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Road vehicles — Modular vehicle communication interface (MVCI) —

Part 1: Hardware design requirements

Véhicules routiers — Interface de communication modulaire du véhicule (MVCI) —

Partie 1: Exigences de conception du matériel

Reference number
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Contents

Page

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 22900-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 22900 consists of the following parts, under the general title *Road vehicles — Modular vehicle communication interface (MVCI)*:

— *Part 1: Hardware design requirements*

— *Part 2: Diagnostic protocol data unit application programming interface (D-PDU API)*

— *Part 3: Diagnostic server application programming interface (D-Server API)*

Introduction

The ISO 22900 series of standards is applicable to diagnose and program vehicle electronic control modules with off-board applications through the vehicle's communication interface.

This part of ISO 22900 has been established in order to define the requirements of cascading multiple communication interfaces supporting current, future, and legacy standardized and original equipment manufacturer (OEM) proprietary protocols implemented by different tool manufacturers. Today's situation in the automotive after-market requires different vehicle communication interfaces for different vehicle OEMs. Many vehicle communication interfaces are incompatible with regard to their interconnect ability because this was not a requirement when designed.

The objective of this part of ISO 22900 is to specify the hardware design requirements to support a “plug and play” type concept of different vehicle communication interfaces from different tool manufacturers. The hardware design requirements are applicable to different levels of compliance, and they will address the inter-vendor operability at the vehicle diagnostic connector end as well as the test equipment end, which executes the applications (Electronic Control Unit diagnostics, programming, etc.).

Implementation of the Modular Vehicle Communication Interface (MVCI) server concept supports overall cost reduction to the end user because a single diagnostic or programming application will support many vehicle communication interfaces supporting different protocols.

Road vehicles — Modular vehicle communication interface (MVCI) —

Part 1: Hardware design requirements

1 Scope

This part of ISO 22900 provides the framework to allow diagnostic and reprogramming software applications from all vehicle manufacturers the flexibility to work with multiple vehicle communication interfaces (VCI) from multiple tool suppliers. This system enables each vehicle manufacturer to support all vehicle communication interfaces to perform diagnostics and to control the programming sequence for electronic control units (ECUs) in their vehicles.

This part of ISO 22900 describes the applicable use cases to justify the benefits of ISO 22900. It also specifies the design requirements to be followed by diagnostic and programming vehicle communication interface designers. The design requirements are categorized into different levels of conformance classes to provide:

— "software compliance", a set of requirements for existing VCIs, which are software but not hardware compliant;

— "electrical compliance", defining all signals and electrical interfaces that allow a system integrator to connect more than one VCI Protocol Module to the vehicle diagnostic connector and the host system;

— "mechanical compliance", defining standard connectors on the VCI Protocol Module to interface to the vehicle Data Link Connector (DLC) and the host system, as well as defining a cabling concept to support interfacing more than one VCI Protocol Module.

The technical requirements specified in this part of ISO 22900 have been influenced by the requirements of legal authority with regard to "vehicle OBD and programming".

The Modular Vehicle Communication Interface hardware design requirements will provide appropriate development guidance for vehicle communication interface manufacturers to meet legal authority and automotive manufacturer demands with regard to inter-vendor operability.

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 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*

3 Terms and definitions

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

3.1
Universal Serial Bus On-The-Go
USB OTG
supplement to the USB 2.0 specification that augments the capability of mobile devices and USB peripherals by adding host function for connection to USB peripherals

3.2
Ethernet
physical network media type

4 Abbreviated terms

API	Application Programming Interface
ASCII	American Standard for Character Information Interchange
DLC	Data Link Connector
DLL	Dynamic Link Library
D-PDU API	Diagnostic Protocol Data Unit Application Programming Interface
D-Server API	Diagnostic Server Application Programming Interface
EC	Electrical Compliance
ECU	Electronic Control Unit
MC	Mechanical Compliance
MVCI	Modular Vehicle Communication Interface
ODX	Open Diagnostic data eXchange
OEM	Original Equipment Manufacturer
PC	Personal Computer
PDA	Personal Digital Assistant
PDU	Protocol Data Unit
PEC	Protocol Expansion Connector
PEM	Protocol Expansion Module
PES	Protocol Expansion Slot
SC	Software Compliance
USB	Universal Serial Bus
USB OTG	Universal Serial Bus On-The-Go

5 Specification release version information

5.1 Specification release version location

Specification release version information is contained in each Modular VCI release document specification under the same title “Specification release version information”. It is important to check for feature support between Modular VCI release specifications if the hardware and most recent API features shall be implemented. The D-PDU-API supports the reading of version information by the API function call PDUGetVersion.

Release version information is also contained in the following files:

— Root Description File (RDF);

— Module Description File (MDF);

— Cable Description File (CDF);

— D-PDU API Library File.

