



SURFACE VEHICLE RECOMMENDED PRACTICE

J2602™-1

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(R) LIN Network for Vehicle Applications

RATIONALE

The LIN protocol is a low speed, low cost communication protocol that is capable of reducing wire counts to simple devices like switches and sensors. This document defines an implementation of the LIN protocol with the focus on enabling ASIC designs commonly found in switches and sensors. Rationale behind major updates since previous release is listed in Appendix F.

FOREWORD

The objective of this document is to define a level of standardization in the implementation of low speed vehicle serial data network communications using the local interconnect network (LIN) protocol.

The goal of this document is to define a serial data physical layer, data link layer and media design criteria to be installed in various automotive electronic control units (ECUs). This standard will allow ECU and tool manufacturers to satisfy the needs of multiple end users with minimum modifications to the basic design. This standard will benefit vehicle original equipment manufacturers (OEMs) by achieving lower ECU costs due to higher industry volumes of the basic design.

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 17987:2016. Requirements stated in this document will provide a minimum standard level of performance to which all compatible ECUs and media shall be designed. This will assure full serial data communication among all connected devices regardless of supplier.

The goal of SAE J2602-1 is to improve the interoperability and interchangeability of LIN devices within a network by adding additional requirements that are not present in ISO 17987:2016 (e.g., fault tolerant operation, network topology, etc.).

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The term “master” has been replaced by “commander” and term “slave” with “responder” in the following sections.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

This serial data link layer network is intended for use in applications where high data rate is not required and a lower data rate can achieve cost reductions in both the physical media components and in the microprocessor and/or dedicated logic devices (ASICs) which use the network.

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 J2602-1 networks will be further specified in this document.

1.3 Relationship to the LIN Specifications

As described in the LIN specification package, the ISO 17987:2016 protocol specification suite consists of seven standards:

1.3.1 ISO 17987-1 - Road Vehicles - Local Interconnect Network (LIN) - Part 1 - General Information and Use Case Definition

This document gives an overview of the structure and the partitioning of ISO 17987 (all parts). In addition, it outlines the use case where the ISO 17987 (all parts) will be used. The terminology defined in this document is common for all LIN communication systems and is used throughout ISO 17987 (all parts). This document has been established in order to define the use cases for LIN.

1.3.2 ISO 17987-2 - Road Vehicles - Local Interconnect Network (LIN) - Part 2 - Transport Protocol and Network Layer Services

This document specifies a transport protocol and network layer services tailored to meet the requirements of LIN-based vehicle network systems on local interconnect networks. The protocol specifies an unconfirmed communication.

1.3.3 ISO 17987-3 - Road Vehicles - Local Interconnect Network (LIN) - Part 3 - Protocol Specification

This document specifies the LIN protocol including the signal management, frame transfer, schedule table handling, task behavior and status management and LIN master and slave node. It contains also OSI layer 5 properties according to ISO 14229-7 UDS on LIN-based node configuration and identification services (SID: B016 to B816) belonging to the core protocol specification.

1.3.4 ISO 17987-4 - Road Vehicles - Local Interconnect Network (LIN) - Part 4 - Electrical Physical Layer (EPL) Specification 12 V and 24 V

This document specifies the 12 V and 24 V electrical physical layers (EPL) of the LIN communications system. The electrical physical layer for LIN is designed with bit rates up to 20 kbit/s. The medium that is used is a single wire for each receiver and transmitter with reference to ground. This document includes the definition of electrical characteristics of the transmission itself and also the documentation of basic functionality for bus driver devices.

1.3.5 ISO/TR 17987-5 - Road Vehicles - Local Interconnect Network (LIN) - Part 5 - Application Programmers Interface (API)

This document 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.

1.3.6 ISO 17987-6 - Road Vehicles - Local Interconnect Network (LIN) - Part 6 - Protocol Conformance Test Specification

This document specifies the LIN protocol conformance test. This test verifies the conformance of LIN communication controllers with respect to ISO 17987-2 and ISO 17987-3. This document provides all necessary technical information to ensure that test results are identical even on different test systems, provided that the particular test suite and the test system are compliant to the content of this document.

