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

**Part 2:  
Data link layer**

**iTeh STANDARD PREVIEW**  
*Véhicules routiers — Communication de diagnostic sur la ligne K  
(DoK-Line) —  
Partie 2: Couche de liaison de données*  
**(standards.iteh.ai)**

[ISO 14230-2:2013](https://standards.iteh.ai/catalog/standards/sist/9af79d0b-da74-41cc-92da-7d0593b048e3/iso-14230-2-2013)

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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 14230-2 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 14230-2:1999), 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* [ISO 14230-2:2013](https://standards.iteh.ai/catalog/standards/sist/9af79d0b-da74-41cc-92da-7d0593b048e3/iso-14230-2-2013)
- *Part 2: Data link layer* <https://standards.iteh.ai/catalog/standards/sist/9af79d0b-da74-41cc-92da-7d0593b048e3/iso-14230-2-2013>
- *Part 3: Application layer*
- *Part 4: Requirements for emission-related systems*

## Introduction

This part of 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 ISO 14230-1.

To achieve this, it is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO/IEC 7498-1:1994 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the services specified by ISO 14230 are broken into:

- Diagnostic services (layer 7), specified in ISO 14229-1, ISO 14229-6,
- Presentation layer (layer 6),
  - vehicle manufacturer specific,
  - legislated WWH-OBD: specified in ISO 27145-2, SAE J1930-DA, SAE J1979-DA, SAE J2012-DA, SAE J1939, Companion Spreadsheet (SPNs), SAE J1939-73:2010, Appendix A (FMIs),
- Session layer services (layer 5),
  - legislated OBD: specified in ISO 14229-2,
  - legislated WWH-OBD: specified in ISO 14229-2,
- Transport layer services (layer 4), specified in ISO 14230-2,
- Network layer services (layer 3), specified in ISO 14230-2,
- Data link layer (layer 2), specified in ISO 14230-4, ISO 14230-2,
- Physical layer (layer 1), specified in ISO 14230-1.

This breakdown is shown in [Table 1](https://standards.iteh.ai/catalog/standards/sist/9af79d0b-da74-41cc-92da-7d0593b048e3/iso-14230-2-2013).

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

Applicability	OSI seven layer	Enhanced diagnostics	Legislated OBD (On-Board Diagnostics)		Legislated WWH-OBD (On-Board Diagnostics)	
Seven layer according to ISO/IEC 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 J1939 Companion Spreadsheet (SPNs), SAE J1939-73:2010, Appendix A (FMIs), SAE J1979-DA, SAE J2012-DA,	
	Session (layer 5)	ISO 14229-2				
	Transport (layer 4)	ISO 14230-2	ISO 15765-2	ISO 15765-4	ISO 15765-4, ISO 15765-2	ISO 27145-4
	Network (layer 3)		ISO 11898-1, ISO 11898-2		ISO 15765-4, ISO 11898-1, ISO 11898-2	
	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 14230-2:2013(E)

ISO 14229-6 is also compatible with most diagnostic services defined in national standards or vehicle manufacturer's specifications.

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

## Part 2: Data link layer

### 1 Scope

This part of ISO 14230 specifies data link layer services tailored to meet the requirements of UART-based vehicle communication systems on K-Line as specified in ISO 14230-1. It has been defined in accordance with the diagnostic services established in ISO 14229-1 and ISO 15031-5, but is not limited to use with them, and is also compatible with most other communication needs for in-vehicle networks. The protocol specifies an unconfirmed communication.

The diagnostic communication over K-Line (DoK-Line) protocol supports the standardized service primitive interface as specified in ISO 14229-2.

This part of ISO 14230 provides the data link layer services to support different application layer implementations like:

- enhanced vehicle diagnostics (emissions-related system diagnostics beyond legislated functionality, non-emissions-related system diagnostics),
- emissions-related OBD as specified in ISO 15031, SAE J1979-DA, and SAE J2012-DA.

