QSI Corporation

Engineering Standard

SAE J1587

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JOINT SAE/TMC ELECTRONIC DATA INTERCHANGE BETWEEN MICROCOMPUTER SYSTEMS IN HEAVY-DUTY VEHICLE APPLICATIONS

Foreword—This SAE/TMC Joint document has been developed by the Truck and Bus Data Format Diagnostics Subcommittee of the Truck and Bus Electrical and Electronics Committee and by the S.1 Electrical & Electronics Study Group of the Maintenance Council. The objectives of the subcommittee are to develop information reports, recommended practices, and standards concerned with the format of electronic signals and information transmitted among Truck and Bus electronic components.

1. *Scope*—This SAE Recommended Practice defines a document for the format of messages and data that is of general value to modules on the data communications link. Included are field descriptions, size, scale, internal data representation, and position within a message. This document also describes guidelines for the frequency of and circumstances in which messages are transmitted.

   In order to promote compatibility among all aspects of electronic data used in heavy-duty applications, it is the intention of the Data Format Subcommittee (in conjunction with other industry groups) to develop recommended message formats for:

   a. Vehicle and Component Information: This includes all information that pertains to the operation of the vehicle and its components (such as performance, maintenance, and diagnostic data).

   b. Routing and Scheduling Information: Information related to the planned or actual route of the vehicle. It includes current vehicle location (for example, geographical coordinates) and estimated time of arrival.

   c. Driver Information: Information related to driver activity. Includes driver identification, logs (for example, DOT), driver expenses, performance, status, and payroll data.

   d. Freight Information: Provides data associated with cargo being shipped, picked up, or delivered. Includes freight status, overage, shortage and damage reporting, billing and invoice information as well as customer and consignee data.

   This document represents the recommended formats for basic vehicle and component identification and performance data. This document is intended as a guide toward standard practice and is subject to change to keep pace with experience and technical advances.

1.1 **Purpose**—The purpose of this document is to define the format of the messages and data being communicated between microprocessors used in heavy-duty vehicle applications. It is meant to serve as a guide toward a standard practice to promote software compatibility among microcomputer based modules. This document is to be used with SAE J1708. SAE J1708 defines the requirements for the hardware and basic protocol that is needed to implement this document.

The primary use of the communications link and message format is expected to be the sharing of data among stand-alone modules. It is anticipated that this document (when used in conjunction with SAE J1708) will reduce the cost and complexity associated with developing and maintaining software for heavy-duty vehicle microprocessor applications.

2. References

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

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

SAE J1708—Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications.

SAE J1455—Recommended Environmental Practices for Electrical Equipment Design (Heavy-Duty Trucks)

2.1.2 OTHER PUBLICATIONS

EIA RS-485—"Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems," Electronics Industries Association, Washington, DC, April 1983

ANSI/IEEE STANDARD 754-1985—"IEEE Standard for Binary Floating-Point Arithmetic"

RTCM-104, Version 2.0, Radio Technical Commission For Maritime Services, P.O. Box 19087, Washington, DC, 20036, January 1990

3. Electronic Data Interchange—All data transmitted on the communication link, defined by SAE J1708, using message identification (MID) in the range 128 to 255, shall follow this document.

3.1 **Message Format**—The message shall consist of the following:

Message ID
One or More Parameters
Checksum

The number of parameters in a message is limited by the total message length defined in SAE J1708. MIDs are assigned to transmitter categories as identified in Table 1.

3.2 **MID Assignment List Additions**—No two transmitters in the system shall have the same MID. System manufacturers may request additions be made to the MID list. The Data Format Subcommittee will review the value of any additional MIDs for general interest and/or purpose and may or may not add it to the list.

TABLE 1—MESSAGE ID ASSIGNMENT LIST

0-127	Defined by J1708
128	Engine #1
129	Turbocharger
130	Transmission
131	Power Takeoff
132	Axle, Power Unit
133	Axle, Trailer #1
134	Axle, Trailer #2
135	Axle, Trailer #3
136	Brakes, Power Unit
137	Brakes, Trailer #1
138	Brakes, Trailer #2
139	Brakes, Trailer #3
140	Instrument Cluster
141	Trip Recorder
142	Vehicle Management System
143	Fuel System
144	Cruise Control
145	Road Speed Indicator
146	Cab Climate Control
147	Cargo Refrigeration/Heating, Trailer #1
148	Cargo Refrigeration/Heating, Trailer #2
149	Cargo Refrigeration/Heating, Trailer #3
150	Suspension, Power Unit
151	Suspension, Trailer #1
152	Suspension, Trailer #2
153	Suspension, Trailer #3
154	Diagnostic Systems, Power Unit
155	Diagnostic Systems, Trailer #1
156	Diagnostic System, Trailer #2
157	Diagnostic System, Trailer #3
158	Electrical Charging System
159	Proximity Detector, Front
160	Proximity Detector, Rear
161	Aerodynamic Control Unit
162	Vehicle Navigation Unit
163	Vehicle Security
164	Multiplex
165	Communication Unit - Ground
166	Tires, Power Unit
167	Tires, Trailer #1
168	Tires, Trailer #2
169	Tires, Trailer #3
170	Electrical
171	Driver Information Center
172	Off-board Diagnostics #1
173	Engine Retarder
174	Cranking/Starting System
175	Engine #2
176	Transmission, Additional
177	Particulate Trap System
178	Vehicle Sensors to Data Converter
179	Data Logging Computer
180	Off-board Diagnostics #2
181	Communication Unit - Satellite
182	Off-board Programming Station
183	Engine #3
184	Engine #4
185	Engine #5
186	Engine #6
187	Vehicle Control Head Unit

TABLE 1 (CONTINUED)

188	Vehicle Logic Control Unit
189	Vehicle Head Signs
190	Refrigerant Management System
191	Vehicle Location Unit - Differential Correction
192	Front Door Status Unit
193	Middle Door Status Unit
194	Rear Door Status Unit
195	Annunciator Unit
196	Fare Collection Unit
197	Passenger Counter Unit
198	Schedule Adherence Unit
199	Route Adherence Unit
200	Environment Monitor Unit
201	Vehicle Status Points Monitor Unit
202	High Speed Communications Unit
203	Mobile Data Terminal Unit
204	Vehicle Proximity, Right Side
205	Vehicle Proximity, Left Side
206	Base Unit (Radio Gateway to Fixed End)
207	Bridge from J1708 Drivetrain Link
208	Maintenance Printer
209	Vehicle Turntable
210	Bus Chassis Identification Unit
211	Smart Card Terminal
212	Mobile Data Terminal
213	Vehicle Control Head Touch Screen
214	Silent Alarm Unit
215	Surveillance Microphone
216	Lighting Control Administrator Unit
217	Tractor/Trailer Bridge, Tractor Mounted
218	Tractor/Trailer Bridge, Trailer Mounted
219	Collision Avoidance Radar
220	Tachograph
221-255	Reserved - to be assigned

3.3 Parameter Identification Assignments—The first character of every parameter shall be the parameter identification character (PID). The permitted range of PIDs shall include numbers 0 to 255. Assignment of a PID to a parameter shall be done according to the number of data characters required by the parameter.

PIDs 256 to 511 represent a second page of PIDs (page 2) for use with the extension PID 255. These PIDs are transmitted modulo 256, such that PID 256 is transmitted as 0, PID 257 is transmitted as 1, etc.

PIDs 0 to 127 and PIDs 256 to 383 shall be allocated to parameters using a single data character to represent its value. The single data character follows the PID.

PIDs 128 to 191 and PIDs 384 to 447 shall be allocated to double data character parameters. The two data characters follow the PID.

Parameters requiring more than two data characters and parameters requiring varying numbers of data characters shall be allocated PIDs 192 to 253 and PIDs 448 to 509. The number of data characters used is contained in the first character after the PID. This character count is followed by the specified number of data characters. The minimum character count value is 0. The maximum character count is limited by the total message character count permitted by SAE J1708.

PID 254 is a data link escape PID. All characters excluding the message checksum following an escape PID are defined as escape data. The first data byte contains the Message ID of the desired receiving device. The remaining escape data is to be defined by the manufacturer of the transmitting device and may be disclosed in an applications document (reference SAE J1708). It is used to transmit special commands, data, and other proprietary information to a specified component.

PID 255 is an extension PID. All characters in this message excluding the message checksum following an extension PID are to be interpreted using PID 256 to 511 definitions. When receiving PID 255 data, a value of 256 should be added to the PIDs received to determine their page 2 PID identification.

The format of a message incorporating PID 255 is as follows:

MID, PID=255, PID/Data, [PID/Data, PID/Data, ...], Checksum

where the PIDs in this message are interpreted as PID 256 to 511. PID 255 is only valid immediately following the MID.

PID 510 is a page 2 data link escape PID. All characters excluding the message checksum following an escape PID are defined as escape data. The subcommittee will need to review and approve any use of this PID.

PID 511 is a page 2 extension PID. The subcommittee will need to review and approve any use of this PID.

The PID assignment list is shown in Table 2.

The procedure for assigning new PIDs is contained in 3.9.

TABLE 2—Parameter Identification Assignment List

PID	Parameter
	Single Data Character Length Parameters
0	Request Parameter
1[1/]	Invalid Data Parameter (see Appendix A)
2[1/]	Transmitter System Status (see Appendix A)
3[1/]	Transmitter System Diagnostic (see Appendix A)
4	Reserved - to be assigned
5[1/]	Underrange Warning Condition (see Appendix A)
6[1/]	Overrange Warning Condition (see Appendix A)
7-50	Reserved - to be assigned
51	Throttle Position
52	Engine Intercooler Temperature
53	Transmission Synchronizer Clutch Value
54	Transmission Synchronizer Brake Value
55	Shift Finger Positional Status
56	Transmission Range Switch Status
57	Transmission Actuator Status #2
58	Shift Finger Actuator Status
59	Shift Finger Gear Position
60	Shift Finger Rail Position
61	Parking Brake Actuator Status
62	Retarder Inhibit Status
63	Transmission Actuator Status #1
64	Direction Switch Status
65	Service Brake Switch Status
66	Vehicle Enabling Component Status
67	Shift Request Switch Status
68	Torque Limiting Factor
69	Two Speed Axle Switch Status
70	Parking Brake Switch
71	Idle Shutdown Timer Status
72	Blower Bypass Value Position
73	Auxiliary Water Pump Pressure
74	Maximum Road Speed Limit
75	Steering Axle Temperature
76	Axle Lift Air Pressure
77	Forward Rear Drive Axle Temperature
78	Rear Rear-Drive Axle Temperature
79	Road Surface Temperature
80	Washer Fluid Level
81	Particulate Trap Inlet Pressure
82	Air Start Pressure
83	Road Speed Limit Status
84	Road Speed
85	Cruise Control Status
86	Cruise Control Set Speed
87	Cruise Control High-Set Limit Speed
88	Cruise Control Low-Set Limit Speed
89	Power Takeoff Status
90	PTO Oil Temperature
91	Percent Accelerator Pedal Position
92	Percent Engine Load
93	Output Torque
94	Fuel Delivery Pressure
95	Fuel Filter Differential Pressure
96	Fuel Level
97	Water in Fuel Indicator

TABLE 2 (CONTINUED)

PID	Parameter
98	Engine Oil Level
99	Engine Oil Filter Differential Pressure
100	Engine Oil Pressure
101	Crankcase Pressure
102	Boost Pressure
103	Turbo Speed
104	Turbo Oil Pressure
105	Intake Manifold Temperature
106	Air Inlet Pressure
107	Air Filter Differential Pressure
108	Barometric Pressure
109	Coolant Pressure
110	Engine Coolant Temperature
111	Coolant Level
112	Coolant Filter Differential Pressure
113	Governor Droop
114	Net Battery Current
115	Alternator Current
116	Brake Application Pressure
117	Brake Primary Pressure
118	Brake Secondary Pressure
119	Hydraulic Retarder Pressure
120	Hydraulic Retarder Oil Temperature
121	Engine Retarder Status
122	Engine Retarder Percent
123	Clutch Pressure
124	Transmission Oil Level
125	Transmission Oil Level High/Low
126	Transmission Filter Differential Pressure
127	Transmission Oil Pressure
	Double Data Character Length Parameters
128	Component-specific request
129-153	Reserved - to be assigned
154	Auxiliary Input and Output Status #2
155	Auxiliary Input and Output Status #1
156	Injector Timing Rail Pressure
157	Injector Metering Rail Pressure
158	Battery Potential (Voltage) - Switched
159	Gas Supply Pressure
160	Main Shaft Speed
161	Input Shaft Speed
162	Transmission Range Selected
163	Transmission Range Attained
164	Injection Control Pressure
165	Compass Bearing
166	Rated Engine Power
167	Alternator Potential (Voltage)
168	Battery Potential (Voltage)
169	Cargo Ambient Temperature
170	Cab Interior Temperature
171	Ambient Air Temperature
172	Air Inlet Temperature
173	Exhaust Gas Temperature
174	Fuel Temperature
175	Engine Oil Temperature

TABLE 2 (CONTINUED)

PID	Parameter
176	Turbo Oil Temperature
177	Transmission Oil Temperature
178	Front Axle Weight
179	Rear Axle Weight
180	Trailer Weight
181	Cargo Weight
182	Trip Fuel
183	Fuel Rate
184	Instantaneous Fuel Economy
185	Average Fuel Economy
186	Power Takeoff Speed
187	Power Takeoff Set Speed
188	Idle Engine Speed
189	Rated Engine Speed
190	Engine Speed
191	Transmission Output Shaft Speed
	Variable and Long Data Character Length Parameters
192	Multisection Parameter
193 1/ (see Appendix A)	Transmitter System Diagnostic Table
194	Transmitter System Diagnostic Code and Occurrence Count Table
195	Diagnostic Data Request/Clear Count
196	Diagnostic Data/Count Clear Response
(R) 197	Connection Management
(R) 198	Connection Mode Data Transfer
199	Traction Control Disable State
200-231	Reserved - to be assigned
232	DGPS Differential Correction
233	Unit Number (Power Unit)
234	Software Identification
235	Total Idle Hours
236	Total Idle Fuel Used
237	Vehicle Identification Number
238	Velocity Vector
239	Vehicle Position
240	Change Reference Number
241	Tire Pressure
242	Tire Temperature
243	Component Identification
244	Trip Distance
245	Total Vehicle Distance
246	Total Vehicle Hours
247	Total Engine Hours
248	Total PTO Hours
249	Total Engine Revolutions
250	Total Fuel Used
251	Clock
252	Date
253	Elapsed Time
	Special Parameters
254	Data Link Escape
255	Extension

TABLE 2 (CONTINUED)

PID	Parameter
	Single Data Character Length Parameters (modulo 256 value identified in parentheses)
256 (0)	Request Parameter
257 (1)	Cold Restart of Specific Component
258 (2)	Warm Restart of Specific Component
259 (3)	Acknowledgement of Warm or Cold Restart
260-377 (4-121)	Reserved - to be assigned
378 (122)	Fare Collection Unit Status
379 (123)	Transit Door Status
380 (124)	Articulation Angle
381 (125)	Vehicle Use Status
382 (126)	Transit Silent Alarm Status
383 (127)	Vehicle Acceleration
	Double Data Character Length Parameters
384 (128)	Component-specific request
385-446 (129-190)	Reserved - to be assigned
447 (191)	Passenger Counter
	Variable and Long Data Character Length Parameters
448 (192)	Page 2 Multisection Parameter
449 (193)	Reporting Interval Request
450 (194)	Bridge Filter Control
451-500 (195-244)	Reserved - to be assigned
501 (245)	Signage Message
502 (246)	Fare Collection Unit - Point of Sale
503 (247)	Fare Collection Unit - Service Detail
504 (248)	Annunciator Voice Message
505 (249)	Vehicle Control Head Keyboard Message
506 (250)	Vehicle Control Head Display Message
507 (251)	Driver Identification
508 (252)	Transit Route Identification
509 (253)	Mile Post Identification
	Special Parameters
510 (254)	Page 2 Data Link Escape
511 (255)	Page 2 Extension

[1/] Note: These PIDs are superseded by PIDs 194, 195, and 196.

3.4 Parameter Data-Types—Parameter data shall use one or more of the following data-types as in Table 3:

TABLE 3—Parameter Data Types

Data-Type	Characters
Binary Bit-Mapped (B/BM)	1
Unsigned Short Integer (Uns/SI)	1
Signed Short Integer (S/SI)	1
Unsigned Integer (Uns/I)	2
Signed Integer (S/I)	2
Unsigned Long Integer (Uns/LI)	4
Signed Long Integer (S/LI)	4
Alphanumeric (ALPHA)	1
Single-Precision Floating-Point (SP/FP)	4
Double-Precision Floating-Point (DP/FP)	8

Alphanumeric data will be transmitted with the most significant character first. All other data will be transmitted least significant character first.

Signed integer values will use two's complement notation.

Alphanumeric characters will conform to the ASCII character set for values 0 to 127. Values from 128 to 255 may be used but are not defined in this document.

Floating-Point values will conform to the IEEE Floating-Point Standard.

(R) 3.4.1 TEMPERATURE SCALING—All parameters which identify temperatures are transmitted in degree Fahrenheit. Conversion to degree Celsius is the responsibility of the receiver of the data.

3.5 Parameter Transmission Update Period and Message Priority—The update period and message priority at which a parameter is transmitted on the data link is primarily the responsibility of the transmitting electronic device. Because overloading the data link and providing compatible update rates are major concerns, a recommended transmission update period and message priority for each parameter is included in Appendix A. Variations from the listed update periods shall be included in the application document (reference SAE J1708).

If multiple parameters are grouped into one message, the message assignment would be based on the highest message priority associated with the group parameters. All requested parameters were assigned the lowest message priority, priority 8, so that the messages would not disrupt the regularly broadcast data.

3.6 Parameter Definitions—See Appendix A for parameter definitions.

(R) **3.7 Transport Protocol Definitions**—The J1587 transport protocol provides a mechanism for transmitting free-form data that extends beyond 21 bytes. The protocol consists of PID 197, Connection Management and PID 198, Connection Mode Data Transfer. The Connection Management Control Command list is shown in Table 4 and the Standardized Free-format Data Assignments list is shown in Table 5. See Appendix B for a discussion on the use of these PIDs and their related tables.

3.8 Subsystem Identification Assignments—Subsystem Identification Numbers (SIDs) are numbers assigned by the SAE staff or the Data Format Subcommittee. There are 255 SIDs definable for each controller or MID. SIDs are numbers that can be used to identify a section of a control system without a related PID. SIDs should only be assigned to field-repairable or replaceable subsystems for which failures can be detected and isolated by the controller (MID). SIDs 1 to 150 are assigned by SAE staff using the procedure in 3.9. SIDs 156 to 255 are assigned by the Data Format Subcommittee using the procedure in 3.9. MID related SIDs start with number 1 and sequentially increase. Common SIDs start at 254 and sequentially decrease.

SIDs 151 through 155 are defined as "System Diagnostic Codes" and are used to identify failures that cannot be tied to a specific field replaceable component. Specific subsystem fault isolation is the goal of any diagnostic system, but for various reasons this cannot always be accomplished. These SIDs allow the manufacturer some flexibility to communicate non-"specific component" diagnostic information. PID 194 SID/FMI format of SIDs 151-155 permit the use of standard diagnostic tools, electronic dashboards, satellite systems and other advanced devices that scan for PID 194. Because manufacturer defined codes are not desirable in terms of standardization, the use of these codes should only be used when diagnostic information cannot be communicated as a specific component and failure mode.

Possible reasons for using a System Diagnostic Code include:
1. Cost of specific component fault isolation is not justified, or
2. New concepts in Total Vehicle Diagnostics are being developed, or
3. New diagnostic strategies that are not component specific are being developed.

Due to the fact that SIDs 151-155 are manufacturer defined and are not component specific, FMIs 0-13 have little meaning. Therefore, FMI 14, "Special Instructions", will usually be used. The goal is to refer the service personnel to the manufacturer's troubleshooting manual for more information on the particular diagnostic code.

The SID assignment list is shown in Table 6.

3.9 Failure Mode Identifier Assignments—The Failure Mode Identifier, FMI, describes the type of failure detected in the subsystem identified by the PID or SID. The FMI, and either the PID or SID combine to form a given diagnostic code (see PID 194 for added clarification). The remaining failure mode identifiers would be assigned by the Data Format Subcommittee if additional common failure modes become detectable.

