INTERNATIONAL STANDARD

ISO 13209-1

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Road vehicles — Open Test sequence eXchange format (OTX) —

Part 1: General information and use cases

Véhicules routiers — Format public d'échange de séquence-tests (OTX) —
Partie 1: Information générale et cas d'utilisation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 13209-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 13209 consists of the following parts, under the general title *Road vehicles — Open Test sequence eXchange format (OTX)*:

— *Part 1: General information and use cases*

— *Part 2: Core data model specification and requirements*

— *Part 3: Standard extensions and requirements*

Introduction

Diagnostic test sequences are utilized whenever automotive components or functions with diagnostic abilities are being diagnosed, tested, reprogrammed or initialized by off-board test equipment. Test sequences define the succession of interactions between the user (i.e. workshop or assembly line staff), the diagnostic application (the test equipment) and the vehicle communication interface as well as any calculations and decisions that have to be carried out. Test sequences provide a means to define interactive, guided diagnostics or similar test logic.

Today, the automotive industry mainly relies on paper documentation and/or proprietary authoring environments to document and to implement such test sequences for a specific test application. An author who is setting up engineering, assembly line or service diagnostic test applications needs to implement the required test sequences manually, supported by non-uniform test sequence documentation, most likely using different authoring applications and formats for each specific test application. This redundant effort can be greatly reduced if processes and tools support the OTX (Open Test sequence eXchange) concept.

ISO 13209 proposes an open and standardized format for the human- and machine-readable description of diagnostic test sequences. The format supports the requirements of transferring diagnostic-test-sequence logic uniformly between electronic system suppliers, vehicle manufacturers and service dealerships/repair shops.

ISO 13209 (also referred to as the OTX standard) is comprised of three parts:

Part 1: General information and use cases

This provides a general overview over the individual parts. It documents use cases that were considered during the standardization and which are derived from real world scenarios as found in the automotive industry. It also provides the rationale for proposing the OTX standard, explaining the considerations that went into the development of that standard and giving an overview of the structure of the concepts and documents related to ISO 13209.

Part 2: Core data model specification and requirements

This provides the data model specification of the core part of the OTX test sequence description language in the form of UML design diagrams, XML Schema definitions and descriptive documentation. The core describes the basic structure underlying every OTX document. This comprises detailed data model definitions of all required control structures by which test sequence logic is described, as well as definitions of the outer, enveloping document structure in which test sequence logic is embedded. A tool implementing the OTX standard has to implement all definitions within Part 2 to be considered compliant with the OTX standard.

Part 3: Standard extensions and requirements

This provides specifications for ubiquitous functionalities that may, to various extents, be used by every OTX-based environment. The core data model extensions defined in Part 3 makes use of the extension mechanisms provided by the OTX language to provide interface definitions for feature sets like HMI (Human-Machine Interface), internationalization or diagnostic vehicle communication. A tool implementing the OTX standard does not have to implement all (or any) of the extension definitions within Part 3 to be considered compliant with the OTX standard.

Road vehicles — Open Test sequence eXchange format (OTX) —

Part 1: General information and use cases

1 Scope

This part of ISO 13209 specifies a standardized, tester-independent, XML-based data exchange format for the documentation and formal description of diagnostic test sequences. The format serves to support the requirements of transferring diagnostic-test-sequence logic between electronic system suppliers, vehicle manufacturers and service dealerships/repair shops.

This part of ISO 13209 provides an introduction to the rationale behind ISO 13209. It gives an overview of the document set and structure along with the use case definitions and a common set of resources (definitions, references) for use by all subsequent parts.

