



SURFACE VEHICLE RECOMMENDED PRACTICE

J2602™-3

OCT2021

Issued 2010-01
Revised 2021-10

Superseding J2602-3 JAN2010

(R) File Structures for a Node Capability File (NCF) and LIN Description File (LDF)

RATIONALE

The scope of this document covers the outcome of an analysis, performed by the SAE J2602-3 Task Force, of the application program interface, node configuration file, and LIN description file portions of the ISO 17987 specifications. The purpose of the analysis was to identify and resolve requirements in these specific specifications that are ambiguous, conflicting, or optional, and to document a method for accommodating SAE J2602 node and network specific data elements in the ISO 17987 NCF/LDF file structure(s). Development and adoption of this recommended practice will allow the design and development tools to consistently identify, extract, interpret, and utilize the required information relative to specific network operational characteristics. This document was updated to match SAE J2602-1 (2021 revision).

FOREWORD

SAE J2602-3 provides additional requirements that are not present in ISO 17987 specifications (e.g., NCF syntax, LDF syntax, data definitions, etc.). This document is to be utilized by Tier 1 suppliers of components, software developers, tool developers, vehicle or OEM system engineers, and vehicle or OEM communications engineers.

NOTE: Understanding of this document requires a working knowledge of the ISO 17987 specification package.

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1. SCOPE

This document covers the requirements for SAE implementations based on ISO 17987. Requirements stated in this document will provide a minimum standard level of performance to which all compatible systems, design and development tools, software, ECUs, and media shall be designed. This will assure consistent and unambiguous serial data communication among all connected devices regardless of supplier.

This document may be referenced by any vehicle OEM component technical specification that describes any given ECU in which the single wire data link controller and physical layer interface is located.

The intended audience includes, but is not limited to, ECU suppliers, LIN controller suppliers, LIN transceiver suppliers, component release engineers, and vehicle system engineers.

The term “master” has been replaced by “commander” and term “slave” with “responder” in the following sections.

1.1 Mission/Theme

The goal of SAE J2602 is to improve the interoperability and interchangeability of LIN devices within a network by resolving those ISO 17987 requirements that are ambiguous, conflicting, or optional. Moreover, SAE J2602 provides additional requirements that are not present in ISO 17987 (e.g., fault tolerant operation, network topology, etc.).

1.2 Overview

LIN is a single wire, low cost, Class A communication protocol. LIN is a commander-responder protocol and utilizes the basic functionality of most universal asynchronous receiver transmitter (UART) or serial communication interface (SCI) devices as the protocol controllers in both commander and responder nodes. To meet the target of “lower cost than either an OEM proprietary communications link or CAN link” for low speed data transfer requirements, a single wire transmission media based on the ISO 9141 specification was chosen. The protocol is implemented around a UART/SCI capability set, because the silicon footprint is small (lower cost), many small microprocessors are equipped with either a UART or SCI interface (lower cost), and the software interface to these devices is relatively simple to implement (lower software cost). Finally, the relatively simplistic nature of the protocol controller (UART/SCI) and the nature of state-based operation, enable the creation of application specific integrated circuits (ASICs) to perform as input sensor gathering and actuator output controlling devices, in the vein of mechatronics.

All message traffic on the bus is initiated by the commander-node. Responder-nodes receive commands and respond to requests from the commander-node. Since the commander-node initiates all bus traffic, it follows that the responder-nodes cannot communicate unless requested by the commander-node. However, responder-nodes can generate a bus wakeup, if their inherent functionality requires this feature.

The LIN Consortium developed the set of LIN specifications. The Consortium was a group of automotive OEMs, semiconductor manufacturers, and communication software and tool developers. The LIN specification set is no longer available through the LIN Consortium. Instead, it has been converted to a series of ISO 17987 specifications.

