
**Road vehicles — Diagnostic
communication over K-Line (DoK-Line) —**

**Part 1:
Physical layer**

Véhicules routiers — Communication de diagnostic sur la ligne K (DoK-Line) —

Partie 1: Couche physique

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ISO 14230-1:2012

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14230-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 14230-1:1999), which has been technically revised.

ISO 14230 consists of the following parts, under the general title *Road vehicles — Diagnostic communication over K-Line (DoK-Line)*:

— Part 1: Physical layer

— Part 2: Data link layer

— Part 3: Application layer

— Part 4: Requirements for emission-related systems

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Introduction

ISO 14230 has been established in order to define common requirements for vehicle diagnostic systems implemented on K-Line (UART based) communication link, as specified in this part of ISO 14230.

To achieve this, it is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO/IEC 7498-1 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the services specified by ISO 14230 are broken down into the following.

- a) Diagnostic services (layer 7), specified in ISO 14229-6, ISO 14229-1;
- b) Presentation layer (layer 6):
 - vehicle manufacturer specific,
 - legislated OBD: specified in ISO 15031-2, ISO 15031-5, ISO 15031-6, SAE J1930-DA, SAE J1979-DA, SAE J2012-DA,
 - legislated WWH-OBD: specified in ISO 27145-2, SAE J1930-DA, SAE J1979-DA, SAE J2012-DA, SAE J1939 Appendix C (SPNs), SAE J1939-73 Appendix A (FMIs);
- c) Session layer services (layer 5):
 - legislated OBD: specified in ISO 14229-2,
 - legislated WWH-OBD: specified in ISO 14229-2;
- d) Transport layer services (layer 4), specified in ISO 14230-2;
- e) Network layer services (layer 3), specified in ISO 14230-2;
- f) Data link layer (layer 2), specified in ISO 14230-4, ISO 14230-2;
- g) Physical layer (layer 1), specified in ISO 15765-4, ISO 14230-1.

This breakdown is shown in Table 1.

Table 1 — Enhanced and legislated OBD diagnostic specifications applicable to the OSI layers

Applicability	OSI 7 layer	Vehicle manufacturer enhanced diagnostics	Legislated OBD (On-Board Diagnostics)		Legislated WWH-OBD (On-Board Diagnostics)	
Seven layers according to ISO 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 14229-1, ISO 14229-6	ISO 15031-5		ISO 14229-1, ISO 27145-3	
	Presentation (layer 6)	vehicle manufacturer specific	ISO 15031-2, ISO 15031-5, ISO 15031-6, SAE J1930-DA, SAE J1979-DA, SAE J2012-DA		ISO 27145-2, SAE 1930-DA, SAE J1979-DA, SAE J2012-DA, SAE J1939:2011 Appendix C (SPNs), SAE J1939-73:2010 Appendix A (FMIs)	
	Session (layer 5)	ISO 14229-2				
	Transport (layer 4)	ISO 14230-2	ISO 15765-2	ISO 15765-4	ISO 15765-4, ISO 15765-2	
	Network (layer 3)				ISO 27145-4	
	Data link (layer 2)	ISO 14230-2	ISO 11898-1, ISO 11898-2		ISO 15765-4, ISO 11898-1, ISO 11898-2	
	Physical (layer 1)	ISO 14230-1				

The application layer services covered by ISO 14229-6 have been defined in compliance with diagnostic services established in ISO 14229-1 and ISO 15031-5, but are not limited to use only with them. ISO 14229-6 is also compatible with most diagnostic services defined in national standards or vehicle manufacturers' specifications.

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Road vehicles — Diagnostic communication over K-Line (DoK-Line) —

Part 1: Physical layer

1 Scope

This part of ISO 14230 specifies the physical layer, based on ISO 9141, on which the diagnostic services will be implemented. It is based on the physical layer described in ISO 9141-2, but expanded to allow for road vehicles with either 12 V d.c. or 24 V d.c. voltage supply.

NOTE In this part of ISO 14230, values given in parentheses apply to 24 V d.c. systems.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7637-1, *Road vehicles — Electrical disturbances from conduction and coupling — Part 1: Definitions and general considerations*

ISO 7637-2, *Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only*

ISO 14230-2, *Road vehicles — Diagnostic communication over K-Line (DoK-Line) — Part 2: Data link layer*

ISO 15031-2, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 2: Guidance on terms, definitions, abbreviations and acronyms*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15031-2 and the following apply.

3.1.1

rise time

<transmitters> time taken for the voltage to change from $20 V_B/100$ to $80 V_B/100$, where V_B is the vehicle battery voltage

3.1.2

fall time

<transmitters> time taken for the voltage to change from $80 V_B/100$ to $20 V_B/100$, where V_B is the vehicle battery voltage

3.2 Abbreviated terms

C_{TE} capacitance contribution of external test equipment and associated cables

C_{OBW} capacitance contribution of on-board wiring

- C_{ECU} capacitance contribution of electronic control unit
- ECU electronic control unit
- EMI electromagnetic interference
- NRZ non-return to zero
- V_B vehicle battery voltage

4 Conventions

This part of ISO 14230 is based on the conventions discussed in the OSI Service Conventions (ISO/IEC 10731:1994) as they apply for communication services.

5 Document overview

Figure 1 illustrates the most applicable application implementations utilizing the DoK-Line protocol.

