



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 39851.3-2021

**Road vehicles - Diagnostic communication over Controller Area
Network (DoCAN) - Part 3: Requirements for emissions-related
systems**

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1 Scope

This document specifies requirements for Controller Area Networks (CAN)

where one or more controllers comply with on-board diagnostics (OBD) or world-wide harmonized on-board diagnostics (WWH-OBD) regulations. The network presumes the use of an external test equipment for inspection and repair diagnostics, as defined by the regulations. The CAN network requirements for the vehicle and the external test equipment are based on the specifications of GB/T 39851.2, ISO 11898-1 and ISO 11898-2.

This document defines the requirements to successfully establish, maintain and terminate communication with a vehicle that implements the requirements of the OBD/WWH-OBD regulations. Plug-and-play communication capabilities among vehicles and test equipment are defined to assure the interoperation of external test equipment and vehicles. This document details all of the OSI layer requirements to achieve this goal.

This document does not specify in-vehicle CAN bus architecture, but seeks to ensure that the vehicle's regulated CAN communications comply with external test equipment requirements.

This document is the entry point for DoCAN (Diagnostic communication over Controller Area Network). Based on the results of the initialization, the external test equipment determines which protocol and diagnostic services are supported by the vehicle's emissions-related system:

- OBD:ISO 15031(all parts);
- WWH-OBD:ISO 27145(all parts).

2 Normative references

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

GB/T 39851.2, Road vehicles - Diagnostic communication over Controller Area Network (DoCAN) - Part 2: Transport protocol and network layer services (GB/T 39851.2-2021, ISO

15765-2:2016, MOD)

ISO 11898-1, Road vehicles - Controller area network (CAN) - Part 1: Data link layer and physical signaling

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

BS: Block Size CAN: Controller Area Network CF: Consecutive Frame DLC:

CAN frame data link layer Data Length Code DoCAN: Diagnostic communication over

Controller Area Network ECU: Electronic Control Unit ECM: Engine Control Module FC:

FlowControl FF: FirstFrame FS: FlowStatus OBD: On-Board Diagnostics SA: Source

Address SF: SingleFrame SJW: Synchronization Jump Width SP: Nominal Sample Point TA:

Target Address TCM: Transmission Control Module WWH-OBD: World-Wide Harmonized

On-Board Diagnostics

4 Conventions This document is based on the conventions specified in the OSI Service Conventions (ISO/IEC 10731) as they apply for diagnostic services.

5 Document overview

Figure 1 illustrates the most applicable application implementations utilizing the DoCAN protocol.

6 External test equipment initialization sequence

6.1 General The external test equipment shall support the initialization sequence specified in this document (see Figure 2).

The purpose of the external test equipment initialization sequence is to automatically detect whether the vehicle supports legislated OBD or WWH-OBD on CAN using the physical layer specified in Clause 12.

Furthermore, the initialization sequence determines the communication compliance status of vehicles by analyzing their responses to -- ISO 15031-5 service 0116 0016 (PID supported) requests; or -- ISO 27145-3 service 2216 F816 1016 (DID protocol identification) request with a positive response.

Only vehicles that follow the WWH-OBD regimen will have ECUs that reply to the functional request service 2216 DID F81016 for protocol identification.

Vehicles that respond only to the functional request service 0116 PID 0016 support earlier OBD communication methods. Vehicles that do not respond to either request do not support regulated OBD diagnostics described in 6.3.

For each legislated OBD/WWH-OBD service that requires the determination of "supported" information, the external test equipment has to update its list of expected responding legislated OBD/WWHOBDE CUs prior to any data parameter requests. For applicable services, see either ISO 15031-5 (for legislated OBD) or ISO 27145-3 (for legislated

WWH-OBD).

The external test equipment initialization sequence supports single baudrate initialization (e.g., 500 kbit/s) and multiple baudrate initialization (see 6.2.2) (e.g., 250 kbit/s and 500 kbit/s) and is separated into the following tests:

- a) 11 bit CAN identifier validation;
- b) 29 bit CAN identifier validation.

