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**Road vehicles - Diagnostic communication over
controller area network (DoCAN) - Dictionary**

道路车辆 基于控制器局域网的诊断通信 符号集

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1 Scope

This document specifies the general requirements, format structure, description of diagnostic trouble codes, for the diagnostic communication symbol set of the vehicle controller area network.

This document is applicable to the diagnostic trouble code (DTC) of the diagnostic communication standard for road vehicle controller area network. The on-board diagnostic system (OBD) needs to report the code, when a fault is detected.

This document also applies to the decoding of enhanced diagnostic DTC. Meanwhile it reserves bytes for specific purposes of vehicle manufacturers.

The format of diagnostic trouble codes in this document includes:

- a) The set of standard diagnostic trouble codes AND the description contained in SAE J2012-DA. The two most significant bytes of DTC can be decoded, according to two different lists. The DTC format identifiers 00₁₆ and 04₁₆;
- b) The description of the standard set of diagnostic fault code subtypes, which is contained in SAE J2012-DA, is called the fault type (only applicable to the use of three-byte DTC).

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, for dated reference documents, only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to this document.

ISO 15031-2 Road vehicles - Communication between vehicles and external equipment for emissions-related diagnostics - Part 2: Guidelines on terms, definitions, abbreviations and acronyms

sub-fault strategies, are specified by four basic categories:

- Ordinary open-circuit;
- Scope/performance fault;
- Low circuit state;
- High circuit state.

The low circuit state is measured by external circuits, components or connected systems. The signal type (voltage, frequency, etc.) shall be included behind the low circuit state signal.

The high circuit state is measured by external circuits, components or connected systems. The signal type (voltage, frequency, etc.) shall be included behind the high circuit state signal.

5 Format structure

5.1 Description

The diagnostic trouble code consists of an alphanumeric indicator, which is followed by a hexadecimal number. The alphanumeric indicator B0-B3 is used for the vehicle body; C0-C3 is used for the chassis; P0-P3 is used for the powertrain; U0-U3 is used for network/vehicle integration. The correct assignment of alphanumeric indicators depends on the area, which is most suitable for the function. In most cases, diagnostic information needs to be requested from a specific controller. Therefore, the alphanumeric indicator will be implied, BUT this does not mean that all codes supported by a specific controller have the same alphanumeric indicator.

The DTC structure is as shown in Figure 1.

numbers, in each group, are reserved for future growth. Although service procedures may vary greatly between manufacturers, the indicated fault is common enough, to be designated as a specific fault code. Without approval, manufacturers shall not use codes in this field.

5.3 Manufacturer controlled code (non-uniform DTC)

The area, within each letter indicator, can be used for manufacturer-controlled DTC. Due to differences in basic system, execution process or diagnostic strategy, these fault codes are usually not widely adopted by manufacturers. When assigning fault codes in the manufacturer's control area, each vehicle manufacturer or supplier shall maintain the consistent design and development, of diagnostic algorithms, software, diagnostic fault codes, on their production lines. Although each manufacturer can define a controlled DTC, to meet its specific controller algorithm, all DTC descriptions shall comply with SAE J1930 or ISO 15031-2.

5.4 Body system

The DTC number and description are in SAE J2012-DA:

- B0XXX ISO/SAE controlled;
- B1XXX manufacturer controlled;
- B2XXX manufacturer controlled;
- B3XXX files reserved.

5.5 Chassis system

The DTC number and description are in SAE J2012-DA:

- C0XXX ISO/SAE controlled;
- C1XXX manufacturer controlled;
- C2XXX manufacturer controlled;
- C3XXX files reserved.

5.6 Powertrain

The DTC number and description are in SAE J2012-DA:

- P0XXX ISO/SAE controlled;
- P1XXX manufacturer controlled;

The basic DTC description of all body and chassis systems, in SAE J2012-DA, is more general (that is, the failure mode is not embedded), so it is only allocated for the 3-byte DTC structure. Due to the use of the fault type byte as the third (least significant) byte, these DTCs only need to assign a single DTC number and description to each component, not the failure mode.