The failure mode identifier assignment list is shown in Table 7.

3.10 SAE Procedure for MID, PID, and SID Assignment

a. Purpose—To outline the procedure for the assignment of MID, PID, and SID elements within the documents established in the SAE Data Format Subcommittee.

b. General—MIDs, PIDs, and SIDs will be requested using the request form (Figure 1). All requests for MIDs, PIDs, and common SIDs will be forwarded to the chairperson of the SAE Data Format Subcommittee for action at the next scheduled committee meeting. All requests for MID related SIDs will be processed by the SAE staff. A confirmation for MID, PID, and common SID requests will be sent to the requestor stating the date the request will be reviewed to ensure the requestor has the opportunity to be present at that meeting. MID related SID requests will be handled by SAE staff with copies of the request form sent to the chairperson of the SAE Data Format Subcommittee.

c. Verification of Request—The request form will be reviewed to ensure all required fields are provided by the requestor. If information is missing, the request form shall be returned to the requestor asking for the additional information. If the information is complete, either the MID/PID/Common SID process or the MID related SID process shall be followed depending on the type of request.

MID/PID/Common SID Process—SAE will complete the request form by filling in the date and time of the next SAE Data Format Subcommittee meeting. They will make two copies of the request form. File one copy in a SAE staff maintained file of requests. Send the original to the chairperson of the SAE Data Format Subcommittee for review and approval by the committee. Send the second copy of the request back to the requestor.

The chairperson of the SAE Data Format Subcommittee will present to the committee all MID, PID, and common SID requests since the last meeting. An approval or disapproval vote is required during the committee meeting. The chairperson of the SAE Data Format Subcommittee will document the approval or disapproval by completing the review section of the request form. These completed request forms for all MIDs, PIDs, and common SIDs will be sent to the SAE staff.

The SAE staff will verify that all requests were handled and notify the requestor by sending a copy of the completed form to the requestor. The original form should be filed in a completed request file. The copy of the request form that is in the request file should be removed.

d. MID Related SID Process—The SAE staff will keep records of SIDs allocated to each MID. This will be accomplished by maintaining a control log for each MID. If the requestor is asking for a new SID that is similar to an existing SID, the SAE staff will document the current SID on the request form and return it to the requestor. If the request is for a new MID related SID which is not currently assigned, the SAE staff will assign the next sequential number. This will be documented on the request form (Figure 1). The SAE staff will make two copies of the request form. The original will be returned to the requestor. The first copy will be sent to the SAE Data Format Subcommittee chairperson. The second copy will be filed in the assigned SID file by MID. The new SID number will be logged on the MID/SID control log for that MID. If the total number of SIDs assigned reaches 100 for an MID, the SAE staff is required to notify the chairperson of the SAE Data Format Subcommittee.

NOTE - Parameters considered to be of a data link command or control nature should be added to the parameter list at the lowest PID value available within the appropriate data size grouping. All other parameters should be added at the highest PID value available within the appropriate data grouping.

4. Notes

4.1 Marginal Indicia—The (R) is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

PREPARED BY THE SAE TRUCK & BUS DATA FORMAT SUBCOMMITTEE OF THE
SAE TRUCK & BUS ELECTRICAL COMMITTEE

Requestor Name _____

Requestor Address _____
_____
_____

Company Name _____

Request Type MID _____ PID _____

SID _____ Requested FOR MID # _____

Description of MID/PID/SID

_____
_____
_____
_____
_____
_____
_____
_____

For PIDs Only (See SAE J1587 for Description)

Parameter Data Length _____
Data Type _____
Resolution _____
Maximum Range _____
Transmission Update Period _____
Message Priority _____
Format _____

For Use By SAE Only

Approved _____ Disapproved _____ Signature _____
New MID Number _____ New PID Number _____ New SID Number _____
Current MID _____ Current PID _____ Current SID _____

Date of next SAE Data Format Committee meeting _____
Location _____ Time _____

Incomplete Information _____ (Please complete items marked)

Please mail completed form to:

SAE
Data Format Subcommittee
400 Commonwealth Drive
Warrendale, PA 15096

FIGURE 1—SAE Data Format Subcommittee MID, PID, SID Request Form

(R) TABLE 4—CONNECTION MANAGEMENT CONTROL COMMANDS[2/]

0	Reserved
1	Request to Send (RTS)
2	Clear to Send (CTS)
3	End of Message Acknowledgement (EOM)
4	Request for Standardized Data
5-254	Reserved for future assignment by the SAE Data Format Subcommittee
255	Reset

(R) TABLE 5—STANDARDIZED FREE-FORMAT DATA ASSIGNMENTS[2/]

0	Reserved
1	Trip Recorder Data
2	Driver Log
3	Programmable Parameters
4	Executable Code
5	Calibration Parameters
6-65535	Reserved for future assignment by the SAE Data Format Subcommittee

[2/] See Appendix B.

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST

SIDs 1 to 150 are not common with other systems and are assigned by SAE. SIDs 151 to 255 are common among other systems and are assigned by the Data Format Subcommittee.

151	System Diagnostic Code #1
152	System Diagnostic Code #2
153	System Diagnostic Code #3
154	System Diagnostic Code #4
155	System Diagnostic Code #5
156-227	Reserved for future assignment by SAE Data Format Subcommittee
228	High Side Refrigerant Pressure Switch
229	Kickdown Switch
230	Idle Validation Switch
231	SAE J1939 Data Link
232	5 Volts DC Supply
233	Controller #2
234	Parking Brake On Actuator
235	Parking Brake Off Actuator
236	Power Connect Device
237	Start Enable Device
238	Diagnostic Lamp - Red
239	Diagnostic Light - Amber
240	Program Memory
241[3/]	Set aside for Systems Diagnostics
242	Cruise Control Resume Switch
243	Cruise Control Set Switch
244	Cruise Control Enable Switch
245	Clutch Pedal Switch #1
246	Brake Pedal Switch #1
247	Brake Pedal Switch #2
248	Proprietary Data Link
249	SAE J1922 Data Link
250	SAE J1708 (J1587) Data Link
251	Power Supply
252	Calibration Module
253	Calibration Memory
254	Controller #1
255	Reserved

Engine SIDs (MID = 128, 175, 183, 184, 185, 186)

0	Reserved
1	Injector Cylinder #1
2	Injector Cylinder #2
3	Injector Cylinder #3
4	Injector Cylinder #4
5	Injector Cylinder #5
6	Injector Cylinder #6
7	Injector Cylinder #7
8	Injector Cylinder #8
9	Injector Cylinder #9
10	Injector Cylinder #10
11	Injector Cylinder #11
12	Injector Cylinder #12
13	Injector Cylinder #13

[3/] Superseded by SIDs 151-155.

TABLE 6—CONTINUED

Engine SIDs (MID = 128, 175, 183, 184, 185, 186) - continued

14	Injector Cylinder #14
15	Injector Cylinder #15
16	Injector Cylinder #16
17	Fuel Shutoff Valve
18	Fuel Control Valve
19	Throttle Bypass Valve
20	Timing Actuator
21	Engine Position Sensor
22	Timing Sensor
23	Rack Actuator
24	Rack Position Sensor
25	External Engine Protection Input
26	Auxiliary Output Device Driver #1
27	Variable Geometry Turbocharger Actuator #1
28	Variable Geometry Turbocharger Actuator #2
29	External Fuel Command Input
30	External Speed Command Input
31	Tachometer Signal Output
32	Wastegate Output Device Driver
33	Fan Clutch Output Device Driver
34	Exhaust Back Pressure Sensor
35	Exhaust Back Pressure Regulator Solenoid
36	Glow Plug Lamp
37	Electronic Drive Unit Power Relay
38	Glow Plug Relay
39	Engine Starter Motor Relay
40	Auxiliary Output Device Driver #2
41	ECM 8 Volts DC Supply
42	Injection Control Pressure Regulator
43	Autoshift High Gear Actuator
44	Autoshift Low Gear Actuator
45	Autoshift Neutral Actuator
46	Autoshift Common Low Side (Return)
47	Injector Cylinder #17
48	Injector Cylinder #18
49	Injector Cylinder #19
50	Injector Cylinder #20
51	Auxiliary Output Device Driver #3
52	Auxiliary Output Device Driver #4
53	Auxiliary Output Device Driver #5
54	Auxiliary Output Device Driver #6
55	Auxiliary Output Device Driver #7
56	Auxiliary Output Device Driver #8
57	Auxiliary PWM Driver #1
58	Auxiliary PWM Driver #2
59	Auxiliary PWM Driver #3
60	Auxiliary PWM Driver #4
61	Variable Swirl System Valve
62	Prestroke Sensor
63	Prestroke Actuator
64	Engine Speed Sensor #2
65-150	Reserved for Future Assignment by SAE

TABLE 6—CONTINUED

Transmission SIDs (MID = 130, 176)

0	Reserved
1	C1 Solenoid Valve
2	C2 Solenoid Valve
3	C3 Solenoid Valve
4	C4 Solenoid Valve
5	C5 Solenoid Valve
6	C6 Solenoid Valve
7	Lockup Solenoid Valve
8	Forward Solenoid Valve
9	Low Signal Solenoid Valve
10	Retarder Enable Solenoid Valve
11	Retarder Modulation Solenoid Valve
12	Retarder Response Solenoid Valve
13	Differential Lock Solenoid Valve
14	Engine/Transmission Match
15	Retarder Modulation Request Sensor
16	Neutral Start Output
17	Turbine Speed Sensor
18	Primary Shift Selector
19	Secondary Shift Selector
20	Special Function Inputs
21	C1 Clutch Pressure Indicator
22	C2 Clutch Pressure Indicator
23	C3 Clutch Pressure Indicator
24	C4 Clutch Pressure Indicator
25	C5 Clutch Pressure Indicator
26	C6 Clutch Pressure Indicator
27	Lockup Clutch Pressure Indicator
28	Forward Range Pressure Indicator
29	Neutral Range Pressure Indicator
30	Reverse Range Pressure Indicator
31	Retarder Response System Pressure Indicator
32	Differential Lock Clutch Pressure Indicator
33	Multiple Pressure Indicators
34	Reverse Switch
35	Range High Actuator
36	Range Low Actuator
37	Splitter Direct Actuator
38	Splitter Indirect Actuator
39	Shift Finger Rail Actuator 1
40	Shift Finger Gear Actuator 1
41	Upshift Request Switch
42	Downshift Request Switch
43	Torque Converter Interrupt Actuator
44	Torque Converter Lockup Actuator
45	Range High Indicator
46	Range Low Indicator
47	Shift Finger Neutral Indicator
48	Shift Finger Engagement Indicator
49	Shift Finger Center Rail Indicator
50	Shift Finger Rail Actuator 2
51	Shift Finger Gear Actuator 2
52	Hydraulic System
53	Defuel Actuator
54	Inertia Brake Actuator
55	Clutch Actuator
56-150	Reserved for future assignment by SAE

TABLE 6—CONTINUED

Brake SIDs (MID = 136, 137, 138, 139)

0	Reserved
1	Wheel Sensor ABS Axle 1 Left
2	ABS Axle 1 Right
3	ABS Axle 2 Left
4	ABS Axle 2 Right
5	ABS Axle 3 Left
6	ABS Axle 3 Right
7	Pressure Modulation Valve ABS Axle 1 Left
8	ABS Axle 1 Right
9	ABS Axle 2 Left
10	ABS Axle 2 Right
11	ABS Axle 3 Left
12	ABS Axle 3 Right
13	Retarder Control Relay
14	Relay Diagonal 1
15	Relay Diagonal 2
16	Mode Switch ABS
17	Mode Switch ASR
18	DIF 1 - ASR Valve
19	DIF 2 - ASR Valve
20	Pneumatic Engine Control
21	Electronic Engine Control (Servomotor)
22	Speed Signal Input
23	Warning Light Bulb
24	ASR Light Bulb
25	Wheel Sensor, ABS Axle 1 Average
26	Wheel Sensor, ABS Axle 2 Average
27	Wheel Sensor, ABS Axle 3 Average
28	Pressure Modulator, Drive Axle Relay Valve
29	Pressure Transducer, Drive Axle Relay Valve
30	Master Control Relay
31	Trailer Brake Slack Out of Adjustment Forward Axle Left
32	Forward axle Right
33	Rear Axle Left
34	Rear Axle Right
35	Tractor Brake Slack Out of Adjustment Axle 1 Left
36	Axle 1 Right
37	Axle 2 Left
38	Axle 2 Right
39	Axle 3 Left
40	Axle 3 Right
41-150	Reserved for Future Assignment by SAE

Instrument Panel SIDs (MID = 140)

0	Reserved
1	Left Fuel Level Sensor
2	Right Fuel Level Sensor
3	Fuel Feed Rate Sensor
4	Fuel Return Rate Sensor
5-150	Reserved for future assignment by SAE

Fuel System SIDs (MID = 143)

0	Reserved
1	Injector Cylinder #1
2	Injector Cylinder #2

TABLE 6—CONTINUED

Fuel System SIDs (MID = 143) - continued

3	Injector Cylinder #3
4	Injector Cylinder #4
5	Injector Cylinder #5
6	Injector Cylinder #6
7	Injector Cylinder #7
8	Injector Cylinder #8
9	Injector Cylinder #9
10	Injector Cylinder #10
11	Injector Cylinder #11
12	Injector Cylinder #12
13	Injector Cylinder #13
14	Injector Cylinder #14
15	Injector Cylinder #15
16	Injector Cylinder #16
17	Fuel Shutoff Valve
18	Fuel Control Valve
19	Throttle Bypass Valve
20	Timing Actuator
21	Engine Position Sensor
22	Timing Sensor
23	Rack Actuator
24	Rack Position Sensor
25	External Engine Protection Input
26	Auxiliary Output Device Driver
27-150	Reserved for future assignment by SAE

Vehicle Navigation SIDs (MID = 162,191)

0	Reserved
1	Dead Reckoning Unit
2	Loran Receiver
3	Global Positioning System (GPS)
4	Integrated Navigation Unit
5-150	Reserved for future assignment by SAE

Particulate Trap System SIDs (MID = 177)

1	Heater Circuit #1
2	Heater Circuit #2
3	Heater Circuit #3
4	Heater Circuit #4
5	Heater Circuit #5
6	Heater Circuit #6
7	Heater Circuit #7
8	Heater Circuit #8
9	Heater Circuit #9
10	Heater Circuit #10
11	Heater Circuit #11
12	Heater Circuit #12
13	Heater Circuit #13
14	Heater Circuit #14
15	Heater Circuit #15
16	Heater Circuit #16
17	Heater Regeneration System
18-150	Reserved for future assignment by SAE

TABLE 6—CONTINUED

Refrigerant Management System SIDs (MID = 190)

0	Reserved
1	Refrigerant Charge
2	Refrigerant Moisture Level
3	Non-condensable Gas in Refrigerant
4	Refrigerant Flow Control Solenoid
5-150	Reserved for future assignment by SAE

Tractor/Trailer Bridge SIDs (MIDS = 217, 218)

0	Reserved
1	Auxiliary input #1
2	Auxiliary input #2
3	Auxiliary input #3
4	Auxiliary input #4
5	Auxiliary input #5
6	Auxiliary input #6
7	Auxiliary input #7
8	Auxiliary input #8
9	Clearance, side marker, identification lamp circuit (Black)
10	Left turn lamp circuit (Yellow)
11	Stop lamp circuit (Red)
12	Right turn lamp circuit (Green)
13	Tail lamp/license plate lamp circuit (Brown)
14	Auxiliary lamp circuit (Blue)
15	Tractor mounted rear axle slider control unit
16	Trailer mounted rear axle slider control unit
17-150	Reserved for future assignment by SAE

Collision Avoidance Radar SIDs (MIDS = 219)

0	Reserved
1	Forward Antenna
2	Antenna Electronics
3	Brake Input Monitor
4	Speaker Monitor
5	Steering Sensor Monitor
6	Speedometer Monitor
7	Right Turn Signal Monitor
8	Left Turn Signal Monitor
9	Control Display Unit
10	Right Side Sensor
11	Left Side Sensor
12	Rear Sensor
13-150	Reserved for future assignment by SAE

TABLE 7—FAILURE MODE IDENTIFIERS (FMI)

0	Data valid but above normal operational range (that is, engine overheating)
1	Data valid but below normal operational range (that is, engine oil pressure too low)
2	Data erratic, intermittent, or incorrect
3	Voltage above normal or shorted high
4	Voltage below normal or shorted low
5	Current below normal or open circuit
6	Current above normal or grounded circuit
7	Mechanical system not responding properly
8	Abnormal frequency, pulse width, or period
9	Abnormal update rate
10	Abnormal rate of change
11	Failure mode not identifiable
12	Bad intelligent device or component
13	Out of Calibration
14	Special Instructions
15	Reserved for future assignment by the SAE Data Format Subcommittee

APPENDIX A
PARAMETER DEFINITIONS

A.O Request Parameter—Used to request parameter data transmission from other components on the data link.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
0	a

a - Parameter ID of the requested parameter

Any and all components measuring or calculating the specified parameter should transmit it if possible.

A.1 Invalid data parameter—Used to notify other components on the data link that invalid data has been detected in a parameter that is normally available and will not be transmitted.

The SAE Truck and Bus Data Format Subcommittee established PIDs 194 to 196 in May 1988; therefore, this Parameter ID should no longer be used by manufacturers in the design of new components. However, this parameter is being reserved for use by manufacturers who have developed systems prior to January 1989 and are, therefore, unable to accommodate the new diagnostic formats as defined in PIDs 194 to 196. It is recommended that manufacturers using this parameter fully define the contents and circumstances under which it is used in the application document.

A.2 Transmitter System Status—Used to notify other components on the data link of the present status of the transmitting electronic component.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
2	a

a - Status code defined by the component manufacturer in an application document.

The SAE Truck and Bus Data Format Subcommittee established PIDs 194 to 196 in May 1988; therefore, this Parameter ID should no longer be used by manufacturers in the design of new components. However, this parameter is being reserved for use by manufacturers who have developed systems prior to January 1989 and are, therefore, unable to accommodate the new diagnostic formats as defined in PIDs 194 to 196. It is recommended that manufacturers using this parameter fully define the contents and circumstances under which it is used in the application document.

A.3 Transmitter System Diagnostic—Used to notify other components on the data link of the diagnostic condition of the transmitting electronic component.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
3	a

a - Status code defined by the component manufacturer in an application document.

The SAE Truck and Bus Data Format Subcommittee established PIDs 194 to 196 in May 1988, therefore, this Parameter ID should no longer be used by manufacturers in the design of new components. However, this parameter is being reserved for use by manufacturers who have developed systems prior to January 1989 and are therefore unable to accommodate the new diagnostic formats as defined in PIDs 194 to 196. It is recommended that manufacturers using this parameter fully define the contents and circumstances under which it is used in the application document.

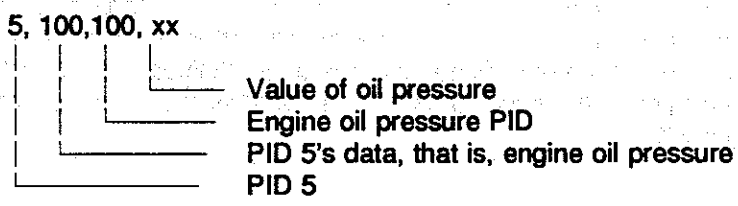
A.4 Reserved—To be assigned

A.5 Under Range Warning Condition—Used to notify other components on the data link that the transmitter's internal monitoring process has declared the data transmitted by this PID is below or less than the acceptable operating level.

