



SURFACE VEHICLE RECOMMENDED PRACTICE

J2602™-2

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(R) LIN Network for Vehicle Applications Conformance Test

RATIONALE

Historically, original equipment manufacturers (OEMs) had their own communication transceiver qualification requirements that varied over time. The intent of this standard is to minimize test variation and to consolidate requirements among OEMs. Updates were made to reflect changes in the SAE J2602-1 2021 revision; this document is arranged such that the conformance test for a given section in SAE J2602-1 is in the same section in SAE J2602-2.

FOREWORD

The objective of this document is to define a standard conformance test for SAE J2602-1 devices.

The goal of this document is to define a basic conformance test for SAE J2602-1 nodes that can be used to determine the suitability of devices for use. This is not a complete qualification test. This does not replace the individual suppliers' IC and/or module qualification.

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1. SCOPE

This document covers the tests to be performed on all SAE J2602-1 (2021 revision) devices. Tests described in this document will ensure a minimum standard level of performance to which all compatible electronic control units (ECUs) and media shall be designed. This will assure full serial data communication among all connected devices regardless of supplier.

The goal of SAE J2602-2 is to improve the interoperability and interchangeability of LIN devices within a network by verifying the devices pass a minimum set of tests.

To allow for easy cross-reference, this document is arranged such that the conformance test for a given section in SAE J2602-1 (2021 revision) is in the same section in SAE J2602-2.

This document is to be referenced by the particular vehicle original equipment manufacturer (OEM) component technical specification that describes any given ECU in which the LIN data link controller and physical layer interface is located. Primarily, the performance of the physical layer is specified in this document. ECU environmental and other requirements, when provided in the component technical specification, shall supersede the requirements of this document.

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The term “master” has been replaced by “**commander**” and term “slave” with “**responder**” in the following sections.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 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 controller area network (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 conformance test specifications contains tests for the physical layer, data link layer, node configuration, and network management.

1.3 Relationship to the LIN Conformance Test Specification

This document includes complete information for testing SAE J2602-1 (2021 revision) compliant devices. ISO 17987 is referenced only for optional behaviors not defined in SAE J2602-1.

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

SAE J2602-3 File Structures for a Node Capability File (NCF)

SAE J2962-1 Communication Transceivers Qualification Requirements - LIN

2.1.2 ISO Documents

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

ISO 9141 Road Vehicles - Diagnostic Systems - Requirements for Interchange of Digital Information

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

3. DEFINITIONS

3.1 AGING FACTOR OF THE CLOCK

This is provided by the supplier of the clock device (crystal, ceramic resonator, etc.) and is the portion of the maximum total clock tolerance over the device lifetime due to aging (time).

3.2 HEXADECIMAL

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

4. ACRONYMS

API	Application program interface
AWG	American wire gauge
ASIC	Application specific integrated circuit
CAN	Controller area network
CTS	Component technical specification
DLC	Diagnostic link connector
DNN	Device node number
DUT	Device under test

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

5. LIN SYSTEM REQUIREMENTS

General test assumptions:

1. All responder-nodes shall have at least one request message to which they respond.
2. The C_{load} and R_{load} values specified shall include the characteristics of the test tool, so that this is the entire load external to the DUT.
3. All responder-nodes are assumed to contain 220 pF nominal capacitance and 30 K nominal resistance.
4. All commander-nodes are assumed to contain 680 pF nominal capacitance and 1K nominal resistance.
5. The power supply voltage shall be 12 V unless otherwise specified.
6. The ambient temperature shall be between 20 °C and 28 °C (68 °F and 82.4 °F).
7. The length of each wire segment shall be between 0.5 m and 2 m in length unless otherwise specified.
8. Each wire segment shall consist of 20 or 22 AWG copper wire.

9. The value of all external load resistors shall be within 0.1% of the specified resistance value.
10. The value of all external load capacitors shall be within 1.0% of the specified capacitance value.
11. Status byte for all tests in this document refers to the V2 version (2021 release) unless otherwise specified.

5.1 LIN Specification Package

This section is informative in nature and does not require any tests.

5.2 SAE J2602-1 Serial Data Link Characteristics

This section is informative in nature and does not require any tests.

5.3 LIN Product Identification

This section is informative in nature and does not require any tests.

5.4 Signal Management

5.4.1 Signal Consistency

This section is informative in nature and does not require any tests.

5.4.2 Signal Repetition

This section is informative in nature and does not require any tests.

5.4.3 Signal Encoding Types

Recommended messaging, not verifiable.

