

— Comparing the contrast between normal operating functionalities in the absence of errors and limp-home operation functionalities in the presence of errors;

5.2 Use case clusters

This chapter defines use case clusters of the LIN communications system.

Table 1 provides an overview of the main LIN use case clusters. A main LIN use case cluster may have one or more use case definitions.

Table 1 — LIN communications system main use case clusters

Main title of use case cluster	Description
LIN master task	The purpose of these use cases is the description of LIN specific frame handling in the LIN master node based on schedule tables comprising frame order and timing.
LIN slave task	The purpose of these use cases is the description of main tasks slave nodes. Beside the frame processing other tasks are reporting of errors to the LIN network, the reconfiguration of slave nodes and diagnostic capabilities.
LIN communication protocol	The purpose of these use cases is the description of the protocol driven property range of systems and applications when using LIN for their internal communication.
LIN physical layer	The purpose of these use cases is the description of the electrical physical layer properties when interconnecting the logical links of the distributed LIN ECUs by electrical hardware components inside a vehicle.
LIN network management	The purpose of these use cases is the description of the LIN network management.