The Engineering Society For Advancing Mobility Land Sea Air and Space®
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SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1587

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Electronic Data Interchange Between Microcomputer Systems in Heavy-Duty Vehicle Applications

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 SAE Truck and Bus Low Speed Communications Network Subcommittee (formerly 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 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 Publications—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAEJ1708—Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications
SAEJ1455—Recommended Environmental Practices for Electrical Equipment Design (Heavy-Duty Trucks)

2.1.2 ANSI/IEEE PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

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

2.1.3 EIA PUBLICATION—Available from Electronics Industries Association, Washington, DC.

EIARS-485—Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems, April 1983

2.1.4 RTCM PUBLICATION—Available from RTCM, P.O. Box 19087, Washington, DC 20036.

RTCM-104, Version 2.0—Radio Technical Commission for Maritime Services, 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. Designers need to be aware that messages starting with MIDs 0 to 127 are allowed to coexist with current SAE J1587 messages. The content of the messages broadcast by MIDs 0 to 127 may or may not conform to SAE J1587 format.

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 SAE Truck and Bus Low Speed Communications Network 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 SAE 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 Systems, Trailer #2
157	Diagnostic Systems, 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

TABLE 1—MESSAGE ID ASSIGNMENT LIST (CONTINUED)

184	Engine #4
185	Engine #5
186	Engine #6
187	Vehicle Control Head Unit/Vehicle Management System #2
188	Vehicle Logic Control Unit/Vehicle Management System #3
189	Vehicle Head Signs
190	Refrigerant Management Protection and Diagnostics
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 #1
198	Schedule Adherence Unit
199	Route Adherence Unit
200	Environment Monitor Unit/Auxiliary Cab Climate Control
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 SAE 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 Systems
220	Tachograph
221	Driver Information Center #2
222	Driveline Retarder
223	Transmission Shift Console—Primary
224	Parking Heater
225	Weighing System, Axle Group #1/Vehicle
226	Weighing System, Axle Group #2
227	Weighing System, Axle Group #3
228	Weighing System, Axle Group #4
229	Weighing System, Axle Group #5
230	Weighing System, Axle Group #6
231	Communication Unit—Cellular
232	Safety Restraint System
233	Intersection Preemption Emitter
234	Instrument Cluster #2
235	Engine Oil Control System
236	Entry Assist Control #1
237	Entry Assist Control #2
238	Idle Adjust System
239	Passenger Counter Unit #2
240	Passenger Counter Unit #3
241	Fuel Tank Monitor

TABLE 1—MESSAGE ID ASSIGNMENT LIST (CONTINUED)

242	Axles, Trailer #4
243	Axles, Trailer #5
244	Diagnostic Systems, Trailer #4
245	Diagnostic Systems, Trailer #5
246	Brakes, Trailer #4
247	Brakes, Trailer #5
248	Forward Road Image Processor
249	Body Controller
250	Steering Column Unit
251-255	Reserved to be assigned

NOTE Designers need to be aware that messages starting with MIDs 0 to 127 are allowed to coexist with current SAE J1587 messages. The content of the messages broadcast by MIDs 0 to 127 may or may not conform to SAE J1587 format.

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	Axle #2 Lift Air Pressure
8	Brake System Air Pressure Low Warning Switch Status
9	Axle Lift Status
10	Axle Slider Status
11	Cargo Securement
12	Brake Stroke Status
13	Entry Assist Position/Deployment
14	Entry Assist Motor Current
15	Fuel Supply Pump Inlet Pressure
16	Suction Side Fuel Filter Differential Pressure
17	Engine Oil Level Remote Reservoir
18	Extended Range Fuel Pressure
19	Extended Range Engine Oil Pressure
20	Extended Range Engine Coolant Pressure
21	Engine ECU Temperature
22	Extended Engine Crankcase Blow-by Pressure
23	Generator Oil Pressure
24	Generator Coolant Temperature
25	Air Conditioner System Status #2
26	Estimated Percent Fan Speed
27	Percent Exhaust Gas Recirculation Valve #1 Position
28	Percent Accelerator Position #3
29	Percent Accelerator Position #2
30	Crankcase Blow-by Pressure
31	Transmission Range Position
32	Transmission Splitter Position
33	Clutch Cylinder Position
34	Clutch Cylinder Actuator Status
35	Shift Finger Actuator Status #2
36	Clutch Plates Wear Condition
37	Transmission Tank Air Pressure
38	Second Fuel Level (Right Side)
39	Tire Pressure Check Interval
40	Engine Retarder Switches Status
41	Cruise Control Switches Status

TABLE 2—PARAMETER IDENTIFICATION ASSIGNMENT LIST (CONTINUED)

PID	Parameter
42	Pressure Switch Status
43	Ignition Switch Status
44	Attention/Warning Indicator Lamps Status
45	Inlet Air Heater Status
46	Vehicle Wet Tank Pressure
47	Retarder Status
48	Extended Range Barometric Pressure
49	ABS Control Status
50	Air Conditioner System Clutch Status/Command #1
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 Status
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 #1 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

TABLE 2—PARAMETER IDENTIFICATION ASSIGNMENT LIST (CONTINUED)

PID	Parameter
93	Output Torque
94	Fuel Delivery Pressure
95	Fuel Filter Differential Pressure
96	Fuel Level
97	Water in Fuel Indicator
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	Injector Metering Rail #2 Pressure
130	Power Specific Fuel Economy
131	Exhaust Back Pressure
132	Mass Air Flow
133	Average Fuel Rate
134	Wheel Speed Sensor Status
135	Extended Range Fuel Delivery Pressure (Absolute)
136	Auxiliary Vacuum Pressure Reading
137	Auxiliary Gage Pressure Reading #1
138	Auxiliary Absolute Pressure Reading
139	Tire Pressure Control System Channel Functional Mode
140	Tire Pressure Control System Solenoid Status

TABLE 2—PARAMETER IDENTIFICATION ASSIGNMENT LIST (CONTINUED)

PID	Parameter
141	Trailer #1, Tag #1, or Push Channel #1 Tire Pressure Target
142	Drive Channel Tire Pressure Target
143	Steer Channel Tire Pressure Target
144	Trailer #1, Tag #1, or Push Channel #1 Tire Pressure
145	Drive Channel Tire Pressure
146	Steer Channel Tire Pressure
147	Average Fuel Economy (Natural Gas)
148	Instantaneous Fuel Economy (Natural Gas)
149	Fuel Mass Flow Rate (Natural Gas)
150	PTO Engagement Control Status
151	ATC Control Status
152	Number of ECU Resets
153	Crankcase Pressure
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
176	Turbo Oil Temperature
177	Transmission #1 Oil Temperature
178	Front Axle Weight
179	Rear Axle Weight
180	Trailer Weight
181	Cargo Weight
182	Trip Fuel
183	Fuel Rate (Instantaneous)
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

TABLE 2—PARAMETER IDENTIFICATION ASSIGNMENT LIST (CONTINUED)

PID	Parameter
	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
197	Connection Management
198	Connection Mode Data Transfer
199	Traction Control Disable State
200–208	Reserved—to be assigned
209	ABS Control Status, Trailer
210	Tire Temperature (By Sequence Number)
211	Tire Pressure (By Sequence Number)
212	Tire Pressure Target (By Sequence Number)
213	Wheel End Assembly Vibration Level
214	Vehicle Wheel Speeds
215	Brake Temperature
216	Wheel Bearing Temperature
217	Fuel Tank/Nozzle Identification
218	State Line Crossing
219	Current State and Country
220	Engine Torque History
221	Anti-theft Request
222	Anti-theft Status
223	Auxiliary A/D Counts
224	Immobilizer Security Code
225	Reserved for Text Message Acknowledged
226	Reserved for Text Message to Display
227	Reserved for Text Message Display Type
228	Speed Sensor Calibration
229	Total Fuel Used (Natural Gas)
230	Total Idle Fuel Used (Natural Gas)
231	Trip Fuel (Natural Gas)
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 by Position
242	Tire Temperature by Position
243	Component Identification
244	Trip Distance
245	Total Vehicle Distance

TABLE 2—PARAMETER IDENTIFICATION ASSIGNMENT LIST (CONTINUED)

PID	Parameter
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
	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)	Component Restart Response
260-361	Reserved (page 2) to be assigned
362 (106)	Percent Exhaust Gas Recirculation Valve #2 Position
363 (107)	Hydraulic Retarder Control Air Pressure
364 (108)	HVAC Unit Discharge Temperature
365 (109)	Weighing System Status Command
366 (110)	Engine Oil Level High/Low
367 (111)	Lane Tracking System Status
368 (112)	Lane Departure Indication
369 (113)	Distance to Rear Object (Reverse)
370 (114)	Trailer Pneumatic Brake Control Line Pressure
371 (115)	Trailer Pneumatic Supply Line Pressure
372 (116)	Remote Accelerator
373 (117)	Center Rear Drive Axle Temperature
374 (118)	Alternator AC Voltage
375 (119)	Fuel Return Pressure
376 (120)	Fuel Pump Inlet Vacuum
377 (121)	Compression Unbalance
378 (122)	Fare Collection Unit Status
379 (123)	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
385–405	Reserved (page 2)—to be assigned
406 (150)	HVAC Blower Motor Speed
407 (151)	Axle Group Full Weight Calibration

TABLE 2—PARAMETER IDENTIFICATION ASSIGNMENT LIST (CONTINUED)

PID	Parameter
408 (152)	Axle Group Empty Weight Calibration
409 (153)	Axle Group Weight
410 (154)	Extended Range Road Surface Temperature
411 (155)	Recirculated Engine Exhaust Gas Differential Pressure
412 (156)	Recirculated Engine Exhaust Gas Temperature
413 (157)	Net Vehicle Weight Change
414 (158)	Air Conditioner Refrigerant Low Side Pressure
415 (159)	Air Conditioner Refrigerant High Side Pressure
416 (160)	Evaporator Temperature
417 (161)	Gross Vehicle Weight
418 (162)	Transmission # 2 Oil Temperature
419 (163)	Starter Circuit Resistance
420 (164)	Starter Current (Average)
421 (165)	Alternator/Generator Negative Cable Voltage
422 (166)	Auxiliary Current
423 (167)	Extended Range Net Battery Current
424 (168)	DC Voltage
425 (169)	Auxiliary Frequency
426 (170)	Alternator/Generator Field Voltage
427 (171)	Battery Resistance Change
428 (172)	Battery Internal Resistance
429 (173)	Starter Current Peak
430 (174)	Starter Solenoid Voltage
431 (175)	Starter Negative Cable Voltage
432 (176)	Starter Motor Voltage
433 (177)	Fuel Shutoff Solenoid Voltage
434 (178)	AC Voltage
435 (179)	Cargo Ambient Temperature (By location)
436 (180)	Trip Sudden Decelerations
437 (181)	Trailer #2, Tag #2, or Push Channel #2 Tire Pressure Target
438 (182)	Trailer #2, Tag #2, or Push Channel #2 Tire Pressure
439 (183)	Extended Range Boost Pressure #1
440 (184)	Extended Range Boost Pressure #2
441 (185)	Auxiliary Temperature #1
442 (186)	Auxiliary Temperature #2
443 (187)	Auxiliary Gage Pressure Reading #2
444 (188)	Battery #2 Potential (Voltage)
445 (189)	Cylinder Head Temperature Bank B (right bank)
446 (190)	Cylinder Head Temperature Bank A (left bank)
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
451–497	Reserved (page 2)—to be assigned
498 (242)	Send Keypress Command
499 (243)	Driver Interface Unit (DIU) Object/Form Command
500 (244)	Intersection Preemption Status and Configuration
501 (245)	Signage Message

TABLE 2—PARAMETER IDENTIFICATION ASSIGNMENT LIST (CONTINUED)

PID	Parameter
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. 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.

Unless otherwise specified, alphanumeric characters will conform to the ISO Latin 1 ASCII character set as shown in 3.4.2.

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

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.

3.4.2 ISO LATIN 1 CHARACTER SET—Horizontal boldface characters are the single hexidecimal digit representing the lower nibble of the single byte code for the character. Vertical boldface characters are the single hexidecimal digit representing the upper nibble of the single byte code for the character. See Figure 1.

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.

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.

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	---------- should not be displayed ----------															
1	---------- should not be displayed ----------															
2	space	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	nil
8	---------- should not be displayed ----------															
9	---------- should not be displayed ----------															
A	nil	¡	¢	£	¤	¥	|	§	¨	©	ª	«	¬	–	®	—
B	°	±	²	³	´	µ	¶	·	¸	¹	º	»	¼	½	¾	¿
C	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
D	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	ß
E	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï
F	ð	ñ	ò	ó	ô	õ	ö	÷	ø	ù	ú	û	ü	ý	þ	ÿ

FIGURE 1—ISO LATIN 1 CHARACTER SET

3.8 Subsystem Identification Assignments—Subsystem Identification Numbers (SIDs) are numbers assigned by the SAE staff or the SAE Truck and Bus Low Speed Communications Network 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 3.10. SIDs 156 to 255 are assigned by the SAE Truck and Bus Low Speed Communications Network Subcommittee using the procedure in 3.10. 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:

a. Cost of specific component fault isolation is not justified, or
b. New concepts in Total Vehicle Diagnostics are being developed, or
c. 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 SAE Truck and Bus Low Speed Communications Network 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 Truck and Bus Low Speed Communications Network Subcommittee.

b. General—MIDs, PIDs, and SIDs will be requested using the request form (Figure 2). All requests for MIDs, PIDs, and common SIDs will be forwarded to the chairperson of the SAE 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 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 Truck and Bus Low Speed Communications Network 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 Truck and Bus Low Speed Communications Network Subcommittee for review and approval by the committee. Send the second copy of the request back to the requestor.

The chairperson of the SAE 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 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 2). 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 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 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.

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 2—SAE SUBCOMMITTEE MID, PID, SID REQUEST FORM

TABLE 4—CONNECTION MANAGEMENT CONTROL COMMANDS(1)

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

1. See Appendix B.

TABLE 5—STANDARDIZED FREE-FORMAT DATA ASSIGNMENTS(1)

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 Subcommittee

1. 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 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

Common SIDs

156–206	Reserved for future assignment by SAE Subcommittee
207	Battery #1 Temperature
208	Battery #2 Temperature
209	Start Enable Device #2
210	Oil Temperature Sensor
211	Sensor Supply Voltage #2 (+5V DC)
212	Sensor Supply Voltage #1 (+5V DC)
213	PLC Data Link
214	ECU Backup Battery
215	Cab Interior Temperature Thermostat
216	Other ECUs Have Reported Fault Codes Affecting Operation
217	Anti-theft Start Inhibit (Password Valid Indicator)
218	ECM Main Relay
219	Start Signal Indicator
220	Electronic Tractor/Trailer Interface (ISO 11992)
221	Internal Sensor Voltage Supply
222	Protect Lamp
223	Ambient Light Sensor
224	Audible Alarm
225	Green Lamp
226	Transmission Neutral Switch
227	Auxiliary Analog Input #1
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(1)	Set aside for Systems Diagnostics
242	Cruise Control Resume Switch
243	Cruise Control Set Switch
244	Cruise Control Enable Switch

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

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
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	Turbocharger #1 Wastegate Drive
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

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

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	Heated Oxygen Sensor
66	Ignition Control Mode Signal
67	Ignition Control Timing Signal
68	Secondary Turbo Inlet Pressure
69	After Cooler-Oil Cooler Coolant Temperature
70	Inlet Air Heater Driver #1
71	Inlet Air Heater Driver #2
72	Injector Cylinder #21
73	Injector Cylinder #22
74	Injector Cylinder #23
75	Injector Cylinder #24
76	Knock Sensor
77	Gas Metering Valve
78	Fuel Supply Pump Actuator
79	Engine (Compression) Brake Output #1
80	Engine (Compression) Brake Output #2
81	Engine (Exhaust) Brake Output
82	Engine (Compression) Brake Output #3
83	Fuel Control Valve #2
84	Timing Actuator #2
85	Engine Oil Burn Valve
86	Engine Oil Replacement Valve
87	Idle Shutdown Vehicle Accessories Relay Driver
88	Turbocharger #2 Wastegate Drive
89	Air Compressor Actuator Circuit

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

90	Engine Cylinder #1 Knock Sensor
91	Engine Cylinder #2 Knock Sensor
92	Engine Cylinder #3 Knock Sensor
93	Engine Cylinder #4 Knock Sensor
94	Engine Cylinder #5 Knock Sensor
95	Engine Cylinder #6 Knock Sensor
96	Engine Cylinder #7 Knock Sensor
97	Engine Cylinder #8 Knock Sensor
98	Engine Cylinder #9 Knock Sensor
99	Engine Cylinder #10 Knock Sensor
100	Engine Cylinder #11 Knock Sensor
101	Engine Cylinder #12 Knock Sensor
102	Engine Cylinder #13 Knock Sensor
103	Engine Cylinder #14 Knock Sensor
104	Engine Cylinder #15 Knock Sensor
105	Engine Cylinder #16 Knock Sensor
106	Engine Cylinder #17 Knock Sensor
107	Engine Cylinder #18 Knock Sensor
108	Engine Cylinder #19 Knock Sensor
109	Engine Cylinder #20 Knock Sensor
110	Engine Cylinder #21 Knock Sensor
111	Engine Cylinder #22 Knock Sensor
112	Engine Cylinder #23 Knock Sensor
113	Engine Cylinder #24 Knock Sensor
114	Multiple Unit Synchronization Switch
115	Engine Oil Change Interval
116	Engine was Shut Down Hot
117	Engine has been Shut Down from Data Link Information
118	Injector Needle Lift Sensor #1
119	Injector Needle Lift Sensor #2
120	Coolant System Thermostat
121	Engine Automatic Start Alarm
122	Engine Automatic Start Lamp
123	Engine Automatic Start Safety Interlock Circuit
124	Engine Automatic Start Failed (Engine)
125	Fuel Heater Driver Signal
126	Fuel Pump Pressurizing Assembly #1
127	Fuel Pump Pressurizing Assembly #2
128	Starter Solenoid Lockout Relay Driver Circuit
129	Cylinder #1 Exhaust Gas Port Temperature
130	Cylinder #2 Exhaust Gas Port Temperature
131	Cylinder #3 Exhaust Gas Port Temperature
132	Cylinder #4 Exhaust Gas Port Temperature
133	Cylinder #5 Exhaust Gas Port Temperature
134	Cylinder #6 Exhaust Gas Port Temperature
135	Cylinder #7 Exhaust Gas Port Temperature
136	Cylinder #8 Exhaust Gas Port Temperature
137	Cylinder #9 Exhaust Gas Port Temperature
138	Cylinder #10 Exhaust Gas Port Temperature
139	Cylinder #11 Exhaust Gas Port Temperature
140	Cylinder #12 Exhaust Gas Port Temperature
141	Cylinder #13 Exhaust Gas Port Temperature

