

 SURFACE VEHICLE RECOMMENDED PRACTICE	SAE J1939-82 AUG2008	
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Compliance—Truck and Bus		

RATIONALE

Not applicable.

FOREWORD

This series of SAE Recommended Practices has been developed by the Truck and Bus Control and Communications Network Subcommittee of the Truck and Bus Electrical and Electronics Committee. The objectives of the subcommittee are to develop information reports, recommended practices, and standards concerned with the requirements, design, and usage of devices that transmit electronic signals and control information among vehicle components. The usage of these Recommended Practices is not limited to truck and bus applications. Other applications may be accommodated with immediate support being provided for construction and agricultural equipment, and stationary power systems. These SAE Recommended Practices are intended as a guide toward standard practice and are subject to change so as to keep pace with experience and technical advances.

This particular document, SAE J1939-82, describes the compliance tests and procedures to verify an SAE J1939 ECU will operate correctly on a SAE J1939 network. This compliance document is used for all SAE J1939 applications.

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1. SCOPE

The purpose of these compliance procedures is to generate one or more test documents that outline the tests needed to assure that an ECU that is designed to operate as a node on a SAE J1939 network would do so correctly. SAE does not certify devices and these tests and their results do not constitute endorsement by SAE of any particular device. These tests are presented to allow testing of a Device to determine self-compliance by the manufacturer of a device. The manufacturer can use its record of what procedures were run successfully to show the level of compliance with SAE J1939.

2. REFERENCES

This specification takes precedence over all conflicts in the documents cited in this section.

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, 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 724-776-4970 (outside USA), www.sae.org.

SAE J1455 Recommended Environmental Practices for Electronic Equipment Design in Heavy-Duty Vehicle Applications

SAE J1939 Recommended Practice for a Serial Control and Communications Vehicle Network

SAE J1939-11 Physical Layer, 250K bits/s, Twisted Shielded Pair

SAE J1939-15 Reduced Physical Layer, 250K Bits/Sec, Un-Shielded Twisted Pair (UTP)

SAE J1939-21 Data Link Layer

SAE J1939-31 Network Layer

SAE J1939-81 Network Management

2.1.2 ISO Publications

Available from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 11898-1 Road vehicles—Controller area network (CAN)—Part 1: Data link layer and physical signaling

3. DEFINITIONS

Terms and definitions are defined in SAE J1939, except the following:

3.1 Certification

Public announcement, using documentation with signatures from a member of a duly recognized competent body (i.e. UL, TUV, CSA), to give notice that a given device has been tested and found to meet all necessary issues of a particular requirement or standard, whether legislated or of purely common industrial usage.

3.2 Compliance

Announcement that a device has been tested and found to meet a particular set (not necessarily all) of issues of a particular requirement or standard, without any supporting signatures from a recognized standard agency as performed by a third party investigator.

3.3 Self-Compliance

Announcement that a device has been tested and found to meet a particular set (not necessarily all) of issues of a particular requirement or standard, without any supporting signatures from a recognized standard agency.

4. ABBREVIATIONS

CTC Compliance Test Computer
DUT Device Under Test

5. EQUIPMENT

The Standard Test Configuration will contain two nodes, the Compliance Test Computer (CTC) and the Device Under Test (DUT), with appropriate media and termination, as well as power supplies and DUT loads.

5.1 Compliance Test Computer (CTC)

A Compliance Test Computer with the following capabilities:

5.1.1 Message Transmission

Must be able to send any specified message.

5.1.2 Message Reception

Must be able to receive all bus messages.

5.1.3 Time Stamp

Must be able to time stamp at the beginning of received messages at the required resolution.

5.1.4 Time Resolution

Must possess a minimum time resolution of 10 microsecond. The actual time resolution must be specified.

5.1.5 Time Stamp Accuracy

The error between any two timestamps shall be less than 1% of the time difference between the two timestamps or 1 millisecond, whichever is greater.

5.1.6 Time Stamp Latency Error

Must be less than 1 count of the time resolution.

5.1.7 Transmission Synchronization

Must be able to control the time between messages it transmits.

5.1.8 Reception Timeout

In cases where DUT should have 'no response' the CTC must be able to monitor that no response message is transmitted by the DUT for a minimum time equal to the allowed transmission response time plus two times the allowed latency (for example when transmission should be within 200 milliseconds and 50 millisecond latency is allowed then CTC must check for a minimum time of 300 milliseconds). Longer times are at the discretion of the designers.

5.1.9 CAN Interface

At least one CAN interface is required. Two CAN interfaces are required for testing Bridge functions.

