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Road vehicles — Vehicle interface for electronic Periodic Technical Inspection (ePTI) —

Part 1: Application and communication requirements

Véhicules routiers — Interface de véhicule pour contrôle technique périodique électronique (ePTI) —

Partie 1: Exigences d'application et de communication

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

A list of all parts in the ISO 20730 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Roadworthiness testing is a part of a wider regime designed to ensure that road vehicles are kept in a safe and environmentally acceptable condition during their use. This regime covers periodic roadworthiness testing of vehicles and technical roadside inspections of vehicles used for commercial road transport activities and provides a vehicle registration procedure allowing for the suspension of a vehicle's authorisation to be used in road traffic where the vehicle constitutes an immediate risk to road safety. Periodic testing is the main tool to ensure roadworthiness. Technical roadside inspections of commercial vehicles are merely complementary to periodic testing.

An ePTI system list, which is defined in ISO 20730-3, summarises ePTI-relevant systems and specifies a defined name (system), a unique identifier (ePTI system identifier) and a description for each ePTI system. All the definitions in this document refer to this ePTI system list.

The ISO 20730 series is based on the Open Systems Interconnection (OSI) basic reference model specified in ISO/IEC 7498-1 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the application protocol and data link framework requirements specified/referenced in the ISO 20730 series are structured according to Figure 1.

Figure 1 illustrates a standard-based documentation concept, which consists of the following main clusters:

— vehicle diagnostic communication framework: covers all relevant basic vehicle diagnostic communication specifications of OSI layers 7, 6 and 5;

— vehicle diagnostic communication use case framework: covers the master specification, which specifies the use cases and requirements of the subject matter of OSI layer 7;

— presentation layer framework: covers all data relevant specifications of OSI layer 6;

— conformance test plan: covers the conformance test plan requirements of the use cases and communication requirements of OSI layers 7, 6 and 5;

— lower OSI layer framework: covers all vehicle diagnostic protocol standards of OSI layers 4, 3, 2 and 1, which are relevant and referenced by the use case specific standard.

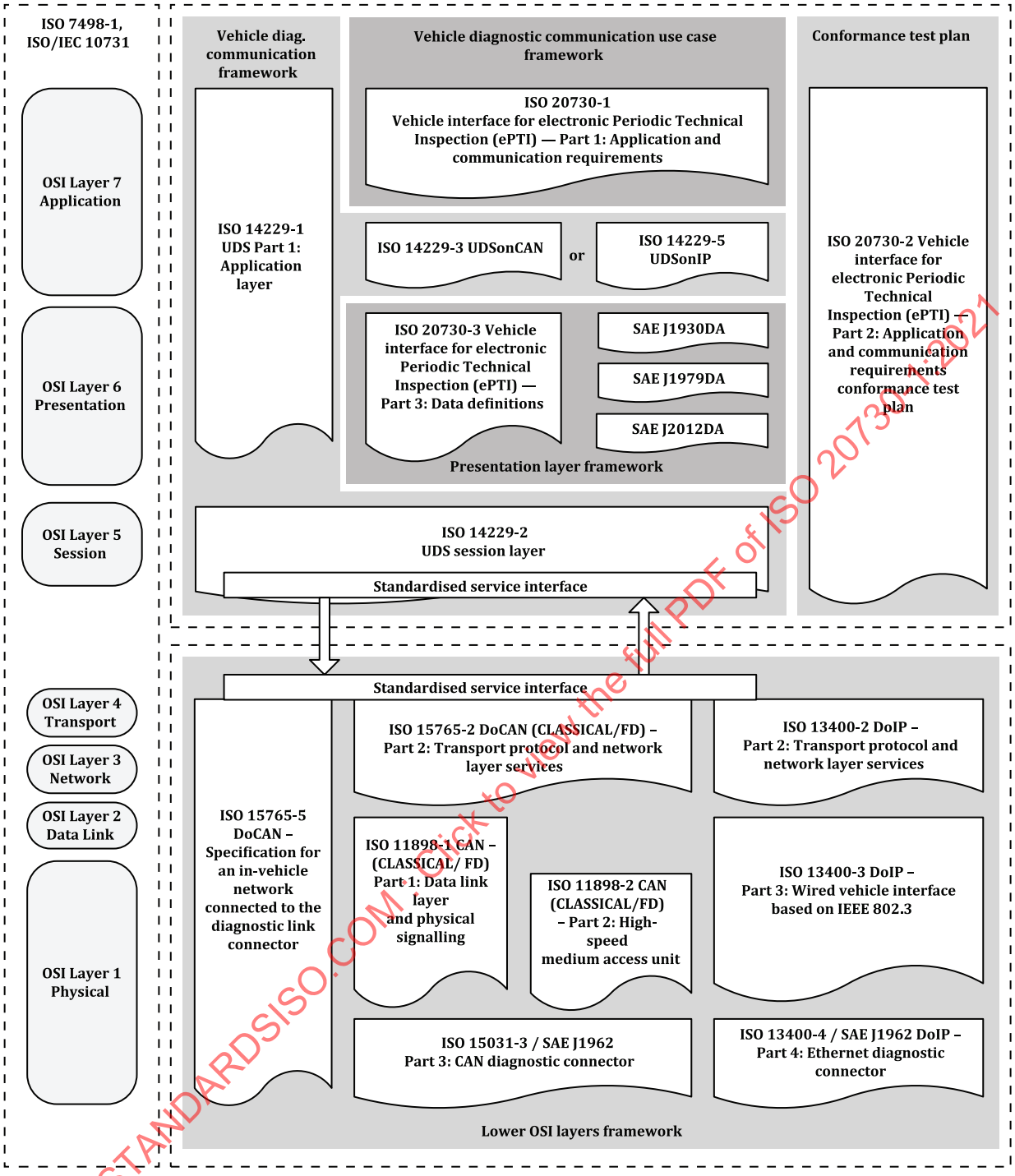


Figure 1 — ePTI document reference according to OSI model

Road vehicles — Vehicle interface for electronic Periodic Technical Inspection (ePTI) —

Part 1:
Application and communication requirements

1 Scope

This document is applicable to road vehicles, where the electronic vehicle interface is used to perform a test method that is part of a periodic technical inspection (ePTI).

This document describes use cases and specifies technical requirements in order to support the ePTI-relevant vehicle safety system(s) checks during the periodic technical inspection via the electronic interface. This document references the ISO 14229 series, the unified diagnostic services implemented on diagnostic communication over controller area network (DoCAN) and the Internet protocol (DoIP) along with the required provision of data definitions.

The technical requirements of diagnostic services and data definitions of emissions-related systems are specified in other International Standards, for example, ISO 15031 and ISO 27145. Other environmental systems' ePTI use cases and technical requirements can be considered in the future.

This document defines:

— all requirements describing the vehicle-communication functionality via the diagnostic link connector related to ePTI, for example:

  1) discovery of the ePTI data link;

  2) discovery of the ePTI-relevant systems;

  3) query of ePTI-relevant systems' information, including software identification, software integrity, current and/or stored values;

  4) query of ePTI-relevant systems' error information;

  5) activation of ePTI-relevant systems' actuators or routines;

— the use cases about the individual vehicle communication functionality, for example, query identification information, command functional test method.

This document does not directly specify any type of test method or pass/fail criteria of the ePTI-relevant system during a PTI, but provides data, which may support PTI test methods.

The document specifies:

— terminology;

— communication establishment between the ePTI external test equipment and the vehicle's ePTI-relevant systems;

— usage of a credentials-based authentication and authorisation mechanism between the ePTI external test equipment and the vehicle;

— protection against tampering of the defined ePTI methods;

- definition of ePTI-relevant use cases:
  - ePTI external test equipment discovers available data identifier as specified in ISO 20730-3;
  - ePTI external test equipment queries the ePTI-relevant system's information, including software numbers, software integrity information, current and/or stored values, self-test completion status, system status, and error information (e.g. DTC and/or DID information);
  - ePTI external test equipment activates the ePTI-relevant system's actuators or routines;
- definition of ePTI-relevant technical requirements;
- ePTI external test equipment minimum requirements.

This document excludes:

- process definitions for performing the PTI check;
- process and data definitions for off-board data provision;
- standardised data exchange formats;
- validation and verification of vehicle safety systems according to vehicle manufacturer specifications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 11898-1, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

ISO 11898-2, *Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access unit*

ISO 13400-2, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 2: Transport protocol and network layer services*

ISO 13400-3, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 3: Wired vehicle interface based on IEEE 802.3*

ISO 13400-4, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 4: Ethernet-based high-speed data link connector*

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Application layer*

ISO 14229-2, *Road vehicles — Unified diagnostic services (UDS) — Part 2: Session layer services*

ISO 14229-3, *Road vehicles — Unified diagnostic services (UDS) — Part 3: Unified diagnostic services on CAN implementation (UDSonCAN)*

ISO 14229-5, *Road vehicles — Unified diagnostic services (UDS) — Part 5: Unified diagnostic services on Internet Protocol implementation (UDSonIP)*

ISO 15031-3, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 3: Diagnostic connector and related electrical circuits: Specification and use*

ISO 15765-2, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 2: Transport protocol and network layer services*

ISO 15765-5[1)], *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 5: Specification for an in-vehicle network connected to the diagnostic link connector*

ISO 19689, *Motorcycles and mopeds — Communication between vehicle and external equipment for diagnostics — Diagnostic connector and related electrical circuits, specification and use*

ISO 20730-3[2)], *Road vehicles — Vehicle interface for electronic Periodic Technical Inspection (ePTI) — Part 3: Data definitions*

SAE J1939-13, *Off-Board Diagnostic Connector*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14229-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
credentials
data that are transferred to establish the claimed identity of an entity

[SOURCE: ISO/IEC 2382:2015, 2126254, modified — The notes to entry have been deleted.]