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 14229 (all parts), *Road vehicles — Unified diagnostic services (UDS)*

ISO 22900 (all parts), *Road vehicles — Modular vehicle communication interface (MVCI)*

ISO 22901 (all parts), *Road vehicles — Open diagnostic data exchange (ODX)*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

3.1.1
aftermarket
part of the automotive industry concerned with manufacturing, remanufacturing, distribution, retailing and installation of all vehicle parts, chemicals, tools, equipment and accessories for light and heavy vehicles, after the sale of the automobile by the original equipment manufacturer (OEM) to the consumer

3.1.2
after sales
after-sales department
department of an automotive OEM which is concerned with the distribution, retailing, servicing, repair and installation of vehicles

3.1.3
engineering
engineering department
department of an automotive OEM which is concerned with the design, development, integration and testing of vehicles

3.1.4
manufacturing
manufacturing department
department of an automotive OEM which is concerned with the production and end-of-line testing of vehicles

3.1.5
original equipment manufacturer
OEM
automotive company that engineers, manufactures, sells and services vehicles

3.1.6
OTX Core
most generic and stand-alone part of the overall OTX data model which describes the basic structure underlying every OTX document and comprises detailed data model definitions of all required control structures (loops, branches, etc.) by which test sequence logic is described, and definitions of the outer, enveloping document structure in which test sequence logic is embedded

3.1.7
OTX Extension
OTX Standard Interface Definition
otxIFD
set of OTX data type-, action-, term- and signature-definitions that are tailored for a specific area of application and that are defined outside of the OTX Core

NOTE OTX Extension model data types, actions and terms needed for communication with systems are usually hidden behind diverse interfaces (e.g. a MVCI, HMI, GDI, etc.). Through these interfaces, calls can be performed to external systems whose internal behaviours do not have to be known to the (client) OTX test sequence/runtime. The system-side interface (server-side) can be proprietary because the adapter design pattern is applied.

3.1.8
test procedure
procedure
stand-alone, configurable flow of OTX actions that can be executed separately by a diagnostic application or be called from other OTX procedures

3.1.9
test sequence
main procedure
test procedure defining a full test

NOTE A test sequence is a procedure, but not all procedures are test sequences. By using procedures, a test sequence can be split into several procedure modules. An adequately assembled set of frequently needed procedures can serve as a library which provides procedures that are callable from any other (client) procedure or test sequence.

3.2 Abbreviated terms

API Application programming interface

CM Configuration management

GDI Generic device interface

HMI Human-machine interface

JRE Java runtime environment

MVCI Modular vehicle communication interface

OEM Original equipment manufacturer

OTX Open test sequence eXchange

UML Unified modeling language

XML Extensible markup language

XSD XML Schema Definition

4 Document overview and structure

This part of ISO 13209 is structured into three main sections.

— Clauses 1 to 3 and the Introduction provide an overview of the concepts that ISO 13209 aims to cover, define the scope of what is being standardized and provide the basic terms, definitions and abbreviated terms.

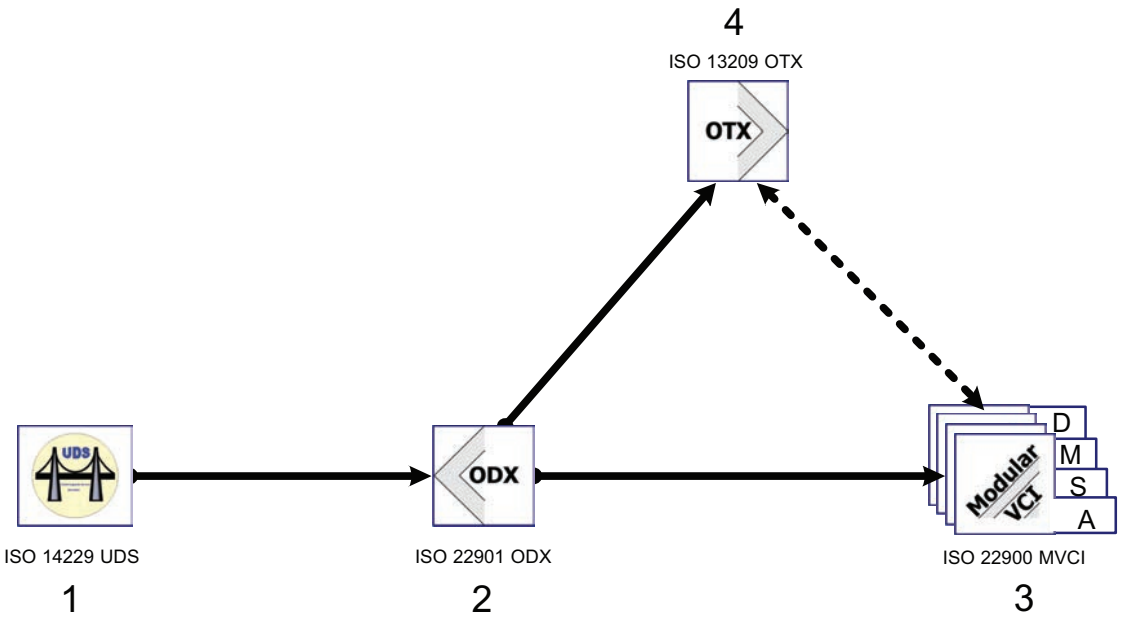
— Clause 5 details the general considerations that went into the standardization effort, illustrates usage scenarios on a high level and introduces the design of OTX-based processes and systems.