5.2 Device Under Test (DUT)

The Device Under Test with the following features:

5.2.1 Operation

Must be able to perform its normal intended use (not operating any special testing mode of operation).

5.2.2 Controls

Must be able to initiate the action under test when directed.

6. SETUP

The setup will consist of a minimum network with two nodes. Any additional requirements for a specific test procedure will be specified within that procedure.

6.1 Minimum Network

Two nodes, the DUT and the CTC, with terminations, a short length of the appropriate media, power supplies.

6.2 Message Traffic

Minimal normal network traffic, only the messages necessary for the specific test procedure (see 5.2.1).

6.3 Test Message Set

Messages that are applicable to a specific test procedure will be listed in the test outline. This message list will be broken into two pieces: those supported for reception and those supported for transmission.

7. TEST SELECTION

The procedure to select a test or set thereof, necessary to check for compliance to a particular function or set of functions from the standard, are outlined within Appendix A. Appendix A is broken into tables, which identify functions, based on which document section(s) they are described within. Some tests will be pointed to by more than one entry.

7.1 Document Identifying Test

The specific document identifying a particular function will be outlined with any necessary cross-references within a Table for the specific task force document.

7.2 Requirement versus Device Characteristics

The 'SAE and User Requirements' status of each function will be cross referenced with the Device Characteristics (such as: Arbitrary Address Capable, Command Configurable, Diagnostic Tool, etc.) that will affect whether a device should provide said function.

8. RUNNING A TEST

The steps necessary to run a test are outlined as follows:

8.1 Identify Test

Using Appendix A the reviewer should identify the test number(s) necessary to check any particular function(s) that they desire. Note that all tests are not applicable to all systems. The "Requiring Document" column refers the reviewer to the appropriate document section the test is intended to cover.

8.2 Report Generation

Using APPENDIX A the reviewer should document the test(s) performed and the results, as well as whether the device had requirement exceptions (additions or exclusions) for each of the particular functions.

9. REPORTING COMPLIANCE TEST RESULTS

Appendix A, Compliance Tests, contains columns in the forms for reporting the results of compliance testing. These columns are used to report the test date, whether a particular test is required for the specific device being tested and whether the test has been run, as well as whether the device passed (complied with) the test.

9.1 Self-Compliance

Appendix A is intended to be used by an OEM as self-compliance documentation. When certifying a device the OEM can indicate whether that the device is intended to provide each function, as well as the general level to which the device is designed. The passage of each function by the particular device can then be documented along with the date of testing. The inclusion of the specific test number(s) should enable future comparison among devices, as well as, among testers.

9.2 Device Support

The reporting forms record the test(s) conducted, the test results, and whether a device is intended to support a particular function, which makes these reporting forms very helpful to a customer locating a desired device.

PREPARED BY THE SAE TRUCK AND BUS CONTROL AND COMMUNICATIONS NETWORK SUBCOMMITTEE
OF THE SAE TRUCK AND BUS ELECTRICAL AND ELECTRONICS COMMITTEE

APPENDIX A - COMPLIANCE TESTS

A.1 INTRODUCTION

Tables herein describe tests and/or procedures needed to check compliance of a device against each requirement of the SAE J1939 document set. The sections are divided by document title with section number references to the specific text defining a function and its operation. The tables include all described network functions not simply minimum requirements. The requirement to perform a test or procedure for an ECU can be discerned by looking in the applicable ECU Class columns under the 'SAE and User Requirements' heading. See Section A.2.5 below for more details about interpreting testing requirements.

A.2 TEST OUTLINE TABLE STRUCTURE AND COLUMN DEFINITIONS

The following definitions and values are identified to enable completion of the entries into the respective columns of the compliance test tables.

A.2.1 Row

Provides a numeric tag to use in references to particular tests.

A.2.2 Test Name

Name or title for the particular test.

A.2.3 Requiring Document

Specifies the source of the particular item. Usually this will be a particular section of a SAE J1939-xx document.

A.2.4 Description

Provides a short outline of the identified feature and the test.

A.2.5 SAE and User Requirements

The SAE and User Requirements consists of several 'ECU Classes' columns and a User column. The set of columns under the 'ECU Class' heading are used to identify the necessity to check compliance to a particular test, based upon the ECU class. The column under the 'User Add./Excl.' heading is provided to allow users to customize the necessity to check compliance to a particular test. An 'X' in any of the 'ECU Classes' columns implies the test is required by SAE for that ECU Class (see A.2.5.2 below for ECU Class definition). A 'D' in the User column implies this test is desired as an additional feature for the particular ECU under test. An 'E' implies that the ECU under test is not required to provide this feature even when it might be a requirement.

