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SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) CLASS B DATA COMMUNICATION NETWORK MESSAGES— PART 2: DATA PARAMETER DEFINITIONS

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1. **Scope**—This SAE Recommended Practice defines the information contained in the header and data fields of non-diagnostic messages for automotive serial communications based on SAE J1850 Class B networks. This document describes and specifies the header fields, data fields, field sizes, scaling, representations, and data positions used within messages.

The general structure of a SAE J1850 message frame without in-frame response is shown in Figure 1. The structure of a SAE J1850 message with in-frame response is shown in Figure 2. Figures 1 and 2 also show the scope of frame fields defined by this document for non-diagnostic messages. Refer to SAE J1979 for specifications of emissions related diagnostic message header and data fields. Refer to SAE J2190 for the definition of other diagnostic data fields. The description of the network interface hardware, basic protocol definition, electrical specifications, and the CRC byte are given in SAE J1850.

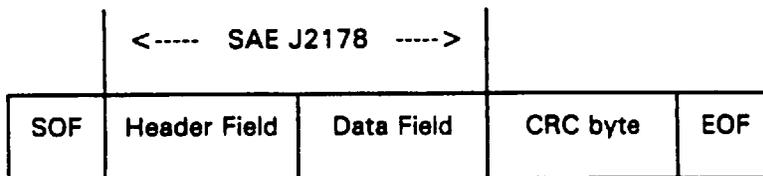


FIGURE 1—SCOPE OF SAE J2178 FOR A SAE J1850 FRAME WITHOUT IN-FRAME RESPONSE (IFR)

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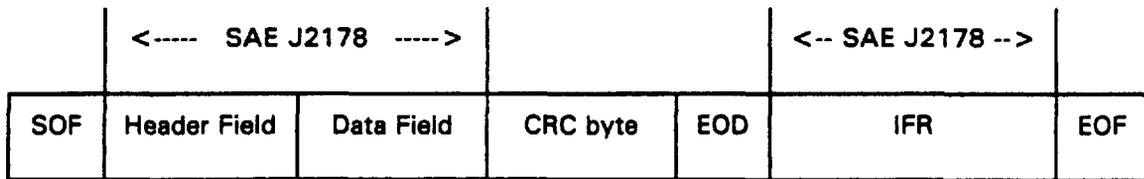


FIGURE 2—SCOPE OF SAE J2178 FOR A SAE J1850 FRAME WITH IN-FRAME RESPONSE (IFR)

SAE J1850 defines two and only two formats of message headers. They are the Single Byte header format and the Consolidated header format. The Consolidated header format has two forms, a single byte form and a three byte form. This document covers all of these formats and forms to identify the contents of messages which could be sent on a SAE J1850 network.

This document consists of four parts, each published separately.

SAE J2178-1, Part 1 of SAE J2178 (Titled: Detailed Header Formats and Physical Address Assignments) describes the two allowed forms of message header formats, Single Byte and Consolidated. It also contains the physical node address range assignments for the typical sub-systems of an automobile.

SAE J2178-2, Part 2 of SAE J2178 (this part, Titled: Data Parameter Definitions) defines the standard parametric data which may be exchanged on SAE J1850 (Class B) networks. The parameter scaling, ranges, and transfer functions are specified. Messages which refer to these parametric definitions shall always adhere to these parametric definitions. It is intended that at least one of the definitions for each parameter in this part match the SAE J1979 definition.

SAE J2178-3, Part 3 of SAE J2178 (Titled: Frame IDs for Single Byte Forms of Headers) defines the message assignments for the Single Byte header format and the one byte form of the Consolidated header format.

SAE J2178-4, Part 4 of SAE J2178 (Titled: Message Definition for Three Byte Headers) defines the message assignments for the three byte form of the Consolidated header format.

- 1.1 Standardized Parameter Definitions**—The parameters used to describe data variables are one of the most important functions of this document. To achieve commonality of messages in Class B networks, the data parameters must become standardized. This applies to data parameter definitions for use during normal vehicle operations as well as during diagnostic operations. By using common parameter definitions for non-diagnostic and diagnostic functions on the network, the modules which form the network can maintain one image or description of a data parameter.

At this time however, it is felt that there is not enough experience and commonality of philosophy within the industry to define standard parameters. The purpose of this document is therefore to provide standard methods of defining parameters and examples of defined parameters for many potential applications within a vehicle. With this basis, it should be possible to avoid the definition of arbitrarily different parameters and move toward standard parameters in the future.

Where parameters have been defined in the Diagnostic Test Modes, documents (SAE J1979 and J2190), such as Parameter Identifies for diagnostic purposes, the definitions in Part 2 of this document match the diagnostic definition.

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SAE J2178-2 defines the parameters to be used for non-diagnostic and diagnostic data format definitions. For new parameter definitions which are needed in the future, the new definitions, if they are expected to become widely used, must be integrated into this document for commonality across these types of applications. Of course, manufacturers are free to assign their own definitions to data parameters which are unique or proprietary to their products. They are, however, restricted to using the "Manufacturer Reserved" message header assignments in Parts 3 and 4 of this document when using these unique or proprietary data parameter definitions.

2. References

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

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

SAE J1213-1—Glossary of Vehicle Networks for Multiplex and Data Communication

SAE J1850—Class B Data Communication Network Interface

SAE J1930—Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms

SAE J1979—E/E Diagnostic Test Modes

SAE J2190—Enhanced E/E Diagnostic Test Modes

2.1.2 OTHER PUBLICATIONS

ANSI/IEEE Std 754-1985 August 12, 1985—IEEE Standard for Binary Floating-Point Arithmetic

3. Definitions

3.1 Data [Data Field]—Data and data field are used interchangeably in this document and they both refer to a field within a frame that may include bytes with parameters pertaining to the message and/or secondary ID and/or extended addresses and/or test modes which further defines a particular message content being exchanged over the network.

3.2 Extended Address—The extended address is a means to allow a message to be addressed to a specific geographical location or zone of the vehicle, independent of any node's physical address.

3.3 Frame—A frame is one complete transmission of information which may or may not include an In-Frame Response. The frame is enclosed by the start of frame and end of frame symbols. For Class B networks, each frame contains one and only one message (see "message" definition).

3.4 Frame ID—The Frame ID is the header byte for the Single Byte Header format and the one byte form of the consolidated header format. The definition of the Frame ID is found in SAE J2178-3. This header byte defines the target and source and content of the frame.

3.5 Functional Addressing—Functional addressing allows a message to be addressed or sent to one or more nodes on the network interested in that function. Functional addressing is intended for messages that may be of interest to more than a single node. For example, an exterior lamp "off" message could be sent to all nodes controlling the vehicle exterior lamps by using a functional address. The functional address consists of a primary ID and may include a secondary ID and may also include an extended address.

3.6 Header [Header Field]—The header (or header field, used interchangeably) is a one or three byte field within a frame which contains information about the message priority, message source and target addressing, message type, and in-frame response type.

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- 3.7 In-Frame Response (IFR) Type**—The IFR type identifies the form of the in-frame response which is expected within that message.
- 3.8 Load**—The load command indicates the operation of directly replacing the current/existing value of a parameter with the parameter value(s) contained in the message.
- 3.9 Message**—A message consists of all of the bytes of a frame excluding the delimiter symbols (SOF, EOD, EOF, NB).
- 3.10 Modify**—The modify command indicates the operation of using the message data parameter value to change (e.g., increment, decrement, or toggle) the current/existing value.
- 3.11 Parameter**—A parameter is the variable quantity included in some messages. The parameter value, scaling, offset, units, transfer function, etc., are unique to each particular message. (The assigned parameters are contained herein.)
- 3.12 Physical Addressing**—Physical addressing allows a message to be addressed to a specific node or to all nodes or to a non-existent, null node. The information in this message is only of relevance to a particular node, so the other nodes on the bus should ignore the message, except for the case of the "all nodes" address.
- 3.13 Primary ID**—The primary ID identifies the target for this functional message. This is the primary discriminator used to group functions into main categories.
- 3.14 Priority**—The priority describes the rank order and precedence of a message. Based upon the SAE J1850, Class B arbitration process, the message with the highest priority will win arbitration.
- 3.15 Report**—A report indicates the transmission of parametric data values, based on: a change of state; a change of value; on a periodic rate basis; or as a response to a specific request.
- 3.16 Request**—A request is a command to, or a query for data, or action from another node on the network.
- 3.17 Response Data**—The response data is the information from a node on the network in response to a request from another node on the network. This may be an in-frame response or a report type of message.
- 3.18 Secondary ID**—The secondary ID (along with the primary ID or Frame ID) identifies the functional target node for a message. The purpose of the secondary ID field within the frame is to further define the function or action being identified by the primary ID.

4. Abbreviations and Acronyms

| | |
|--------|---|
| 4WD | Four (4) Wheel Drive |
| A/C | Air Conditioning |
| ASC | ASCII Encoded SLOT |
| BCD | Binary Coded Decimal (BCD) SLOT |
| BMM | Bit Mapped with Mask SLOT |
| BMP | Bit Mapped without Mask SLOT |
| CRC | Cyclic Redundancy Check |
| CS | Checksum |
| DTC | Diagnostic Trouble Code |
| EOD | End of Data |
| EOF | End of Frame |
| ERR | Error Detection |
| EV-ETS | Electric Vehicle Energy Transfer System |
| HVAC | Heating, Ventilation, Air Conditioning |

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| | |
|-------|--|
| ID | Identifier |
| IFR | In-Frame Response |
| LSB | Least Significant Bit/Byte |
| MAF | Mass Air Flow |
| MIL | Malfunction Indicator Lamp |
| MSB | Most Significant Bit/Byte |
| NB | Normalization Bit |
| PID | Parameter Identification (number, NOT the primary ID, see Section 8) |
| PKT | Multiple Parameter Packet SLOT |
| PRN | Parameter Reference Number |
| PRNDL | Park, Reverse, Neutral, Drive, and Low - Indicator |
| RPM | Revolutions Per Minute |
| SED | State Encoded SLOT |
| SFP | Signed Floating Point (Scientific Notation) SLOT |
| SLOT | Scaling, Limit, Offset, and Transfer Function (see Section 9) |
| SNM | 2's Complement Signed Numeric SLOT |
| SOF | Start of Frame |
| UNM | Unsigned Numeric SLOT |
| VIN | Vehicle Identification Number |

5. General Information

5.1 Part 2 Overview—Section 6 provides a description of the parameter reference number (PRN) number groupings used for assigning PRN numbers to individual parameters. Section 7 defines the formats used to define all standard parameters to be used in SAE J2178 messages. Section 8 defines the specific parameter assignments in terms of names, units, and scale factor reference. Section 9 defines the actual parameter specifications (SLOT), in terms of the length, bit resolution, range, scale factor details, etc. Section 10 describes the case of very long parameters which cannot be transmitted in a single message. Table 30 provides a numerical cross reference to assist in finding the correct name of a parameter if the parameter identification number is known. Appendix A is an alphabetical cross reference to assist in finding the correct parameter identification number if the parameter name is known.

The messages contain header fields and data fields, described in SAE J2178-1. The header field contains target, source, priority, and message type information, while the data field contains optional additional addressing and parametric information. This document defines the parametric information.

For some applications, it is desirable to include multiple parameters in a single message. The multiple parameter format is called a packet in this document. For example, some diagnostic messages consist of combinations of these parameters to improve information density or to insure simultaneous readings of different variables. A very limited set of these combinations is defined here as industry standards but individual manufacturers are free to use this form in manufacturer specific messages, as needed.

5.2 How to Use This Document—This document (SAE J2178-2) provides the definition of parameters which are commonly found, or could be expected in vehicle Electrical/Electronic Systems today. These parameters have been defined to allow messages on a Class B communication system to have consistent meaning between manufacturers and over time. The parameter definition consists of two parts, the "PRN" and the "SLOT." The "PRN" (Parameter Reference Number) is a number used to identify a specific parameter by name, unit of measure, and its associated "SLOT." The "SLOT" defines the mathematical characteristics of parameters in terms of its representation (Binary, Unsigned Numeric, ASCII, BCD, etc.), its scaling (1 Bit =), its limits and offsets, and its transfer function.

To find a parameter by name or PRN number, Appendices A and B provide cross references to the page of this document where the PRN can be found. The PRN numbers have also been grouped by subsystem to enable the reader to look for parameters if the name is not know.

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If the parameter has not as yet been included in the list of PRNs, users can define new parameters in terms of the SLOTS which have been defined.

6. **Parameter Reference Number (PRN) Structure**—Parameter Reference Numbers (PRNs) are used to simplify documentation. They do not, in themselves, have particular significance. PRNs do allow simplification of reference, particularly for diagnostic purposes. To this end, a structure for PRN number assignments has been developed. The structure is described in the following paragraphs.

All PRN addresses are two bytes long, with the first byte identifying a grouping or classification reference (refer to Tables 1 and 2). The second byte is then a sequence number pointing to the specific parameter used (refer to Tables 4 through 19). There has not been any attempt made to group or commonize the meaning in the second byte. The specific assignments are found in Section 8. Note that all PRN addresses are listed as hexadecimal numbers throughout this document.

SAE J1979 refers to PID numbers which are a single byte reference number. The first 256 PRNs defined here (first byte = 00), are identical with the SAE J1979 definitions.

Figure 3 shows the basic structure of PRNs and Tables 1 and 2 show bit assignments and address ranges based on these assignments.

