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SPECIFICATION

ISO/PAS  
27145-3

First edition  
2006-09-15

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**Road vehicles — Implementation of  
WWH-OBD communication  
requirements —**

**Part 3:  
Common message dictionary**

**iTeh STANDARD PREVIEW**  
*Véhicules routiers — Mise en application des exigences de  
communication WWH-OBD —  
(standards.iteh.ai)  
Partie 3: Dictionnaire de messages communs*

ISO/PAS 27145-3:2006

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Reference number  
ISO/PAS 27145-3:2006(E)

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Published in Switzerland

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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/PAS 27145-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO/PAS 27145 consists of the following parts, under the general title *Road vehicles — Implementation of WWH-OBD communication requirements*:

- *Part 1: General information and use case definition*
- *Part 2: Common emissions-related data dictionary*
- *Part 3: Common message dictionary*
- *Part 4: Connection between vehicle and test equipment*

NOTE ISO/PAS 27145-4 will be extended as necessary due to introduction of additional communication media.

## Introduction

This document set includes the communication between the vehicle's OBD systems and test equipment implemented across vehicles within the scope of the WWH-OBD GTR (World Wide Harmonized On-Board Diagnostics Global Technical Regulations).

It has been established in order to apply the unified diagnostic services (specified in ISO 14229-1) to WWH OBD systems.

To achieve this, it is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO/IEC 7498-1 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the services specified by ISO/PAS 27145 are broken into:

- Presentation layer (layer 7), specified in ISO/PAS 27145-3;
- Application services (layer 6), specified in ISO/PAS 27145-2;
- Session layer services (layer 5), specified in ISO/PAS 27145-4;
- Transport layer services (layer 4), specified in ISO/PAS 27145-4;
- Network layer services (layer 3), specified in ISO/PAS 27145-4;
- Data link layer (layer 2), specified in ISO/PAS 27145-4; and
- Physical layer (layer 1), specified in ISO/PAS 27145-4;

in accordance with Table 1.

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

Applicability	OSI 7 layers	Implementation of WWH-OBD communication requirements, e.g. emissions-related UDS
Seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO/PAS 27145-3
	Presentation (layer 6)	ISO/PAS 27145-2 / ISO 14229-1
	Session (layer 5)	ISO/PAS 27145-4
	Transport (layer 4)	
	Network (layer 3)	
	Data link (layer 2)	
	Physical (layer 1)	

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# Road vehicles — Implementation of WWH-OBD communication requirements —

## Part 3: Common message dictionary

### 1 Scope

ISO/PAS 27145 is intended to become the single communication standard for access to OBD-related information. To allow for a smooth migration from the existing communication standards to this future worldwide standardized communication standard, the initial communication concept will be based on CAN. In a second step, ISO/PAS 27145 will be extended to define the world-wide harmonized OBD communication standard based on existing industry communications standards (e.g. Internet Protocol) over Ethernet. Due to the usage of standard network layer protocols, future extensions to optional physical layers (e.g. wireless) are possible.

This part of ISO/PAS 27145 specifies the implementation of a subset of unified diagnostic services (UDS) as specified in ISO 14229-1. The diagnostic services are used to communicate all diagnostic data as defined in ISO/PAS 27145-2.

The subset of unified diagnostic services derives from the requirements stated in the WWH-OBD GTR (World Wide Harmonised Global Technical Regulations). The common message set defined in this part is independent of the underlying Transport, Network, Data Link and Physical Layer. This document does not specify any requirements for the in-vehicle network architecture.

This part of ISO/PAS 27145 includes a superset of a modified version of ISO 14229-1. Several significant modifications are included in this part in order to support the data set of SAE J1939, ISO 15031-5 and ISO 15031-6:

- ISO/PAS 27145-3 supports a 3-byte Unified Data Identifier format in all services which support a 2-byte data identifier format in the ISO 14229-1.
- ISO/PAS 27145-3 supports a 4-byte Diagnostic Trouble Code format in all services which support a 3-byte Diagnostic Trouble Code format in the ISO 14229-1.
- ISO/PAS 27145-3 supports a separation of BaseDTC number from a FailureTypeByte including the symptom of the Diagnostic Trouble Code.