NOTE: See 6.2.2.

The external test equipment initialization sequence contains provisions for legacy vehicles using either CAN (same or different physical layer as defined for legislated OBD/WWH-OBD) or a different protocol (non-CAN) on the CAN pins of the ISO 15031-3 diagnostic connector.

Key 1) Following the CAN interface setup, the external test equipment shall connect to the CAN bus and immediately transmit a functionally addressed request message with service 0116 (read supported PIDs) using the legislated OBD/WWH-OBD 11 bit functional request CAN identifier as defined in 10.5.2.

NOTE: The immediate transmission is needed in order to activate the CAN error monitoring as specified further down, since initializing the CAN controller at the wrong baudrate without transmitting any data can leave the CAN controller in a state of generating error frames on the CAN bus.

2) The external test equipment shall check for any CAN error. If the request message is successfully transmitted onto the CAN bus, the external test equipment shall indicate a successful transmission and proceed with the validation of the CAN identifier as specified in 6.3.

3) If an acknowledge (ACK) check error is detected, then the external test equipment shall continue to retry the transmission of the request message until the 25 ms timeout (N_A_s) has elapsed.

4) If any other CAN error occurred, or an acknowledge check error still occurs after the 25 ms (N_A_s) timeout has elapsed, then the external test equipment shall disconnect its CAN interface from the CAN bus.

5) Proceed with sequence according to Figure 4.

6) The external test equipment shall check whether more baudrates are contained in the baudrateRecord. If the end of the baudrateRecord is not reached, the external test equipment shall set up its CAN interface using the next baudrate in the baudrateRecord and restart the baudrate validation at step (1) in Figure 3. If no further baudrate is contained in the baudrateRecord, it shall be assumed that the request was not transmitted successfully. This indicates that the vehicle complies with neither this document nor ISO

27145-4.

Figure 3 - Perform baudrate validation

6.2.3 External test equipment error detection provisions

Where the vehicle uses a CAN with a physical layer different from that specified for OBD/WWH-OBD (see Clause 12) or a non-CAN protocol on the CAN pins of the OBD/WWH-OBD connector, the transmit procedure specified in this document shall guarantee that in all cases, the external test equipment will detect that the vehicle does not support CAN as specified for legislated OBD/WWH-OBD and will stop the transmission of the request message immediately.

Where the vehicle uses CAN and the physical layer in accordance with Clause 12, the transmit procedure given as follows shall guarantee that in all cases, the external test equipment will detect that it uses the wrong baudrate for the transmission of the request message and will stop disturbing the CAN bus immediately. Under normal in-vehicle conditions (i.e., no error frames during in-vehicle communication when the external test equipment is disconnected), the external test equipment will disable its CAN interface prior to the situation where the internal error counters of the legislated OBD/WWH-OBD ECU(s) reach critical values.

To achieve this, the external test equipment shall implement the following provisions:

- possibility to immediately stop sending during transmission of any CAN frame;
- * the CAN interface shall be disconnected within 12 μ s from reception of a bus frame error signal. The maximum time for the disconnection is 100 μ s;
- * with the CAN interface disconnected, the external test equipment shall not be able to transmit dominant bits on the CAN bus;
- possibility to immediately detect any frame error on the CAN bus.

The second provision implies that the external test equipment cannot solely rely on the usual CAN controller error handling since it will most likely flag a frame error only after the "bus-off" state has been reached (refer to ISO 11898 for further details).

6.3 CAN identifier validation procedure

6.3.1 CAN identifier validation procedure OBD The response handling procedure shall be used to receive 11 bit CAN identifier response messages from legislated OBD ECU(s) or to indicate that no response message has been received. If legislated OBD-related ECUs are detected, this procedure also builds the list of available ECUs on the legislated OBD-compliant vehicle.

The response validation procedure shall be performed as defined in Figure 4, after the 11 bit CAN identifier request message transmit procedure (see Figure 3) has succeeded