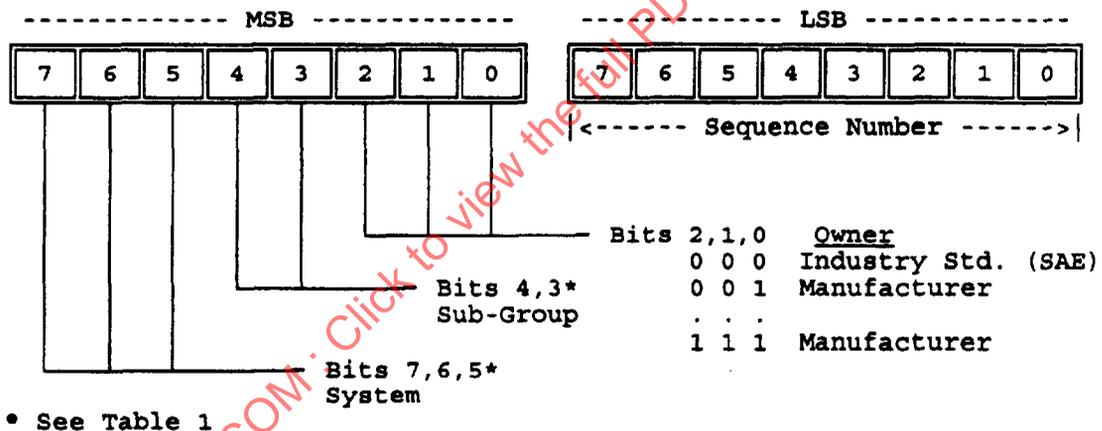


FIGURE 3—PRN STRUCTURE

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TABLE 1—PRN GROUPINGS

| 7 6 5 | System | 4 3 | Subgroup | Address (Hex) |
|-------|------------|-----|----------------------|---------------|
| 0 0 0 | Powertrain | 0 0 | SAE J1979 Compatible | 0000 - 00FF |
| | | 0 0 | Reserved | 0100 - 07FF |
| | | 0 1 | Reserved | 0800 - 0FFF |
| | | 1 0 | Engine | 1000 - 17FF |
| | | 1 1 | Transmission | 1800 - 1FFF |
| 0 0 1 | Chassis | 0 0 | Reserved | 2000 - 27FF |
| | | 0 1 | Brakes/Tires/Wheels | 2800 - 2FFF |
| | | 1 0 | Steering | 3000 - 37FF |
| 0 1 0 | Body 1 | 1 1 | Suspension | 3800 - 3FFF |
| | | 0 0 | Reserved | 4000 - 47FF |
| | | 0 1 | Reserved | 4800 - 4FFF |
| 0 1 1 | Body 2 | 1 0 | Reserved | 5000 - 57FF |
| | | 1 1 | Restraints | 5800 - 5FFF |
| | | 0 0 | Driver Info. | 6000 - 67FF |
| 1 0 0 | Body 3 | 0 1 | Reserved | 6800 - 6FFF |
| | | 1 0 | Lighting | 7000 - 77FF |
| | | 1 1 | Reserved | 7800 - 7FFF |
| 1 0 1 | Body 4 | 0 0 | Audio | 8000 - 87FF |
| | | 0 1 | Reserved | 8800 - 8FFF |
| | | 1 0 | Pers. Comm. | 9000 - 97FF |
| | | 1 1 | HVAC | 9800 - 9FFF |
| 1 1 0 | Other 1 | 0 0 | Convenience | A000 - A7FF |
| | | 0 1 | Reserved | A800 - AFFF |
| | | 1 0 | Reserved | B000 - B7FF |
| | | 1 1 | Reserved | B800 - BFFF |
| 1 1 1 | Other 2 | 0 0 | Security | C000 - C7FF |
| | | 0 1 | EV-ETS | C800 - CFFF |
| | | 1 0 | Reserved | D000 - D7FF |
| | | 1 1 | Reserved | D800 - DFFF |
| 1 1 1 | Other 2 | 0 0 | Config. Codes | E000 - E7FF |
| | | 0 1 | Reserved | E800 - EFFF |
| | | 1 0 | Tester/Diag. | F000 - F7FF |
| | | 1 1 | Miscellaneous | F800 - FFFF |

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TABLE 2—PRN RANGES

| System | Subgroup | Address Map | Size |
|------------|-------------------------|-------------|--------|
| Powertrain | SAE J1979 Compatible | 0000 - 00FF | 0.25 K |
| | Reserved | 0100 - 0FFF | 3.75 K |
| | Engine | 1000 - 17FF | 2.00 K |
| | Transmission | 1800 - 1FFF | 2.00 K |
| Chassis | Reserved | 2000 - 27FF | 2.00 K |
| | Brakes/Tires/Wheels | 2800 - 2FFF | 2.00 K |
| | Steering | 3000 - 37FF | 2.00 K |
| | Suspension | 3800 - 3FFF | 2.00 K |
| Body 1 | Reserved | 4000 - 57FF | 6.00 K |
| | Restraints | 5800 - 5FFF | 2.00 K |
| Body 2 | Driver Information | 6000 - 67FF | 2.00 K |
| | Reserved | 6800 - 6FFF | 2.00 K |
| | Lighting | 7000 - 77FF | 2.00 K |
| | Reserved | 7800 - 7FFF | 2.00 K |
| Body 3 | Audio | 8000 - 87FF | 2.00 K |
| | Reserved | 8800 - 8FFF | 2.00 K |
| | Personal Communications | 9000 - 97FF | 2.00 K |
| | HVAC | 9800 - 9FFF | 2.00 K |
| Body 4 | Convenience | A000 - A7FF | 2.00 K |
| | Reserved | A800 - BFFF | 6.00 K |
| Other 1 | Security | C000 - C7FF | 2.00 K |
| | EV-ETS | C800 - CFFF | 2.00 K |
| | Reserved | D000 - DFFF | 4.00 K |
| Other 2 | Configuration Codes | E000 - E7FF | 2.00 K |
| | Reserved | E800 - EFFF | 2.00 K |
| | Tester/Diagnostics | F000 - F7FF | 2.00 K |
| | Miscellaneous | F800 - FFFF | 2.00 K |

7. **Parameter Formats**—Parameter values are represented in bit, byte, word, and multi-byte forms. The length of the parameter is uniquely associated with the message header and any included secondary ID field. These parameter definitions are referenced by one or more messages. The parameters allow a wide variety of variables, data definitions, and representations to provide the ability to use this definition for all messages, even when the industry standard messages are not useful for particular applications.

7.1 **Bit Mapped Parameters**—The bit mapped parameters, that is, those which have only two logical values (for example: True/False), are handled in one of two ways. The “Q” bit described in Section 8 of SAE J2178-1 is used if there is only one bit of information. In many cases, however, the bit values are associated together and form byte groupings, generally around common functional characteristics. Bit mapped data are transmitted either with or without corresponding mask bytes as described as follows:

7.1.1 **BIT MAPPED DATA WITHOUT MASK BYTE(S)**—In some cases, such as configuration identification, there is information which can be grouped as binary bits which represent whether, for example, a function or test is supported in a system. This form does not allow the bits to be supplied from different nodes in the network. If the bits potentially come from more than one node, the form with mask bytes described in 7.1.2, is used. The general form of the bit data bytes without mask is shown in Figure 4.

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FIGURE 4—FORMAT FOR BIT DATA WITHOUT MASK

For these bit data cases, the bit names (that is: items) are somewhat different to emphasize the difference in format. These numbers are shown in Figure 5. If there is more than one byte of this form, the item numbers are incremented by one, sequentially, beginning at one from the MSB of the first byte.

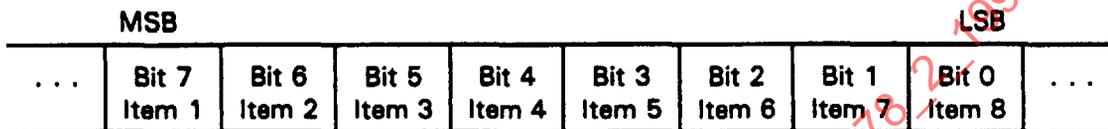


FIGURE 5—BITS WITHOUT MASK BYTE

For definition purposes, it is also possible to describe a single or multiple bit group which is smaller than a byte but which is combined into a byte or multiple bytes when the complete message is defined. This is a convenience used in this document to define some parameters. This definition notation applies equally to byte(s) with or without masks.

7.1.2 BIT MAPPED DATA WITH MASK BYTE(S)—For bit mapped data value groups that may come from several nodes or may not be valid for an application, a special format has been defined. Figures 6 and 7 show the data byte formats used. The data format allows two options in the number of bits in group; 8 or 16. Since the defined bits for such groupings may not always come from a single network node, the format includes mask bytes indicating if an individual bit is valid for this message or if it should be ignored. The mask bytes map directly to the data bits with which they are associated. Figures 8 and 9 show how these bits are mapped within each byte. Table 3 shows the bit value for the mask bits.

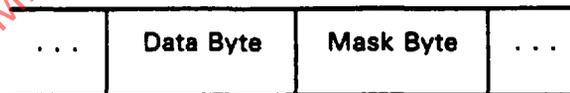


FIGURE 6—FORMAT FOR 8-BIT DATA WITH MASK

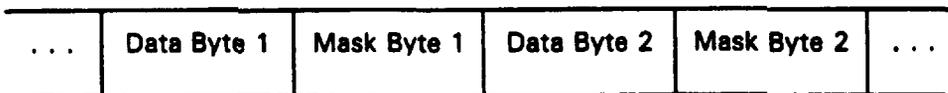


FIGURE 7—FORMAT FOR 16-BIT DATA WITH MASK

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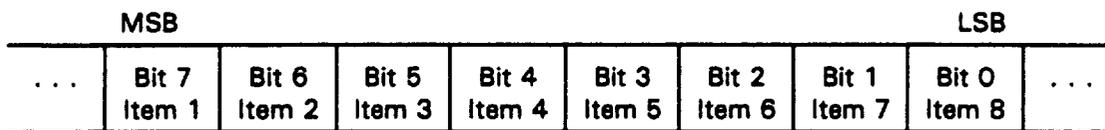


FIGURE 8—BIT MAPPED DATA BYTE

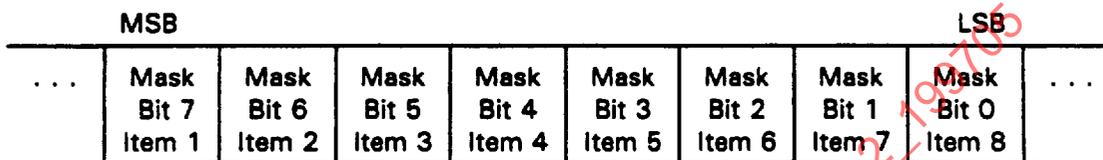


FIGURE 9—BIT MAPPED MASK BYTE

TABLE 3—MASK BIT ASSIGNMENT

| Mask Bit | Bit Mapped Masking |
|----------|--------------------|
| 0 | Not a Valid Bit |
| 1 | Valid Bit |

7.1.3 **BIT VALUES**—The general form of binary data is that 1 = true and 0 = false. One bit can carry a wide variety of interpretations, depending on the subject that it describes.

7.2 **Byte (8 Bit) Parameters**—Data parameters which can be expressed in 8 bits or less are expressed in a byte format. Byte parameters are the most common format. Figure 10 shows this format.

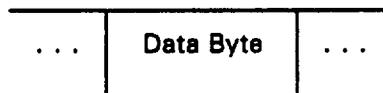


FIGURE 10—BYTE PARAMETERS

7.3 **Word (16 Bit) Parameters**—Data parameters which can be expressed in 9 to 16 bits are expressed in word format with the most significant byte transmitted first (high byte/low byte). Figure 11 shows this format.

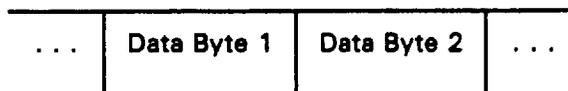


FIGURE 11—WORD PARAMETERS

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- 7.4 Multi-Byte (>16 Bit) Parameters**—Data parameters which can be expressed in more than 16 bits are expressed in multi-byte format with the most significant byte transmitted first (highest byte /.../ lowest byte). Figure 12 shows this format.

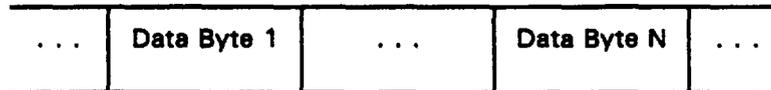


FIGURE 12—MULTI-BYTE PARAMETERS

- 7.5 Multiple Parameter Packets**—It is often useful to group parameters together into a packet to increase the information density of messages. For example, sending a fluid level and maximum capacity value in the same message, or a packet of single bit(s) or multiple bit definitions that may be smaller than a full byte, can be combined in this way. Parameter packets will be defined in this document in the same way as any other parameter, having a packet PRN number and SLOT reference assignment. If bit mapped parameters are included in a packet, the bit mapped byte(s) and the associated mask byte(s) are grouped together as a set representing a parameter. Thus, the data bytes and mask bytes for each parameter are together within the packet. Note that packets may be made of other packets, but each will be uniquely defined by combining each sub-part into a message. Figure 13 shows the general form of a parameter packet.

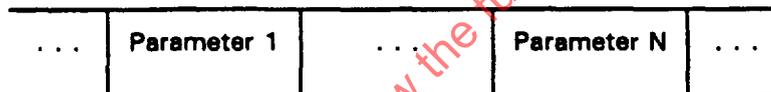


FIGURE 13—MULTIPLE PARAMETER PACKETS

A few examples, such as some of the SAE J1979 PRN definitions in Section 8 will make this format clear.

- 8. Specific Parameter (PRN) Assignments**—This section defines industry standard parameters used in messages found in parts 3 and 4. These parameters have been listed in random order based on when they were defined. Note that any PRN address in the SAE range that is not currently defined is reserved for SAE use. Cross references are provided in Appendices A and B of this part of SAE J2178 to assist the reader in finding the specific definition for each parameter.
- 8.1 Specific Parameters**—The following definitions include the Parameter Reference Number (PRN), parameter name, units of measure, and associated SLOT number. The SLOT number is a reference to the Scaling, Limit, Offset, and Transfer function (SLOT) definition found in Section 9. The SLOT reference numbers have a format of: F-N-#, where F is a three letter mnemonic indicating the format code type (see Section 9), N is the number of bits in the parameter, and # is the sequence number for that type of SLOT. There is no relationship between sequence numbers for different format codes or number of bytes. Notes that the sequence number is randomly assigned. Decimal sequence numbers of 1000 and above are available for manufacturers to assign. All SAE assigned sequence numbers will be in the range from 1 to 999 exclusively and are not to be used by manufacturers. The sequence number ZERO (0) has the special purpose of a fill sequence which is used in packet definitions. The ZERO sequence number is all zeros, for the number of bits specified. The Parameter Reference Numbers (PRNs) are the index reference used by the message definitions found in SAE J2178-3 and J2178-4. The specific parameters are grouped as follows:

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| | |
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**TABLE 4—SAE J1979 COMPATIBLE PRN ASSIGNMENTS
(PRNS 0000 - 00FF)**

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|---|-------------------------|--------------------|-------------------|
| 0000 | PIDs Supported (01h - 20h) | — | Bit Mapped | BMP-32-1 |
| 0001 | Number of Emission-Related Trouble Codes and MIL Status | — | Packeted | PKT-32-1 |
| 0002 | Trouble Code that Caused Freeze Frame Storage | — | Packeted | PKT-16-1 |
| 0003 | Fuel System Status | — | Packeted | PKT-16-2 |
| 0004 | Calculated Load Value | 100/255 | % Full Load | UNM-08-61 |
| 0005 | Engine Coolant Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 0006 | Short Term Fuel Trim - Bank 1 | 100/128 | % Enrichment | UNM-08-92 |
| 0007 | Long Term Fuel Trim - Bank 1 | 100/128 | % Enrichment | UNM-08-92 |
| 0008 | Short Term Fuel Trim - Bank 2 | 100/128 | % Enrichment | UNM-08-92 |
| 0009 | Long Term Fuel Trim - Bank 2 | 100/128 | % Enrichment | UNM-08-92 |
| 000A | Fuel Pressure (Gage) | 3 | kPaG | UNM-08-131 |
| 000B | Intake Manifold Absolute Pressure | 1 | kPaA | UNM-08-101 |
| 000C | Engine RPM - High Resolution | 1/4 | RPM | UNM-16-31 |
| 000D | Vehicle Speed - Low Resolution - Metric | 1 | KPH | UNM-08-101 |
| 000E | Ignition Timing Advance (#1) | 1/2 | Degrees before TDC | UNM-08-72 |
| 000F | Intake Air Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 0010 | Air Flow Rate from MAF | 1/100 | gm/sec | UNM-16-11 |
| 0011 | Absolute Throttle #1 Position | 100/255 | % Full Throttle | UNM-08-61 |
| 0012 | Commanded Secondary Air | — | Bit Mapped | BMP-08-5 |
| 0013 | Oxygen Sensor Location | — | Bit Mapped | BMP-08-6 |
| 0014 | Oxygen Sensor - BANK 1 - Sensor 1 | — | Packeted | PKT-16-3 |
| 0015 | Oxygen Sensor - BANK 1 - Sensor 2 | — | Packeted | PKT-16-3 |
| 0016 | Oxygen Sensor - BANK 1 - Sensor 3 | — | Packeted | PKT-16-3 |
| 0017 | Oxygen Sensor - BANK 1 - Sensor 4 | — | Packeted | PKT-16-3 |
| 0018 | Oxygen Sensor - BANK 2 - Sensor 1 | — | Packeted | PKT-16-3 |
| 0019 | Oxygen Sensor - BANK 2 - Sensor 2 | — | Packeted | PKT-16-3 |