1.3.7 ISO 17987-7 - Road Vehicles - Local Interconnect Network (LIN) - Part 7 - Electrical Physical Layer (EPL) Conformance Test Specification

This document specifies the 12 V and 24 V electrical physical layers (EPL) of the LIN communications system. The electrical physical layer for LIN is designed with bit rates up to 20 kbit/s. The medium that is used is a single wire for each receiver and transmitter with reference to ground. This document includes the definition of electrical characteristics of the transmission itself and also the documentation of basic functionality for bus driver devices.

The remainder of this document (SAE J2602-1) will directly reference these LIN specifications (publication date: 2016).

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 and Canada), www.sae.org.

SAE J551 (All Parts)	Performance Levels and Methods of Measurement of Electromagnetic Compatibility for Vehicles and Devices (30 to 1000 MHz)
SAE J1113 (All Parts)	Electromagnetic Susceptibility Measurement Procedures for Vehicle Components (Except Aircraft)
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 J2962-1	File Structures for a Node Capability File (NCF) and LIN Description File (LDF)

2.1.2 ISO Publications

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

ISO 7498	Data Processing Systems, Open Systems Interconnection Standard Reference Model
ISO 7637	Road Vehicles - Electrical Interference by Conduction and Coupling - Parts 1 and 2
ISO 9141	Road Vehicles - Diagnostic Systems - Requirements for Interchange of Digital Information
ISO 17987:2016	Road Vehicles - Local Interconnect Network (LIN) Protocol Specification Suite

3. DEFINITIONS

3.1 COMMAND FRAME

An unconditional frame published by the LIN commander-node and subscribed to by one or more 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 PHYSICAL LAYER

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

3.8 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.

3.9 PUBLISHER

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

3.10 RADIATED EMISSIONS

The energy that radiates from the LIN physical layer.

3.11 RADIATED IMMUNITY

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

3.12 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.

3.13 REQUEST FRAME

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

3.14 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).

3.15 SUBSCRIBER

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

3.16 HEXADECIMAL

Hexadecimal numbers in this document are represented using N₁₆ or 0xN or \$N format.

4. ACRONYMS, ABBREVIATIONS, AND SYMBOLS

API	Application Program Interface
ASIC	Application Specific Integrated Circuit
CAN	Controller Area Network
CTS	Component Technical Specification
DNN	Device Node Number
ECU	Electronic Control Unit
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ID	Identifier
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

5. LIN SYSTEM REQUIREMENTS

All ECU LIN interfaces shall conform to the ISO 17987:2016 specification package unless otherwise specified in this specification.

5.1 LIN Specification Package

The information contained in this section may or may not be representative of SAE J2602-1 based implementations. However, Section 3 of this LIN specification contains definitions and terms needed to comprehend the LIN protocol and SAE J2602-1.

5.2 SAE J2602-1 Serial Data Link Characteristics

- Commander/responder collision avoidance.
- Capable of interoperating with ISO 17987:2016, LIN 2.0, LIN 2.1¹, and LIN 2.2(A)¹ devices, as well as SAE J2602:2012 devices.
- Responder-node to responder-node communication is not supported and is highly discouraged.

¹ Excludes responder-node position detection service, SID5=\$B5.

5.3 LIN Product Identification

The following requirements provide further clarification to the intent of the LIN supplier ID, function ID and variant ID assignment conditions.

5.3.1 Supplier ID

The LIN responder-node supplier shall use their own supplier ID that was provided to them.

Supplier IDs are requested using the ISO/CiA validated supplier ID process for use on all ISO and SAE products.

5.3.2 Clarification to Function ID Paragraph

Two products (ECUs) are identical in function and shall be assigned identical function identifiers if they exhibit all of the following characteristics:

- They exhibit identical functional behavior.
- They exhibit identical mandatory node capability file declarations.
- Both LIN communications and application functionality are configured identically by the IC supplier.

5.3.3 Clarification to Variant ID Paragraph

Two products (ECUs) are invariant and shall be assigned identical variant identifiers if they exhibit all of the following characteristics:

- They have identical operating range characteristics (voltage, temperature).
- They are constructed from the identical integrated circuit processes and manufacturing technology.

NOTE: Any change in the binary image loaded in a microprocessor-based responder-node implementation shall constitute a difference in the variant ID.