3.2
electronic periodic technical inspection
ePTI
standardised communication functionality utilising the electronic vehicle communication interface supporting the *PTI* (3.8)

3.3
ePTI external test equipment
test system external to the vehicle's diagnostic link connector, which uses serial communication to perform *ePTI-relevant system* (3.4) assessments, measurements and control functions

3.4
ePTI-relevant system
system which is able to perform a function required to be tested during the *PTI* (3.8)

Note 1 to entry: The *ePTI system list* (3.6), which is defined in ISO 20730-3, summarises safety-relevant systems which may be part of a PTI test.

Note 2 to entry: An *ePTI-relevant system* (3.4) consists of one or multiple ECUs with dedicated sensors and actuators.

3.5
ePTI inspection module
container of one or more use cases related to the same subject

1) Under preparation. Stage at the time of publication: ISO/FDIS 15765-5:2021.

2) Under preparation. Stage at the time of publication: ISO/DIS 20730-3:2021.

3.6
ePTI system list
list of *ePTI-relevant systems* (3.4)

Note 1 to entry: It contains a basis of defined electronic systems to be tested via the electronic vehicle interface as part of the *PTI* (3.8). The *ePTI system list* (3.6) specifies a defined name (system), a unique ID (ePTI system ID) and a description for each ePTI-relevant system.

3.7
ePTI system identifier
unique identifier for an *ePTI-relevant system* (3.4)

3.8
periodic technical inspection
PTI
roadworthiness testing at predefined intervals and authorized test facilities

Note 1 to entry: Roadworthiness testing is part of a wider regime designed to ensure that vehicles are kept in a safe and environmentally acceptable condition during their use.

[SOURCE: DIRECTIVE 2014/45/EC]

3.9
safety-relevant system
vehicle systems and components, that when not operating to their design criteria, affect the safety of the vehicle

3.10
system self-test completion status
finalised status of the on-board diagnosis of the *ePTI-relevant system(s)* (3.4)

3.11
technical classification
<use case> indication of the relevance of the use case related to the communication between the vehicle's *ePTI-relevant system(s)* (3.4) and the *ePTI external test equipment* (3.3) as specified in this document

3.12
use case
description of a system's behaviour as it responds to a request that originates from outside that system

[SOURCE: ISO 15118-1:2019, 3.1.71, modified — The notes to entry have been deleted.]

3.13
conditional
mandatory if a certain criterion is met

3.14
mandatory
keyword indicating an item that is required to be implemented as defined in this document to claim compliance with this document

[SOURCE: ISO/IEC 14776-113:2002, 3.3.3, modified — The word "standard" has been replaced by "document".]

3.15
optional
keyword indicating that the referenced item is not required to claim compliance with this document

Note 1 to entry: Implementation of an optional item should be as defined in this document.

[SOURCE: ISO/IEC 15205:2000, 2.1.23, modified — The wording “keyword indicating that” has been added; the word “standard” has been replaced by “document”; the last sentence in the definition has been moved to Note 1 to entry.]

4 Symbols and abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO 14229-1 and the following apply.

BP	basic principle
CANID	CAN identifier
DID	data identifier
ePTI	electronic periodic technical inspection
ECU	electronic control unit
ETE	external test equipment
IM	inspection module
MsgParam	message parameter
N/A	not applicable
NRC	negative response code
PDU	protocol data unit
PTI	periodic technical inspection
PosRspMsgParam	positive response message parameter
REQ	requirement
ReqMsgParam	request message parameter
RID	routine identifier
RMI	repair and maintenance information
SEQ	sequence
SF	subFunction
UC	use case
VIN	vehicle identification number
VM	vehicle manufacturer

5 How to read this document

5.1 Layout of the document

This subclause provides an overview about the structuring of the content of this document. Table 1 describes the layout of the main clauses in the document.

Table 1 — Layout of the document

Overview of vehicle system requirements	Clause/Subclause
Definition of ePTI inspection modules (IM) and basic principles (BP)	Clause 6
Definition of use cases (UC)	Clauses 7 to 12
Technical requirements versus use cases coverage matrix	Clause 13
Technical requirement statements to setup the vehicle data links	Clause 14
ePTI application layer requirements related to diagnostic services with message sequence implementation and examples	Clause 15

5.2 Use case structure explanation

Table 2 provides an overview about the use case structure and the elements accompanied by an example.

Table 2 — Use case structure

Title	Use case number – Use case name EXAMPLE UC 4.1 – Query vehicle identification number.
Actor	Entity in charge of performing the operation in the use case EXAMPLE ePTI external test equipment.
Goal	Definition of the purpose and objective of the use case EXAMPLE UC 4.1 – Query vehicle identification number.
Input	Definition of input information required to start the purpose and objective of the use case EXAMPLE VIN data identifier.
Output	Definition of output information expected to achieve the purpose and objective of the use case EXAMPLE VIN data.
Description	Detailed description of the sequence of steps to be performed to achieve the purpose and objective of the use case EXAMPLE The ePTI external test equipment requests the VIN. The vehicle responds with the VIN.
Technical classification	Indication of the relevance of the use case related to communication between the vehicle's ePTI-relevant system(s) and the ePTI external test equipment (mandatory/conditional/optional).

5.3 Requirements statement structure

A requirement statement is indicated by the following notation:

— REQ: requirement statement indication;

— X = main requirement statement number;

— Y = sub requirement statement number.

NOTE 1 A requirement statement table does not have a table title.

REQ	X.Y Clause/subclause reference – Category (optional) – Individual requirement statement name
The requirement statement description (one or multiple sentences) shall always include the word 'shall' and uniquely specify what is required by whom. A reference to a document is included as a "NOTE #" by using the description "... is defined in ...". Only one requirement statement shall be stated in the requirement statement description. EXAMPLE The DID (SupportedePTISystems) parameter shall be used to request the supported ePTISystemIdentifier. NOTE 2 The DID (SupportedePTISystems) parameter is defined in ISO 20730-3.	

5.4 ePTI application example

Figure 2 shows an ePTI application example from ISO 20730-1. The three columns illustrate the

— PTI step,

— method, and

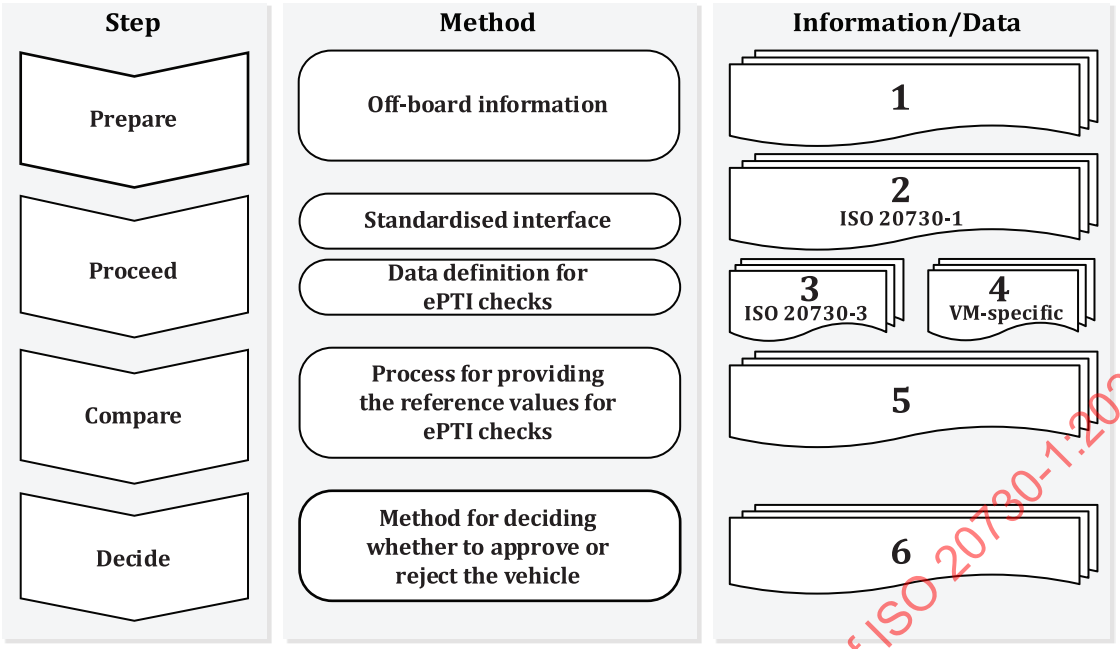
— information/data.

The step "Prepare" describes the process of providing off-board information necessary for performing ePTI on a VIN-based access or other unequivocal identification method. Such information is required to prepare the vehicle for PTI testing, for example, preconditions for ePTI self-tests, preconditions for ePTI routines of activations, etc.

The step "Proceed" covers the standardised interface and the data definition for ePTI checks. Such definitions are specified in this document or in the vehicle manufacturer-specific documentation and are required to establish and perform communication between the external test equipment and the vehicle, for example, communication requirements, authentication, standardised data, vehicle manufacturer-specific data, etc.

The step "Compare" describes the process for providing the reference values for ePTI checks, which requires data to perform a comparison between the read-out data from the vehicle and the reference values provided by an external information source, for example, list of ePTI systems installed end of line, software/variant references, thresholds, ePTI-relevant errors, etc.

The step "Decide" describes the method for deciding, whether to approve or reject the vehicle based on the test, for example, pass/fail criteria, list of additional tests (manual/visual) to confirm the decision, etc.



Key

1 information required to prepare the vehicle to the PTI

2 information required to establish and perform communication between the external test equipment and the vehicle

3 standardised data required to collect and interpret ePTI information from the vehicle with the external test equipment

4 vehicle manufacturer-specific data required to collect and interpret ePTI information from the vehicle with the external test equipment

5 data required to perform a comparison between the read-out data from the vehicle and the reference values provided by an external information source

6 data required for deciding, whether the vehicle fails

NOTE Information/data of Key 1, 5, and 6 are not within the scope of the ISO 20730 series.