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

142	Cylinder #14 Exhaust Gas Port Temperature
143	Cylinder #15 Exhaust Gas Port Temperature
144	Cylinder #16 Exhaust Gas Port Temperature
145	Adaptive Cruise Control Mode
146	Exhaust Gas Re-Circulation (EGR) Valve Mechanism
147	Variable Nozzle Turbocharger (VNT) Mechanism
148	Engine (Compression) Brake Output #4
149	Engine (Compression) Brake Output #5
150	Engine (Compression) Brake Output #6

Transmission SIDs (MID = 130)

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

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

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	Auxiliary Range Mechanical System
57	Shift Console Data Link
58	Main Box Shift Engagement System
59	Main Box Rail Selection System
60	Main Box Shift Neutralization System
61	Auxiliary Splitter Mechanical System
62	Transmission Controller Power Relay
63	Output Shaft Speed Sensor
64	Throttle Position Device
65–150	Reserved for future assignment by SAE

Brake SIDs (MID = 136, 137, 138, 139, 246, 247)

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

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

23	Tractor ABS 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	Ride Height Relay
42	Hold Modulator Valve Solenoid Axle 1 Left
43	Axle 1 Right
44	Axle 2 Left
45	Axle 2 Right
46	Axle 3 Left
47	Axle 3 Right
48	Dump Modulator Valve Solenoid Axle 1 Left
49	Axle 1 Right
50	Axle 2 Left
51	Axle 2 Right
52	Axle 3 Left
53	Axle 3 Right
54	Hydraulic Pump Motor
55	Brake Light Switch 1
56	Brake Light Switch 2
57	Electronic Pressure Control, Axle 1
58	Pneumatic Back-up Pressure Control, Axle 1
59	Brake Pressure Sensing, Axle 1
60	Electronic Pressure Control, Axle 2
61	Pneumatic Back-up Pressure Control, Axle 2
62	Brake Pressure Sensing, Axle 2
63	Electronic Pressure Control, Axle 3
64	Pneumatic Back-up Pressure Control, Axle 3
65	Brake Pressure Sensing, Axle 3
66	Electronic Pressure Control, Trailer Control
67	Pneumatic Back-up Pressure Control, Trailer Control
68	Brake Pressure Sensing, Trailer Control
69	Axle Load Sensor
70	Lining Wear Sensor, Axle 1 Left
71	Lining Wear Sensor, Axle 1 Right
72	Lining Wear Sensor, Axle 2 Left
73	Lining Wear Sensor, Axle 2 Right
74	Lining Wear Sensor, Axle 3 Left

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

75	Lining Wear Sensor, Axle 3 Right
76	Brake Signal Transmitter
77	Brake Signal Sensor 1
78	Brake Signal Sensor 2
79	Tire Dimension Supervision
80	Vehicle Deceleration Control
81	Trailer ABS Warning Light Bulb
82	Brake Torque Output Axle 1 Left
83	Brake Torque Output Axle 1 Right
84	Brake Torque Output Axle 2 Left
85	Brake Torque Output Axle 2 Right
86	Brake Torque Output Axle 3 Left
87	Brake Torque Output Axle 3 Right
88	Vehicle Dynamic Stability Control System (VDC)
89	Steering Angle Sensor
90	Voltage Supply for Stability Control System
91	Brake Lining Display
92	Pressure Limitation Valve
93	Auxiliary Valve
94	Hill holder System
95	Voltage Supply, Lining Wear Sensors, Axle 1
96	Voltage Supply, Lining Wear Sensors, Axle 2
97	Voltage Supply, Lining Wear Sensors, Axle 3
98–150	Reserved for future assignment by SAE

Instrument Panel SIDs (MID = 140,234)

0	Reserved
1	Left Fuel Level Sensor
2	Right Fuel Level Sensor
3	Fuel Feed Rate Sensor
4	Fuel Return Rate Sensor
5	Tachometer Gauge Coil
6	Speedometer Gauge Coil
7	Turbocharger Air Pressure Gauge Coil
8	Fuel Pressure Gauge Coil
9	Fuel Level Gauge Coil
10	Second Fuel Level Gauge Coil
11	Engine Oil Pressure Gauge Coil
12	Engine Oil Temperature Gauge Coil
13	Engine Coolant Temperature Gauge Coil
14	Pyrometer Gauge Coil
16	Transmission Oil Pressure Gauge Coil
15	Transmission Oil Temperature Gauge Coil
17	Forward Rear Axle Temperature Gauge Coil
18	Rear Rear Axle Temperature Gauge Coil
19	Voltmeter Gauge Coil
20	Primary Air Pressure Gauge Coil
21	Secondary Air Pressure Gauge Coil
22	Ammeter Gauge Coil
23	Air Application Gauge Coil
24	Air Restriction Gauge Coil

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

25–150	Reserved for future assignment by SAE

Vehicle Management System SIDs (MID = 142)

0	Reserved
1	Timing Sensor
2	Timing Actuator
3	Fuel Rack Position Sensor
4	Fuel Rack Actuator
5	Oil Level Indicator Output
6	Tachometer Drive Output
7	Speedometer Drive Output
8	PWM Input (ABS/ASR)
9	PWM Output
10	Auxiliary Output #1
11	Auxiliary Output #2
12	Auxiliary Output #3
13–150	Reserved for future assignment by SAE

Fuel System SIDs (MID = 143)

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
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	Cooling Fan Drive Output
28	Engine (Compression) Brake Output #1
29	Engine (Compression) Brake Output #2
30	Engine (Exhaust) Brake Output

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

31	Pressure Control Valve #1
32	Pressure Control Valve #2
33–150	Reserved for future assignment by SAE

Cab Climate Control SIDs (MID = 146, 200)

1	HVAC Unit Discharge Temperature Sensor
2	Evaporator Temperature Sensor
3	Solar Load Sensor #1
4	Solar Load Sensor #2
5	Fresh/Recirculation Air Intake Door Actuator
6	Mode Door #1 Actuator
7	Mode Door #2 Actuator
8	Mode Door #3 Actuator
9	Blend Door Actuator
10	Blower Motor
11	A/C Clutch Relay
12	Water Valve
13	Heater Exchanger Temperature Sensor
14	In Cabin Temperature Sensor Blower
15	Blower Clutch
16	Stepper Motor Phase 1
17	Stepper Motor Phase 2
18	Stepper Motor Phase 3
19	Stepper Motor Phase 4
20	Refrigerant Evaporator Inlet Temperature Sensor
21	Refrigerant Evaporator Outlet Temperature Sensor
22	Refrigerant Evaporator Inlet Pressure Sensor
23	Refrigerant Evaporator Outlet Pressure Sensor
24	Refrigerant Compressor Inlet Temperature Sensor
25	Refrigerant Compressor Outlet Temperature Sensor
26	Refrigerant Compressor Inlet Pressure Sensor
27	Refrigerant Compressor Outlet Pressure Sensor
28	Refrigerant Condenser Outlet Temperature Sensor
29	Refrigerant Condenser Outlet Pressure Sensor
30-150	Reserved for future assignment by SAE

Suspension SIDs (MID = 150, 151, 152, 153)

0	Reserved
1	Solenoid Valve Axle 1 Right
2	Axle 1 Left
3	Axle 2 Right
4	Axle 2 Left
5	Axle 3 Right
6	Axle 3 Left
7	Central (Lowering/Lifting Control)
8	Solenoid Valve for Lifting the Lifting/Trailing Axle
9	Solenoid Valve for Lowering the Lifting/Trailing Axle
10	Solenoid Valve for Control of the Lift Bellow
11	Solenoid Valve for Starting Lock
12	Solenoid Valve for Door Release

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

13	Solenoid Valve for Mainflow Throttle
14	Solenoid Valve for Transverse Lock/Throttle
15	Solenoid Valve for Automatic Load-Dependent Brake-Power Balance
16	Height Sensor Axle 1 Right
17	Axle 1 Left
18	Axle 2 Right
19	Axle 2 Left
20	Axle 3 Right
21	Axle 3 Left
22	Pressure Sensor Axle 1 Right
23	Axle 1 Left
24	Axle 2 Right
25	Axle 2 Left
26	Axle 3 Right
27	Axle 3 Left
28	Lift Bellow
29	Sidewalk Detector Sensor
30	Switch for Maximum Permanent Permissible Pressure
31	Switch for Maximum Temporary Permissible Pressure
32	Speed Signal Input
33	Remote Control Unit #1
34	Central Valve Relay
35	Auxiliary Tank Control
36	Exterior Kneel (warning lamp & audible alarm)
37	Wheel Chair Lift Inhibit
38	Checksum ECU Specific Data
39	Checksum Parameter Data
40	Checksum Calibration Data Level Sensors
41	Checksum Calibration Data Pressure Sensors
42	Checksum Maximum Axle Load Data
43	Central 3/2 Solenoid Valve Axle 3
44	Central 3/2 Solenoid Valve Front Axle
45	Pressure Sensor Brake Pressure
46	Power Supply for Pressure Sensors
47	Power Supply for Remote Controls
48	Remote Control #1 Data Line
49	Remote Control #1 Clock Line
50	Remote Control #2 Data Line
51	Remote Control #2 Clock Line
52	Remote Control Unit #2
53	Power Supply for Solenoid Valves
54	Proportional Valve Front Axle Left
55	Proportional Valve Front Axle Right
56	Proportional Valve Drive Axle Left
57	Proportional Valve Drive Axle Right
58	Proportional Valve Axle 3 Left
59	Proportional Valve Axle 3 Right
60–150	Reserved for future assignment by SAE

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

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

Vehicle Security SIDs (MID = 163)

0	Reserved
1	Transceiver Antenna
2	Security Transponder
3–150	Reserved for future assignment by SAE

Tire SIDs (MID = 166, 167, 168, 169)

0	Reserved
1	Operator Control Panel (OCP)
2	Pneumatic Control Unit (PCU)
3	PCU Steer Solenoid
4	PCU Drive Solenoid
5	PCU Solenoid Trailer #1, Tag #1, or Push #1
6	PCU Supply Solenoid
7	PCU Control Solenoid
8	PCU Deflate Solenoid
9	Pneumatic—Steer Channel
10	Pneumatic—Drive Channel
11	Pneumatic—Trailer #1, Tag #1, or Push #1 Channel
12	Drive Axle Manifold Deflation Solenoid
13	Steer Axle Manifold Deflation Solenoid
14	PCU Solenoid Trailer #2, Tag #2, or Push #2
15	Brake Priority Pressure Switch
16	Pneumatic-Trailer #2, Tag #2, or Push #2 Channel
17	Wiring Harness
18	Tire Pressure Sensor - # 1
19	Tire Pressure Sensor - # 2
20	Tire Pressure Sensor - # 3
21	Tire Pressure Sensor - # 4
22	Tire Pressure Sensor - # 5
23	Tire Pressure Sensor - # 6
24	Tire Pressure Sensor - # 7
25	Tire Pressure Sensor - # 8
26	Tire Pressure Sensor - # 9
27	Tire Pressure Sensor - # 10
28	Tire Pressure Sensor - # 11
29	Tire Pressure Sensor - # 12
30	Tire Pressure Sensor - # 13
31	Tire Pressure Sensor - # 14
32	Tire Pressure Sensor - # 15
33	Tire Pressure Sensor - # 16

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

34	Tire Temperature Sensor - # 1
35	Tire Temperature Sensor - # 2
36	Tire Temperature Sensor - # 3
37	Tire Temperature Sensor - # 4
38	Tire Temperature Sensor - # 5
39	Tire Temperature Sensor - # 6
40	Tire Temperature Sensor - # 7
41	Tire Temperature Sensor - # 8
42	Tire Temperature Sensor - # 9
43	Tire Temperature Sensor - # 10
44	Tire Temperature Sensor - # 11
45	Tire Temperature Sensor - # 12
46	Tire Temperature Sensor - # 13
47	Tire Temperature Sensor - # 14
48	Tire Temperature Sensor - # 15
49	Tire Temperature Sensor - # 16
50	Tire Sensor Voltage - # 1
51	Tire Sensor Voltage - # 2
52	Tire Sensor Voltage - # 3
53	Tire Sensor Voltage - # 4
54	Tire Sensor Voltage - # 5
55	Tire Sensor Voltage - # 6
56	Tire Sensor Voltage - # 7
57	Tire Sensor Voltage - # 8
58	Tire Sensor Voltage - # 9
59	Tire Sensor Voltage - # 10
60	Tire Sensor Voltage - # 11
61	Tire Sensor Voltage - # 12
62	Tire Sensor Voltage - # 13
63	Tire Sensor Voltage - # 14
64	Tire Sensor Voltage - # 15
65	Tire Sensor Voltage - # 16
66–150	Reserved for future assignment by SAE

Particulate Trap System SIDs (MID = 177)

0	Reserved
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

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

16	Heater Circuit #16
17	Heater Regeneration System
18–150	Reserved for future assignment by SAE

Refrigerant Management Systems SIDs (MID = 190)

0	Reserved
1	Refrigerant Charge
2	Refrigerant Moisture Level
3	Non-condensable Gas in Refrigerant
4	Refrigerant Flow Control Solenoid
5	Low Side Refrigerant Pressure Switch
6	Compressor Clutch Circuit
7	Evaporator Thermostat Circuit
8	Refrigerant Flow
9–150	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

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

12	Rear Sensor
13–150	Reserved for future assignment by SAE

Driveline Retarder SIDs (MID = 222)

0	Reserved
1	Retarder Enable Solenoid Valve
2	Retarder Modulation Solenoid Valve
3	Retarder Response Solenoid Valve
4	Retarder Modulation Request Sensor
5	Retarder Response System Pressure Indicator
6–150	Reserved for future assignment by SAE

Vehicle Sensors to Data Converter SIDs (MID = 178)

0	Reserved
1	Battery Positive Input
2	Battery Negative Input
3	Current Shunt (-) Input
4	Current Shunt (+) Input
5	Starter Negative Input
6	Alternator Negative Input
7	Transducer +5V Excitation
8	Starter Positive Input
9	Starter Solenoid Input
10	Alternator Positive Input
11	Alternator Field Input
12	Fuel Solenoid Positive Input
13	User Probe Input
14	Fuel Supply Sender Input
15	Air Cleaner Delta P Sender Input
16	Fuel Filter Delta P Sender Input
17	Oil Filter Inlet Sender Input
18	Fuel Return Sender Input
19	Oil Filter Outlet Sender Input
20	Fuel Vacuum Sender Input
21	Battery Negative Input Circuit
22	Battery Positive Input Circuit
23	Starter Positive Input Circuit
24	Starter Negative Input Circuit
25	Starter Solenoid Input Circuit
26	Alternator Field Input Circuit
27	Alternator Positive Input Circuit
28	Alternator Negative Input Circuit
29	Current Sensor Discharge Circuit
30	Current Sensor Charge Circuit
31-150	Reserved for future assignment by SAE

TABLE 6—SUBSYSTEM IDENTIFICATION (SID) ASSIGNMENT LIST (CONTINUED)

Safety Restraint System SIDs (MID = 232)

0	Reserved
1	Driver Air Bag Ignitor Loop
2	Passenger Air Bag Ignitor Loop
3	Left Belt Tensioner Ignitor Loop
4	Right Belt Tensioner Ignitor Loop
5	Safety Restraint System (SRS) Lamp—directly controlled by the ECU
6	Automotive Seat Occupancy Sensor (AOS)—Passenger Side
7	Side Collision Detector (SDC)—Left
8	Side Bag Ignitor Loop 1—Left
9	Side Bag Ignitor Loop 2—Left
10	Side Collision Detector—Right
11	Side Bag Ignitor Loop 1—Right
12	Side Bag Ignitor Loop 2—Right
13	Rollover Sensor
14	Driver Air Bag Stage 2 Igniter Loop
15	Passenger Air Bag Stage 2 Igniter Loop
16–150	Reserved for future assignment by SAE

Forward Road Image Processor SIDs (MID = 248)

0	Reserved
1	Forward View Imager System
2-150	Reserved for future assignment by SAE

1. Superseded by SIDs 151–155.

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 Subcommittee

4. Notes

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

PREPARED BY THE SAE TRUCK AND BUS LOW SPEED COMMUNICATIONS SUBCOMMITTEE
OF THE SAE TRUCK AND BUS ELECTRICAL/ELECTRONIC COMMITTEE

APPENDIX A

PARAMETER DEFINITIONS

A.0 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 Low Speed Communications Network 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 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 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.