This part of ISO/PAS 27145 is designed to provide the basis of unified diagnostic services for future GTR modules provided by legislation.

## 2 Normative references

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

ISO 7498-1, *Information technology — Open Systems Interconnection — Basic Reference Model — Part 1: The Basic Model*

ISO/IEC 10731, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services*

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

ISO 15031-5, *Road vehicles — Communication between vehicle and external test equipment for emissions-related diagnostics — Part 5: Emissions-related diagnostic services*

ISO 15031-6, *Road vehicles — Communication between vehicle and external test equipment for emissions-related diagnostics — Part 6: Diagnostic trouble code definition*

ISO/PAS 27145-1, *Road vehicles — Implementation of WWH-OBD communication requirements — Part 1: General information and use case definition*

ISO/PAS 27145-2, *Road vehicles — Implementation of WWH-OBD communication requirements — Part 2: Common emissions-related data dictionary*

ISO/PAS 27145-4, *Road vehicles — Implementation of WWH-OBD communication requirements — Part 4: Connection between vehicle and test equipment*

SAE J1939-21, *Recommended Practice for a Serial Control and Communication Vehicle Network — Data link layer*

SAE J1939-71, *Recommended Practice for a Serial Control and Communication Vehicle Network — Vehicle application layer*

SAE J1939-73, *Recommended Practice for a Serial Control and Communication Vehicle Network — Application layer — Diagnostics*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/PAS 27145-1, ISO/PAS 27145-2 and ISO 14229-1 apply.

## 4 Symbols and abbreviated terms

ASCII	American Standard Code for Information Interchange
CALID	Calibration Identification
CVN	Calibration Verification Number
DID	Diagnostic Data Identifier
DTC	Diagnostic Trouble Code



ECM	Engine Control Module
ECU	Electronic Control Unit
GTR	Global Technical Regulations
LDTC	Legacy Diagnostic Trouble Code
LITID	Legacy InfoType Identifier
LMID	Legacy Monitor Identifier
LPID	Legacy Parameter Identifier
LRID	Legacy Routine Identifier
MI	Malfunction Indicator
OTL	OBD threshold limit
PGN	Parameter Group Number
SFID	Sub-function Identifier
SID	Service Identifier
SPN	Suspect Parameter Number
SUDID	Supported Unified Data Identifier
UCID	Unified Control (Input/Output) Identifier
UDID	Unified Data Identifier
UDTC	Unified Diagnostic Trouble Code
UITID	Unified InfoType Identifier
UMID	Unified Monitor Identifier
UPID	Unified Parameter Identifier
URID	Unified Routine Identifier
VIN	Vehicle Identification Number
VOBD	Vehicle On-Board Diagnostics
WWH-OBD	Word Wide Harmonized On-Board Diagnostics

## 5 Conventions

ISO/PAS 27145 is based on the conventions discussed in the O.S.I. Service Conventions (ISO/IEC 10731:1994) as they apply for diagnostic services.

## 6 General requirements

### 6.1 Overview of unified diagnostic services

ISO/PAS 27145-3 implements applicable diagnostic services of ISO 14229-1.

This part of ISO/PAS 27145 defines the diagnostic services as defined in ISO 14229-1 that are applicable to systems which are required to be compliant to the GTR. For each applicable service the applicable sub-function and data parameters are defined.

**Table 2 — Overview of applicable ISO 14229-1 Unified diagnostic services and data ranges**

Diagnostic service name	SID	SFID	Comment
ReadProtocolIdentification	0x12	—	This service provides server implemented protocol version information.
ClearDiagnosticInformation — groupOfDTC	0x14	— —	This service clears all diagnostic information. Emissions system group identifier.
ReadDTCInformation — reportDTCSnapshotRecordByDTCNumber — reportDTCExtendedDataRecordByDTCNumber — reportDTCWithPermanentStatus — reportNumberOfOBDDTCByMaskRecord — reportOBDDTCByMaskRecord	0x19	 0x04 0x06 0x15 0x16 0x17	This service provides read capabilities for all diagnostic trouble code related information.  Unified DTC range: ISO/PAS 27145-2: 0x200000 – 0x27FFFF
ReadDataByIdentifier — Legacy SAE SPN range — Legacy SAE PGN range — Legacy ISO DTC range — Legacy ISO DID range — Unified BaseDTC range — Unified DID range	0x22	— — — — — —	This service provides read capabilities for static and dynamic data. SAE J1939: 0x000000 – 0x07FFFF SAE J1939: 0x080000 – 0x0BFFFF ISO 15031-6: 0x100000 – 0x10FFFF ISO 15031-5: 0x180000 – 0x18FFFF ISO/PAS 27145-2: 0x200000 – 0x27FFFF ISO/PAS 27145-2: 0x280000 – 0x2FFFFF
RoutineControl — StartRoutine — RequestRoutineResults	0x31	— 0x01 0x03	This service provides control capability for routines. Sub-function starts a routine. Sub-function stops a routine.