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TABLE 4—SAE J1979 COMPATIBLE PRN ASSIGNMENTS
(PRNS 0000 - 00FF) (CONTINUED)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|-------|-----------------------------------|-------------------------|------------------|-------------------|
| 001A | Oxygen Sensor - BANK 2 - Sensor 3 | — | Packeted | PKT-16-3 |
| 001B | Oxygen Sensor - BANK 2 - Sensor 4 | — | Packeted | PKT-16-3 |
| 001C | Reserved SAE | — | — | — |
| 001D | Reserved SAE | — | — | — |
| 001E | Reserved SAE | — | — | — |
| 001F | Reserved SAE | — | — | — |
| 0020 | PIDs Supported (21h - 40h) | — | Bit Mapped | BMP-32-2 |
| 0021- | Reserved SAE | — | — | — |
| 003F | | | | |
| 0040 | PIDs Supported (41h - 60h) | — | Bit Mapped | BMP-32-3 |
| 0041- | Reserved SAE | — | — | — |
| 00FF | | | | |

TABLE 5—ENGINE PRN ASSIGNMENTS
(PRNS 1000 - 17FF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|--------------------------------------|-------------------------|------------------|-------------------|
| 1000 | MIL Status | — | Bit Mapped | BMP-01-1 |
| 1001 | Number of Emissions Related DTCs | 1 | Quantity | UNM-07-1 |
| 1002 | Continuous Evaluation Supported | — | Bit Mapped | BMP-08-1 |
| 1003 | Trip Evaluation Supported | — | Bit Mapped | BMP-08-2 |
| 1004 | Trip Evaluation Complete | — | Bit Mapped | BMP-08-3 |
| 1005 | Subsystem Category of DTC | — | State Encoded | SED-02-1 |
| 1006 | Most Significant Digit of DTC | — | State Encoded | SED-02-2 |
| 1007 | Lower 3 Digits of DTC | — | BCD | BCD-12-1 |
| 1008 | Fuel System Status - Bank 1 | — | Bit Mapped | BMP-08-4 |
| 1009 | Fuel System Status - Bank 2 | — | Bit Mapped | BMP-08-4 |
| 100A | Oxygen Sensor Voltage | 1/200 | volts | UNM-08-11 |
| 100B | Short Term Fuel Trim | 100/128 | % Enrichment | UNM-08-92 |
| 100D | Most Significant Digit of VIN Number | — | ASCII | ASC-08-11 |
| 100E | A/C Clutch Load | 25 | Watts | UNM-08-165 |
| 1015 | Injector On Time | 2048 | microseconds | UNM-08-231 |
| 1016 | Injector On Time - High Resolution | 64 | microseconds | UNM-16-61 |
| 1017 | MIL Status - Expanded | — | Bit Mapped | BMP-08-8 |
| 1018 | Fuel Consumed - Volume | 1 | μ liter | UNM-16-41 |
| 1019 | Crankshaft Torque - Absolute | 4 | NM Torque | UNM-08-141 |
| 1020 | Crankshaft Torque - Percent | 100/255 | % Maximum Torque | UNM-08-61 |
| 1021 | Engine Boost | 100/255 | % Full Boost | UNM-08-61 |
| 1022 | Engine RPM - Low Resolution | 32 | RPM | UNM-08-171 |
| 1023 | Engine Idle RPM | 16 | RPM | UNM-08-161 |
| 1024 | Engine Revolutions | 2 | Quantity | UNM-08-121 |
| 1025 | Barometric Pressure | 1 | kPaA | UNM-08-101 |
| 1026 | Engine Coolant Level - Percent | 1/2 | % Full | UNM-08-71 |
| 1027 | Engine Coolant Level - Volume | 1/10 | liters | UNM-08-41 |
| 1028 | Engine Coolant Capacity | 1/10 | liters | UNM-08-41 |
| 1029 | Engine Coolant Pressure | 4 | kPaG | UNM-08-141 |
| 102A | Engine Coolant Fan #1 Speed | 100/255 | % Full On | UNM-08-61 |

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TABLE 5—ENGINE PRN ASSIGNMENTS
(PRNS 1000 - 17FF) (CONTINUED)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|--|-------------------------|--------------------|-------------------|
| 102B | Engine Oil Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 102C | Engine Oil Level - Percent | 1/2 | % Full | UNM-08-71 |
| 102D | Engine Oil Level - Volume | 1/10 | liters | UNM-08-41 |
| 102E | Engine Oil Capacity | 1/10 | liters | UNM-08-41 |
| 102F | Engine Oil Pressure | 4 | kPaG | UNM-08-141 |
| 1030 | Engine Oil Remaining Life | 100/255 | % Remaining Life | UNM-08-61 |
| 1031 | Hydraulic Fan Speed | 100/255 | % Full On | UNM-08-61 |
| 1032 | Methanol Content | 100/255 | % Methanol | UNM-08-61 |
| 1033 | Maximum Crankshaft Torque | 4 | NM Torque | UNM-08-141 |
| 1034 | Accelerator Pedal Position | 100/255 | % Pressed Down | UNM-08-61 |
| 1035 | Absolute Throttle #2 Position | 100/255 | % Full Throttle | UNM-08-61 |
| 1036 | Absolute Throttle #3 Position | 100/255 | % Full Throttle | UNM-08-61 |
| 1037 | Bank #1 - Converter #1 Temperature | 8 | Degrees Centigrade | UNM-08-151 |
| 1038 | Bank #1 - Converter #2 Temperature | 8 | Degrees Centigrade | UNM-08-151 |
| 1039 | Bank #2 - Converter #1 Temperature | 8 | Degrees Centigrade | UNM-08-151 |
| 103A | Bank #2 - Converter #2 Temperature | 8 | Degrees Centigrade | UNM-08-151 |
| 103B | Engine Coolant #2 Fan Speed | 100/255 | % Full On | UNM-08-61 |
| 103C | Engine Coolant Temperature - Low Range | 1 | Degrees Centigrade | UNM-08-104 |
| 103D | Engine Coolant Remaining Life | 100/255 | % Remaining Life | UNM-08-61 |
| 103F | Engine Oil Viscosity | 1/10 | Centistokes (cSt.) | UNM-08-41 |
| 1040 | Number of Engine Cylinders | 1 | Quantity | UNM-08-101 |
| 1041 | Number of Valves per Cylinder | 1 | Quantity | UNM-08-101 |
| 1043 | Engine Displacement | 1/10 | liters | UNM-08-41 |
| 1044 | Fuel Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 1047 | Ignition Switch Position | — | State Encoded | SED-08-5 |
| 1048 | Engine Redline - Low Resolution | 32 | RPM | UNM-08-171 |
| 1049 | Engine Redline - High Resolution | 1/4 | RPM | UNM-16-31 |

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TABLE 6—TRANSMISSION PRN ASSIGNMENTS
(PRNS 1800 - 1FFF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|--|-------------------------|--------------------|-------------------|
| 1801 | Transmission Fluid Level - Percent | 1/2 | % Full | UNM-08-71 |
| 1802 | Transmission Fluid Level - Volume | 1/10 | liters | UNM-08-41 |
| 1803 | Transmission Fluid Capacity | 1/10 | liters | UNM-08-41 |
| 1804 | Transmission Oil Life | 100/255 | % Remaining Life | UNM-08-61 |
| 1805 | Transmission Gear and Lockup Status | — | Packeted | PKT-08-1 |
| 1806 | Transmission Range Actual (PRNDL) | — | State Encoded | SED-08-4 |
| 1807 | Transmission Lockup Status | — | State Encoded | SED-02-3 |
| 1808 | Transmission Actual Gear | — | State Encoded | SED-06-1 |
| 1809 | Transmission Range Selected (PRNDL) | — | State Encoded | SED-08-4 |
| 180A | Transmission Transfer Case (4WD) | — | State Encoded | SED-08-6 |
| 180B | Transmission Fluid Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 180C | Transmission Fluid Pressure | 8 | kPaG | UNM-08-151 |
| 180D | Transmission Commanded Gear | — | State Encoded | SED-08-4 |
| 180E | Transmission Actual Gear | — | State Encoded | SED-08-4 |
| 180F | Transmission Gear and Lockup Status - Expanded | — | Packeted | PKT-08-2 |
| 1810 | Transmission Actual Gear - Expanded | — | State Encoded | SED-06-2 |

TABLE 7—BRAKES/TIRES/WHEELS PRN ASSIGNMENTS
(PRNS 2800 - 2FFF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|---|-------------------------|--------------------|-------------------|
| 2801 | Wheel Speed - Low Resolution | 1 | KPH | UNM-08-101 |
| 2802 | Wheel Speed - High Resolution | 1/128 | KPH | UNM-16-5 |
| 2809 | Wheel Slip | 1/255 | Dimensionless | UNM-08-6 |
| 2819 | Hydraulic Brake Fluid Supply Pump Pressure | 32 | kPaG | UNM-08-171 |
| 281A | Hydraulic Brake Fluid Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 281B | Hydraulic Brake Fluid Recirculation Pump Pressure | 1 | kPaG | UNM-08-101 |
| 2821 | Wheel Rate | | SAE Reserved | SAE Reserved |
| 2829 | Wheel Angular Velocity | | SAE Reserved | SAE Reserved |
| 2831 | Wheel Angular Acceleration | | SAE Reserved | SAE Reserved |
| 2839 | Wheel Load | 100/255 | % Full Load | UNM-08-61 |
| 2841 | Brake Fluid Level - Percent | 1/2 | % Full | UNM-08-71 |
| 2842 | Brake Fluid Level - Volume | 1/100 | liters | UNM-08-15 |
| 2843 | Brake Fluid Remaining Life | 100/255 | % Remaining Life | UNM-08-61 |
| 2844 | Brake Fluid Capacity | 1/100 | liters | UNM-08-15 |
| 2849 | Tire Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 2851 | Tire Pressure | 4 | kPaG | UNM-08-141 |
| 2859 | Tire Type | | SAE Reserved | SAE Reserved |
| 2861 | Tire Tread Wear Level | 100/255 | % Tread Remaining | UNM-08-61 |

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TABLE 8—STEERING PRN ASSIGNMENTS

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|--------------------------------------|-------------------------|------------------------|-------------------|
| 3001 | Steering Wheel Angle | 6 | Degrees CW from Center | SNM-08-61 |
| 3005 | Power Steering Fluid Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 3006 | Power Steering Fluid Pressure | 100 | kPaG | UNM-08-185 |
| 3007 | Power Steering Fluid Level - Percent | 1/2 | % Full | UNM-08-71 |
| 3008 | Power Steering Fluid Level - Volume | 1/100 | liters | UNM-08-15 |
| 3009 | Power Steering Fluid Remaining Life | 100/255 | % Remaining Life | UNM-08-61 |
| 300B | Power Steering Fluid Capacity | 1/100 | liters | UNM-08-15 |
| 300C | Steering Wheel Rate | 1 | RPM | UNM-08-101 |
| 300D | Steering Wheel Torque | 1 | NM Torque | UNM-08-101 |
| 300E | Wheel Steer Angle | 1/2 | Degrees CW from Center | SNM-08-11 |

TABLE 9—SUSPENSION PRN ASSIGNMENTS
(PRNS 3800 - 3FFF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|----------------------------------|-------------------------|--------------------|-------------------|
| 3801 | Lateral Acceleration | | SAE Reserved | SAE Reserved |
| 3802 | Longitudinal Acceleration | | SAE Reserved | SAE Reserved |
| 3803 | Yaw Acceleration | | SAE Reserved | SAE Reserved |
| 3804 | Suspension Ride Setting | 100/255 | % Stiff Setting | UNM-08-61 |
| 3805 | Suspension Fluid Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 3806 | Suspension Fluid Pressure | 100 | kPaG | UNM-08-185 |
| 3807 | Suspension Fluid Level - Percent | 1/2 | % Full | UNM-08-71 |
| 3808 | Suspension Fluid Level - Volume | 1/32 | liters | UNM-08-26 |
| 3809 | Suspension Fluid Remaining Life | 100/255 | % Remaining Life | UNM-08-61 |
| 380A | Suspension Fluid Capacity | 1/32 | liters | UNM-08-26 |
| 380B | Vehicle Lateral Velocity | | SAE Reserved | SAE Reserved |
| 380C | Vehicle Longitudinal Velocity | | SAE Reserved | SAE Reserved |
| 830D | Vehicle Yaw Velocity | | SAE Reserved | SAE Reserved |

TABLE 10—RESTRAINTS PRN ASSIGNMENTS
(PRNS 5800 - 5FFF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|------------------------|-------------------------|------------------|-------------------|
| 5801 | Shoulder Belt Position | 1 | Raw A/D Counts | UNM-08-101 |

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TABLE 11—DRIVER INFORMATION PRN ASSIGNMENTS
(PRNS 6000 - 67FF)

| PRN | Parameter Name | Resolution (1Bit =) | Units of Measure | SLOT # (F-N#) |
|------|--|------------------------|-----------------------|------------------|
| 6001 | Vehicle Speed - High Resolution - Metric | 1/128 | KPH | UNM-16-5 |
| 6002 | Vehicle Speed - High Resolution - English | 1/128 | MPH | UNM-16-5 |
| 6003 | Compass Direction | 3/2 | Degrees CW from North | SNM-08-51 |
| 6004 | Odometer - Vehicle - Metric | 1/64 | kilometers | UNM-32-31 |
| 6005 | Fuel Level - Percent | 100/255 | % Full | UNM-08-81 |
| 6006 | Fuel Level - Volume | 1/100 | liters | UNM-16-11 |
| 6007 | Fuel Capacity | 1/100 | liters | UNM-16-11 |
| 600A | Battery Voltage - Low Resolution | 1/16 | volts | UNM-08-32 |
| 600B | Battery Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 600C | Electrical Energy Load | 1 | Amps | UNM-08-101 |
| 600D | Date (Dw ₈ :DD:MM:YY) | — | Packeted | PKT-32-3 |
| 600E | Year (YY) | — | BCD | BCD-08-1 |
| 600F | Year (Yr) | 1 | year | UNM-08-101 |
| 6010 | Month (Mn) | — | State Encoded | SED-04-2 |
| 6011 | Month (MM) | — | BCD | BCD-08-1 |
| 6012 | Day of Week (Dw ₄) | — | State Encoded | SED-04-1 |
| 6013 | Day of Week (Dw ₈) | — | State Encoded | SED-08-2 |
| 6014 | Day of Month (Dm) | — | State Encoded | SED-08-3 |
| 6015 | Day of Month (DD) | — | BCD | BCD-08-1 |
| 6016 | Time of Day (HH:MM:SS) | — | Packeted | PKT-24-1 |
| 6017 | Hours (HH) | — | BCD | BCD-08-1 |
| 6018 | Minutes (MM) | — | BCD | BCD-08-1 |
| 6019 | Seconds (SS) | — | BCD | BCD-08-1 |
| 601A | Battery Voltage - High Resolution | 1/128 | volts | UNM-16-5 |
| 601B | Distance Traveled - English | 1/8000 | miles | UNM-08-1 |
| 601C | Fuel Used - Metric | 1/64 | liters | UNM-16-8 |
| 601D | Distance to Empty - English | 1/10 | miles | UNM-16-21 |
| 601E | Vehicle Speed - Low Resolution - English | 1 | MPH | UNM-08-101 |
| 601F | Hours (Hr) - 0 - 23 numeric | 1 | hour | UNM-08-101 |
| 6020 | Average Fuel Economy - Low Resolution - Metric | 1 | liters/100 kilometers | UNM-08-101 |
| 6021 | Average Fuel Economy - Low Resolution - English | 1 | MPG | UNM-08-101 |
| 6022 | Elapsed Time - Seconds | 1 | Seconds | UNM-08-101 |
| 6023 | Date (Dw ₄ :Mn:Dm) | — | Packeted | PKT-16-6 |
| 6024 | Elapsed Time - Minutes | 1 | Minutes | UNM-08-101 |
| 6025 | Accumulated Ignition On Time | — | Packeted | PKT-24-2 |
| 6026 | Fuel Used - English | 1/64 | gallons | UNM-16-8 |
| 6027 | Distance to Empty - Metric | 1/10 | kilometers | UNM-16-21 |
| 6028 | Average Fuel Economy - High Resolution - Metric | 1/10 | liters/100 kilometers | UNM-16-21 |
| 6029 | Average Fuel Economy - High Resolution - English | 1/10 | MPG | UNM-16-21 |
| 602A | Elapsed Time - Hours | 1 | Hours | UNM-08-101 |
| 602B | Display Brightness | 100/255 | % Full On | UNM-08-61 |
| 602C | Ignition Off Duration | 1 | Minutes | UNM-08-101 |
| 602D | Outside Air Temperature - High Resolution | 1/256 | Degrees Centigrade | UNM-16-3 |
| 602E | Outside Air Temperature Display | 1/2 | Degrees Centigrade | UNM-08-73 |
| 602F | Minutes (MN) 0 - 59 numeric | 1 | minute | UNM-08-101 |
| 6030 | Time (Hr:Mn) | — | Packeted | PKT-16-5 |