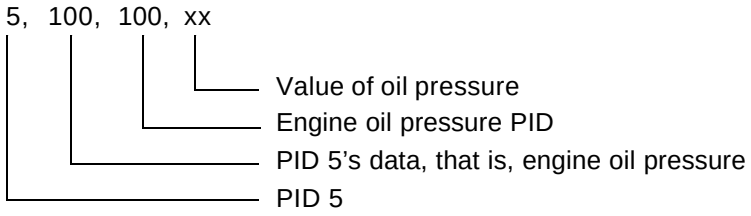
A.4 Reserved—To be assigned

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:

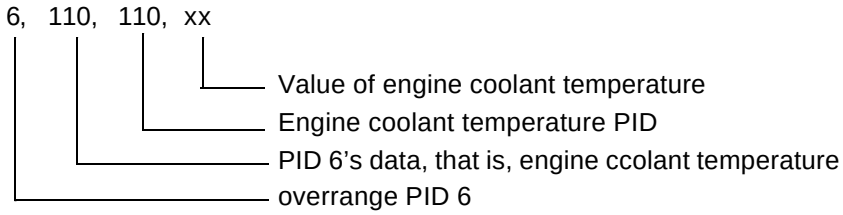


The SAE Truck and Bus Subcommittee established PIDs 194 to 196 in May 1988, therefore, this Parameter ID should no longer be used by manufacturers in the design of new components. However, this parameter is being reserved for use by manufacturers who have developed systems prior to January 1989 and are, 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 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 Axle #2 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
7	a
a—	Axle #2 lift air pressure

A.8 Brake System Air Pressure Low Warning Switch Status—Identifies the current status of the low pressure warning switch that monitors the air brake system.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 500 msec
Message Priority: 4
Format:

PID	Data
8	a
a—	Brake system low air pressure warning switch status

Bits 8-7: Emergency reservoir - trailer
Bits 6-5: Service reservoir - trailer
Bits 4-3: Secondary reservoir - powered vehicle
Bits 2-1: Primary reservoir - powered vehicle

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

00	Off/Normal
01	On/Warning
10	Error condition
11	Not available

A.9 Axle Lift Status—Identifies the current status or position of a lift axle.

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

PID	Data
9	a
a—	Axle lift lock status

Bits 8-5: Reserved-all bits set to 1
Bits 4-3: Axle lift position
Bits 2-1: Axle lift switch status

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

00	Off/Down
01	On/Up
10	Error condition
11	Not available

A.10 Axle Slider Status—Identifies the current status of a sliding axle suspension.

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

PID	Data
10	a
a—	Slider lock status Bits 8-5: Reserved-all bits set to 1 Bits 4-3: Axle slider lock status Bits 2-1: Axle slider lock switch status

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

00	Off/Unlocked
01	On/Locked
10	Error condition
11	Not available

A.11 Cargo Securement—Used to monitor hold down device to include chain, cable or other device that may be used to secure a load.

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

PID	Data
11	a
a—	Cargo securement information Bit 8-5: Cargo sector number 1 to 16 Bit 4-3: Reserved-all bits set to 1 Bit 2-1: Status of the cargo securement sensors 00 = Cargo secure 01 = Loose cargo 10 = Error condition 11 = Not available

A.12 Brake Stroke Status—Identifies the current state of the vehicle foundation brakes.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
12	a
a –	Brake stroke status
	Bit 8-5: Axle number 1 to 16 (represented as 0 to 15)
	Bit 4-2: Brake status/Stroke adjustment
	000 = OK
	001 = Out of adjustment
	010 = Delay brake return
	011 = Brake pads worn
	100 = Delayed brake application
	101 = Reserved
	110 = Error
	111 = Not available
	Bit 1: 1 = Left wheel, 0 = Right wheel

Axle number is incremented from front to back of the vehicle with the front most axle being number 1.

For example, a value of 0 in bits 8-5 identifies axle number 1 and a value of 15 in bits 8-5 identifies axle number 16.

A.13 Entry Assist Position/Deployment—Position of the steps, chair lift, etc. 0% is used to represent fully deployed, 102% is used to represent in full travel 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: On request
Message Priority: 8
Format:

PID	Data
13	a
a—	Entry assist position/deployment

A.14 Entry Assist Motor Current—Current measured of the entry assist motor.

Parameter Data Length: 1 Character
Data Type: Unsigned Short integer
Bit Resolution: 0.04 A
Maximum Range: 0.0 to 10.2 A
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
14	a
a—	Entry Assist Motor Current

A.15 Fuel Supply Pump Inlet Pressure—Absolute pressure of fuel at fuel supply pump inlet.

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
15	a
a—	Fuel supply pump inlet pressure

A.16 Suction Side Fuel Filter Differential Pressure—Differential pressure measured across the fuel filter between the fuel tank and the supply pump.

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
16	a
a—	Suction side fuel filter differential pressure

NOTE—See also PID 95.

A.17 Engine Oil Level Remote Reservoir—Ratio of current volume of engine oil in remote reservoir to maximum recommended volume.

If a single switch (on/off) is used, 20% and 100% respectively will be used where the 100% means no oil needs to be added and 20% means oil needs to be added. If two switches are used, 20%, 50%, and 100% will be used where 20% indicates the oil level is critically low, 50% indicates the oil level is low, and 100% means no oil needs to be added. For continuous sensors, the actual measured percent will be used.

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
17	a
a—	Engine oil level remote reservoir

A.18 Extended Range Fuel Pressure—Gage pressure of fuel in system as delivered from the supply pump to the injection pump.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4 kPa (0.58 lbf/in^2)
Maximum Range: 0.0 to 1020 kPa (0.0 to 148 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
18	a
a—	Extended range fuel pressure

NOTE—See PID 94 for alternate range and bit resolution.

A.19 Extended Range Engine Oil Pressure—Gage pressure of oil in the engine lubrication system as provided by the oil pump.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4 kPa (0.58 lbf/in^2)
Maximum Range: 0.0 to 1020 kPa (0.0 to 148 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
19	a
a—	Extended range engine oil pressure

NOTE—See PID 100 for alternate range and bit resolution.

A.20 Extended Range Engine Coolant Pressure—Gage pressure of liquid found in the engine cooling system.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 2 kPa (0.29 lbf/in^2)
Maximum Range: 0.0 to 510 kPa (0.0 to 74 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
20	a
a—	Extended range engine coolant pressure

NOTE—See PID 109 for alternate range and bit resolution.

A.21 Engine ECU Temperature—Internal air temperature of the engine ECU.

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: 1.0 s
Message Priority: 8
Format:

PID	Data
21	a
a—	Engine ECU temperature

A.22 Extended Crankcase Blow-by Pressure—Crankcase blow-by pressure as measured through a tube with a venturi.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.029275 kPa (0.004245 lbf/in^2)
Maximum Range: 0.0 to 7.4651 kPa (0.0 to 1.0824 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
22	a
a—	Extended crankcase blow-by pressure

NOTE—See PID 30 for alternate range and bit resolution.

A.23 Generator Oil Pressure—Gage pressure of oil in an auxiliary generator engine lubrication system.

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
23	a
a—	Generator oil pressure

NOTE—See PID 100 for primary engine oil pressure.

A.24 Generator Coolant Temperature—The temperature of liquid found in an auxiliary generator 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
24	a
a—	Generator coolant temperature

NOTE—See PID 110 for primary engine coolant temperature.

A.25 Air Conditioner System Status #2—Identifies the current state of the air conditioner (A/C) compressor pressures and the evaporator temperatures.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 225
Transmission Update Period: 10.0 s or on change
Message Priority: 8
Format:

PID	Data
25	a

a— Air conditioner system status #2

Bits 8-7: Compressor discharge side
00 = Not at high pressure
01 = Is at high pressure
10 = Error
11 = Not available/not applicable

Bits 6-5: Compressor discharge side
00 = Not at very high pressure
01 = Is at very high pressure
10 = Error
11 = Not available/not applicable

Bits 4-3: Compressor suction side
00 = Not at low pressure
01 = Is at low pressure
10 = Error
11 = Not available/not applicable

Bits 2-1: Evaporator temperature
00 = Evaporator thermostat signal is above the low temperature set point
01 = Evaporator thermostat signal is below the low temperature set point
10 = Error
11 = Not available/not applicable

NOTE—See PID 50 for additional A/C system parameters.

A.26 Estimated Percent Fan Speed—Fan speed as a ratio of the actual fan drive (current speed) to the fully engaged fan drive (maximum fan speed). A two state fan (off/on) will use 0% and 100% respectively. A three state fan (off/intermediate/on) will use 0%, 50%, and 100% respectively. A variable speed fan will use 0% to 100%. Multiple fan systems will use 0% to 100% to indicate the percent cooling capacity being provided.

Note that the intermediate fan speed of a three state fan will vary with different fan drives, therefore 50% is being used to indicate that the intermediate speed is required from the fan drive.

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
26	a
a—	Estimated percent fan speed

A.27 Percent Exhaust Gas Recirculation Valve #1 Position—Ratio of current exhaust gas recirculation (EGR) valve position to the maximum EGR valve position. A value of 0% means no EGR.

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
27	a
a—	Percent exhaust gas recirculation valve position

A.28 Percent Accelerator Position #3—Ratio of actual accelerator position to maximum accelerator 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
28	a
a—	Percent accelerator position #3

NOTE—See PIDs 29 and 91 for additional accelerator position parameters. If only one accelerator position exists on a vehicle, PID 91 should be used.

A.29 Percent Accelerator Position #2—Ratio of actual accelerator position to maximum accelerator 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
29	a
a—	Percent accelerator position #2

NOTE—See PIDs 28 and 91 for additional accelerator position parameters. If only one accelerator position exists on a vehicle, PID 91 should be used.

A.30 Crankcase Blow-by Pressure—Crankcase blow-by pressure as measured through a tube with a venturi.

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
30	a
a—	Crankcase blow-by pressure

NOTE—See PID 22 for alternate range and bit resolution.

A.31 Transmission Range Position—The current position of the range cylinder. 0% = range cylinder fully toward the low range position; 100% = range cylinder fully toward the high range 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: On request
Message Priority: 8
Format:

PID	Data
31	a
a—	Transmission Range Position

A.32 Transmission Splitter Position—The current position of the splitter cylinder. 0% = splitter cylinder fully toward the low split position; 100% = splitter cylinder fully toward the high split 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: On request
Message Priority: 8
Format:

PID	Data
32	a
a—	Transmission Splitter Position

A.33 Clutch Cylinder Position—The current position of the clutch engagement cylinder. 0% = cylinder fully retracted (i.e., clutch fully engaged); 100% = cylinder fully extended (i.e., clutch fully disengaged.)

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
33	a
a—	Clutch Cylinder Position

A.34 Clutch Cylinder Actuator Status—Identifies the current status of the actuators used to control the functions of the clutch cylinder.

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
34	a
a—	Clutch Cylinder Actuator Status Bits 8-7: Coarse engagement actuator status Bits 6-5: Fine engagement actuator status Bits 4-3: Coarse disengagement actuator status Bits 2-1: Fine disengagement actuator status

Each status will be described using the following nomenclature:

00	Off
01	On
10	Error Condition
11	Not available

A.35 Shift Finger Actuator Status #2—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
35	a
a—	Shift Finger Actuator Status Bits 8-5: Not defined Bits 4-3: Gear actuator #3 status Bits 2-1: Rail actuator #3 status

NOTE—Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

NOTE—See PID 58 for additional gear actuator status.

A.36 Clutch Plates Wear Condition—The current wear condition of the clutch plates. 0% = clutch plates with no wear; 100% = clutch plates are completely worn out.

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
36	a
a—	Clutch Plates Wear Condition

A.37 Transmission Tank Air Pressure—The pressure of the air in the tank supplying the automatically shifting transmission.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 6.89 kPa (1.0 lbf/in^2)
Maximum Range: 0.0 to 1757.0 kPa (0.0 to 255.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
37	a
a—	Transmission Tank Air Pressure

A.38 Second Fuel Level (Right Side)—Ratio of volume of fuel to the total volume of the second fuel storage container.

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

PID	Data
38	a
a—	Second Fuel Level (Right Side)

NOTE—See PID 96 for the primary fuel level.

A.39 Tire Pressure Check Interval—Identifies the interval at which the system will check the tire pressures (e.g., 5, 10, 15 min).

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 1 min
Maximum Range: 0 to 255 min
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
39	a
a—	Tire pressure check interval

NOTE—A value of 0 indicates continuous (real time) pressure readings.

A.40 Engine Retarder Switches Status—Identifies the current state of the switch contacts used in the engine retarder system.

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

PID	Data
40	a

a— Engine retarder switches status
Bits 8-7: Reserved—all bits set to 1
Bits 6-3: Engine retarder level switch
0 = 0 cylinders
1 = 1 cylinders
2 = 2 cylinders
3 = 3 cylinders
4 = 4 cylinders
5 = 5 cylinders
6 = 6 cylinders
7 = 7 cylinders
8 = 8 cylinders
9-13 = reserved—to be assigned
14 = error
15 = not available
Bits 2-1: Engine retarder switch
00 = off
01 = on
10 = error
11 = not available

A.41 Cruise Control Switches Status—Identifies the current state of the switch contacts used in the cruise control system.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s, or on state change
Message Priority: 3
Format:

PID	Data
41	a
a—	Cruise control switches status Bits 8-7: Reserved—all bits set to 1 Bits 6-5: Cruise control on/off switch status Bits 4-3: Cruise control set switch status Bits 2-1: Cruise control resume switch status

NOTE—Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.42 Pressure Switch Status—Identifies the current state of an open/closed type switch used to determine if adequate pressure exists for system implementation.

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

PID	Data
42	a
a—	Pressure switch status Bits 8-3: Reserved—all bits set to 1 Bits 2-1: Tire pressure supply switch status

NOTE—Each status will be described using the following nomenclature:

00	Below set pressure
01	At or above set pressure
10	Error condition
11	Not available

A.43 Ignition Switch Status—Identifies the current state of the contacts within the ignition switch. These contacts are not necessarily mutually exclusive.

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

PID	Data
43	a
a—	Ignition switch status
	Bits 8-7: Start aid contacts status
	Bits 6-5: Crank contacts status
	Bits 4-3: Run contacts status
	Bits 2-1: Accessory contacts status

NOTE—Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

A.44 Attention/Warning Indicator Lamps Status—Identifies the current state of the lamps used as driver attention or warning indicators.

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

PID	Data
44	a
a—	Attention/warning indicator lamps status
	Bits 8-7: Reserved—both bits set to 1
	Bits 6-5: Protect lamp status
	Bits 4-3: Amber lamp status
	Bits 2-1: Red lamp status

NOTE 1—Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

NOTE 2—The red lamp is used to indicate a mission-critical or mission-disabling situation.

NOTE 3—The amber lamp is used to indicate a non-mission-critical or non-mission-disabling situation.

NOTE 4—The protect lamp is used to report a problem that is most probably not electronic subsystem related. This could indicate reduced performance or potentially a mission-critical or mission-disabling situation. For instance, engine coolant temperature is exceeding its prescribed temperature range.

A.45 Inlet Air Heater Status—Identifies the current state of the inlet air heaters. The "wait to start lamp" signal indicates that the engine is too cold to start and the operator should wait until the signal becomes inactive (turns off).

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s when active, or on state change
Message Priority: 5
Format:

PID	Data
45	a
a—	Inlet air heater status
	Bits 8-7: Reserved—all bits set to 1
	Bits 6-5: Wait to Start Lamp
	Bits 4-3: Heater 2 status
	Bits 2-1: Heater 1 status

NOTE—Each status will be described using the following nomenclature:

00	Off
01	On
10	Error Condition
11	Not available

A.46 Vehicle Wet Tank Pressure—Identifies the current gage pressure inside the vehicle wet tank.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 6.89 kPa (1.0 lbf/in^2)
Maximum Range: 0.0 to 1757.0 kPa (0.0 to 255.0 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
46	a
a—	Vehicle wet tank pressure

A.47 Retarder Status—Identifies the current state of vehicle retarders.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 1.0 s when active, or on state change
Message Priority: 5
Format:

PID	Data
47	a
a—	Retarder status Bits 8-3: Reserved - all bits set to 1 Bits 2-1: Transmission output retarder status

NOTE 1—Each status will be described using the following nomenclature:

00	Off
01	On
10	Error condition
11	Not available

NOTE 2—See PID 121 for engine retarder status.

A.48 Extended Range Barometric Pressure—Absolute air pressure of the atmosphere.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.6 kPa (0.087 lbf/in^2)
Maximum Range: 0.0 to 153.0 kPa (0.0 to 22.2 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
48	a
a—	Extended range barometric pressure

NOTE—See PID 108 for alternate bit resolution.

A.49 ABS Control Status—Identifies the current state of the ABS control functions, lamp and switch.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 0.5 s
Message Priority: 3
Format:

PID	Data
49	a
a—	ABS control status Bits 8-7: ABS off-road function switch Bits 6-5: ABS retarder control Bits 4-3: ABS brake control Bits 2-1: ABS warning lamp

NOTE—Each status will be described using the following nomenclature:

00	Off/Not active
01	On/Active
10	Error condition
11	Not available

A.50 Air Conditioner System Status/Command #1—Used to request the air conditioner (A/C) compressor clutch unit to temporarily disable the clutch. This parameter also provides the current state of the engine fan, A/C system, and compressor clutch.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 5.0 s (during disengagement) or on change
Message Priority: 8
Format:

PID	Data
50	a

a— Air conditioner compressor clutch status/command
- Bits 8-7: Engine fan request
  - 00=No request
  - 01=Fan is requested
  - 10=Error
  - 11=Not available/not applicable
- Bits 6-5: Air Conditioning Request Input
  - 00=No request
  - 01=A/C is requested
  - 10=Error
  - 11=Not available/not applicable.
- Bits 4-3: Request temporary clutch disengagement sense
  - 00=No request
  - 01=Clutch disengagement requested
  - 10=Error
  - 11=Not available/not applicable.
- Bits 2-1: Clutch engagement status
  - 00=Off (disengaged)
  - 01=On (engaged)
  - 10=Error
  - 11=Not available/not applicable

NOTE—The reception of a clutch disengagement request by the clutch unit will restart the clutch disengagement timer. The clutch engagement status bits (Bits 2-1) are ignored if the clutch disengagement bits (Bits 4-3) are requesting clutch disengagement. See PID 25 for additional A/C system parameters.

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

NOTE—See PID 35 for additional gear actuator status.

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 actual 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 Brake Switch Status—Identifies the current state of the brake switches.

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
65	a
a—	Brake switch status Bits 8-5: Reserved—all bits set to 1 Bits 4-3: Brake system switch status 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 #1 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
75	a
a—	Steering axle temperature

NOTE—See also PID 410.

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

NOTE—See PIDs 28 and 29 for additional accelerator position parameters. If only one accelerator position exists on a vehicle, this PID should be used.

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 N·m (20 lbf-ft)
Maximum Range: –3471 to +3444 N·m (–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

NOTE—See PIDs 19 and 135 for alternate range and/or bit resolution.