5.5 Detection of Errors by Commander-Node

5.5.1 Errors During the Transmission of the Sync Byte Sequence

This test verifies that the commander-node DUT stops transmitting the header when the sync byte is not \$55 or when there is a framing error in the sync byte (STOP bit = 0).

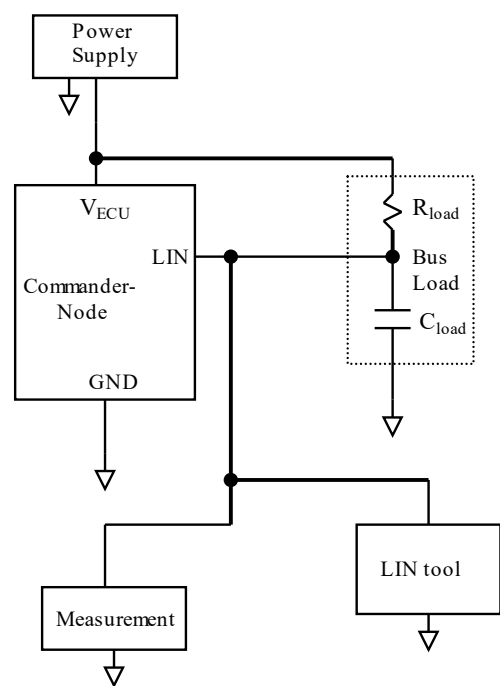


Figure 1 - Detection of errors by commander-node test setup

Table 1A - Detection of errors by commander-node test plan

DUT Node as	Commander-node With C = 680 pF	Test Case 5.5.1.x (two cases)
Parameter	V _{ECU} R _{load} and C _{load}	12 V 30 kΩ, 220 pF
Test Steps	See Table 1B	
Response	See Table 1B	
Reference	SAE J2602-1, 5.5	

Table 1B - Detection of errors by commander-node test plan

# Test	Test Steps	Response
5.5.1.1	1. DUT sends out any message. 2. Test tool sends out a \$F0 data byte when a start bit is detected after the break symbol.	The DUT must not transmit the ID. The next thing transmitted by the DUT must be a break/sync byte.
5.5.1.2	1. DUT sends out any message. 2. Test tool corrupts the stop bit of the sync byte.	The DUT must not transmit the ID. The next thing transmitted by the DUT must be a break/sync byte.

5.5.2 Errors During the Transmission of the Protected Identifier Sequence

This test verifies that the commander-node DUT stops transmitting when there is an error in the protected identifier, a framing error in any data byte, or a data bit is corrupted.

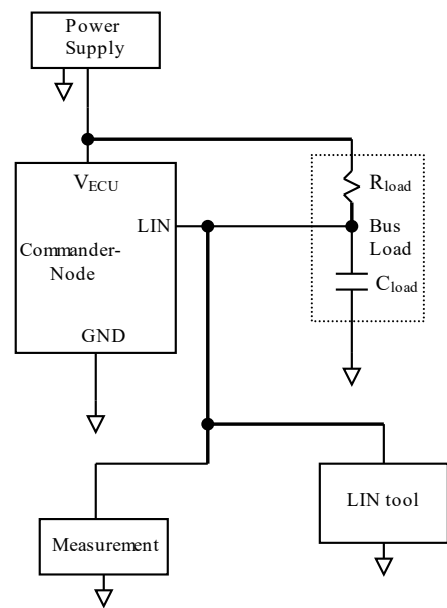


Figure 2 - Responder-node task in a commander-node error behavior test setup

Table 2A - Responder-node task in a commander-node error behavior test plan

DUT Node as	Commander-node With C = 680 pF	Test Case 5.5.2.x (three cases)
Parameter	V _{ECU} R _{load} and C _{load}	12 V 30 kΩ, 220 pF
Test Steps	See Table 2B	
Response	See Table 2B	
Reference	SAE J2602-1, 5.5	

Table 2B - Responder-node task in a commander-node error behavior test plan

# Test	Test Steps	Response
5.5.2.1	Corrupt the parity of the ID byte of any command message initiated by the DUT.	The DUT must not transmit any other bytes of this message. The next thing transmitted by the DUT must be a break/sync byte.
5.5.2.2	Corrupt the stop bit of any data byte of any command message initiated by the DUT.	The DUT must not transmit any other bytes of this message. The next thing transmitted by the DUT must be a break/sync byte.
5.5.2.3	Corrupt any single data bit of any data byte of any command message initiated by the DUT.	The DUT must not transmit any other bytes of this message. The next thing transmitted by the DUT must be a break/sync byte.