Figure 2 — ePTI application example

6 ePTI inspection modules and use cases overview and principles

6.1 Basic principles

Basic principles have been established as a guideline to develop this document.

— BP1: ePTI use cases describe the interaction between the ePTI external test equipment with an ePTI application and the vehicle's ePTI-relevant system(s) utilising the vehicle's communication interface at the diagnostic link connector.

— BP2: ePTI use cases of the same subject are combined in one ePTI inspection module.

— BP3: ePTI use cases are described from an external test equipment and vehicle point of view.

— BP4: ePTI use cases are described independently of the vehicle system group, for example, safety systems.

— BP5: All communication messages are compatible with the ISO 14229 series.

— BP6: All data definitions are compatible with the ISO 14229 series.

— BP7: Sensors, internal signals, current and stored values, input/output controls and routines, which are available in the vehicle via the diagnostic communication interface as specified in this document and are assigned to a standardised identifier (DID, RID) in ISO 20730-3, are mandatory for applicable use cases and interface requirements as specified in this document unless otherwise noted.

— BP8: For DIDs, Routines and Input/Output controls as specified in ISO 20730-3, the defined format shall not cause a change to the sensor(s)/actuator(s) range and resolution. The conversion is used by the ePTI external test equipment to convert the data sent in the response message into a physical value and is not a requirement on the actual sensor.

— BP9: Requirements inherit the classification of the corresponding use cases.

— BP10: A "REQ X.Y" requirement specifies a single requirement (not multiple).

— BP11: Only diagnostic services and data that are within the scope of the ISO 20730 series are guaranteed to work in the context of ePTI.

— BP12: This document specifies the support of periodic technical inspection of safety-relevant systems in road vehicles.

6.2 ePTI inspection modules

Table 3 provides an overview of the main ePTI inspection modules and associated use cases.

Table 3 — ePTI inspection modules and associated use cases

#	Main title of the inspection module (IM)	Use case reference
1	IM-1 – Discover ePTI data link and ePTI-relevant system(s)	UC 1.1 – Discover ePTI data link
		UC 1.2 – Discover ePTI-relevant system(s)
2	IM-2 – Authentication, authorisation	UC 2.1 – ePTI external test equipment authentication
		UC 2.2 – Vehicle ECU authentication
3	IM-3 – Query available ePTI identifier(s)	UC 3.1 – Query supported data identifier(s)
		UC 3.2 – Query supported routine identifier(s)
		UC 3.3 – Query supported input/output control identifier(s)
4	IM-4 – Query ePTI system information	UC 4.1 – Query vehicle identification number
		UC 4.2 – Query vehicle odometer value
		UC 4.3 – Query system's software number
		UC 4.4 – Identify installed system's software integrity information
		UC 4.5 – Query information from system
5	IM-5 – Query system's self-test completion and error information	UC 5.1 – Query system's self-test completion status
		UC 5.2 – Query system status and error information
6	IM-6 – Activate system's routines, input/output control(s)	UC 6.1 – Activate system's routine(s)
		UC 6.2 – Activate system's input/output control(s)

7 IM-1 – Discover ePTI data link and ePTI-relevant system(s)

7.1 UC 1.1 – Discover ePTI data link

Table 4 defines the UC 1.1 – Discover ePTI data link.

Table 4 — UC 1.1 – Discover ePTI data link

Title	UC 1.1 – Discover ePTI data link
Actor	ePTI external test equipment
Goal	Discover the standardised ePTI data link supported by the vehicle utilising the vehicle's standardised diagnostic link connector according to either ISO 15031-3, ISO 13400-4, ISO 19689 or SAE J1939-13.
Input	The ePTI external test equipment tries to discover the data link according to this document.
Output	The ePTI external test equipment has identified the data link according to this document. The ePTI external test equipment displays an error message in case the ePTI data link initialisation procedure failed as specified in this document.
Description	The ePTI external test equipment is connected to the vehicle's diagnostic connector. The ePTI external test equipment starts the ePTI data link discovery procedure as referenced in this document. The ePTI external test equipment displays an error message in case the ePTI data link discovery procedure failed.
Technical classification	Mandatory

7.2 UC 1.2 – Discover ePTI-relevant system(s)

Table 5 defines the UC 1.2 – Discover ePTI-relevant system(s).

Table 5 — UC 1.2 – Discover ePTI-relevant system(s)

Title	UC 1.2 – Discover ePTI-relevant system(s)
Actor	ePTI external test equipment
Goal	Discover vehicle's ePTI-relevant systems' identifiers via the electronic interface in the vehicle as defined in ISO 20730-3 to determine relevant inspection modules for the vehicle under test.
Input	ePTI-relevant system data identifier as defined in ISO 20730-3
Output	Discovered ePTI-relevant system identifier(s) and associated ECUs, which are required for ePTI communication from each installed ePTI-relevant system. ePTI-relevant systems installed in the vehicle identify themselves using the IDs defined in ISO 20730-3.
Description	The ePTI external test equipment uses the standardised ePTI-relevant system data identifier as defined in ISO 20730-3 to request from the vehicle the reporting of the currently supported ePTI-relevant system identifier(s) and associated ECUs.
Technical classification	Mandatory

8 IM-2 – Authentication, authorisation

8.1 UC 2.1 – ePTI external test equipment authentication

Table 6 defines the UC 2.1 – ePTI external test equipment authentication.

Table 6 — UC 2.1 – ePTI external test equipment authentication

Title	UC 2.1 – ePTI external test equipment authentication
Actor	ePTI external test equipment
Goal	Authenticate the ePTI external test equipment against at least one ECU.
Input	Valid credentials sent by the ePTI external test equipment to at least one ECU of the ePTI-relevant system(s)
Output	At least one ECU of the ePTI-relevant system(s) sends the result of the authentication to the ePTI external test equipment. A positive authentication response message confirms the authenticity.
Description	The ePTI external test equipment uses credentials to authenticate against at least one of the vehicle's ECUs. At least one ECU of the vehicle's ePTI-relevant system(s) respond with the result of the authentication and if successful, grant access rights to all diagnostic services and data necessary to fulfil the use cases specified in this document.
Technical classification	Optional

8.2 UC 2.2 – Vehicle ECU authentication

Table 7 defines the UC 2.2 – Vehicle ECU authentication.

Table 7 — UC 2.2 – Vehicle ECU authentication

Title	UC 2.2 – Vehicle ECU authentication
Actor	ePTI-relevant system(s)
Goal	Authenticate at least one ECU of the ePTI-relevant system(s) against the ePTI external test equipment.
Input	Valid credentials sent by at least one ECU of the ePTI-relevant systems to the ePTI external test equipment
Output	The ePTI external test equipment sends the result of the authentication to at least one ECU of the ePTI-relevant systems. A positive authentication response message confirms the authenticity.
Description	At least one ECU of the ePTI-relevant system(s) uses credentials to authenticate against the ePTI external test equipment. The ePTI external test equipment responds with the result of the authentication.
Technical classification	Optional

9 IM-3 – Query available ePTI identifier(s)

9.1 UC 3.1 – Query supported data identifier(s)

Table 8 defines the UC 3.1 – Query supported data identifier(s).

Table 8 — UC 3.1 – Query supported data identifier(s)

Title	UC 3.1 – Query supported data identifier(s)
Actor	ePTI external test equipment
Goal	Query the supported ePTI-relevant data identifiers (DID) from the vehicle.

Table 8 *(continued)*

Input	Standardised DID (as defined in ISO 20730-3) to request supported ePTI-relevant data identifier(s) (DID) from the vehicle
Output	Supported ePTI-relevant data identifiers (DID) from the vehicle as defined in ISO 20730-3
Description	The ePTI external test equipment requests the ePTI-relevant data identifier(s) supported by the vehicle. The vehicle responds with the supported ePTI-relevant data identifier(s) (DID).
Technical classification	Mandatory

9.2 UC 3.2 – Query supported routine identifier(s)

Table 9 defines the UC 3.2 – Query supported routine identifier(s).

Table 9 — UC 3.2 – Query supported routine identifier(s)

Title	UC 3.2 – Query supported routine identifier(s)
Actor	ePTI external test equipment
Goal	Query the supported ePTI-relevant system's routine identifier(s) (RID) from the vehicle.
Input	Standardised DID (as defined in ISO 20730-3) to request supported ePTI-relevant routine identifier(s) (RID) from the vehicle
Output	Supported ePTI-relevant routine identifier(s) (RID) from the vehicle as defined in ISO 20730-3
Description	The ePTI external test equipment requests the ePTI-relevant system's routine identifier(s) supported by the vehicle. The vehicle responds with the supported ePTI-relevant system's routine identifier(s) (RID).
Technical classification	Mandatory

9.3 UC 3.3 – Query supported input/output control identifier(s)

Table 10 defines the UC 3.3 – Query supported input/output control identifier(s).

Table 10 — UC 3.3 – Query supported input/output control identifier(s)

Title	UC 3.3 – Query supported input/output control identifier(s)
Actor	ePTI external test equipment
Goal	Query the supported ePTI-relevant system's input/output control identifier(s) (DID) from the vehicle.
Input	Standardised DID (as defined in ISO 20730-3) to request supported ePTI-relevant input/output control identifier(s) (DID) from the vehicle
Output	Supported ePTI-relevant input/output control identifier(s) (DID) from the vehicle as defined in ISO 20730-3.
Description	The ePTI external test equipment requests the ePTI-relevant system's input/output control identifier(s) supported by the vehicle. The vehicle responds with the supported ePTI-relevant system's input/output control identifier(s) (DID).
Technical classification	Mandatory

10 IM-4 – Query ePTI system information

10.1 UC 4.1 – Query vehicle identification number

Table 11 defines the UC 4.1 – Query vehicle identification number.