A.95 Fuel Filter Differential Pressure—Change in fuel delivery pressure, measured across 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

NOTE—See also PID 16.

A.96 Fuel Level—Ratio of volume of fuel to the total volume of the primary 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

NOTE—See PID 38 for the second (right side) 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

NOTE—See PID 19 for alternate range and bit resolution. See PID 23 for generator 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

NOTE—See PID 153 for alternate bit resolution.

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

NOTE—See PIDs 439 and 440 for alternate range and resolution.

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

NOTE—See PID 48 for alternate bit resolution.

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

NOTE—See PID 20 for alternate range and bit resolution.

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

NOTE—See PID 24 for generator 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 drop

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

Parameter Data Length: 1 Character
Data Type: Signed 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 count

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

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—The temperature of the oil in the hydraulic retarder system.

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: Signed 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 Injector Metering Rail #2 Pressure—The gage pressure of fuel in the metering rail #2 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
129	a a
a a—	Injector metering rail #2 pressure

A.130 ***Power Specific Fuel Economy—***Instantaneous fuel economy of the engine, typically for off-highwayequipment.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 1.97 x 10^{-3} kW·h/L (0.01 hp·h/gal)
Maximum Range: 0.0 to 129.1 kW·h/L (0.0 to 655.35 hp·h/gal)
Transmission Update Period: 1 s
Message Priority: 3
Format:

PID	Data
130	a a
a a—	Power specific fuel economy

NOTE—See PID 184 for alternate bit resolution.

A.131 ***Exhaust Back Pressure—***Gage pressure of exhaust gas measured at the exhaust manifold.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 6.733 x 10^{-3} kPa (1/1024 lbf/in^2)
Maximum Range: 0.0 to 441.258 kPa (0.0 to 63.999 lbf/in^2)
Transmission Update Period: 1 s
Message Priority: 4
Format:

PID	Data
131	a a
a a—	Exhaust back pressure

A.132 ***Mass Air Flow—***Mass air flow measured at the fresh air intake.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.125 kg/min (0.2756 lb/min)
Maximum Range: 0.0 to 8192.875 kg/min (0.0 to 18 059.99 lb/min)
Transmission Update Period: 1 s
Message Priority: 4
Format:

PID	Data
132	a a
a a—	Mass air flow

A.133 Average Fuel Rate—Continuous averaging of gallons of fuel per hour per segment of engine operation. The average period and reset options are to be defined in the manufacturer's application document.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 16.428 x 10^{-6} L/s (4.34 x 10^{-6} gal/s or 1/64 gal/h)
Maximum Range: 0.0 to 1.076 65 L/s (0.0 to 0.284 421 90 gal/s or 0.0 to 1023.98 gal/h)
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
133	a a

a a— Average fuel rate

A.134 Wheel Speed Sensor Status—Identifies the current state of the device that signals individual wheel speeds to the ABS Electronic control Unit.

Parameter Data Length: 2 Characters
Data Type: Binary Bit Mapped
Resolution: Binary
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
134	a b

a— Wheel speed sensor status: left side
- Bits 8-7: Wheel sensor ABS axle: 1 left
- Bits 6-5: Wheel sensor ABS axle: 2 left
- Bits 4-3: Wheel sensor ABS axle: 3 left
- Bits 2-1: Wheel sensor ABS axle: 4 left

b— Wheel speed sensor status: right side
- Bits 8-7: Wheel sensor ABS axle: 1 right
- Bits 6-5: Wheel sensor ABS axle: 2 right
- Bits 4-3: Wheel sensor ABS axle: 3 right
- Bits 2-1: Wheel sensor ABS axle: 4 right

NOTE—Each status will be described using the following nomenclature:

00	Off/Not active (Sensor present/No active signal)
01	On/Active (Sensor present/Active signal)
10	Error condition (Sensor present/Error condition detected)
11	Not available (Sensor not present)

A.135 Extended Range Fuel Delivery Pressure (Absolute)—Absolute pressure of fuel in system delivered from the supply pump.

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
135	a a
a a—	Extended Range Fuel Delivery Pressure (Absolute)

NOTE—See PID 94 for alternate bit resolution.

A.136 Auxiliary Vacuum Pressure Reading—Identifies the current vacuum pressure (relative to atmosphere) that is configured uniquely per application. Not to be used in place of existing PIDs.

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: On request
Message Priority: 8
Format:

PID	Data
136	a a
a—	Auxiliary Vacuum Pressure Reading

A.137 Auxiliary Gage Pressure Reading #1—Identifies the current gage pressure (relative to atmosphere) that is configured uniquely per application. Not to be used in place of existing PIDs.

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: On request
Message Priority: 8
Format:

PID	Data
137	a a
a a—	Auxiliary Gage pressure reading #1

NOTE—See also PID 443.

A.138 Auxiliary Absolute Pressure Reading—Identifies the current absolute pressure (relative to absolute 0 pressure) that is configured uniquely per application. Not to be used in place of existing PIDs.

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: On request
Message Priority: 8
Format:

PID	Data
138	a a

a a— Auxiliary Absolute Pressure Reading

A.139 Tire Pressure Control System Channel Functional Mode—Indicates the functional mode of each channel.

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
139	a b

a— Tire pressure control system functional mode #1
Bits 8-5: Reserved—all bits set to 1
Bits 4-1: Steer channel mode
b— Tire pressure control system functional mode #2
Bits 8-5: Drive channel mode
Bits 4-1: Trailer/tag channel mode

NOTE—Each status will be described using the following nomenclature:

0000	Maintain
0001	Inflate
0010	Deflate
0011	Confirm
0100	Inflate wait—system will inflate when conditions allow
0101	Deflate wait—system will deflate when conditions allow
0110	Pressure check
0111-1101	Reserved
1110	Error condition
1111	Not available

A.140 ***Tire Pressure Control System Solenoid Status—***Identifies the current state of the solenoids used to implement a tire pressure control system in its pneumatic control unit (PCU).

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
140	a b
a—	Tire pressure control system solenoid status #1
	Bits 8-5: Reserved—all bits set to 1
	Bits 4-3: PCU steer solenoid status
	Bits 2-1: PCU drive solenoid status
b—	Tire pressure control system solenoid status #2
	Bits 8-7: PCU trailer, tag, or push solenoid status
	Bits 6-5: PCU supply solenoid status
	Bits 4-3: PCU control solenoid status
	Bits 2-1: PCU deflate solenoid status

NOTE—Each status will be described using the following nomenclature:

00	Off
00	On
10	Error condition
11	Not available

A.141 ***Trailer #1, Tag #1, or Push Channel #1 Tire Pressure Target—***The tire pressure control system's target gage pressure for the trailer #1, tag #1, or push #1 group of tires.

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: On request
Message Priority: 8
Format:

PID	Data
141	a a
a a—	Trailer #1, tag #1, or push #1 tire pressure target

NOTE—See also PID 437.

A.142 ***Drive Channel Tire Pressure Target—***The tire pressure control system's target gage pressure for the drive group of tires.

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: On request
Message Priority: 8
Format:

PID	Data
142	a a
a—	Drive channel tire pressure target

A.143 ***Steer Channel Tire Pressure Target—***The tire pressure control system's target gage pressure for the steer group of tires.

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: On request
Message Priority: 8
Format:

PID	Data
143	a a
a—	Steer channel tire pressure target

A.144 ***Trailer #1, Tag #1, or Push Channel #1 Tire Pressure—***The latest gage pressure reading of the trailer #1, tag #1, or push #1 group of tires, as opposed to the pressure in each tire.

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: On request
Message Priority: 8
Format:

PID	Data
144	a a
a a—	Trailer #1, tag #1, or push #1 tire pressure

NOTE—See also PID 438.

A.145 Drive Channel Tire Pressure—The latest gage pressure reading of the drive group of tires, as opposed to the pressure in each tire.

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: On request
Message Priority: 8
Format:

PID	Data
145	a a
a—	Drive channel tire pressure

A.146 Steer Channel Tire Pressure—The latest gage pressure reading of the steer group of tires, as opposed to the pressure in each tire.

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: On request
Message Priority: 8
Format:

PID	Data
146	a a
a—	Steer channel tire pressure

A.147 Average Fuel Economy (Natural Gas)—Average of instantaneous fuel economy for that segment of vehicle operation of interest.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 1/512 km/kg (1/1816.6 m/lb)
Maximum Range: 0.0 to 127.998 km/kg (0.0 to 36.076 m/lb)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
147	a a
a—	Average fuel economy (natural gas)

NOTE—See PID 185 for alternate units.

A.148 Instantaneous Fuel Economy (Natural Gas)—Current fuel economy at current vehicle velocity.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 1/512 km/kg (1/1816.6 m/lb)
Maximum Range: 0.0 to 127.998 km/kg (0.0 to 36.076 m/lb)
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
148	a a
a—	Instantaneous fuel economy (natural gas)

NOTE—See PID 184 for alternate units.

A.149 Mass Flow Rate (Natural Gas)—Amount of fuel consumed by engine per unit of time.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.125 kg/h (0.275 lb/h)
Maximum Range: 0.0 to 8191.875 kg/h (0.0 to 18 022.125 lb/h)
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
149	a a
a—	Fuel mass flow rate (natural gas)

NOTE—See PID 183 for alternate units.

A.150 PTO Engagement Control Status—Identifies the current state of the input and output functions used to control the engagement of PTO devices.

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
150	a b
a—	PTO input status
	Bits 8-5: Reserved—all bits set to 1
	Bits 4-3: PTO #2 engagement control switch status
	Bits 2-1: PTO #1 engagement control switch status
b—	PTO output status
	Bits 8-5: Reserved—all bits set to 1
	Bits 4-3: PTO #2 engagement actuator status
	Bits 2-1: PTO #1 engagement actuator status

NOTE—Each status will be described using the following nomenclature:

00	Off/Not active
01	On/Active
10	Error condition
11	Not available

A.151 ATC Control Status—Identifies the current state of the ATC control functions, signals, lamp, and switch.

Parameter Data Length: 2 Characters
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 65535
Transmission Update Period: 0.5 s
Message Priority: 3
Format:

PID	Data
151	a b
a—	ATC control status #1
	Bits 8-7: ATC spin-out signal detection
	Bits 6-5: ATC engine control
	Bits 4-3: ATC brake control
	Bits 2-1: ATC status lamp
b—	ATC control status #2
	Bits 8-3: Reserved—all bits set to 1
	Bits 2-1: ATC deep snow/mud function switch

NOTE—Each status will be described using the following nomenclature:

00	Off/Not active
01	On/Active
10	Error condition
11	Not available

A.152 Number of ECU Resets—The number of times the ECU has completed a successful power-up sequence.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 1
Maximum Range: 0 to 65535
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
152	a a
a—	Number of ECU resets

A.153 Crankcase Pressure—Gage air pressure inside engine crankcase.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 7.8125 x 10^{-3} kPa (1.133 x 10^{-3} lbf/in^2)
Maximum Range: –256.00 to +255.99 kPa (–37.13 to +37.12 lbf/in^2)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
153	a a
a—	Crankcase pressure

NOTE—See PID 101 for alternate bit resolution.

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 displayable character is required (ASCII 32 to 127), the second character shall be used and the first character shall be either a space (ASCII 32) or a control character (ASCII 0 to 31). If the first character is a control character, refer to the manufacturer's application document for definition.

Parameter Data Length: 2 Characters
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Operating Range: 0 to 127 (each character)
Transmission Update Period: 0.5 s
Message Priority: 4
Format:

PID	Data
162	a a

a a— Transmission range selected and/or control character

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 displayable character is required (ASCII 32 to 127), the second character shall be used and the first character shall be either a space (ASCII 32) or a control character (ASCII 0 to 31). If the first character is a control character, refer to the manufacturer's application document for definition.

Parameter Data Length: 2 Characters
Data Type: Alphanumeric
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Operating Range: 0 to 127 (each character)
Transmission Update Period: 0.5 s
Message Priority: 4
Format:

PID	Data
163	a a

a a— Transmission range attained and/or control character

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)—Measured electrical potential of the alternator.

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)

NOTE—See also PID 444.

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

NOTE—See also PID 435.

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.172Air 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 #1 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

NOTE—See PID 231 for alternate units.

A.183 Fuel Rate (Instantaneous)—Amount of fuel consumed by engine per unit of time.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 16.428 x 10^{-6} L/s (4.34 x 10^{-6} gal/s or 1/64 gal/h)
Maximum Range: 0.0 to 1.076 65 L/s (0.0 to 0.284 421 90 gal/s or 0.0 to 1023.98 gal/h)
Transmission Update Period: 0.2 s
Message Priority: 3
Format:

PID	Data
183	a a
a a—	Fuel rate (instantaneous)

NOTE—See PID 149 for alternate units.

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 x 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

NOTE—See PID 148 for alternate units.

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 x 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

NOTE—See PID 147 for alternate units.

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

n— Byte count of data within this section 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, as byte d is transmitted only in the first packet. May be 1 to 15 characters in the middle and ending packets.

d— Total byte count of the original data. It is the same value as the byte count of the parameter being sectioned. This character is broadcast only in the first packet. The value must be greater than 17 but is limited to 239.

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. PID 192 is used to transmit a single PID whose length exceeds the message packet length limitation of SAE J1708. Message packets of type PID 192 may not include data from PIDs other than that given in byte 'a' of the first packet until all data of that PID has been transferred.

EXAMPLE—PID 192 response to a PID 243 request—

Character Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Section 1	MID	192	17	243	32	33	MID	MK	MK	MK	MK	MK	42	ML	ML	ML	ML	ML	ML	ML	cs
Section 2	MID	192	17	243	33	ML	ML	ML	42	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	cs
Section 3	MID	192	6	243	34	SN	SN	SN	SN	cs											

FIGURE A1—EXAMPLE—PID 192 RESPONSE TO A PID 243 REQUEST

NOTE 1—All Sections—Character number 3 is the byte count of this section. Character number 4 is the PID being sectioned. Character number 5 is the section number. A value of 32 (20_{16}) as shown in Section 1 indicates 3 sections and Section 1 is the 1st section.

NOTE 2—Section 1—Character 6 shows the total byte count of the original data, 33 in this example. The total byte count is only included in the first section. Character 7 is the MID of the component being identified. This is the first byte of the PID 243 data field. MK is the make, 5 characters in this example. The value of 42 in character number 13 is the ASCII "*" delimiter. ML is the model, 10 characters in this example. The first 7 characters of the model are in section 1 with the remainder in Section 2.

NOTE 3—Section 2—SN is the serial number, 15 characters in this example. The first 11 characters of the serial number are in section 2 with the remainder in section 3.

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
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 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. Activediagnostic 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.

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.

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

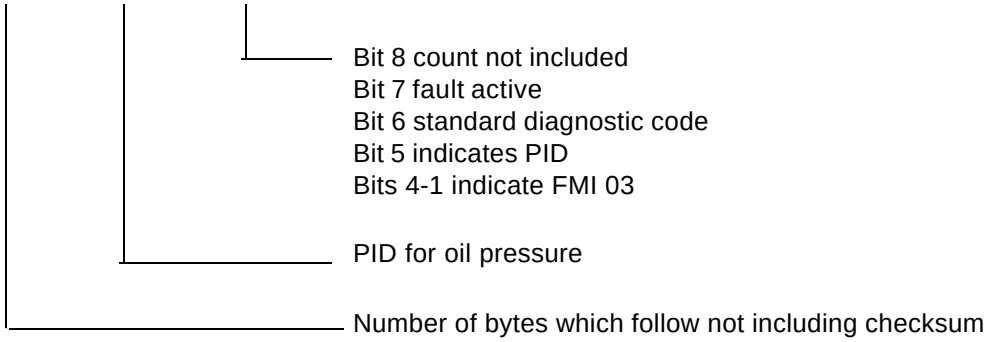
5. In the event the data is invalid, for example, the case of a shorted sensor, the PID at fault will not be broadcast. However, a PID 194 with the offending PID will be broadcast per the above.

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)

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 ....

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)

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 isresponding. 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 remainingcharacters if the ATA/VMRS make code is less than five characters in length. Datatype c would be omitted if Bits 7 and 8 of character b are either (01) or (10) or if nodata 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.

A.197 Communication Management—See Appendix B.

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 viable.
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.

NOTE 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.

NOTE 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.)

NOTE 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.

NOTE 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.

NOTE 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

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

Bits 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 requests 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

Bits 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

Bits 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

Bits 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)

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

Bits 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 ***Reserved—***To be assigned.

A.201 ***Reserved—***To be assigned.

A.202 ***Reserved—***To be assigned.

A.203 ***Reserved—***To be assigned.

A.204 ***Reserved—***To be assigned.

A.205 ***Reserved—***To be assigned.

A.206 ***Reserved—***To be assigned.

A.207 ***Reserved—***To be assigned.

A.208 ***Reserved—***To be assigned.

A.209 ABS Control Status, Trailer—To be used to send trailer ABS control and warning lamp status. A tractor mounted ECU may broadcast this message and report the ABS status of all trailers at once.

Parameter Data Length: Variable
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 0.5 s
Message Priority: 3
Format:

PID	Data
209	n a b c
n—	Count of characters
a—	ABS Control Status, Trailer
	Bits 8-7: ABS brake control Status, Trailer # 1
	Bits 6-5: ABS warning lamp, Trailer # 1
	Bits 4-3: Trailer ABS Control Status
	Bits 2-1: Tractor Mounted Trailer ABS Lamp
b—	ABS Control Status, Trailer
	Bits 8-7: ABS brake control Status, Trailer # 3
	Bits 6-5: ABS warning lamp, Trailer # 3
	Bits 4-3: ABS brake control Status, Trailer # 2
	Bits 2-1: ABS warning lamp, Trailer # 2
c—	ABS Control Status, Trailer
	Bits 8-7: ABS brake control Status, Trailer # 5
	Bits 6-5: ABS warning lamp, Trailer #5
	Bits 4-3: ABS brake control Status, Trailer # 4
	Bits 2-1: ABS warning lamp, Trailer # 4

NOTE 1—Character “a” bits 4-3 are a composite of one or more individual trailer ABS control status messages. Status will be “on” if trailer ABS control status “on” is received from any trailer.