NOTE The sub-function parameter (SFID) definitions take into account that the most significant bit of the parameter `suppressPosRspMsgIndicationBit` is always set to logic state '0' to always force the vehicle server(s) to send a response message.

### 6.2 Message byte order

Alphanumeric data will be transmitted with the most significant byte first. Unless otherwise specified, alphanumeric characters will conform to the ISO Latin 1 ASCII character set as specified in ISO/PAS 27145-2.

## 7 Emissions-related diagnostic services implementation

### 7.1 ReadProtocolIdentification (12 hex) service

#### 7.1.1 Service description

The ReadProtocolIdentification service is used by the client to identify the ISO 14229-1 UDS implementation version. This service shall always be the first service to be expected by the vehicle's emissions-related systems if an ISO/PAS 27145-5 compliant external test equipment is connected. The response message of this service provides ISO 14229-1 UDS implementation version information to the external test equipment.

The initial version of ISO 14229-1 publication supports 2-byte data identifiers and 3-byte diagnostic trouble codes. The harmonisation of the SAE J1939, ISO 15031-5, ISO 14229-1 protocols and the requirements derived from the GTR provided the need for 3-byte data parameters and 4-byte diagnostic trouble codes.

Which version of the ISO 14229-1 UDS is implemented in the WWH-OB D GTR compliant system in the vehicle is reported in the response message of this service. The external test equipment requires this information to properly interpret the data identifiers and diagnostic trouble codes.

**IMPORTANT — The server and the client shall meet the request and response message behaviour as specified in ISO 14229-1.**

#### 7.1.2 Request message

##### 7.1.2.1 Request message definition

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Table 3 — Request message definition

A_Data byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	ReadProtocolIdentification Request Service Id	M	0x12	RPROTID
#2	FunctionalGroupID	M	0x00-0xFF	FGID

##### 7.1.2.2 Request message sub-function parameter \$Level (LEV\_) definition

This service does not use a sub-function parameter.

##### 7.1.2.3 Request message data parameter definition

The following data parameter is defined for this service.

Table 4 — Request message data parameter definition

Definition
<p><b>FunctionalGroupID</b></p> <p>The FunctionalGroupIdentifier contains the functional system group e.g. emissions, brakes, all functional system groups, etc. According to the FunctionalGroupID included in the request message the server shall provide the UDVersionRecord information in the response message. The FunctionalGroupIDs are specified in Annex A.1.</p>

7.1.3 Positive response message

7.1.3.1 Positive response message definition

Table 5 — Positive response message definition

A_Data byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	ReadProtocolIdentification Positive Response Service Id	M	0x52	RPROTIDPR
#2	FunctionalGroupID	M	0x00-0xFF	FGID
#3 : #n	UDSVersionRecord[] = [ Data byte #1 : Data byte #m ]	M : C	0x00-0xFF : 0x00-0xFF	UDSVREC_ DB#1 : DB#m

7.1.3.2 Positive response message data parameter definition

The following data parameters are defined for this service:

Table 6 — Response message data parameter definition

Definition							
<p><b>UDSVersionRecord[]</b></p> <p>The UDSVersionRecord consists of an ASCII string according to the ISO/PAS 27145-2 specification (see section: ISO LATIN 1 ASCII character set). The ASCII string defines the UDS protocol version implemented by the server according to the FunctionalGroupID. The ASCII string is terminated by ASCII character 0x00.</p> <p>EXAMPLE Differences between ISO 14229-1 publication and version 2.0.0 and beyond:</p> <ul style="list-style-type: none"> <li>— 2-byte data identifiers versus 3-byte unified data identifier,</li> <li>— 3-byte DTC format versus 4-byte DTC format.</li> </ul>							
	<b>ASCII</b>	<b>Data byte #1</b>	<b>Data byte #2</b>	<b>Data byte #3</b>	<b>Data byte #4</b>	<b>Data byte #5</b>	<b>Data byte #6</b>
	2.0.0	0x32	0x2E	0x30	0x2E	0x30	0x00

