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Road vehicles — Information for remote diagnostic support — General requirements, definitions and use cases

Véhicules routiers — Information pour support de diagnostic à distance — Exigences générales, définitions et cas d'utilisation

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Contents

Page

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Introduction

Remote diagnostic support is used for diagnosing vehicles at a distance prior to repair work, thereby minimizing the time spent in workshops, reducing disturbances on the road network, reducing inconvenience for the vehicle users and reducing cost for vehicle owners.

This document defines remote diagnostic support and the constraints that need to be respected. This document may also serve as a reference for other standards that relate to remote diagnostic support.

This document will facilitate exchange of information for remote diagnostic support between the different stakeholders (including vehicle manufacturers and independent operators) of the vehicle repair industry.

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Road vehicles — Information for remote diagnostic support — General requirements, definitions and use cases

1 Scope

This document specifies general requirements and constraints applicable to a remote diagnostic process, the use cases and scenarios to support the implementation of a remote diagnostic process using a standardized interface of the ExVe.

It concerns:

— the road vehicles with four or more wheels designed and constructed primarily for the carriage of persons that are defined as Category 1 vehicles in the United Nations Special Resolution No.1 in TRANS/WP.29/1045, as last amended on 19 June 2012, and

— the road vehicle with four or more wheels designed and constructed primarily for the carriage of goods that are defined as Category 2 vehicles in the United Nations Special Resolution No.1 in TRANS/WP.29/1045, as last amended on 19 June 2012,

where these road vehicles are still in accordance with the specifications of the vehicle manufacturer.

This document does not define the interfaces provided by the ExVe nor the internal implementation inside the ExVe.

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Processes like repair, prognostics, monitoring, configuration, re-programming and variant coding are not part of this document.

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The prerequisites (e.g. authentication and authorization) for all use cases are not covered within this document. A possible specification of the required content for the implementation of a remote diagnostic application using the web interface of the ExVe according to ISO 20078 is given in Annex A.

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 20077-1:2017, *Road Vehicles — Extended vehicle (ExVe) methodology — Part 1: General information*

3 Terms and definitions

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

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

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

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

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3.1 Actors

3.1.1
local diagnostic facilitator
person at the vehicle that is in communication with the *remote diagnostician* (3.1.2) and facilitates the *diagnostics* (3.2) by that person's capacity to act as requested by the remote diagnostician and to answer the remote diagnostician's questions

Note 1 to entry: A local diagnostic facilitator is normally able to understand or describe the indications of the on-board instruments and tell-tales.

Note 2 to entry: The local diagnostics facilitator will normally have the necessary consent to operate the concerned device, system, or vehicle.

3.1.2
remote diagnostician
physical person, who may be assisted by technology, to perform a remote *diagnostic process* (3.2)

3.2
diagnostics
diagnostic process
process including the detection process of possible *malfunctions* (3.8), the identification of the likely root cause of these malfunctions and the appraisal of its relevance for the operation of the vehicle

[SOURCE: ISO 20077-1:2017]

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3.3
diagnostics step 1
detection process of possible vehicle *malfunctions* (3.8)

Note 1 to entry: The detection process of possible vehicle malfunctions (diagnostics step 1) may lead to the conclusion of an absence of malfunction.

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[SOURCE: ISO 20077-1:2017]

3.4
diagnostics step 2
identification of the likely root cause of *malfunctions* (3.8)

Note 1 to entry: Root cause analysis (diagnostics step 2) is only performed in presence of a malfunction. Root cause analysis is performed if diagnostics step 1 has been performed.

[SOURCE: ISO 20077-1:2017]

3.5
extended vehicle
entity, still in accordance with the specifications of the *vehicle manufacturer* (3.7), that extends beyond the physical boundaries of the road vehicle and consists of the road vehicle, off-board systems, external interfaces and the data communication between the road vehicle and the off-board systems

Note 1 to entry: Road vehicles without off-board systems and road vehicles equipped with telematics units are extended vehicles.

[SOURCE: ISO 20077-1:2017]

3.6
ExVe manufacturer
vehicle manufacturer (3.7) responsible for the extended vehicle

[SOURCE: ISO 20077-1:2017]

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3.7
vehicle manufacturer
person or body who is responsible to the approval authority for all aspects of the type approval or authorization process and for ensuring conformity of production of a vehicle

Note 1 to entry: It is not essential that the person or body be directly involved in all stages of the construction of the vehicle, system, component or separate technical unit which is the subject of the approval process.