Parameter Data Length: 1 character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum range: 0 to 255
Transmission Update Period: Transmitted as frequently as, and immediately prior to, the offending PID
Message Priority: Parameter specific
Format:

PID	Data
5	a - Where a is the value of the offending PID

a. Example—The Monitoring device (perhaps the engine controller) determines oil pressure is below acceptable operating range. The portion of the transmitted message would read:

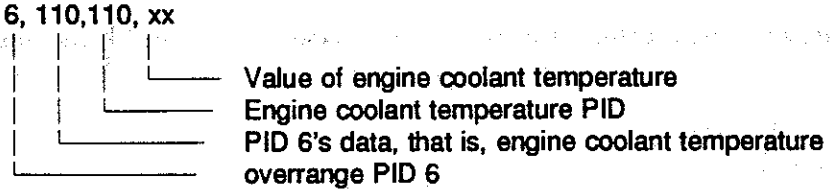


The SAE Truck and Bus Data Format Subcommittee established PIDs 194 to 196 in May 1988, therefore, this Parameter ID should no longer be used by manufacturers in the design of new components. However, this parameter is being reserved for use by manufacturers who have developed systems prior to January 1989 and are, therefore, unable to accommodate the new diagnostic formats as defined in PIDs 194 to 196. It is recommended that manufacturers using this parameter fully define the contents and circumstances under which it is used in the application document.

A.6 PID Over Range Warning Condition—Used to notify other components on the data link that the transmitter's internal monitoring process has declared the data transmitted by this PID is above or greater than the acceptable operating level.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum range: 0 to 255
Transmission Update Period: Transmitted as frequently as, and immediately prior to, the offending PID.

a. Example: The monitoring device (perhaps the engine controller) determines coolant temperature is above the acceptable operating range. The portion of the transmitted message would read:



The SAE Truck and Bus Data Format Subcommittee established PIDs 194 to 196 in May 1988, therefore, this Parameter ID should no longer be used by manufacturers in the design of new components. However, this parameter is being reserved for use by manufacturers who have developed systems prior to January 1989 and are, therefore, unable to accommodate the new diagnostic formats as defined in PIDs 194 to 196. It is recommended that manufacturers using this parameter fully define the contents and circumstances under which it is used in the application document.

A.7 to A.50 Reserved—To be assigned

A.51 Throttle Position—The position of the valve used to regulate the supply of a fluid, usually air or fuel/air mixture, to an engine. 0% represents no supply and 100% is full supply.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.4%
Maximum Range: 0.0 to 102.0%
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
51	a

a - Throttle position

A.52 ***Engine Intercooler Temperature***—The temperature of liquid found in the engine intercooler, located after the turbocharger.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.0 °F
Maximum Range: 0.0 to 255.0 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
52	a

a - Engine intercooler temperature

A.53 ***Transmission Synchronizer Clutch Value***—The current modulation value for the air supply to the synchronizer clutch.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.4%
Maximum Range: 0.0 to 102.0%
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
53	a

a - Transmission synchronizer clutch value

A.54 ***Transmission Synchronizer Brake Value***—The current modulation value for the air supply to the synchronizer brake.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.4%
Maximum Range: 0.0 to 102.0%
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
54	a

a - Transmission synchronizer brake value

A.55 ***Shift Finger Positional Status***—Identifies the current status of the switches that represent the position of the shift finger.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
55	a

a - Shift finger positional status
Bits 8-7: Reserved - both bits set to 1
Bits 6-5: Center rail sense
Bits 4-3: Fore/aft sense
Bits 2-1: Neutral sense

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.56 ***Transmission Range Switch Status***—Identifies the current status of the switches that represent range position.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
56	a

a - Transmission range switch status
Bits 8-5: Reserved - all bits set to 1
Bits 4-3: Low range sense
Bits 2-1: High range sense

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.57 ***Transmission Actuator Status #2***—Identifies the current status of the actuators that control the clutch, the engine defuel mechanism, and the inertia brake.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
57	a

a - Transmission actuator status #2
- Bits 8-7: Inertia brake actuator status
- Bits 6-5: Defuel actuator status
- Bits 4-3: Lockup clutch actuator status
- Bits 2-1: Clutch actuator status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.58 ***Shift Finger Actuator Status***—Identifies the current status of the actuators that move the shift finger.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
58	a

a - Shift finger actuator status
Bits 8-7: Gear actuator #2 status
Bits 6-5: Rail actuator #2 status
Bits 4-3: Gear actuator #1 status
Bits 2-1: Rail actuator #1 status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.59 ***Shift Finger Gear Position***—The current position of the shift finger in the gear direction.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.4%
Maximum Range: 0.0 to 102.0%
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
59	a

a - Shift finger gear position

A.60 ***Shift Finger Rail Position***—The current position of the shift finger in the rail direction.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.4%
Maximum Range: 0.0 to 102.0%
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
60	a

a - Shift finger rail position

A.61 ***Parking Brake Actuator Status***—Identifies the current status of the actuators that control the parking brakes.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
61	a

a - Parking brake actuator status
Bits 8-5: Reserved - all bits set to 1
Bits 4-3: Parking brake off actuator status
Bits 2-1: Parking brake on actuator status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.62 ***Retarder Inhibit Status***—Identifies the current state of the device that inhibits use of the engine retarder.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
62	a

a - Retarder inhibit status
Bits 8-3: Reserved - all bits set to 1
Bits 2-1: Retarder inhibit status

Note: Each status will be described using the following nomenclature:

00	Off (Retarder inhibit not active)
01	On (Retarder inhibit is active)
10	Error condition
11	Not available

A.63 ***Transmission Actuator Status #1***—Identifies the current status of the actuators used to control the functions of the auxiliary unit.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
63	a

a - Transmission actuator status #1
- Bits 8-7: Splitter indirect actuator status
- Bits 6-5: Splitter direct actuator status
- Bits 4-3: Range low actuator status
- Bits 2-1: Range high actuator status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.64 ***Direction Switch Status***—Identifies the current state of the switches that indicate the direction of the transmission.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
64	a

a - Direction switch status
- Bits 8-7: Reserved - both bits set to 1
- Bits 6-5: Forward switch status
- Bits 4-3: Neutral switch status
- Bits 2-1: Reverse switch status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.65 ***Service Brake Switch Status***—Identifies the current state of the switch that indicates the status of the service brakes.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
65	a

a - Service brake switch status
Bits 8-3: Reserved - all bits set to 1
Bits 2-1: Service brake switch status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.66 ***Vehicle Enabling Component Status***—Identifies the current state of the components that enable the vehicle to start and operate properly.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
66	a

a - Vehicle enabling component status
Bits 8-7: Reserved - both bits set to 1
Bits 6-5: Power connect device status
Bits 4-3: Start enable device status
Bits 2-1: Ignition switch status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.67 ***Shift Request Switch Status***—Identifies the current state of the switches used to request an upshift or downshift.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
67	a

a - Vehicle enabling component status
Bits 8-5: Reserved - all bits set to 1
Bits 4-3: Downshift switch status
Bits 2-1: Upshift switch status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.68 ***Torque Limiting Factor***—Ratio of current output torque allowed (due to adverse operating conditions) to the maximum torque available at the current engine speed (under normal operating conditions).

$$\text{Torque Limiting Factor} = 100 \times \frac{\text{Allowed Max. Torque at current engine speed}}{\text{Max. Torque Available at current engine speed}} \qquad \text{(Eq. A1)}$$

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
68	a

a - Torque Limiting Factor

A.69 ***Two Speed Axle Switch Status***—Identifies the commanded range for a two speed axle.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s
Message Priority: 6
Format:

PID	Data
69	a

a - Two speed axle switch status
Bit 8: 0=high range is commanded
1=low range is commanded
Bits 7-1: Undefined

A.70 ***Parking Brake Switch Status***—Identifies the state (active/inactive) of the parking brake switch.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
70	a

a - Parking brake switch status
Bit 8: 1=active / 0=inactive
Bits 7-1: Undefined

A.71 ***Idle Shutdown Timer Status***—State of the idle shutdown timer system (active, not active) for the various modes of operation.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
71	a

a - Idle shutdown timer status

Bit 8:	Idle shutdown timer status	1=active / 0=inactive
Bits 7-5:	Undefined	
Bit 4:	Idle shutdown timer function	1=enabled in calibration 0=disabled in calibration
Bit 3:	Idle shutdown timer override	1=active / 0=inactive
Bit 2:	Engine has shutdown by idle timer	1=yes / 0=no
Bit 1:	Driver alert mode	1=active / 0=inactive

A.72 ***Blower Bypass Valve Position***—Relative position of the blower bypass valve.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.4%
Maximum Range: 0.0 to 102.0%
Transmission Update Period: 0.5 s
Message Priority: 3
Format:

PID	Data
72	a

a - Blower bypass valve position

A.73 ***Auxiliary Water Pump Pressure***—Gage pressure of auxiliary water pump driven as a PTO device.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 13.8 kPa (2 lbf/in^2)
Maximum Range: 0.0 to 3516 kPa (0.0 to 510 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

D	Data
73	a

a - Auxiliary water pump pressure

A.74 ***Maximum Road Speed Limit***—Maximum vehicle velocity allowed.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5 mph (0.805 km/h)
Maximum Range: 0.0 to 205.2 km/h (0.0 to 127.5 mph)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
74	a

a - Maximum road speed limit

A.75 ***Steering Axle Temperature***—Temperature of lubricant in steering axle.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.2 °F
Maximum Range: 0.0 to 306.0 °F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
75	a

a - Steering axle temperature

A.76 ***Axle Lift Air Pressure***—Gage pressure of air in system that utilizes compressed air to provide force between axle and frame.

Parameter Data Length: 1 Character
Data Type: Unsigned short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in^2)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
76	a

a - Axle lift air pressure

A.77 ***Forward Rear Drive Axle Temperature***—Temperature of axle lubricant in forward rear drive axle.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.2 °F
Maximum Range: 0.0 to 306.0°F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
77	a

a - Forward rear drive axle temperature

A.78 ***Rear Rear Drive Axle Temperature***—Temperature of axle lubricant in rear rear drive axle.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.2 °F
Maximum Range: 0.0 to 306.0 °F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
78	a

a - Rear rear drive axle temperature

A.79 ***Road Surface Temperature***—Indicated temperature of road surface over which vehicle is operating.

Parameter Data Length: 1 Character
Data Type: Signed Short Integer
Bit Resolution: 2.5 °F
Maximum Range: -320.0 to +317.5 °F
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
79	a

a - Road surface temperature

A.80 ***Washer Fluid Level***—Ratio of volume of liquid to total container volume of fluid reservoir in windshield wash system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
80	a

a - Washer fluid level

A.81 ***Particulate Trap Inlet Pressure***—Exhaust back pressure as a result of particle accumulation on filter media placed in the exhaust stream.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.169 kPa (0.05 in Hg)
Maximum Range: 0.0 to 43.1 kPa (0.0 to 12.75 in Hg)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
81	a

a - Particulate trap inlet pressure

A.82 ***Air Start Pressure***—Gage pressure of air in an engine starting system that utilizes compressed air to provide the force required to rotate the crankshaft.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in^2)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153 lbf/in^2)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
82	a

a - Air start pressure

A.83 ***Road Speed Limit Status***—State (active or not active) of the system used to limit maximum vehicle velocity.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
83	a

a - Road speed limit status
Bit 8: 1=active / 0=not active
Bits 7-1: Undefined

A.84 ***Road Speed***—Indicated vehicle velocity.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.805 km/h (0.5 mph)
Maximum Range: 0.0 to 205.2 km/h (0.0 to 127.5 mph)
Transmission Update Period: 0.1 s
Message Priority: 1
Format:

PID	Data
84	a

a - Road speed

A.85 ***Cruise Control Status***—State of the vehicle velocity control system (active, not active), and system switch (on, off), for various system operating modes.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
85	a

a - Cruise control status

Bit 8:	cruise mode	1=active / 0=not active
Bit 7:	clutch switch	1=on / 0=off
Bit 6:	brake switch	1=on / 0=off
Bit 5:	accel switch	1=on / 0=off
Bit 4:	resume switch	1=on / 0=off
Bit 3:	coast switch	1=on / 0=off
Bit 2:	set switch	1=on / 0=off
Bit 1:	cruise control switch	1=on / 0=off

A.86 ***Cruise Control Set Speed***—Value of set (chosen) velocity of velocity control system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.805 km/h (0.5 mph)
Maximum Range: 0.0 to 205.2 km/h (0.0 to 127.5 mph)
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
86	a

a - Cruise control set speed

A.87 ***Cruise Control High Set Limit Speed***—Maximum vehicle velocity allowed at any cruise control set speed.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.805 km/h (0.5 mph)
Maximum Range: 0.0 to 205.2 km/h (0.0 to 127.5 mph)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
87	a

a - Cruise control high set limit speed

A.88 ***Cruise Control Low Set Limit Speed***—Minimum vehicle velocity allowed by cruise control before a speed adjustment is called for.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.805 km/h (0.5 mph)
Maximum Range: 0.0 to 205.2 km/h (0.0 to 127.5 mph)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
88	a

a - Cruise control low set limit speed

A.89 ***Power Takeoff Status***—State of the system used to transmit engine power to auxiliary equipment. Status indication is for system (active, not active), and system switch (on, off), for various operating modes.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data	
89	a	
a -	Power takeoff status	
	Bit 8: PTO mode	1=active / 0=not active
	Bit 7: clutch switch	1=on / 0=off
	Bit 6: brake switch	1=on / 0=off
	Bit 5: accel switch	1=on / 0=off
	Bit 4: resume switch	1=on / 0=off
	Bit 3: coast switch	1=on / 0=off
	Bit 2: set switch	1=on / 0=off
	Bit 1: PTO control switch	1=on / 0=off

A.90 ***Power Takeoff Oil Temperature***—Temperature of lubricant in device used to transmit engine power to auxiliary equipment.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.2 °F
Maximum Range: 0.0 to 306.0 °F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
90	a
a -	Power takeoff oil temperature

A.91 ***Percent Accelerator Pedal Position***—Ratio of actual accelerator pedal position to maximum pedal position.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.4%
Maximum Range: 0.0 to 102.0%
Transmission Update Period: 0.1 S
Message Priority: 3
Format:

PID	Data
91	a
a -	Percent accelerator pedal position

A.92 ***Percent Engine Load***—Ratio of current output torque to maximum torque available at the current engine speed.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 0.1 s
Message Priority: 3
Format:

PID	Data
92	a

a - Percent engine load

A.93 ***Output Torque***—Amount of torque available at the engine flywheel.

Parameter Data Length: 1 Character
Data Type: Signed short Integer
Bit Resolution: 27.1 Nm (20 lbf ft)
Maximum Range: -3471 to +3444 Nm (-2560 to +2540 lbf ft)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
93	a

a - Output torque

A.94 ***Fuel Delivery Pressure***—Gage pressure of fuel in system as delivered from supply pump to the injection pump.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 3.45 kPa (0.5 lbf/in^2)
Maximum Range: 0.0 to 879.0 kPa (0.0 to 127.5 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
94	a

a - Fuel delivery pressure

A.95 ***Fuel Filter Differential Pressure***—Change in fuel delivery pressure, measured after the filter, due to accumulation of solid or semisolid matter on the filter element.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.724 kPa (0.25 lbf/in^2)
Maximum Range: 0.0 to 439.5 kPa (0.0 to 63.75 lbf/in^2)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
95	a

a - Fuel filter differential pressure

A.96 ***Fuel Level***—Ratio of volume of fuel to the total volume of fuel storage container.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
96	a

a - Fuel level

A.97 ***Water in Fuel Indicator***—Indication (yes/no) of presence of unacceptable amount of water in fuel system.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
97	a

a - Water in fuel indicator
Bit 8: 1=yes / 0=no
Bits 7-1: Undefined

A.98 ***Engine Oil Level*** —Ratio of current volume of engine sump oil to maximum required volume.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
98	a

a - Engine oil level

A.99 ***Engine Oil Filter Differential Pressure***—Change in engine oil pressure, measured after filter, due to accumulation of solid or semisolid material on or in the filter.

Parameter Data Length: 1 Character
Data Type: Unsigned short Integer
Bit Resolution: 0.431 kPa (0.0625 lbf/in^2)
Maximum Range: 0.0 to 109.9 kPa (0.0 to 15.9375 lbf/in^2)
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
99	a

a - Oil filter differential pressure

A.100 ***Engine Oil Pressure***—Gage pressure of oil in engine lubrication system as provided by oil pump.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 3.45 kPa (0.5 lbf/in^2)
Maximum Range: 0.0 to 879.0 kPa (0.0 to 127.5 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 2
Format:

PID	Data
100	a

a - Engine oil pressure

A.101 ***Crankcase Pressure***—Gage air pressure inside engine crankcase.

Parameter Data Length: 1 Character
Data Type: Signed Short Integer
Bit Resolution: 0.862 kPa (0.125 lbf/in^2)
Maximum Range: -110.0 to +109.5 kPa (-16.00 to +15.875 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
101	a

a - Crankcase pressure

A.102 ***Boost Pressure***—Gage pressure of air measured downstream on the compressor discharge side of the turbocharger.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.862 kPa (0.125 lbf/in^2)
Maximum Range: 0.0 to 219.8 kPa (0.0 to 31.875 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
102	a

a - Boost pressure

A.103 ***Turbo Speed***—Rotational velocity of rotor in turbocharger.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 500 rpm
Maximum Range: 0 to 127 500 rpm
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
103	a

a - Turbo speed

A.104 Turbo Oil Pressure—Gage pressure of oil in turbocharger lubrication system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in^2)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
104	a

a - Turbo oil pressure

A.105 Intake Manifold Temperature—Temperature of precombustion air found in intake manifold of engine air supply system.

Parameter Data Length: 1 Character
Data Type: Unsigned short Integer
Bit Resolution: 1.0°F
Maximum Range: 0.0 to 255.0 °F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
105	a

a - Intake manifold temperature

A.106 Air Inlet Pressure—Absolute air pressure at inlet to intake manifold or air box.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.724 kPa (0.25 lbf/in^2)
Maximum Range: 0.0 to 439.5 kPa (0.0 to 63.75 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
106	a

a - Air inlet pressure

A.107 ***Air Filter Differential Pressure***—Change in engine air system pressure, measured after the filter, due to accumulation of solid foreign matter on or in the filter.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.0498 kPa (0.2 in H_2O)
Maximum Range: 0.0 to 12.7 kPa (0.0 to 51.0 in H_2O)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
107	a

a - Air filter differential pressure

A.108 ***Barometric Pressure***—Absolute air pressure of the atmosphere.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.431 kPa (0.0625 lbf/in^2)
Maximum Range: 0.0 to 109.9 kPa (0.0 to 15.9375 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
108	a

a - Barometric pressure

A.109 ***Coolant Pressure***—The gage pressure of liquid found in engine cooling system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.862 kPa (0.125 lbf/in^2)
Maximum Range: 0.0 to 219.8 kPa (0.0 to 31.875 lbf/in^2)
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
109	a

a - Coolant pressure

A.110 ***Engine Coolant Temperature***—The temperature of liquid found in engine cooling system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.0 °F
Maximum Range: 0.0 to 255.0 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
110	a

a - Engine coolant temperature

A.111 ***Coolant Level***—Ratio of volume of liquid found in engine cooling system to total cooling system volume.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
111	a

a - Coolant level

A.112 ***Coolant Filter Differential Pressure***—Change in coolant pressure, measured after the filter, due to accumulation of solid or semisolid matter on or in the filter.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.431 kPa (0.0625 lbf/in^2)
Maximum Range: 0.0 to 109.9 kPa (0.0 to 15.9375 lbf/in^2)
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
112	a

a - Coolant filter differential pressure

A.113 ***Governor Droop***—The difference between full load rated engine speed and maximum no-load governed engine speed.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 2.0 rpm
Maximum Range: 0.0 to 510.0 rpm
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
113	a

a - Governor droop

A.114 ***Net Battery Current***—Net flow of electrical current into/out of the battery or batteries.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.2 A
Maximum Range: -153.6 to +152.0 A
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
114	a

a - Net battery current

A.115 ***Alternator Current***—Measure of electrical flow from the alternator.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.2 A
Maximum Range: 0.0 to 306 A
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
115	a

a - Alternator current

A.116 ***Brake Application Pressure***—Gage pressure of compressed air or fluid in vehicle braking system measured at the brake chamber when brake shoe (or pad) is placed against brake drum (or disc).

