

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2012

REV.
MAR1999

Issued 1992-03
Revised 1999-03

Superseding J2012 OCT1996

Submitted for recognition as an American National Standard

Recommended Practice for Diagnostic Trouble Code Definitions

Foreword—Most automobile manufacturers are equipping at least a portion of their product line with some On-Board Diagnostic (OBD) capability. Although currently confined to California, emission regulations sponsored by the California Air Resources Board are requiring the implementation of OBD systems across all manufacturers' product lines of cars and light- and medium-duty trucks offered for sale in California, beginning with Model Year 1988. These systems are required to provide an indication to the service technician as to the general location of the diagnosed malfunction so that the proper service procedures are used to resolve the problem. In most cases, this information is provided through a numeric code.

Additional on-board diagnostic requirements have been defined by the OBD-II legislation in California and the Federal Clean Air Act. These requirements include the need for standardization of various parts of the system, including some of the Diagnostic Trouble Codes.

Currently, there is no uniformity in these numeric Diagnostic Trouble Codes (DTC) between manufacturers, and in some cases, even within the same manufacturer across different product lines. This document (SAE J2012) provides some recommended uniformity for these numeric codes. It further provides guidance for uniform messages associated with these codes.

The document itself (SAE J2012) is comprised of several sections addressing applicability, format structure, messages, and a few examples applying the recommendations of the document. The actual code assignments and messages are contained in four appendices attached to the document (Appendices A, B, C, and D). Codes and messages for Body systems are covered in Appendix A, Chassis systems in Appendix B, Powertrain systems in Appendix C, and Network Communication in Appendix D.

The recommended DTCs consist of a three-digit numeric code preceded by an alpha-numeric designator. The alpha-numeric designators are "B0," "B1," "B2," "B3," "C0," "C1," "C2," "C3," "P0," "P1," "P2," "P3," "U0," "U1," "U2," "U3," corresponding to four sets of Body, four sets of Chassis, four sets of Powertrain, and four sets of Network Communication Trouble Codes. The code structure itself is partially open-ended. A portion of the available numeric sequences (portions of "B0," "C0," "P0," and "U0") are reserved for uniform codes assigned by this or future updates of this document. Detailed specifications on the DTC format structure are covered in Section 4. Because of continued development in OBD systems and the flexibility of the partially open assignment structure, particular attention should be paid to the month and year of the publishing code contained in the full "J" number designation. It is possible that this document could be updated frequently, which would be reflected in the complete "J" number designation.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-8512 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS <http://www.sae.org>

TABLE OF CONTENTS

1.	Scope	2
1.1	Application	2
2.	References	3
2.1	Applicable Documents	3
3	Definitions	3
4.	Format Structure	4
4.1	Description	4
4.2	Core DTCs	4
4.3	Nonuniform DTC	5
4.4	Body System Groupings	5
4.5	Chassis System Groupings	5
4.6	Powertrain System Groupings	5
4.7	Network Communication Groupings	6
5.	Messages	6
6.	Examples	6
7.	Change Requests	6
8.	Notes	7
8.1	Marginal Indicia.....	7
APPENDIX A BODY SYSTEM DIAGNOSTIC CODES.....		8
APPENDIX B CHASSIS SYSTEM DIAGNOSTIC CODES		9
APPENDIX C POWERTRAIN SYSTEM DIAGNOSTIC TROUBLE CODES		10
APPENDIX D NETWORK COMMUNICATION		21

- 1. Scope**—This SAE Recommended Practice is applicable to all light-duty and medium-duty passenger vehicles and trucks with feedback fuel control system. Specific applications of this document include diagnostic, service and repair manuals, repair databases, and off-board readout devices.

This document focuses on a diagnostic code format and code messages for automotive electronic control systems.

The use and appropriate updating of this document is strongly encouraged; however, this document does not prohibit the use of additional codes for additional diagnostics.

- 1.1 Application**—This document is applicable to all light-duty gasoline and diesel vehicles (LDV and LDDV), light-duty gasoline and diesel trucks (LDT and LDDT), and medium-duty gasoline vehicles (MDGV).

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1930—Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms
SAE J1979—E/E Diagnostic Test Modes

3. Definitions—Most circuit, component, or system Diagnostic Trouble Codes are defined by four basic categories: General Circuit Malfunction, Range/Performance Problem, Low or High Circuit Input. Most terms for components and systems contained in this document are included in SAE J1930. This section includes additional definitions of terms not included in SAE J1930.