5.6 Responder-Node Task Error Detection

The purpose of this test is to:

1. Verify that the responder-node DUT stops transmission when an error occurs during transmission and sets the appropriate error code in the SAE J2602-1 status byte.
2. Verify that the responder-node DUT recognizes an error in a received message and sets the appropriate error code in the SAE J2602-1 status byte.
3. Verify that the responder-node DUT does not transmit when the sync byte is anything other than \$55 and sets the appropriate error code in the SAE J2602-1 status byte.

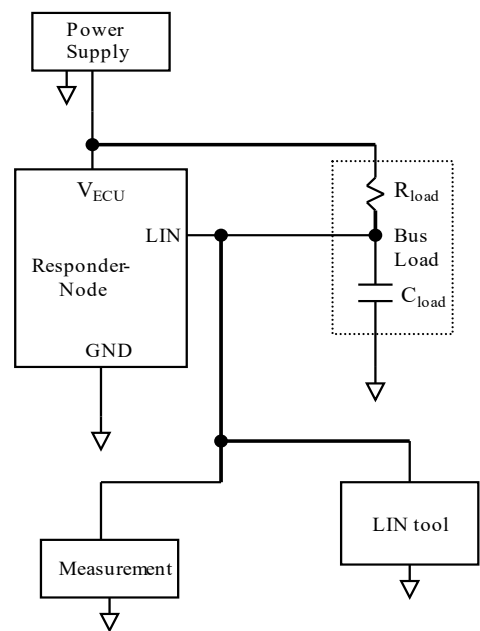


Figure 3 - Responder-node error behavior test setup

Table 3A - Responder-node error behavior test plan

DUT Node as	Responder-node With C = 220 pF	Test Case 5.6.x (six cases)
Parameter	V _{ECU} R _{load} and C _{load}	12 V 1 kΩ, 680 pF
Test Steps	See Table 3B	
Response	See Table 3B	
Reference	SAE J2602-1, 5.6	

Table 3B - Responder-node error behavior test plan

# Test	Test Steps	Response
5.6.1	1. Verify no error codes are set in the responder-node by sending a responder-node specific request message ID for DUT and checking the status byte. There are no error codes set when comm error bit of the status byte is "0." Repeat until no errors are found. 2. Send a \$3C targeted reset to the DUT. 3. Send a \$3D response with the ID parity bits corrupted, i.e., protected ID of (0011 1101) 4. Send a responder-node specific request message ID for DUT without error.	After step 3 the DUT must not send any data. After step 4 the status byte returned by the DUT must be 11xx xxxx. Comm error and reset bit should be 1.
5.6.2	1. Verify no error codes are set in the responder-node by sending a responder-node specific request message ID for DUT and checking the status byte. There are no error codes set when comm error bit of the status byte is "0." Repeat until no errors are found. 2. Send a responder-node specific command message ID and data for the DUT and corrupt the Stop bit (transmit a dominant) of the last data byte in the frame. 3. Send a responder-node specific request message ID for DUT without error.	After step 3 the status byte returned by the DUT must be 10xx xxxx. Comm error should be 1 and reset bit should be 0.
5.6.3	1. Verify no error codes are set in the responder-node by sending a responder-node specific request message ID for DUT and checking the status byte. There are no error codes set when the comm error bit of the status byte is "0." Repeat until no errors are found. 2. Send a \$3C targeted reset with a corrupted checksum to the DUT. 3. Send a responder-node specific request message ID for DUT without error.	After step 3 the status byte returned by the DUT must be 11xx xxxx. Comm error and reset bit should be 1.
5.6.4	1. $x = 0$ (sync byte value) 2. Verify no error codes are set in the responder-node by sending a responder-node specific request message ID for DUT and checking the status byte. There are no error codes set when the comm error bit of the status byte is "0." Repeat until no errors are found. 3. Send a \$3C targeted reset to the DUT. 4. Send a \$3D response with sync byte = x. 5. Send a responder-node specific request message ID for DUT without error. 6. $x = x + 1$. 7. If $x \leq 255$ go to 2, else END.	After step 4 the DUT must only transmit if the sync byte transmitted was \$55. After step 5 the status byte returned by the DUT must be 11xx xxxx. Comm error and reset bit should be 1. If the device has a fixed clock. Alternatively, if the device is performing auto bauding and the sync byte was not \$55, the status byte is ignored, but a valid response shall be sent by the DUT.