6.2 Powertrain

The powertrain category covers the functions of the engine, transmission, its powertrain accessories. For the powertrain, a description has been assigned to each designated fault code, to indicate the circuit, component or system area, that has been determined to be faulty. Where possible, different descriptions, which are related to a particular sensor or system, are combined. If there are different fault descriptions for different types of faults, the group will also have a "generic" description, as the code/information of the first group. According to the specific strategy and the complexity of the diagnosis, the manufacturer has the right to choose, when performing the diagnosis.

In the case of circuits, components or systems with more specific fault descriptions, the manufacturer shall select the DTC, that is most suitable for diagnosable faults. The description is intended to be more applicable, so that the manufacturer uses it as frequently as possible, without conflicting with its dedicated maintenance procedures. The terms "low" and "high", which are used in the description, especially the terms related to the input signal, refer to the voltage and frequency at the controller pins. The specific levels of "low" and "high" shall be specified by each manufacturer, to better meet their needs.

For example, when diagnosing a 5 V reference voltage throttle position sensor (TP sensor), if the input signal of the powertrain control module (PCM) is fixed at close to 0 V, the manufacturer can select freely from two codes: P0120 (throttle/pedal position sensor/switch A circuit) or P0122 (accelerator/pedal position sensor/switch a low circuit state), depending on the manufacturer's diagnostic procedures. If the input signal of the powertrain control module (PCM) is stable at a reference voltage of 5 V, the manufacturer can also select freely from two codes: P0120 (throttle/pedal position sensor/switch A circuit) or P0123 (throttle/pedal position sensor/switch A high circuit state), depending on the manufacturer's diagnostic procedures. If the input signal of the powertrain control module is stable at 1.5 V at idling speed, instead of the expected 1.0 V, the manufacturer can select freely from two codes: P0120 (throttle valve/pedal position sensor/switch A circuit) or P0121 (throttle valve/pedal position sensor/switch A circuit range/performance), depending on the manufacturer's diagnostic procedures. The root cause, that causes the throttle position sensor's voltage to be higher than expected, may be the malfunction of throttle position sensor, the corrosion of connection, or the inappropriate correction of throttle position. The root cause is determined through diagnostic procedures.

The relevant description is not defined in DTC, thus allowing manufacturers to flexibly define DTC.

6.3 Body system

The body system category covers the relevant functions inside the passenger compartment, which can provide passengers with help, comfort, convenience, safety. A description has been assigned to each specific fault code, to indicate the component or system area, that is determined to be faulty. Unlike the powertrain, the description of the body system's fault codes is general. The powertrain DTC includes different DTCs (such as low circuit state, high circuit state, principle, etc.), for each failure mode. The body system DTC is designed to support only basic components, in the description, which makes it dependent on the diagnostic protocol, that supports sub-fault failure strategies. The manufacturer shall select the appropriate failure mode (for example: short-circuit to ground, short-circuit to power supply, signal instability, etc.), to apply to general DTC descriptions. The body sub-part, which is supported by this component, is currently the restraint system.

6.4 Chassis system

The chassis system category covers the related functions outside the passenger compartment, which mainly include mechanical systems, such as braking, steering, suspension. A description has been assigned to each specific fault code, to indicate the component or system area, that is determined to be faulty. Unlike the powertrain, the description of the chassis system's fault codes is general. The powertrain DTC includes different DTCs (such as low circuit state, high circuit state, principle, etc.), for each failure mode. The chassis system DTC is designed to support only basic components, in the description, which makes it dependent on the diagnostic protocol, that supports sub-fault failure strategies. The manufacturer shall select the appropriate failure mode (such as short-circuit to ground, short-circuit to power, signal instability, etc.), to apply to general DTC descriptions. The supported chassis sub-parts, which are included in this group, are brakes and traction control.

6.5 Network/vehicle integration system

The network communication/vehicle integration system category covers the functions, which are shared between the computers and/or systems on the vehicle. A description has been assigned to each specific fault code, to indicate the component or system area, that is determined to be faulty. The description of the data link is general, in order to allow manufacturers to use different communication protocols. The description of the control module is universal, to allow manufacturers to reuse DTC for new control modules, along with technological innovations. In addition, additional sub-fault information can be used, to supplement the description, such as the "fault type byte" data, which

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