Table 11 — UC 4.1 – Query vehicle identification number

Title	UC 4.1 – Query vehicle identification number
Actor	ePTI external test equipment
Goal	Query the vehicle identification number (VIN).
Input	VIN data identifier as defined in ISO 20730-3
Output	VIN data
Description	The ePTI external test equipment requests the VIN. The vehicle responds with the VIN.
Technical classification	Mandatory for at least one system

10.2 UC 4.2 – Query vehicle odometer value

Table 12 defines the UC 4.2 – Query vehicle odometer value.

Table 12 — UC 4.2 – Query vehicle odometer value

Title	UC 4.2 – Query vehicle odometer value
Actor	ePTI external test equipment
Goal	Query the vehicle odometer value.
Input	Odometer data identifier as defined in ISO 20730-3
Output	Displayed vehicle odometer value
Description	The ePTI external test equipment requests the vehicle odometer value. The vehicle responds with the displayed vehicle odometer value.
Technical classification	Mandatory for at least one system

10.3 UC 4.3 – Query system's software number

Table 13 defines the UC 4.3 – Query system's software number.

Table 13 — UC 4.3 – Query system's software number

Title	UC 4.3 – Query system's software number
Actor	ePTI external test equipment
Goal	Identify the currently installed ePTI-relevant systems/ECU(s) with their current software number.
Input	Software number data identifier as defined in ISO 20730-3 and vehicle manufacturer-specific services/data identifier(s) for non-standardised services/DID(s)
Output	Queried software number from each installed ePTI-relevant system/ePTI-relevant system ECU

Table 13 *(continued)*

Description	The ePTI external test equipment requests software number identification about the ePTI-relevant systems/ECU(s). In case of using vehicle manufacturer-specific services/data identifier(s) for non-standardised services/DID(s), all information to identify the ECUs software will be requested. The standardised software number as defined in ISO 20730-3 differentiates at least all safety-relevant changes of the ePTI-relevant system software. The vehicle responds with the current software number identification of each installed ePTI-relevant system/system ECU. In case of using vehicle manufacturer-specific services/data identifier(s) for non-standardised services/DID(s), the software version number is provided by the vehicle.
Technical classification	If at least one (standardised or proprietary) software number related to ePTI-relevant systems is available in the vehicle via the electronic interface as specified in this document, the use case is mandatory. — In the case of standardised data: Implementation is via the electronic interface function. — In the case of proprietary data: Implementation is the vehicle manufacturer's proprietary access to data via the electronic interface.

10.4 UC 4.4 – Identify installed system's software integrity information

Table 14 defines the UC 4.4 – Identify installed system's software integrity information.

Table 14 — UC 4.4 – Identify installed system's software integrity information

Title	UC 4.4 – Identify installed system's software integrity information
Actor	ePTI external test equipment
Goal	Identify the software integrity information (e.g. status OK/NOK, checksum, possibly multiple values for one system) of each ePTI-relevant system equipped in the vehicle.
Input	Software integrity access information ePTI-relevant system software integrity information
Output	Queried ePTI-relevant system software integrity information (e.g. status OK/NOK, checksum, possibly multiple values for one system) from each ePTI-relevant system
Description	The ePTI external test equipment queries the software integrity information (e.g. status OK/NOK, checksum, possibly multiple values for one system) of each ePTI-relevant system equipped in the vehicle.
Technical classification	If at least one (standardised or proprietary) software integrity information related to ePTI-relevant systems is available in the vehicle via the electronic interface as specified in this document, the use case is mandatory. — In the case of standardised data: Implementation is via the electronic interface function. — In the case of proprietary data: Implementation is the vehicle manufacturer's proprietary access to data via the electronic interface.

NOTE The system integrity mechanism can be vehicle-manufacturer specific.

10.5 UC 4.5 – Query information from system

Table 15 defines the UC 4.5 – Query information from system.

Table 15 — UC 4.5 – Query information from system

Title	UC 4.5 – Query information from system
Actor	ePTI external test equipment
Goal	Query ePTI-relevant system(s) information, for example, current and/or stored values.

Table 15 *(continued)*

Input	Data identifier(s) as defined in ISO 20730-3 and vehicle manufacturer-specific data identifier(s) for non-standardised DID(s)
Output	Current and/or stored values of ePTI-relevant system(s)
Description	The ePTI external test equipment requests ePTI-relevant system(s) information by data identifier. The vehicle responds with the requested ePTI-relevant system(s) current and/or stored values.
Technical classification	If relevant current or stored value related to ePTI-relevant systems are available in the vehicle via the electronic interface as specified in this document, the use case is mandatory. — In the case of standardised data: Implementation is via the electronic interface function. — In the case of proprietary data: Implementation is the vehicle manufacturer's proprietary access to data via the electronic interface.

11 IM-5 – Query system's self-test completion and error information

11.1 UC 5.1 – Query system's self-test completion status

Table 16 defines the UC 5.1 – Query system's self-test completion status.

Table 16 — UC 5.1 – Query system's self-test completion status

Title	UC 5.1 – Query system's self-test completion status
Actor	ePTI external test equipment
Goal	Query information about the system self-test completion status of the ePTI-relevant systems.
Input	System self-test completion status data identifier as defined in ISO 20730-3
Output	Current system self-test completion status of the requested ePTI-relevant system (system self-test completed or not)
Description	The ePTI external test equipment requests the ePTI-relevant system's self-test completion status. The vehicle responds with the current system self-test completion status of each ePTI-relevant system. The system self-test completion status indicates, whether the ePTI-relevant system's self-test is completed or not.
Technical classification	Mandatory

NOTE If a self-test is not completed then additional information is provided offline to allow a system assessment. The additional information is proprietary and therefore not in the scope of this document.

11.2 UC 5.2 – Query system status and error information

Table 17 defines the UC 5.2 – Query system status and error information.

Table 17 — UC 5.2 – Query system status and error information

Title	UC 5.2 – Query system status and error information
Actor	ePTI external test equipment
Goal	Get the ePTI system status and the standardised or vehicle manufacturer-specific error information (e.g. DTC and/or DID information) of the ePTI-relevant system.
Input	ePTI system status data identifier as defined in ISO 20730-3 and error information (e.g. DTC and/or DID information)

Table 17 *(continued)*

Title	UC 5.2 – Query system status and error information
Output	ePTI system status of the ePTI-relevant system and standardised or vehicle manufacturer-specific error information (e.g. DTC and/or DID information) of the ECU(s)
Description	The ePTI external test equipment requests the ePTI system status of the ePTI-relevant systems and/or the error information (e.g. DTC and/or DID information) of the ECU(s). The vehicle responds with the requested information.
Technical classification	Mandatory

12 IM-6 – Activate system's routines, input/output control(s)

12.1 UC 6.1 – Activate system's routine(s)

Table 18 defines the UC 6.1 – Activate system's routine(s).

Table 18 — UC 6.1 – Activate system's routine(s)

Title	UC 6.1 – Activate system's routine(s)
Actor	ePTI external test equipment
Goal	Control (activate/deactivate) the execution of ePTI-relevant system(s) routine(s).
Input	ePTI-relevant server's routine(s) identifier as defined in ISO 20730-3
Output	Execution of the ePTI-relevant system(s) routine and routine status
Description	The ePTI external test equipment controls an ePTI-relevant system(s) routine. The description of necessary preconditions for the activation is not part of this document.
Technical classification	Conditional – Only required, if system routines, which are part of an ePTI-relevant system, are assigned to a standardised routine identifier (RID) as defined in ISO 20730-3.

NOTE The main use of the activation of system's routines and input/output controls is to check the functionality which might not be covered by the vehicle's self-diagnosis (e.g. the function is permanently deactivated) or the verification of a potential defect is detected by other means.

12.2 UC 6.2 – Activate system's input/output control(s)

Table 19 defines the UC 6.2 – Activate system's input/output control(s).

Table 19 — UC 6.2 – Activate system's input/output control(s)

Title	UC 6.2 – Activate system's input/output control(s)
Actor	ePTI external test equipment
Goal	Control (activate/deactivate) the execution of ePTI-relevant system(s) input/output control(s).
Input	ePTI-relevant server's input/output controls data identifier as defined in ISO 20730-3
Output	Execution of the ePTI-relevant system(s) input/output control(s) and input/output control status
Description	The ePTI external test equipment controls an ePTI-relevant system(s) input/output control. The description of necessary preconditions for the activation is not part of this document.

Table 19 *(continued)*

Technical classification	Conditional – Only required, if system input/output control(s), which are part of an ePTI-relevant system, are assigned to a standardised input/output control identifier (DID) as defined in ISO 20730-3.

NOTE The main use of the activation of system's routines and input/output controls is to check the functionality which might not be covered by the vehicle's self-diagnosis (e.g. the function is permanently deactivated) or the verification of a potential defect is detected by other means.

13 Overview of vehicle system requirements

13.1 ePTI external test equipment and vehicle message exchange sequence

Figure 3 shows the ePTI external test equipment and vehicle message exchange sequence.