3.8
malfunction
state of a system or component that deviates from the specifications of the *vehicle manufacturer* (3.7)

Note 1 to entry: A malfunction may be the object of an alert on board the vehicle and possibly lead to a DTC, but a malfunction does not necessarily preclude a DTC.

Note 2 to entry: A slight deterioration of a system, such as the normal wear of that system, is not a malfunction as long as it does not impair the performance of that system against the design specifications of the vehicle manufacturer.

[SOURCE: ISO 20077-1:2017]

3.9
remote, adjective
performed on a vehicle from a distance where the operator responsible for the concerned operation is not co-located with the vehicle and where the vehicle is connected via an external network

EXAMPLE Remote diagnostics, remote access

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Note 1 to entry: The operator responsible for the concerned operation is a specific actor in terms of use case.

[SOURCE: ISO 20077-1:2017]

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3.10
remote diagnostic process
process including the detection of possible vehicle *malfunctions* (3.8), the identification of the likely root-cause of these malfunctions, and the assessment of its relevance for the operation of the vehicle, which is performed on a vehicle from a distance where the remote diagnostician responsible for the concerned operation is not co-located with the vehicle and where the vehicle is connected via an external network

3.11
remote diagnostic support
information provided to a *remote diagnostician* (3.1.2) to assist in the performance of the *remote diagnostic process* (3.10) of a vehicle

Note 1 to entry: Typical examples of remote diagnostics support are:

— information for performing a remote diagnostic process on a vehicle (for example instructions, training material, etc.),

— information specified for remote diagnostics use-cases, and

— information used by the after-sales remote diagnostics tool equipment systems.

Note 2 to entry: Diagnostic support that is provided for performing conventional diagnostics is the foundation for remote diagnostic support (the access to that information in the case of conventional diagnostics is standardised in ISO 18541-1).

[SOURCE: ISO 20077-1:2017]

3.12 Vehicle states

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3.12.1
vehicle state
condition of the vehicle at a point in time with regard to motion and operation

EXAMPLE Stationary, moving, normally operating, non-operating vehicle.

3.12.2
moving vehicle
vehicle which is not stationary

3.12.3
stationary vehicle
vehicle which had a speed of 0 km/h for at least 1 minute

Note 1 to entry: The engagement of any measure such as a parking brake, a trailer-brake, or a hand-brake is not necessary for being stationary.

3.12.4
non-operating vehicle
stationary vehicle with propulsion system OFF and power-take-off systems off

Note 1 to entry: The engagement of any measure such as a parking brake, a trailer-brake, or a handbrake may be necessary for being non-operating vehicle.

3.12.5
normally operating vehicle
vehicle operating within its design criteria under normal duty operation

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Note 1 to entry: A vehicle with a power take off engaged shall be considered as normally operating even if it is a stationary vehicle.

Note 2 to entry: A vehicle in a repair, maintenance, or inspection process shall not be considered as a normally operating vehicle.

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3.13
prognostics
prognostic process
<automotive> process of forecasting the possible occurrence of vehicle *malfunctions* (3.8) and appraising the likely remaining operation time of the vehicle until these malfunctions occur

Note 1 to entry: A prognostic process cannot be performed without having performed the detection process for possible malfunctions of the same functionally related system [*diagnostics step 1* (3.3)].

Note 2 to entry: A *diagnostic process* (3.2) may be performed without performing a prognostic process for example, in the case of the presence of a malfunction, when *diagnostics step 2* (3.4) is performed.

[SOURCE: ISO 20077-1:2017]

3.14
snapshot data
specific data records associated with a DTC which are generated and stored at the time the DTC was detected

4 Symbols and abbreviated terms

API Application program interface

ECU Electronic control unit

ExVe Extended vehicle

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DTC Diagnostic trouble code

ID Identifier

VIN Vehicle identification number

VM Vehicle manufacturer

5 Overview and general requirements for the remote diagnostic process and support

5.1 Remote diagnostic application and ExVe interaction

This document focuses on the interaction between a remote diagnostic client application and the ExVe as defined in ISO 20077-1 (see Figure 1).