In addition, this part of ISO 14230 clarifies the differences in initialization for K-line protocols defined in ISO 9141 and ISO 14230. This is important since a server supports only one of the protocols mentioned above and the client has to handle the coexistence of all protocols during the protocol-determination procedure.

### 2 Normative references

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

ISO 14230-1, *Road vehicles — Diagnostic communication over K-Line (DoK-Line) — Part 1: Physical layer*

ISO 14230-4, *Road vehicles — Diagnostic systems — Keyword Protocol 2000 — Part 4: Requirements for emission-related systems*

### 3 Terms, definitions, symbols, and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

##### 3.1.1

##### **5-baud initialization**

##### **5-BAUD\_INIT**

starts with bus idle and ends with inverted address byte sent by the server

# ISO 14230-2:2013(E)

## 3.1.2 fast initialization FAST\_INIT

starts with bus idle and ends with the reception of all positive responses of the StartCommunication service from all addressed servers

## 3.1.3 topology

serial link between client and servers that consists of a K-Line and an optional L-Line

## 3.1.4 server

function that is part of an electronic control unit and that provides the diagnostic services

## 3.1.5 client

function that is part of the tester and that makes use of the diagnostic services

Note 1 to entry: A tester normally makes use of other functions such as data base management, specific interpretation, human-machine interface.

## 3.2 Abbreviated terms

5-BAUD_INIT	5-baud initialization
ISO 9141-2, 5-BAUD_INIT	protocol on K-Line according to ISO 9141-2 including 5-BAUD_INIT
ISO 14230-2, 5-BAUD_INIT	protocol on K-Line according to ISO 14230-2 including 5-BAUD_INIT
ISO 14230-2 FAST_INIT	protocol on K-Line according to ISO 14230-2 including FAST_INIT
ISO 14230-4, 5-BAUD_INIT	protocol on K-Line according to ISO 14230-4 including 5-BAUD_INIT
ISO 14230-4 FAST_INIT	protocol on K-Line according to ISO 14230-4 including FAST_INIT
bus converter	electronic control unit that links bus systems
client	external test equipment
confirm	confirmation service primitive
Cvt	M = mandatory, C = conditional, U = user-optional
ECU	electronic control unit
FAST_INIT	fast initialization
FB	first byte
FMT	format byte
gateway	linking hardware between bus systems
DA	destination address
DoK-Line	diagnostic communication over K-Line
DoK-Line_SA	data link source address
DoK-Line_TA	data link target address



DoK-Line_TAtype	data link target address type
indication	indication service primitive
LEN	length byte
Mtype	message type
request	request service primitive
DL_Data	data link data
DoK-Line_PCI	data link protocol control information
DoK-Line_PCIttype	data link protocol control information type
DoK-Line_PDU	data link protocol data unit
DoK-Line_SA	data link source address
DoK-Line_SDU	data link service data unit
P1Receiver	inter-byte timing parameter of the server
P2Server	time between client request and server response or two server responses
P3Client	time between end of server responses and start of new client request
P4Sender	inter-byte timing parameter of the client
SA	source address
server	electronic control unit (ECU)
TA	target address
UART	universal asynchronous receiver and transmitter
WuP	wake-up pattern

#### 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 diagnostic services.

These conventions specify the interactions between the service user and the service provider. Information is passed between the service user and the service provider by service primitives, which may convey parameters.

[Figure 1](#) summarizes the distinction between service and protocol.

