

	SURFACE VEHICLE RECOMMENDED PRACTICE	
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Class B Data Communication Network Messages - Detailed Header Formats and Physical Address Assignments		

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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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, the electrical specifications, and the CRC byte are given in SAE J1850.

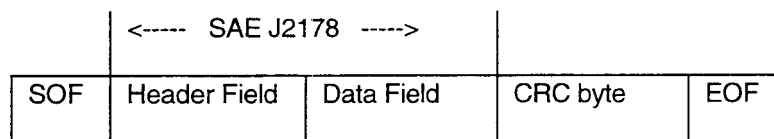


FIGURE 1—SCOPE OF SAE J2178 FOR A SAE J1850 FRAME WITHOUT IN-FRAME RESPONSE (IFR)

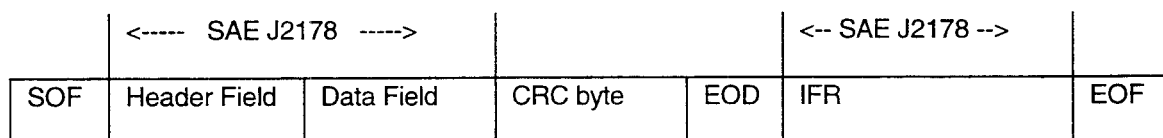


FIGURE 2—SCOPE OF SAE J2178 FOR A SAE J1850 FRAME WITH IN-FRAME RESPONSE (IFR)

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 (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 (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 matches the SAE J1979 definition.

SAE J2178-3 (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 (Titled: Message Definition for Three Byte Headers) defines the message assignments for the three byte form of the consolidated header format.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, 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 Networks 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 ANSI/IEEE PUBLICATION—Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002.

ANSI/IEEE 754-1985—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 geographical location (such as geographic) 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 below).

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.

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 of relevance only 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

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
EVSE - Electric Vehicle Supply Equipment
HVAC - Heating, Ventilation, Air Conditioning
ID - Identifier
IFR - In-Frame Response
LSB - Least Significant Bit/Byte
MSB - Most Significant Bit/Byte
NB - Normalization Bit
PID - Parameter IDentification (number, NOT the primary ID, (See Section 7)
PKT - Multiple Parameter Packet SLOT
PRN - Parameter Reference Number
SED - State Encoded SLOT

SFP - Signed Floating Point (Scientific Notation) SLOT
SLOT - Scaling, Limit, Offset, and Transfer Function (See Section 8)
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 1 Overview—The messages defined by this four part document are specified for networks using single byte headers or consolidated one and three byte headers as specified in SAE J1850. Sections 6 and 7 of SAE J2178-1 provide the system architecture for the different possible headers used in Class B network communication (see Appendix A for supporting discussion). Section 8 of SAE J2178-1 defines the data fields used by the different header byte formats. Section 9 of SAE J2178-1 defines the physical address assignments.

Figure 3 shows an overview of this part (Part 1) which encompasses the different possible messages and their component parts.