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in ^{2})
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in^2)
Transmission Update Period: 0.2 s
Message Priority: 1
Format:

PID	Data
116	a

a - Brake application pressure

A.117 ***Brake Primary Pressure***—Gage pressure of air in the primary, or supply side, of the air brake system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in^2)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 1
Format:

PID	Data
117	a

a - Brake primary pressure

A.118 ***Brake Secondary Pressure***—Gage pressure of air in the secondary, or service side, of the air brake system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in^2)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 1
Format:

PID	Data
118	a

a - Brake secondary pressure

A.119 ***Hydraulic Retarder Pressure***—Gage pressure of oil in hydraulic retarder system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in^2)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
119	a

a - Hydraulic retarder pressure

A.120 ***Hydraulic Retarder Oil Temperature*** -

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 2 °F
Maximum Range: 0.0 to 510°F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
120	a

a - Hydraulic retarder oil temperature

A.121 ***Engine Retarder Status***—State of device used to convert engine power to vehicle retarding (stopping) force.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
121	a

a - Engine retarder status
- Bit 8: 1=on / 0=off
- Bit 7: undefined
- Bit 6: undefined
- Bit 5: 1=8 cylinder active / 0=8 cylinder not active
- Bit 4: 1=6 cylinder active / 0=6 cylinder not active
- Bit 3: 1=4 cylinder active / 0=4 cylinder not active
- Bit 2: 1=3 cylinder active / 0=3 cylinder not active
- Bit 1: 1=2 cylinder active / 0=2 cylinder not active

A.122 ***Engine Retarder Percent***—Ratio of current engine retard force to maximum retard force available.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
122	a

a - Engine retarder percent

A.123 ***Clutch Pressure***—Gage pressure of oil within a wet clutch.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 13.8 kPa (2.0 lbf/in^2)
Maximum Range: 0.0 to 3516 kPa (0.0 to 510.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
123	a

a - Clutch pressure

A.124 ***Transmission Oil Level***—Ratio of volume of transmission sump oil to recommended volume.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5%
Maximum Range: 0.0 to 127.5%
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
124	a

a - Transmission oil level

A.125 ***Transmission Oil Level High/Low***—Amount of current volume of transmission sump oil compared to recommended volume.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.473 L (1.0 pt)
Maximum Range: -60.6 to 60.1 L (-128 to +127 pt)
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
125	a

a - Transmission oil level High/Low

A.126 ***Transmission Filter Differential Pressure***—Change in transmission fluid pressure, measured after the filter, due to accumulation of solid or semisolid material on or in the filter.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1.724 kPa (0.25 lbf/in^2)
Maximum Range: 0.0 to 439.5 kPa (0.0 to 63.75 lbf/in^2)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
126	a

a - Transmission filter differential pressure

A.127 ***Transmission Oil Pressure***—Gage pressure of lubrication fluid in transmission, measured after pump.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 13.8 kPa (2.0 lbf/in^2)
Maximum Range: 0.0 to 3516 kPa (0.0 to 510.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
127	a

a - Transmission oil pressure

A.128 Component Specific Parameter Request—Used to request parameter data transmissions from a specified component on the data link.

Parameter Data Length: 2 Characters
Data Type: Unsigned Short Integer (both characters)
Resolution: Binary (both characters)
Maximum Range: 0 to 255 (both characters)
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
128	a b

a - Parameter number of the requested parameter
b - MID of the component from which the parameter data is requested

Only the specified component should transmit the specified parameter. If the specified component is in the MID range 0 to 127, its response is not defined in this document.

A.129 to A.153 Reserved—To be assigned.

A.154 Auxiliary Input and Output Status #2—Identifies the current status of auxiliary input and output functions that are configured uniquely per application. Not to be used in place of existing PIDs.

Parameter Data Length: 2 Characters
Data Type: Binary Bit-mapped
Bit Resolution: Binary
Maximum Range: 0 to 65535
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
154	a b

a - Auxiliary input status
  Bits 8-7: Auxiliary input #8
  Bits 6-5: Auxiliary input #7
  Bits 4-3: Auxiliary input #6
  Bits 2-1: Auxiliary input #5
b - Auxiliary output status
  Bits 8-7: Auxiliary output #8
  Bits 6-5: Auxiliary output #7
  Bits 4-3: Auxiliary output #6
  Bits 2-1: Auxiliary output #5

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.155 ***Auxiliary Input and Output Status #1***—Identifies the current status of auxiliary input and output functions that are configured uniquely per application. Not to be used in place of existing PIDs.

Parameter Data Length: 2 Characters
Data Type: Binary Bit-mapped
Bit Resolution: Binary
Maximum Range: 0 to 65535
Transmission Update Period: On request
Message Priority: 8
Format:

PID Data
155 a b
a - Auxiliary input status
Bits 8-7: Auxiliary input #4
Bits 6-5: Auxiliary input #3
Bits 4-3: Auxiliary input #2
Bits 2-1: Auxiliary input #1
b - Auxiliary output status
Bits 8-7: Auxiliary output #4
Bits 6-5: Auxiliary output #3
Bits 4-3: Auxiliary output #2
Bits 2-1: Auxiliary output #1

Note: Each status will be described using the following nomenclature:

00 Off
01 On
10 Error condition
11 Not available

A.156 ***Injector Timing Rail Pressure***—The gage pressure of fuel in the timing rail as delivered from the supply pump to the injector timing inlet.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.689 kPa (0.1 lbf/in^2)
Maximum Range: 0.0 to 45 153.6 kPa (0.0 to 6553.5 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
156	a a

a a - Injector timing rail pressure

A.157 ***Injector Metering Rail Pressure***—The gage pressure of fuel in the metering rail as delivered from the supply pump to the injector metering inlet.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.689 kPa (0.1 lbf/in^2)
Maximum Range: 0.0 to 45 153.6 kPa (0.0 to 6553.5 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
157	a a

a a - Injector metering rail pressure

A.158 ***Battery Potential (Voltage) - Switched***—Electrical potential measured at the input of the electronic control unit supplied through a switching device.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.05 V
Maximum Range: 0.0 to 3276.75 V
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
158	a a

a a - Battery potential (voltage) - switched

A.159 ***Gas Supply Pressure***—Gas supply pressure (gage) to fuel metering device.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.345 kPa (0.05 lbf/in^2)
Maximum Range: 0.0 to 22 609.6 kPa (0.0 to 3276.75 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
159	a a

a a - Gas supply pressure

A.160 ***Main Shaft Speed***—Rotational velocity of the first intermediate shaft of the transmission.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: On request
Message Priority: 2
Format:

PID	Data
160	a a

a a - Main shaft speed

A.161 ***Input Shaft Speed***—Rotational velocity of the primary shaft transferring power into the transmission. When a torque converter is present, it is the output of the torque converter.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: On request
Message Priority: 2
Format:

PID	Data
161	a a

a a - Input shaft speed

A.162 ***Transmission Range Selected***—Range selected by the operator. Characters may include P, R2, R1, R, N, D, D1, D2, L, L1, L2, 1, 2, 3, ... If only one character is required, the second character shall be used and the first character shall be a space (ASCII 32).

Parameter Data Length: 2 Characters
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: 0.5 s
Message Priority: 4
Format:

PID	Data
162	a a

a a - Transmission range selected

A.163 ***Transmission Range Attained***—Range currently being commanded by the transmission control system. Characters may include P, R2, R1, R, N, D, D1, D2, L, L1, L2, 1, 2, 3, ... If only one character is required, the second character shall be used and the first character shall be a space (ASCII 32).

Parameter Data Length: 2 Characters
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: 0.5 s
Message Priority: 4
Format:

PID	Data
163	a a

a a - Transmission range attained

A.164 ***Injection Control Pressure***—The gage pressure of the hydraulic accumulator that powers fuel injection.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 1/256 MPa
Maximum Range: 0 to 255.996 MPa
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
164	a a

a a - Injection control pressure

A.165 ***Compass Bearing***—Present compass bearing of vehicle

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.01 degree
Maximum Range: 0.00 to 655.35 degree
Transmission Update Period: On request
Message Priority: 6
Format:

PID	Data
165	a a

a a - Present compass bearing

A.166 ***Rated Engine Power***—Net brake power that the engine will deliver continuously, specified for a given application at a rated speed.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.745 kW (1.0 hp)
Maximum Range: 0.0 to 48 869.4 kW (0.0 to 65 535.0 hp)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
166	a a

a a - Rated engine power

A.167 ***Alternator Potential (Voltage)***—

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.05 V
Maximum Range: 0.0 to 3276.75 V

Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
167	a a

a a - Alternator potential

A.168 Battery Potential (Voltage)—Measured electrical potential of the battery.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.05 V
Maximum Range: 0.0 to 3276.75 V
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
168	a a

a a - battery potential (voltage)

A.169 Cargo Ambient Temperature—Temperature of air inside vehicle container used to accommodate cargo.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
169	a a

a a - Cargo ambient temperature

A.170 Cab Interior Temperature—Temperature of air inside the part of the vehicle that encloses the driver and vehicle operating controls.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
170	a a

a a - Cab interior temperature

A.171 Ambient Air Temperature—Temperature of air surrounding vehicle.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
171	a a

a a - Ambient air temperature

A.172 Air Inlet Temperature—Temperature of air entering vehicle air induction system.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
172	a a

a a - Air inlet temperature

A.173 Exhaust Gas Temperature—Temperature of combustion byproducts leaving the engine.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
173	a a

a a - Exhaust gas temperature

A.174 Fuel Temperature—Temperature of fuel entering injectors.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
174	a a

a a - Fuel temperature

A.175 Engine Oil Temperature—Temperature of engine lubricant.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25°F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
175	a a

a a - Engine oil temperature

A.176 Turbo Oil Temperature—Temperature of turbocharger lubricant.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
176	a a

a a - Turbo oil temperature

A.177 Transmission Oil Temperature—Temperature of transmission lubricant.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: -8192.00 to +8191.75 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
177	a a

a a - Transmission oil temperature

A.178 ***Front Axle Weight***—Total force of gravity imposed by the front tires on the road surface.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 4.448 N (1.0 lbf)
Maximum Range: 0.0 to 291 514.2 N (0.0 to 65 535.0 lbf)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
178	a a

a a - Front axle weight

A.179 ***Rear Axle Weight***—Force of gravity imposed on the road surface by all the tires on each individual rear axle.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 4.448 N (1.0 lbf)
Maximum Range: 0.0 to 291 514.2 N (0.0 to 65 535.0 lbf)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
179	a a

a a - Rear axle weight

A.180 ***Trailer Weight***—Total force of gravity of freight-carrying vehicle designed to be pulled by truck, including the weight of the contents.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 17.792 N (4.0 lbf)
Maximum Range: 0.0 to 1 166 056.9 N (0.0 to 262 140.0 lbf)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
180	a a

a a - Trailer weight

A.181 ***Cargo Weight***—The force of gravity of freight carried.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 17.792 N (4.0 lbf)
Maximum Range: 0.0 to 1 166 056.9 N (0.0 to 262 140.0 lbf)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
181	a a

a a - Cargo weight

A.182 ***Trip Fuel***—Fuel consumed during all or part of a journey.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.473 L (0.125 gal)
Maximum Range: 0.0 to 31 009.6 L (0.0 to 8191.875 gal)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
182	a a

a a - Trip fuel

A.183 ***Fuel Rate***—Amount of fuel consumed by engine per unit of time.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 16.428×10^{-5} L/s (4.34×10^{-6} gal/s)
Maximum Range: 0.0 to 1.076 65 L/s (0.0 to 0.284 421 90 gal/s)
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
183	a a

a a - Fuel rate

A.184 ***Instantaneous Fuel Economy***—Current fuel economy at current vehicle velocity.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: $1.660\ 72 \times 10^{-3}$ km/L (1/256 mpg)
Maximum Range: 0.0 to 108.835 km/L (0.0 to 255.996 mpg)
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
184	a a

a a - Instantaneous fuel economy

A.185 ***Average Fuel Economy***—Average of instantaneous fuel economy for that segment of vehicle operation of interest.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: $1.660\ 72 \times 10^{-3}$ km/L (1/256 mpg)
Maximum Range: 108.835 km/L (0.0 to 255.996 mpg)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
185	a a

a a - Average fuel economy

A.186 ***Power Takeoff Speed***—Rotational velocity of device used to transmit engine power to auxiliary equipment.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: 0.1 s
Message Priority: 2
Format:

PID	Data
186	a a

a a - Power takeoff speed

A.187 ***Power Takeoff Set Speed***—Rotational velocity selected by operator for device used to transmit engine power to auxiliary equipment.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
187	a a

a a - Power takeoff set speed

A.188 ***Idle Engine Speed***—Minimum nontransient rotational velocity of crankshaft while engine is supplying power to itself and its attendant support systems.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
188	a a

a a - Idle engine speed

A.189 ***Rated Engine Speed***—The maximum governed rotational velocity of the engine crankshaft under full load conditions.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
189	a a

a a - Rated engine speed

A.190 ***Engine Speed***—Rotational velocity of crankshaft.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: 0.1 s
Message Priority: 1
Format:

PID	Data
190	a a

a a - Engine speed

A.191 ***Transmission Output Shaft Speed***—Rotational velocity of shaft transferring force from transmission to driveshaft.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0.0 to 16383.75 rpm
Transmission Update Period: 0.1 s
Message Priority: 2
Format:

PID	Data
191	a a

a a - Transmission output shaft speed

A.192 Multisection Parameter—Used to transmit parameters that are longer than what is limited by SAE J1708. A specified parameter can be broken into sections with each section being transmitted in a different message.

Parameter Data Length: Variable
Data Type: Defined by specified sectioned parameter
Resolution: Defined by specified sectioned parameter
Maximum Range: Defined by specified sectioned parameter
Transmission Update Period: Defined by specified sectioned parameter
Message Priority: Parameter specific
Format:

PID	Data
192	n, a, b, c/d, c, c, c, c, c, c, c

(R)

- n - Byte count of data that follows this character. This excludes characters MID, PID 192, and n, but it includes a, b, c, or d type characters.
- a - PID from page 1 (PIDs 0 to 254) specifying the parameter that has been selected.
- b - The last section number (total number of sections minus ONE) and the current section number. The upper nibble contains the last section number (1 to 15). The lower nibble contains the current section number and is limited to the range 0 to 15. Section numbers are assigned in ascending order.
- c - Data portion of sectioned parameters. May be 1 to 14 characters in the first packet. May be 1 to 15 characters in the middle and ending packets.
- d - Byte count of the total data portion. This character is sent only in the first packet. The values are limited to 239 or less but must be greater than 17.

Application Notes -

1. Single sections of data are not allowed to be sent alone. Message packets must be sent in sequence from the transmitting device.

2. Receiver devices should have the capacity to receive concurrent PID 192 type messages from different transmitters.

3. Caution must be taken in interpreting data. The value of a parameter with multiple sections may have been updated during the time between which the packets are sent.

4. Other PID's and associated parameters can be incorporated in the message packet if character count limitations are not violated.

A.193 ***Transmitter System Diagnostic Table***—Used to notify other components on the data link of the diagnostic condition of the transmitting electronic component. The parameter contains a list of diagnostic codes.

Parameter Data Length: Variable
Data Type: Defined by manufacturer application document
Resolution: Defined by manufacturer application document
Maximum Range: Defined by manufacturer application document
Transmission Update Period: Defined in application document
Message Priority: 8
Format:

PID	Data
193	n a a a a a a a a

n - Byte count of data that follows this character
a - Diagnostic codes defined by the component manufacturer in an application document.

The SAE Truck and Bus Data Format Subcommittee established PIDs 194 to 196 in May 1988; therefore, this Parameter ID should no longer be used by manufacturers in the design of new components. However, this parameter is being reserved for use by manufacturers who have developed systems prior to January 1989 and are, therefore, unable to accommodate the new diagnostic formats as defined in PIDs 194 to 196. It is recommended that manufacturers using this parameter fully define the contents and circumstances under which it is used in the application document.

A.194 ***Transmitter System Diagnostic Code and Occurrence Count Table***—Used to notify other components on the data link of the diagnostic condition of the transmitting electronic component. The parameter contains a list of diagnostic codes and occurrence counts.

Parameter Data Length: Variable
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: The diagnostic code is transmitted once whenever the fault becomes active and once whenever the fault becomes inactive but never more than once per second. All diagnostic codes are also available on request. All active diagnostic codes are retransmitted at a rate greater than or equal to the refresh rate of the associated PID but not greater than once per second. Active diagnostic codes for on-request PIDs and SIDs are transmitted at a rate of once every 15 s.
Message Priority: 8
Format:

PID	Data
194	n a b c a b c a b c a b c a b c a b c . . .

n - Byte count of data that follows this character. This excludes characters MID, PID 194, and n but includes a, b and c type characters.
a - SID or PID of a standard diagnostic code.
b - Diagnostic code character.
- Bit 8: Occurrence Count included
  - 1=count is included
  - 0=count not included
- Bit 7: Current Status of fault
  - 1=fault is inactive
  - 0=fault is active
- Bit 6: Type of diagnostic code
  - 1=standard diagnostic code
  - 0=expansion diagnostic code PID (PID from page 2)
- Bit 5: Low character identifier for a standard diagnostic code
  - 1=low character is subsystem identifier (SID)
  - 0=low character is parameter identifier (PID)
- Bits 4-1: Failure mode identifier (FMI) of a standard diagnostic code

c - Occurrence count for the diagnostic code defined by the preceding 2 characters. The count is optional and bit 8 of the first character of the diagnostic code is used to determine if it is included.

Using the MID, FMI, and PID or SID associated with a diagnostic code, the control system which has the fault, which subsystem of the control system is failing, and how the subsystem is failing can be determined. The text used in J1587 to describe the FMIs and SIDs should be used whenever a standard diagnostic code is being described. The use of common descriptions for the FMIs and SIDs is needed to allow the diagnostic codes to be interpreted consistently. The subsystem identification assignment list is shown in Table 3. The failure mode identifier assignment list is shown in Table 4.

A.194 (continued)

1. If the diagnostic code PID is requested and there are no diagnostic codes, the response would be a PID 194 with the n set to 0.

2. If the length of the message would exceed the maximum message length allowable, PID 192 would be used and the data would be sent in a multisection transmission.

(R) 3. When the zero state of bit 6 of character b is used, the PID identified in character a is from page 2 (PIDs 256 to 511). The value 256 should be added to the data in character a to determine the PID value. This state does not apply to SIDs.

4. In the event the data is valid but detected to be above or below normal operating range, for example, the case of low oil pressure, the PID and its data will continue to be broadcast. In addition, a PID 194 with the offending PID will be broadcast per the above.

   Example—Normal broadcast of engine speed (PID 190) and oil pressure (PID 100) prior to low oil pressure detection

MID	PID	DATA	DATA	PID	DATA	CKSM	
128	190	32	28	100	70	220	Decimal
80	be	20	1c	64	46	dc	Hexadecimal

   Diagnostic broadcast, Oil pressure sensor data valid but below normal range

MID	PID	DATA	DATA	DATA	CKSM	
128	194	02	100	33	55	Decimal
80	c2	02	64	21	37	Hexadecimal

   Bit 8 count not included
   Bit 7 fault active
   Bit 6 standard diagnostic code
   Bit 5 indicates PID
   Bits 4-1 indicate FMI 01

   PID for oil pressure

   Number of bytes which follow not including checksum.

   Next scheduled broadcast of engine speed (PID 190) and oil pressure (PID 100). Note that oil pressure continues to be broadcast.

MID	PID	DATA	DATA	PID	DATA	CKSM	
128	190	32	28	100	20	14	Decimal
80	be	20	1c	64	14	0e	Hexadecimal

A.194 (continued)

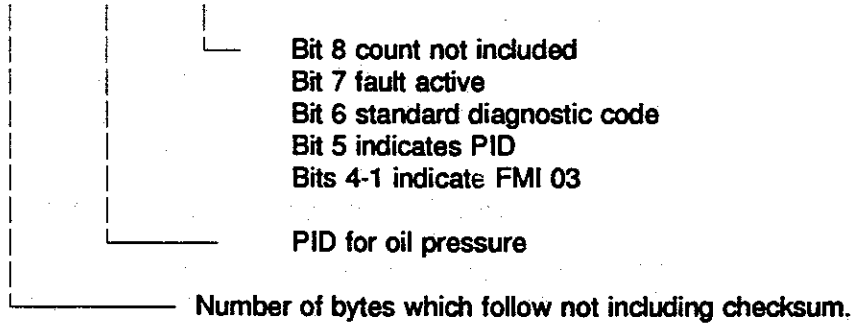
5. In the event the data is invalid, for example, the case of a shorted sensor, the PID at fault will not be broadcast. However, a PID 194 with the offending PID will be broadcast per the above.