NOTE 2—Character “a” bits 2-1 are a composite of one or more individual trailer ABS warning lamp messages. Status will be “on” if trailer ABS warning lamp 'on' is received from any trailer.

NOTE 3—Each status will be described using the following nomenclature:

00	Off/Not Active
01	On/Active
10	Error condition
11	Not available

A.210 Tire Temperature (By Sequence Number)—Communicates the tire temperature(s) by sequence number. (Not position specific)

Parameter Data Length: Variable
Data Type: Unsigned Short Integer (each character)
Bit Resolution: 2.5 °F per bit
Maximum Range: 0.0 to 625.0 °F
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
210	n a a a…
n—	Number of parameter data characters
a—	Tire temperature by sequence number 251-253 = Reserved for future assignment by SAE 254 = Error 255 = Not available

NOTE—See PID 242 for position specific tire temperature

A.211 Tire Pressure (By Sequence Number)—PID to communicate the tire pressure(s) by sequence number. (Not position specific)

Parameter Data Length: Variable
Data Type: Unsigned Short Integer (each character)
Bit Resolution: 4.14 kPa/bit (0.6 psi/bit)
Maximum Range: 0.0 to 1035 kPa (0.0 to 150.0 psi)
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
211	n a a a…
n—	Number of parameter data characters
a—	Tire pressure by sequence number 251-253 = Reserved for future assignment by SAE 254 = Error 255 = Not available

NOTE—See PID 241 for position specific tire pressure.

A.212 ***Tire Pressure Target (By Sequence Number)—***Communicates the tire pressure target(s) by sequence number. (Not position specific)

Parameter Data Length: Variable
Data Type: Unsigned Short Integer (each character)
Bit Resolution: 4.14 kPa/bit (0.6 psi/bit)
Maximum Range: 0.0 to 1035 kPa (0.0 to 150.0 psi)
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
212	n a a a…
n—	Number of parameter data characters
a—	Tire pressure target by sequence number 251-253 = Reserved for future assignment by SAE 254 = Error 255 = Not available

A.213 ***Wheel End Assembly Vibration Level—***Measurement of vibration level at wheel end assembly.

Parameter Data Length: 3 Characters
Data Type: Unsigned Short Integer
Bit Resolution: 1 g/bit
Maximum Range: 0 to 255 g (multiplier for the acceleration of gravity)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
213	n a b c
n—	Number of parameter data characters = 3
a—	Trailer or power unit MID
b—	Wheel position = (axle number x 16) + Wheel end assembly number
c—	Vibration level of the wheel end assembly

Wheel end assembly numbers on the axle are assigned as follows:

Left wheel end assembly = 1
Right wheel end assembly = 4

NOTE—PID has to be broadcast as many times as necessary to transmit all available information.

A.214 Vehicle Wheel Speeds—Indicated velocity of the individual wheels.

Parameter Data Length: 6 Characters
Data Type: Unsigned Short Integer
Bit Resolution: 0.805 km/h (0.5 mph)/bit
Maximum Range: 0.0 to 205.2 km/h (0.00 to 127.5 mph)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
214	n a b c d e f
n—	Number of parameter data characters
a—	Wheel speed ABS axle 1 Left
b—	Wheel speed ABS axle 1 Right
c—	Wheel speed ABS axle 2 Left
d—	Wheel speed ABS axle 2 Right
e—	Wheel speed ABS axle 3 Left
f—	Wheel speed ABS axle 3 Right

A.215 Brake Temperature—Temperature of the brake shoe/brake pad/brake drum.

Parameter Data Length: 3 Characters
Data Type: Character 1-2 = Unsigned Short Integer
Character 3 = Signed Short Integer
Bit Resolution: Character 1-2 = Binary
Character 3 = 5 °F/bit
Maximum Range: 0 °F to 1275.0 °F
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
215	n a b c
n—	Number of parameters data characters = 3
a—	Trailer or power unit MID
b—	Wheel position = (axle number x 16) + brake number
c—-	Brake temperature

Brake numbers on the axle are assigned as follows:

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

A.216 Wheel Bearing Temperature—Measurement of bearing temperature at axle end.

Parameter Data Length: 3 Characters
Data Type: Character 1-2 = Unsigned Short Integer
Character 3 = Signed Short Integer
Bit Resolution: Character 1-2 = Binary
Character 3 = 1.2 °F/bit
Maximum Range: 0 °F to 306.0 °F
Transmission Update Period: 10.0 s
Message Priority: 6
Format:

PID	Data
216	n a b c

n— Number of parameter data characters = 3
a— Trailer or power unit MID
b— Wheel position = (axle number x 16) + bearing number
c— Bearing temperature

Bearing numbers on the axle are assigned as follows:

Outer left wheel bearings = 1
Inner left wheel bearings = 2
Inner right wheel bearings = 3
Outer right wheel bearings = 4

A.217 Fuel Tank/Nozzle Identification—Used to identify the fuel tank and fuel nozzle during fueling.

Parameter Data Length: 11 Characters
Data Type: Character 1-2 = Unsigned Short Integer
Character 3-11 = Alphanumeric
Bit Resolution: Character 1-2 = Binary
Character 3-11 = ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: On request or at introduction/extraction of nozzle into the fuel tank. Not continuously broadcasted while nozzle is inserted.
Message Priority: 8
Format:

PID	Data
217	n a b b b b b b b b b

n— Number of parameter data characters = 11
a— Tank identification/Antenna status
Bits 4-1: Tank Identification
0000 = tank 1
through
1111 = tank 16
Bits 6-5: Reserved-all bits set to 1
Bits 8-7: Tank antenna status
00 = Not active
01 = Active
10 = Error condition
11 = Not available
b—Nozzle identification (10 ASCII)

A.218 State Line Crossing—Used to report when a vehicle crosses, or last crossed, a state line.

Parameter Data Length: Variable
Data Type: Characters 1-5—Unsigned short integer
Characters 6-17—Alpha
Resolution: Character 1 = 0.25 day/bit
Character 2 = 1 month/bit
Character 3 = 1 year/bit
Character 4 = 1 min/bit
Character 5 = 1 h/bit
Character 6-17 = ASCII
Maximum Range: Character 1 = 0 to 63.75 day
Character 2 = 0 to 255 month
Character 3 = 0 to 255 year
Character 4 = 0 to 255 min
Character 5 = 0 to 255 h
Character 6-17 = 0 to 255 (each character)
Valid Range: Character 1 = 0.25 to 31.75 day
Character 2 = 1 to 12 month
Character 3 = 0 to 255 year
Character 4 = 0 to 59 min
Character 5 = 0 to 23 h
Character 6-17 = 0 to 255 (each character)

Transmission Update Period: On change or on request
Message Priority: 8
Format:

PID	Data
218	n a b c d e f f f g g g h h h j j j
n—	Number of parameter data characters = 17
a—	Day
b—	Month
c—	(Year - 1985)
d—	Minutes
e—	Hours
f—	Old State abbreviation
g—	Old Country abbreviation
h—	New State abbreviation
j—	New Country abbreviation

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.

NOTE—It is recommended that spaces (ASCII 32) are used at the end of each abbreviation to fill each field out to three characters, as required. State abbreviations will conform to the United States Postal Publication 65 and Country abbreviations will conform to ISO 3166.

A.219 Current State—Used to report the current country and state.

Parameter Data Length: Variable
Data Type: Alpha
Resolution: ASCII
Maximum Range: 0 to 255 (each character)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
219	n a a a b b b
n—	Number of parameter data characters = 6
a—	Current State abbreviation
b—	Current Country abbreviation

NOTE—It is recommended that spaces (ASCII 32) are used at the end of each abbreviation to fill each field out to three characters, as required. State abbreviations will conform to the United States Postal Publication 65 and Country abbreviations will conform to ISO 3166.

A.220 Engine Torque History—Used to report the current engine torque configuration and all previous engine torque configurations available.

Parameter Data Length: Variable

Data Type:
Characters 1-4—Unsigned integer
Characters 5-7—Unsigned short integer
Character 8—Unsigned long integer
Character 9—Binary bit-mapped
Characters 10-18—Unsigned integer

Bit Resolution:
Character 1 = 1 record/bit
Character 2—0.5 kW/bit
Characters 3-4—1 Nm/bit
Character 5—1 month/bit
Character 6—0.25 day/bit
Character 7—1 year/bit
Character 8—0.05 hours/bit
Character 9—Binary
Character 10—0.01 ratio/bit
Character 11—1 Nm/bit
Character 12—0.01 ratio/bit
Character 13—1 Nm/bit
Characters 14—0.01 ratio/bit
Characters 15-17—1 Nm/bit
Character 18—2 Nm/bit

Valid Range:
Character 1 = 0 to 255
Character 2 = 0 to 32 767.5 kW
Characters 3-4 = 0 to 65 535 Nm
Character 5 = 1 to 12 month
Character 6 = 0.25 to 31.75 day
Character 7 = 0 to 255 year
Character 8 = 0 to 214 741 811 hours
Character 9 = 0 to 255
Character 10 = 0 to 655

Character 11 = 0 to 65 535 Nm
Character 12 = 0 to 655
Character 13 = 0 to 65 535 Nm
Character 14 = 0 to 655
Characters 15-17 = 0 to 65 535 Nm (each character)
Character 18 = 0 to 100 000 Nm

Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
220	n a b b c c d d e f g h h h h j k k m m n n p p q q r r t t u u v v w w w w w w
n—	Number of parameter data characters
a—	Number of calibration records
b—	Engine power
c—	Peak engine torque 1
d—	Peak engine torque 2
e—	Calibration record start month
f—	Calibration record start day
g—	(Calibration record start year – 1985)
h—	Calibration record duration time
j—	Torque limiting feature status
	Bits 8-6: Reserved—all bits set to 1
	Bits 5-3: Torque limiting feature
	000: Not available
	001: Highest torque rating
	010: First torque rating
	011: Previous torque rating (rating prior to the one active)
	100: Current torque rating
	101-111: Reserved
	Bits 2-1: Torque limiting feature status
	00=Feature is disabled
	01=Feature is enabled
	10=Reserved
	11=Not available/not applicable
k—	Transmission gear ratio 1
m—	Engine torque limit 1—Transmission
n—	Transmission gear ratio 2
p—	Engine torque limit 2—Transmission
q—	Transmission gear ratio 3
r—	Engine torque limit 3—Transmission
t—	Engine torque limit 4—Transmission
u—	Engine torque limit 5—Switch
v—	Engine torque limit 6—Axle input
w—	Reserved—for future assignment

NOTE 1—The number of calibration records (character 1) shall be set to 0 if no torque history records are stored in the ECU. Each calibration record is 38 bytes in length. If more than one calibration record exists, the records are concatenated one after the other in a single message.

NOTE 2—The engine power (character 2) shall represent the advertised power that a customer will find on a sales sheet for an engine with a certain calibration.

NOTE 3—For calibrations that support two torque curves, peak engine torque 1 (character 3) should be assigned the value of the lower curve and peak engine torque 2 (character 4) should be assigned the value of the higher curve. For calibrations that support one torque curve, peak engine torque should be used to represent this torque and peak engine torque 2 should be set to0.

NOTE 4—The calibration record time stamp (characters 5-7) shall represent the time when an ECU record was established. A value of 0 for the year (character 7) identifies the year 1985, a value of 1 identifies 1986, etc.

NOTE 5—The calibration record duration time (character 8) shall represent the duration in hours for which the engine operated in the conditions captured in the record.

NOTE 6—The gear ratio values define a range of transmission gears for which a limit is applied to the engine output torque. Transmission gear ratio 1 (character 10) should be the numerically highest transmission gear ratio breakpoint with transmission gear ratio 2 (character 12) and transmission gear ratio 3 (character 14) representing gear ratios in descending order.

NOTE 7—Engine torque limit 1—transmission (character 11) is the limit applied to the engine output torque during vehicle operation in transmission gear ratios numerically greater than transmission gear ratio 1.

NOTE 8—Engine torque limit 2—transmission (character 13) is the limit applied to the engine output torque during vehicle operation in transmission gear ratios numerically less than or equal to transmission gear ratio 1 and numerically greater than transmission gear ratio 2. For example, if transmission gear ratio 1 is equal to 12.0:1 and transmission gear ratio 2 is equal to 5.0:1, vehicle operation in a transmission gear with a ratio of 6.0:1 will result in application of engine torque limit 2—transmission.

NOTE 9—Engine torque limit 3—transmission (character 15) is the limit applied to the engine output torque during vehicle operation in transmission gear ratios numerically less than or equal to transmission gear ratio 2 and numerically greater than transmission gear ratio 3. For example, if transmission gear ratio 2 is equal to 5.0:1 and transmission gear ratio 3 is equal to 2.0:1, vehicle operation in a transmission gear with a ratio of 3.0:1 will result in application of engine torque limit 3—transmission.

NOTE 10—Engine torque limit 4—transmission (character 16) is the limit applied to the engine output torque during vehicle operation in transmission gear ratios numerically less than or equal to transmission gear 3.

NOTE 11—Engine torque limit 5—switch (character 17) is the limit applied to the engine output torque based on activation of an ECU switch input.

NOTE 12—Engine torque limit 6—axle input (character 18) is the limit applied to the engine output torque based on the maximum allowable axle input torque. Axle input torque is calculated as current engine torque output multiplied by transmission gear ratio.

A.221 Anti-theft Request—See Appendix E.

A.222 Anti-theft Response—See Appendix E.

A.223 Auxiliary A/D Counts—Provides a mechanism to report the number of digital counts identifying one or more analog channels. Each channel is represented by 2 bytes and the number of channels reported can be determined by dividing the number of data characters (n) by 2. The definition and transfer function of each channel is manufacturer specific. All channels are broadcast upon request of this parameter. Not to be used in place of existing PIDs.

Parameter Data Length: Variable
Data Type: Unsigned Integer (each channel)
Bit Resolution: 1 count
Maximum Range: 0 to 65 535 counts
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
223	n a a (b b c c ...)
n—	Number of parameter data characters
a a—	A/D counts for channel 1
b b—	A/D counts for channel 2 (optional)
c c—	A/D counts for channel 3 (optional)
—	

A.224 Immobilizer Security Code—The encrypted security code data that is communicated between the vehicle security immobilizer control unit and the engine electronic control unit, immediately after the ignition key is turned on. The correct key transponder and the correct mating of the immobilizer and engine security codes allow the engine controller to unlock the fuel control system.

Parameter Data Length: Variable
Data Type: Defined by manufacturer
Bit Resolution: Defined by manufacturer
Maximum Range: Defined by manufacturer
Transmission Update Period: 0.1 s for the first 3 s after ignition on
Message Priority: 1
Format:

PID	Data
224	n a a a a
n—	Number of parameter data characters
a a a a—	Immobilizer Security Code

A.225 Reserved for Text Message Acknowledged—See Appendix C.

A.226 Reserved for Text Message to Display—See Appendix C.

A.227 Reserved for Test Message Display Type—See Appendix C.

A.228 Speed Sensor Calibration—The number of pulses per kilometer (pulses per mile) produced by the speed sensor.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.621 pulses per km (1 pulse per mile)
Maximum Range: 0.0 to 2 667 174 690 ppkm (0.0 to 4 294 967 295 ppm)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
228	n a a a a
n—	Number of parameter data characters = 4
a a a a—	Speed sensor calibration

A.229 Total Fuel Used (Natural Gas)—Accumulated amount of fuel used during vehicle operation.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.5 kg (1.10 lb)
Maximum Range: 0.0 to 2 147 483 648 kg (0.0 to 4 724 464 025 lb)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
229	n a a a a
n—	Number of parameter data characters = 4
a a a a—	Total fuel used (natural gas)

NOTE—See PID 250 for alternate units.

A.230 Total Idle Fuel Used (Natural Gas)—Accumulated amount of fuel used during vehicle operation while under idle conditions.

Parameter Data Length: 4 Characters
Data Type: Unsigned Long Integer
Bit Resolution: 0.5 kg (1.10 lb)
Maximum Range: 0.0 to 2 147 483 648 kg (0.0 to 4 724 464 025 lb)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
230	n a a a a
n—	Number of parameter data characters = 4
a a a a—	Total idle fuel used (natural gas)

NOTE—See PID 236 for alternate units.

A.231 Trip Fuel (Natural Gas)—Fuel consumed during all or part of a journey.

Parameter Data Length: 4 Characters
Data Type: Long Integer
Bit Resolution: 0.5 kg (1.10 lb)
Maximum Range: 0.0 to 2 147 483 648 kg (0.0 to 4 724 464 025 lb)
Transmission Update Period: 10.0 s
Message Priority: 7
Format:

PID	Data
231	n a a a a
n—	Number of parameter data characters = 4
a a a a—	Trip fuel (natural gas)

NOTE—See PID 182 for alternate units.

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
Characters 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
Characters 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 [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

NOTE—See PID 230 for alternate units.

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

Parameter Data Length: Variable
Data 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 = –24 to +180 km/h (–15 to +112.5 mph)
(range is offset to acknowledge backward motion)
180.8 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 by Position—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 by Position—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 * 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
250	n a a a a
n—	Number of parameter data characters = 4
a a a a—	Total fuel used

NOTE—See PID 229 for alternate units.

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
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

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 ***Reserved—***To be assigned.

A.261 ***Reserved—***To be assigned.

A.262 ***Reserved—***To be assigned.

A.263 ***Reserved—***To be assigned.

A.264 ***Reserved—***To be assigned.

A.265 ***Reserved—***To be assigned.

A.266 ***Reserved—***To be assigned.

A.267 ***Reserved—***To be assigned.

A.268 ***Reserved—***To be assigned.

A.269 ***Reserved—***To be assigned.

A.270 ***Reserved—***To be assigned.

A.271 ***Reserved—***To be assigned.

A.272 ***Reserved—***To be assigned.

A.273 ***Reserved—***To be assigned.

A.274 ***Reserved—***To be assigned.

A.275 ***Reserved—***To be assigned.

A.276 ***Reserved—***To be assigned.