# Test	Test Steps	Response
5.6.5	1. Verify no error codes are set in the responder-node by sending a responder-node specific request message ID for DUT and checking the status byte. There are no error codes set when the comm error bit of the status byte is "0." Repeat until no errors are found. 2. Send a \$3C targeted reset to the DUT. 3. Send a \$3D Response and corrupt bit 6 (send a dominant) of the NAD byte sent by the DUT. 4. Send a responder-node specific request message ID for DUT without error.	After step 3 the DUT must not transmit another byte after the NAD. After step 4 the status byte returned by the DUT must be 11xx xxxx. Comm error and reset bit should be 1.
5.6.6	1. Verify no error codes are set in the responder-node by sending a responder-node specific request message ID for DUT and checking the status byte. There are no error codes set when the comm error bit of the status byte is "0." Repeat until no errors are found. 2. Send a \$3C targeted reset to the DUT 3. Send a \$3D response with the ID parity bits corrupted, i.e., protected ID of (0011 1101) 4. Send a \$3C targeted reset with a corrupted checksum to the DUT 5. Send a \$3D Response and corrupt bit 6 (send a dominant) of the NAD byte sent by the DUT. 6. Send a responder-node specific request message ID for DUT without error. 7. Send a responder-node specific request message ID for DUT without error.	After step 3 the DUT should not send any data. After step 6 the status byte returned by the DUT should be 11xx xxxx. Comm error and reset bit should be 1. After step 7 the status byte returned by the DUT 00xx xxxx. Comm error and reset bit should be 0.

5.7 Device Communication Error Detection and Report Management

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

Verified in [5.6](#).

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

Verified in [5.6](#).

5.8 Message Management

5.8.1 SAE J2602-1 Status Byte

Verified in [5.6](#).

5.8.2 Unused Bits in the Data Field

Verify using NCF or LDF.

5.8.3 Checksum

If this is not correct, no other messaging would work correctly. The tool shall check the checksum in every message sent by the DUT. If the checksum is not correct an error shall be logged.

5.8.4 Message Types

5.8.4.1 Availability of Unconditional Frames

This is a guideline and does not require any tests.

5.8.4.2 Event Triggered Frames

Not to be utilized in SAE J2602-1 compliant LIN networks, does not require any tests.

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

Verified by component/system level testing by the OEM/Tier 1 supplier.

5.8.4.4 Sporadic Frame (Refer to 5.2.4, ISO 17987-3 Specification)

Verified by component/system level testing by the OEM/Tier 1 supplier.

5.9 Network Management

5.9.1 Message Transmission Time Tolerance

Use the following messages for the test frames called out in this section:

Table 4 - Test frame assignments

TST_Frame	Requirements for the Test Frame
TST_FRAME_1	Any frame sent by the commander-node
TST_FRAME_2	Targeted reset
TST_FRAME_3	Not used
TST_FRAME_4	Device specific frame, reference NCF
TST_FRAME_5	Not used
TST_FRAME_6	Responder-node response command frame, identifier = 0x3D
TST_FRAME_7	Not used
TST_FRAME_8	Not used
TST_FRAME_9	Command frame sleep request, identifier = 0x3C, NAD = 0x00

Use the following values for the variables in this section based on expected communication rate of device. Optional, if the device is designed to operate at both speeds or does “auto baud rate detect,” test at both speeds.

Table 5 - Test variable times

Parameter	Time (10417)	Time (19230)
T _{SYNBRK_MIN}	1241 µs	672 µs
T _{SYNBRK_MAX}	2580 µs	1397 µs
T _{SYNDEL_MIN}	95 µs	51 µs
T _{SYNDEL_MAX}	1422 µs	776 µs
T _{HEADER_NOMINAL}	3264 µs	1768 µs
T _{HEADER_MAXIMUM}	4606 µs	2488 µs
T _{FRAME_NOMINAL}	11904 µs	6448 µs
T _{FRAME_MAXIMUM}	T _{HEADER_MAXIMUM} + safety factor * 90 * max clock tol * 96	T _{HEADER_MAXIMUM} + safety factor * 90 * max clock tol * 52
40 bits	3840 µs	2080 µs
20 bits	1920 µs	1040 µs
19 bits	1824 µs	988 µs
15 bits	1440 µs	780 µs
13 bits	1248 µs	676 µs
10 bits	960 µs	520 µs
8 bits	768 µs	416 µs
6 bits	576 µs	312 µs
3 bits	288 µs	156 µs
2 bits	192 µs	104 µs

NOTE: Maximum delays include 13.2 µs for transceiver propagation delay (includes transmit and receive delays).