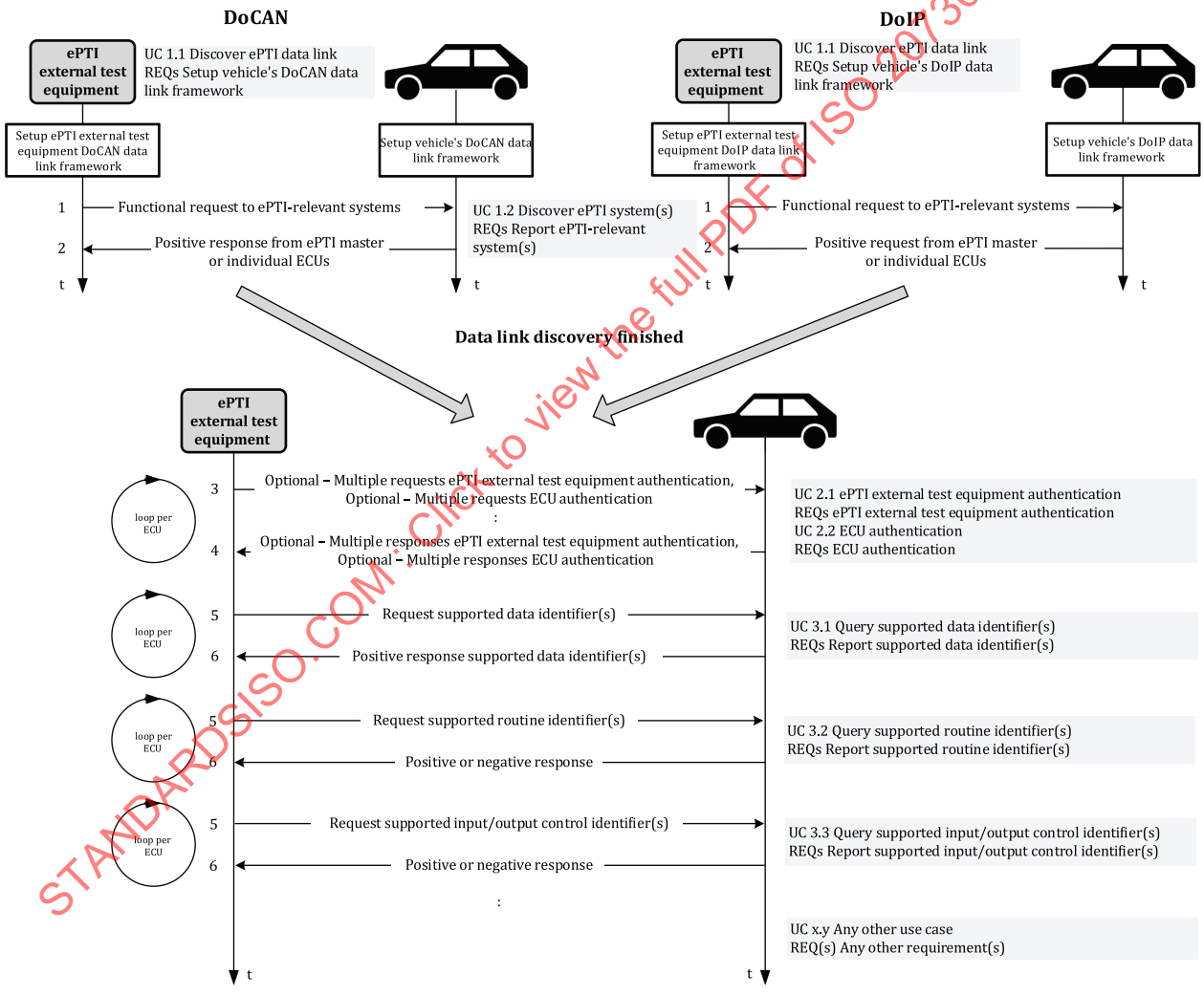


Figure 3 — ePTI external test equipment and vehicle message exchange sequence

13.2 Technical requirements and use case coverage

Table 20 provides an overview about the technical requirements, associated requirement number and use case coverage. The "SEQ" column represents the order of requirements as they should occur in the communication between the vehicle and the ePTI external test equipment. The "REQ" column shows the requirement number for reference purposes by other documents. The "Technical requirement title"

column contains the main title of the related requirement. The "Use case # and title" column lists all use cases related to the requirement in the same row.

Table 20 — Technical requirements and use case coverage

SEQ	REQ	Technical requirement title	Use case # and title
1	8.1 to 8.9	Setup vehicle's DoCAN data link framework	UC 1.1 – Discover ePTI data link
1	8.10 to 8.16	Setup vehicle's DoIP data link framework	UC 1.1 – Discover ePTI data link
—[a]	8.17	Choice of DoCAN and DoIP data link in the vehicle	UC 1.1 – Discover ePTI data link
—[a]	7.1 to 7.2	Applicable ISO 14229-1 UDS functionality	N/A
2	7.8 to 7.12	ReadDataByIdentifier – Report ePTI-relevant system(s)	UC 1.2 – Discover ePTI-relevant systems
3	7.3 to 7.6	ePTI external test equipment authentication	UC 2.1 – ePTI external test equipment authentication
3	7.7	ECU authentication	UC 2.2 – Vehicle ECU authentication
4	7.13 to 7.17	ReadDataByIdentifier – Report ECU supported data identifier(s)	UC 3.1 – Query supported data identifier
4	7.18 to 7.22	ReadDataByIdentifier – Report ECU supported routine identifier(s)	UC 3.2 – Query supported routine identifiers
4	7.23 to 7.27	ReadDataByIdentifier – Report ECU supported input/output control identifier(s)	UC 3.3 – Query supported input/output control identifiers
N/A	7.28 to 7.32	ReadDataByIdentifier – Report VIN from ECU	UC 4.1 – Query vehicle identification number
N/A	7.33 to 7.37	ReadDataByIdentifier – Report vehicle odometer value	UC 4.2 – Query vehicle odometer value
N/A	7.38 to 7.39	ReadDataByIdentifier – Report vehicle's ePTI system's software number(s)	UC 4.3 – Query system's software number
N/A	7.40 to 7.45	ReadDataByIdentifier – Report information from system	UC 4.4 – Identify installed system's software integrity information UC 4.5 – Query information from system
N/A	7.46 to 7.51	ReadDataByIdentifier – Report vehicle's ePTI system self-test completion and system status	UC 5.1 – Query system's self-test completion status UC 5.2 – Query system status and error information
N/A	7.52 to 7.62	RoutineControl – Activate system's routines	UC 6.1 – Activate system's routines
N/A	7.63 to 7.73	InputOutputControlByIdentifier – Activate system's input/output controls	UC 6.2 – Activate system's input/output controls

[a] Empty.

14 Application (APP)

14.1 Setup vehicle's DoCAN data link framework

The requirements specified in this subclause are applicable if a DoCAN data link framework is used for ePTI.

The applicable use case is: UC 1.1 – Discover ePTI data link.

REQ	8.1 APP – Setup vehicle's DoCAN data link framework – DoCAN diagnostic link connector
The vehicle shall meet the requirements stated in ISO 15031-3.	

REQ	8.2 APP – Setup vehicle's DoCAN data link framework – DoCAN connection on diagnostic link connector
The vehicle shall support the ISO 11898-1, ISO 11898-2 CAN, ISO 15765-5 data link and ISO 15765-2 DoCAN transport and network layer. The vehicle shall have installed at least one of the following diagnostic link connectors with the according pin assignment to support DoCAN. ISO 15031-3 (Type A or B): — pin 6: CAN_H line; and — pin 14: CAN_L line. SAE J1939-13 (Type 2): — pin C: CAN_H line; and — pin D: CAN_L line. ISO 19689: — pin 2: CAN_H line; and — pin 5: CAN_L line. In case a vehicle is equipped with more than one diagnostic link connector, then the ePTI initialisation sequence shall be supported via only one diagnostic link connector.	

REQ	8.3 APP – Setup vehicle's DoCAN data link framework – DoCAN configuration of 29-bit CANID protocol
The vehicle shall use the following DoCAN configuration: — bit rate: 500 kbit/s; — definition of 29-bit CAN identifiers: see Table 21.	

Table 21 — Summary of 29-bit CAN identifier format — Normal fixed addressing

Message type	Bit position				
	28 to 24	23 to 16	Target address (TA)	Source address (SA)	Description
Functional request	18_{16}	DB_{16}	$D0_{16}$	$F9_{16}$	SA = ePTI external test equipment TA = all ePTI-relevant server(s)/ECU(s)
Physical request	18_{16}	DA_{16}	TA	$F9_{16}$	SA = ePTI external test equipment TA = one ePTI-relevant server/ECU
Physical response	18_{16}	DA_{16}	$F9_{16}$	SA	SA = one ePTI-relevant server/ECU TA = ePTI external test equipment

REQ	8.4 APP – Setup vehicle's DoCAN data link framework – DoCAN 29-bit CANID maximum number of ECUs
The vehicle shall have less than 240 ePTI-relevant system servers/ECUs installed.	

REQ	8.5 APP – Setup vehicle's DoCAN data link framework – DoCAN normal fixed addressing format
The vehicle interface(s) to the ePTI external test equipment shall only use the normal fixed addressing format according to ISO 15765-5.	

REQ	8.6 APP – Setup vehicle's DoCAN data link framework – DoCAN functional addressing
The vehicle shall support REQ 7.8 to REQ 7.12 Report ePTI-relevant system(s) with functional addressing defined for ePTI-relevant servers/ECUs. For other services, functional addressing is not required.	

REQ	8.7 APP – Setup vehicle's DoCAN data link framework – DoCAN physical addressing
The ePTI-relevant server(s)/ECU(s) shall be able to process physical addressed services (request message).	

REQ	8.8 APP – Setup vehicle's DoCAN data link framework – Size of A_PDU in the request message
The ePTI-relevant server(s)/ECU(s) shall be able to process physical addressed services (request message) with a maximum of 20 application data bytes (A_PDU size). NOTE 1 The ECU can respond to longer requests, i.e. certificates.	

REQ	8.9 APP – Setup vehicle's DoCAN data link framework – DoCAN application message timing definition in defaultSession
The DoCAN application message timing definition in the defaultSession shall be in accordance with the following definitions. For the parameters which are standardized in ISO 20730-3, the vehicle shall be able to support an external test equipment with the following timings: — $P2_{client}$ = 5 000 ms; — $P2^*_{client}$ = 10 000 ms. NOTE 2 ISO 20730-3 does not define standardised PDUs with a total length of diagnostic request and response of more than 4 Kbyte. NOTE 3 For vehicle manufacturer-specific diagnostic services, the communication parameters defined by the vehicle manufacturer are applicable.	