5.4 Signal Management

5.4.1 Signal Consistency

The requirement in ISO 17987-3 section 5.1.3 indicating that all "scalar signal writing or reading must be atomic" is not externally verifiable in all LIN implementations. Consequently, this requirement is a guideline.

NOTE: Since there is a very close coupling between the signals within the SAE J2602-1 status byte, implementers of SAE J2602-1 nodes are encouraged to make every effort to publish all signals within this byte with consistency, so that any/all error signaling between the responder-node and the commander-node can be interpreted properly.

5.4.2 Signal Repetition

The same signals may belong to multiple frames, e.g., SAE J2602-1 status byte within the same cluster.

5.4.3 Signal Encoding Types

Since only two signal encoding types are defined in the ISO 17987-3 section 5.1.2, and there is an expectation to employ other standard signal encoding types commonly used in other serial data implementations, the following recognized signal encoding types shall be mapped into the two LIN signal encoding types in accordance with the following table. [Appendix B](#) contains descriptions and examples of each of the signal encoding types listed.

Table 1 - Common signal encoding type mapping to LIN defined data entities

Signal Encoding Type	Slot Type	Mapped to LIN Data Type	Notes
ASCII	ASC	8-bit Scalar	Most Significant Bit reserved and set to "0", ASCII codes 0 through 127. Must be on nibble boundaries.
Binary Coded Decimal	BCD	4 bit Scalar per BCD character	
Boolean	BLN	1 bit Scalar	
Enumerated	ENM	N bit Scalar, in increments of 1 bit (1-16 bits)	
Signed Floating Point	SFP	4 byte - Byte Array	As defined in ANSI/IEEE Std 754-1985.
Signed Numeric	SNM	8, 16, or 32 bit Byte Array	Unsigned with a negative offset number.
Unsigned Numeric	UNM	N bit Scalar, increments of 8 bits (1 byte)	Not to exceed 16 bits (2 bytes).

5.5 Detection of Errors by Commander-Node

The commander-node task state machine shall detect errors during the transmission of the break field/sync byte/protected ID sequence. If an error is detected (e.g., data mismatch or data not received), the commander-node shall cease transmission of the frame and shall start transmission of the next frame as dictated by the schedule table.

5.6 Responder-Node Task Error Detection

This section provides clarification of detecting and reporting errors.

The responder task state machine (either in a responder- or the commander-node) shall detect the following errors:

- LIN frame ID parity error: The receiver shall detect an ID parity error if the received ID parity (bits 6 and 7) does not match the ID parity calculated from the equations in ISO 17987-3 section 5.2.2.5.3 based on the received identifier (bits 0-5).
- Byte field framing error (i.e., invalid stop bit): The receiver shall detect a byte field framing error if the ninth bit after a valid start bit is dominant.
- Data error (i.e., data transmitted does not match data read, data transmitted is not received, fixed form data received is incorrect, transmitted stop bit is disturbed): A data error shall be detected when the bit or byte value that is received is different from the bit or byte value that is transmitted. A responder or commander-node that is transmitting a bit on the bus shall also monitor the bus.

- Sync field consistency error: The receiver shall detect a sync field consistency error when the data in the fixed form sync byte is received incorrectly, i.e., is not \$55.
- Checksum Error: A checksum error shall be detected if the inverted modulo-256 sum over all received data bytes and the protected identifier (when using enhanced checksum) and the received checksum byte field does not result in \$FF. Example of checksum calculation can be found in ISO 17987-3 Annex A.3.

-- Identification of the two errors listed below are optional and NOT required for SAE J2602-1 compliance --

- Header timeout (PID or SYNC byte field is absent or received out of header maximum time): When sync byte field following break field is not received or PID following sync byte field is not received within THEADER_MAX or break field is received before PID.
- Command frame response reception timeout: When the response part of the LIN frame is not received within TRESPONSE_MAX or break field is received before response is completed including checksum.

The detection of errors shall only be performed over frames designed for reception and transmission by the responder-node task. That is to say that the responder-node task shall only monitor the communication errors of the frames with protected identifies that it has been assigned.