5.9.1.1 Length of Sync Break Low Phase (DUT as Commander-Node)

This test verifies that the DUT as commander-node transmits the correct length of the Sync Break Low Phase T_{SYNBRK} as defined in the LIN specification.

Table 6 - Length of sync break low phase test plan

DUT Node as	Commander-node With C = 680 pF	
Parameter	V _{ECU} Test Frames	12 V TST_FRAME_1
Test Steps	The DUT sends TST_FRAME_1	
Response	T _{SYNBRK} ≥ T _{SYNBRK_MIN}	
Reference	SAE J2602-1, 5.9	

5.9.1.2 Variation of Length of Sync Break Low Phase (DUT as Responder-Node)

This test verifies that the DUT as responder-node recognises an ID request with different lengths of sync break low phase T_{SYNBRK}.

Table 7A - Variation of length of sync break low phase test plan

DUT Node as	Responder-node With C = 220 pF	Test Case 5.9.1.1.x (three cases)
Parameter	V _{ECU} Test Frames	12 V TST_FRAME_2, TST_FRAME_6
Test Steps	See Table 7B	
Response	See Table 7B	
Reference	SAE J2602-1, 5.9	

Table 7B - Variation of length of sync break low phase test plan

# Test	Test Steps	Response
5.9.1.1.1	- The test tool as commander-node sends TST_FRAME_2 with the length of SYNC BREAK LOW PHASE T_{SYNBRK} as defined below. $T_{\text{SYNBRK}} = T_{\text{SYNBRK_MIN}}$ $T_{\text{SYNDEL}} = T_{\text{SYNDEL_MIN}}$ $T_{\text{H_Interbyte}} = 0$ ($T_{\text{H_Interbyte}}$ is the interbyte space between sync byte and identifier) - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.
5.9.1.1.2	- The test tool as commander-node sends TST_FRAME_2 with the length of SYNC BREAK LOW PHASE T_{SYNBRK} as defined below. $T_{\text{SYNBRK}} = T_{\text{SYNBRK_MAX}}$ $T_{\text{SYNDEL}} = T_{\text{SYNDEL_MIN}}$ $T_{\text{H_Interbyte}} = 0$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.
5.9.1.1.3	- The test tool as commander-node sends TST_FRAME_2 with the length of SYNC BREAK LOW PHASE T_{SYNBRK} as defined below. $T_{\text{SYNBRK}} = 20 \text{ bits}$ $T_{\text{SYNDEL}} = T_{\text{SYNDEL_MIN}}$ $T_{\text{H_Interbyte}} = 0$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.

5.9.1.3 Length of Sync Break Delimiter (DUT as Commander-Node)

This test verifies that the DUT as commander-node transmits the correct length of the sync break delimiter T_{SYNDEL} .

Table 8 - Length of sync break delimiter test plan

DUT Node as	Commander-node With C = 680 pF	
Parameter	V_{ECU} Test Frames	12 V TST_FRAME_1
Test Steps	The DUT sends TST_FRAME_1	
Response	$T_{\text{SYNDEL}} \geq T_{\text{SYNDEL_MIN}}$	
Reference	SAE J2602-1, 5.9	

5.9.1.4 Variation of Length of Sync Break Delimiter (DUT as Responder-Node)

This test verifies that the DUT as responder-node recognizes an ID request with different lengths of sync break delimiter T_{SYNDEL} . The minimum sync break delimiter time is tested in [5.5.2](#).

Table 9A - Variation of length of sync break delimiter test plan

DUT Node as	Responder-node With C = 220 pF	Test Case 5.9.1.2.x (two cases)
Parameter	V_{ECU} Test Frames	12 V TST_FRAME_2, TST_FRAME_6
Test Steps	See Table 9B	
Response	See Table 9B	
Reference	SAE J2602-1, 5.9	

Table 9B - Variation of length of sync break delimiter test plan

# Test	Test Steps	Response
5.9.1.2.1	- The test tool as commander-node sends TST_FRAME_2 with the length of SYNC BREAK DELIMITER T_{SYNDEL} as defined below. $T_{SYNBRK} = T_{SYNBRK_MIN}$ $T_{SYNDEL} = T_{SYNDEL_MAX}$ $T_{H_Interbyte} = 0$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.
5.9.1.2.2	- The test tool as commander-node sends TST_FRAME_2 with the length of SYNC BREAK DELIMITER T_{SYNDEL} as defined below. $T_{SYNBRK} = T_{SYNBRK_MIN}$ $T_{SYNDEL} = 10\text{bits}$ $T_{H_Interbyte} = 0$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.

