INTERNATIONAL STANDARD

ISO 9141-2

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Road vehicles — Diagnostic systems —

Part 2:
CARB requirements for interchange of digital information

Véhicules routiers — Systèmes de diagnostic —

Partie 2: Caractéristiques CARB de l'échange de données numériques

Reference number
ISO 9141-2:1994(E)

Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

International Standard ISO 9141-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Sub-Committee SC 3, *Electrical and electronic equipment*.

ISO 9141 consists of the following part, under the general title *Road vehicles — Diagnostic systems:*

— *Part 2: CARB requirements for interchange of digital information.*

NOTE — ISO 9141:1989, *Road vehicles — Diagnostic systems — Requirements for interchange of digital information*, is regarded as being part 1 of this International Standard.

Annex A forms an integral part of this part of ISO 9141.

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Road vehicles — Diagnostic systems —

Part 2:
CARB requirements for interchange of digital information

1 Scope

This part of ISO 9141 describes a subset of ISO 9141:1989. It specifies the requirements for setting up the interchange of digital information between on-board emission-related Electronic Control Units (ECUs) of road vehicles and the SAE OBD II scan tool as specified in SAE J1978. This communication is established to facilitate compliance with California Code of Regulation, Title 13, 1968.1, *Malfunction and Diagnostic Systems Requirements, 1994 and subsequent model year passenger cars, light-duty trucks, and medium duty vehicles with feedback fuel control systems.*

This part of ISO 9141 is limited to vehicles with nominal 12 V supply voltage.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9141. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9141 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7637-1:1990, *Road vehicles — Electrical disturbance by conduction and coupling — Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage — Electrical transient conduction along supply lines only.*

ISO 9141:1989, *Road vehicles — Diagnostic systems — Requirements for interchange of digital information.*

SAE J1962, *Diagnostic Connector.*

SAE J1978, *OBD II Scan Tool.*

SAE J1979, *E/E Diagnostic Test Modes.*

SAE J2012, *Format and Messages for Diagnostic Trouble Codes.*

California Code of Regulation, Title 13, 1968.1, *Malfunction and Diagnostic Systems Requirements.*

3 Definitions

For the purposes of this part of ISO 9141, the definitions given in ISO 9141 apply.

4 Specific configurations

4.1 Vehicle ECUs required by OBD II to communicate with the SAE J1978 OBD II scan tool shall support either a one-wire (K line only) or a two-wire (K and L line) communication connection to the SAE J1978 OB II scan tool through the SAE J1962 diagnostic connector. Vehicle battery voltage, V_B, power ground and signal ground shall be provided by ECUs or the vehicle to the SAE J1962 diagnostic connector. Pin assignment of the diagnostic connector shall be in accordance with SAE J1962.

Line K is a bidirectional line. It is used during initialization to convey address information from the diagnostic tester to vehicle ECUs, simultaneously with the line L. After conveying the address, the K line is used to convey bidirectional data between vehicle ECUs and the diagnostic tester to complete initialization. After initialization, it is used to convey request messages from the diagnostic tester to vehicle ECUs and response messages from the vehicle ECUs to the diagnostic tester.

Line L is a unidirectional line and is only used during initialization to convey address information from the diagnostic tester to vehicle ECUs, simultaneously with the K line. At all other times it should idle in the logic "1" state.

Figure 1 shows the system configurations indicating the role of each of the communication lines K and L.

4.2 If any ECUs, either of one type or in combination, are linked on a bus, the system designer shall ensure that the configuration is capable of correct operation. For example, data from one ECU shall not initialize the serial communication of another ECU on the bus and an initialization signal shall not cause more than one ECU to respond simultaneously; it may, however, initialize a number of ECUs on the bus which then respond in an orderly sequential manner.

If lines K and L are used for purposes other than inspection, test and diagnosis, care shall be taken to avoid data collision and incorrect operation in all modes.

5 Signal and communication specifications

5.1 Signal

For proper operation of the serial communication, both ECU and diagnostic tester shall correctly determine each logic state as follows:

— a logic "0" is equivalent to a voltage level on the line of less than 20 % V_B for transmitter, 30 % V_B for receiver;

— a logic "1" is equivalent to a voltage level on the line of greater than 80 % V_B for transmitter, 70 % V_B for receiver.

In addition, the slope times shall be less than 10 % of the bit time. The slope times are defined as the time taken for the voltage to change from 20 % to 80 % V_B, and from 80 % to 20 % V_B for transmitters. Voltage levels between 30 % and 70 % of V_B may be detected as either logic "1" or logic "0". NRZ (Non-Return-to Zero) coding shall be used. The bit time is defined as half of the time between the 50 % V_B levels of successive rising or falling edges of alternating "1" and "0" bits.

Figure 2 illustrates the worst case on signal levels. For electrical specifications of diagnostic testers, see 8.3 and of ECUs, see 9.2.