Section [5.6.1](#) defines the method for reporting errors by the LIN responder-node to the LIN commander-node. OEM shall design the LIN responder-node to use this method and assign the signal in the SAE J2602 status byte as specified in [5.8.1](#).

5.6.1 Communication Error Reporting

Nodes that are compliant with the SAE J2602-1 2021 release of the standard shall implement only 1-bit communication error signal response and shall use V2 (2021 release) version of the status byte as defined in [5.8.1](#).

5.6.1.1 1-bit Communication Error Signal Response

The communication error signal shall be a 1-bit enumerated value with the following definition (\$0 = No Comm Error, \$1 = Comm Error Detected). This is equivalent to ERR2 used in the V1 (legacy) version of the status byte.

The LIN responder-node shall have the capability to detect errors listed in [5.6](#). If one or multiple of these errors are detected, the "communications error" bit shall be set to \$1 (Comm Error Detected). This bit shall be considered a "sticky" bit, which remains set until it is successfully reported in the communication error signal to the commander-node. After successful transmission, all pending communication errors are cleared.

Since the responder-node will be physically unable to report the error in the frame that the error was detected, the responder-node shall transmit the error in the succeeding response frame. The communication error bit also serves the purpose of the 1-bit response error in ISO 17987-3 section 5.5.4.

5.6.1.2 3-bit Error Signal Response

Details of this reporting method can be found in the SAE J2602-1 NOV2012 release. This method of error reporting is used in networks that are compliant with the SAE J2602-1 NOV2012 release of the standard and utilizes V1 (legacy) version of the status byte.

5.7 Device Communication Error Detection and Report Management

In addition to the requirements listed in ISO 17987-3 section 5.5, the following error behavior shall be followed.

5.7.1 Responder-Node Behavior in the Presence of Errors When Transmitting

When a responder-node task state machine detects a byte field framing error, data error, or checksum error, the responder-node task state machine shall cease transmission prior to transmission of the next byte field, unless the error occurs during the transmission of the checksum byte, and return to the "dormant" state. The responder-node task shall also set the communication error signal as defined in [5.6](#).

5.7.2 Responder-Node Behavior in the Presence of Errors When Receiving

When a responder-node task state machine detects a sync field consistency, ID parity error, byte field framing error, data error, checksum error, header timeout, or response reception timeout the responder-node task state machine shall discard any data buffered from the current frame and return to the "dormant" state. The responder-node task shall also set the communication error signal as defined in [5.6](#).

5.8 Message Management

5.8.1 SAE J2602-1 Status Byte

This section defines SAE J2602 status byte, which encompasses both LIN protocol response error reporting and application specific information. The status byte shall be included in each response message published by the LIN responder-node. Status byte shall be transmitted as the first byte of every responder-node transmission, where the identifier is in the range of \$00 through \$3B (unconditional frame).

SAE J2602-1 Status Byte

Version	Bit 7 (msb)	6	5	4	3	2	1	Bit 0 (lsb)
V1 (Legacy)	ERR2	ERR1	ERR0	APINFO4	APINFO3 to APIFNO0			
V2 (2021 release)	Comm Error	Reset	APINFO5 to APINFO0					

5.8.1.1 V1 - Legacy from November 2012 Release

Details for this version of the status byte can be found in J2602-1 NOV 2012 release and is referred to in this document as V1 or legacy version of the status byte. It is used in networks that are compliant with the J2602-1 NOV 2012 release of the standard.

Nodes that are compliant with J2602-1 2021 release of the standard shall implement only V2 version of the status byte.

5.8.1.2 V2 - New for 2021 Release

Defines one bit for communication error, one bit for reset and remaining APINFO 0:5 are undefined.

Comm error shall be used to report errors specified in [5.6](#) and shall be implemented using details specified in [5.6.1](#).

Reset shall be used to indicate any reset including targetted reset. A responder-node shall set this state upon interruption and resumption of power, after a watchdog timeout, for targetted rest application as defined in section [5.9.6](#) or after receipt of a reset command.

Note that for those devices that require configuration and store the configuration information in volatile memory, this state indicates that the device is currently unconfigured and requires configuration. For those devices that use non-volatile memory for configuration information storage, then the state indicates configuration is required the first time the part is powered on and only indicates a reset from then on.