— Clauses 6 and 7 define the use cases that were considered during the development of the OTX standard.

5 General considerations

5.1 Integration of OTX with existing standards

An overview of how OTX fits into the structure of existing diagnostic ISO standards is given in Figure 1. Please note that although this overview depicts OTX in the context of ISO 22900 (MVCI) and ISO 22901 (ODX) standards, **OTX is by no means designed to be used only in conjunction with these standards**. The use of any other equivalent symbolic data description is also supported. It is an explicit design goal of OTX that the OTX data model can be used within any system context.



Key

1 ISO 14229 (all parts), *Road vehicles — Unified diagnostic services (UDS)*
2 ISO 22901 (all parts), *Road vehicles — Open diagnostic data exchange (ODX)*
3 ISO 22900 (all parts), *Road vehicles — Modular vehicle communication interface (MVCI)*
4 ISO 13209 (all parts), *Road vehicles — Open Test sequence eXchange format (OTX)*
D OEM development
M OEM manufacturing
S OEM service/aftersales
A aftermarket
solid arrows “used by”
dotted arrows “interacts with”

Figure 1 — Integration of OTX with existing standards

5.2 Improvement of documentation quality

At present, documentation of diagnostic test sequences is done in various ways. Documentation exists in the form of text documents, flow charts, tables, etc. The transporting media are non-uniform paper printouts or computer files/database entries that are based on proprietary formats. Moreover, some of the diagnostic test sequence knowledge is transported by verbal communication only.

Since neither the storage format nor the human-readable presentation is standardized, test sequences have to be re-implemented frequently; the various media used for documenting the related knowledge lead to misunderstandings and interpretation gaps. Even if the content (the diagnostic expert knowledge) of documentation is of high quality, the quality and usability of the actual documentation tend to be rather poor.

One of the goals of ISO 13209 is to provide a formal, machine-readable, uniform documentation format. OTX shall also be designed for easy visualization of diagnostic test sequences. This allows for providing diagnostic test sequences in a formal, machine-readable format that can at the same time be easily visualized to be comprehensible to human readers.

5.3 Refinement of diagnostic authoring processes

Diagnostic test sequences exist in a lot of different formats produced by various proprietary authoring tools. This results in a tight interlocking of authoring tools, data formats and runtime applications. The effect is poor to non-existent interchangeability of authoring tools, diagnostic applications and of diagnostic test

sequences themselves. As a consequence, there is a high degree of redundancy within OEM processes, as test sequences have to be re-modelled multiple times to make them work with different diagnostic applications, e.g. in engineering, manufacturing or after sales. This reduces productivity and, at the same time, quality.