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TABLE 11—DRIVER INFORMATION PRN ASSIGNMENTS
(PRNS 6000 - 67FF) (CONTINUED)

| PRN | Parameter Name | Resolution (1Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|--|------------------------|-----------------------|-------------------|
| 6031 | Odometer - Vehicle - High Resolution - English | 1/8000 | miles | UNM-32-11 |
| 6032 | Odometer - Trip - High Resolution - English | 128/8000 | miles | UNM-24-21 |
| 6033 | Odometer - Vehicle - Low Resolution - English | 1/10 | miles | UNM-24-11 |
| 6034 | Odometer - Trip - Low Resolution - English | 1/10 | miles | UNM-16-21 |
| 6035 | Charging Voltage - Low Resolution | 1/16 | volts | UNM-08-32 |
| 6036 | Charging Voltage - High Resolution | 1/128 | volts | UNM-16-5 |
| 6037 | Charging Current | 1 | amps | UNM-08-101 |
| 6038 | Battery Current | 1 | amps | SNM-08-21 |
| 6039 | Odometer - Trip - Metric | 1/64 | kilometers | UNM-24-41 |
| 603A | Instantaneous Fuel Economy - Low Resolution - Metric | 1 | liters/100 kilometers | UNM-08-101 |
| 603B | Fuel Used - Percent | 100/255 | % Used | UNM-08-61 |
| 603C | Fuel Used - Volume | 1/100 | liters | UNM-16-11 |
| 603D | Audible Signal Volume | 100/255 | % Full Volume | UNM-08-61 |
| 603E | Audible Signal Type | | SAE Reserved | SAE Reserved |
| 603F | Instantaneous Fuel Economy - High Resolution - Metric | 1/10 | liters/100 kilometers | UNM-16-21 |
| 6040 | Instantaneous Fuel Economy - Low Resolution - English | 1 | MPG | UNM-08-101 |
| 6041 | Instantaneous Fuel Economy - High Resolution - English | 1/10 | MPG | UNM-16-21 |
| 6042 | Seconds (Sc) 0 - 59 numeric | 1 | second | UNM-08-101 |
| 6047 | Alarm Time (HH:MM:SS) | — | Packeted | PKT-24-1 |
| 6049 | Elapsed Years | 1 | Years | UNM-08-101 |
| 604A | Elapsed Months | 1 | Months | UNM-08-101 |
| 604B | Elapsed Days | 1 | Days | UNM-08-101 |
| 604C | Ignition Off Duration - Long | 1 | Minutes | UNM-16-41 |
| 604D | Lamp Status | — | Bit Mapped | BMP-08-7 |
| 604E | Fuel Level - Unscaled | 1 | Raw A/D Counts | UNM-08-101 |
| 604F | Fuel Level - English | 1/8 | gallons | UNM-08-45 |

TABLE 12—LIGHTING PRN ASSIGNMENTS
(PRNS 7000 - 77FF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|-----|----------------|-------------------------|------------------|-------------------|
| | | | | |

TABLE 13—AUDIO PRN ASSIGNMENTS
(PRNS 8000 - 87FF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|-----|----------------|-------------------------|------------------|-------------------|
| | | | | |

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TABLE 14—PRN GROUPINGS

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|-----|----------------|-------------------------|------------------|-------------------|
|-----|----------------|-------------------------|------------------|-------------------|

TABLE 15—PRN GROUPINGS

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|-------------------------------------|-------------------------|---------------------|-------------------|
| 9801 | HVAC Fan Speed | 100/255 | % Full On | UNM-08-61 |
| 9803 | HVAC Door Position | 100/255 | % Open | UNM-08-61 |
| 9804 | Electric Defrost Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 9808 | HVAC High-Side Fluid Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 9809 | HVAC Low-Side Fluid Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| 980A | HVAC Low-Side Pressure | 5/2 | kPaG | UNM-08-125 |
| 980B | HVAC Fluid Charge - % Full Charge | 100/255 | % Full | UNM-08-61 |
| 980C | HVAC Fluid Charge - Absolute Weight | 10 | grams | UNM-08-155 |
| 980D | HVAC Fluid Charge Remaining Life | 100/255 | % Remaining Life | UNM-08-61 |
| 980E | HVAC Fluid Charge Capacity | 10 | grams | UNM-08-155 |
| 9810 | HVAC Intake Temperature | 1/2 | Degrees Centigrade | UNM-08-73 |
| 9813 | HVAC High-Side Pressure | 14 | kPaG | UNM-08-159 |
| 9815 | Interior Humidity Level | 100/255 | % Relative Humidity | UNM-08-61 |
| 9816 | Interior Air Filter Remaining Life | 100/255 | % Remaining Life | UNM-08-61 |
| 9817 | Heat Load Sensor | 1/2 | mW/CM ² | UNM-08-71 |
| 9820 | Interior Set Temperature | 1/2 | Degrees Centigrade | UNM-08-73 |
| 9830 | HVAC Zone Temperature | 1/2 | Degrees Centigrade | UNM-08-73 |

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**TABLE 16—CONVENIENCE PRN ASSIGNMENTS
(PRNS A000 - A7FF)**

| PRN | Parameter | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|---|-------------------------|--------------------|-------------------|
| A001 | Seat Temperature | 1/2 | Degrees Centigrade | UNM-08-73 |
| A003 | Wiper Mode | — | State Encoded | SED-08-1 |
| A004 | Wiper Delay | 1/4 | seconds | UNM-08-51 |
| A006 | Washer Fluid Temperature | 1 | Degrees Centigrade | UNM-08-102 |
| A007 | Washer Fluid Pressure | 4 | kPaG | UNM-08-141 |
| A008 | Washer Fluid Level - Percent | 100/255 | % Full | UNM-08-61 |
| A009 | Washer Fluid Level - Volume | 1/10 | liters | UNM-08-41 |
| A00A | Washer Fluid Capacity | 1/10 | liters | UNM-08-41 |
| A00C | Mirror Dimming Level | 100/255 | % Full Dim | UNM-08-61 |
| A00D | Mirror Horizontal Position | 1 | Raw A/D Counts | UNM-08-101 |
| A00E | Mirror Vertical Position | 1 | Raw A/D Counts | UNM-08-101 |
| A00F | Window Position | 1 | Raw A/D Counts | UNM-08-101 |
| A010 | Door Lock Cylinder State | — | State Encoded | SED-08-7 |
| A011 | Steering Column Horizontal Position | 1 | Raw A/D Counts | UNM-08-101 |
| A012 | Steering Column Vertical Position | 1 | Raw A/D Counts | UNM-08-101 |
| A014 | Autolamp Off Delay Time | 1 | Seconds | UNM-08-101 |
| A015 | Vehicle Speed Setting - Low Resolution - Metric | 1 | KPH | UNM-08-101 |
| A016 | Vehicle Speed Setting - High Resolution - Metric | 1/128 | KPH | UNM-16-5 |
| A017 | Vehicle Speed Setting - Low Resolution - English | 1 | MPH | UNM-08-101 |
| A018 | Vehicle Speed Setting - High Resolution - English | 1/128 | MPH | UNM-16-5 |
| A019 | Module Physical Address | 1 | ID Number | UNM-08-101 |

**TABLE 17—SECURITY PRN ASSIGNMENTS
(PRNS C000 - C7FF)**

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|-----------------------|-------------------------|------------------|-------------------|
| C001 | Remote Transmitter Id | 1 | Id Number | UNM-08-101 |

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TABLE 18—ELECTRIC VEHICLE ENERGY TRANSFER SYSTEM PRN ASSIGNMENTS
(PRNS C800 - CFFF)

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|------------------------------|-------------------------|------------------|-------------------|
| C800 | Battery Design Capacity | 1/128 | Kilowatt-hours | UNM-16-5 |
| C801 | Battery SOC | 100/255 | % | UNM-08-61 |
| C802 | Conversion Load | 1/128 | Kilowatts | UNM-16-5 |
| C803 | Conversion Power Range | — | Packeted | PKT-40-1 |
| C804 | Current Limit | 1/64 | Amperes | UNM-16-8 |
| C805 | Current Limit Mandate | 1/64 | Amperes | UNM-16-8 |
| C806 | Delay Timer Count | 1 | Minutes | UNM-16-41 |
| C807 | Delay Timer Period | 1 | Minutes | UNM-16-41 |
| C808 | EVSE Configuration | — | Bit Mapped | BMP-16-01 |
| C809 | EVSE Ready | — | State Encoded | SED-08-08 |
| C80A | LMS Current Limit Mandate | 1/64 | Amperes | UNM-16-8 |
| C80B | LMS Current Limit Preference | 1/64 | Amperes | UNM-16-8 |
| C80C | LMS Power Limit Mandate | 1/256 | Kilowatts | UNM-16-2 |
| C80D | LMS Power Limit Preference | 1/256 | Kilowatts | UNM-16-2 |
| C80E | Max Conversion Power | 1/256 | Kilowatts | UNM-16-2 |
| C80F | Max Power Level | 1/256 | Kilowatts | UNM-16-2 |
| C810 | Max Power Level Mandate | 1/256 | Kilowatts | UNM-16-2 |
| C811 | Max Stage Index | 1 | — | UNM-08-101 |
| C812 | Max Stage Power | 1/256 | Kilowatts | UNM-16-2 |
| C813 | Max Transfer Power | 1/256 | Kilowatts | UNM-16-2 |
| C814 | Max Conversion Power | 1/256 | Kilowatts | UNM-16-2 |
| C815 | Min Stage Power | 1/256 | Kilowatts | UNM-16-2 |
| C816 | Power Level | 1/256 | Kilowatts | UNM-16-2 |
| C817 | Power Out of Range | — | State Encoded | SED-08-09 |
| C818 | Pulse Hi Period | 1 | millisec | UNM-16-41 |
| C819 | Pulse Lo Period | 1 | millisec | UNM-16-41 |
| C81A | Pulse Period | — | Packeted | PKT-32-4 |
| C81B | Requested Stage Index | 1 | — | UNM-08-101 |
| C81C | Stage Index | 1 | — | UNM-08-101 |
| C81D | Stage Power Range | — | Packeted | PKT-40-2 |
| C81E | Transfer Type | — | State Encoded | SED-08-12 |
| C81F | Usage Mode | — | State Encoded | SED-08-10 |
| C820 | Usage Mode Time | 1 | Minutes | UNM-16-41 |
| C821 | Vehicle Ready | — | State Encoded | SED-08-08 |
| C822 | Voltage Level | 1/64 | Volts | UNM-16-8 |
| C823 | Voltage Mode Control | — | Packeted | PKT-24-3 |
| C824 | Voltage Mode Enabled | — | State Encoded | SED-08-11 |
| C825 | App Comm State | — | Packeted | PKT-56-01 |
| C826 | App Service Request | — | Packeted | PKT-56-02 |
| C827 | App Service Request Enable | — | Packeted | PKT-56-02 |
| C828 | Comm State | — | Bit Mapped | BMP-16-02 |
| C829 | App ID | — | State Encoded | SED-24-01 |
| C82A | App Type | — | State Encoded | SED-16-02 |
| C82B | State Flag | — | State Encoded | SED-16-01 |

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**TABLE 19—CONFIGURATION CODES PRN ASSIGNMENTS
(PRNS E000 - E7FF)**

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|---|-------------------------|----------------------|-------------------|
| E021 | Vehicle Id Number (VIN) #1 | — | VIN Character 1 | PKT-32-2 |
| E022 | Vehicle Id Number (VIN) #2 | — | VIN Characters 2-5 | ASC-32-1 |
| E023 | Vehicle Id Number (VIN) #3 | — | VIN Characters 6-9 | ASC-32-1 |
| E024 | Vehicle Id Number (VIN) #4 | — | VIN Characters 10-13 | ASC-32-1 |
| E025 | Vehicle Id Number (VIN) #5 | — | VIN Characters 14-17 | ASC-32-1 |
| E026 | Vehicle Id Number (VIN) #6 (reserved for future use) | — | Reserved - SAE | Reserved - SAE |
| E027 | Vehicle Id Number (VIN) #7 (reserved for future use) | — | Reserved - SAE | Reserved - SAE |

**TABLE 20—TESTER/DIAGNOSTICS PRN ASSIGNMENTS
(PRNS F000 - F7FF)**

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|-----|----------------|-------------------------|------------------|-------------------|
|-----|----------------|-------------------------|------------------|-------------------|

**TABLE 21—MISCELLANEOUS PRN ASSIGNMENTS
(PRNS F800 - FFFF)**

| PRN | Parameter Name | Resolution (1 Bit =) | Units of Measure | SLOT # (F-N-#) |
|------|----------------------|-------------------------|------------------|-------------------|
| F801 | One Byte Zero Fill | 0 | Zero | UNM-08-0 |
| F802 | Two Byte Zero Fill | 0 | Zero | UNM-16-0 |
| F803 | Three Byte Zero Fill | 0 | Zero | UNM-24-0 |
| F804 | Four Byte Zero Fill | 0 | Zero | UNM-32-0 |
| F805 | Five Byte Zero Fill | 0 | Zero | UNM-40-0 |
| F806 | Six Byte Zero Fill | 0 | Zero | UNM-48-0 |
| F807 | Seven Byte Zero Fill | 0 | Zero | UNM-56-0 |
| F810 | One Bit Zero Fill | 0 | Zero | UNM-01-0 |
| F811 | Two Bit Zero Fill | 0 | Zero | UNM-02-0 |
| F812 | Three Bit Zero Fill | 0 | Zero | UNM-03-0 |
| F813 | Four Bit Zero Fill | 0 | Zero | UNM-04-0 |
| F814 | Five Bit Zero Fill | 0 | Zero | UNM-05-0 |
| F815 | Six Bit Zero Fill | 0 | Zero | UNM-06-0 |
| F816 | Seven Bit Zero Fill | 0 | Zero | UNM-07-0 |

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- 9. Scaling, Limit, Offset, and Transfer Function (SLOT) Definitions**—This section defines the parameter scaling, limit(s), offset value, and transfer function for bit, byte, or larger variables. These SLOT definitions have been grouped together to avoid duplication in this document and to offer a common list of definitions for use in assigning new parameter definitions. The wide range of these definitions is expected to cover a large number of applications, and should be used for most new definitions as well. Each of these definitions has been assigned a SLOT number for reference purposes but is formatted to include a three letter mnemonic representing the format, the parameter length in bits, followed by a random sequence number.