5.9.1.5 Length of Header (DUT as Commander-Node)

This test verifies that the DUT as commander-node transmits the correct length of the header T_{HEADER} .

Table 10 - Length of header test plan

DUT Node as	Commander-node With C = 680 pF	
Parameter	V_{ECU} Test Frames	12 V TST_FRAME_1
Test Steps	The DUT sends TST_FRAME_1.	
Response	$(T_{HEADER_NOMINAL} * 0.995) \leq T_{HEADER} \leq T_{HEADER_MAXIMUM}$	
Reference	SAE J2602-1, 5.9	

5.9.1.6 Variation of Length of Header (DUT as Responder-Node)

This test verifies that the DUT as responder-node recognizes an ID request with different lengths of the header T_{HEADER} .

Table 11A - Variation of length of header test plan

DUT Node as	Responder-node With C = 220 pF	Test Case 5.9.1.3.x (four cases)
Parameter	V_{ECU} Test Frames	12 V TST_FRAME_2, TST_FRAME_6
Test Steps	See Table 11B	
Response	See Table 11B	
Reference	SAE J2602-1, 5.9	

Table 11B - Variation of length of header test plan

# Test	Test Steps	Response
5.9.1.3.1	- The test tool as commander-node sends TST_FRAME_2 with the length of the parts of the header as defined below. $T_{\text{SYNBRK}} = T_{\text{SYNBRK_MIN}}$ $T_{\text{SYNDEL}} = T_{\text{SYNDEL_MIN}}$ $T_{\text{H_Interbyte}} = 0$ $T_{\text{HEADER}} = T_{\text{HEADER_NOMINAL}}$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.
5.9.1.3.2	- The test tool as commander-node sends TST_FRAME_2 with the length of the parts of the header as defined below. $T_{\text{SYNBRK}} = 19 \text{ bits}$ $T_{\text{SYNDEL}} = 2 \text{ bits}$ $T_{\text{H_Interbyte}} = 6 \text{ bits}$ $T_{\text{HEADER}} = T_{\text{HEADER_MAXIMUM}}$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.
5.9.1.3.3	- The test tool as commander-node sends TST_FRAME_2 with the length of the parts of the header as defined below. $T_{\text{SYNBRK}} = 15 \text{ bits}$ $T_{\text{SYNDEL}} = 3 \text{ bits}$ $T_{\text{H_Interbyte}} = 2 \text{ bits}$ $T_{\text{HEADER}} = 40 \text{ bits}$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.
5.9.1.3.4	- The test tool as commander-node sends TST_FRAME_2 with the length of the parts of the header as defined below. $T_{\text{SYNBRK}} = T_{\text{SYNBRK_MIN}}$ $T_{\text{SYNDEL}} = T_{\text{SYNDEL_MIN}}$ $T_{\text{H_Interbyte}} = 13 \text{ bits}$ $T_{\text{HEADER}} = T_{\text{HEADER_MAXIMUM}}$ - The test tool as commander-node sends TST_FRAME_6.	The DUT must answer the request.

5.9.1.7 Length of Frame (DUT as Responder-Node Answering to a Commander-Node Request)

5.9.1.7.1 DUT as Responder-Node

This test verifies that the length of $T_{\text{FRAME_MAXIMUM}}$ is not exceeded by the DUT's in-frame-response space and interbyte spaces.

The header length is set to the maximum $T_{\text{HEADER_MAXIMUM}}$ (worst case).

Table 12 - Length of frame (DUT as responder-node) test plan

DUT Node as	Responder-node With C = 220 pF	
Parameter	V _{ECU} Test Frames	12 V TST_FRAME_2 as defined below, TST_FRAME_6 TST_FRAME_2 parameters: Header size = max Data Frame size = 8 SyncBreak length = 19 bits SyncDelimiter length = 8 bits T _{HInterbyte} = 0
Test Steps	The Test Tool as commander-node sends a request with the maximum length of header, followed by TST_FRAME_6	
Response	The DUT must answer the request with $T_{FRAME_NOMINAL} + (T_{Header_Maximum} - T_{Header_Nominal}) \leq T_{Frame} \leq T_{FRAME_MAXIMUM}$	
Reference	SAE J2602-1, 5.9	

5.9.1.7.2 DUT as Commander-Node with Responder-Node Task

This test verifies that the length of T_{FRAME_MAXIMUM} is not exceeded by the DUT's in-frame-response space and interbyte spaces.