5.2 Specification release version

The specification release version of this part of ISO 22900 is: V2.2.0.

6 Use cases

6.1 OEM merger

In the past, several OEMs in the automotive industry have merged into one company.

All companies leverage existing (legacy) components and jointly develop new products, which are common across different vehicle types and badges. OEMs specify requirements and design electronic systems to be implemented in multiple vehicle platforms in order to avoid re-inventing a system for different vehicles. The majority of design, normal operation, and diagnostic data of an electronic system are re-used if installed in various vehicles. This may create situations where more than one OEM proprietary vehicle communication protocol needs to be supported by the off-board diagnostic and programming VCI.

At least two possible solutions are available to address this scenario:

a) each dealership of the newly formed company shall have all OEM proprietary VCIs to diagnose/program the new vehicle design with carry over components/ECUs from legacy vehicles;

b) each dealership of the newly formed company shall have a Modular VCI which meets the “mechanical compliance” requirement.

Solution b) is more attractive to an after-market dealership because of the flexibility to enhance the communication capability at any time.

6.2 Compatibility between VCIs from after-market tool suppliers

The after-market tool suppliers design VCIs according to protocol standards, which are referenced by legal authorities or implemented by OEMs to diagnose and program vehicle servers. Each VCI behaves differently and requires individual support and maintenance.

The Modular VCI concept provides different levels of compliance to provide compatibility between different Modular VCIs from different after-market tool suppliers.

6.3 Future vehicle technology and data link(s)

Vehicle technology is growing into faster and more complex data links. Legal authorities request industry to agree on a single solution data link, but do not limit the vehicle manufacturer to implement faster data busses, which might be connected to the vehicle diagnostic connector manufacturer proprietary pins.

Non Modular VCI compliant interfaces meet the communication requirements as specified for a particular model line, model year range, or a certain number of data links and protocols. In many cases, a VCI needs to be replaced if a new diagnostic data bus or protocol is implemented in the vehicle.

In order to adapt to new vehicle technology and data links, the Modular VCI concept specifies different compliance levels, which accommodate various levels of compatibility to provide data link and protocol enhancement capabilities.

7 Modular VCI concept

7.1 Compliance levels

This clause specifies three different compliance levels for the Modular VCI concept, as described in Table 1.

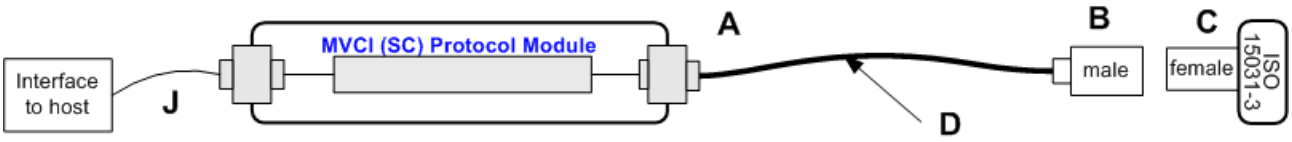
Table 1 — Modular VCI compliance levels

Tier	MVCI compliance levels	Description
1	Software compliance (SC)	Software compliance defines a set of requirements for existing VCIs, which are software but not hardware compliant (e.g. software solution).
2	Electrical compliance (EC)	Electrical compliance defines all signals and electrical interfaces that allow a system integrator to connect more than one VCI Protocol Module to the vehicle diagnostic connector and the host system. This compliance level includes Tier 1 Modular VCI software compliance.
3	Mechanical compliance (MC)	Mechanical compliance defines standard connectors on the VCI Protocol Module to interface with the vehicle DLC and the host system. In addition, it defines a cabling concept to support interfacing more than one VCI Protocol Module. This compliance level includes Tier 1 Modular VCI software compliance and Tier 2 Modular VCI electrical compliance.

7.2 Tier 1 Modular VCI software compliance (SC)

This compliance level neither requires compatibility between vehicle communication interfaces nor scan tool. Compliance is required in software and specified in ISO 22900-2 and ISO 22900-3.

Figure 1 shows software compliant VCI Protocol Module linked to the vehicle diagnostic connector utilizing the original cable [D] and diagnostic connector adapter [C]. The cable [D] is linked to the diagnostic connector adapter [C] via the connector [B]. The software compliant VCI Protocol Module uses the connection [J] to the host system. The host connection can be realized via cable or standard wireless technology.