14.2 Setup vehicle's DoIP data link framework

The requirements specified in this subclause are applicable if a DoIP data link framework is used for ePTI.

The applicable use case is: UC 1.1 – Discover ePTI data link.

REQ	8.10 APP – Setup vehicle's DoIP data link framework – DoIP diagnostic link connector
The vehicle shall meet the requirements stated in ISO 13400-4.	

REQ	8.11 APP – Setup vehicle's DoIP data link framework – DoIP configuration of protocol
The vehicle shall use the DoIP configuration and shall meet the requirements stated in ISO 13400-2 and ISO 13400-3.	

REQ	8.12 APP – Setup vehicle's DoIP data link framework – DoIP logical address
The vehicle shall use the logical address assignments according to ISO 13400-2. According to this document, the DoIP logical source and target addresses for functional and physical request and response message shall be as specified in Table 22.	

Table 22 — DoIP logical address assignment

Addressing message type	Target address (TA)	Source address (SA)	Description
Functional request	$E001_{16}$	$0E01_{16}$	SA = ePTI external test equipment TA = all ePTI-relevant server(s)/ECU(s)
Physical request	$YYXX_{16}$[a]	$0E01_{16}$	SA = ePTI external test equipment TA = one ePTI-relevant server/ECU
Physical response	$0E01_{16}$	$YYXX_{16}$[a]	SA = one ePTI-relevant server/ECU TA = ePTI external test equipment
[a] $YYXX_{16}$ range from 0001_{16} to $0DFF_{16}$ or 1000_{16} to $7FFF_{16}$.			

REQ	8.13 APP – Setup vehicle's DoIP data link framework – DoIP functional addressing
The vehicle shall support REQ 7.8 to REQ 7.12 Report ePTI-relevant system(s) with functional addressing defined for ePTI-relevant servers/ECUs. For other services, functional addressing is not required.	

REQ	8.14 APP – Setup vehicle's DoIP data link framework – DoIP physical addressing
The ePTI-relevant server(s)/ECU(s) shall be able to process physical addressed services (request message).	

REQ	8.15 APP – Setup vehicle's DoIP data link framework – Size of A_PDU in the request message
The ePTI-relevant server(s)/ECU(s) shall be able to process physical addressed services (request message) with a maximum of 20 application data bytes (A_PDU size). NOTE 1 The ECU can respond to longer requests, i.e. certificates.	

REQ	8.16 APP – Setup vehicle's DoIP data link framework – DoIP application message timing definition in defaultSession
The DoIP application message timing definition in the defaultSession shall be in accordance with the following definitions. For the parameters which are standardised in ISO 20730-3, the vehicle shall be able to support an external test equipment with the following timings: — P6client = 5 000 ms; — P6*client = 10 000 ms. NOTE 2 For vehicle manufacturer-specific diagnostic services, the communication parameters defined by the vehicle manufacturer are applicable. NOTE 3 These timings can only be achieved if the total length of diagnostic request and response is smaller than 4 kbyte. Thus, ISO 20730-3 does not define standardised services greater than this boundary.	

The application message timing definition specified in this subclause ensures that an ISO 20730-1-compliant vehicle can respond within its response performance required.

14.3 Choice of DoCAN and DoIP data link in the vehicle

The requirement specified in this subclause is applicable to the mixture of ePTI-relevant system servers/ECUs across both data links, DoCAN and DoIP.

REQ	8.17 APP – Choice of DoCAN and DoIP data link in the vehicle
Following the successful initialisation of one data link the vehicle shall provide all ePTI-relevant information on this data link.	

15 Application layer (AL)

15.1 Applicable ISO 14229-1 UDS functionality

The requirements specified in this subclause are applicable to ISO 14229-1 UDS functionality.

REQ	7.1 AL – Applicable ISO 14229-1 UDS functionality – ePTI-relevant system applicable diagnostic services
If implemented, the vehicle interface(s) to the ePTI-relevant systems shall be in accordance to the services, subFunctions and data ranges as they are applicable for an implementation according to ISO 14229-3 UDSon-CAN or ISO 14229-5 UDSonIP as specified in Table 23.	

REQ	7.2 AL – Applicable ISO 14229-1 UDS functionality – No use of Authentication subFunction transmitCertificate
The ISO 14229-1 authentication service, subFunction transmitCertificate shall not be used for the purpose of this document.	

Table 23 — ISO 14229-1 Unified diagnostic services applicable to ePTI-relevant systems

Diagnostic service name	subFunction	Data range	de-fault-Ses-sion	extend-ed-Session
ReadDataByIdentifier	N/A	— ISO 20730-3 — VM-specific	X	X
Authentication[a]	All subFunctions except subFunction transmitCertificate	N/A	X	X
SecuredDataTransmission	N/A	N/A	N/A	X
InputOutputControl-By-Identifier	00_{16} = returnControlToECU 03_{16} = shortTermAdjustment	— ISO 20730-3 — VM-specific	N/A	X
RoutineControl	01_{16} = startRoutine 02_{16} = stopRoutine 03_{16} = requestRoutineResults	— ISO 20730-3 — VM-specific	X[b]	X
ReadDTCInformation	Vehicle manufacturer selects subFunction from ISO 14229-1	— ISO 20730-3 — VM-specific	X	X
DiagnosticSessionControl	01_{16} = defaultSession 03_{16} = extendedDiagnosticSession	N/A	X	X
SecurityAccess	All subFunctions[c]	N/A	N/A	X
TesterPresent	zeroSubFunction	N/A	X	X

Table 23 *(continued)*

Diagnostic service name	subFunction	Data range	de-fault-Ses-sion	extend-ed-Session
[a] The authentication service is defined in ISO 14229-1. [b] Secured routines require a SecurityAccess service and therefore, a non-default diagnostic session. A routine that requires to be stopped actively by the client also requires a non-default session. [c] SubFunctions are vehicle-manufacturer specific.				

NOTE Table 23 shows a superset of applicable diagnostic services.

15.2 Authentication

15.2.1 Requirements definition — ePTI external test equipment authentication

The implementation requirements of ePTI external test equipment authentication specify the message sequence and relevant requirements.

The applicable use case is: UC 2.1 – ePTI external test equipment authentication.

REQ	7.3 AL – ePTI external test equipment authentication – General requirement #1
The authentication of the ePTI external test equipment against the ECU(s) shall be in accordance to ISO 14229-1 services “Authentication” or “SecurityAccess”.	

REQ	7.4 AL – ePTI external test equipment authentication – General requirement #2
If the ePTI external test equipment has sent valid ePTI or appropriate RMI credentials, the vehicle shall grant access rights to the ePTI external test equipment for at leasta the safety-relevant content, which is also used for vehicle repair, maintenance or PTI including the reading of: — on-board DTC information and/or error DID information, and — current and/or stored values. The vehicle shall grant access to at least the activation of routine(s) and input/output controls as defined in ISO 20730-3 and used for repair, maintenance or PTI purposes. It is strongly recommended to use the same algorithm as for other diagnostic use cases. NOTE All relevant credentials required by the ePTI external test equipment are delivered offline.	
[a] More information beside safety-relevant content may be provided for simplicity of ECU implementations (e.g. an ECU provides safety- and comfort-relevant content).	

REQ	7.5 AL – ePTI external test equipment authentication – Allowed security concepts for using service “Authentication”
Authentication shall be implemented using PKI certificate exchange (APCE).	

REQ	7.6 AL – ePTI external test equipment authentication – Publication of used algorithms
If an algorithm is used for authentication, its reference shall be published in the object identifier (OID) repository http://oid-info.com/ according to ISO/IEC 9834-1 under the node being used for vehicle system and external test equipment diagnostic authentication.	

15.2.2 Requirements definition — ECU authentication

The implementation requirements of ECU authentication specify the message sequence and relevant requirements.

The applicable use case is: UC 2.2 – Vehicle ECU authentication.

REQ	7.7 AL – ECU authentication – Vehicle ECU authentication
The authentication of the ECU(s) against the ePTI external test equipment shall be in accordance to ISO 14229-1. NOTE All relevant credentials required by the ePTI external test equipment are delivered offline.	

15.3 ReadDataByIdentifier — Report ePTI-relevant system(s)

15.3.1 Requirements definition — Report ePTI-relevant system(s)

The implementation requirements of report ePTI-relevant system(s) specify the message sequence and relevant requirements.

The applicable use case is: UC 1.2 – Discover ePTI-relevant system(s).

REQ	7.8 AL – Report ePTI-relevant system(s) – General requirement
The vehicle shall report the ePTISystemIdentifier of each ePTI-relevant system supported by an ePTI-relevant server/ECU upon an ePTI external test equipment functional request message using the standardised DID (SupportedePTISystems) as defined in ISO 20730-3.	

REQ	7.9 AL – Report ePTI-relevant system(s) – Request and response message processing
After the successful reception and processing of the ReadDataByIdentifier functional request message, the vehicle's ePTI-relevant server(s)/ECU(s) shall send a ReadDataByIdentifier positive response message as specified in Table 24.	

REQ	7.10 AL – Report ePTI-relevant system(s) – MsgParam – DID (SupportedePTISystems)
The DID (SupportedePTISystems) parameter shall be used to request all supported ePTISystemIdentifier. NOTE The DID (SupportedePTISystems) parameter is defined in ISO 20730-3.	

REQ	7.11 AL – Report ePTI-relevant system(s) – PosRspMsgParam – dataRecord
This dataRecord shall contain one grouping of the requested ePTISystemIdentifier.	

REQ	7.12 AL – Report ePTI-relevant system(s) – PosRspMsgParam – ePTISystemIdentifier
The ePTISystemIdentifier parameter shall identify each supported ePTI-relevant system. All ePTISystemIdentifier are defined in ISO 20730-3.	