While each manufacturer has the ability to define the specific DTCs to meet their specific controller algorithms, all DTC words must meet applicable SAE J1930.

3.1 General Circuit Malfunction—Fixed value or no response from the system. Manufacturers may choose to use this code in place of the dual High/Low (defined as follows) or use to indicate any other failure mode.

3.2 Range/Performance—The circuit is functional but not in the normal operating range. May also be used to indicate stuck, erratic, intermittent, or skewed values indicating poor performance of a circuit, component, or system.

3.3 Low Input—Circuit voltage, frequency, or other signal measured at the control module input terminal or pin that is at or near zero. This is measured with the external circuit, component, or system connected. The signal type (voltage, frequency, etc.) shall be included in the message in place of the word "input."

3.4 High Input—Circuit voltage, frequency, or other signal measured at the control module input terminal or pin that is at or near full scale for the particular signal being measured. This is measured with the external circuit, component, or system connected. The signal type (voltage, frequency, etc.) shall be included in the message in place of the word "input."

3.5 Bank—A specific group of cylinders sharing a common control sensor. Bank 1 contains cylinder #1. The next sensor in the same bank is number two, etc. If there is only one bank, use bank #1 DTCs and the word bank may be omitted. With a single "bank" system utilizing multiple sensors, use bank #1 DTCs identifying the sensors as #1, #2, #3 in order as they move further away from the cylinder(s).

3.6 Sensor—If the sensors are numbered (i.e., Bank #1 Sensor #1) they follow the convention described previously in "Bank." If the sensors are indicated by a letter (i.e., A, B, C, etc.) this would be manufacturer defined. If a manufacturer uses only a single sensor then the number or letter may be omitted.

3.7 Left/Right and Front/Rear—These definitions are used to identify a component by its position as if it can be viewed from the drivers seating position.

While each manufacturer has the ability to define the specific DTC's to meet their specific controller algorithms, all DTC words must meet applicable SAE J1930.

4. Format Structure

4.1 Description—The Diagnostic Trouble Code consists of an alpha-numeric designator, B0 — B3 for Body, C0 — C3 for Chassis, P0 — P3 for Powertrain, and U0 — U3 for Network Communication, followed by three digits. The assignment of the proper alpha designator should be determined by the controller into which the particular function being diagnosed is being integrated, or in the case of multiple controllers, the area most appropriate for that function. In most cases, the alpha designator will be implied since diagnostic information will be requested from a particular controller. In the cases where the source of the diagnostic information is not clear, the uppermost nibble of the two-byte code message as defined in SAE J1979 will define the source system as follows:

0000 - P0 - Powertrain codes SAE controlled
 0001 - P1 - Powertrain codes Manufacturer controlled
 0010 - P2 - Powertrain codes SAE controlled
 0011 - P3 - Powertrain codes P3000 to P3399 Manufacturer controlled
 0011 - P3 - Powertrain codes P3400 - P3999 SAE Reserved

0100 - C0 - Chassis codes SAE controlled
 0101 - C1 - Chassis codes Manufacturer controlled
 0110 - C2 - Chassis codes Manufacturer controlled
 0111 - C3 - Chassis codes Reserved

1000 - B0 - Body codes SAE controlled
 1001 - B1 - Body codes Manufacturer controlled
 1010 - B2 - Body codes Manufacturer controlled
 1011 - B3 - Body codes Reserved

1100 - U0 - Network Communication codes SAE controlled
 1101 - U1 - Network Communication codes Manufacturer controlled
 1110 - U2 - Network Communication codes Manufacturer controlled
 1111 - U3 - Network Communication codes Reserved

Within each code class, the first of the three digits identifies a particular grouping of codes. These particular groupings each contain a series of 100 sequence numbers for particular code definitions.

Codes have been defined to indicate a suspected trouble or problem area and are intended to be used as a directive to the proper service procedure. To minimize service confusion, fault codes should not be used to indicate the absence of problems or the status of parts of the system (e.g., Powertrain System O.K., or MIL illuminated), but should be confined to indicated areas in need of service attention. The decision to illuminate the MIL for any DTC is manufacturer-specific based on their testing of how each system malfunction affects emissions.