For the use cases detailed, this document specify the communication established between the remote diagnostic application or server of the service provider and the ExVe ("machine-to-machine"). The output of the use-cases presented in this document is information that constitutes a major part of remote diagnostic support. This information may be used as well by the remote diagnostician when remotely diagnosing a vehicle or by the designer of a remote diagnostic application.

NOTE Such an application can be used at a later stage by the remote diagnostician.

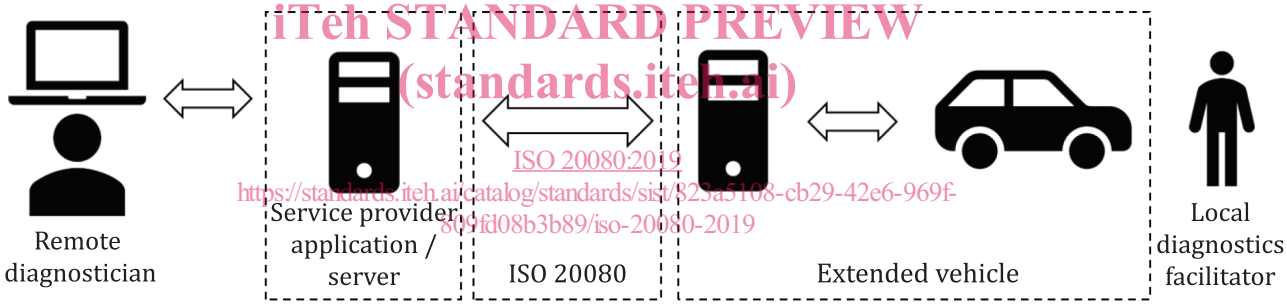

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Figure 1 — Remote diagnostic client application and ExVe server to server communication

5.2 Content and use case scenarios

5.2.1 Capability to perform use cases

The capability to perform the different use cases can depend on the authorization, on the diagnosis tasks (e.g., remote activation of actuators), technical parameters (e.g. stability of connection, battery capability, vehicle status) and e.g. the brand and model of the vehicle.

5.2.2 Use case scenarios

There are two major scenarios: stationary vehicle and moving vehicle. In both situations, a remote diagnostician is responsible for the diagnostic procedure and a local diagnostic facilitator is in place and responsible for the vehicle.

5.3 Basic principles

Basic principle 1:

— All use cases are based on the condition that the diagnostician in charge for the remote diagnostic process is remote from the vehicle.

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Basic principle 2:

— Some use cases require that a local diagnostic facilitator shall be present for necessary interactions within the remote diagnostic process. The use case description describes when this is required.

Basic principle 3:

— In the case of concurrent requests from service providers to the ExVe, the ExVe shall react to concurrent requests in a safe way. This reaction may for example be to respond that the requested functionality is currently not available, or to put the latter request in the queue.

Basic principle 4:

— The ExVe manufacturer is responsible for ensuring that the designed ExVe functionality respects that the correlation between the vehicle owner and the performed functions is not monitored for competition purposes.

Basic principle 5:

— The ExVe manufacturer is responsible for ensuring that the designed ExVe functionality respects that the correlation between the after-sales service provider and the performed functions is not monitored for competition purposes.

5.4 Access to information for remote diagnostic support

There are several alternatives for the vehicle manufacturer to provide remote diagnostic support:

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— According to Annex A

  — The vehicle manufacturer shall supply supplementary vehicle manufacturer specific information.

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— Vehicle manufacturer specific solution

  — Vehicle manufacturer shall supply specifications describing the solution to the service provider.

— Other standardised solution

Constraints such as vehicle state, compatibility with manufacturer specific functions, accessibility of data, freight and transport security and safety, etc. shall be considered.

5.5 Error conditions and handling

5.5.1 General

This clause describes the different error conditions that the ExVe interface may return to the service provider during a remote diagnostic process. Even if the service provider has access to a remote diagnostic functionality an error might be returned when the function is accessed. The error might be due to different reasons, e.g. wrong vehicle state, no connectivity or vehicle specification not supporting the requested remote diagnostic function.

Internal errors inside the ExVe itself (i.e.: errors between the ExVe backend server and the physical vehicle) are not relevant here.