Key

A MVCI Protocol Module standardized DLC connector
B DLC connector to plug-in diagnostic connector adapter
C Diagnostic connector adapter
D Data Link Cable (DLC)
J MVCI Protocol Module host connector

Figure 1 — Use case of Modular VCI software compliance (SC)

7.3 Tier 2 Modular VCI electrical compliance (EC)

This compliance level requires a high impedance state as the default state (power down, power on and no communication established) for each communication port (physical layer) supported in the electrical compliant VCI Protocol Module or scan tool hardware. This is required in order to combine more than one VCI Protocol module and/or scan tool hardware via a “Y-cable” design to the vehicle diagnostic connector. The communication ports shall only be enabled by software commands to the VCI Protocol Module or scan tools. It shall be the responsibility of the diagnostic, programming, and other applications to only enable electrically compatible protocols as well as valid combinations of communication protocols at the same diagnostic connector pin.

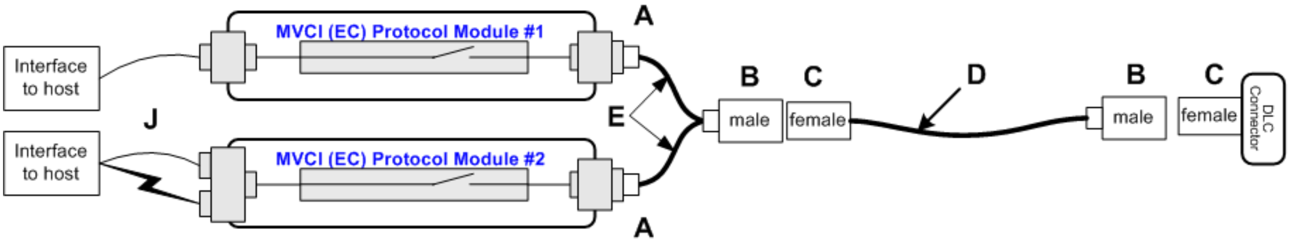
In addition, compliance is required in software and specified in ISO 22900-2 and ISO 22900-3.

The following describes a use case of more than one MVCI (EC) Protocol Module.

Figure 2 shows two electrical compliant MVCI (EC) Protocol Modules linked to the vehicle diagnostic connector utilizing the original cable [D] and the diagnostic connector adapter. A “Y” type cable [E] is used to connect both MVCI (EC) Protocol Modules to the DLC cable [D]. The tool supplier is free to choose the vehicle DLC connector types. It is recommended, but not required, to use the same DLC connector type as specified for “mechanical compliance”.

Figure 2 only shows one cable configuration of multiple configurations that are possible. It is the system integrator’s responsibility to ensure that the cabling system is compatible with the MVCI (EC) Protocol Modules that are being used.

Each MVCI (EC) Protocol Module uses a different connection [J] to the host system. In this example, the host connection of MVCI (EC) Protocol Module #1 is cable based and the MVCI (EC) Protocol Module #2 uses a standard wireless technology [cable of MVCI (EC) Protocol Module #2 is also shown because this is the standard interface to be implemented].



Key

A MVCI Protocol Module standardized DLC connector

B DLC connector to plug-in diagnostic connector adapter

C Diagnostic connector adapter

D Data Link Cable (DLC)

E “Y” type cable is used to connect both MVCI (EC) Protocol Modules to the DLC cable

J MVCI Protocol Module host connector (either wired or wireless)

Figure 2 — Use case of two electrical compliant MVCI (EC) Protocol Modules

7.4 Tier 3 Modular VCI mechanical compliance (MC)

The mechanical compliance level requires a chassis with at least one vehicle protocol expansion slot to insert a vehicle Protocol Expansion Module (PEM). The purpose of this compliance level is to support protocol upgrade capability by a plug-in vehicle Protocol Expansion Module(s) into a Modular VCI chassis. The chassis provides a tool supplier specific vehicle Protocol Expansion Slot (PES) for a plug-in vehicle Protocol Expansion Module/card (PEM). In addition, the chassis may provide appropriate space for an integrated or plug-in server module/card.

The vehicle protocols integrated into a Modular VCI chassis are required to support a high impedance state for each vehicle protocol port (physical layer). This requirement enables the system to support multiple protocols on the same pin of the vehicle diagnostic connector. The vehicle communication ports shall be enabled by software commands. It shall be the responsibility of the diagnostic, programming, and other applications to only enable electrical compatible vehicle protocols as well as valid combinations of vehicle communication protocols at the same diagnostic connector pin.

Standard connectors are required on the chassis to interface with the vehicle Data Link Connector (DLC) and the host system. The vehicle Data Link Connector is specified in 8.6.2. The host system connector is specified in 8.5.5.5.

In addition, it defines a cabling concept to support interfacing more than one VCI Protocol Module.

Figure 3 shows one possible use case of Modular VCI mechanical compliance.

This Modular VCI chassis [A] has a server board [B], which also includes a base set of vehicle communication protocols. The front side of the chassis [A] provides two Protocol Expansion Slots (PES) [C] and [D]. A tool supplier specific vehicle Protocol Expansion Module/card (PEM) [E] can be inserted into the chassis [A].