- The presence of a code in an 'ECU Class' column conveys a requirement to evaluate the test for an ECU of that class.
- The presence of a code in the 'User Add./Excl.' column conveys a requirement to evaluate the test per the requirements of the 'user'.
- The absence of a code in a 'SAE and User Requirements' column indicates there is no explicit requirement to evaluate the test for an ECU of that class or per the requirements of the 'user'.

A.2.5.1 Requirement Codes

There are currently three (3) codes defined to denote the requirement for evaluating a particular test. New codes will be added as the need is identified. The test requirement codes supported for the Test Outlines are summarized in Table A1.

TABLE A1 - TEST REQUIREMENT CODES

Code	Meaning	Specified By
X	Compliance to the test is Required by SAE for that ECU Class	SAE J1939 Subcommittee
D	Compliance to the test is Desired as an additional feature for the particular ECU under test	User
E	Compliance to the test is not required (i.e. may be excluded) for the test ECU, even though the test might be a requirement for the ECU Class	User

A.2.5.2 For example, an 'X' in any of the 'ECU Classes' columns implies the test is required by SAE for that ECU Class. A 'D' in the 'User Add./Excl.' column implies this test is desired as an additional feature for the particular ECU under test. An 'E' in the 'User Add./Excl.' column implies that the ECU under test is not required to provide this feature even when it might be a requirement. The marking of these extra conditions would enable the tables to be used for test reporting or purchasing specification, as well as to identify all the compliance tests. ECU Class

There are currently seven (7) ECU Classes defined for testing requirement association. New ECU Classes will be added as the need is identified. The ECU Class codes supported for the Test Outlines are summarized in Table A2.

TABLE A2 - ECU CLASS CODES

ECU Class Code	Code Description	Description of Applicable ECUs
ALL	All ECUs	All SAE J1939 ECUs, regardless of the ECU's design function or specifications
BDG	Network Interconnect ECUs	General network interconnect devices (bridge, router, etc...)
AAC	'Arbitrary Address Capable' ECUs	ECUs or Controller Applications that are 'Arbitrary Address Capable' regarding address claim
CC	'Command Configurable' Address ECUs	ECUs or Controller Applications that support 'Command Configurable' addressing
SC	'Self Configurable' Address ECUs	ECUs or Controller Applications that are 'Self Configurable' regarding address claim
TOO	Tool	ECU's that are to function as a 'tool'
EMS	On-Highway Emissions Regulated ECUs	ECU's are operating with On-Highway Emissions regulated engines

A.2.5.3 User Add./Excl.

The 'User Add./Excl.' column provides a place for the "User" to indicate the Addition (D) or Exclusion (E) of the test for a test ECU. The "User" is the user of this document and could be a purchasing agent, a system specifier, a supplier, a tester, etc. The marking of these extra conditions enable the tables to be used for test reporting or other specification, such as purchasing specification, as well as to identify all the compliance tests.

A.2.6 Date Tested

Identifies the date the test was conducted.

A.2.7 Pass - Fail

Record the test results. The designation choices are

P for Pass

F for Fail

A.2.8 Test Result Comments

Record the comments the tester or others may choose to include.

A.3 COMPLIANCE TESTS FOR DATA LINK LAYER (J1939-21)

A.3.1 Data Link Layer Tests - Transmit Behavior

The Compliance Tests in Table A3 evaluate the general message transmit behaviors of the DUT. The tests for evaluating the behaviors of the DUT as the data source using the Transport Protocols are presented in Table A5 and Table A7.

TABLE A3 - DATA LINK TRANSMIT TESTS - GENERAL

[illegible]

TABLE A3 - DATA LINK TRANSMIT TESTS - GENERAL (CONTINUED)

[illegible]

A.3.2 Data Link Layer Tests - Receive Behavior

The Compliance Tests in Table A4 evaluate the general message receive behaviors of the DUT. The tests for evaluating the behaviors of the DUT as the data recipient using Transport Protocol are presented in Table A6 and Table A8.

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL

[illegible]

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

[illegible]

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

[illegible]

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

[illegible]

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

[illegible]

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

[illegible]

A.3.3 Data Link Layer Tests - BAM Originator Behaviors

The Compliance Tests in Table A5 evaluate the behaviors of the DUT as the data originator for the SAE J1939 Transport Protocol BAM service. The SAE J1939 Transport Protocol RTS/CTS tests for the data originator are presented in Table A7.