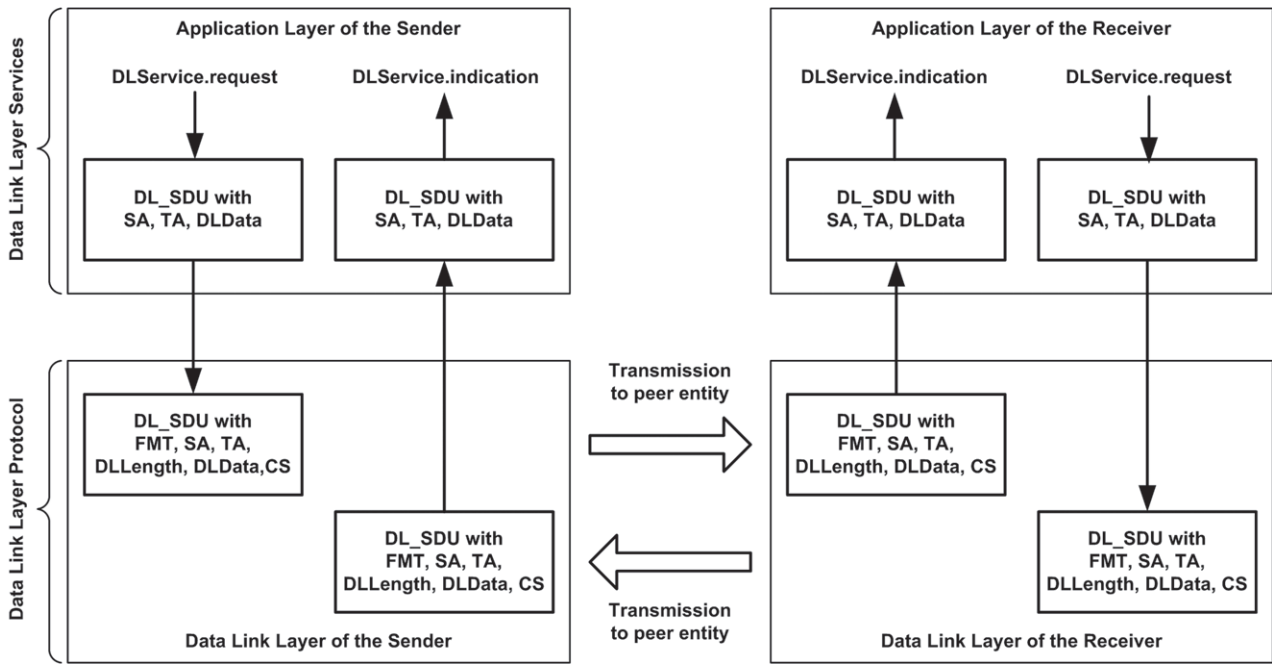


Figure 1 — The services and the protocol

NOTE The figure above does not show the confirmation generated on the transmitter side of the message.

ISO 14230-2 defines confirmed services. The confirmed services use the three service primitives: request, indication, and confirmation.

For all services defined in ISO 14230-2, the request and indication service primitives always have the same format and parameters.

## 5 Document overview

Figure 2 shows the diagnostic communication over K-Line document reference according to OSI model.