Table 13 - Length of frame (DUT as commander-node with responder-node task) test plan

DUT node as	Commander-node with Responder-node Task With C = 680 pF	
Parameter	V _{ECU} Test Frames	12 V TST_FRAME_4
Test Steps	The DUT is forced to start scheduling	
Response	For a period of at least 10 seconds it is verified that the frames are within tolerance	
Reference	SAE J2602-1, 5.9	

5.9.2 Device Configuration Using LIN Diagnostic Services

Verify using NCF or LDF.

5.9.3 General Configuration Requirements

5.9.3.1 Responder-Node Execution of Configuration (DUT as Responder-Node)

This test verifies that the responder-node DUT will perform the \$3C command without receiving a \$3D request using the targeted reset command.

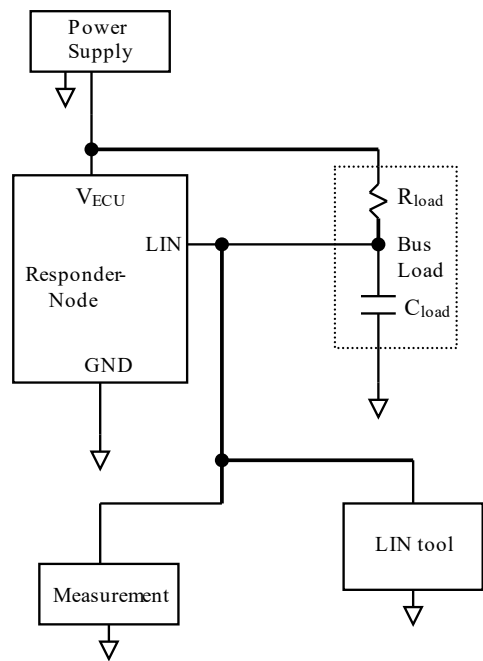


Figure 4 - Responder-node execution of configuration test setup

Table 14A - Responder-node execution of configuration test plan

DUT Node as	Responder-node With C = 220 pF	Test Case 5.9.3.1
Parameter	V _{ECU} R _{load} and C _{load}	12 V 1 kΩ, 680 pF
Test Steps	See Table 14B	
Response	See Table 14B	
Reference	SAE J2602-1, 5.9.3.1	

Table 14B - Responder-node execution of configuration test plan

# Test	Test Steps	Response
5.9.3.1	1. Verify no error codes are set in the responder-node by sending a responder-node specific request message ID for DUT and checking the status byte. There are no error codes set when comm error bit of the status byte is “0.” Repeat until no errors are found. 2. Send a \$3C targeted reset to the DUT. Do not follow this with a \$3D request. 3. Send a responder-node specific request message ID for DUT without error.	After step 3, the status byte returned by the DUT must be (01xx xxxx). Reset bit should be 1. This verifies that the reset was performed without the device receiving a \$3D.

5.9.3.2 Responder-Node Configuration Capabilities

Verify NCF is available and complete.

5.9.3.3 Commander-Node Configuration Message Pairing

Application software specific.

5.9.4 NAD and Message ID Assignment

5.9.4.1 NAD Assignment

5.9.4.1.1 Responder-Node NAD Assignment

Devices which have a hardware selectable DNN and are also configurable via software must be conformance tested via 5.9.4.1.4. This may require that two devices be tested. The hardware selection shall always have a higher priority. Hardware selectable DNN (DUT as responder-node).

This test verifies that the DUT takes on the proper NAD based on the setting of the DNN pins.