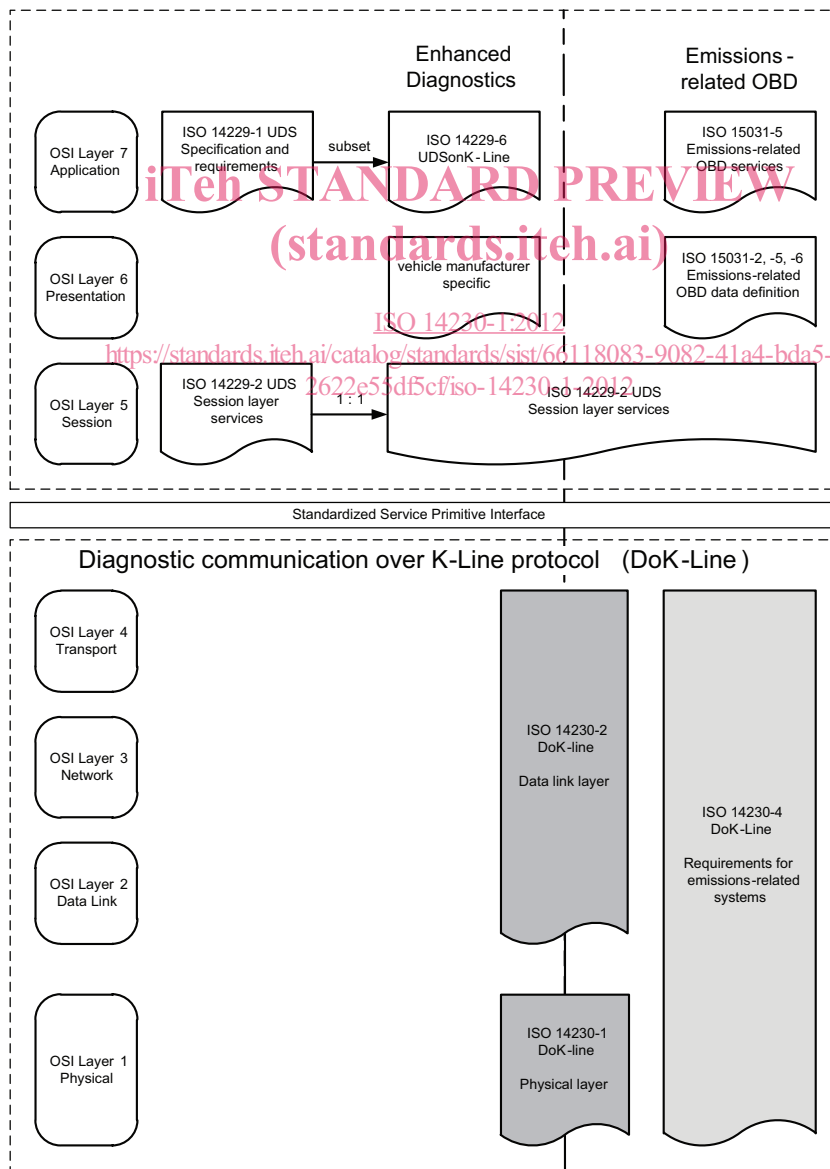


Figure 1 — Diagnostic communication over K-Line document reference according to OSI model

6 Vehicle to external test equipment connection

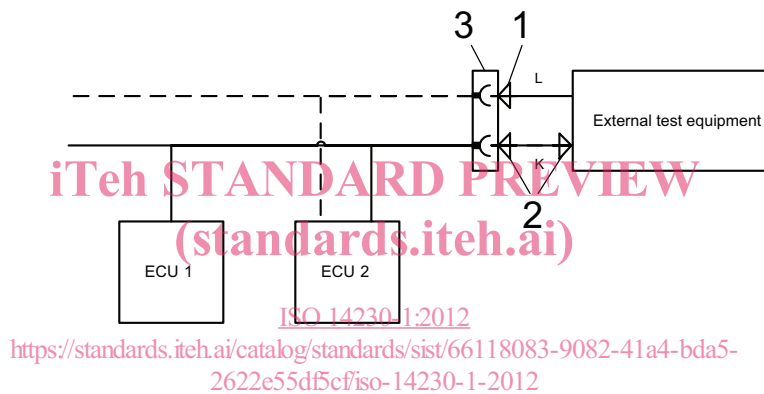
6.1 K- and L-line configurations

Vehicle ECUs which support the protocol described in ISO 14230 shall support either a one-wire (K line only) or a two-wire (K and L) communication connection for diagnosis, test or maintenance. Vehicle battery voltage, V_B , power ground and signal ground shall be provided by the ECU(s) or the vehicle to the tester.

Line K is a bidirectional line. It is used during initialization to convey address information or, in the case of fast initialization, the wake-up pattern from the external test equipment to vehicle ECUs, simultaneously with the L line. After conveying this information, the K line is used for all other diagnostic communications between tester and vehicle ECUs, in both directions. This includes the completion of the initialization sequence and all other communication services as described in ISO 14230-2.

Line L is a unidirectional line and is only used during initialization to convey address information or, in the case of fast initialization, the wake-up pattern from the external test equipment to vehicle ECUs, simultaneously with the K line. At all other times, it should idle in the logic "1" state.

Figure 2 shows the system configurations allowed, indicating the role of each of the lines K and L.



Key

- 1 unidirectional data flow from external test equipment to ECU 2
- 2 bidirectional data flow between external test equipment and ECUs 1 and 2
- 3 vehicle diagnostic connector

Figure 2 — Possible system configurations

6.2 Configuration requirements

If any ECU, 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.