7.1.4 Supported negative response codes (NRC\_)

The following negative response codes shall be implemented for this service. The circumstances under which each response code would occur are documented in Table 7.

Table 7 — Supported negative response codes

A_Data byte	Description	Cvt	Mnemonic
0x11	<p><b>serviceNotSupported</b></p> <p>This response code indicates that the requested action will not be taken because the server does not support the requested service.</p> <p>The server shall send this response code in case the client has sent a request message with a service identifier, which is either unknown or not supported by the server.</p> <p>This response code indicates that service 0x12 is not supported and that the ISO 14229-1 UDS specification implemented in the server supports the version &lt; 2.0.0.</p>		SNS
0x13	<p><b>incorrectMessageLengthOrInvalidFormat</b></p> <p>The length of the message is wrong</p>	M	IMLOIF

### 7.1.5 Message flow example ReadProtocolIdentification

The client sends a ReadProtocolIdentification request message to retrieve the UDS version number from the servers. The emissions-related system consists of two (2) servers. The FunctionalGroupID is set to emissions. Both servers send a positive response to report the UDVersionRecord.

**Table 8 — ReadProtocolIdentification request message flow example**

<b>Message direction:</b>	client → server		
<b>Message Type:</b>	Request		
<b>A_Data Byte</b>	<b>Description (all values are in hexadecimal)</b>	<b>Byte Value</b>	<b>Mnemonic</b>
#1	ReadProtocolIdentification request SID	0x12	RPROTID
#2	FunctionalGroupID (FunctionalGroupID=emissions=0x33)	0x33	FGID

**Table 9 — ReadProtocolIdentification positive response message flow example from server#1**

<b>Message direction:</b>	Server#1 → client		
<b>Message Type:</b>	Response		
<b>A_Data Byte</b>	<b>Description (all values are in hexadecimal)</b>	<b>Byte Value</b>	<b>Mnemonic</b>
#1	ReadProtocolIdentification request SID	0x52	RPROTIDPR
#2	FunctionalGroupID (FunctionalGroupID=emissions=0x33)	0x33	FGID
#3	UDVersionRecord[] = [ ] data byte #1 (2)	0x32	UDSVREC_DB#1
#4	UDVersionRecord[] = [ ] data byte #2 (.)	0x2E	UDSVREC_DB#2
#5	UDVersionRecord[] = [ ] data byte #3 (0)	0x30	UDSVREC_DB#3
#6	UDVersionRecord[] = [ ] data byte #4 (.)	0x2E	UDSVREC_DB#4
#7	UDVersionRecord[] = [ ] data byte #5 (0)	0x30	UDSVREC_DB#5
#8	UDVersionRecord[] = [ ] data byte #6 (ASCII termination byte)	0x00	UDSVREC_DB#6

**Table 10 — ReadProtocolIdentification negative response message flow example from server#2**

<b>Message direction:</b>	Server#2 → client		
<b>Message Type:</b>	Response		
<b>A_Data Byte</b>	<b>Description (all values are in hexadecimal)</b>	<b>Byte Value</b>	<b>Mnemonic</b>
#1	Negative Response SID	0x7F	SIDRSIDNRQ
#2	ReadProtocolIdentification request SID	0x12	RPROTID
#3	Negative Response Code: serviceNotSupported	0x11	SNS

Server#2 sends a neagtive response message with NRC 0x11 serviceNotSupported to indicate that the ISO 14229-1 UDS specification implemented supports the version < 2.0.0.

## 7.2 ClearDiagnosticInformation (14 hex) service

### 7.2.1 Service description

The ClearDiagnosticInformation service is used by the client to clear diagnostic information in one or multiple servers' memory.