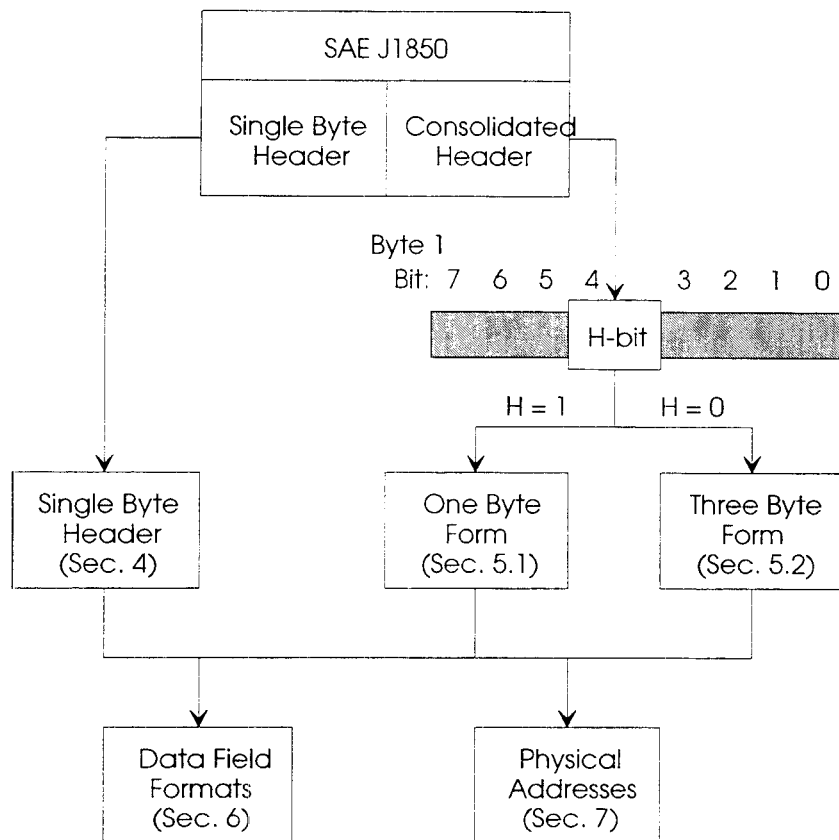


FIGURE 3—PART 1 OVERVIEW

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, identified by the value of the H Bit. The two forms are: a one byte form and a three byte form. The information in the header field for both formats contains target, source, priority and message type information, while the data field contains additional addressing and/or parametric information and/or diagnostic test modes. This information is explicitly defined in some headers and implicitly defined in others. Messages defined by this document (Parts 1, 2, 3, and 4) are classified generally into two types:

- a. Requests, that is, commands (load or modify) or queries for data, and
- b. Responses, that is, reports or acknowledgments.

When a node generates a request, the target nodes which are responsible for the requested data or function must respond by reporting the requested information or by performing the requested function. For responses (that is, reports or acknowledgments), data information that a node responds with may have been previously requested by another node, or reported by the node when the desired information has changed, or reported by the node on a periodic basis.

SAE J2178-1 describes the overall structure of messages. In total, parts 1, 2, 3, and 4:

- a. Fully define SAE (automotive industry) standard messages.
- b. Reserve messages for future SAE standardization.
- c. Reserve messages for manufacturers to allocate, which are typically unique or proprietary to that manufacturer.

In order to comply with this document, implementations need to use the defined messages on SAE J1850 networks in the exact way that they are defined here. However, there are a large number of message codes that are reserved for each manufacturer to independently allocate.

5.2 In-Frame Response Field Formats—The total number of bytes in the frame (not including frame delimiters) is 12, including the header (1 or 3 depending on header type), data (both in the message and IFR), and single byte CRC. Therefore, the total number of message and IFR data bytes can be 10 if using a single byte header or the one byte form of the consolidated header, or 8 bytes if using the three byte form of the consolidated header.

- 5.2.1 **IN-FRAME RESPONSE TYPE 0**—The in-frame response type 0 is used to indicate the form without any in-frame response.
- 5.2.2 **IN-FRAME RESPONSE TYPE 1**—The in-frame response type 1 is a single byte response from a single responder. The response byte shall be the physical address of a receiver of the message. No CRC byte is included for this response data.
- 5.2.3 **IN-FRAME RESPONSE TYPE 2**—The in-frame response type 2 is a single byte response from multiple responders. The response byte(s) shall be the physical address of the receiver(s) of the message. No CRC byte is included for the response data.
- 5.2.4 **IN-FRAME RESPONSE TYPE 3**—The in-frame response type 3 is a multiple byte response from a single responder. The response bytes shall be data (generally not its address) from a single responder. The second CRC byte is included for the data integrity of the response data. The actual in-frame response data shall be one byte in length, as a minimum.

Figure 4 illustrates the four IFR types.