The transfer function is shown in two forms to allow use in implementing messages in modules and in interpreting messages found on a network. The two forms are identical but are solved for each of the two variables. The transfer function defines the relationship between computer units (N) in decimal, and engineering units (E) of the data.

The format of the SLOT, identified by the three letter mnemonic, indicates the category of bit representation. These formats include:

| | |
|---|-----|
| Multiple Parameter Packeted | PKT |
| Bit Mapped with Mask | BMM |
| Bit Mapped without Mask | BMP |
| Unsigned Numeric | UNM |
| 2's Complement Signed Numeric | SNM |
| State Encoded | SED |
| ASCII Encoded | ASC |
| Binary Coded Decimal (BCD) | BCD |
| Signed Floating Point (Scientific Notation) | SFP |

These formats are described in the following paragraphs.

- 9.1 Multiple Parameter Packeted (PKT) SLOTS**—The multiple parameter packet is used to define PRNs which refer to more than one parameter as a group that are related. By grouping multiple parameters, the efficiency of utilization can be improved, if the groupings are accomplished such that the individual parameters that need to be associated with each other are transmitted together. These packets are defined as a sequence of other PRN numbers, in the order that they appear in the message (MSB first). In some cases, a PRN may be assigned to fill bits or bytes with zeros. Each zero fill PRN is an unsigned numeric SLOT with zero as the sequence number.

9.1.1 MULTIPLE PARAMETER PACKETED ASSIGNMENTS

| | | | | |
|----------|---|----------|--------------------------------------|---------|
| PKT-08-1 | Transmission Gear and Lockup Status (PRN 1805) | | | |
| | MSB | PRN 1807 | Transmission Lockup Status | 2 bits |
| | LSB | PRN 1808 | Transmission Gear Engaged | 6 bits |
| PKT-08-2 | Transmission Gear and Lockup Status - Expanded (PRN 180F) | | | |
| | MSB | PRN 1807 | Transmission Lockup Status | 2 bits |
| | LSB | PRN 1810 | Transmission Gear Engaged - Expanded | 6 bits |
| PKT-16-1 | Trouble Code that Caused Freeze Frame Storage (PRN 0002) | | | |
| | MSB | PRN 1005 | Sub-System Category | 2 bits |
| | | PRN 1006 | MSB of Trouble Code | 2 bits |
| | LSB | PRN 1007 | Lower Bytes of Trouble Code - BCD | 12 bits |
| PKT-16-2 | Fuel System Status (PRN 0003) | | | |
| | MSB | PRN 1008 | Fuel System Status - Bank 1 | 8 bits |
| | LSB | PRN 1009 | Fuel System Status - Bank 2 | 8 bits |

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| | | | | |
|----------|--|----------|--|---------|
| PKT-16-3 | Oxygen BANK 1, 2 - Sensor 1, 2, 3, or 4 (PRN 0014 - 001B) | | | |
| | MSB | PRN 100A | Oxygen Sensor Voltage | 8 bits |
| | LSB | PRN 100B | Short Term Fuel Trim | 8 bits |
| PKT-16-5 | Time (Hr:Mn) (PRN 6030) | | | |
| | MSB | PRN 601F | Hours (0 - 23) | 8 bits |
| | LSB | PRN 602F | Minutes (0 - 59) | 8 bits |
| PKT-16-6 | Date (Dw ₄ /Mn:Dm) (PRN 6023) | | | |
| | MSB | PRN 6012 | Day of Week (1 - 7) | 4 bits |
| | | PRN 6010 | Month (1 - 12) | 4 bits |
| | LSB | PRN 6014 | Day of Month (1 - 31) | 8 bits |
| PKT-24-1 | Time of Day (HH:MM:SS) (PRN 6016) | | | |
| | MSB | PRN 6017 | Hours (HH) - BCD | 8 bits |
| | | PRN 6018 | Minutes (MM) - BCD | 8 bits |
| | LSB | PRN 6019 | Seconds (SS) - BCD | 8 bits |
| PKT-24-2 | Accumulated Ignition on Time (PRN 6025) | | | |
| | MSB | PRN 602A | Elapsed Time - Hours (0 - 99) | 8 bits |
| | | PRN 6024 | Elapsed Time - Minutes (0 - 59) | 8 bits |
| | LSB | PRN 6022 | Elapsed Time - Seconds (0 - 59) | 8 bits |
| PKT-24-3 | Voltage Mode Control (PRN C823) | | | |
| | MSB | PRN C822 | Voltage Level | 16 bits |
| | LSB | PRN C824 | Voltage Mode Enabled | 8 bits |
| PKT-32-1 | Number of Emission-Related Trouble Codes and MIL Status (PRN 0001) | | | |
| | MSB | PRN 1000 | MIL Status | 1 bit |
| | | PRN 1001 | Number of Emission-Related Trouble Codes | 7 bits |
| | | PRN 1002 | Continuous Evaluation Supported | 8 bits |
| | | PRN 1003 | Trip Evaluation Supported | 8 bits |
| | LSB | PRN 1004 | Trip Evaluation Complete | 8 bits |
| PKT-32-2 | Vehicle Id Number (VIN) #1 (PRN E021) | | | |
| | MSB | PRN F803 | Three Byte - Zero Fill | 24 bits |
| | LSB | PRN 100D | MSB of VIN Number | 8 bits |
| PKT-32-3 | Date (Dw ₈ :DD:MM:YY) (PRN 600D) | | | |
| | MSB | PRN 6013 | Day of Week (1 - 7) | 8 bits |
| | | PRN 6015 | Day of Month (DD) - BCD | 8 bits |
| | | PRN 6011 | Month (MM) - BCD | 8 bits |
| | LSB | PRN 600E | Year (YY) - BCD | 8 bits |
| PKT-32-4 | Pulse Period (PRN C81A) | | | |
| | MSB | PRN C818 | Pulse Hi Period | 16 bits |
| | LSB | PRN C819 | Pulse Lo Period | 16 bits |
| PKT-40-1 | Conversion Power Range (PRN C803) | | | |
| | MSB | PRN C80E | Max Conversion Power | 16 bits |
| | | PRN C814 | Min Conversion Power | 16 bits |
| | LSB | PRN C811 | Max Stage Index | 8 bits |
| PKT-40-2 | Stage Power Range (PRN C81D) | | | |
| | MSB | PRN C812 | Max Stage Power | 16 bits |
| | | PRN C815 | Min Stage Power | 16 bits |
| | LSB | PRN C81C | Stage Index | 8 bits |

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| | | | | |
|----------|--------------------------------|---------------------------------------|------------|---------|
| PKT-56-1 | App Comm State (PRN C825) | | | |
| | MSB | PRN C82A | App Type | 16 bits |
| | | PRN C829 | App ID | 24 bits |
| | LSB | PRN C828 | Comm State | 16 bits |
| PKT-56-2 | App Service Request (PRN C826) | | | |
| | | App Service Request Enable (PRN C827) | | |
| | MSB | PRN C82A | App Type | 16 bits |
| | | PRN C829 | App ID | 24 bits |
| | LSB | PRN C82B | State Flag | 16 bits |

9.2 Bit Mapped Without Mask (BMP) SLOTS—Bit mapped (BMP) SLOTS are used to encode data that typically contains several binary parameters, such as status bits or flags, grouped into a single byte or several bytes. Bit mapped SLOTS can also be used for discrete output control such as warning lamps where each bit would indicate the state of a particular lamp. The data in these bit mapped SLOTS is not followed by a MASK byte. There can be up to 4 bytes of data without a mask.

9.2.1 BIT MAPPED WITHOUT MASK PARAMETER ASSIGNMENTS

| | | | |
|----------|--|------------------|--------------|
| BMP-01-1 | MIL Status (PRN 1000) | | |
| Length: | 1 Bit | 0 | 1 |
| MSB | Item 1: Malfunction Indicator Lamp (MIL) | Not Commanded On | Commanded On |
| BMP-08-1 | Continuous Evaluation Supported (PRN 1002) | | |
| Length: | 8 bits | 0 | 1 |
| MSB | Item 1: Not Used | | |
| | Item 2: Not Used | | |
| | Item 3: Not Used | | |
| | Item 4: Not Used | | |
| | Item 5: Not Used | | |
| | Item 6: Comprehensive Component Monitoring | Not Supported | Supported |
| | Item 7: Fuel System Monitoring | Not Supported | Supported |
| LSB | Item 8: Misfire Monitoring | Not Supported | Supported |
| BMP-08-2 | Trip Evaluation Supported (PRN 1002) | | |
| Length: | 8 bits | 0 | 1 |
| MSB | Item 1: EGR System | Not Supported | Supported |
| | Item 2: Oxygen Sensor Heater | Not Supported | Supported |
| | Item 3: Oxygen Sensor | Not Supported | Supported |
| | Item 4: A/C System Refrigerant | Not Supported | Supported |
| | Item 5: Secondary Air System | Not Supported | Supported |
| | Item 6: Evaporative Purge System | Not Supported | Supported |
| | Item 7: Heated Catalyst | Not Supported | Supported |
| LSB | Item 8: Catalyst | Not Supported | Supported |

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| | | | |
|------------------|----------|--|---------------------------------|
| BMP-08-3 | | Trip Evaluation Complete (PRN 1004) | |
| | Length: | 8 bits | 0 1 |
| MSB | Item 1: | EGR System | Test Complete Test Not Complete |
| | Item 2: | Oxygen Sensor Heater | Test Complete Test Not Complete |
| | Item 3: | Oxygen Sensor | Test Complete Test Not Complete |
| | Item 4: | A/C System Refrigerant | Test Complete Test Not Complete |
| | Item 5: | Secondary Air System | Test Complete Test Not Complete |
| | Item 6: | Evaporative Purge System | Test Complete Test Not Complete |
| | Item 7: | Heated Catalyst | Test Complete Test Not Complete |
| LSB | Item 8: | Catalyst | Test Complete Test Not Complete |
| BMP-08-4 | | Fuel System Status (PRN 1008 and 1009) | |
| | Length: | 8 bits | 0 1 |
| MSB | Item 1: | Reserved | |
| | Item 2: | Reserved | |
| | Item 3: | Reserved | |
| | Item 4: | Closed Loop, Faulty O ₂ Sensor | False True |
| | Item 5: | Open Loop, Detected Fault | False True |
| | Item 6: | Open Loop, Driving Conditions | False True |
| | Item 7: | Closed Loop, Using O ₂ Sensor | False True |
| LSB | Item 8: | Open Loop, Not Ready for Closed | False True |
| BMP-08-05 | | Commanded Secondary Air Status (PRN 0012) | |
| | Length: | 8 bits | 0 1 |
| MSB | Item 1: | Reserved | |
| | Item 2: | Reserved | |
| | Item 3: | Reserved | |
| | Item 4: | Reserved | |
| | Item 5: | Reserved | |
| | Item 6: | Atmosphere / Off | Not Supported Supported |
| | Item 7: | Downstream—First Catalyst | Not Supported Supported |
| LSB | Item 8: | Upstream—First Catalyst | Not Supported Supported |
| BMP-08-6 | | O₂ Sensor Location (PRN 0013) | |
| | Length: | 8 bits | 0 1 |
| MSB | Item 1:8 | Bank 2—Sensor 4 (B2-S4) | Not Present Present |
| | Item 2: | Bank 2—Sensor 3 (B2-S3) | Not Present Present |
| | Item 3: | Bank 2—Sensor 2 (B2-S2) | Not Present Present |
| | Item 4: | Bank 2—Sensor 1 (B2-S1) | Not Present Present |
| | Item 5: | Bank 1—Sensor 4 (B1-S4) | Not Present Present |
| | Item 6: | Bank 1—Sensor 3 (B1-S3) | Not Present Present |
| | Item 7: | Bank 1—Sensor 2 (B1-S2) | Not Present Present |
| LSB | Item 8: | Bank 1—Sensor 1 (B1-S1) | Not Present Present |

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| | | | | | |
|------------------|----------|--------------------------------------|---------------|-----------|--|
| BMP-08-7 | | Lamp Status (PRN 604D) | | | |
| | Length: | 8 bits | 0 | 1 | |
| MSB | Item 1: | Display Brightness Mode | Off | On | |
| | Item 2: | Park Lamps | Off | On | |
| | Item 3: | Low Beam Headlamps | Off | On | |
| | Item 4: | High Beam Headlamps | Off | On | |
| | Item 5: | Daytime Running Lamps | Off | On | |
| | Item 6: | Electronic Displays | Off | On | |
| | Item 7: | Front Fog Lamps | Off | On | |
| LSB | Item 8: | Rear Fog Lamps | Off | On | |
| BMP-08-8 | | MIL Lamp Data (PRN 1017) | | | |
| | Length: | 8 bits | 0 | 1 | |
| MSB | Item 1: | Malfunction Indicator Lamp | Off | On | |
| | Item 2: | Display Trouble Code | False | True | |
| | Item 3: | Misfire Detected | False | True | |
| | Item 4: | Reserved | | | |
| | Item 5: | Reserved | | | |
| | Item 6: | Reserved | | | |
| | Item 7: | Reserved | | | |
| LSB | Item 8: | Reserved | | | |
| BMP-16-01 | | EVSE Configuration (PRN C808) | | | |
| | Length: | 16 Bits | 0 | 1 | |
| MSB | Byte 1: | | | | |
| | Item 1: | AC Energy Transfer | Not Supported | Supported | |
| | Item 2: | Inductive Energy Transfer | Not Supported | Supported | |
| | Item 3: | DC Energy Transfer | Not Supported | Supported | |
| | Item 4: | Positive Pulse Mode | Not Supported | Supported | |
| | Item 5: | Voltage Mode | Not Supported | Supported | |
| | Item 6: | Reserved | | | |
| LSB | Item 7: | Reserved | | | |
| | Item 8: | Reserved | | | |
| MSB | Byte 2: | | | | |
| | Item 9: | Reserved | | | |
| | Item 10: | Reserved | | | |
| | Item 11: | Reserved | | | |
| | Item 12: | Reserved | | | |
| | Item 13: | Reserved | | | |
| | Item 14: | Reserved | | | |
| LSB | Item 15: | Reserved | | | |
| | Item 16: | Reserved | | | |

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| | | | | | |
|-----------|-------------|-------------------------------------|--|---------------|-----------|
| BMP-16-02 | | Comm State (PRN C828) | | | |
| | Length: | 16 Bits | | 0 | 1 |
| MSB | Byte 1: | | | | |
| | Item 1: | Tx Enabled | | False | True |
| | Item 2: | Rx Enabled | | False | True |
| | Item 3: | Reserved | | | |
| | Item 4: | Reserved | | | |
| | Item 5: | Reserved | | | |
| | Item 6: | Reserved | | | |
| | Item 7: | Reserved | | | |
| LSB | Item 8: | Reserved | | | |
| MSB | Byte 2: | | | | |
| | Item 9: | Reserved | | | |
| | Item 10: | Reserved | | | |
| | Item 11: | Reserved | | | |
| | Item 12: | Reserved | | | |
| | Item 13: | Reserved | | | |
| | Item 14: | Reserved | | | |
| | Item 15: | Reserved | | | |
| LSB | Item 16: | Reserved | | | |
| BMP-32-1 | | PIDs Supported 01h - 20h (PRN 0000) | | | |
| | Length: | 32 bits | | 0 | 1 |
| MSB | Byte 1: | | | | |
| | Item 1-8: | PID 01h - 08h Supported | | Not Supported | Supported |
| MSB | Byte 2: | | | | |
| | Item 9-16: | PID 09h - 10 h | | Not Supported | Supported |
| MSB | Byte 3: | | | | |
| | Item 17-24: | PID 11h - 18h Supported | | Not Supported | Supported |
| MSB | Byte 4: | | | | |
| | Item 25-32: | PID 19h - 20h Supported | | Not Supported | Supported |

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| | | | |
|----------|------------------------|--------------------------------------|-------------------------|
| BMP-32-2 | | PIDs Supported 21 h - 40h (PRN 0020) | |
| | Length: | 32 bits | 0 1 |
| MSB | Byte 1: Item 1-8: | PID 21h - 28h Supported | Not Supported Supported |
| MSB | Byte 2: Item 9-16: | PID 29h - 30h Supported | Not Supported Supported |
| MSB | Byte 3: Item 17-24: | PID 31h - 38h Supported | Not Supported Supported |
| MSB | Byte 4: Item 25-32: | PID 39h - 40 h Supported | Not Supported Supported |
| BMP-32-3 | | PIDs Supported 41h - 60h (PRN 0040) | |
| | Length: | 32 bits | 0 1 |
| MSB | Byte 1: Item 1-8: | PID 41h - 48h Supported | Not Supported Supported |
| MSB | Byte 2: Item 9-16: | PID 49h - 50h Supported | Not Supported Supported |
| MSB | Byte 3: Item 17-24: | PID 51h - 58h Supported | Not Supported Supported |
| MSB | Byte 4: Item 25-32: | PID 59h - 60h Supported | Not Supported Supported |

9.3 Bit Mapped With Mask Bytes (BMM) SLOTS—Bit mapped with mask (BMM) SLOTS are used to encode data that typically contains several binary parameters, such as status bits or flags, grouped into a single byte or several bytes. Bit mapped SLOTS can also be used for discrete output control such as warning lamps where each bit would indicate the state of a particular lamp. The data in these bit mapped SLOTS are always followed by a MASK byte which is used to indicate which bits of the data byte are valid. There can be up to 4 bytes of data including the mask bytes. Valid combinations include up to 2 data bytes each with mask.