The LIN specifications contain more than just a definition of the LIN protocol and physical layer. In addition, a work flow process, diagnostics and configuration methods, definition of an application program interface (API), file structures for a node capability file (NCF) and a LIN description file (ldf), and semantics are identified as required (mandatory in all implementations). However, since there is a great deal of flexibility in the protocol and physical layer, applicability of these specifications to SAE J2602 networks will be further specified in this document.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1213-1 Glossary of Vehicle Networks for Multiplexing and Data Communications

SAE J1930 Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms - Equivalent to ISO/TR 15031-2

SAE J2602-1 LIN Network for Vehicle Applications

2.1.2 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 7498 Open systems interconnection (OSI)

ISO 17987:2016 Road Vehicles - Local Interconnect Network (LIN) Protocol Specification Suite

3. DEFINITIONS

3.1 COMMAND FRAME

A frame with data published by the responder-node task in the commander-node and subscribed to by one or more responder-node tasks in responder-nodes.

3.2 DATA LINK LAYER

This provides for the reliable transfer of information across the physical layer. It includes the message structure, framing, and error control.

3.3 DOMINANT SIGNAL

The driven and low voltage state of the LIN bus. If multiple devices access the bus, this state dominates the recessive or non-driven state.

3.4 DORMANT STATE

The state in which the responder-node task state machine is waiting for reception of the break field/sync byte sequence.

3.5 COMMANDER-NODE

Responsible for initiating all message traffic. Refer to ISO 17987-3 for additional information (defined as “master node” in ISO 17987-3).

3.6 MEDIA

The physical entity that conveys the electrical (or equivalent means of communication) signal transmission among ECUs on the network.

3.7 MUST

The word “must” is used to indicate that a binding requirement exists on components or devices which are outside the scope of this specification.

3.8 PHYSICAL LAYER

This ISO 7498 subsection consists of the media, mechanical interconnections, and transceivers that provide the interconnection between all ECU nodes.

3.9 PROTOCOL

The formal set of conventions or rules for the exchange of information among the ECUs. This includes the specification of the signal frame administration, frame transfer, and physical layer.

3.10 PUBLISHER

A commander-node or responder-node that is the source of the data transmitted onto the bus within a LIN message.

3.11 RADIATED EMISSIONS

The energy that radiates from the LIN physical layer.

3.12 RADIATED IMMUNITY

The level of susceptibility of physical layer components to communication errors in the presence of high energy electromagnetic fields.

3.13 RECESSIVE SIGNAL

The undriven and high voltage state of the LIN bus. If multiple devices access the bus, this state is overridden by the dominant state.

3.14 REQUEST FRAME

A frame with data published by the responder-node task in one and only one responder-node and only subscribed to by the responder-node task in the commander-node.

3.15 SHALL

The word “shall” is to be used in the following ways:

- a. To state a binding requirement on the LIN interfaces which comprise the ECU, which is verifiable by external manipulation and/or observation of an input or output.
- b. To state a binding requirement upon an ECU's NCF that is verifiable through a review of the document.

3.16 SHOULD

The word “should” is used to denote a preference or desired conformance.

3.17 RESPONDER-NODE

A device that receives messages from the commander-node or responds to messages initiated by the commander-node. Refer to ISO 17987-3 for additional information (defined as “slave node” in ISO 17987-3).

3.18 SUBSCRIBER

A commander or responder-node that receives the data within a LIN message.

3.19 WILL

The word “will” is used to state an immutable law of physics.

3.20 HEXADECIMAL

Hexadecimal numbers shall be represented using N16 or 0xN or \$N format.

4. ACRONYMS

API	Application Program Interface
ASIC	Application Specific Integrated Circuit
CAN	Controller Area Network
DLC	Diagnostic Link Connector
DNN	Device Node Number
ECU	Electronic Control Unit
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ISO	International Organization for Standardization
kbit/s	Thousands of Data Bits per Second
LDF	LIN Description File
LIN	Local Interconnect Network
LSB	Least Significant Byte
lsb	Least Significant Bit
MSB	Most Significant Byte
msb	Most Significant Bit
NAD	Node Address (for Diagnostics)
NCF	Node Capability File
OEM	Original Equipment Manufacturer
RE	Radiated Emissions
RI	Radiated Immunity
SCI	Serial Communication Interface
UART	Universal Asynchronous Receiver/Transmitter