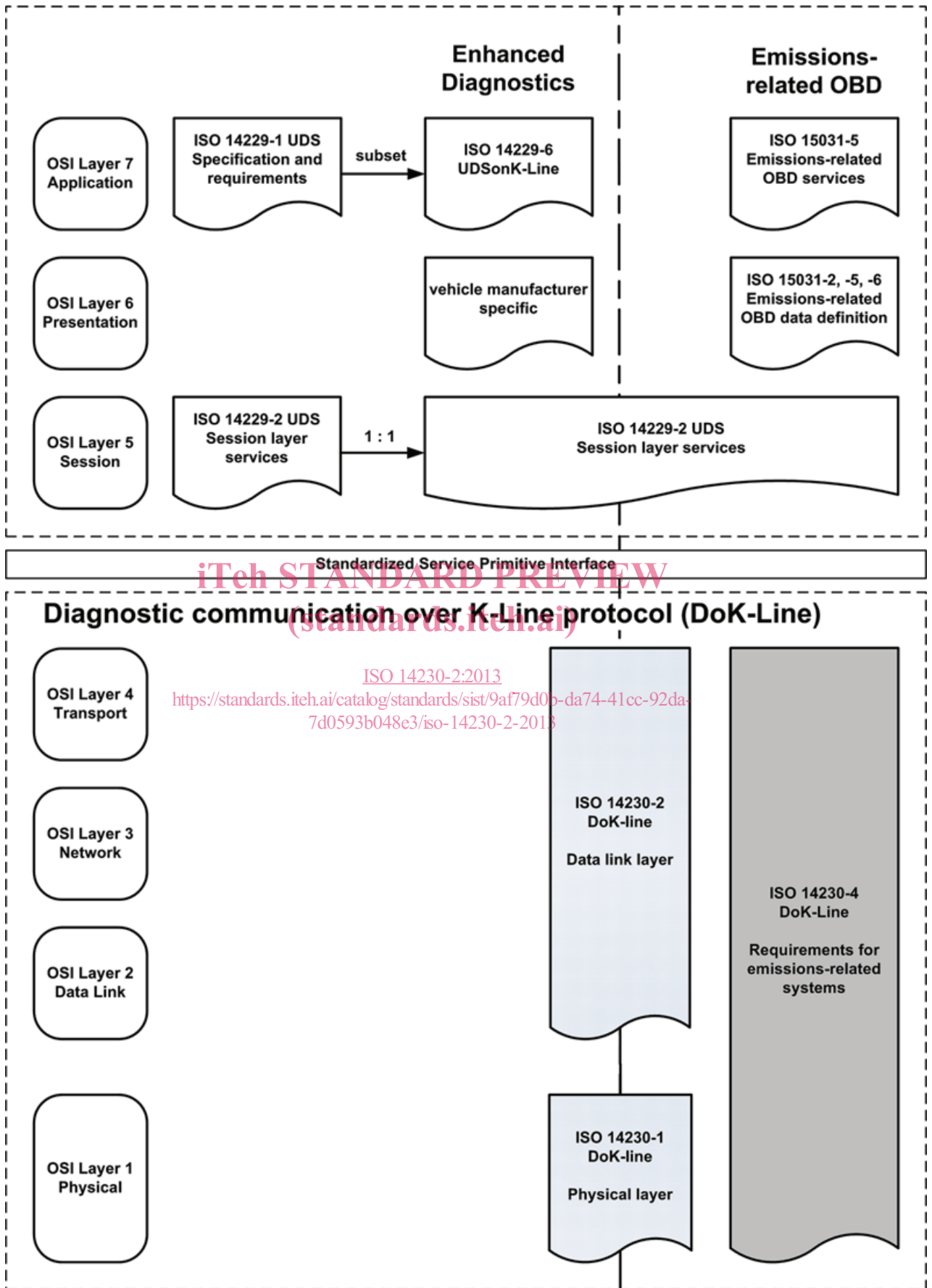
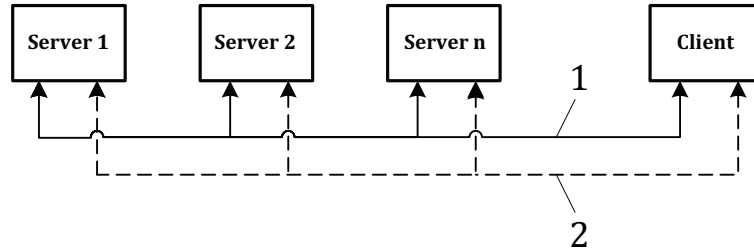


Figure 2 — DoK-Line document reference according to OSI model

## 6 Physical bus topology

DoK-Line is a bus concept based on a serial link consisting of one or two physical lines.

Figure 3 shows the server and client topology.