9.3.1 BIT MAPPED WITH MASK PARAMETER ASSIGNMENTS—None Defined

9.4 Unsigned Numeric (UNM) SLOTS—Unsigned numeric (UNM) SLOTS are used to encode data that is typically associated with information such as temperature, speed, or percent. The SLOT can be 8, 16, 24, ... 56 bits in length (1 to 7 bytes) and may or may not have an offset. Unsigned number SLOTS can also be used for sequential data such as month (1-12) or day of month (1-31). Each SLOT definition contains a field for: resolution per bit; minimum and maximum value; and transfer function. The transfer function defines the relationship between computer units (N) in decimal, and engineering units (E) of the data.

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9.4.1 UNSIGNED NUMERIC VARIABLE ASSIGNMENTS—The unsigned numeric variables have been grouped as follows:

- Table 22—ZEROs SLOT assignments
- Table 23—UNM-xx, Short (< 8 Bit) SLOTS
- Table 24—UNM-08, 8 Bit SLOT Assignments
- Table 25—UNM-16, 16 Bit SLOT Assignments
- Table 26—UNM-24, 24 Bit SLOT Assignments
- Table 27—UNM-32, 32 Bit SLOT Assignments

TABLE 22—ZEROs SLOT ASSIGNMENTS

| SLOT # | Description | Length |
|----------|-------------|---------|
| UNM-01-0 | Zero (0) | 1 Bit |
| UNM-02-0 | Zero (0) | 2 Bits |
| UNM-03-0 | Zero (0) | 3 Bits |
| UNM-04-0 | Zero (0) | 4 Bits |
| UNM-05-0 | Zero (0) | 5 Bits |
| UNM-06-0 | Zero (0) | 6 Bits |
| UNM-07-0 | Zero (0) | 7 Bits |
| UNM-08-0 | Zero (0) | 8 Bits |
| UNM-16-0 | Zero (0) | 16 Bits |
| UNM-24-0 | Zero (0) | 24 Bits |
| UNM-32-0 | Zero (0) | 32 Bits |
| UNM-40-0 | Zero (0) | 40 Bits |
| UNM-48-0 | Zero (0) | 48 Bits |
| UNM-56-0 | Zero (0) | 56 Bits |

TABLE 23—UNM-xx, Short (<8 Bit) SLOTS

| SLOT # | Scaling (Resolution; 1 Bit =) | Minimum Limit | Maximum Limit | Invalid Range | Transfer Function N = | Transfer Function E = | Comment |
|--------|-------------------------------|---------------|---------------|---------------|-----------------------|-----------------------|---------|
| 01-1 | 1 | 0 | 1 | — | E | N | — |
| 02-1 | 1 | 0 | 3 | — | E | N | — |
| 03-1 | 1 | 0 | 7 | — | E | N | — |
| 04-1 | 1 | 0 | 15 | — | E | N | — |
| 05-1 | 1 | 0 | 31 | — | E | N | — |
| 06-1 | 1 | 0 | 63 | — | E | N | — |
| 07-1 | 1 | 0 | 127 | — | E | N | — |

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TABLE 24—UNM-08, 8 Bit SLOTS

| SLOT # | Scaling / Resolution (1 Bit =) | Minimum Limit | Maximum Limit | Invalid Range | Transfer Function N = | Transfer Function E = | Comment |
|--------|--------------------------------|---------------|---------------|-----------------|-----------------------|-----------------------|---------------------|
| 1 | 1/8000 | 0 | 0.031875 | — | E * 8000 | N / 8000 | =0.000125 |
| 2 | 1/4000 | 0 | 0.06375 | — | E * 4000 | N / 4000 | =0.00025 |
| 3 | 1/2000 | 0 | 0.1275 | — | E * 2000 | N / 2000 | =0.0005 |
| 4 | 1/1000 | 0 | 0.255 | — | E * 1000 | N / 1000 | =0.001 |
| 5 | 1/511 | 0 | 0.499 | — | E * 511 | N / 511 | =0.001957 |
| 6 | 1/255 | 0 | 1 | — | E * 255 | N / 255 | =0.003922 |
| 7 | 1/100 | -1.28 | +1.27 | — | (E + 1.28) * 100 | (N / 100) - 1.28 | =0.01 w/ offset |
| 11 | 1/200 | 0 | 1.275 | — | E * 200 | N / 200 | =0.005 |
| 15 | 1/100 | 0 | 2.55 | — | E * 100 | N / 100 | =0.001 |
| 21 | 1/64 | 0 | 3.98 | — | E * 64 | N / 64 | =0.00156 |
| 26 | 1/32 | 0 | 7.969 | — | E * 32 | N / 32 | =0.03125 |
| 31 | 1/25 | 0 | 10.2 | — | E * 25 | N / 16 | =0.04 |
| 32 | 1/16 | 0 | 15.94 | — | E * 16 | N / 13 | =0.0625 |
| 41 | 1/10 | 0 | 25.5 | — | E * 10 | N / 10 | =0.01 |
| 45 | 1/8 | 0 | 31.875 | — | E * 8 | N / 8 | =0.125 |
| 51 | 1/4 | 0 | 63.75 | — | E * 4 | N / 4 | =0.25 |
| 55 | 1/3 | 0 | 85 | — | E * 3 | N / 3 | =0.333333 |
| 61 | 100/255 | 0 | 100 | — | E * 2.55 | N / 2.55 | =0.39215 |
| 71 | 1/2 | 0 | 127.5 | — | E * 2 | N / 2 | =0.5 |
| 72 | 1/2 | -64 | +63.5 | — | (E + 64) * 2 | (N / 2) - 64 | =0.5 w/ offset |
| 73 | 1/2 | -40 | +87.5 | — | (E + 40) * 2 | (N / 2) - 40 | =0.5 w/ offset |
| 76 | 2/3 | 0 | 170 | — | E * 1.5 | N / 1.5 | =0.666667 |
| 77 | 2/3 | 0 | 100 | 100.3 to 170 | E * 1.5 | N / 1.5 | =0.666667 w/ limits |
| 81 | 3/4 | 0 | 191.25 | — | E / 0.75 | N * 0.75 | =0.75 |
| 82 | 3/4 | -90 (00h) | +90 (F0h) | 90.75 (F1h-FFh) | (E + 90) / 0.75 | (N * 0.75) - 90 | =0.75 w/ offset |
| 91 | 100/128 | 0 | 199.22 | — | E * 1.28 | N / 1.28 | =0.78125 |
| 92 | 100/128 | -100 | +99.22 | — | (E + 100) * 1.28 | (N/1.28) - 100 | =0.78125 w/ Offset |
| 101 | 1 | 0 | 255 | — | E | N | 1 |
| 102 | 1 | -40 | +215 | — | E + 40 | N - 40 | 1 w/ Offset |
| 104 | 1 | -128 | +127 | — | E + 128 | N - 128 | 1 w/ Offset |
| 111 | 3/2 | 0 (00h) | 360 (F0h) | 361.5 (F1h-FFh) | E * 1.5 | N * 1.5 | — |
| 121 | 2 | 0 | 510 | — | E / 2 | N * 2 | — |
| 125 | 5/2 | 0 | 637.5 | — | E * 2 / 5 | N * 5 / 2 | — |
| 131 | 3 | 0 | 765 | — | E / 3 | N * 3 | — |
| 141 | 4 | 0 | 1020 | — | E / 4 | N * 4 | — |
| 151 | 8 | 0 | 2040 | — | E / 8 | N * 8 | — |
| 155 | 10 | 0 | 2550 | — | E / 10 | N * 10 | — |
| 159 | 14 | 0 | 3570 | — | E / 14 | N * 14 | — |
| 161 | 16 | 0 | 4080 | — | E / 16 | N * 16 | — |
| 165 | 25 | 0 | 6375 | — | E / 25 | N * 25 | — |
| 171 | 32 | 0 | 8160 | — | E / 32 | N * 32 | — |
| 181 | 64 | 0 | 16320 | — | E / 64 | N * 64 | — |
| 185 | 100 | 0 | 25500 | — | E / 100 | N * 100 | — |
| 191 | 128 | 0 | 32640 | — | E / 128 | N * 128 | — |
| 201 | 256 | 0 | 65280 | — | E / 256 | N * 256 | — |
| 211 | 512 | 0 | 130560 | — | E / 512 | N * 512 | — |
| 221 | 1024 | 0 | 261120 | — | E / 1024 | N * 1024 | — |
| 231 | 2048 | 0 | 522240 | — | E / 2048 | N * 2048 | — |
| 241 | 4096 | 0 | 104480 | — | E / 4096 | N * 4096 | — |

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TABLE 25—UNM-16, 16 Bit SLOTS

| SLOT # | Scaling / Resolution (1 Bit =) | Minimum Limit | Maximum Limit | Invalid Range | Transfer Function N = | Transfer Function E = | Comment |
|--------|--------------------------------|---------------|---------------|---------------|-----------------------|-----------------------|---------------------|
| 1 | 100/65,535 | 0 | 100 | — | $E * 655.35$ | $N / 655.35$ | =0.001526 |
| 2 | 1/256 | 0 | 255.99 | — | $E * 256$ | $N / 256$ | =0.003906 |
| 3 | 1/256 | -70 | 185.99 | — | $(E + 70) * 256$ | $(N / 256) - 70$ | =0.003906 w/ offset |
| 5 | 1/128 | 0 | 511.99 | — | $E * 128$ | $N / 128$ | =0.007813 |
| 8 | 1/64 | 0 | 1023.984 | — | $E * 64$ | $N / 64$ | =0.015625 |
| 11 | 1/100 | 0 | 655.35 | — | $E * 100$ | $N / 100$ | =0.01 |
| 21 | 1/10 | 0 | 6553.5 | — | $E * 10$ | $N / 10$ | =0.1 |
| 31 | 1/4 | 0 | 16383.75 | — | $E * 4$ | $N / 4$ | =0.25 |
| 41 | 1 | 0 | 65535 | — | E | N | — |
| 61 | 64 | 0 | 4194304 | — | $E / 64$ | $N * 64$ | — |

TABLE 26—UNM-24, 24 Bit SLOTS

| SLOT # | Scaling / Resolution (1 Bit =) | Minimum Limit | Maximum Limit | Invalid Range | Transfer Function N = | Transfer Function E = | Comment |
|--------|--------------------------------|---------------|---------------|---------------|-----------------------|-----------------------|----------|
| 11 | 1/10 | 0 | 1677721.5 | — | $E * 10$ | $N / 10$ | =0.1 |
| 21 | 128/8000 | 0 | 268435.44 | — | $(E/128) * 8000$ | $(N * 128) / 8000$ | =0.016 |
| 31 | 128/4000 | 0 | 536870.88 | — | $(E/128) * 4000$ | $(N * 128) / 4000$ | =0.032 |
| 41 | 1/64 | 0 | 262143.98 | — | $E * 64$ | $N / 64$ | =0.01563 |

TABLE 27—UNM-32, 32 Bit SLOTS

| SLOT # | Scaling / Resolution (1 Bit =) | Minimum Limit | Maximum Limit | Invalid Range | Transfer Function N = | Transfer Function E = | Comment |
|--------|--------------------------------|---------------|---------------|---------------|-----------------------|-----------------------|-----------|
| 11 | 1/8000 | 0 | 536870.9 | — | $E * 8000$ | $N / 8000$ | =0.000125 |
| 21 | 1/4000 | 0 | 1073741.4 | — | $E * 4000$ | $N / 4000$ | =0.00025 |
| 41 | 1/64 | 0 | 67108864 | — | $E * 64$ | $N / 64$ | =0.01563 |

- 9.5 **2's Complement Signed Numeric (SNM) SLOTS**—Signed numeric (SNM) SLOTS are represented in 2's complement notation. If the most significant bit of the number is set (one, 1), then the number is negative and the absolute value of the number is found by taking the 2's complement of the number. The 2's complement is found by inverting each bit of the number and then adding a binary one (1) to the result. For example, the number FFh, which has its most significant bit set, corresponds to -1.

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9.5.1 2's COMPLEMENT SIGNED NUMERIC VARIABLE ASSIGNMENTS—The 2's complement signed numeric variables are grouped as follows:

TABLE 28—SNM-08, 8 Bit SLOTS

| SLOT # | Scaling / Resolution (1 Bit =) | Minimum Limit | Maximum Limit | Invalid Range | Transfer Function N = | Transfer Function E = | Comment |
|--------|--------------------------------|---------------|---------------|---------------|-----------------------|-----------------------|---------|
| 11 | 1/2 | -64 | +63.5 | — | E * 2 | N / 2 | =0.5 |
| 21 | 1 | -128 | +127 | — | E | N | — |
| 41 | 4 | -512 | +508 | — | E / 4 | N * 4 | — |
| 51 | 3/2 | -192 | +190.5 | — | E * 2/3 | N * 3/2 | — |
| 61 | 6 | -768 | +762 | — | E / 6 | N * 6 | — |

9.6 State Encoded (SED) SLOTS—State enclosed (SED) SLOTS are used for data that can take one of several states such as Day of Week or Wiper Mode. Each SLOT definition contains a field for describing each state within the SLOT. There can be between 1 and 8 bits in any given SLOT with 2^n possible states where n is the number of bits in the SLOT.