The server shall send a positive response when the ClearDiagnosticInformation service is completely processed. The server shall send a positive response even if no DTCs are stored. The server shall support an

additional copy of permanentDTC status information in memory. Individual DTCs are erased by the server DTC monitoring logic if successfully executed with a 'pass' result. The permanentDTC status information within a server's memory shall neither be possible to be cleared by an external test equipment nor by a battery disconnect. Additional copies, e.g. backup copy in long-term memory, are updated according to the appropriate backup strategy (e.g. in the power-latch phase).

NOTE In case the power-latch phase is disturbed (e.g., a battery disconnect during the power-latch phase) this may cause data inconsistency.

The request message of the client contains the parameter groupOfDTC which allows the client to clear a functional system group of DTCs (e.g., emissions), or a specific DTC.

This service provides means for the external test equipment to command servers to clear all diagnostic information related to the functional group identifier included in the request message.

For the emissions functional system group the following diagnostic information shall be cleared:

- MIL and number of diagnostic trouble codes,
- I/M (Inspection/Maintenance) readiness bits,
- Confirmed diagnostic trouble codes,
- Pending diagnostic trouble codes,
- Diagnostic trouble code for snapshot record data,
- Snapshot record data,
- Status of system monitoring tests,
- On-board monitoring test results,
- Distance travelled while MIL is activated,
- Number of warm-ups since DTCs cleared,
- Distance travelled since DTCs cleared,
- Time run by the engine while MIL is activated,
- Time since diagnostic trouble codes cleared,
- Reset misfire counts of standardized Test ID 0x0B to zero,
- DTC status byte,
- captured DTC extended data (DTCExtendedData, ReadDTCInformationX),
- other DTC related data such as first/most recent DTC, flags, counters, timers, etc. specific to DTCs.

Other manufacturer specific “clearing/resetting” actions may also occur in response to this request message. If any of the above requirements is in conflict with the applicable local regulation the legislated requirements supersede.

DTC information reset / cleared via this service includes but is not limited to the following:

- Permanent DTCs shall be stored in non-volatile memory. These DTCs cannot be cleared by any test equipment (e.g. on-board tester, off-board tester) or by simply disconnecting the vehicle's battery. The OBD system shall clear these DTCs itself by completing and passing the on-board monitor.
- Permanent DTCs shall be erasable if the server is reprogrammed and the readiness status for all monitored components and systems are set to "not complete."

**IMPORTANT — The server and the client shall meet the request and response message behaviour as specified in ISO 14229-1.**

## 7.2.2 Request message

### 7.2.2.1 Request message definition

**Table 11 — Request message definition**

A_Data byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	ClearDiagnosticInformation Request Service Id	M	0x14	CDTCI
#2	groupOfDTC[] = [ groupOfDTCHighByte groupOfDTCMiddleHighByte groupOfDTCMiddleLowByte groupOfDTCLowByte]	M	0x00-0xFF	GODTC_ HB
#3		M	0x00-0xFF	MHB
#4		M	0x00-0xFF	MLB
#5		M	0x00-0xFF	LB

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### 7.2.2.2 Request message sub-function parameter definition

There are no sub-function parameters used by this service.

### 7.2.2.3 Request message data parameter definition

The following data parameter is defined for this service.

The groupOfDTC parameter is compatible to the DTC format in the DTCHighByte, DTCMiddleHighByte and DTCMiddleLowByte. Depending on the value contained in these bytes the DTCLowByte either contains the FunctionalGroupIdentifier or the FailureTypeByte/FailureModelIdentifier (see Table 12). The FunctionalGroupIdentifier contains the functional system group e.g. emissions, brakes, all functional system groups, etc. If a server supports multiple functional system groups in a single server the external test equipment can clear the DTCs of the selected functional system group. The FunctionalGroupID has been introduced to distinguish commands send by the test equipment between different functional system groups within an electrical architecture which consists of many different ECUs. If an ECU has implemented software of the emissions system as well as other systems which may be inspected during a an I/M test it is important that only the DTC information of the requested functional system group is reported. An I/M test should not be failed because another functional system group has DTC information stored.

**NOTE** While there is not a complete list of FunctionalGroupIdentifiers at the time the specification is published, this will be a growing list influenced by future legislation (e.g. future defined WWH-OBD GTR modules).