As shown in Figure 2, OTX is a means to improve the exchangeability of diagnostic test sequences. It enables OEMs to base their OTX-specific processes on the single source principle, where OTX sequences are the root of the diagnostic-test-sequence-authoring process starting at the supplier and extending through engineering, manufacturing and after sales to aftermarket and legislative applications.

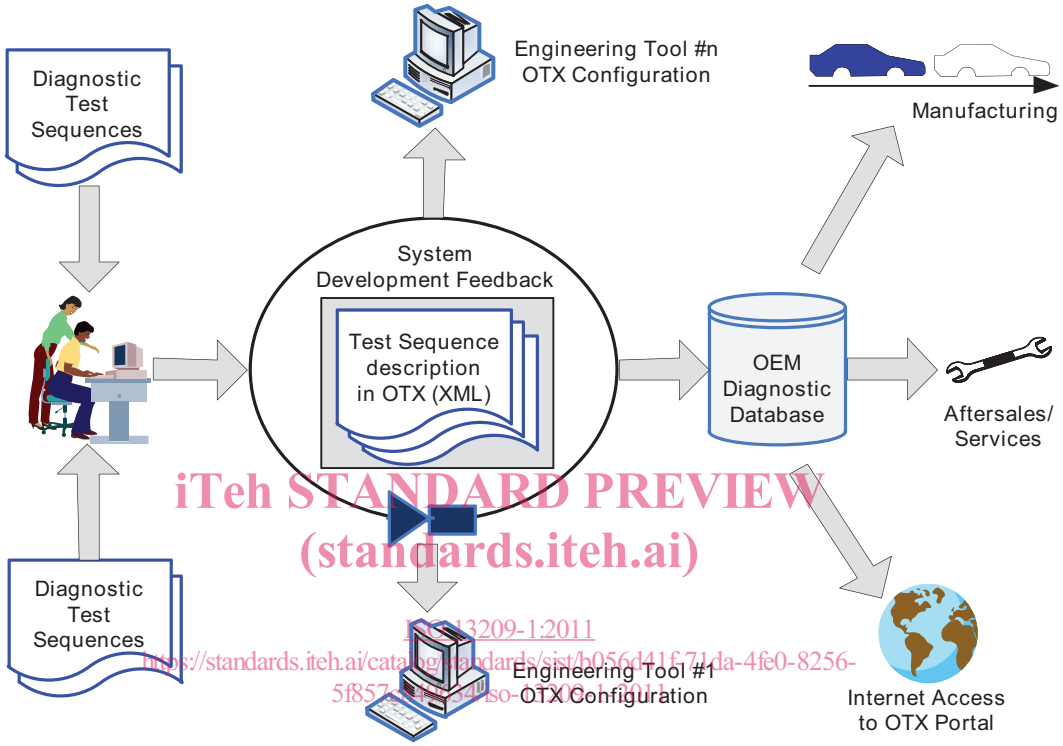


Figure 2 — Usage of OTX data in the ECU life cycle

Although the adaptation of a test sequence to a specific runtime context might require a certain amount of manual implementation work in some cases, the OTX diagnostic test sequence format makes it possible to automatically convert OTX documentation into proprietary data formats. This can be done by implementing converters and code generators for target authoring tools and diagnostic applications.

5.4 Achieving long-term availability of test sequences

Because of the reasons outlined in 5.3, automotive OEMs are often tied to their proprietary authoring-system/data-format/diagnostic-application tool chain. Vast diagnostic test sequence libraries that were accumulated over years eventually become unusable when migrating to a new diagnostic application that doesn't support the old, proprietary sequence formats. Being a standardized data format, OTX offers a higher degree of independency from proprietary tools. At the same time, suppliers are freed from inventing and maintaining customer-specific solutions for the representation of the test sequences that are used by their tools, enabling them to provide OTX-based products instead of customer-tailored solutions. Companies competing on this level can focus on providing real added value for their authoring and runtime product offerings, the differentiator being tool features, usability aspects and integration concepts rather than subtle intricacies of highly customer-specific peculiarities of underlying data formats.