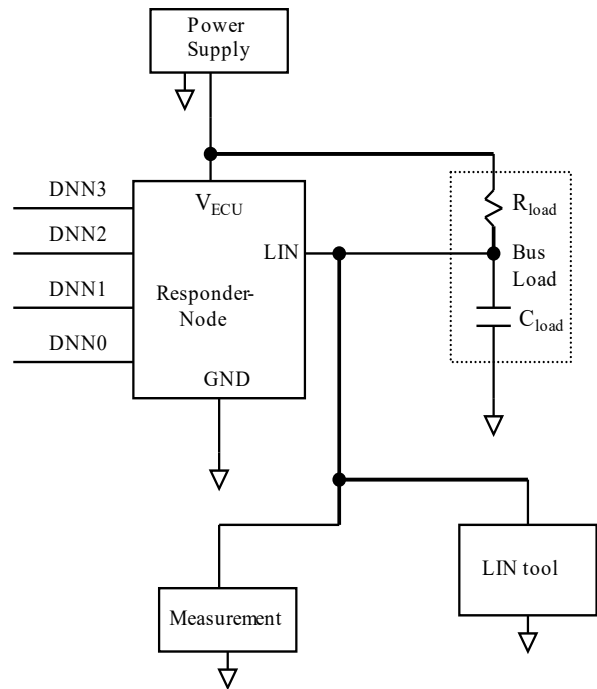


Figure 5 - Hardware selectable DNN test setup

Table 15A - Hardware selectable DNN test plan

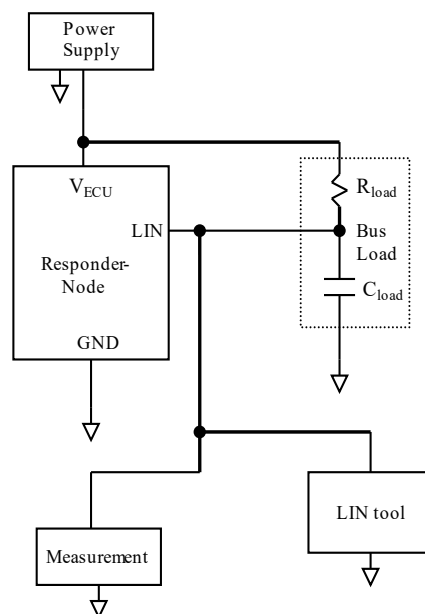
DUT Node as	Responder-node With C = 220 pF	Test Case 5.9.4.1.1
Parameter	V _{ECU} R _{load} and C _{load}	12 V 1 kΩ, 680 pF
Test Steps	See Table 15B	
Response	See Table 15B	
Reference	SAE J2602-1, 5.9.4	

Table 15B - Hardware selectable DNN test plan

# Test	Test Steps	Response
5.9.4.1.1	1. Set DNN = \$0. 2. X = \$01. 3. Send a \$3C targeted reset to NAD = X. 4. Send a \$3D request. 5. X = X+1. 6. If X = \$7F, X = X+1. 7. If X ≤ \$FF, go to 3. 8. Set DNN = DNN+1. 9. If DNN ≤ \$D, go to 2.	In step 4, the DUT must transmit a response when X = \$6(DNN); otherwise, there must be no response sent.

5.9.4.1.2 Fixed DNN (DUT as Responder-Node)

This test verifies the NAD of the DUT.

**Figure 6 - Fixed DNN test setup****Table 16A - Fixed DNN test plan**

DUT Node as	Responder-node With C = 220 pF	Test Case 5.9.4.1.2
Parameter	V _{ECU} R _{load} and C _{load}	12 V 1 kΩ, 680 pF
Test Steps	Perform test with each available fixed NAD See Table 16B	
Response	See Table 16B	
Reference	SAE J2602-1, 5.9.4	

Table 16B - Fixed DNN test plan

# Test	Test Steps	Response
5.9.4.1.2	1. X = \$01. 2. Send a \$3C targeted reset to NAD = X. 3. Send a \$3D request. 4. X = X+1. 5. If X = \$7F, X = X+1. 6. If X ≤ \$FF, go to 2.	In step 3, the DUT must transmit a response when X = NAD of the DUT; otherwise, there must be no response sent.

5.9.4.1.3 Software Programmable DNN (DUT as Responder-Node)

This test verifies that the DUT takes on the proper NAD based on the programmed DNN.

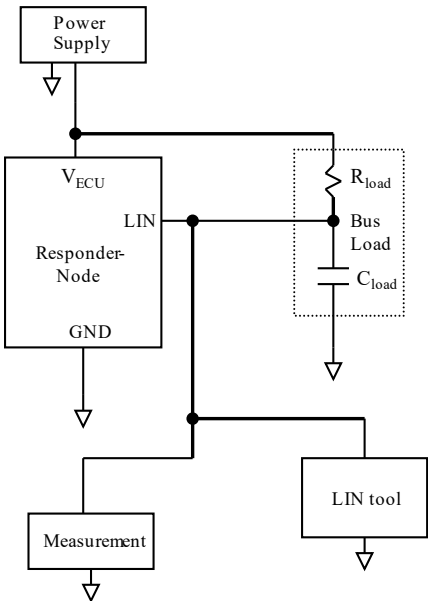


Figure 7 - Software programmable DNN test setup

Table 17A - Software programmable DNN test plan

DUT Node as	Responder-node With C = 220 pF	Test Case 5.9.4.1.3
Parameter	V _{ECU} R _{load} and C _{load} DNN	12 V 1 kΩ, 680 pF \$F at start of test (uninitialized device)
Test Steps	See Table 17B	
Response	See Table 17B	
Reference	SAE J2602-1, 5.9	