   Example—Normal broadcast of engine speed (PID 190) and oil pressure (PID 100) prior to oil pressure sensor failure.

MID	PID	DATA	DATA	PID	DATA	CKSM	
128	190	32	28	100	70	220	Decimal
80	be	20	1c	64	46	dc	Hexadecimal

   Diagnostic broadcast, Oil pressure sensor shorted high

MID	PID	DATA	DATA	DATA	CKSM	
128	194	02	100	35	53	Decimal
80	c2	02	64	23	35	Hexadecimal



   Next scheduled broadcast of engine speed (PID 190). Oil pressure (PID 100) is not broadcast due to a failed sensor.

MID	PID	DATA	DATA	CKSM	
128	190	32	28	134	Decimal
80	be	20	1c	86	Hexadecimal

A.195 ***Diagnostic Data Request/Clear Count***—Used to request additional information about a given diagnostic code or clear its count.

Parameter Data Length: 3 Characters
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
195	n a b c

n - Number of parameter data characters = 3
a - MID of device to which request is directed.
b - SID or PID of a standard diagnostic code.
c - Diagnostic code character

Bits 8-7:
(00) - Request an ASCII descriptive message for the given SID or PID
(01) - Request count be cleared for the given diagnostic code on the device with the given MID.
(10) - Request counts be cleared for all diagnostic codes on the device with the given MID. The diagnostic code given in this transmission is ignored.
(11) - Request additional diagnostic information for the given diagnostic code, the content of which is defined in a manufacturer's application document.

Bit 6: Type of diagnostic code
1=standard diagnostic code
0=expansion diagnostic code PID (PID from page 2)

(R)

Bit 5: Low character identifier for a standard diagnostic code
1=low character is subsystem identifier (SID)
0=low character is parameter identifier (PID)

Bits 4-1: Failure mode identifier (FMI) of a standard diagnostic code

A.196 Diagnostic Data/Count Clear Response—Used to acknowledge the clearing of diagnostic codes or supply additional information about a diagnostic code as requested by PID 195.

Parameter Data Length: Variable
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
196	n a b c c c c c c c c c c c . . . .

n - Byte count of data that follows this character. This excludes characters MID, PID 196, and n, but includes a, b, c type characters.

a - SID or PID of a standard diagnostic code.

b - Diagnostic code character

Bits 8-7: (00) - Message is an ASCII descriptive message for the given SID or PID.
(01) - The count has been cleared for the given diagnostic code.
(10) - All clearable diagnostic counts have been cleared for this device.
(11) - Message is additional diagnostic information for the given diagnostic code, the content of which is defined in a manufacturer's application document.

Bit 6: Type of diagnostic code
1=standard diagnostic code
0=expansion diagnostic code PID (PID from page 2)

(R)

Bit 5: Low character identifier for a standard diagnostic code
1=low character is subsystem identifier (SID)
0=low character is parameter identifier (PID)

Bits 4-1: Failure mode identifier (FMI) of a standard diagnostic code.

c - If bits 7 and 8 of character b are (00), the data in field C are an ASCII string, which describes the given SID or PID. If bits 7 and 8 of character b are (11), the data in field C are defined by the manufacturer's application document with the exception that the first five characters of the data define the make of the component, which is responding. The five characters defining the make correspond to the codes defined in the American Trucking Association Vehicle Maintenance Reporting Standard (ATA/VMRS). It is suggested that spaces (ASCII 32) are used to fill the remaining characters if the ATA/VMRS make code is less than five characters in length. Data type c would be omitted if bits 7 and 8 of character b are either (01) or (10) or if no data of the type requested is available.

Application Note—If the length of the message would exceed the maximum message length allowable, PID 192 would be used and the data would be sent in a multisection transmission.

(R) ***A.197 Communication Management***—See Appendix B.

(R) ***A.198 Connection Mode Data Transfer***—See Appendix B.

A.199 Traction Control Disable State—Used to request the traction control unit to temporarily disable the traction control function during vehicle testing.

Parameter Data Length: Variable
Data Type: Character 1 = Binary Bit-Mapped
Characters 2-x = Alphanumeric
Resolution: Character 1 = Binary
Characters 2-x = ASCII
Maximum Range: Character 1 = Binary
Characters 2-x = 0 to 255 (each character)
Transmission Update Period: 1 s (after initial request) or on request
Message Priority: 8
Format:

PID	Data
199	n a b b b . . .

n - Byte count of data that follows this character
a - Traction control disable state character
Bits 8-7: Request/response
(00) - Indicates that the message is a request directed to the traction control unit.
(01) - Indicates that the message is a response from the traction control unit.
(10) - Error
(11) - Not available
Bit 6-4: Traction Control Active/Passive
(000)- Traction control function passive
(001)- Traction control differential braking function active
(010)- Traction control engine control function active
(011)- Traction control differential braking and engine control functions active
(100)- Reserved
(101)- Reserved
(110)- Error
(111)- Not available
Bit 3-1: Traction Control Function Enabled/Disabled
(000)- Traction control differential braking and engine control functions disabled
(001)- Traction control differential braking enabled
Traction control engine control function disabled
(010)- Traction control differential braking disabled
Traction control engine control function enabled
(011)- Traction control differential braking and engine control functions enabled
(100)- Reserved
(101)- Reserved
(110)- Error
(111)- Not available
b - Access code. An ASCII string of 0 to 15 bytes which is selected by the manufacturer of the traction control unit to protect the traction control function from becoming disabled by accident or due to malfunction of the requesting units.

A.199 (continued)

Notes:

1. The traction control unit may have a switch that disables the engine control and/or the differential braking of the traction control function. If this switch is in the disable position, it may be impossible to enable the traction control function using this PID as this switch should have priority. Please contact the manufacturer of the traction control unit for more information.

2. When PID 199 is requested by the off-board diagnostic or test unit using PID 0 or PID 128, the response from the traction control unit may contain an access code. This access code must be used by the off-board diagnostic or test unit in the request to disable traction control. The same access code should be used throughout a session. However, the access code may change from session to session. The manufacturer of the traction control unit must ensure that the traction control function is not disabled if the access code received from the diagnostic or test unit does not match its own access code. (There is no need for the off-board unit to program, into ROM, an access code for any manufacturer of a traction control unit).

3. Test conditions: The traction control unit may disregard requests to enable or disable the traction control function when any measured wheel speed is above 0 km/h or when either or both of the traction control functions are active. If the traction control unit chooses to disregard a request, the proper response is to send NOT AVAILABLE for the request/response parameter bits.

4. Traction control function disabled time-out: After the traction control unit receives a request to disable the traction control function, the traction control unit may enable the traction control function after a time designated by the manufacturer of the traction control unit which is greater than 5 seconds. After this time, the traction control function will be allowed to revert to the normal operating mode, provided initial conditions have been met to return to normal operating mode. To ensure that the traction control function is disabled for the entire test or battery of tests, the off-board diagnostic of test units should transmit the request at an update rate of 1 second until the testing is completed.

5. Traction control function disabled indication: The traction control unit must ensure that a visual indication is present when the traction control function has been disabled.

Example —

MID 172 will be used for the off-board diagnostic unit in this example
MID 136 will be used for the traction control unit in this example.
The access code ASCII '1234' will be used in this example.

1. The off-board diagnostic unit requests the traction control disable state PID from the traction control unit.

MID	PID	DATA	CKSM	
172	0	199	141	Decimal
ac	0	c7	8d	Hexadecimal

A.199 (continued)

2. The traction control unit responds with the current traction control activity, enabled state, and access code.

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA	CKSM	
136	199	5	3	49	50	51	52	223	Decimal
88	c7	5	3	31	32	33	34	df	Hexadecimal

Bit 8,7 indicate a response (00)
Bits 6-4 indicate the traction control function is passive (000)
Bits 3-1 indicate traction control functions are enabled (011)

3. The off-board diagnostic unit request the traction control function to be disabled

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA	CKSM	
172	199	5	120	49	50	51	52	70	Decimal
ac	c7	5	78	31	32	33	34	46	Hexadecimal

Bit 8,7 indicate a request (01)
Bits 6-4 indicate information is not available (111)
Bits 3-1 request that traction control functions are to be disabled (000)

4. The traction control unit responds with the current traction control activity, enabled state and access code.

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA	CKSM	
136	199	5	0	49	50	51	52	226	Decimal
88	c7	5	0	31	32	33	34	e2	Hexadecimal

Bit 8,7 indicate a response (00)
Bits 6-4 indicate the traction control function is passive (000)
Bits 3-1 indicate traction control functions are disabled (000)

5. If the traction control implements the optional time-out function as described in note #4, continue with the following procedure; however it should be noted that to collect data, implement another function or start another test it may be necessary for the off-board diagnostic or test unit to update this message as a background task or another off-board diagnostic or test unit may be necessary.

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA	CKSM	
172	199	5	120	49	50	51	52	70	Decimal
ac	c7	5	78	31	32	33	34	46	Hexadecimal

Bit 8,7 indicate a request (01)
Bits 6-4 indicate information is not available (111)
Bits 3-1 request that traction control functions are to be disabled (000)

A.199 (continued)

6. The traction control unit responds with the current traction control activity, enabled state and access code.

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA	CKSM	
136	199	5	0	49	50	51	52	226	Decimal
88	c7	5	0	31	32	33	34	e2	Hexadecimal

Bit 8,7 indicate a response (00)
Bits 6-4 indicate the traction control function is passive (000)
Bits 3-1 indicate traction control functions are disabled (000)

A.200 to A.231 Reserved—To be assigned.

A.232 DGPS Differential Correction — Equivalent to an RTCM-104 Type 9 differential GPS correction message.

For more information, refer to the standards document "RTCM-104, Version 2.0, January 1990." Note that the following field sizes, data types, bit resolutions and maximum ranges are identical to those in the RTCM-104 version 2.0 document, and are repeated here for completeness.

Parameter Data Length: Variable

Data Type:
- Characters 1-2 = Binary Bit-Mapped - transmitted least significant character first
- Character 3 = Binary Bit-Mapped
- Character 4-5 = Signed Integer
- Character 6 = Signed Short Integer
- Character 7 = Unsigned Short Integer

Bit Resolution:
- Characters 1-2
  - Reference station health = Binary
  - Modified Z-count = 0.6 s
- Character 3 = Binary
  - Scale factor = Binary
  - User Differential Range Error (UDRE) = Binary
  - Satellite ID = Binary
- Character 4-5
  - Pseudorange correction (PRC) = 0.02 m (0.79 in) if scale factor = 0
  - Pseudorange correction = 0.32 m (12.60 in) if scale factor = 1
- Character 6
  - Range-rate correction (RRC) = 0.002 m/s (0.079 in/s) if scale factor = 0
  - Range-rate correction = 0.032 m/s (1.260 in/s) if scale factor = 1
- Character 7
  - Issue of data = Binary

Maximum range:
- Characters 1-2
  - Station health = 0 to 7
  - Modified Z-count = 0 to 4914.6 s
- Character 3
  - Scale factor = 0 to 1
  - UDRE = 0 to 3
  - Satellite ID = 1 to 32 (satellite 32 is indicated with all zeros, 00000_2)

Characters 4-5
Pseudorange correction = -655.34 to +655.34 m (-25 800.93 to +25 800.93 in) if scale factor = 0
Pseudorange correction = -10 485.44 to +10 485.44 m (-412 812.6 to +412 812.6 in) if scale factor = 1
Note: The value 8000_{16} indicates a problem and the user equipment should immediately stop using this satellite.
Character 6
Range-rate correction = -0.254 to +0.254 m/s (-10.0 to +10.0 in/s) if scale factor = 0
Range-rate correction = -4.064 to +4.064 m/s (-160.0 to +160.0 in/s) if scale factor = 1
Note: The value 80_{16} indicates a problem and the user equipment should immediately stop using this satellite.
Character 7 = 0 to 255

Transmission Update Period: 5.0 to 30.0 s (depends on position accuracy required)
Message Priority: 7
Format:

PID	Data
232	n a a b c c d e

n - Number of parameter data characters = 7
a - Modified Z-count/Station health
Bits 16-14: Station health
Bits 13-1: Modified Z-count
b - Scale factor/UDRE/Satellite ID
Bit 8: Scale factor
Bits 7-6: UDRE
Bits 5-1: Satellite ID
c - Pseudorange correction
d - Range-rate correction
e - Issue of data

A.233 Unit Number (Power Unit)—Owner assigned unit number for power unit of a combination vehicle, straight truck, or transit vehicle.

Parameter Data Length: Variable
Data Type: Alphanumeric
Bit Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
233	n a a a . . .

n - Number of parameter data characters
a - Unit number

A.234 Software Identification—Software identification of an electronic module.

Parameter Data Length: Variable
Data Type: Alphanumeric
Bit Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
234	n a a a a [b c c c ...]

n - Number of parameter data characters
a - Software identification field
b - Optional delimiter: ASCII "*"
c - Optional additional software identification field

The software identification field is variable in length and may contain more than one software identification designator. An ASCII "*" is used as a delimiter to separate multiple software identifications when required. If only one software identification field is contained in the parameter, the delimiter is not required. Additional software identification fields may be added at the end, each separated by an ASCII "*" as a delimiter. If the software identification for a particular product exceeds 18 bytes then PID 192 shall be used to section this parameter.

A.235 Total Idle Hours—Accumulated time of operation of the engine while under idle conditions.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.05 h
Maximum Range: 0.0 to 214 748 364.8 h
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
235	n a a a a

n - Number of parameter data characters = 4
a a a a - Total idle hours

A.236 Total Idle Fuel Used—Accumulated amount of fuel used during vehicle operation while under idle conditions.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.473 L (0.125 gal)
Maximum Range: 0.0 to 2 032 277 476 L (0.0 to 536 870 911.9 gal)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
236	n a a a a

n - Number of parameter data characters = 4
a a a a - Total idle fuel used

A.237 Vehicle Identification Number—Vehicle Identification Number (VIN) as assigned by the vehicle manufacturer.

Parameter Data Length: Variable
Date Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission: On request
Message Priority: 8
Format:

PID	Data
237	n a a a . . .

n - Number of parameter data characters
a - VIN

A.238 Velocity Vector—Any combination of the velocity, heading, and pitch, as calculated by the navigation device(s).

Parameter Data Length: 5 Characters
Data Type: Character 1 = Unsigned Short Integer
Characters 2-3 = Unsigned Integer
Characters 4-5 = Signed Integer
Bit Resolution: Character 1 = 0.805 km/h (0.5 mph)
Characters 2-3 = 0.01 degree/bit
Characters 4-5 = 0.01 degree/bit
Maximum Range: Character 1 = -36.2 to +90.6 km/h (-45 to +112.5 mph)
(range is offset to acknowledge backward motion)
91 km/h (113 mph) indicates "Data Not Available"
Characters 2-3 = 0 to 655.34 degree
655.35 degree indicates "Data Not Available"
Characters 4-5 = -327.67 to +327.67 degree
-327.68 degree indicates "Data Not Available"
Transmission Update Period: On request
Message Priority: 6
Format:

PID	Data
238	n a b b c c

n - Number of parameter data characters
a - Calculated vehicle speed
b - Present vehicle heading
c - Pitch, positive = ASCENT, negative = DESCENT

A.239 ***Position***—The three-dimensional location of the vehicle.

Parameter Data Length: 10 Characters
Data Type: Characters 1-4 = Signed Long Integer
Characters 5-8 = Signed Long Integer
Characters 9-10 = Signed Integer
Resolution: Characters 1-4 = (10^{-6}) degree/bit
Characters 5-8 = (10^{-6}) degree/bit
Characters 9-10 = 0.15 m/bit (0.5 ft/bit)
Maximum Range: Characters 1-4 = -2147.483 648 to +2147.483 647 degree
Characters 5-8 = -2147.483 648 to +2147.483 647 degree
Characters 9-10 = -2497 to 4993.7 m (16 384 to +16 383.5 ft)
Transmission Update Period: On request
Message Priority: 6
Format:

PID	Data
239	n a a a a b b b b c c

n - Number of parameter data characters
8 = latitude and longitude only (a a a a b b b b)
2 = altitude only (c c)
10 = latitude, longitude, and altitude
a - Latitude, positive = NORTH, negative = SOUTH
b - Longitude, positive = EAST, negative = WEST
c - Altitude referenced to sea level at standard atmospheric pressure and temperature

A.240 ***Change Reference Number***—Used to indicate that a change has occurred in the calibration data.

Parameter Data Length: Variable
Data Type: Defined by manufacturer
Resolution: Defined by manufacturer
Maximum Range: Defined by manufacturer
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
240	n a a a . . .

n - Number of parameter data characters
a - Change reference number

A.241 ***Tire Pressure***—Pressure at which air is contained in cavity formed by tire and rim.

Parameter Data Length: 3 Characters
Data Type : Character 1 = Unsigned Short Integer
Character 2 = Unsigned Short Integer
Character 3 = Unsigned Short Integer
Resolution: Character 1 = Binary
Character 2 = Binary
Character 3 = 4.14 kPa/bit (0.6 lbf/in^2/bit)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in^2)
Transmission Update Period: 10.0s
Message Priority: 6
Format:

PID	Data
241	n a b c

n - Number of parameter data characters = 3
a - Trailer or power unit MID
b - Tire position = (axle number x 16) + wheel number
c - Tire pressure

Axle number is incremented from front to back with the front most axle being number 1. Wheel numbers on the axle are assigned as follows:

Outer left tire = 1
Inner left tire = 2
Inner right tire = 3
Outer right tire = 4

The outer numbers are used when only one tire is on either side of an axle.

A.242 Tire Temperature—Temperature at the surface of the tire sidewall.

Parameter Data Length: 3 Characters
Data Type: Character 1 = Unsigned Short Integer
Character 2 = Unsigned Short Integer
Character 3 = Unsigned Short Integer
Resolution: Character 1 = Binary
Character 2 = Binary
Character 3 = 2.5 °F/bit
Maximum Range: 0.0 to 637.5 °F
Transmission Update Period: 10.0s
Message Priority: 6
Format:

PID	Data
242	n a b c

n - Number of parameter data characters = 3
a - Trailer of power unit MID
b - Tire position = (axle number x 16) + wheel number
c - Tire temperature

Axle number is incremented from front to back with the front most axle being number 1. Wheel numbers on the axle are assigned as follows:

Outer left tire = 1
Inner left tire = 2
Inner right tire = 3
Outer right tire = 4

The outer numbers are used when only one tire is on either side of an axle.

A.243 ***Component Identification Parameter***—Used to identify the Make, Model, and Serial Number of any component on the vehicle.

Parameter Data Length: Variable
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
243	n b c c c c c * d d d d d d d d d d * e e e e e e e e e e

n - Number of parameter data characters following this byte
b - MID of component being identified
c - Characters specifying component Make
d - Characters specifying component Model
e - Characters specifying component Serial Number

When used, the Make is five characters long and shall correspond to the codes defined in the American Trucking Association Vehicle Maintenance Reporting Standard (ATA/VMRS). It is suggested that spaces (ASCII 32) are used to fill the remaining characters if the ATA/VMRS make code is less than five characters in length. The Model and Serial Number fields are variable in length and separated by an ASCII "*". It is not necessary to include all three fields; however, the delimiter ("*") is always required.