9.6.1 STATE ENCODED VARIABLE ASSIGNMENTS

SED-02-1 Sub-System Category Reference Letter (PRN 1005)

Length: 2 bits (0 - 3)

0 "P" = Powertrain
 1 "C" = Chassis
 2 "B" = Body
 3 "U" = Undefined

SED-02-2 Most Significant Digit of Trouble Code (PRN 1006)

Length: 2 bits (0 - 3)

0 "0"
 1 "1"
 2 "2"
 3 "3"

SED-02-3 Transmission Lock-up Status (PRN 1807)

Length: 2 bits (0 - 3)

0 Unlock
 1 Partial Lock
 2 Full Lock
 3 Invalid

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SED-04-1 Day of the Week (PRN 6012)

Length: 4 bits (0 - F)

| | |
|-------|-----------|
| 0 | Unknown |
| 1 | Sunday |
| 2 | Monday |
| 3 | Tuesday |
| 4 | Wednesday |
| 5 | Thursday |
| 6 | Friday |
| 7 | Saturday |
| 8 - F | Invalid |

SED-04-2 Month (PRN 6010)

Length: 4 bits (0 - F)

| | |
|-------|-----------|
| 0 | Unknown |
| 1 | January |
| 2 | February |
| 3 | March |
| 4 | April |
| 5 | May |
| 6 | June |
| 7 | July |
| 8 | August |
| 9 | September |
| A | October |
| B | November |
| C | December |
| D - F | Invalid |

SED-06-1 Transmission Gear Engaged (PRN 1808)

Length: 6 bits (00 - 3F)

| | |
|--------|-----------|
| 00 | Neutral |
| 01 | Reverse |
| 02 | Forward 1 |
| 04 | Forward 2 |
| 08 | Forward 3 |
| 10 | Forward 4 |
| 20 | Forward 5 |
| Others | Invalid |

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SED-06-2 Transmission Gear Engaged—Expanded (PRN 1810)

Length: 6 bits (00 - 3F)

| | |
|-------|----------------------------|
| 00 | Unknown |
| 01 | Neutral |
| 02-0F | Reserved |
| 10 | Reverse |
| 11-1F | Reserved for Reverse Gears |
| 20 | Forward 1 |
| 21 | Forward 2 |
| 22 | Forward 3 |
| 23 | Forward 4 |
| 24 | Forward 5 |
| 25 | Forward 6 |
| 26-2F | Reserved for Forward Gears |
| 30-3E | Reserved |
| 3F | Invalid |

SED-08-1 Wiper Mode (PRN A003)

Length: 8 bits (00 - FF)

| | |
|---------|--------------|
| 00 | Invalid |
| 01 | Off |
| 02 | Intermittent |
| 03 | Low Speed |
| 04 | Medium Speed |
| 05 | High Speed |
| 06 | Pulse |
| 07 - FF | Invalid |

SED-08-2 Day of the Week (PRN 6013)

Length: 8 bits (00 - FF)

| | |
|---------|-----------|
| 00 | Unknown |
| 01 | Sunday |
| 02 | Monday |
| 03 | Tuesday |
| 04 | Wednesday |
| 05 | Thursday |
| 06 | Friday |
| 07 | Saturday |
| 08 - FF | Invalid |

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SED-08-3 Day of Month (PRN 6014)

Length: 8 bits (00 - FF)

| | |
|---------|------------------|
| 00 | Invalid |
| 01 | 1 st |
| 02 | 2 nd |
| 03 | 3 rd |
| 04 | 4 th |
| 05 | 5 th |
| 06 | 6 th |
| 07 | 7 th |
| 08 | 8 th |
| 09 | 9 th |
| 0A | 10 th |
| 0B | 11 th |
| 0C | 12 th |
| 0D | 13 th |
| 0E | 14 th |
| 0F | 15 th |
| 10 | 16 th |
| 11 | 17 th |
| 12 | 18 th |
| 13 | 19 th |
| 14 | 20 th |
| 15 | 21 th |
| 16 | 22 nd |
| 17 | 23 rd |
| 18 | 24 th |
| 19 | 25 th |
| 1A | 26 th |
| 1B | 27 th |
| 1C | 28 th |
| 1D | 29 th |
| 1E | 30 th |
| 1F | 31 st |
| 20 - FF | Invalid |

SED-08-4 Transmission Range (PRN 1806, 1809, 180d, and 180e)

Length: 8 bits (00 - FF)

| | |
|--------|------------------|
| 00 | Unknown |
| 01 | Reverse |
| 02 | Forward 1 |
| 04 | Forward 2 |
| 08 | Forward 3 |
| 10 | Forward 4 |
| 20 | Forward 5 |
| 40 | Forward 6 / Park |
| 80 | Neutral |
| Others | Invalid |

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SED-08-5 Ignition Switch Position (PRN 1047)

Length: 8 bits (00 - FF)

| | |
|--------|--------------|
| 00 | Invalid |
| 01 | ACC |
| 02 | OFF / LOCK |
| 04 | OFF / UNLOCK |
| 08 | RUN |
| 10 | START |
| Others | Invalid |

SED-08-6 Transmission Transfer Cases (4WD) (PRN 180A)

Length: 8 bits (00 - FF)

| | |
|---------|-----------------------|
| 00 | Invalid |
| 01 | Neutral |
| 02 | Two Wheel Drive |
| 03 | Four Wheel Drive—Low |
| 04 | Four Wheel Drive—High |
| 05 - FF | Invalid |

SED-08-7 Door Lock Cylinder State (PRN A010)

Length: 8 bits (00 - FF)

| | |
|---------|------------------------|
| 00 | Key Out |
| 01 | Key in Lock Position |
| 02 | Key in Unlock Position |
| 03 - FF | Invalid |

SED-08-08 EVSE Ready (PRN C809)
Vehicle Ready (PRN C821)

Length: 8 Bits (00 - FF)

| | |
|-------|-----------|
| 00 | Not Ready |
| 01 | Ready |
| 02 | Undefined |
| 03-FF | Invalid |

SED-08-09 Power Out of Range (PRN C817)

Length: 8 Bits (00 - FF)

| | |
|-------|---------|
| 00 | OK |
| 01 | LO |
| 02 | HI |
| 03-FF | Invalid |

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SED-08-10 Usage Mode (PRN C81F)

Length: 8 Bits (00 - FF)

| | |
|-------|-------------|
| 00 | No Transfer |
| 01 | Base |
| 02 | Over |
| 03 | Support |
| 04-FF | Invalid |

SED-08-11 Voltage Mode Enabled (PRN C824)

Length: 8 Bits (00 - FF)

| | |
|-------|---------|
| 00 | False |
| 01 | True |
| 02-FF | Invalid |

SED-08-12 Transfer Type (PRN C81E)

Length: 8 bits (00 - FF)

| | |
|---------|-------------|
| 00 | No Transfer |
| 01 | AC |
| 02 | Inductive |
| 03 | DC |
| 04 - FF | Invalid |

SED-16-01 State Flag (PRN C82B)

Length: 16 Bits (0000 - FFFF)

| | |
|-----------|----------|
| 0000 | False |
| 0001 | True |
| 0002-FFFF | Reserved |

SED-16-02 App Type (PRN C82A)

Length: 16 Bits (0000 - FFFF)

| | |
|------|------------------|
| 0000 | All Applications |
| 0001 | SAE |
| 0002 | Chrysler |
| 0003 | Ford |
| 0004 | GM |
| 0005 | Reserved SAE |

Remaining values assigned to EV and EVSE manufacturers who request an App Type ID.

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| | |
|------------------|----------------------------|
| SED-24-01 | App ID (PRN C829) |
| Length: | 24 Bits (000000 - FFFFFFF) |
| 000000 | All Applications |
| 000001 | SAE J2293 ETS |
| 000002 - FFFFFFF | Reserved |

These ID values apply to messages which have an App Type of SAE.

- 9.7 ASCII Encoded (ASC) SLOTS**—ASCII (ASC) SLOTS are used to encode ASCII data. The least significant 7 bits represent the standard ASCII codes from 0 to 127. The most significant bit is reserved at this time but may be assigned a special function in the future. Several ASCII characters can be included in a single message by placing up to 7 ASCII characters sequentially in the data field. This allows a character string of up to 7 characters to be sent in a single message.

The ASCII character set is included in Table 29.

9.7.1 ASCII ENCODED VARIABLE ASSIGNMENTS

| | |
|----------|------------------------|
| ASC-08-1 | One ASCII Character |
| Length: | 8 bits |
| Byte 1: | One ASCII Character |
| ASC-16-1 | Two ASCII Characters |
| Length: | 16 bits |
| Byte 1: | Left Most Character |
| Byte 2: | Right Most Character |
| ASC-24-1 | Three ASCII Characters |
| Length: | 24 bits |
| Byte 1: | Left Most Character |
| Byte 2: | Middle Character |
| Byte 3: | Right Most Character |
| ASC-32-1 | Four ASCII Characters |
| Length: | 32 bits |
| Byte 1: | Left Most Character |
| Byte 2: | Middle Left Character |
| Byte 3: | Middle Right Character |
| Byte 4: | Right Most Character |

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ASC-40-1 Five ASCII Characters

Length: 40 bits

Byte 1: Left Most Character
Byte 2: Middle Left Character
Byte 3: Middle Character
Byte 4: Middle Right Character
Byte 5: Right Most Character

ASC-48-1 Six ASCII Characters

Length: 48 bits

Byte 1: Left Most Character
Byte 2: Middle Left Character
Byte 3: Middle Middle Left Character
Byte 4: Middle Middle Right Character
Byte 5: Middle Right Character
Byte 6: Right Most Character

ASC-56-1 Seven ASCII Characters

Length: 56 bits

Byte 1: Left Most Character
Byte 2: Middle Left Character
Byte 3: Middle Middle Left Character
Byte 4: Middle Character
Byte 5: Middle Middle Right Character
Byte 6: Middle Right Character
Byte 7: Right Most Character

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9.7.2 ASCII CHARACTER SET—The conversion chart, Table 29, can be used to convert from a two-digit (one byte) hexadecimal number to an ASCII character or from an ASCII character to a two-digit hexadecimal number.

TABLE 29—ASCII CONVERSION CHART
BITS 4 to 6
FIRST HEX DIGIT (MSB)

| Bits 0 to 3 (LSB) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------------------|-----|-----|----|---|---|---|---|-----|
| 0 | NUL | DLE | SP | 0 | @ | P | ' | p |
| 1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 2 | STX | DC2 | " | 2 | B | R | b | r |
| 3 | ETX | DC3 | # | 3 | C | S | c | s |
| 4 | EOT | DC4 | \$ | 4 | D | T | d | t |
| 5 | ENQ | NAK | % | 5 | E | U | e | u |
| 6 | ACK | SYN | & | 6 | F | V | f | v |
| 7 | BEL | ETB | ' | 7 | G | W | g | w |
| 8 | BS | CAN | (| 8 | H | X | h | x |
| 9 | HT | EM |) | 9 | I | Y | i | y |
| A | LF | SUB | * | : | J | Z | j | z |
| B | VT | ESC | + | ; | K | [| k | { |
| C | FF | FS | , | < | L | \ | l | ; |
| D | CR | GS | - | = | M |] | m | } |
| E | SO | RS | . | > | N | ^ | n | ~ |
| F | SI | US | / | ? | O | _ | o | DEL |

9.8 Binary Coded Decimal (BCD) SLOTS:—BCD SLOTS are similar to ASCII SLOTS and are used to encode BCD data. The upper nibble is used to represent the most significant digit in a 2-digit number and the lower nibble the least significant digit. For example, the data value 38h would represent 38 decimal. Invalid data ranges include any value that has either nibble greater than 9 (i.e., A, B, ..., F in either nibble). Therefore, a valid value can represent a number from 0 to 9. Several BCD numbers can be included in a single message by placing up to 14 BCD digits sequentially in the data field. This allows any number from 0 to 99,999,999,999,999 to be sent in a single message.

9.8.1 BINARY CODED DECIMAL (BCD) VARIABLE ASSIGNMENTS:

BCD-04-1 1 digit

Length: 4 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 0
 Maximum: 9

BCD-08-1 2 digits

Length: 8 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 00
 Maximum: 99

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BCD-12-1 3 digits

Length: 12 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 000
 Maximum: 999

BCD-16-1 4 digits

Length: 16 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 0000
 Maximum: 9999

BCD-20-1 5 digits

Length: 20 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 00000
 Maximum: 99999

BCD-24-1 6 digits

Length: 24 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 000000
 Maximum: 999999

BCD-28-1 7 digits

Length: 28 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 0000000
 Maximum: 9999999

BCD-32-1 8 digits

Length: 32 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 00000000
 Maximum: 99999999

BCD-36-1 9 digits

Length: 36 bits
 Scaling (Resolution:): 1 bit = 1 (BCD)
 Limit:
 Minimum: 000000000
 Maximum: 999999999

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BCD-40-1 10 digits

Length: 40 bits
 Scaling (Resolution:) 1 bit = 1 (BCD)
 Limit:
 Minimum: 0000000000
 Maximum: 9999999999

BCD-44-1 11 digits

Length: 44 bits
 Scaling (Resolution:) 1 bit = 1 (BCD)
 Limit:
 Minimum: 00000000000
 Maximum: 99999999999

BCD-48-1 12 digits

Length: 48 bits
 Scaling (Resolution:) 1 bit = 1 (BCD)
 Limit:
 Minimum: 000000000000
 Maximum: 999999999999

BCD-52-1 13 digits

Length: 52 bits
 Scaling (Resolution:) 1 bit = 1 (BCD)
 Limit:
 Minimum: 0000000000000
 Maximum: 9999999999999

BCD-56-1 14 digits

Length: 56 bits
 Scaling (Resolution:) 1 bit = 1 (BCD)
 Limit:
 Minimum: 00000000000000
 Maximum: 99999999999999

9.9 Signed Floating Point (Scientific Notation) (SFP) SLOT—The Signed Floating Point (SFP) SLOT is used to encode data that needs to be represented in floating point arithmetic, and always includes a leading sign character. The format exactly follows the ANSI/IEEE Standard (Std 754-1985) Single format. Please note that the data byte boundaries of the transmitted frame do not align with the boundaries of this format. The floating point parameter is sent as a 32-bit (4-byte) value. The bit order is shown in Figure 14.