A.277 ***Reserved—***To be assigned.

A.278 ***Reserved—***To be assigned.

A.279 ***Reserved—***To be assigned.

A.280 ***Reserved—***To be assigned.

A.281 ***Reserved—***To be assigned.

A.282 ***Reserved—***To be assigned.

A.283 ***Reserved—***To be assigned.

A.284 ***Reserved—***To be assigned.

A.285 ***Reserved—***To be assigned.

A.286 ***Reserved—***To be assigned.

A.287 ***Reserved—***To be assigned.

A.288 ***Reserved—***To be assigned.

A.289 ***Reserved—***To be assigned.

A.290 ***Reserved—***To be assigned.

A.291 ***Reserved—***To be assigned.

A.292 ***Reserved—***To be assigned.

A.293 ***Reserved—***To be assigned.

A.294 ***Reserved—***To be assigned.

A.295 ***Reserved—***To be assigned.

A.296 ***Reserved—***To be assigned.

A.297 ***Reserved—***To be assigned.

A.298 ***Reserved—***To be assigned.

A.299 ***Reserved—***To be assigned.

A.300 ***Reserved—***To be assigned.

A.301 ***Reserved—***To be assigned.

A.302 ***Reserved—***To be assigned.

A.303 ***Reserved—***To be assigned.

A.304 ***Reserved—***To be assigned.

A.305 ***Reserved—***To be assigned.

A.306 ***Reserved—***To be assigned.

A.307 ***Reserved—***To be assigned.

A.308 ***Reserved—***To be assigned.

A.309 ***Reserved—***To be assigned.

A.310 ***Reserved—***To be assigned.

A.311 ***Reserved—***To be assigned.

A.312 ***Reserved—***To be assigned.

A.313 ***Reserved—***To be assigned.

A.314 ***Reserved—***To be assigned.

A.315 ***Reserved—***To be assigned.

A.316 ***Reserved—***To be assigned.

A.317 ***Reserved—***To be assigned.

A.318 ***Reserved—***To be assigned.

A.319 ***Reserved—***To be assigned.

A.320 ***Reserved—***To be assigned.

A.321 ***Reserved—***To be assigned.

A.322 ***Reserved—***To be assigned.

A.323 ***Reserved—***To be assigned.

A.324 ***Reserved—***To be assigned.

A.325 ***Reserved—***To be assigned.

A.326 ***Reserved—***To be assigned.

A.327 ***Reserved—***To be assigned.

A.328 ***Reserved—***To be assigned.

A.329 ***Reserved—***To be assigned.

A.330 ***Reserved—***To be assigned.

A.331 ***Reserved—***To be assigned.

A.332 ***Reserved—***To be assigned.

A.333 ***Reserved—***To be assigned.

A.334 ***Reserved—***To be assigned.

A.335 ***Reserved—***To be assigned.

A.336 ***Reserved—***To be assigned.

A.337 ***Reserved—***To be assigned.

A.338 ***Reserved—***To be assigned.

A.339 ***Reserved—***To be assigned.

A.340 ***Reserved—***To be assigned.

A.341 ***Reserved—***To be assigned.

A.342 ***Reserved—***To be assigned.

A.343 ***Reserved—***To be assigned.

A.344 ***Reserved—***To be assigned.

A.345 ***Reserved—***To be assigned.

A.346 ***Reserved—***To be assigned.

A.347 ***Reserved—***To be assigned.

A.348 ***Reserved—***To be assigned.

A.349 ***Reserved—***To be assigned.

A.350 ***Reserved—***To be assigned.

A.351 ***Reserved—***To be assigned.

A.352 ***Reserved—***To be assigned.

A.353 ***Reserved—***To be assigned.

A.354 ***Reserved—***To be assigned.

A.355 ***Reserved—***To be assigned.

A.356 ***Reserved—***To be assigned.

A.357 ***Reserved—***To be assigned.

A.358 ***Reserved—***To be assigned.

A.359 ***Reserved—***To be assigned.

A.360 ***Reserved—***To be assigned.

A.361 ***Reserved—***To be assigned.

A.362 ***Percent Exhaust Gas Recirculation Valve #2 Position—***Ratio of current exhaust gas recirculation (EGR) valve position to the maximum EGR valve position. A value of 0% means no EGR.

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
362	a

a— Percent Exhaust Gas Recirculation Valve Position

A.363 ***Hydraulic Retarder Control Air Pressure—***The air pressure used to control the oil pressure of the hydraulic retarder.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in²)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in²)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
363	a

a— Hydraulic Retarder Control Air Pressure

A.364 HVAC Unit Discharge Temperature—Temperature of air on the discharge side of the mix door.

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: On request
Message Priority: 7
Format:

PID	Data
364	a
a—	HVAC unit discharge temperature

A.365 Weighing System Status Command—Communicates the current zeroing status of the vehicle weighing system.

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

PID	Data
365	a
a—	Weighing System Status Bits 8-5: Reserved-all bits set to 1 Bits 4-3: 00 = No change to fifth wheel 01 = fifth wheel will be off its calibration point 10 = fifth wheel is on its calibration point 11 = Not available / not applicable Bits 2-1: 00 = No change to Net Vehicle Weight Change 01 = Zero Net Vehicle Weight Change command 10 = Reserved 11 = Don't care / Take no action

A.366 Engine Oil Level High/Low—Amount of current volume of engine sump oil compared to recommended volume.

Parameter Data Length: 1 Character
Data Type: Signed 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
366	a
a—	Engine oil level high/low

A.367 Lane Tracking System Status—Indicates the current status of the lane tracking system.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 0.5 s
Message Priority: 6
Format:

PID	Data
367	a
a—	Lane tracking system status
	Bits 8-7: Lane Tracking System Status Left Side
	00 = Not Tracking
	01 = Tracking
	10 = Error Condition
	11 = Not available
	Bits 6-5: Lane Tracking System Status Right Side
	00 = Not Tracking
	01 = Tracking
	10 = Error Condition
	11 = Not available:
	Bits 4-3: Lane Tracking System Status
	00 = Disabled
	01 = Enabled
	10 = Error Condition
	11 = Not available
	Bits 2-1 - Reserved-all bits set to 1

A.368 Lane Departure Indication—Identifies the in-lane or out-of-lane status of the vehicle.

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Bit Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: 0.1 s when active, or on change of state
Message Priority: 2
Format:

PID	Data
368	a
a—	Lane departure indication
	Bits 8-7: Left side indication status
	Bits 6-5: Right side indication status
	Bits 4-1: Reserved-all bits set to 1

NOTE—Each status will be described using the following nomenclature:

00	Not Active/Out of lane not detected
01	Active/Out of lane detected
10	Error condition
11	Not available

A.369 ***Distance to Rear Object (Reverse)—***Measures the distance from the back of the vehicle to the nearest object. The device sends a message only when the transmission is in reverse.

Parameter Data Length: 1 Character
Data Type: Unsigned Integer
Bit Resolution: 0.1 m (0.328 ft)
Maximum Range: 0.0 to 25.0 m (0.0 to 82.0 ft)
Transmission Update : 0.1 s (when transmission is in reverse)
Message Priority: 2
Format:

PID	Data
369	a
a—	Distance to object from rear of vehicle 0-250 = Distance to object from rear of vehicle 251–253 = Reserved for future assignment by SAE 254 = Error 255 = Not available

A.370 ***Trailer Pneumatic Brake Control Line Pressure—***Gage pressure of air in the pneumatic line that controls the brake application of the trailer, measured at the tractor. (Service Brakes)

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in²)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in²)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
370	a
a—	Trailer pneumatic brake control line pressure (service brakes)

A.371 ***Trailer Pneumatic Supply Line Pressure—***Gage pressure of air in the pneumatic line that supplies air to the trailer pneumatic system, measured at the tractor. Typically controlled by the trailer supply valve. (Red Button)

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 4.14 kPa (0.6 lbf/in²)
Maximum Range: 0.0 to 1055 kPa (0.0 to 153.0 lbf/in²)
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
371	a
a—	Trailer pneumatic supply line pressure

A.372 ***Remote Accelerator—***Ratio of the actual remote accelerator position to the maximum remote accelerator 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: 4
Format:

PID	Data
372	a
a—	Remote accelerator percent

NOTE—The remote accelerator enable switch must be enabled and the accelerator interlock switch must be inactive before the remote accelerator can be used by engine controller.

A.373 ***Center Rear Drive Axle Temperature—***Temperature of axle lubricant in center 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
373	a
a—	Center rear drive axle temperature

NOTE—See PIDs 77 and 78 for related drive axle temperature information. This PID is intended for use on powered vehicles utilizing more than two rear drive axles.

A.374 ***Alternator AC Voltage—***Measurement of AC (RMS) voltage at the alternator output.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.125 V
Maximum Range: 0 to 31.875 V
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
374	a
a—	Alternator AC voltage

A.375 Fuel Return Pressure—Pressure in fuel return line used to detect line blockage.

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.5 psi
Maximum Range: 0 to 127.5 psi
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
375	a
a—	Fuel return pressure (psi)

A.376 Fuel Pump Inlet Vacuum—Vacuum reading on inlet side of the fuel pump (after the primary fuel filter).

Parameter Data Length: 1 Character
Data Type: Unsigned Short Integer
Bit Resolution: 0.2 in Hg
Maximum Range: 0 to 51.0 in Hg
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
376	a
a—	Fuel pump inlet vacuum

A.377 Compression Unbalance—The percent difference between the highest and the lowest compression values in an engine cycle as determined by monitoring the starter current.

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

PID	Data
377	a
a—	Compression unbalance

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 status
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 Door Status—Used to report the open or closed status of a given door.

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—	Door status
	Bits 8-5: Reserved—all bits set to 1
	Bits 4-3: Trailer cargo door status
	Bits 2-1: Transit door status

NOTE—Each status will be described using the following nomenclature:

00	Door Closed
01	Door Open
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
10	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 ***Reserved—***To be assigned

A.386 ***Reserved—***To be assigned.

A.387 ***Reserved—***To be assigned.

A.388 ***Reserved—***To be assigned.

A.389 ***Reserved—***To be assigned.

A.390 ***Reserved—***To be assigned.

A.391 ***Reserved—***To be assigned.

A.392 ***Reserved—***To be assigned.

A.393 ***Reserved—***To be assigned.

A.394 ***Reserved—***To be assigned.

A.395 ***Reserved—***To be assigned.

A.396 ***Reserved—***To be assigned.

A.397 ***Reserved—***To be assigned.

A.398 ***Reserved—***To be assigned.

A.399 ***Reserved—***To be assigned.

A.400 ***Reserved—***To be assigned.

A.401 ***Reserved—***To be assigned.

A.402 ***Reserved—***To be assigned.

A.403 ***Reserved—***To be assigned.

A.404 ***Reserved—***To be assigned.

A.405 ***Reserved—***To be assigned.

A.406 ***HVAC Blower Motor Speed—***Rotational velocity of blower motor rotor shaft.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 rpm
Maximum Range: 0 to 16383.75 rpm
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
406	a a
a a—	HVAC blower motor speed

A.407 ***Axle Group Full Weight Calibration—***Allows for communication of the existing full weight calibration measurement of an axle or axle group.

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
407	a a
a a—	Axle group full weight at time of calibration

A.408 ***Axle Group Empty Weight Calibration—***Allows for communication of the existing empty weight calibration measurement of an axle or axle group.

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
408	a a
a a—	Axle group empty weight at time of calibration

A.409 ***Axle Group Weight—***Force of gravity imposed on the road surface by all the tires in an axle group.

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
409	a a
a a—	Axle group weight

A.410 ***Extended Range Road Surface Temperature—***Indicated temperature of road surface over which vehicle is operating.

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

PID	Data
410	a a
a a—	Extended range road surface temperature

NOTE—See also PID 79.

A.411 ***Recirculated Engine Exhaust Gas Differential Pressure—***Current differential pressure across the engine EGR system.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 1/128 kPa/bit
Maximum Range: –250 to 251.99 kPa
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
411	a a
a a—	Recirculated Engine Exhaust Gas Differential Pressure

A.412 ***Recirculated Engine Exhaust Gas Temperature—***Current temperature of re-circulated engine exhaust gas.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.25 °F
Maximum Range: –8192 to +8191.75 °F
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
412	a a
a a—	Recirculated Engine Exhaust Gas Temperature

A.413 ***Net Vehicle Weight Change—***Identifies Net Vehicle Weight Change from the time of last vehicle net weight zeroing.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 17.792 n (4.0 lbs)
Maximum Range: –583 020.1 to 583 037.3 n (–131 068.0 to 131 072.0 lbs)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
413	a a
a a—	Net Vehicle Weight Change

A.414 ***Air Conditioner Refrigerant Low Side Pressure—***Gage pressure of the refrigerant on the low pressure (suction) side of the air conditioning system.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 1.379 kPa (0.20 lbf/in²)
Maximum Range: –45185 to 45184 kPa (–6553.6 to +6553.4 lbf/in²)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
414	a a
a a—	Low side pressure

A.415 ***Air Conditioner Refrigerant High Side Pressure—***Gage pressure of the refrigerant on the high pressure side of the air conditioning system.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 1.379 kPa (0.20 lbf/in²)
Maximum Range: –45185 to 45184 kPa (–6553.6 to +6553.4 lbf/in²)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
415	a a
a a—	High side pressure

A.416 ***Evaporator Temperature—***Temperature of the air conditioner evaporator core or the temperature of the refrigerant in or near the evaporator core.

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: On request
Message Priority: 8
Format:

PID	Data
416	a a
a a—	Evaporator temperature

A.417 Gross Vehicle Weight—The PID will allow communication of the Gross Vehicle Weight

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 262140.0 lbf)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
417	a a
a a—	Gross vehicle weight

A.418 Transmission #2 Oil Temperature—Temperature of transmission #2 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
418	a a
a a—	Transmission #2 oil temperature

A.419 Starter Circuit Resistance—Resistance of the starter circuit external to the battery.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 milli-ohm
Maximum Range: 0 to 16383.75 milli-ohm
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
419	a a
a a	Starter circuit resistance

A.420 Starter Current (Average)—Starter current as averaged over the update period.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.125 A
Maximum Range: 0 to 8191.875 A
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
420	a a
a a	Starter average current

A.421 Alternator/Generator Negative Cable Voltage—Voltage measured at the negative cable of the vehicle alternator/generator.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.0001 V
Maximum Range: 0.0 to 6.5535 V
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
421	a a
a a—	Alternator ground path voltage drop

A.422 Auxiliary Current—Auxiliary current measurement.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.125 A
Maximum Range: –4095.875 to +4096 A
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
422	a a
a a—	Current

A.423 Extended Range Net Battery Current—Net flow of electrical current into/out of the battery or batteries.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.125 A
Maximum Range: –4095.875 to +4096 A
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
423	a a
a a—	Net battery current

A.424 DC Voltage—Auxiliary DC voltage measurement.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.05 V
Maximum Range: 0 to 3276.75 V
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
424	a a
a a—	DC voltage

A.425 Auxiliary Frequency—Frequency measurement.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.1 Hz
Maximum Range: 0 to 6553.5 Hz
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
425	a a
a a—	Frequency

A.426 Alternator/Generator Field Voltage—Voltage measured at the field windings.

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: 7
Format:

PID	Data
426	a a
a a—	Field voltage

A.427 ***Battery Resistance Change—***Internal resistance change of the battery calculated by simultaneously measuring battery voltage and current over time.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 mill-ohm per second
Maximum Range: 0 to 16383.75 mill-ohm/sec
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
427	a a
a a—	Internal battery resistance change

A.428 ***Battery Internal Resistance—***Total resistance internal to the battery or batteries as defined by the equivalent circuit for a battery or batteries.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.25 mill-ohm
Maximum Range: 0 to 16383.75 mill-ohm
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
428	a a
a a—	Internal battery resistance

A.429 ***Starter Current Peak—***Current measured when the starter is engaged, before armature movement.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.125 A
Maximum Range: 0 to 8191.875 A
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
429	a a
a a—	Starter peak current

A.430 Starter Solenoid Voltage—Voltage measured at the positive terminal of the starter solenoid.

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: 7
Format:

PID	Data
430	a a
a a—	Starter solenoid voltage

A.431 Starter Negative Cable Voltage—Voltage drop measured on the starter motor ground path.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.0001 V
Maximum Range: 0.0 to 6.5535 V
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
431	a a
a a—	Ground path voltage drop

A.432 Starter Motor Voltage—Voltage measured at the positive terminal of the starter motor.

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: 7
Format:

PID	Data
432	a a
a a—	Starter motor voltage

A.433 Fuel Shutoff Solenoid Voltage—Voltage measured at the positive terminal of the fuel shutoff solenoid.

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: 7
Format:

PID	Data
433	a a
a a—	Fuel shutoff solenoid voltage

A.434 ***AC Voltage—***Auxiliary AC voltage measurement (RMS).

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.125 V
Maximum Range: 0 to 8191.875 V
Transmission Update Period: On request
Message Priority: 7
Format:

PID	Data
434	a a
a a—	AC voltage

A.435 ***Cargo Ambient Temperature (By location)—***Temperature of air inside vehicle container used to accommodate cargo.

Parameter Data Length: 2 Characters
Data Type: Character 1 = Binary Bit-mapped
Character 2 = Signed Integer
Bit Resolution: Character 1 = Binary
Character 2 = 1 °F/ Bit
Maximum Range: Character 1 = 0 to 255
Character 2 = –128 °F to +127 °F
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
435	a b
a—	Location of the air temperature 0 = Temperature up front 1 = Temperature down front 2 = Temperature up rear 3 = Temperature down rear 4-255 = Reserved
b—	Cargo ambient temperature

NOTE—See also PID 169.

A.436 ***Trip Sudden Decelerations—***Total number of decelerations whenever the vehicle is more than XYZ km/h/s (where XYZ is a calibrated threshold), since the last trip reset. A lengthy deceleration shall be counted as one sudden deceleration.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 1 count/bit
Maximum Range: 0 to 65535
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
436	a a
a a—	Trip sudden decelerations

A.437 ***Trailer #2, Tag #2, or Push Channel #2 Tire Pressure Target—***The tire pressure control system's target gage pressure for the trailer #2, tag #2, or push #2 group of tires.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.689 kPa (0.1 lbf/in²)
Maximum Range: 0.0 to 45153.6 kPa (0.0 to 6553.5 lbf/in²)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
437	a a
a a—	Trailer #2, tag #2, or push #2 tire pressure target

NOTE—See also PID 141.