15.3.2 Message sequence implementation requirements — Report ePTI-relevant system(s)

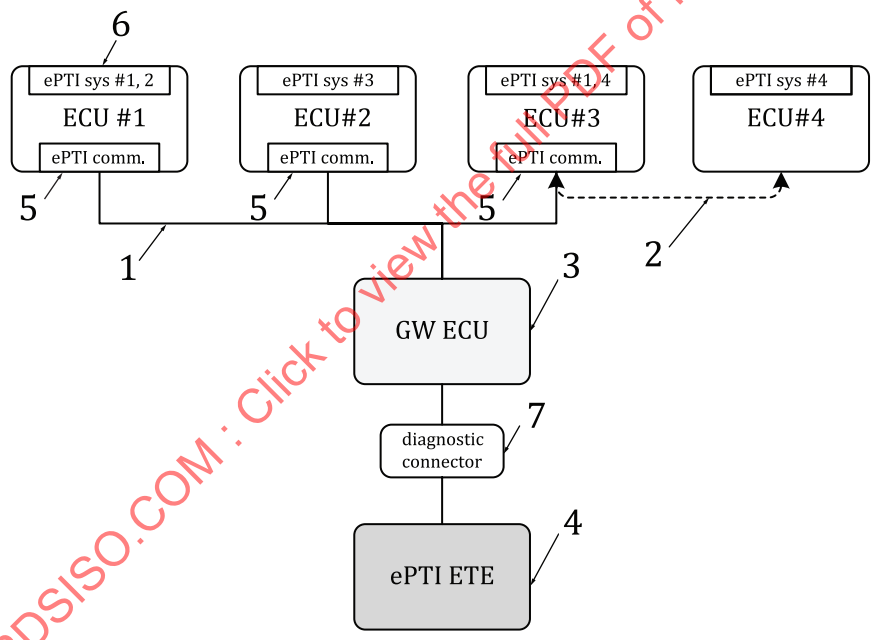
Table 24 defines the report ePTI-relevant system(s).

Table 24 — Report ePTI-relevant system(s)

Length	A_PDU definition	REQ	Cvt
1 byte	**ReadDataByIdentifier request message SID**	7.9	M
2 byte	DID = SupportedePTISystems	7.10	M
1 byte	**ReadDataByIdentifier positive response message SID**	7.9	M
2 byte	DID = SupportedePTISystems	7.10	M
	dataRecord[] = [	7.11	—
m × 2 byte	ePTISystemIdentifier (#1 to m)]	7.12	M

15.3.3 Example of the message sequence — Report ePTI-relevant system(s)

The objective of this example is to show the message communication between the ePTI external test equipment and the vehicle related to the report ePTI-relevant system(s). The example in Figure 4 and Table 25 shows the relationship between vehicle server(s)/ECU(s) and the supported ePTI-relevant systems for all examples described in this document.



Key

1 in-vehicle network – ePTI communication with ePTI external test equipment
2 ECU #3 and ECU #4 VM proprietary communication
3 gateway server/ECU
4 ePTI external test equipment
5 ECU which has implemented the interfaces as specified in this document
6 functional parts of ePTI-relevant systems #1, #2
7 diagnostic link connector, see REQ 8.1, 8.2 and 8.10

Figure 4 — Example of in-vehicle network

Table 25 — Example list of ECUs and supported ePTI systems

ECU			ePTISystemIdentifier	
ECU #	CAN Addr	DoIP Addr	ID	Name/description
1	$5D_{16}$	1001_{16}	0005_{16}	Airbag (ePTI sys#1)
			0020_{16}	Roll-over-Protection (ePTI sys#2)
2	29_{16}	1002_{16}	0033_{16}	Lane Keep Assist (ePTI sys#3)
3	58_{16}	1003_{16}	0005_{16}	Airbag (ePTI sys#1)
			$000E_{16}$	Electro Mechanic Power Steering (ePTI sys#4)
4	VM-specific	VM-specific	—	ECU #4 is part of the Electronic Power Steering system but not visible to the ePTI external test equipment. ECU #4 exchanges Electronic Power Steering system data with ECU #3 (visible to ePTI external test equipment). ECU #3 reports ECU #4 information to the ePTI external test equipment upon request.

Table 26 defines an example of the report ePTI-relevant system(s) message sequence with a functional request message received by the vehicle and three (3) ePTI-relevant servers/ECUs responding to the request.

Table 26 — Example of the report ePTI-relevant system(s) message sequence

Data	A_PDU definition
22_{16}	**ReadDataByIdentifier request message SID**
$FA21_{16}$	DID = SupportedePTISystems
62_{16}	**ReadDataByIdentifier positive response message SID (ECU #1)**
$FA21_{16}$	DID = SupportedePTISystems
—	dataRecord[] = [
0005_{16}	ePTISystemIdentifier #1 = Airbag
0020_{16}	ePTISystemIdentifier #2 = Roll over-Protection]
62_{16}	**ReadDataByIdentifier positive response message SID (ECU #2)**
$FA21_{16}$	DID = SupportedePTISystems
—	dataRecord[] = [
0033_{16}	ePTISystemIdentifier #1 = Lane Keep Assist]
62_{16}	**ReadDataByIdentifier positive response message SID (ECU #3)**
$FA21_{16}$	DID = SupportedePTISystems
	dataRecord[] = [
0005_{16}	ePTISystemIdentifier #1 = Airbag
$000E_{16}$	ePTISystemIdentifier #2 = Electro Mechanic Power Steering]

15.4 ReadDataByIdentifier — Report ECU supported data identifier(s)

15.4.1 Requirements definition — Report ECU supported data identifier(s)

The implementation requirements of report ECU supported data identifier(s) specify the message sequence and relevant requirements.

The applicable use case is: UC 3.1 – Query supported data identifier(s).

REQ	7.13 AL – Report ECU supported data identifier(s) – General requirement
If an ECU supports an ePTI-relevant system, the ECU shall report the supported ePTI standardised DIDs upon an ePTI external test equipment physical request message using the standardised DID (SupportedePTIData-IDs).	

REQ	7.14 AL – Report ECU supported data identifier(s) – Request and response message processing
After the successful reception and processing of the ReadDataByIdentifier physical request message, the ECU shall send a ReadDataByIdentifier positive response message as specified in Table 27.	

REQ	7.15 AL – Report ECU supported data identifier(s) – MsgParam – DID (SupportedePTIDataIDs)
The DID (SupportedePTIDataIDs) parameter shall be used to request the supported data identifier(s).	
NOTE The DID (SupportedePTIDataIDs) parameter is defined in ISO 20730-3.	

REQ	7.16 AL – Report ECU supported data identifier(s) – PosRspMsgParam – dataRecord
This dataRecord shall contain supported ePTI standardised data identifiers (DIDs).	

REQ	7.17 AL – Report ECU supported data identifier(s) – PosRspMsgParam – DID
The DID(s) shall be used to request and report the vehicle's ePTI system data.	

15.4.2 Message sequence implementation requirements — Report ECU supported data identifier(s)

Table 27 defines the report ECU supported data identifier(s).

Table 27 — Report ECU supported data identifier(s)

Length	A_PDU definition	REQ	Cvt
1 byte	**ReadDataByIdentifier request message SID**	7.14	M
2 byte	DID = SupportedePTIDataIDs	7.15	M
1 byte	**ReadDataByIdentifier positive response message SID**	7.14	M
2 byte	DID = SupportedePTIDataIDs	7.15	M
	dataRecord = [	7.16	—
m × 2 byte	DID (#1 to m)]	7.17	M

15.4.3 Example of the message sequence — Report ECU supported data identifier(s)

Table 28 gives an example of the report ECU supported data identifier(s) message sequence.

Table 28 — Example of the report ECU supported data identifier(s) message sequence

Data	A_PDU definition
22_{16}	**ReadDataByIdentifier request message SID**
$FA20_{16}$	DID = SupportedePTIDataIDs
62_{16}	**ReadDataByIdentifier positive response message SID**
$FA20_{16}$	DID = SupportedePTIDataIDs
	dataRecord = [
$F190_{16}$	VIN
$F4A6_{16}$	VehicleOdometer]

15.5 ReadDataByIdentifier — Report ECU supported routine identifier(s)

15.5.1 Requirements definition — Report ECU supported routine identifier(s)

The implementation requirements of report ECU supported routine identifier(s) specify the message sequence and relevant requirements.

The applicable use case is: UC 3.2 – Query supported routine identifier(s).

REQ	7.18 AL – Report ECU supported routine identifier(s) – General requirement
If an ECU supports an ePTI-relevant system, the ECU shall report the supported ePTI standardised routine identifier(s) upon an ePTI external test equipment physical request message using the standardised DID (SupportedePTIRoutineIDs).	

REQ	7.19 AL – Report ECU supported routine identifier(s) – Request and response message processing
After the successful reception and processing of the ReadDataByIdentifier physical request message, the ECU shall send a readDataByIdentifier positive response message as specified in Table 29.	

REQ	7.20 AL – Report ECU supported data identifier(s) – MsgParam – DID (SupportedePTIRoutineIDs)
The DID (SupportedePTIRoutineIDs) parameter shall be used to request the supported routine identifier(s). NOTE The DID (SupportedePTIRoutineIDs) parameter is defined in ISO 20730-3.	

REQ	7.21 AL – Report ECU supported routine identifier(s) – PosRspMsgParam – dataRecord
This dataRecord shall contain supported ePTI standardised routine identifiers (RIDs).	

REQ	7.22 AL – Report ECU supported routine identifier(s) – PosRspMsgParam – RID
The RID(s) shall be used to start, stop and request routine results from the vehicle's ePTI system.	

15.5.2 Message sequence implementation requirements — Report ECU supported routine identifier(s)

Table 29 defines the report ECU supported routine identifier(s).