TABLE A5 - DATA LINK TRANSMIT TEST - TP BAM

[illegible]

TABLE A5 - DATA LINK TRANSMIT TEST - TP BAM (CONTINUED)

[illegible]

A.3.4 Data Link Layer Tests - BAM Receive Behaviors

The Compliance Tests in Table A6 evaluate the behaviors of the DUT as the data recipient for the SAE J1939 Transport Protocol BAM service. The SAE J1939 Transport Protocol RTS/CTS tests for the data recipient are presented in Table A8.

TABLE A6 - DATA LINK RECEIVE TESTS - TP BAM

[illegible]

SAE

[illegible]

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS (CONTINUED)

[illegible]

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS (CONTINUED)

[illegible]

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS (CONTINUED)

[illegible]

A.3.6 Data Link Layer Tests - RTS/CTS Transport Protocol Responder Behaviors

The Compliance Tests in Table A8 evaluate the behaviors of the DUT as the data recipient (Responder) for the SAE J1939 Transport Protocol RTS/CTS service. The SAE J1939 Transport Protocol BAM tests for the data recipient are presented in Table A6.

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS

[illegible]

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

[illegible]

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

[illegible]

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

[illegible]

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

[illegible]

TABLE A9 - NETWORK LAYER TESTS (CONTINUED)

[illegible]

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TABLE A10 - NETWORK MANAGEMENT TESTS (CONTINUED)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded												Date Tested	Pass-Fail	Test Result Comments
				ECU Classes						User		Add./Excl						
				A L	B D	A A	C C	C C	O O	T O	E M							
7	Request for Address Claimed	J1939-81 4.2.1	Verify an ECU responds to a request for address claimed with an Address Claimed/Cannot Claim message (or nothing if that ECU has not yet attempted to claim an address).	X														
8	Address Claimed Cannot Claim	J1939-81 4.2.2	Verify an ECU sends an Address Claimed message upon initialization and waits for the defined period (250 ms or 50 ms) before resuming normal network traffic.	X														
9	Address Claimed Cannot Claim	J1939-81 4.2.2	Verify an ECU receiving an Address Claimed message with a lower priority claiming it's own source address responds with an Address Claimed Message.	X														
10	Address Claimed Cannot Claim	J1939-81 4.2.2	Verify an ECU receiving an Address Claimed message with a higher priority claiming it's own source address either attempts to claim a new address or responds with a Cannot Claim message after a time delay.	X														
11	Address Not Claimed	J1939-81 4.2.2.3	Verify an ECU that cannot claim an address sends the Cannot Claim message in response to the Request for Address Claimed. No other messages shall be sent.	X														
12	Power Interruption	J1939-81 4.5.1	Verify an ECU does not perform network initialization with a power loss < 2ms. Verify an ECU does perform network initialization with a power loss > 1 second.	X	X	X	X	X							X			

TABLE A10 - NETWORK MANANEMENT TESTS (CONTINUED)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded												Date Tested	Pass-Fail	Test Result Comments
				ECU Classes						User								
				A	B	A	C	S	T	E	M	Add./	Excl.					
				L	D	G	C	C	O	O	S							
13	Network Disruption	J1939-81 4.5.2.3	Verify that an ECU can be connected, disconnected, and powered up without disrupting network communications.	X														
14	Address Continuity	J1939-81 4.5.2.4	Verify that an ECU attempts (if applicable) to use the same address and addresses for ECUs that are communicated with across power-down and power-up cycles.		X					X								

TABLE A11 - PHYSICAL LAYER TESTS

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded														Date Tested	Pass-Fail	Test Result Comments
				ECU Classes									User							
				A			B			C			Add./	Excl						
				L	D	G	A	D	A	C	C	C			S	O	M			
1	J1939-11 physical layer	J1939-11	Verify to requirements of SAE J1939-11 Conformance Tests.																	
2	J1939-15 physical layer	J1939-15	Verify to requirements of SAE J1939-15 Conformance Tests.																	

APPENDIX B - FORMAT FOR COMPLIANCE TEST REPORTING FORMS

The Tables herein shows the format that should be used for reporting compliance tests results. Such a form could serve for self-certifying compliance, as well as for ordering to identify what functions a given device can or must support.

B.1 COMPLIANCE TEST REPORTING FORMS

This form shows the format for reporting the results of compliance tests conducted to SAE J1939 Recommended Practice, Appendix A of SAE J1939-82 contains a set of forms listing all the compliance tests as well as this reporting formatting.

See SAE J1939-82 Appendix A Section A.2.5.2 for a definition of 'Class' for an ECU.

[illegible]