A.438 ***Trailer #2, Tag #2, or Push Channel #2 Tire Pressure—***The latest gage pressure reading of the trailer #2, tag #2, or push #2 group of tires, as opposed to the pressure in each tire.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.689 kPa (0.1 lbf/in²)
Maximum Range: 0.0 to 45153.6 kPa (0.0 to 6553.5 lbf/in²)
Transmission Update Period: On request
Message Priority: 8
Format:

PID	Data
438	a a
a a—	Trailer #2, tag #2, or push #2 tire pressure

NOTE—See also PID 144.

A.439 ***Extended Range Boost Pressure #1—***Gage pressure of air is measured downstream on the compressor discharge side.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.125 kPa (0.018 lbf/in²)
Maximum Range: 0.0 to 8191.875 kPa (0.0 to 1188.131 lbf/in²)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
439	a a
a a—	Extended range boost pressure #1

NOTE— If only one pressure is reported, Extended Range Boost Pressure #1 should be used. If two or more turbochargers are used in series and all are to be reported, the Extended Range Boost Pressure #1 should reflect the first of the series. If boost pressures are to be reported as left bank/right bank, Extended Range Boost Pressure #1 should report the left bank. The Extended Range Boost Pressure #2 (PID 440) should be used for the second in series or the right bank as needed.

Extended Range Boost Pressure #1 should be used instead of PID 102 if pressures higher than 32 lbf/in² (219.8 kPa) are desired.

A.440 ***Extended Range Boost Pressure #2—***Gage pressure of air is measured downstream on the compressor discharge side.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.125 kPa (0.018 lbf/in²)
Maximum Range: 0.0 to 8191.875 kPa (0.0 to 1188.131 lbf/in²)
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
440	a a
a a—	Extended range boost pressure #2

NOTE—If only one pressure is reported, Extended Range Boost Pressure #1 (PID 439) should be used. If two or more turbochargers are used in series and all are to be reported, the Extended Range Boost Pressure #1 (PID 439) should reflect the first of the series. If boost pressures are to be reported as left bank/right bank, Extended Range Boost Pressure #1 (PID 439) should report the left bank. The Extended Range Boost Pressure #2 should be used for the second in series or the right bank as needed.

A.441 ***Auxiliary Temperature #1—***Auxiliary sensor #1 temperature reading. Not to be used in place of existing PIDs.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.1 °F
Maximum Range: –3276.8 to +3276.7 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
441	a a
a a—	Auxiliary temperature #1

NOTE—See also PID 442.

A.442 ***Auxiliary Temperature #2—***Auxiliary sensor #2 temperature reading. Not to be used in place of existing PIDs.

Parameter Data Length: 2 Characters
Data Type: Signed Integer
Bit Resolution: 0.1 °F
Maximum Range: –3276.8 to +3276.7 °F
Transmission Update Period: 1.0 s
Message Priority: 4
Format:

PID	Data
442	a a
a a—	Auxiliary temperature #2

NOTE—See also PID 441.

A.443 ***Auxiliary Gage Pressure Reading #2—***Identifies the current gage pressure (relative to atmosphere) that is configured uniquely per application. Not to be used in place of existing PIDs.

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: On request
Message Priority: 8
Format:

PID	Data
443	a a
a a—	Auxiliary gage pressure reading #2

NOTE—See also PID 137.

A.444 ***Battery #2 Potential (Voltage)—***Measured electrical of the isolated battery #2.

Parameter Data Length: 2 Characters
Data Type: Unsigned Integer
Bit Resolution: 0.05 V
Maximum Range: 0.0 to 3.276.75 V
Transmission Update Period: 1.0 s
Message Priority: 5
Format:

PID	Data
444	a a
a a—	Battery #2 potential (voltage)

NOTE—See also PID 168.

A.445 ***Cylinder Head Temperature Bank B (right)—***Temperature of cylinder head on the bank B (or right) side of 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: 4
Format:

PID	Data
445	a a
a a—	Cylinder head temperature bank B (right)

A.446 ***Cylinder Head Temperature Bank A (left)—***Temperature of cylinder head on the bank A (or left) side of 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: 4
Format:

PID	Data
446	a a
a a—	Cylinder head temperature bank A (left)

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—boarding passenger (second passenger stream) 4—exiting passenger (second passenger stream) 5 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 13 characters in the first packet as byte d is transmitted only in the first packet. May be 1 to 14 characters in the middle and ending packets.

d - Total byte count of the original data. It is the same value as the byte count of the parameter being sectioned. This character is broadcast only in the first packet. The value must be greater than 16 but is limited to 224.

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 PIDs 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 occurrence of the PID)
bit resolution: 0.2s
maximum range: 0.2 to 51.0 s

NOTE—When character a = 255 and character b = 0, all subsequent character a values identify page 2 PIDs.

A.451 ***Reserved—***To be assigned.

A.452 ***Reserved—***To be assigned.

A.453 ***Reserved—***To be assigned.

A.454 ***Reserved—***To be assigned.

A.455 ***Reserved—***To be assigned.

A.456 ***Reserved—***To be assigned.

A.457 ***Reserved—***To be assigned.

A.458 ***Reserved—***To be assigned.

A.459 ***Reserved—***To be assigned.

A.460 ***Reserved—***To be assigned.

A.461 ***Reserved—***To be assigned.

A.462 ***Reserved—***To be assigned.

A.463 ***Reserved—***To be assigned.

A.464 ***Reserved—***To be assigned.

A.465 ***Reserved—***To be assigned.

A.466 ***Reserved—***To be assigned.

A.467 ***Reserved—***To be assigned.

A.468 ***Reserved—***To be assigned.

A.469 ***Reserved—***To be assigned.

A.470 ***Reserved—***To be assigned.

A.471 ***Reserved—***To be assigned.

A.472 ***Reserved—***To be assigned.

A.473 ***Reserved—***To be assigned.

A.474 ***Reserved—***To be assigned.

A.475 ***Reserved—***To be assigned.

A.476 ***Reserved—***To be assigned.

A.477 ***Reserved—***To be assigned.

A.478 ***Reserved—***To be assigned.

A.479 ***Reserved—***To be assigned.

A.480 ***Reserved—***To be assigned.

A.481 ***Reserved—***To be assigned.

A.482 ***Reserved—***To be assigned.

A.483 ***Reserved—***To be assigned.

A.484 ***Reserved—***To be assigned.

A.485 ***Reserved—***To be assigned.

A.486 ***Reserved—***To be assigned.

A.487 ***Reserved—***To be assigned.

A.488 ***Reserved—***To be assigned.

A.489 ***Reserved—***To be assigned.

A.490 ***Reserved—***To be assigned.

A.491 ***Reserved—***To be assigned.

A.492 ***Reserved—***To be assigned.

A.493 ***Reserved—***To be assigned.

A.494 ***Reserved—***To be assigned.

A.495 ***Reserved—***To be assigned.

A.496 ***Reserved—***To be assigned.

A.497 ***Reserved—***To be assigned.

A.498 ***Send Keypress Command—***See Appendix D.

A.499 ***Driver Interface Unit (DIU) Object/Form Command—***See Appendix D.

A.500 Intersection Preemption Status and Configuration—Status and configuration of the device used for intersection preemption.

Parameter Data Length: Variable
Data Type: Character 1 = Binary bit-mapped
Character 2 = Binary bit-mapped
Character 3-4 = Unsigned Integer
Resolution: Binary (All characters)
Maximum Range: Character dependent
Transmission Update Period: On request
Message Priority: 8
Format:

PID Data
500 n a b [c c]
n— Number of parameter data characters = 2 or 4, dependent on bits 2-1 of byte (a)
a— Interleaved data control configuration
Bits 8-7: Request/response
00—Message is a request directed to the emitter
01—Message is a response from the emitter
10—Error condition
11—Not available
Bits 6-5: Transit route ID enable
00—Transit route ID not used for interleaved data
01—Transit route ID used for interleaved data (if range code not enabled)
10—Error condition
11—Not available
Bits 4-3: Range code enable
00—Range code ID NOT used for interleaved data
01—Range code ID used for interleaved data (if range code not enabled)
10—Error condition
11—Not available
Bits 2-1: Vehicle ID
00—Vehicle ID is NOT included in byte (c)
01—Vehicle ID is included in byte (c)
10—Error condition
11—Not available
b— Strobe activation control status
Bits 8-7: Strobe activation
00—Deactivate Strobe
01—Activate strobe
10—Error condition
11—Not available

NOTE—Strobe will flash if not overriden by transit door status, strobe is working, and emitter is in the normal mode.

Bits 6-5: Transit door enable
00—Ignore transit door status
01—Transit door status will override strobe activation
10—Error condition
11—Not available

Bits 4-1: Priority of response sent by emitter (16 values)
0 = Reserved
1 = Low priority
2 = Probe priority
3 = High priority
4-8 = Reserved+
9 = Priority set by hardware to low priority
10 = Priority set by hardware to probe priority
11 = Priority set by hardware to high priority
12 -13 = Reserved
14 = Error condition
15 = Not available

c— Vehicle ID (Values from 0 to 65535)

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 501 Data: 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)

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="1" intensity
b1="O" blink on time in tenths of seconds
b1="P" 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

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 information 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).

NOTE—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:

PIDData
509n 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

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 SAE J1708 protocol serves primarily as physical and media access control layer functionality. SAE J1587 provides an application layer functionality as shown in Figure B1. The application layer parameter definitions of SAE 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 SAE 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.[1] 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 SAE 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 SAE J1708 network in the manner of the SAE 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.

1. Andrew Tannenbaum; *Computer Networks* (Englewood Cliffs, NJ:Prentice-Hall), 18

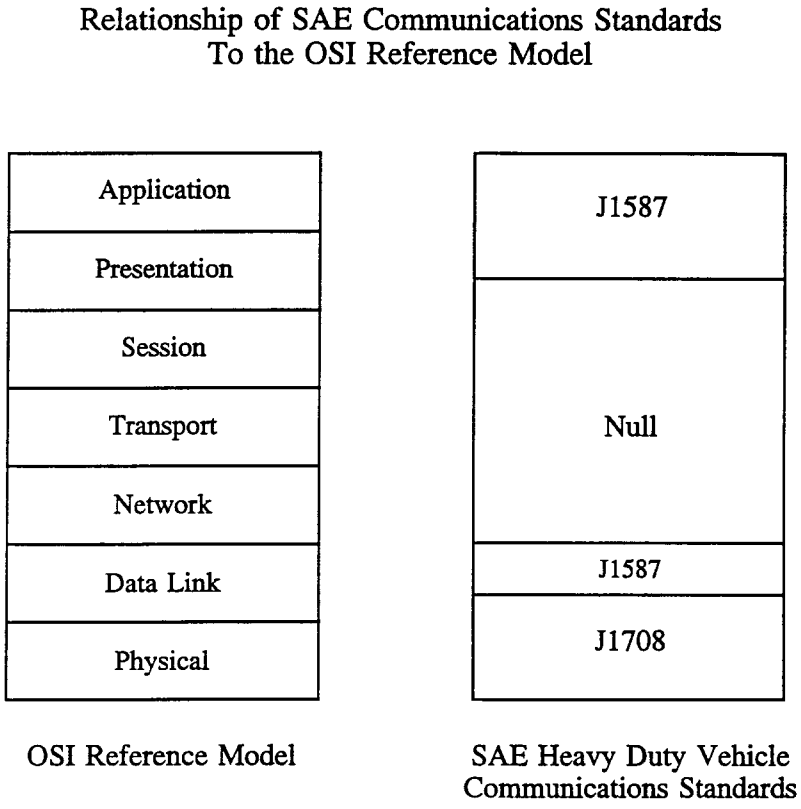


FIGURE B1—SAE STANDARDS AND THE OSI REFERENCE MODEL

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 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.[2] In the context of the OSI reference model, an application layer gateway is shown in Figure B2.

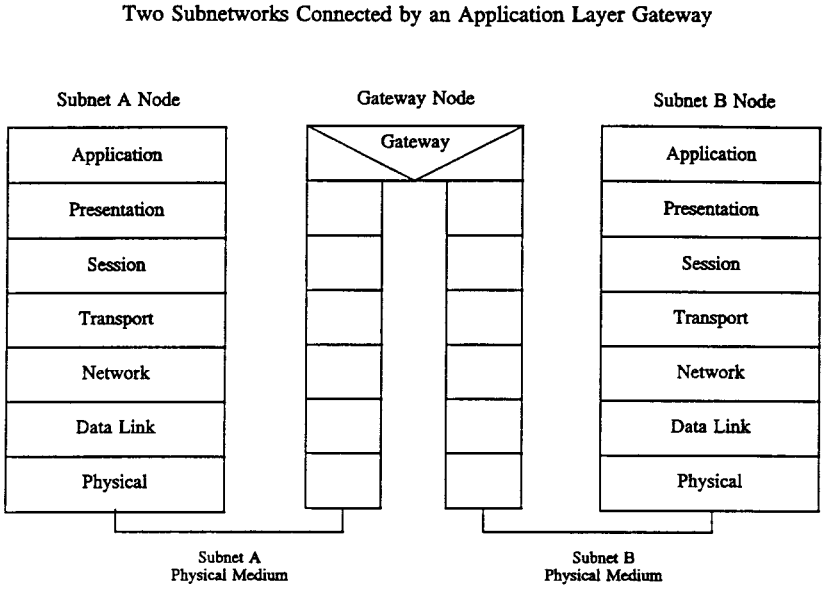


FIGURE B2—THE GATEWAY MODEL

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.[3]

2. John D. Dpragins, et al, *Telecommunications, Protocol and Design* (Reading, MA:Addison-Wesley Publishing, 1991), 491
3. Spragins, 522-523

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.[4] This process is shown in Figure B3.

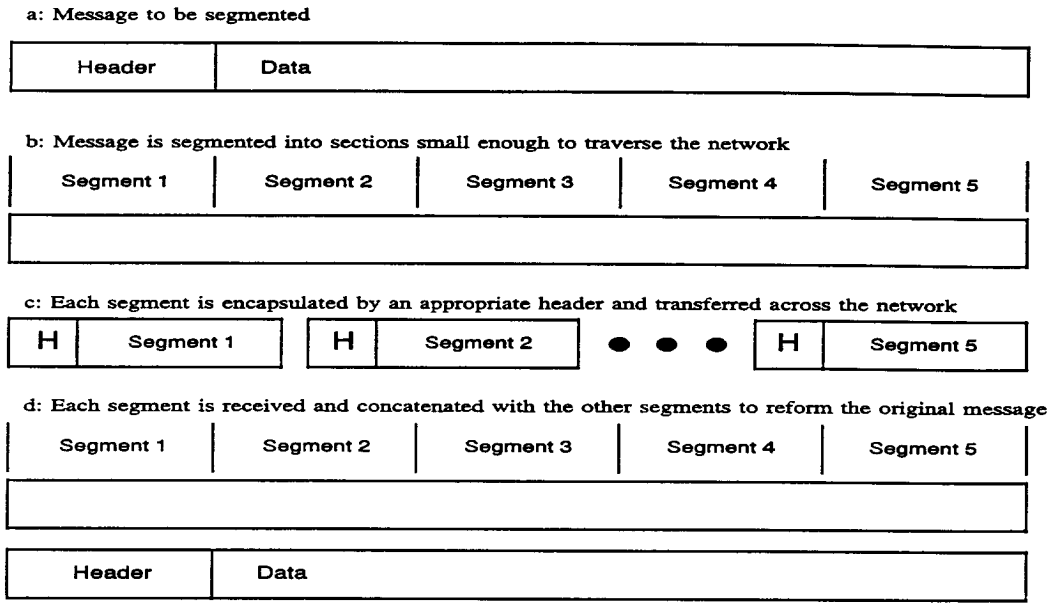


FIGURE B3—MESSAGE SEGMENTATION AND REASSEMBLY

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.

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 SAE 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.

4. William Stalings; *Data and Computer Communications* (New York:MacMillan, 1988), 380

B.5.1 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 SAE 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 are segmented into 15 byte blocks without regard to the structure of the message or the information encoded. The last segment can be less than 15 bytes as the message length may not be a multiple of 15 bytes. Each of these segments is then assigned a segment number, encapsulated within an SAE 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 SAE 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 SAE 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. At the end of ten unsuccessful 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.

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.

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.