Each range maybe expanded beyond 100 numbers in the future by using the hexadecimal base 16 number system. Although no hexadecimal numbers have been assigned at this time, future releases of this document and SAE 1979 may require hexadecimal DTC numbers.

4.2 Core DTCs—Core Diagnostic Trouble Codes are those codes where industry uniformity has been achieved. These codes were felt to be common enough across most manufacturers' applications that a common number and fault message could be assigned. All undefined numbers in each grouping of systems have been reserved for future growth. Although service procedures may differ widely amongst manufacturers, the fault being indicated is common enough to be assigned a particular fault code.

4.3 Nonuniform DTC—Areas within each alpha designator have been made available for nonuniform DTCs. These are fault codes that will not generally be used by a majority of the manufacturers due to basic system differences, implementation differences, or diagnostic strategy differences. Each vehicle manufacturer or supplier who designs and specifies diagnostic algorithms, software, and diagnostic trouble codes are strongly encouraged to remain consistent across their product line when assigning codes in the manufacturer controlled area. For Powertrain codes, the same groupings should be used as in the SAE controlled area, i.e., 100s and 200s for Fuel and Air Metering, 300s for Ignition System or Misfire, etc.

Code groupings for nonpowertrain codes will be defined at a later date.

4.4 Body System Groupings

4.4.1 – B0XXX SAE CONTROLLED

4.4.2 – B1XXX MANUFACTURER CONTROLLED

4.4.3 – B2XXX MANUFACTURER CONTROLLED

4.4.4 – B3XXX RESERVED

4.5 Chassis System Groupings

4.5.1 – C0XXX SAE CONTROLLED

4.5.2 – C1XXX MANUFACTURER CONTROLLED

4.5.3 – C2XXX MANUFACTURER CONTROLLED

4.5.4 – C3XXX RESERVED

4.6 Powertrain System Groupings—DTC numbers and descriptions are given in Appendix C.

4.6.1 – P0XXX SAE CONTROLLED

4.6.1.1 – *P00XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.1.2 – *P01XX Fuel and Air Metering*

4.6.1.3 – *P02XX Fuel and Air Metering*

4.6.1.4 – *P03XX Ignition System or Misfire*

4.6.1.5 – *P04XX Auxiliary Emission Controls*

4.6.1.6 – *P05XX Vehicle Speed, Idle Control, and Auxiliary Inputs*

4.6.1.7 – *P06XX Computer and Auxiliary Outputs*

4.6.1.8 – *P07XX Transmission*

4.6.1.9 – *P08XX Transmission*

4.6.1.10 – *P09XX Transmission*

4.6.2 – P1XXX MANUFACTURER CONTROLLED

4.6.2.1 – *P10XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.2.2 – *P11XX Fuel and Air Metering*

4.6.2.3 – *P12XX Fuel and Air Metering*

4.6.2.4 – *P13XX Ignition System or Misfire*

4.6.2.5 – *P14XX Auxiliary Emission Controls*

4.6.2.6 – *P15XX Vehicle Speed, Idle Control, and Auxiliary Inputs*

4.6.2.7 – *P16XX Computer and Auxiliary Outputs*

4.6.2.8 – *P17XX Transmission*

4.6.2.9 – *P18XX Transmission*

4.6.2.10 – *P19XX Transmission*

4.6.3 – P2XXX SAE CONTROLLED

4.6.3.1 – *P20XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.3.2 – *P21XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.3.3 – *P22XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.3.4 – *P23XX Ignition System or Misfire*

4.6.3.5 – *P24XX SAE Reserved*

4.6.3.6 – *P25XX SAE Reserved*

4.6.3.7 – *P26XX SAE Reserved*

4.6.3.8 – *P27XX SAE Reserved*

4.6.3.9 – *P28XX SAE Reserved*

4.6.3.10 – *P29XX SAE Reserved*

4.6.4 – P3XXX MANUFACTURER CONTROLLED AND SAE RESERVED

4.6.4.1 – *P30XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.4.2 – *P31XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.4.3 – *P32XX Fuel and Air Metering and Auxiliary Emission Controls*