**Key**

- 1 K-Line
- 2 L-Line (optional)

**Figure 3 — Server and client topology**

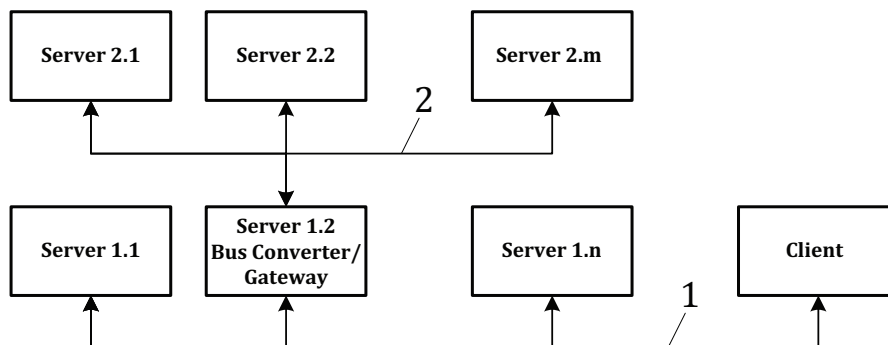
“K-Line” is used for communication and initialization, whereas “L-Line” (optional) is used for initialization only. Special cases are node-to-node connection that means only one server (ECU) is on the line, which also can be a bus converter.

The following recommendations apply:

- It is recommended to no longer support the L-Line in server (ECU) hardware.
- Client (external test equipment) hardware shall support the L-Line if compliance to ISO 15031-4 is required.

For more details, refer to ISO 14230-1 “K-/L-line configurations”.

Figure 4 illustrates an example of multiple servers (ECUs) connected with the K-Line to the client (external test equipment). Server 1.2 (ECU 1.2) functions as a gateway (bus converter) and is operating on a bus system (e.g. ISO 15765, SAE J1850).



**Key**

- 1 K-Line
- 2 arbitrary bus system

**Figure 4 — Gateway topology example**

## 7 Data link layer overview

### 7.1 General

This part of ISO 14230 specifies the data link layer services which are used in client-server based systems to transmit data from one to the other entity. The client, referred to as the external test equipment, uses the data link layer services to transfer diagnostic request data to one or more servers, referred to as an ECU. The server, usually a function that is part of an ECU, uses the data link layer services to send response data, provided by the requested diagnostic service, back to the client. The client is usually the external test equipment but can in some systems also be an on-board test equipment. The usage of data link layer services is independent from the external test equipment being an off-board or on-board test equipment. It is possible to have more than one client (test equipment) in the same vehicle system.

In order to describe the function of the data link layer, services provided to higher layers and the internal operation of the data link layer have to be considered.

### 7.2 Format description of data link layer services

All data link layer services have the same general format. Service primitives are written in the form

```
service_name.type    (
                    [parameter 1, parameter 2, parameter 3, ...]
                    )
```

where

- “service\_name” is the name of the diagnostic service (e.g. DL\_Data),
- “type” indicates the type of the service primitive (e.g. request),
- “[parameter 1, ...]” are parameters that depend on the specific service (e.g. parameter 1 can be the source address of the sender). The brackets indicate that this part of the parameter list may be empty.

### 7.3 Services provided by the data link layer to higher layers

The data link layer service interface defines a set of services that are needed to access the functions offered by the data link layer, i.e. transmission/reception of data, setting of data link layer parameters.

The service access point of the data link layer provides the following service primitives as specified:

- Using the service primitive request (service\_name.request), a service user requests a service from the service provider.
- Using the service primitive indication (service\_name.indication), the service provider informs a service user about an internal event of the network layer or the service request of a peer protocol layer entity service user.
- With the service primitive confirm (service\_name.confirm), the service provider informs the service user about the result of a preceding service request of the service user.

The three types of services are defined:

#### a) Initialization services

These services, of which the following are defined, provide the functionality to perform the initialization of the DoK-Line communication.

- DoK-Line\_Initialize.request  
This service is used to request the DoK-Line communication.
- DoK-Line\_Initialize.confirm

This service confirms to the higher layers that the DoK-Line communication has been carried out (successfully or not).

b) Communication services

These services, of which the following are defined, enable the transfer of up to 255 bytes of data.