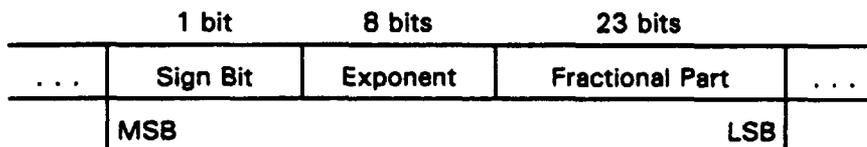


FIGURE 14—SIGNED FLOATING POINT (SCIENTIFIC NOTATION) (SFP) SLOT

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9.9.1 SIGNED FLOATING POINT VARIABLE ASSIGNMENT

SFP-32-1 Floating Point

10. **Multiple Frame, Single Parameter Format**—This section defines the method of encoding long parameters that require more than one frame to complete. The first data byte for this format is a sequence number as shown in Figure 15. The sequence byte consists of an upper nibble that identifies this frame by number in the sequence. The lower nibble is the total number of frames that make up this grouping. The sequence byte is followed by up to the maximum number of data bytes allowed by SAE J1850, for each frame. The entire parameter is thus built up from the total number of frames shown in the sequence tracking byte, in the order carried in that byte. The data field format will thus have an order indicated by Figure 16.

| | | | |
|-----|---------------------|-------------------------|-----|
| MSB | | LSB | |
| ... | Frame # (4 bits) | # of Frames (4 bits) | ... |

FIGURE 15—SEQUENCE TRACKING BYTE

| | | | | | |
|-----|------------------|-------------|-------------|-------------|-----|
| ... | Sequence Byte | Data Byte 1 | Data Byte 2 | Data Byte 3 | ... |
|-----|------------------|-------------|-------------|-------------|-----|

FIGURE 16—MULTIPLE FRAME, SINGLE PARAMETER FIELD

A simple example of this format is shown in Figures 17, 18, and 19, sending an ASCII string of characters.

| | | | | | | | | | |
|-----|--------------------|----------|----------|----------|-----------|----------|----------|----------|-----|
| ... | Sequence 1 of 3 | 54h T | 68h h | 65h e | 20h SP | 51h Q | 75h u | 69h i | ... |
|-----|--------------------|----------|----------|----------|-----------|----------|----------|----------|-----|

FIGURE 17—FIRST SEQUENCE FRAME

| | | | | | | | | | |
|-----|--------------------|----------|----------|----------|-----------|----------|----------|----------|-----|
| ... | Sequence 1 of 3 | 54h T | 68h h | 65h e | 20h SP | 51h Q | 75h u | 69h i | ... |
|-----|--------------------|----------|----------|----------|-----------|----------|----------|----------|-----|

FIGURE 18—SECOND SEQUENCE FRAME

| | | | | | | | | | |
|-----|--------------------|----------|-----------|----------|----------|----------|----------|----------|-----|
| ... | Sequence 3 of 3 | 6Eh n | 20h SP | 54h T | 72h r | 6Fh o | 75h u | 74h t | ... |
|-----|--------------------|----------|-----------|----------|----------|----------|----------|----------|-----|

FIGURE 19—LAST SEQUENCE FRAME

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11. **Manufacturer PRN Usage By J2178 Part**—This section defines the usage of PRNs by those specified in J2178 Parts 3 and 4 and is shown in Table 30. A manufacturer may use many more PRNs than those specified in Table 30 in manufacturer specific messages. The usage of PRNs for manufacturer specific messages will vary between manufacturers.

TABLE 30—MANUFACTURER USAGE CHART

| PRN | Parameter Name | J2178 Part 3 | J2178 Part 4 | Page |
|------|---|-----------------|-----------------|------|
| 0000 | PIDs Supported (01h - 20h) | | | 13 |
| 0001 | Number of Emission-Related Trouble Codes and MIL Status | | | 13 |
| 0002 | Trouble Code That Caused Freeze Frame Storage | | | 13 |
| 0003 | Fuel System Status | | | 13 |
| 0004 | Calculated Load Value | | | 13 |
| 0005 | Engine Coolant Temperature | X | X | 13 |
| 0006 | Short Term Fuel Trim - Bank 1 | | | 13 |
| 0007 | Long Term Fuel Trim - Bank 1 | | | 13 |
| 0008 | Short Term Fuel Trim - Bank 2 | | | 13 |
| 0009 | Long Term Fuel Trim - Bank 2 | | | 13 |
| 000A | Fuel Pressure (Gage) | | X | 13 |
| 000B | Intake Manifold Absolute Pressure | X | X | 13 |
| 000C | Engine RPM - High Resolution | X | X | 13 |
| 000D | Vehicle Speed - Low Resolution - Metric | | X | 13 |
| 000E | Ignition Timing Advance (#1) | | | 13 |
| 000F | Intake Air Temperature | X | X | 13 |
| 0010 | Air Flow Rate from MAF | | X | 13 |
| 0011 | Absolute Throttle #1 Position | | X | 13 |
| 0012 | Commanded Secondary Air | | | 13 |
| 0013 | Oxygen Sensor Location | | | 13 |
| 0014 | Oxygen Sensor - BANK 1 - Sensor 1 | | | 13 |
| 0015 | Oxygen Sensor - BANK 1 - Sensor 2 | | | 13 |
| 0016 | Oxygen Sensor - BANK 1 - Sensor 3 | | | 13 |
| 0017 | Oxygen Sensor - BANK 1 - Sensor 4 | | | 13 |
| 0018 | Oxygen Sensor - BANK 2 - Sensor 1 | | | 13 |
| 0019 | Oxygen Sensor - BANK 2 - Sensor 2 | | | 13 |
| 001A | Oxygen Sensor - BANK 2 - Sensor 3 | | | 14 |
| 001B | Oxygen Sensor - BANK 2 - Sensor 4 | | | 14 |
| 0020 | PIDs Supported (21h - 40h) | | | 14 |
| 0040 | PIDs Supported (41h - 60h) | | | 14 |
| 1000 | MIL Status | | | 14 |
| 1001 | Number of Emissions Related DTCs | | | 14 |
| 1002 | Continuous Evaluation Supported | | | 14 |
| 1003 | Trip Evaluation Supported | | | 14 |
| 1004 | Trip Evaluation Complete | | | 14 |
| 1005 | Subsystem Category of DTC | | | 14 |
| 1006 | Most Significant Digit of DTC | | | 14 |
| 1007 | Lower 3 Digits of DTC | | | 14 |
| 1008 | Fuel System Status - Bank 1 | | | 14 |
| 1009 | Fuel System Status - Bank 2 | | | 14 |
| 100A | Oxygen Sensor Voltage | | | 14 |
| 100B | Short Term Fuel Trim | | | 14 |
| 100D | Most Significant Digit of VIN Number | X | | 14 |

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TABLE 30—MANUFACTURER USAGE CHART

| PRN | Parameter Name | J2178 Part 3 | J2178 Part 4 | Page |
|------|--|-----------------|-----------------|------|
| 100E | A/C Clutch Load | | X | 14 |
| 1015 | Injector On Time | | | 14 |
| 1016 | Injector On Time - High Resolution | X | | 14 |
| 1017 | MIL Status - Expanded | X | | 14 |
| 1018 | Fuel Consumed - Volume | X | | 14 |
| 1019 | Crankshaft Torque - Absolute | | X | 14 |
| 1020 | Crankshaft Torque - Percent | | X | 14 |
| 1021 | Engine Boost | | X | 14 |
| 1022 | Engine RPM - Low Resolution | | X | 14 |
| 1023 | Engine Idle RPM | | X | 14 |
| 1024 | Engine Revolutions | | | 14 |
| 1025 | Barometric Pressure | X | X | 14 |
| 1026 | Engine Coolant Level - Percent | | X | 14 |
| 1027 | Engine Coolant Level - Volume | | X | 14 |
| 1028 | Engine Coolant Capacity | | X | 14 |
| 1029 | Engine Coolant Pressure | | X | 14 |
| 102A | Engine Coolant Fan #1 Speed | | X | 14 |
| 102B | Engine Oil Temperature | | X | 15 |
| 102C | Engine Oil Level - Percent | | X | 15 |
| 102D | Engine Oil Level - Volume | | X | 15 |
| 102E | Engine Oil Capacity | | X | 15 |
| 102F | Engine Oil Pressure | X | X | 15 |
| 1030 | Engine Oil Remaining Life | | X | 15 |
| 1031 | Hydraulic Fan Speed | | | 15 |
| 1032 | Methanol Content | X | | 15 |
| 1033 | Maximum Crankshaft Torque | | X | 15 |
| 1034 | Accelerator Pedal Position | | X | 15 |
| 1035 | Absolute Throttle #2 Position | | X | 15 |
| 1036 | Absolute Throttle #3 Position | | X | 15 |
| 1037 | Bank #1 - Converter #1 Temperature | | X | 15 |
| 1038 | Bank #1 - Converter #2 Temperature | | X | 15 |
| 1039 | Bank #2 - Converter #1 Temperature | | X | 15 |
| 103A | Bank #2 - Converter #2 Temperature | | X | 15 |
| 103B | Engine Coolant #2 Fan Speed | | X | 15 |
| 103C | Engine Coolant Temperature - Low Range | | | 15 |
| 103D | Engine Coolant Remaining Life | | X | 15 |
| 103F | Engine Oil Viscosity | | X | 15 |
| 1040 | Number of Engine Cylinders | | X | 15 |
| 1041 | Number of Valves per Cylinder | | X | 15 |
| 1043 | Engine Displacement | | X | 15 |
| 1044 | Fuel Temperature | | X | 15 |
| 1047 | Ignition Switch Position | | X | 15 |
| 1048 | Engine Redline - Low Resolution | | X | 15 |
| 1049 | Engine Redline - High Resolution | | X | 15 |
| 1801 | Transmission Fluid Level - Percent | | X | 16 |
| 1802 | Transmission Fluid Level - Volume | | X | 16 |
| 1803 | Transmission Fluid Capacity | | X | 16 |
| 1804 | Transmission Oil Life | | X | 16 |
| 1805 | Transmission Gear and Lockup Status | | | 16 |
| 1806 | Transmission Range Actual (PRNDL) | | X | 16 |

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TABLE 30—MANUFACTURER USAGE CHART

| PRN | Parameter Name | J2178 Part 3 | J2178 Part 4 | Page |
|------|---|-----------------|-----------------|------|
| 1807 | Transmission Lockup Status | | | 16 |
| 1808 | Transmission Actual Gear | | | 16 |
| 1809 | Transmission Range Selected (PRNDL) | X | X | 16 |
| 180A | Transmission Transfer Case (4WD) | | X | 16 |
| 180B | Transmission Fluid Temperature | X | X | 16 |
| 180C | Transmission Fluid Pressure | | X | 16 |
| 180D | Transmission Commanded Gear | | X | 16 |
| 180E | Transmission Actual Gear | | X | 16 |
| 180F | Transmission Gear and Lockup Status - Expanded | X | | 16 |
| 1810 | Transmission Actual Gear - Expanded | X | | 16 |
| 2801 | Wheel Speed - Low Resolution | | X | 16 |
| 2802 | Wheel Speed - High Resolution | | X | 16 |
| 2809 | Wheel Slip | | X | 16 |
| 2819 | Hydraulic Brake Fluid Supply Pump Pressure | | X | 16 |
| 281A | Hydraulic Brake Fluid Temperature | | X | 16 |
| 281B | Hydraulic Brake Fluid Recirculation Pump Pressure | | | 16 |
| 2821 | Wheel Rate | | | 16 |
| 2829 | Wheel Angular Velocity | | | 16 |
| 2831 | Wheel Angular Acceleration | | | 16 |
| 2839 | Wheel Load | | X | 16 |
| 2841 | Brake Fluid Level - Percent | | X | 16 |
| 2842 | Brake Fluid Level - Volume | | X | 16 |
| 2843 | Brake Fluid Remaining Life | | X | 16 |
| 2844 | Brake Fluid Capacity | | X | 16 |
| 2849 | Tire Temperature | | X | 16 |
| 2851 | Tire Pressure | | X | 16 |
| 2859 | Tire Type | | | 16 |
| 2861 | Tire Tread Wear Level | | X | 16 |
| 3001 | Steering Wheel Angle | | X | 17 |
| 3005 | Power Steering Fluid Temperature | | X | 17 |
| 3006 | Power Steering Fluid Pressure | | X | 17 |
| 3007 | Power Steering Fluid Level - Percent | | X | 17 |
| 3008 | Power Steering Fluid Level - Volume | | X | 17 |
| 3009 | Power Steering Fluid Remaining Life | | X | 17 |
| 300B | Power Steering Fluid Capacity | | X | 17 |
| 300C | Steering Wheel Rate | | X | 17 |
| 300D | Steering Wheel Torque | | X | 17 |
| 300E | Wheel Steer Angle | | X | 17 |
| 3801 | Lateral Acceleration | | | 17 |
| 3802 | Longitudinal Acceleration | | | 17 |
| 3803 | Yaw Acceleration | | | 17 |
| 3804 | Suspension Ride Setting | | X | 17 |
| 3805 | Suspension Fluid Temperature | | X | 17 |
| 3806 | Suspension Fluid Pressure | | X | 17 |
| 3807 | Suspension Fluid Level - Percent | | X | 17 |
| 3808 | Suspension Fluid Level - Volume | | X | 17 |
| 3809 | Suspension Fluid Remaining Life | | X | 17 |
| 380A | Suspension Fluid Capacity | | X | 17 |
| 380B | Vehicle Lateral Velocity | | | 17 |
| 380C | Vehicle Longitudinal Velocity | | | 17 |

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TABLE 30—MANUFACTURER USAGE CHART

| PRN | Parameter Name | J2178 Part 3 | J2178 Part 4 | Page |
|------|--|-----------------|-----------------|------|
| 380D | Vehicle Yaw Velocity | | | 17 |
| 5801 | Shoulder Belt Position | | X | 17 |
| 6001 | Vehicle Speed - High Resolution - Metric | X | X | 18 |
| 6002 | Vehicle Speed - High Resolution - English | | | 18 |
| 6003 | Compass Direction | | | 18 |
| 6004 | Odometer - Vehicle - Metric | | X | 18 |
| 6005 | Fuel Level - Percent | X | X | 18 |
| 6006 | Fuel Level - Volume | | X | 18 |
| 6007 | Fuel Capacity | | X | 18 |
| 600A | Battery Voltage - Low Resolution | X | X | 18 |
| 600B | Battery Temperature | X | X | 18 |
| 600C | Electrical Energy Load | | | 18 |
| 600D | Date (Dw ₈ :DD:MM:YY) | | X | 18 |
| 600E | Year (YY) | | X | 18 |
| 600F | Year (Yr) | | | 18 |
| 6010 | Month (Mn) | | | 18 |
| 6011 | Month (MM) | | X | 18 |
| 6012 | Day of Week (Dw ₄) | | | 18 |
| 6013 | Day of Week (Dw ₈) | | X | 18 |
| 6014 | Day of Month (Dm) | | | 18 |
| 6015 | Day of Month (DD) | | X | 18 |
| 6016 | Time of Day (HH:MM:SS) | | X | 18 |
| 6017 | Hours (HH) | | X | 18 |
| 6018 | Minutes (MM) | | X | 18 |
| 6019 | Seconds (SS) | | X | 18 |
| 601A | Battery Voltage - High Resolution | | | 18 |
| 601B | Distance Traveled - English | X | | 18 |
| 601C | Fuel Used - Metric | | | 18 |
| 601D | Distance To Empty - English | X | | 18 |
| 601E | Vehicle Speed - Low Resolution - English | | | 18 |
| 601F | Hours (Hr) - 0 - 23 numeric | | | 18 |
| 6020 | Average Fuel Economy - Low Resolution - Metric | | X | 18 |
| 6021 | Average Fuel Economy - Low Resolution - English | | | 18 |
| 6022 | Elapsed Time - Seconds | | | 18 |
| 6023 | Date (Dw ₄ Mn:Dm) | | | 18 |
| 6024 | Elapsed Time - Minutes | | | 18 |
| 6025 | Accumulated Ignition On Time | X | | 18 |
| 6026 | Fuel Used - English | | | 18 |
| 6027 | Distance To Empty - Metric | | | 18 |
| 6028 | Average Fuel Economy - High Resolution - Metric | | | 18 |
| 6029 | Average Fuel Economy - High Resolution - English | X | | 18 |
| 602A | Elapsed Time - Hours | | | 18 |
| 602B | Display Brightness | X | X | 18 |
| 602C | Ignition Off Duration | | | 18 |
| 602D | Outside Air Temperature - High Resolution | X | | 18 |
| 602E | Outside Air Temperature Display | | X | 18 |
| 602F | Minutes (Mn) 0 - 59 numeric | | | 18 |
| 6030 | Time (Hr:Mn) | X | | 18 |
| 6031 | Odometer - Vehicle - High Resolution - English | X | | 19 |
| 6032 | Odometer - Trip - High Resolution - English | X | | 19 |