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5.5.2 Communication interface specific errors

— ExVe interface not responding

  — No communication between the remote diagnostic support application and the ExVe.

— Vehicle identifier not recognised

  — Either the vehicle identifier has been entered incorrectly or the system does not recognize the entered vehicle identifier as a vehicle with remote diagnostic capability.

— Request currently not possible to perform by the ExVe.

5.5.3 General errors for use cases

— Incompatible vehicle state.

5.5.4 Specific errors for use cases

— These are handled in the individual use cases:

  — Actuator identification not valid;

  — Actuation parameters not valid;

  — ECU ID not valid;

  — DTC status not valid;

  — DTC ID not valid;

  — Number of parameters exceeded;

  — Parameter ID not valid;

  — Routine ID not valid;

  — Parameters not valid;

  — Setting ID not valid;

  — Value not valid.

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5.6 Conditions for conformance with this document

Compliance with this document means that the following conditions are met:

— The vehicle manufacturer implements the use case “use case discovery” specified in 6.2, in a web accessible manner, and the service provider will apply the “use case discovery”.

— The vehicle manufacturer, when acting as a service provider, and the service provider implement the use cases they support according to the relevant clauses as specified in this document.

6 Use cases for remote diagnostic support

6.1 General

A precondition is that the service provider has access to VM specific information about identifiers (including vehicle identifier), parameters, units, conversions and the definition of the DTC statuses (e.g. ACTIVE, PENDING and PREVIOUSLY_ACTIVE) used in the use cases.

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For all supported use-cases, the ExVe shall provide an answer.

The actor in each use case is the remote diagnostic application.

The timestamp included in the use cases describes the point in time the data was received by the ExVe back-end server from the vehicle.

The vehicle identifier can be the VIN or similar unique identification of the vehicle. If VIN is not used, this unique vehicle identifier shall also be used consistently by the vehicle manufacturer for remote diagnostic support.

6.2 Use Case 01 — Use case discovery

See Table 1 for Use Case 01 - Use case discovery.

Table 1 — Use Case 01 — Use case discovery

Goal	Provide information about which remote diagnostic functionality that is available for the current vehicle through the ExVe interface.
Input	Command for supported diagnostic functionality. Interface input: — Vehicle identifier
Description	The command is received by the ExVe interface. If the discovery command is executed, the ExVe checks that this command can be carried out with respect to applicable constraints. The ExVe compiles the accessible diagnostic functionality in a format depending on the implementation.
Output	The supported diagnostic use cases, with respect to applicable constraints, are returned. Interface output: — Accessible use cases (remote diagnostic functions)
Example	Interface input: — Vehicle identifier: 12345678909876543 Interface output: — Use case 02, — Use case 03, — Use case 05, — Use case 06, — Use case 07
Error conditions	No use case specific errors

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6.3 Use Case 02 — Identify ECUs installed in the vehicle

See Table 2 for Use Case 02 - Identify ECUs installed in the vehicle.

Table 2 — Use Case 02 — Identify ECUs installed in the vehicle

Goal	Provide all VM ECU IDs and corresponding vehicle manufacturer software and hardware part numbers which are installed in the chosen vehicle through the ExVe interface.
Input	Command to identify VM ECU ID, software and hardware for all ECU fitted to the vehicle. Interface input: — Vehicle identifier
Description	The command is received by the ExVe interface. If the command is executed in the vehicle, the ExVe checks that this command can be carried out with respect to applicable constraints, such as vehicle state. The ExVe reads the current VM ECU ID, software and hardware for all ECUs fitted to the vehicle.
Output	The current VM ECU ID, software and hardware for all ECUs on the vehicle is returned according to the command or the command is denied due to safety or security restrictions applied to the vehicle state. Interface output: — Timestamp (received at ExVe back-end server) — List of ECUs — For each ECU — ECU ID — HW part number(s) — SW part number(s)
Example	Interface input: — Vehicle identifier: 12345678909876543 Interface output: — Timestamp: 2016-02-24 09:23, — ECU ID: ABC, — HW part number: 1234567, — SW part number: 9876543; — ECU ID: DEF, — HW part number: 2345678, — SW part number: 8976543; — ECU ID: GHI, — HW part number: 3456789, — SW part number: 7896543, SW part number: 7896555
Error conditions	No use case specific errors

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