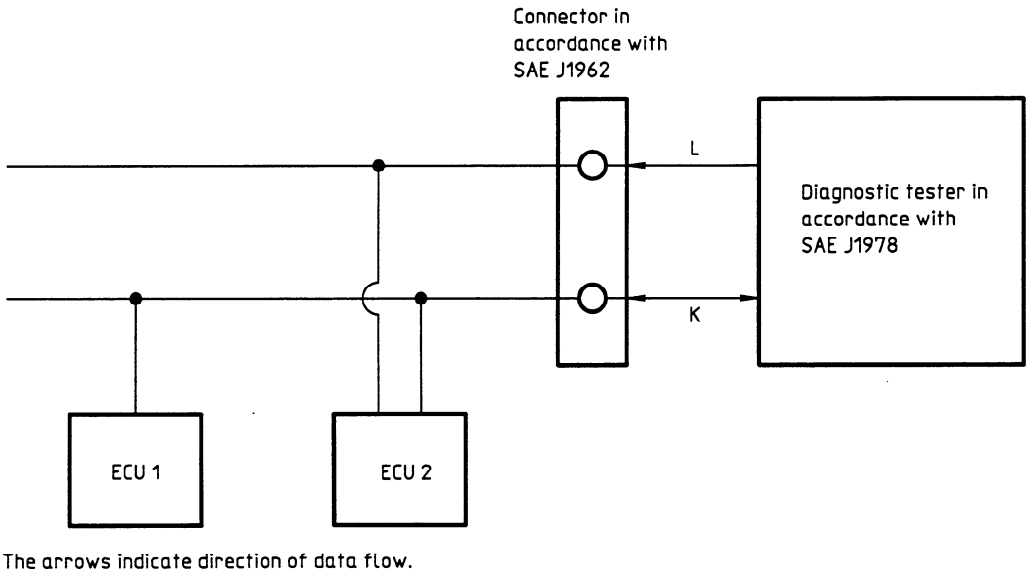

Figure 1 — Possible system configuration

5.2 Communication specification

5.2.1 The configuration is shown schematically in figure 3.

5.2.2 The capacitance contribution of the diagnostic tester according to SAE J1978 and the cables are termed C_{TE}. The capacitance contribution of the on-board wiring is termed C_{OBW}. The sum of the input capacitances of all ECUs on the bus is defined thus:

$$C_{ECU} = \sum_{i=1}^{n} C_{ECUi}$$

where n is the number of ECUs on the bus.

Values for C_{ECU} and C_{OBW} shall be selected such that

$$C_{ECU} + C_{OBW} \leqslant 7{,}6 \text{ nF}$$

and

$$C_{TE} \leqslant 2 \text{ nF}$$

These values are derived from the maximum communication speed (see clause 8) and the circuit resistance (see clause 9).

6 Initialization of vehicle prior to serial communication

The time periods referred to in this clause shall be as defined in tables A.1 and A.2.

In order to communicate with the diagnostic tester, the initialization shall be achieved by transmission of a 5-bit/s address by the diagnostic tester to the vehicle which shall comprise a single byte constructed as shown in figure 4, making an 8-bit address on lines K and L.

In order to invoke communication in the format described in clause 11, the address shall be 33_H. Other addresses may produce responses according to the vehicle manufacturer's definition or future standardization.

Before the initialization, the line K shall be logic "1" for the time period W_0.

Each address byte shall consist of

a) one start bit — logic "0" for one bit duration;

b) 8 bits, the least significant bit (LSB) being sent first;

c) one stop bit — logic "1" for one bit duration.

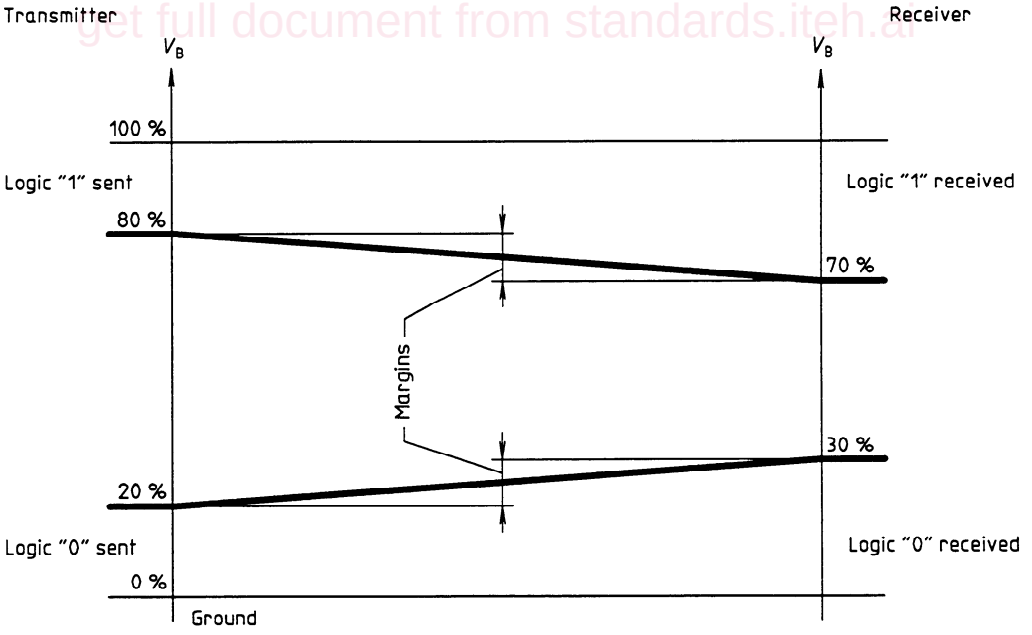

Figure 2 — Signal voltage levels, worst-case values