The application information field (APINFOx) is defined and implemented on a case-by-case basis by the OEM, dependent on the requirements of each responder-node application. These signals may be implemented as any combination of discrete or enumerated status bits or unsigned numerical values. The clearing mechanism used will also be defined by the OEM. The resulting application information field implementation shall be documented in the NCF for each responder-node.

Examples of signals that could be included in the status byte are as follows:

- Alive rolling counter.
- Cyclic redundancy check.
- Internal operation fault (APINFO4).
- Application resets.
- Device configuration required (APINFO3).

5.8.2 Unused Bits in the Data Field

The length of each frame in bytes, used for LIN normal communications (not diagnostics or configuration), shall be defined for each LIN network, on a frame-by-frame basis. As per ISO 17987-3 section 6.3.4.6, all bits not used or not defined shall be transmitted as recessive (logical 1) symbol. Padding of unused data bytes within LIN normal communications messages is not required. That is, normal communications messages may vary in length between 1 byte and 8 bytes.

5.8.3 Checksum

The enhanced checksum method shall be used for all protected identifiers except for those in the range of \$3C to \$3F.

Enhanced checksum is defined in ISO 17987-3 section 5.2.2.7.

5.8.4 Message Types

5.8.4.1 Availability of Unconditional Frames

The requirement that subscribers of an unconditional frame shall make it available to the application is not externally verifiable in all LIN implementations. Consequently, this requirement is a guideline.

5.8.4.2 Event Triggered Frames

Event Triggered frames shall not be utilized in SAE J2602-1 compliant LIN networks.

5.8.4.3 Identifier Assignment (SAE J2602-1 Requirement Resulting from Event Triggered Frame Anomaly)

One and only one responder-node shall be defined as the publisher to a single frame identifier.

5.8.4.4 Sporadic Frame

Messages of the sporadic frame type may be utilized within the SAE J2602-1 environment, if appropriate. The commander-node shall be the only publisher of sporadic frames.

5.9 Network Management

5.9.1 Message Transmission Time Tolerance

Each maximum message transmission time may be specified to be within the range of $T_{\text{Frame_Minimum}}$ and $T_{\text{Frame_Maximum}}$, providing both publisher and subscriber of the frame support a maximum message transmission time of less than $T_{\text{Frame_Maximum}}$.

The minimum $T_{\text{Frame_Maximum}}$ value to which a responder-node can respond shall be identified in its node capability file when the SAE J2602 language is used. Otherwise, in the event a value is not provided in the node capability file (either when an SAE J2602 language or an ISO 17987 language is used), the commander-node shall presume a value of $T_{\text{Frame_Maximum}}$ of no more than 40%.

5.9.2 Device Configuration Using LIN Diagnostic Services

The following LIN diagnostic services are to be used for SAE J2602 LIN responder-node configuration only; they are not to be used for LIN responder-node diagnostics reporting since all relevant diagnostic information is included in the SAE J2602-1 status byte (if available). Furthermore, these configuration messages are only initiated by the LIN commander-node (ECU or test tool for bench testing).

No direct access to any LIN cluster shall be provided through the SAE J1962 connector.

Support of all remaining LIN diagnostics services and configuration as defined in ISO 17987-3 section 6 node configuration and identification is optional in SAE J2602-1 nodes. In other words, support of the services defined as mandatory in ISO 17987-3 section 6 node configuration and identification is optional and is not required for SAE J2602-1 compliance.

The following sections define the required SAE J2602-1 node configuration command/response messages.

5.9.3 General Configuration Requirements

5.9.3.1 Responder-Node Execution of Configuration

Within the limit of its capabilities, a responder-node shall immediately execute any configuration command upon receipt of the \$3C message; it shall not wait for a \$3D message.

5.9.3.2 Responder-Node Configuration Capabilities

A NCF file shall be included with an SAE J2602-1 device.

5.9.3.3 Commander-Node Configuration Message Pairing

A commander-node shall always transmit \$3C/\$3D coupled pairs for all capabilities described within this section. The commander-node shall never send multiple successive \$3C messages without corresponding (interleaved) \$3D messages. There shall be exactly one \$3D response for each \$3C command. The only exception to this is in the case of a broadcast \$3C message, which shall have no corresponding \$3D message.