A.244 ***Trip Distance***—Distance traveled during all or part of a journey.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.16 km (0.1 mi)
Maximum Range: 0.0 to 691 207 984.6 km (0.0 to 429 496 729.5 mi)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
244	n a a a a

n - Number of parameter data characters = 4
a a a a - Trip distance

A.245 ***Total Vehicle Distance***—Accumulated distance travelled by vehicle during its operation.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution : 0.161 km (0.1 mi)
Maximum Range: 0.0 to 691 207 984.6 km (0.0 to 429 496 729.5 mi)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
245	n a a a a

n - Number of parameter data characters = 4
a a a a - Total vehicle distance

A.246 Total Vehicle Hours—Accumulated time of operation of vehicle.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.05 h
Maximum Range: 0.0 to 214 748 364.8 h
Transmission Update Period: On request
Message Priority: 8
Format:

PID		Data
246		n a a a a
n	-	Number of parameter data characters = 4
a a a a	-	Total vehicle hours

A.247 Total Engine Hours—Accumulated time of operation of engine.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.05 h
Maximum Range: 0.0 to 214 748 364.8 h
Transmission Update Period: On request
Message Priority: 8
Format:

PID		Data
247		n a a a a
n	-	Number of parameter data characters = 4
a a a a	-	Total engine hours

A.248 Total PTO Hours—Accumulated time of operation of power takeoff device.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.05 h
Maximum Range: 0.0 to 214 748 364.8 h
Transmission Update Period: On request
Message Priority: 8
Format:

PID		Data
248		n a a a a
n	-	Number of parameter data characters = 4
a a a a	-	Total PTO hours

A.249 Total Engine Revolutions—Accumulated number of revolutions of engine crankshaft during its operation.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 1000 r
Maximum Range: 0 to 4 294 967 295 000 r
Transmission Update Period: On request
Message Priority: 8
Format:

PID		Data
249		n a a a a
n	-	Number of parameter data characters = 4
a a a a	-	Total engine revolutions

A.250 Total Fuel Used—Accumulated amount of fuel used during vehicle operation.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.473 L (0.125 gal)
Maximum Range: 0.0 to 2 032 277 476 L (0.0 to 536 870 911.9 gal)
Transmission Update Period: On request
Message Priority: 8
Format:

PID		Data
249		n a a a a
n	-	Number of parameter data characters = 4
a a a a	-	Total fuel used

A.251 Clock -

Parameter Data Length: 3 Characters
Data Type: Each Character - Unsigned Short Integer
Resolution: Character 1 = 0.25 s/bit
Character 2 = 1 min/bit
Character 3 = 1 h/bit
Maximum Range: Character 1 = 0 to 63.75 s
Character 2 = 0 to 255 min
Character 3 = 0 to 255 h
Transmission Update Period: On request
Message Priority: 8
Format:

PID		Data
251		n a b c
n	-	Number of parameter data characters = 3
a	-	Seconds
b	-	Minutes
c	-	Hours

A.252 Date -

Parameter Data Length: 3 Characters
Data Type: Each Character - Unsigned Short Integer
Resolution: Character 1 = 0.25 day/bit
Character 2 = 1 month/bit
Character 3 = 1 year/bit
Maximum Range: Character 1 = 0 to 63.75 day
Character 2 = 0 to 255 month
Character 3 = 0 to 255 year
Valid Range: Character 1 = 0.25 to 31.75 day
Character 2 = 1 to 12 month
Character 3 = 0 to 255 year
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
252	n a b c

n - Number of parameter data characters = 3
a - Day
b - Month
c - (Year - 1985)

A value of 0 for the date (Character 1) is null. The values 1, 2, 3 and 4 are used to identify the first day of the month; 5, 6, 7, and 8 identify the second day of the month, etc.

A value of 0 for the month (Character 2) is null. The value 1 identifies January; 2 identifies February, etc.

A value of 0 for the year (Character 3) identifies the year 1985, a value of 1 identifies 1986, etc.

A.253 Elapsed Time -

Parameter Data Length: Variable
Data Type: Each Character - Unsigned Short Integer
Resolution: Character 1 = 0.25 s/bit
Character 2 = 1 min/bit
Character 3 = 1 h/bit
Character 4 = 1 day/bit
Maximum Range: Character 1 = 0 to 63.75 s
Character 2 = 0 to 255 min
Character 3 = 0 to 255 h
Character 4 = 0 to 255 day
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
253	n a b c d

n - Number of parameter data characters
a - Seconds
b - Minutes
c - Hours
d - Days

This parameter can be shortened by dropping days, days and hours or days, hours, and minutes.

A.254 Data Link Escape—This PID allows transmission of information on the data bus in a nonstandard (per the protocol outlined in SAE J1587) but specific electronic module vendor's proprietary fashion. The intent of this PID is to allow a means to use the data bus for vendor specific transmissions that do not benefit the general purpose nature of the communication data link.

Parameter Data Length: Variable
Data Type: Variable
Resolution: Variable
Maximum Range: Variable
Transmission Rate: Variable up to 10 times per second
Message Priority: Parameter specific
Format:

PID	Data
254	a b

a - Receiving module's MID
b - Data

(R) *A.255 Extension*—This PID is required to immediately follow the MID for the message. The character after this PID is a PID from page 2 (PIDs 256 to 511). All other PIDs in the messages are also from page 2.
Parameter Data Length: No data bytes
Data Type: Not applicable
Resolution: Not applicable
Maximum Range: Not applicable
Transmission Rate: Not applicable
Message Priority: Parameter specific
Format:

PID	Data
255	No data associated with PID 255

A.256 ***Request Parameter***—Used to request parameter data transmission of page 2 parameters from other components on the data link.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
256	a

a - Parameter ID of the requested parameter from page 2 (transmitted modulo 256)

Any and all components measuring or calculating the specified parameter should transmit it if possible.

A.257 ***Cold Restart of Specific Component***—Components with administrative authority may request the cold restart (powerup) of a selected component, usually to regain control of an errant component.

Note: The component identified by the MID in byte (a) shall perform a cold restart function upon receipt of this command. The component shall acknowledge this action by responding with PID 259 (Component Restart Response).

The issuance of this command is restricted to units which have supervisory control over system devices.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 3
Format:

PID	Data
257	a

a - MID of component requested for cold restart

A.258 ***Warm Restart of Specific Component***—Components with administrative authority may request the warm restart of a selected component, usually to regain control of an errant component.

Note: The component identified by the MID in character a shall perform a warm restart function upon receipt of this command. The component shall acknowledge this action by responding with PID 259 (Component Restart Response).

The issuance of this command is restricted to units which have supervisory control over system devices.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 3
Format:

PID	Data
258	a

a - MID of component requested for warm restart

A.259 ***Component Restart Response***—Used to acknowledge the warm or cold restart as requested by a component with administrative authority using PID 257 or 258.

Note: Components which have become reset due to a loss of power and are returning to service should also acknowledge this action with this PID to notify the Transit Administrator of their resumed service status.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary Bit-mapped
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 3
Format:

PID	Data
259	a

a - Restart status

Bits 8-7: Reserved - both bits set to 1
Bits 6-5: Return to service completed
Bits 4-3: Warm restart completed
Bits 2-1: Cold restart completed

Note: Each status will be described using the following nomenclature:

00 No/Not applicable
01 Yes
10 Error condition
11 Not available

A.260 to A.377 ***Reserved***—To be assigned

A.378 ***Fare Collection Unit Status***—Used to report alarms of the fare collection unit.

Parameter Data Length: 1 Character
Data Type: Binary Bit-mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On change
Message Priority: 6
Format:

PID	Data
378	a

a - Fare collection unit status

Bit 8: 0=non-emergency condition
1=emergency condition

Bits 7-1: Alarm identifier (128 values)
0 = voltage dropout
1 = voltage restored
2 = probe started
3 = probe completed
4 = cashbox removed
5 = cashbox restored
6 = cashbox door timeout
7 = cashbox opened in service (see note)
8 = insufficient fare accepted
9 = coinbox 75% full
10 = coinbox full
11 = currency box 75% full
12 = currency box less than 75% full
13 = currency box full
14 = card/pass box 75% full
15 = card/pass box less than 75% full
16 = card/pass box full
17 = coin de-jam operated
18 = farebox set in manual bypass
19 = farebox reset to automatic mode
20 = pass/transfer jam
21 = pass/transfer jam cleared
22 = paper currency jam
23 = paper currency jam cleared
24 = maintenance access - in service (see note)
25 = maintenance access - out or service
26-96 = reserved - to be assigned
97-127 = Agency defined

Note: Alarms 7 and 24 are defined as emergency alarm conditions. Other alarms may be defined as emergency alarm conditions as required by the farebox owner.

A.379 ***Transit Door Status***—Used to report transit door opening and closing.

Parameter Data Length: 1 Character
Data Type: Binary Bit-mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On change or on request
Message Priority: 7
Format:

PID	Data
379	a

a - Transit door status
Bits 8-3: Reserved - all bits set to 1
Bits 2-1: Transit door status

Note: Each status will be described using the following nomenclature:

00	Door closed
01	Door opened
10	Error condition
11	Not available

A.380 ***Articulation Angle***—Angle of deflection of an articulation turntable of an articulated transit vehicle. A right turn is indicated with a positive angle and a left turn is indicated with a negative angle.

Parameter Data Length: 1 Character
Data Type: Signed Short Integer
Bit Resolution: 1 degree
Maximum Range: -128 to +127 degree
Transmission Update Period: 1.0 s
Message Priority: 8
Format:

PID	Data
380	a

a - Articulation angle

A.381 Vehicle Use Status—Used to indicate the proper or unauthorized use of the vehicle. The administrative control device or any device issuing the vehicle use status PID should be sensitive to the run switch status and any other locally defined criteria for authorized use (i.e. driver log-ons) before the vehicle use status PID is used to generate an unauthorized use alarm.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary Bit-mapped
Maximum Range: 0 to 255
Transmission Update Period: As needed (10 s. updates while an unauthorized condition exists)
Message Priority: 7
Format:

PID	Data
381	a

a - Vehicle use status
- Bits 8-5: Reserved - all bits set to 1
- Bits 4-3: Vehicle use status
  - 00 - Normal use
  - 01 - Unauthorized use
  - 10 - Error condition
  - 11 - Not available
- Bits 2-1: Transit run status
  - 00 - Off
  - 01 - On
  - 10 - Error condition
  - 11 - Not available

A.382 Transit Silent Alarm Status—Used to report silent alarm push button status.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Resolution: Binary Bit-mapped
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 7
Format:

PID	Data
382	a

a - Transit silent alarm status
- Bits 8-3: Reserved - all bits set to 1
- Bits 2-1: Silent alarm status

Note: Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.383 ***Vehicle Acceleration***—Scalar acceleration of vehicle. Negative numbers imply deceleration.

Parameter Data Length: 1 Character
Data Type: Signed Short Integer
Bit Resolution: 0.322 (km/h)/s (0.2 mph/s)
Maximum Range: -41.216 to 40.894 (km/h)/s (-25.6 to 25.4 mph/s)
Transmission Update Period: As requested
Message Priority: 6
Format:

PID	Data
383	a

a - Vehicle acceleration

A.384 ***Component-specific Request Parameter***—Used to request page 2 parameter data (PID) transmissions from a specified component on the data link.

Parameter Data Length: 2 Characters
Data Type: Unsigned Short Integer (both characters)
Resolution: Binary (both characters)
Maximum Range: 0 to 255 (both characters)
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
384	a b

a - Parameter number of the requested parameter from page 2 (transmitted modulo 256)
b - MID of the component from which the parameter data is requested

Only the specified component should transmit the specified parameter. If the specified component is in the MID range 0 to 127, its response is not defined in this document.

A.385 to A.446 ***Reserved***—To be assigned

A.447 ***Passenger Counter***—Used to notify the transit link devices of real-time boarding and exiting passengers or to indicate the total number of passengers on vehicle referenced to the last transit stop.

Some passenger counting systems indicate real-time boarding and exiting data for other devices to accumulate. Other types of passenger counters report a current on-board total relative to a transit door status PID, a fare collection PID, or other signal which can define the end of the boarding/exiting period and a stable underway totalized passenger count.

Parameter Data Length: 2 Characters
Data Type: Unsigned Short Integer (both characters)
Resolution: Binary (both characters)
Maximum Range: 0 to 255 (both characters)
Transmission Update Period: As needed; following door closures or upon boarding event, depending on technology
Message Priority: 8
Format:

PID	Data
447	a b

a - Type of passenger count
- 0 - absolute passenger count
- 1 - boarding passenger
- 2 - exiting passenger
- 3 to 255 - reserved

b - patron count
- if character a = 0, character b indicates the number of patrons currently on vehicle after the door has closed
- if character a = 1 or 2, character b indicates an incremental count of passengers since the last data transmittal

A.448 ***Page 2 Multisection Parameter***—Used to transmit parameters that are longer than what is limited by SAE J1708. A specified parameter can be broken into sections with each section being transmitted in a different message.

Parameter Data Length: Variable
Data Type: Defined by specified sectioned parameter
Resolution: Defined by specified sectioned parameter
Maximum Range: Defined by specified sectioned parameter
Transmission Update Period: Defined by specified sectioned parameter
Message Priority: Parameter specific
Format:

PID	Data
448	n, a, b, c/d, c, c, c, c, c, c, c

n - Byte count of data that follows this character. This excludes characters MID, PID 448, and n, but it includes a, b, c, or d type characters.

a - PID from page 2 (PIDs 256 to 510) specifying the parameter that has been selected.

b - The last section number (total number of sections minus ONE) and the current section number. The upper nibble contains the last section number (1 to 15). The lower nibble contains the current section number and is limited to the range 0 to 15. Section numbers are assigned in ascending order.

c - Data portion of sectioned parameters. May be 1 to 14 characters in the first packet. May be 1 to 15 characters in the middle and ending packets.

d - Byte count of the total data portion. This character is sent only in the first packet. The values are limited to 239 or less but must be greater than 17.

Application Notes -

1. Single sections of data are not allowed to be sent alone. Message packets must be sent in sequence from the transmitting device.

2. Receiver devices should have the capacity to receive concurrent PID 448 type messages from different transmitters.

3. Caution must be taken in interpreting data. The value of a parameter with multiple sections may have been updated during the time between which the packets are sent.

4. Other PID's and associated parameters can be incorporated in the message packet if character count limitations are not violated.

A.449 ***Reporting Interval Request***—Used to request a device to change the specified transmission update period to a new interval for the given page 2 PID.

For example, this parameter may be used to change the transit door status reporting from "as needed" to "1 second" in an emergency situation.

Parameter Data Length: 3 Characters
Data Type: Character 1 = Unsigned Short Integer
Character 2 = Unsigned Short Integer
Character 3 = Unsigned Short Integer
Resolution: Character 1 = Binary
Character 2 = Binary
Character 3 = 1 s/bit
Maximum Range: 0 to 255 s
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
449	n a b c

n - Number of parameter data characters = 3
a - MID of destination device
b - Page 2 PID
c - Desired transmission update period for the PID defined in character b

A.450 Bridge Filter Control—Instructs the device connected to both the drivetrain data link and the transit link with which PIDs to repeat from the drivetrain link on the transit link.

Drivetrain repeaters shall be programmed to transfer no message at powerup. They shall be programmed by the transit vehicle administrative computer for MIDs and PIDs to be transferred before any relay function(s) commence from the drivetrain link to the transit link.

Parameter Data Length: Variable
Data Type: Unsigned Short Integers (all characters)
Resolution: Character dependent
Maximum Range: Character dependent
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
450	n m ab ab ab ...

n - Number of parameter data characters
m - MID of device performing PID filtering
a - The PID which needs to be made available from the drivetrain link to the transit link
b - Transmission update period for the PID defined in character a
0 = continuous (repeat all occurrences of the PID)
bit resolution: 0.2 s
maximum range: 0.2 to 51.0 s

Note: When byte (a) = 255 and byte (b) = 0, all subsequent character a values identify page 2 PIDs.

A.451 to A.500 Reserved—To be assigned

A.501 Signage Message—Used to identify the messages to be displayed on Destination, Head, or Next Stop signs.

Parameter Data Length: Variable
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: Transmitted when information is entered or changed
Message Priority: 6
Format:

PID	Data
501	n a b1 b2 b3 b4 ...

n - Number of parameter data characters
a - Record type (Uppercase ASCII Character)
"B" = Blanking on/off
"D" = Destination code
"P" = Public relations code
"N" = Next stop code
"R" = Route number
"E" = Emergency message enable/disable
"M" = Direct character message entry
"F" = Direct character message parameters
"T" = Direct character message trigger (start display)

A.501 (continued)

b - Data dependent on the record type
if:

a="B" and b1="T" (True) then blank the signs, any other value of b1 will unblank the signs.

a="D", "P", or "N" then b1, b2, b3, ... is the ASCII message code where b1 is the most significant character.

a="R" then b1, b2, b3, ... is the ASCII route number where b1 is the most significant character.

a="E" and b1="T" (True) then the emergency message is enabled, any other value of b1 will disable the emergency message. The emergency message may also be disabled by a destination code input record (a="D").

a="M" then:
b1=sign number (1-255, 0 is not used)
b2=line number of sign (1-255, 0 is not used)
b3=position
Bits 8-5: Horizontal position (1-15, 0 is not used)
where 1=1st character, 2=13th character, 3=25th character, etc.
Bits 4-1: Vertical position (1-15, 0 is not used)
where 1=row 1, 2=row 2, 3=row 3, etc.
b4 to b15=ASCII direct message (up to 12 characters)

a="F" then b1 is the ASCII default parameter and b2 is the parameter value, where:
b1="F" font type
b1="R" retention time in tenths of seconds
b1="B" line blank time in tenths of seconds
b1="S" scroll rate
b1="I" intensity
b1="O" blink on time in tenths of seconds
b1="P" blink off time in tenths of seconds
b1="C" color
NOTE: If the "F" record type is not used then the sign will utilize its internal default parameter values

a="T" then display the direct message as defined by the "M" and "F" record types. Direct messages are canceled by a destination code input record type (a="D").

Note: Upon receiving the warm or cold restart request PID, the sign system will reset and restore the previously displayed message.

A.502 ***Fare Collection Unit - Service Detail***—Used to identify service, assignments, and fare preset detail of the fare collection unit.

Parameter Data Length: 14 Characters
Data Type: Character 1 = Binary bit-mapped
Character 2 = Binary bit-mapped
Characters 3-4 = Unsigned Integer
Characters 5-6 = Unsigned Integer
Characters 7-8 = Unsigned Integer
Characters 9-10 = Unsigned Integer
Characters 11-12 = Unsigned Integer
Characters 13-14 = Unsigned Integer
Resolution: Binary (all characters)
Maximum Range: Character dependent
Transmission Update Period: Transmitted at the start, end, in service, and out of service event
Message Priority: 6
Format:

PID Data
502 n a b cc dd ee ff gg hh

n - Number of parameter data characters = 14
a - Farebox status
Bit 8: 0=farebox out of service
1=farebox in service
Bits 7-5: Trip status
0 = undefined
1 = trip start
2 = trip end
3 = undefined
4 = undefined
5 = layover start
6 = layover end
7 = undefined
Bits 4-1: Trip status
0 = North
1 = South
2 = East
3 = West
4 = In
5 = Out
6-15 = Agency defined
b - Fare presets
Bits 8-5: Reserved - to be assigned
Bits 4-1: Agency defined
cc - Trip number - range 0 to 65535
dd - Pattern number - range 0 to 65535
ee - Assigned route - range 0 to 65535
ff - Assigned run - range 0 to 65535
gg - Assigned block - range 0 to 65535
hh - Driver's security code
0 = farebox is in reporting status
1-65535 = security code

Note: If this parameter is received by the farebox, values shall be accepted the same as if entered at the farebox control panel.

A.503 Fare Collection Unit - Point of Sale—Used to report stop level point of sale detail.

Parameter Data Length: 7 characters
Data Type: Character 1 = Binary bit-mapped
Character 2 = Binary bit-mapped
Character 3 = Binary bit-mapped
Character 4 = Binary bit-mapped
Characters 5-6 = Binary bit-mapped - transmitted least significant character first
Character 7 = Unsigned Short Integer
Resolution: Binary (all characters)
Maximum Range: Character dependent
Transmission Update Period: On occurrence
Message Priority: 6
Format:

PID Data
503 n a b c d ee f

n - Number of parameter data characters = 7
a - Type of transaction
Bits 8-5: 0=cash
1=token
2=ticket
3=pass
4=card
5=permit
6=transfer
7=free
8-11=reserved - to be assigned
12-15=agency defined
Bits 4-1: 0-11=passenger category, indicating whether the passenger paid the full fare or a reduced fare and identifies the type of passenger.
12-15=passenger category, to be agreed to by the operating agency and the fare collection equipment manufacturer.
b - Type of fare and payment details
Bits 8-5: 0=cash/no detail
1=token A
2=token B
3=ticket A
4=ticket B
5=pass A
6=pass B
7-10=reserved - to be assigned
11-15=agency defined
Bits 4-1: 0=not an upgrade
1=cash
2=token
3=ticket
4=pass
5=card
6-10=reserved - to be assigned
11-15=agency defined

A.503 (continued)

c - Fare validity data and ticket category
  Bits 8-5: fare validity - agency defined (range 0-15)
  Bits 4-1: pass category (range 0-15)
    The farebox manufacturer and agency shall define these values corresponding to the pass categories in effect at the agency.

d - Agency and service identification
  Bits 8-4: agency (range 1-31, 0 reserved)
    Identifies where the initial fare is paid. The definition of the agency numbering plan shall be agreed by the operating agency and the farebox manufacturer.
  Bits 3-1: type of service
    0=local service
    1=express service
    2-7=agency defined

ee - Transfer data
  Bits 16-13: direction
    0=North
    1=South
    2=East
    3=West
    4=In
    5=Out
    6-15=Agency defined
  Bits 12-1:route number issuing the transfer (range 0-4095)

f - Transfer sold (range 0 to 255)
  0 is reserved; a non-zero value indicates that a transfer was sold or issued on this transaction including its type and/or restrictions. The final definitions of the transfer issued infirmation shall be agreed by the operating agency and the farebox manufacturer.