Table 29 — Report ECU supported routine identifier(s)

Length	A_PDU definition	REQ	Cvt
1 byte	**ReadDataByIdentifier request message SID**	7.19	M
2 byte	DID = SupportedePTIRoutineIDs	7.20	M
1 byte	**ReadDataByIdentifier positive response message SID**	7.19	M
2 byte	DID = SupportedePTIRoutineIDs	7.20	M
	dataRecord = [	7.21	—
m × 2 byte	RID (#1 to m)]	7.22	M

15.5.3 Example of the message sequence — Report ECU supported routine identifier(s)

Table 30 gives an example of the report ECU supported routine identifier(s) message sequence.

Table 30 — Example of the Report ECU supported routine identifier(s) message sequence

Data	A_PDU definition
22_{16}	**ReadDataByIdentifier request message SID**
$FA22_{16}$	DID = SupportedePTIRoutineIDs
62_{16}	**ReadDataByIdentifier positive response message SID**
$FA22_{16}$	DID = SupportedePTIRoutineIDs
	dataRecord = [
$E202_{16}$	Malfunction Indicator Activation
$E207_{16}$	Exterior Light Device Activation]

15.6 ReadDataByIdentifier — Report ECU supported input/output control identifier(s)

15.6.1 Requirements definition — Report ECU supported input/output control identifier(s)

The implementation requirements of report ECU supported input/output control identifier(s) specify the message sequence and relevant requirements.

The applicable use case is: UC 3.3 – Query supported input/output control identifier(s).

REQ	**7.23 AL – Report ECU supported input/output control identifier(s) – General requirement**
If an ECU supports an ePTI-relevant system, the ECU shall report the supported ePTI standardised input/output control identifier(s) upon an ePTI external test equipment physical request message using the standardised DID (SupportedePTIIOControlIDs).	

REQ	**7.24 AL – Report ECU supported input/output control identifier(s) – Request and response message processing**
After the successful reception and processing of the ReadDataByIdentifier physical request message, the ECU shall send a readDataByIdentifier positive response message as specified in Table 31.	

REQ	**7.25 AL – Report ECU supported input/output control identifier(s) – MsgParam – DID (SupportedePTIIOControlIDs)**
The DID (SupportedePTIIOControlIDs) parameter shall be used to request the supported input/output control identifier(s). NOTE The DID (SupportedePTIIOControlIDs) parameter is defined in ISO 20730-3.	

REQ	7.26 AL – Report ECU supported input/output control identifier(s) – PosRspMsgParam – dataRecord
This dataRecord shall contain supported ePTI standardised input/output control identifier(s) (DID).	

REQ	7.27 AL – Report ECU supported input/output control identifier(s) – PosRspMsgParam – DID
The DID(s) shall be used to control the vehicle's ePTI system input/output controls.	

15.6.2 Message sequence implementation requirements — Report ECU supported input/output control identifier(s)

Table 31 defines the report ECU supported input/output control identifier(s).

Table 31 — Report ECU supported input/output control identifier(s)

Length	A_PDU definition	REQ	Cvt
1 byte	**ReadDataByIdentifier request message SID**	7.24	M
2 byte	DID = SupportedePTIIOControlIDs	7.25	M
1 byte	**ReadDataByIdentifier positive response message SID**	7.24	M
2 byte	DID = SupportedePTIIOControlIDs	7.25	M
	dataRecord = [	7.26	—
m × 2 byte	DID (#1 to m)]	7.27	M

15.6.3 Example of the message sequence — Report ECU supported input/output control identifier(s)

Table 32 gives an example of the report ECU supported input/output control identifier(s) message sequence.

Table 32 — Example of the report ECU supported input/output control identifier(s) message sequence

Data	A_PDU definition
22_{16}	**ReadDataByIdentifier request message SID**
$FA23_{16}$	DID = SupportedePTIIOControlIDs
62_{16}	**ReadDataByIdentifier positive response message SID**
$FA23_{16}$	DID = SupportedePTIIOControlIDs
	dataRecord = [
$FA25_{16}$	Seatbelt Sensor Status
$FA28_{16}$	Tire Pressure Sensor Status]

15.7 ReadDataByIdentifier — Report VIN from ECU

15.7.1 Requirements definition — Report VIN from ECU

The implementation requirements of report VIN from ECU specify the message sequence and relevant requirements.

The applicable use case is: UC 4.1 – Query vehicle identification number.

REQ	7.28 AL – Report VIN from ECU – General requirement
At least one ECU shall report the vehicle identification number upon an ePTI external test equipment physical request message using the standardised DID (VIN).	

REQ	7.29 AL – Report VIN from ECU –Request and response message processing
After the successful reception and processing of the ReadDataByIdentifier physical request message the ECU shall send a ReadDataByIdentifier positive response message as specified in Table 33.	

REQ	7.30 AL – Report VIN from ECU – MsgParam – DID (VIN)
The DID (VIN) parameter shall be used to request the vehicle identification number. NOTE 1 The DID (VIN) parameter is defined in ISO 20730-3.	

REQ	7.31 AL – Report VIN from ECU – PosRspMsgParam – dataRecord
This dataRecord shall contain VINData. NOTE 2 The VIN data type is defined in ISO 20730-3.	

REQ	7.32 AL – Report VIN from ECU – PosRspMsgParam – VINData
The VINData shall contain the VIN.	

15.7.2 Message sequence implementation requirements — Report VIN from ECU

Table 33 defines the report VIN from ECU message sequence.

Table 33 — Report VIN from ECU message sequence

Length	A_PDU definition	REQ	Cvt
1 byte	**ReadDataByIdentifier request message SID**	7.29	M
2 byte	DID = VIN	7.30	M
1 byte	**ReadDataByIdentifier positive response message SID**	7.29	M
2 byte	DID = VIN	7.30	M
	dataRecord = [	7.31	—
17 byte	VINData]	7.32	M

15.7.3 Example of the message sequence — Report VIN from ECU

Table 34 gives an example of the report VIN from ECU message sequence.

Table 34 — Example of the report VIN from ECU message sequence

Data	A_PDU definition
22_{16}	**ReadDataByIdentifier request message SID**
$F190_{16}$	DID = VIN
62_{16}	**ReadDataByIdentifier positive response message SID**
$F190_{16}$	DID = VIN

Table 34 *(continued)*

Data	A_PDU definition
	dataRecord = [
57_{16} 44_{16} 44_{16} 31_{16}	VINData = WDD1
37_{16} 32_{16} 34_{16} 34_{16}	7244
38_{16} 41_{16} 42_{16} 43_{16}	8ABC
44_{16} 31_{16} 32_{16} 33_{16}	D123
34_{16}	4]

15.8 ReadDataByIdentifier — Report vehicle odometer value

15.8.1 Requirements definition — Report vehicle odometer value

The implementation requirements of report vehicle odometer value specify the message sequence and relevant requirements.

The applicable use case is: UC 4.2 – Query vehicle odometer value.

REQ	7.33 AL – Report vehicle odometer value – General requirement
At least one ECU shall report the vehicle odometer value upon an ePTI external test equipment physical request message using the standardised DID (VehicleOdometer).	

REQ	7.34 AL – Report vehicle odometer value – Request and response message processing
After the successful reception and processing of the ReadDataByIdentifier physical request message, the ECU shall send a ReadDataByIdentifier positive response message as specified in Table 35.	

REQ	7.35 AL – Report vehicle odometer value – MsgParam – DID (VehicleOdometer)
The DID (VehicleOdometer) parameter shall be used to request the vehicle odometer value.	
NOTE 1 The DID (VehicleOdometer) parameter is defined in ISO 20730-3.	

REQ	7.36 AL – Report vehicle odometer value – PosRspMsgParam – dataRecord
This dataRecord shall contain OdometerData.	
NOTE 2 The vehicle odometer data type is defined in ISO 20730-3.	

REQ	7.37 AL – Report vehicle odometer value – PosRspMsgParam – OdometerData
The OdometerData shall contain the displayed vehicle odometer value.	

15.8.2 Message sequence implementation requirements — Report vehicle odometer value

Table 35 defines the report vehicle odometer value message sequence.

Table 35 — Report vehicle odometer value message sequence

Length	A_PDU definition	REQ	Cvt
1 byte	**ReadDataByIdentifier request message SID**	7.34	M
2 byte	DID = VehicleOdometer	7.35	M
1 byte	**ReadDataByIdentifier positive response message SID**	7.34	M
2 byte	DID = VehicleOdometer	7.35	M
	dataRecord = [	7.36	—
4 byte	OdometerData]	7.37	M

15.8.3 Example of the message sequence — Report vehicle odometer value

Table 36 gives an example of the report vehicle odometer value message sequence.

Table 36 — Example of the report vehicle odometer value message sequence

Data	A_PDU definition
22_{16}	**ReadDataByIdentifier request message SID**
$F4A6_{16}$	DID = VehicleOdometer
62_{16}	**ReadDataByIdentifier positive response message SID**
$F4A6_{16}$	DID = VehicleOdometer
	dataRecord = [
00010304_{16}	OdometerData = 6 630,8 km]

15.9 ReadDataByIdentifier — Report vehicle's system software number(s)

15.9.1 Requirements definition — Report vehicle's system software number(s)

The implementation requirements of report vehicle's system software number(s) specify the message sequence and relevant requirements.

The applicable use case is: UC 4.3 – Query system's software number.

REQ	7.38 AL – Report vehicle's system software number(s) – General requirement
If an ECU supports an ePTI-relevant system, the ECU shall report the VM-specific ECU software number(s) or at least one of the ECUs shall report the RxSWIN, if applicable, (see Figure 5) upon an ePTI external test equipment physical request message.	

Figure 5 shows the ePTI external test equipment, ECU, software number relationship.

An ECU can provide one or multiple RxSWINs (Regulation x Software Identification Number as defined in ISO 14229-1) and/or one or multiple VM-specific ECU software number(s).