5.9.4 NAD and Message ID Assignment

5.9.4.1 NAD Assignment

The NAD for an SAE J2602-1 device shall be in the range \$60 to \$6D, where the lower nibble of the SAE J2602-1 NAD contains a four bit device node number (DNN). An uninitialized node shall have a NAD of \$6F. A NAD of \$6E may be used; however, its message IDs must be assigned via \$3C or \$3E messages.

IC manufacturers may provide the ability to select the desired device node number, and hence the NAD, based on up to four memory bits, four external pins, or other methods developed by silicon suppliers. These bits or pins shall only impact the value of the lower nibble of the NAD. If the device has a selectable NAD, it shall default to \$6F prior to initialization.

SAE J2602-1 NAD

Bit 7 (msb)	6	5	4	3	2	1	Bit 0 (lsb)
0	1	1	0	DNN3	DNN2	DNN1	DNN0

5.9.4.2 Message ID Assignment

Each device shall be assigned four message IDs based on the DNN, and, therefore, the NAD. If a device does not need that many messages, it shall use the messages with the lowest IDs. If a device requires more than four message IDs, it shall be assigned messages in powers of two; i.e., 4, 8, 16, 32. The system designer must ensure that multiple devices do not use the same message IDs.

As a consequence of having the message IDs associated with the DNN, after a power on reset, or reset command the protected identifiers are still marked as valid for devices with a DNN in the range \$0-\$D. Devices with a DNN of \$E or \$F will have the protected identifiers marked as invalid. The following table shows the boundaries for 4, 8, or 16 messages per node. If 32 message IDs are required, NAD \$60 must be used for this node. SAE J2602-1 networks can combine nodes that use various numbers of message IDs.

Table 2 - NAD to message ID mapping

NAD	Message ID		NAD	Message ID		NAD	Message ID
\$60	\$00 \$01 \$02 \$03		\$60	\$00 \$01 \$02 \$03 \$04 \$05 \$06 \$07		\$60	\$00 \$01 \$02 \$03 \$04 \$05 \$06 \$07 \$08 \$09 \$0A \$0B \$0C \$0D \$0E \$0F
\$61	\$04 \$05 \$06 \$07						
\$62	\$08 \$09 \$0A \$0B		\$62	\$08 \$09 \$0A \$0B \$0C \$0D \$0E \$0F			
\$63	\$0C \$0D \$0E \$0F						
\$64	\$10 \$11 \$12 \$13		\$64	\$10 \$11 \$12 \$13 \$14 \$15 \$16 \$17		\$64	\$10 \$11 \$12 \$13 \$14 \$15 \$16 \$17 \$18 \$19 \$1A \$1B \$1C \$1D \$1E \$1F
\$65	\$14 \$15 \$16 \$17						
\$66	\$18 \$19 \$1A \$1B		\$66	\$18 \$19 \$1A \$1B \$1C \$1D \$1E \$1F			
\$67	\$1C \$1D \$1E \$1F						
\$68	\$20 \$21 \$22 \$23		\$68	\$20 \$21 \$22 \$23 \$24 \$25 \$26 \$27		\$68	\$20 \$21 \$22 \$23 \$24 \$25 \$26 \$27 \$28 \$29 \$2A \$2B \$2C \$2D \$2E \$2F
\$69	\$24 \$25 \$26 \$27						
\$6A	\$28 \$29 \$2A \$2B		\$6A	\$28 \$29 \$2A \$2B \$2C \$2D \$2E \$2F			
\$6B	\$2C \$2D \$2E \$2F						
\$6C	\$30 \$31 \$32 \$33		\$6C	\$30 \$31 \$32 \$33 \$34 \$35 \$36 \$37		\$6C	\$30 \$31 \$32 \$33
\$6D	\$34 \$35 \$36 \$37					\$6D	\$34 \$35 \$36 \$37
\$6E	No Message IDs defined		\$6E	No Message IDs defined		\$6E	No Message IDs defined
\$6F	No Message IDs defined		\$6F	No Message IDs defined		\$6F	No Message IDs defined

NOTE: The message IDs listed in this table are the unprotected identifiers.