4.6.4.4 – *P33XX Ignition System or Misfire*

4.6.4.5 – P34XX SAE Reserved

4.6.4.6 – P35XX SAE Reserved

4.6.4.7 – P36XX SAE Reserved

4.6.4.8 – P37XX SAE Reserved

4.6.4.9 – P38XX SAE Reserved

4.6.4.10 – P39XX SAE Reserved

4.7 Network Communication Groupings

4.7.1 – U0XXX SAE CONTROLLED

4.7.2 – U1XXX MANUFACTURER CONTROLLED

4.7.3 – U2XXX MANUFACTURER CONTROLLED

4.7.4 – U3XXX RESERVED

5. **Messages**—Each defined fault code has been assigned a message to indicate the circuit, component, or system area that was determined to be at fault. The messages are organized such that different messages related to a particular sensor or system are grouped together. In cases where there are various fault messages for different types of faults, the group also has a "**generic**" message as the first Code/Message of the group. A manufacturer has a choice when implementing diagnostics, based on the specific strategy and complexity of the diagnostic, whether to use one "**generic**" code for any fault of that circuit, component, or system or to use the more specific codes for better defining the type of fault that was detected. The manufacturer must determine what codes and messages best fit the diagnostics actually implemented. The intent is to have only one code stored for each fault detected.

Where messages are broken down into more specific fault descriptions for a circuit, component, or system, the manufacturer should choose the code most applicable to their diagnosable fault. The messages are intended to be somewhat general to allow manufacturers to use them as often as possible yet still not conflict with their specific repair procedures.

6. **Examples**—For manufacturers choosing to implement basic diagnostics that provide general fault information but depend on service procedures (Service Charts) and off-board techniques to isolate the problem, general circuit, component, and system codes would be used. If a fault is detected in the Throttle Position Sensor circuit, rather than burden the on-board system with determining the specific type of fault, a Code P0120 would be stored indicating some type of problem with that circuit, and the service procedure would then allow the technician to determine the type of fault and the specific location of the fault. On these types of systems, a shorted sensor input, an open sensor input, and even an out-of-range sensor input, would all set the same fault code.

Manufacturers choosing to allow the on-board diagnostics to better isolate the fault would not use the general fault code/message, but would use the more specific codes/messages associated with the particular circuit, component, or system.

For example, in diagnosing a 5 V reference Throttle Position Sensor (TP Sensor), if the input signal at the Powertrain Control Module (PCM) is stuck at near 0 V, a manufacturer has the flexibility to select from either of two codes - P0120 (TP Sensor Circuit Malfunction) or P0122 (TP Sensor Low Input), depending on the manufacturer's diagnostic procedures. If the input signal at the PCM is stuck at near 5 V, a manufacturer has the flexibility to select from either of two codes - P0120 (TP Sensor Circuit Malfunction) or P0123 (TP Sensor High Input), depending on the manufacturer's diagnostic procedures. If the input signal at the PCM is stuck at 1.5 V at idle instead of the expected 1.0 V, the manufacturer has the flexibility to select from either of two codes - P0120 (TP Sensor Circuit Malfunction) or P0121 (TP Sensor Range/Performance), depending on the manufacturer's diagnostic procedures. The root cause of the higher than expected TP Sensor voltage may be either a faulty TP Sensor, corrosion in the TP Sensor connections or a misadjusted throttle plate. Identification of the root cause is done using the diagnostic procedures and is not implied by the DTC message, thus allowing the manufacturer the flexibility in assigning DTCs.

7. Change Requests—See Figure 1:

Request Form for New SAE J2012 SAE Controlled DTC

What is the purpose of the component, circuit, or system?

Example: Exhaust Gas Recirculation.

What is the purpose of the diagnostic?

Example: detect low EGR flow

Requested Group Number _____

Requested DTC Number _____

Requested DTC Nomenclature _____

Example: EGR Low Flow Detected

Requested by _____

Phone/Fax _____

Email _____

Address _____

Date:

Please send completed form(s) to:

SAE Headquarters
755 West Big Beaver Road
Suite 1600
Troy, MI 48084

ATTN: J2012 Powertrain Committee Chairman

FIGURE 1—REQUEST FORM FOR NEW SAE J2012 SAE CONTROLLED DTC

8. Notes

- 8.1 Marginal Indicia**—The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE VEHICLE E/E SYSTEM DIAGNOSTICS STANDARDS COMMITTEE

APPENDIX A

BODY SYSTEM DIAGNOSTIC CODES

A.1 FOR FUTURE DEFINITION