A.504 ***Annunciator Voice Message***—Used to identify the message to be announced by the annunciator(s).

Parameter Data Length: 3 Characters
Data Type: Character 1 = Binary bit-mapped
Character 2 = Unsigned Integer
Resolution: Binary (both characters)
Maximum Range: Character dependent
Transmission Update Period: As needed
Message Priority: 6
Format:

PID	Data
504	n a bb

n - Number of parameter data characters = 3
a - Annunciator location and volume level
Bit 8: Front, interior
1 = generate message
0 = do not generate message
Bit 7: Middle, interior
1 = generate message
0 = do not generate message
Bit 6: Rear, interior
1 = generate message
0 = do not generate message
Bit 5: Front, external
1 = generate message
0 = do not generate message
Bits 4-1: Volume level
where 0 = minimum level available
and 15 = maximum level available
bb - Binary value of audio message to be generated (up to 65,536 preset messages)

A.505 ***Vehicle Control Head Keyboard Message***—Used to report key depression on the vehicle control head (driver console).

Parameter Data Length: Variable
Data Type: Binary
Resolution: Binary
Maximum Range: 0 to 255 (Each character)
Transmission Update Period: As needed
Message Priority: 7
Format:

PID	Data
505	n ab ab ab ...

n - Number of parameter data characters
a - If zero, character b will contain the value of an IBM scan code (per IEEE AT-101 scan code definition) for a function key depression
If non-zero, this byte contains the scan code value (1-255) of the key depression.
b - If character a is zero, the value of a function key depression
If character a is non-zero, this character is not transmitted.

Note: After the driver's keyboard/display unit receives a cold or warm restart command and its internal self test logic determines no stuck keys or other problems, the unit shall send a zero for both characters a and b as an operational status check message.

A.506 Vehicle Control Head Display Message—Used to display message on the vehicle control head display (driver console).

Parameter Data Length: Variable
Data Type: Alphanumeric
Resolution: ASCII (IBM-PC character set)
Maximum Range: 0 to 255 (Each character)
Transmission Update Period: As needed
Message Priority: 7
Format:

PID	Data
506	n a b cccc...

n - Number of parameter data characters
a - Line position for display of ASCII characters. The value of 0 is reserved for clear screen message
b - Segment position for display of ASCII characters, where the horizontal display line is divided into multiples of 14 displayable characters. The value of 0 is reserved for clear screen message
c - Up to 14 ASCII characters as defined by the IBM extended ASCII character set (including the graphics values 128-255).

Notes: If the value of characters a and b are both zero, the display shall interpret this as a clear screen command (all lines, all columns). In this case, there will be no c characters included.

If the display is equipped with a sound generating device, the receipt of an ASCII Bell character (ASCII 7) shall trigger the sound device.

A.507 Driver Identification—Used to obtain the driver identity.

Parameter Data Length: Variable
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
507	n a a a a * b b b b

n - Number of parameter data characters following this byte
a - Characters specifying the driver identification
b - Characters specifying other driver data

The driver identification and other driver data fields are variable in length and separated by an ASCII "*". It is not necessary to include both fields; however, the delimiter ("*") is always required.

A.508 ***Transit Route Identification***—Used to identify the Route, Run and Block information. This information may be entered into different devices at different authorities (fare collection, radio log, unit control panel, etc.). In any case, the device which is assigned as the entry device shall make the identification available to all other devices on the link with this parameter.

Parameter Data Length: Variable
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
508	n a a a a * b b b b * c c c c

n - Number of parameter data characters following this byte
a - Characters specifying the assigned route
b - Characters specifying the assigned run
c - Characters specifying the assigned block

The route, run, and block data fields are variable in length and separated by an ASCII "*". It is not necessary to include all three fields; however, the delimiter ("*") is always required.

A.509 ***Milepost Identification***—Used to identify the milepost as detected by a milepost sensor.

Parameter Data Length: Variable
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
509	n a a a a

n - Number of parameter data characters following this byte
a - Characters identifying the milepost

A.510 ***Page 2 Data Link Escape***—This PID allows transmission of information on the data bus in a nonstandard (per the protocol outlined in SAE J1587) but specific electronic module vendor's proprietary fashion. The intent of this PID is to allow a means to use the data bus for vendor specific transmissions that do not benefit the general purpose nature of the communication data link.

Parameter Data Length: Variable
Data Type: Variable
Resolution: Variable
Maximum Range: Variable
Transmission Rate: Variable up to 10 times per second
Message Priority: Parameter specific
Format:

PID	Data
510	a b

a - Receiving module's MID
b - Data

A.511 ***Page 2 Extension***—This PID has not been defined at this time. SAE will define it in the future as required.

Parameter Data Length: To be determined
Data Type: To be determined
Resolution: To be determined
Maximum Range: To be determined
Transmission Rate: To be determined
Message Priority: To be determined
Format:

PID	Data
511	To be determined

(R) APPENDIX B
J1587 TRANSPORT PROTOCOL

B.1 Introduction—With the advent of off-vehicle data communications there has come a need for a means to transfer data across intra-vehicle data networks which is ultimately destined for devices and systems outside the vehicle. Indeed the data may be destined for devices and systems which have no knowledge of the operations of the onboard network. As a consequence, this data may well be formatted in a manner unknown and unknowable to the average node on the onboard network; however, the data must still be transferred across the onboard network before it can be transmitted to the extra-vehicular data system.

In OSI terms this means that one onboard device must provide an application layer gateway function. There must also be provision for the segmentation and reassembly of individual messages which are too long for the individual frame defined for the onboard network. In the case of the SAE J1587/J1708 onboard network, the individual frame is limited to a message size of no more than 21 bytes. Clearly the data to be transferred may well be much larger than this size; ergo, a multiple-frame message format and protocol which does not specify the format of the data to be transferred is needed.

In OSI terms, the J1708 protocol serves primarily as physical and media access control layer functionality. J1587 provides an application layer functionality as shown in Figure B1. The application layer parameter definitions of J1587, however, while ensuring that the format of data communicated across the network is uniform, does not provide for the transfer of data using a connection oriented protocol with handshaking and flow control. In addition, the previously defined data block size using PID 192 is limited to 239 bytes.

Given that application, data link and physical layers exist within the J1587/J1708 framework, there is no intervening functionality. For instance, there is not a session, presentation, transport, or network layer.

One function generally allocated to the transport layer in the OSI model is the breaking up of data for transmission as needed, and ensuring that the pieces all arrive correctly at the other end.[4] This function is generally referred to as segmentation and reassembly.

Several transport layer protocols have been defined; the most used of these being TP4, the Connection Oriented Transport Service (COTS). COTS provides for the creation, use, and closure of an end-to-end virtual circuit between the originating application and the receiving application. TP4 also provides for the segmentation and reassembly of large messages to be transferred across the subnetworks (a subnetwork in this case would include the J1587/J1708 intravehicle network).

TP4 is clearly inappropriate for any heavy duty vehicle data communications. However, it is possible to implement a transport layer protocol which will use the services of the J1708 network in the manner of the J1587 protocol. This transport protocol will provide for the transfer of free-form data across the network, for the segmentation and reassembly of large messages to be transferred across the subnetwork, and to efficiently control the flow of free-form data across the subnetwork.

B.2 Connection Oriented Protocol Overview—Connection oriented protocols operate by creating a virtual circuit connection between the communicating entities. Several protocols, including a variation of the IEEE 802.2 Logical Link Control and the venerable X.25 protocol are connection oriented protocols.

In a connection oriented protocol, in order for data to be transferred from the originator to the destination, first a request for a connection must be passed. The destination then passes a connection acceptance confirmation to the originator. At this time data communications between the two entities may begin. When the entire message has been transferred, the connection is closed by one or another of the communicating

[4] Andrew Tannenbaum; *Computer Networks* (Englewood Cliffs, NJ:Prentice-Hall), 18

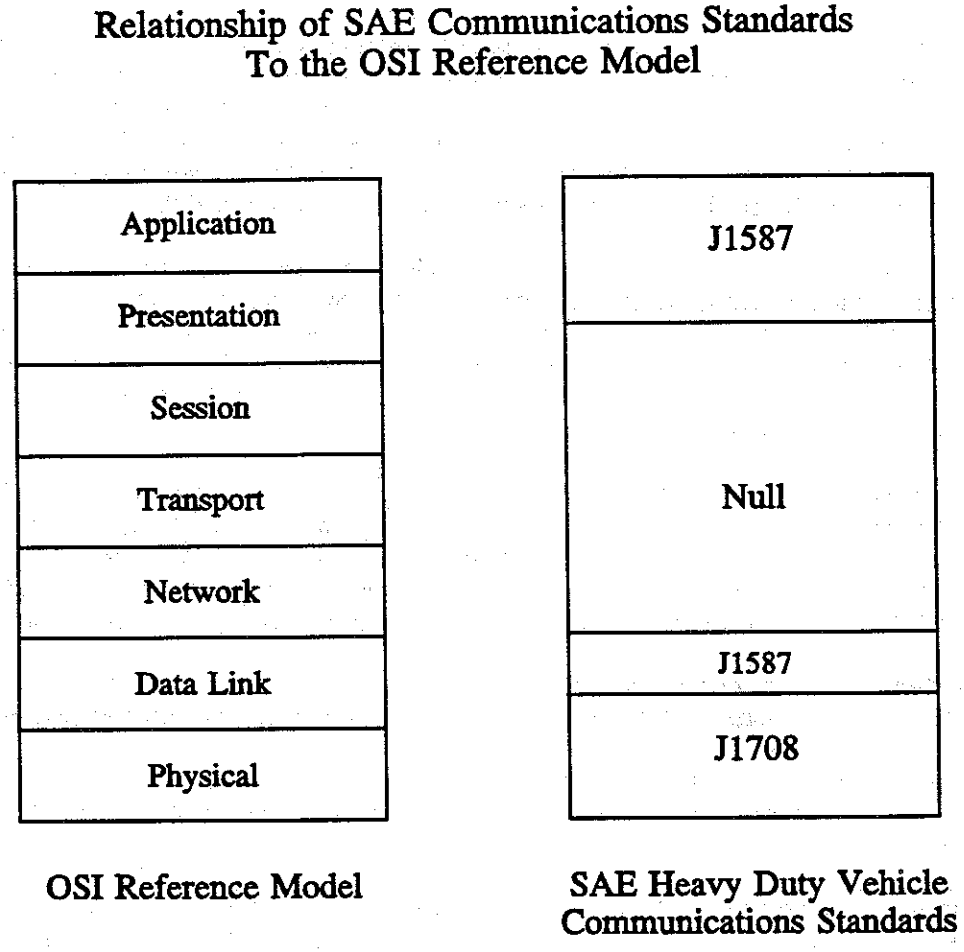


FIGURE B1 - SAE STANDARDS AND THE OSI REFERENCE MODEL

parties. The connection oriented protocol is analogous to the use of a telephone; the act of dialing a phone may be thought of as a connection request; when a person at the other end picks up the phone and says "Hello", he is issuing a connection acceptance and confirmation. At this point the actual data communication, the conversation, may take place. Eventually one of the communicating parties says "Good-bye", issuing a disconnect request. When both parties have hung up, the connection is closed.

B.3 Gateway Function Overview—There are four different types of relay defined for the OSI reference model; differentiated by the layer at which the relay takes place: the repeater is a relay at the physical layer, a bridge performs the relay function at the data link layer, a router at the network layer and a gateway is a relay at any layer higher than the network layer.[5] In the context of the OSI reference model, an application layer gateway is shown in Figure B2.

[5] John D. Spragins, et al, *Telecommunications, Protocol and Design* (Reading, MA: Addison-Wesley Publishing, 1991), 491

Two Subnetworks Connected by an Application Layer Gateway

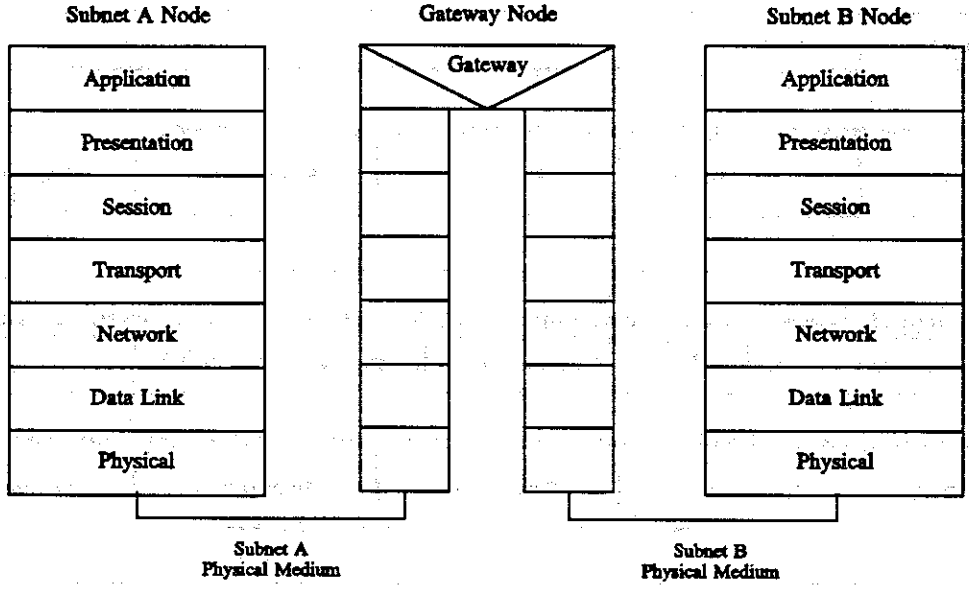


FIGURE B2 - THE GATEWAY MODEL

As the figure implies, the physical media and the protocols used on the two subnetworks may be radically different: subnet A may rely on a local area network such as IEEE 802.3 while subnet B could be based on X.25 using satellite communications. Essentially the gateway accepts messages created and passed on one network, reformulates them into the original application layer format, then uses the services available to it on the other subnetwork to retransmit the message. It is the responsibility of the gateway function to resolve these differences.

It should be noted that a gateway function does not need to exist at the application layer level. The DECnet SNA/DNA gateway protocol is an example of a gateway function at the transport layer level.[6]

B.4 Message Segmentation and Reassembly Overview—A protocol is concerned with exchanging streams of data between two entities. Lower level protocols may need to break the data up into blocks of some smaller bounded size. This process is called segmentation, and its counterpart is called reassembly.[7] This process is shown in Figure B3.

Fortunately, the function performing the segmentation and the reassembly of the original message does not need to know the internal makeup of the message, its encoding or format. The segmentation/reassembly function may treat the message simply as a stream of bits; all that is required of the segmentation/reassembly function is that the original stream of bits be identical to the stream that is finally received at the destination.

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[6] Spragins, 522-523

[7] William Stallings; *Data and Computer Communications* (New York: MacMillan, 1988), 380

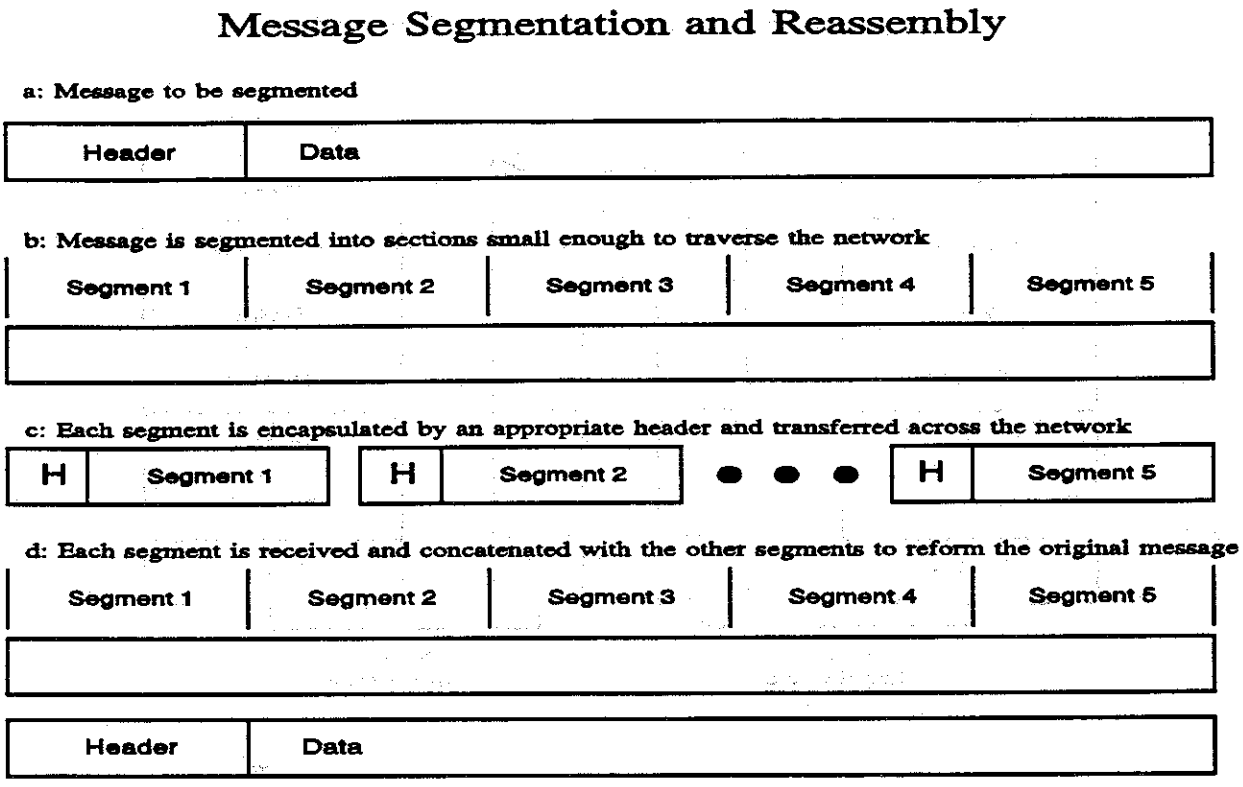

FIGURE B3 - MESSAGE SEGMENTATION AND REASSEMBLY

This is assured if the protocol performing the segmentation and reassembly of the message puts a sequence number on each of the segments transmitted. Indeed, the segment number is a vital part of the segmentation/reassembly protocol.

B.5 PID/Message Definitions—Any transport protocol for J1587/J1708 communications must be defined in terms of the Message Identifiers (MIDs) and Parameter Identifiers (PIDs) defined in those standards. Two PIDs are defined for the transport protocol: a Connection Management PID (CMP) and a Connection Mode Data Transfer PID (CDP). The CMP will be used for requesting connections, closing connections, message acknowledgments, flow control and for aborting a connection if necessary.

The CDP will be used strictly for the transfer of user data.

.1 **Connection Management PID**—The CMP provides a mechanism for controlling the transfer of free-form data across the network.

Parameter Data Length: Variable
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
197	n a b c1 c2 c3 c4 . . .

- n - Byte count of data that follows this character. This excludes characters MID, PID 197, and n but includes a, b and c type characters
- a - MID of the destination device
- b - Connection Management Control Command identifier
- c - Data dependent on the connection management control value

Connection Management Control Command identifiers may be added to by petitioning the SAE J1587 committee.

B.5.1.1 CONNECTION MANAGEMENT CONTROL COMMAND 1: REQUEST TO SEND (RTS)—Used by the station wishing to transfer a segmented message to inform the destination station that it wishes to pass data.