— DL\_Data.request

This service is used to request the transfer of data.

— DL\_Data\_FB.indication

This service is used to signal the beginning of a message reception to the upper layer.

— DL\_Data.indication

This service is used to provide received data to the higher layers.

— DL\_Data.confirm

This service confirms to the higher layers that the requested service has been carried out (successfully or not).

c) InputOutputControl services

These services, of which the following are defined, provide the functionality to perform certain fixed sequences (e.g. 5-baud initialization, wake-up pattern generation).

— DoK-Line\_IOControl.request (standards.iteh.ai)

This service is used to request the execution of a specific data link layer sequence.

— DoK-Line\_IOControl.confirm <https://standards.iteh.ai/catalog/standards/sist/9af79d0b-da74-41cc-92da-7d0593b048e3/iso-14230-2-2013>

This service confirms to the upper layer that the request to execute a specific data link layer sequence has been done (successfully or not).

d) Protocol parameter setting services

These services, of which the following are defined, enable the dynamic setting of protocol parameters.

— DoK-Line\_ChangeParameter.request

This service is used to request the dynamic setting of specific internal parameters (e.g. timing parameters).

— DoK-Line\_ChangeParameter.confirm

This service confirms to the upper layer that the request to change a specific protocol parameter has been carried out (successfully or not).

## 7.4 Specification of DoK-Line data link layer service primitives

### 7.4.1 DL\_Data.request

The service primitive requests transmission of < MessageData > with < Length > bytes from the sender to the receiver peer entities identified by the address information in SA and TA.

Each time the DL\_Data.request service is called, the data link layer shall signal the completion (or failure) of the message transmission to the service user by means of issuing a DL\_Data.confirm service call.

```
DL_Data.request      (
                    SA
                    TA
                    TAtype
                    <MessageData>
                    <Length>
                    )
```

#### 7.4.2 DL\_Data.confirm

The data link layer issues the DL\_Data.confirm service. The service primitive confirms the completion of a DL\_Data.request service identified by the address information in SA and TA. The parameter < Result\_DoK-Line > provides the status of the service request.

```
DL_Data.confirm      (
                    SA
                    TA
                    TAtype
                    <Result_DoK-Line>
                    )
```

#### 7.4.3 DL\_Data\_FB.indication

The data link layer issues the DL\_Data\_FB.indication service. The service primitive indicates to the adjacent upper layer the arrival of the first byte (FB) of a message received from a peer protocol entity identified. This indication shall take place upon reception of the first byte of a message.

The DL\_Data\_FB.indication service shall always be followed by a DL\_Data.indication service call from the data link layer to indicate the completion (or failure) of the message reception.

```
DL_Data_FB.indication (
                    SA
                    TA
                    TAtype
                    <Length>
                    <Result_DoK-Line>
                    )
```

(standards.iteh.ai)  
ISO 14230-2:2013  
<https://standards.iteh.ai/catalog/standards/sist/9af79d0b-da74-41cc-92da-7d0595b048e3/iso-14230-2-2013>

There is no address information contained in the indication, because the first byte only indicates the start of a message. There can only be one message transmitted on the data link layer at a time (no multiple messages can be pending in the data link layer at a time); therefore, the first byte indication does not require any address information. The final indication of the message reception will contain the address information for the received message.

#### 7.4.4 DL\_Data.indication

The data link layer issues the DL\_Data.indication service. The service primitive indicates < Result\_DoK-Line > events and delivers < MessageData > with < Length > bytes received from a peer protocol entity identified by the address information in SA and TA to the adjacent upper layer.

The parameters < MessageData > and < Length > are only valid if < Result\_DoK-Line > equals DoK-Line\_OK.

```
DL_Data.indication  (
                    SA
                    TA
                    TAtype
                    <MessageData>
                    <Length>
                    <Result_DoK-Line>
                    )
```

#### 7.4.5 DoK-Line\_Init.request

The service primitive requests the initialization of the data link layer.