DATA Two elements: Total number of segments to be sent, c1; and the number of data bytes in the original complete message, c2 and c3. The number of segments parameter is one byte, the total number of bytes parameter is two bytes (transmitted least significant byte first; i.e, c2 is the least significant byte of the total number of bytes value).

B.5.1.2 CONNECTION MANAGEMENT CONTROL COMMAND 2: CLEAR TO SEND (CTS)—Used by the receiving station to inform the originating station that it is ready to receive segmented data and to acknowledge segments already received (or to negative acknowledge (NAK) and re-request segments which were not correctly received).

DATA Two elements: Number of segments the receiver is ready to accept, c1; and the *next* segment to be transmitted, c2. Note that if the originator has transmitted segment 0 through 8 but segment 6 failed checksum check, a CTS should be sent with the number of segments set to 1 and the next segment set to 6. Upon receipt of a correct section 6, a CTS should be sent with the number of segments set to whatever is acceptable to the receiver and the next segment number set to 9.

B.5.1.3 CONNECTION MANAGEMENT CONTROL COMMAND 3: END OF MESSAGE ACKNOWLEDGMENT (EOM)—Used by the receiving station to acknowledge receipt of entire message. Note that this is not strictly needed, if all segments have been acknowledged, the entire segmented message has been received.

B.5.1.4 CONNECTION MANAGEMENT CONTROL COMMAND 4: REQUEST FOR STANDARDIZED DATA—Used to request certain standardized free-format data.

DATA 2 bytes, c1 and c2. This forms a 2 byte unsigned binary integer with data request assignments (transmitted least significant byte first; i.e, c1 is the least significant byte of the data request assignment):

0	Reserved
1	Trip Recorder Data
2	Driver Log
3	Programmable Parameters
4	Executable Code
5	Calibration Parameters
6-65535	Reserved for future use

B.5.1.5 CONNECTION MANAGEMENT CONTROL COMMAND 255: ABORT—Used by either communicating party to abort the connection for any reason.

B.5.2 Connection Mode Data Transfer PID—The CDP is used for the actual transfer of the segmented user data.

Parameter Data Length: Variable
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
198	n a b c c c c . . .

n - Byte count of data that follows this character. This excludes characters MID, PID 198, and n but includes a, b and c type characters
a - MID of the destination device
b - Segment Identification - range from 1 to 255 (segment 0 is not used)
c - Segment Data - 1 to 15 bytes

B.6 Protocol Description—This protocol is particularly appropriate for the transfer of data to/from offboard devices through a gateway device and to/from an onboard system. For example, should a dispatch computer system wish to acquire free form data from an onboard system, the dispatch system would compose a message to the gateway device on the vehicle. This message, whose composition, and encoding are outside the scope of J1708/1587, would command the gateway device to request the data needed. That gateway device would compose a request message to be transferred via the free-form/transport protocol to the final destination device. That device, and only that device, would understand the received free form message to be a request for specific information. The end system device would then use the free-form/transport protocol to pass the requested information to the gateway function. The gateway would then encode the requested data in a format convenient to the gateway-to-dispatch-system link and transmit it to the dispatch system.

B.6.1 Message Segmentation/Reassembly—The transport protocol accepts large messages of 3825 bytes or less. These messages would be split into fifteen byte segments without regard to the structure of the message or the information encoded. Each of these segments is then assigned a segment number, encapsulated within a J1708 compliant message with a Connection Data Transfer PID; and that message is then transferred to the destination station.

At the receiving end, the messages will be checksum validated. Each message would have the protocol information, that is the MID, the PID, the data length and segment identifier stripped off. The remaining fifteen bytes of data will then be concatenated together to reform the original message. This long message is then passed to an application process. This application level process could be a gateway function if the message is intended for another communications subnet, or it could be used by the onboard system; a terminal display device for instance. The protocol does not place limitations on the data which may be passed using the services of the protocol.

B.6.2 Connection Management Functions—The heart of this protocol is the connection management function. It is this facility that allows for flow control between the sender and the receiver, the capability to acknowledge received message segments without using bandwidth to acknowledge each individual message, and most importantly, the ability to transfer *any* data across the J1587/1708 data link quickly and reliably.

A connection is by definition not usable for broadcast messages. Only one connection can be supported between any two MIDs at a given time; although there is no reason that a given MID device cannot have connections to two different devices simultaneously. Each connection will be associated with a single MID/MID pair, and all user data transferred across a virtual connection will have a header containing the MID/MID pair with which the connection is associated.

Connection mode data will be passed only at the lowest priority of the network; therefore connection mode data messages may well be interspersed with other, more pressing data on the network. It will be incumbent on the implementation of the protocol to ensure that intervening messages do not disrupt connection mode data and that connection mode data does not disrupt other J1587 message traffic.

B.6.2.1 REQUEST TO SEND—The transfer of data is initiated by the transmission of a RTS. The RTS contains the number of segments to be transferred by the transport protocol; and the actual size of the message before segmentation. Note that this provides all the information needed for the protocol to reassemble the message correctly.

Upon receipt of an RTS, the receiving station must make decisions concerning its ability to buffer the incoming message. If the receiving station cannot accept any connection mode data it may respond with an ABORT message, signaling that the connection was refused. The receiver may wish to accept the connection request, but may not have any resources available to buffer the message at this moment. In this circumstance the receiver shall respond with a CTS indicating the number of segments to be sent to be zero, starting with segment number zero. As segments are numbered from 1 to 255 (FF_{16}), this indicates to the originator that the receiver is amenable to the connection but is at this moment out of resources. When the resources are available, the receiver should transmit a CTS showing the number of segments it can accept, and a beginning segment ID number of 1.

If a Request to Send is transmitted but no response is received, the originator will wait no fewer than 60 seconds before transmitting a second RTS. If at the end of ten such attempts to initiate a connection, the originator will declare a connection mode error and cease attempting to initiate the connection.

B.6.2.2 CLEAR TO SEND—The CTS is used to respond to RTS messages, to acknowledge received data messages, and to provide flow control between the communicating entities. The CTS data field contains a one-byte field indicating the number of segments that the receiver is capable of buffering and/or interpreting at this time and the segment ID number of the *next* segment it is expecting.

The number of segments to be accepted indicates that the originator may send that many bytes and if they are received across the network, the receiver has the resources to deal with them. If, for example, the receiver has a buffer structure which allows it to hold 4 incoming data messages, it would never send a CTS authorizing the transmission of more than four segments. After processing those four messages, however, the receiver may send a CTS indicating that it can accept four more segments, and that the next segment

expected is Segment 5. This is a de facto acknowledgment that segments 1 through 4 were received correctly.

If, on the other hand, the receiver expected to receive segments 1 through 4 and segment 3 was missing, the receiver could transmit a CTS with a number of segments value set to 1 and the next segment ID expected value set to 3.

Flow control is achieved because the two communicating entities collaborate on the amount of data to be sent; bandwidth is conserved because an individual acknowledgment does not have to be transferred for each received data segment, and error control is achieved by the effective re-request of data which was not received properly.

B.6.2.3 END OF MESSAGE ACKNOWLEDGMENT—The End of Message Acknowledgment is passed by the receiving station once it has received the last segment of a segmented message. It acts as an acknowledgment of the last block of segments which were transferred, an acknowledgment of the entire message, and a signal to close the connection.

B.6.2.4 CONNECTION ABORT—The connection abort message may be passed by either of the communicating entities if it cannot continue the data transfer process for any reason.

Connection Mode Data Transfer Sequence

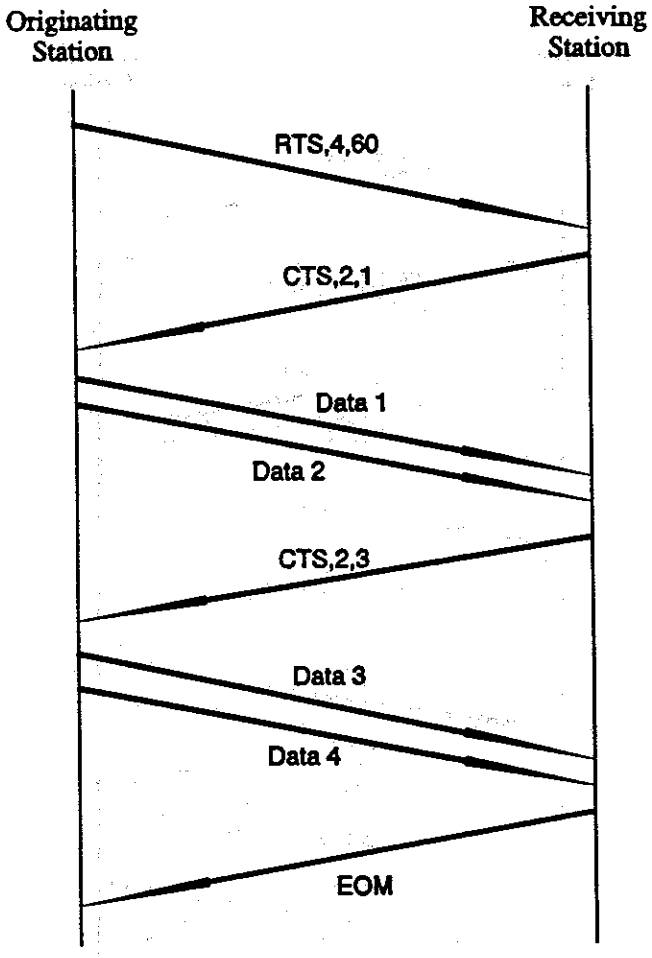

FIGURE B4 - DATA TRANSFER WITHOUT ERRORS

B.6.3 Connection Mode Data Transfer—Under normal circumstances, the flow model for data transfer follows Figure B4. An RTS is transferred indicating that there are four segments to be transferred for this connection, and that there are 60 bytes in the segmented message.

The receiving station replies with a CTS indicating that it is ready to process two segments, beginning with segment 1.

The originating station passes the first two segments across the network. The receiving station then replies with another CTS indicating that it can take two more segments, beginning with Segment 3. Once segments 3 and 4 have been transferred, the receiving station transmits an EOM message indicating that all the segments expected were transmitted and that the connection is now considered closed.

Connection Mode Data Transfer Sequence
With Errors

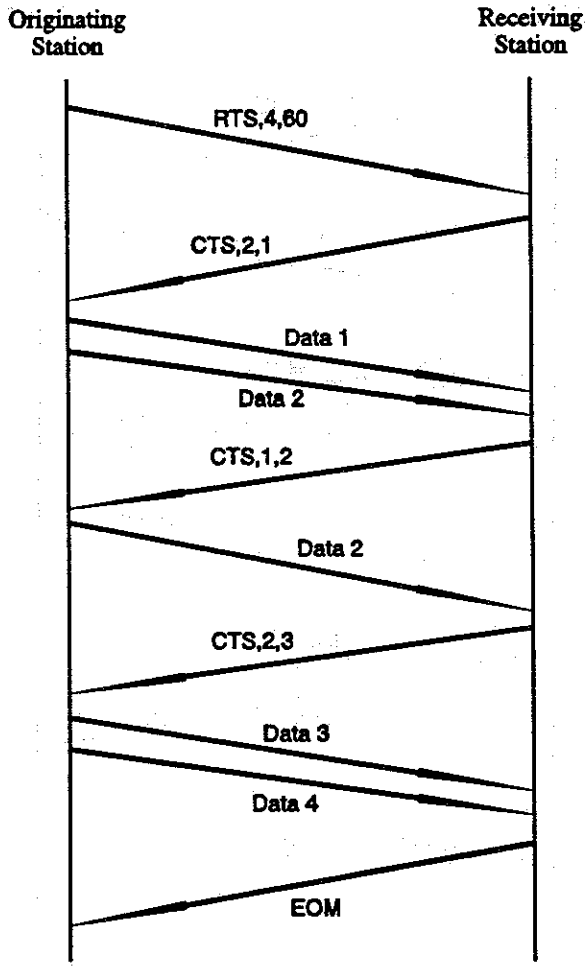

FIGURE B5 - DATA TRANSFER WITH ERRORS

Message transfer in the event of an error on the link is shown in Figure B5. The RTS is transferred and responded to properly, then data is lost during the data transfer phase.

In this situation, the request to send is sent in the same manner as the earlier example. The first two segments are transferred, but segment two fails checksum, or otherwise was considered in error by the receiving station. The receiver then transfers a CTS indicating that it wants a single segment, and that segment is segment 2. The originator complies, transferring segment 2. The receiver then passes a CTS indicating it wants two segments, starting with segment 3. This CTS is the acknowledgment that segments 1 and 2 were received correctly. Once the last segment is received correctly, the receiver passes an EOM signaling that the entire message has been correctly received.

Use of the Transport Protocol for Data Requests

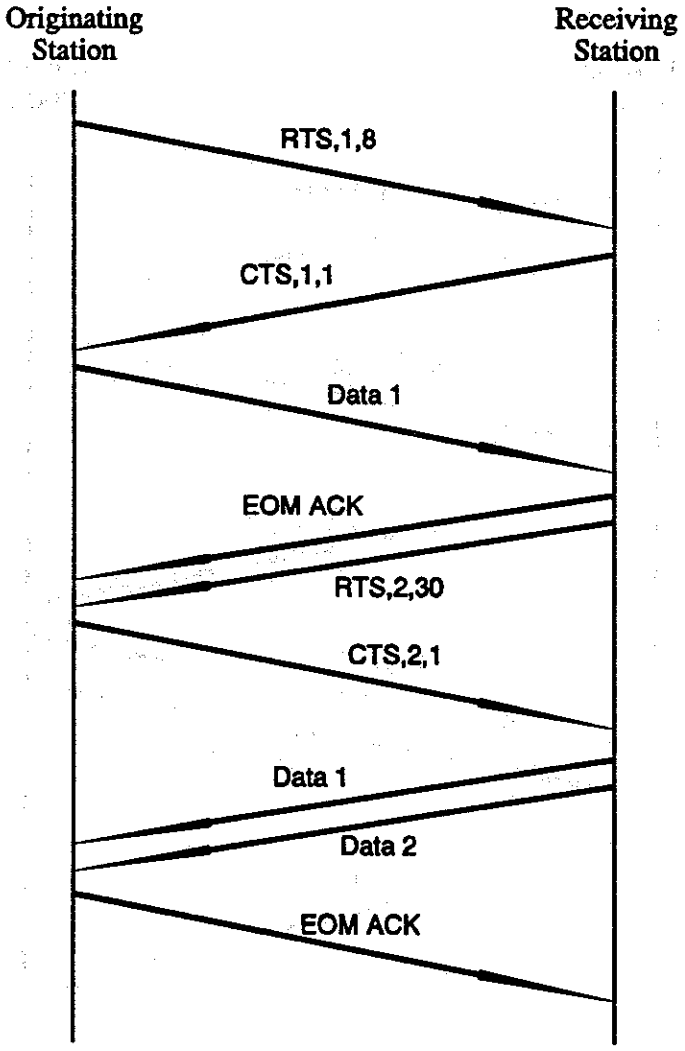

FIGURE B6 - REQUESTED DATA TRANSFER

In the situation shown in Figure B6, a station requests that free form data be transferred. It does so by encapsulating the request for data within a free-form message and utilizing the services provided by the transport layer. When the other unit receives and interprets the encapsulated request, and uses the services of the transport layer to pass the requested data.

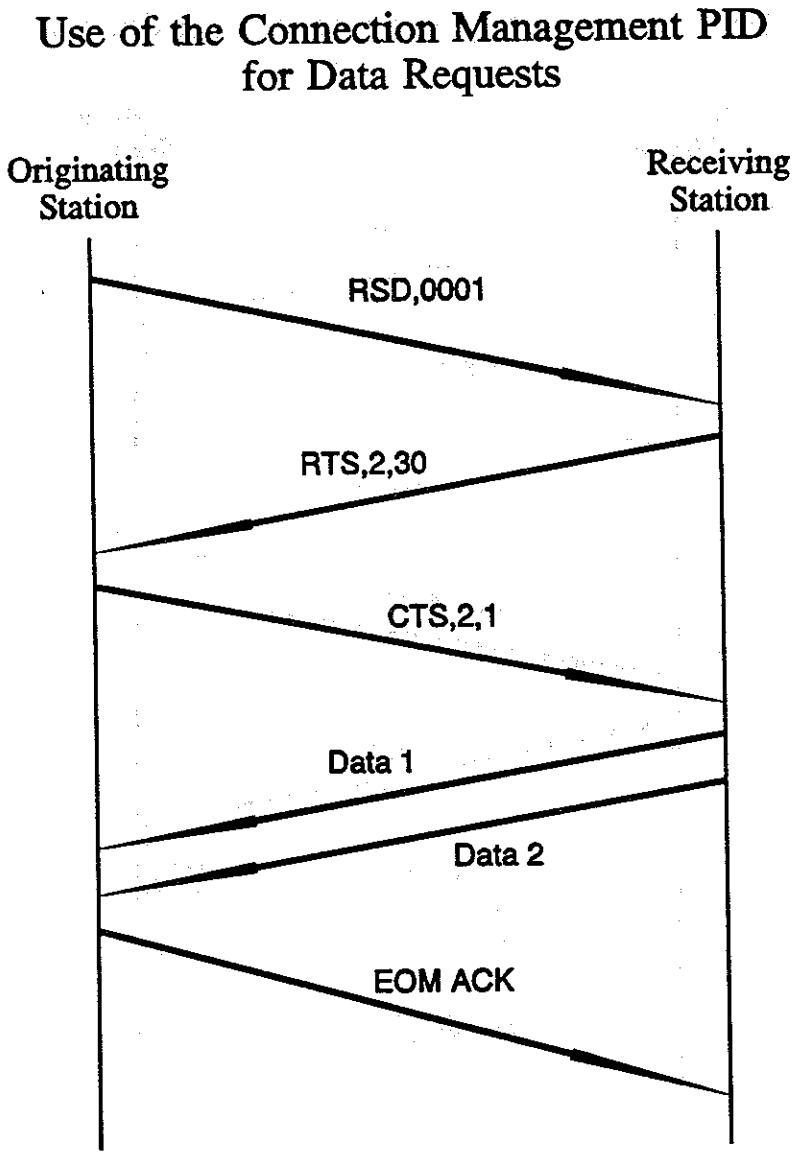

FIGURE B7 - REQUESTED DATA TRANSFER USING THE RSD PARAMETER

In the situation shown in Figure B7, the requesting device uses the Connection Management Control Command 4 to request standardized data (RSD) as defined by the Committee.

J1587 JAN94

Rationale—Not applicable.

Relationship of SAE Standard to ISO Standard—Not applicable.

Application—This SAE Recommended Practice defines a document for the format of messages and data that is of general value to modules on the data communications link. Included are field descriptions, size, scale, internal data representation, and position within a message. This document also describes guidelines for the frequency of and circumstances in which messages are transmitted.

In order to promote compatibility among all aspects of electronic data used in heavy-duty applications, it is the intention of the Data Format Subcommittee (in conjunction with other industry groups) to develop recommended message formats for:

a. Vehicle and Component Information—This includes all information that pertains to the operation of the vehicle and its components (such as performance, maintenance, and diagnostic data).

b. Routing and Scheduling Information—Information related to the planned or actual route of the vehicle. It includes current vehicle location (for example, geographical coordinates) and estimated time of arrival.

c. Driver Information—Information related to driver activity. Includes driver identification, logs (for example, DOT), driver expenses, performance, status and payroll data.

d. Freight Information—Provides data associated with cargo being shipped, picked up or delivered. Includes freight status, overage, shortage and damage reporting, billing and invoice information as well as customer and consignee data.

This document represents the recommended formats for basic vehicle and component identification and performance data. This document is intended as a guide toward standard practice and is subject to change to keep pace with experience and technical advances.

Reference Section

SAE J1455—Recommended Environmental Practices for Electrical Equipment Design (Heavy-Duty Trucks)

SAE J1708—Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications.

EIA RS-485—"Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems," Electronic Industries Association, Washington, DC, April 1983

ANSI/IEEE Standard 754-1985 IEEE Standard for Binary Floating-Point Arithmetic

Developed by the SAE Truck and Bus Data Format Diagnostics Subcommittee

Sponsored by the SAE Truck and Bus Electrical and Electronics Committee