Connection Mode Data Transfer Sequence

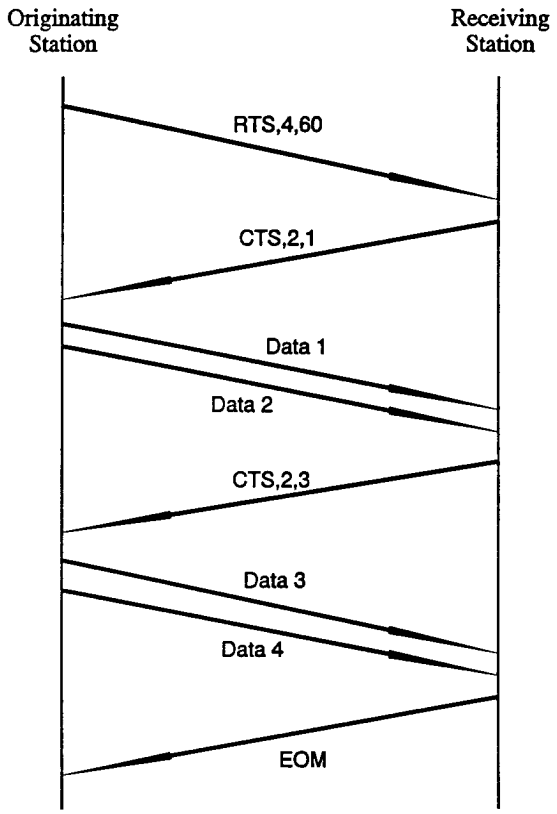


FIGURE B4—DATA TRANSFER WITHOUT ERRORS

Connection Mode Data Transfer Sequence
With Errors

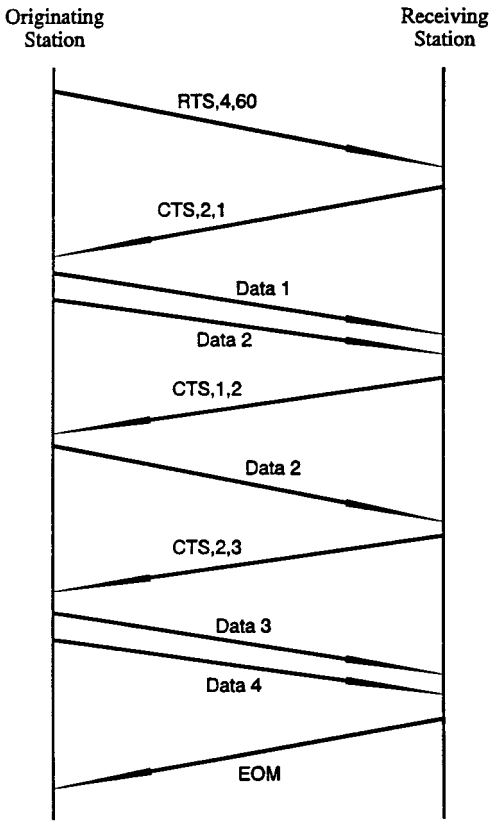
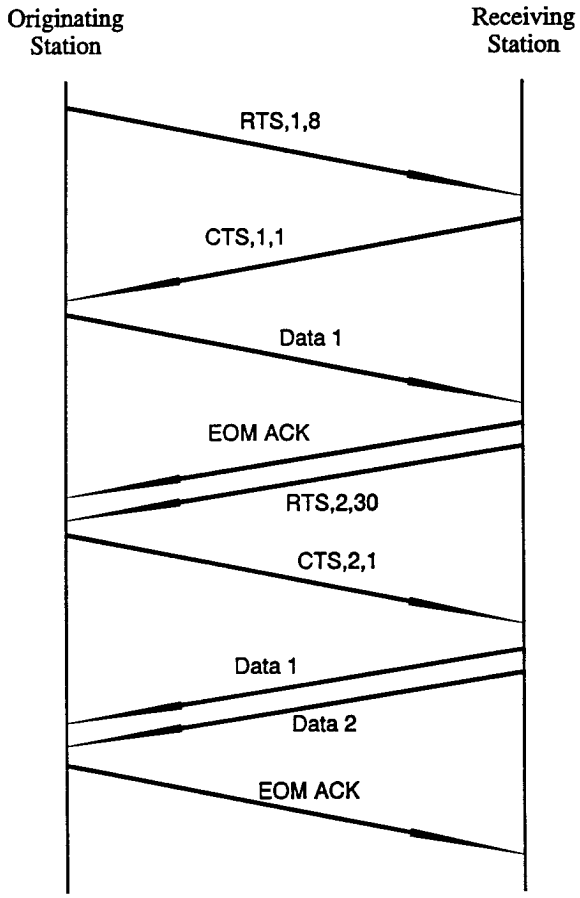


FIGURE B5—DATA TRANSFER WITH ERRORS

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. The other unit receives and interprets the encapsulated request, and uses the services of the transport layer to pass the requested data.

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.

Use of the Transport Protocol for Data Requests



FIGUREB6—REQUESTED DATA TRANSFER

Use of the Connection Management PID
for Data Requests

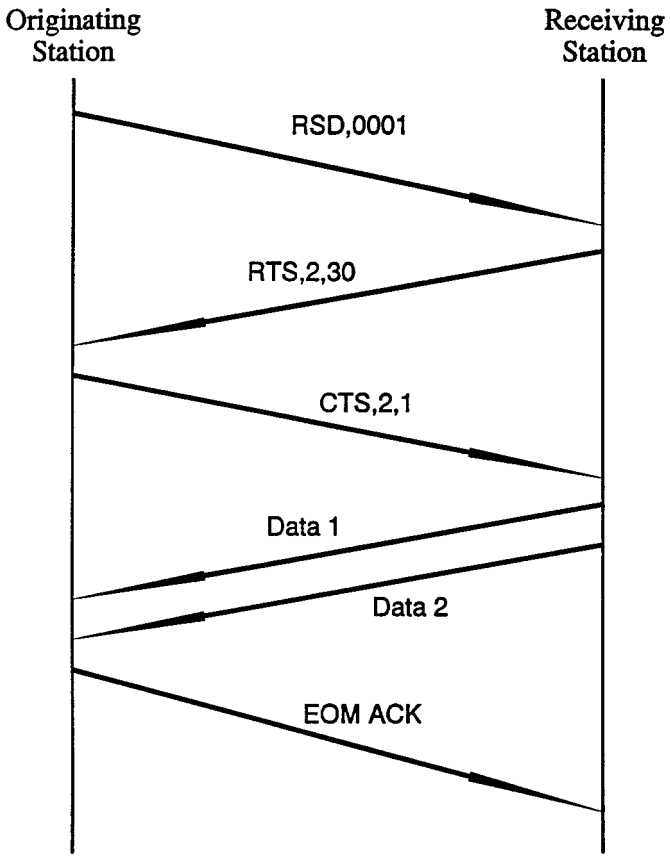


FIGURE B7—REQUESTED DATA TRANSFER USING THE RSD PARAMETER

APPENDIX C

ELECTRONIC DASH DISPLAY

C.1 Introduction. Recently, electronics have added additional displays and switches to the driver's workload. For instance, communications equipment has added displays as large as 4 lines by 40 characters, engine display units have added displays of 2 to 4 lines by 20 characters, refrigeration controls have added displays, collision warning systems are adding displays, load weighing electronics are adding displays. Many of these displays are redundant and could be eliminated by displays capable of being used by several electronic controls on the truck.

PIDs 225, 226, and 227 are intended to provide a minimal set of performance guidelines for an optional text message display that can be accessed by several electronic controls on a truck.

C.2 Guidelines. A display should be capable of sending and receiving three messages over the SAE J1708/J1587 data link for text messaging:

Text Message Display Type
Text Message to Display
Text Message Acknowledged

C.2.1 Text Message Display Type. This message is sent when power is applied through the ignition switch or when any other electronic control on the truck requests the message. This message is intended to provide the other electronic controls on the truck with information regarding the capabilities of the display device.

The display device provides the information on capabilities so that other controls on the truck can format their information for proper display. The display device can also display common messages yet-to-be defined that are not formatted such as warning messages. However, it is the responsibility of the electronic device wanting to display information on the display device to properly format the information for display. It is not the responsibility of the device display to determine how information should be displayed. However, to minimize the complexity of dealing with different display types, the minimum display size is 1 line by 16 characters. Larger displays should be any number of additional lines and should have more characters in increments of 4characters. For instance, the next larger display type would be 1 line by 20 characters. Typical display sizes would be 1x16, 2x16, 2x20, 4x20, 4x40.

The display device has the capability to receive and display the information in different languages. The display device informs the sending device to transmit messages in the proper language format. English language is always supported by the display device. Spanish, French, German, and Italian may be supported by the display device. All transmitters must be able to transmit messages in English format. The character set ISO Latin 1 shall be used (see 3.4.2).

A minimum of twenty memory buffers are needed in the display device to handle all possible transmitters (20transmitters is the SAE J1708 limit) on the network. The minimum buffer size is the same as the maximum display character size.

To provide for consistent display of information and driver interaction, vehicle OEM's or others may provide the display device and additional guidelines for how information is to be displayed on that device. These guidelines will encompass such issues as scrolling of long messages, how to use keys to move through menu trees, how to enter information. The guidelines will be different depending on the capabilities of the display device.

C.2.2 Text Message to Display. This message will allow the display device to receive information to be displayed. The electronic control wanting to display information formats the information in advance and sends this message. For long messages that exceed the size capabilities of the display device, the electronic control will need to follow vehicle OEM or other additional guidelines for breaking up a message into smaller messages or scrolling messages across the display device.

In addition, this message requests one of three acknowledgments from the display device. The display device can acknowledge receipt of the display information immediately upon receipt, after the message has been displayed, or after the message has been displayed and the operator has pressed some key to indicate that he/she has seen the message. The electronic control sending the information determines the type of acknowledgment.

The display device message priority is defined by the type of message to be displayed. If the message requires immediate attention by the driver such as LOW OIL PRESSURE, then the priority would be high, 0 or 1. However, if the message is providing information on some convenience device such as LOW WINDSHIELD WASHER FLUID, then the priority for the message is low, 7 or 8.

If the sending device is transmitting a long, low priority message and then decides to send a higher priority message before it completes its low priority message, an ABORT command can be sent to stop the process. Then the sending device can transmit the higher priority message. Otherwise, the sending device would have to wait until its low priority message is displayed.

C.2.3 Text Message Acknowledged. This message is sent by the display device to the electronic control sending the information to be displayed. The acknowledgment is sent based on what was requested by the electronic control sending the information to be displayed.

C.3 Message Use. If an electronic control does not receive an acceptable display type response, or receives no response, it must minimize loading on the SAE J1708 data link by not sending "Receive Message to Display" commands.

C.4 Display Guidelines. The manufacturer or provider of a common display must also provide a separate document of guidelines for display of information and interaction with the operator. This document is intended to provide consistent operation of that particular display device by all electronic controls using it. These guidelines would be similar to those provided in the personal computer market for display of information in any of several graphical user interfaces (GUI) or display of information in major computer programs such as word processors, spreadsheets, and databases.

These guidelines will encompass such issues as scrolling of long messages, how to use keys to move through menu trees, and how to enter information. The guidelines will be different depending on the capabilities of the display device.

The manufacturer may also elect to predefine messages for display and uses the text data character portion of the Text Message to Display command to indicate which to display.

C.5 PID/Message Definitions

C.5.1 Text Message Display Type. Used to provide other electronic control systems in the truck with information regarding the capabilities of the display type.

Parameter Data Length: 3 Characters
Data Type:Character 1 = Binary bit-mapped
Character 2 = Unsigned Short Integer
Character 3 = Unsigned Short Integer
Resolution: Binary (all characters)
Maximum Range: 0 to 255
Transmission Update Period: Sent once at power up and on request
Message Priority: 8
Format:

PID	Data
227	n a b c

n— Number of parameter data characters = 3

a— Current configuration

Bits 8-5 Language selection
0000—English
0001—Spanish
0010—French
0011 —German
0100—Italian
0101-1111—Reserved

NOTE—English must always be supported on display.

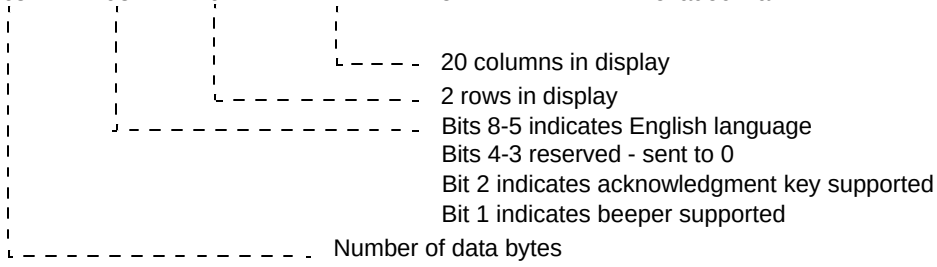
Bit 4: Reserved for future expansion—always set to 0
Bit 3: Reserved for future expansion—always set to 0
Bit 2: Acknowledgment key
1 = Acknowledgment key is supported
0 = Acknowledgment key is not supported
Bit 1: Beeper/sound
1 = Beeper is supported
0 = Beeper is not supported

b— Number of rows in the display

c— Number of columns in the display

EXAMPLE—A 2x20 LCD display designed into an instrument panel with beeper and acknowledgment key capability. English is the displayed language.

MID	PID	DATA	DATA	DATA	DATA	CKSUM	
140	227	03	03	02	20	117	Decimal
8c	e3	03	03	02	14	75	Hexadecimal



C.5.2 Text Message to Display. Used to provide the display device information to be displayed.

Parameter Data Length: Variable
Data Type: Character 1-2 = Binary bit-mapped
Character 3-4 = Unsigned Short Integer
Character 5^+ = ASCII
Resolution: Characters 1-4 = Binary
Characters 5^+ = ASCII
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
226	n a b c d e e e ...

n— Number of parameter data characters
a— Status character 1
Bit 8: Language selection
1 = Revert to English
0 = Use selected language
Bit 7: Abort message
1 = Abort buffered message
0 = Message OK
Bit 6: Predefined message
1 = Message predefined
0 = Message not predefined
Bit 5: Display complete message
1 = Display buffered message
0 = Continue to buffer message
Bit 4: Sound beeper on display
1 = Initiate beeper (time is set by display device)
0 = No sound
Bit 3: Send acknowledgment upon display of message
1 = Send acknowledgment, must be sent with each section of message
0 = No acknowledgment
NOTE—Sent after message is displayed
Bit 2: Send operator acknowledgment of receipt of message
1 = Expect acknowledgment from operator
0 = Do not expect acknowledgment from operator
NOTE—Sent after operator has acknowledged the message by a keystroke
Bit 1: Send received acknowledgment for each network message (partial display message)
1 = Send acknowledgment for receipt of message
0 = Do not send acknowledgment
NOTE—Sent immediately upon receipt of network message
b— Status character 2
Bits 8-4: Message display time—0 to 31 seconds
Bits 3-1: Message priority—0 to 7
NOTE 1—Priorities 0 and 1 are messages which require immediate attention
NOTE 2—Priorities 2 and 3 are messages which require attention in order to prevent severe mechanical damage
NOTE 3—Priorities 4 and 5 are messages which affect the economical operation of the vehicle
NOTE 4—Priorities 6 and 7 are all other messages
c— Message row/line number—1 to 255 (1 is upper most row)
d— Message column number—1 to 255 (1 is left most column)
e— ASCII text data characters to display

EXAMPLE—Immediately (using priority 0) display the following message coming from the satellite unit on a 2x20 display for 30 seconds with no acknowledgments:

Joe, Call Home.
503 777-7777

First message, first line of display text:

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA	
							J	o	e	ASCII
181	226	17	00	240	01	01	74	111	101	Decimal
b5	e2	11	00	f0	01	01	4a	6f	65	Hexadecimal

- Column 1
- Row 1
- Bits 8-4 indicate 30 seconds
  Bits 3-1 indicate priority 0
- Bit 8 = use selected language
  Bit 7 = message OK
  Bit 6 = reserved - sent as 0
  Bit 5 = buffer message
  Bit 4 = no sound
  Bit 3 = no acknowledgment
  Bit 2 = no acknowledgment
  Bit 1 = no acknowledgment
- Number of data bytes

First message, continued:

DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA		
,	<sp>	C	a	l	l	<sp>	h	o	m		ASCII
44	32	67	97	108	108	32	104	111	109	28	Decimal
2c	20	43	61	6c	6c	20	68	6f	6d	1c	Hexadecimal

Second message used to complete first line of the display text:

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA	DATA	CKSM	
							e	.		ASCII
181	226	06	00	240	01	14	101	46	209	Decimal
b5	e2	06	00	f0	01	0e	65	2e	d1	Hexadecimal

- Column 14
- Row 1
- Bits 8-4 indicate 30 seconds
  Bits 3-1 indicate priority 0
- Bit 8 = use selected language
  Bit 7 = message OK
  Bit 6 = reserved - sent as 0
  Bit 5 = buffer message
  Bit 4 = no sound
  Bit 3 = no acknowledgment
  Bit 2 = no acknowledgment
  Bit 1 = no acknowledgment
- Number of data bytes

Third message, second line of display text:

MID	PID	DATA	DATA	DATA	DATA	DATA	DATA 5	DATA 0	DATA 3	
										ASCII
181	226	16	16	240	02	01	53	48	51	Decimal
b5	e2	10	10	f0	02	01	35	30	33	Hexadecimal

Column 1
Row 2
Bits 8-4 indicate 30 seconds
Bits 3-1 indicate priority 0
Bit 8 = use selected language
Bit 7 = message OK
Bit 6 = reserved - sent as 0
Bit 5 = display message
Bit 4 = no sound
Bit 3 = no acknowledgment
Bit 2 = no acknowledgment
Bit 1 = no acknowledgment
Number of data bytes

Third message, continued:

DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA	CKSM	
<sp>	7	7	7	-	7	7	7	7		ASCII
32	55	55	55	45	55	55	55	55	240	Decimal
20	37	37	37	2d	37	37	37	37	f0	Hexadecimal

C.5.3 Text Message Acknowledged. Used to provide an acknowledgment from the display device as requested by the electronic control system sending the information to be displayed, as instructed in status character 1 of the Text Message to Display message (PID 226).

Parameter Data Length: 4 Characters
Data Type: Character 1 = Unsigned Short Integer
Character 2 = Binary bit-mapped
Character 3 = Unsigned Short Integer
Character 4 = Unsigned Short Integer
Resolution: Binary (all characters)
Maximum Range: 0 to 255
Transmission Update Period: As needed
Message Priority: 8
Format:

PID	Data
225	n a b c d
n—	Number of parameter data characters = 4
a—	MID of transmitter of the Text Message to Display command
b—	Display control response
Bit 8	Reserved for future expansion—set to 0
Bit 7	Reserved for future expansion—set to 0
Bit 6	Reserved for future expansion—set to 0
Bit 5	Message aborted 1 = Message aborted 0 = Message OK
Bit 4	Display buffer(s) full 1 = Buffer(s) full 0 = Additional messages can be accepted
Bit 3	Message displayed 1 = Message is being displayed 0 = Message is in buffer
Bit 2	Operator has pressed an acknowledgment key 1 = Operator acknowledge 0 = No key press
Bit 1	Receive network message (partial message to display) from sender 1 = Receive network message 0 = No reply requested
c—	Message row/line number
d—	Message column number

NOTE—Row and column numbers are used to indicate which message is acknowledged or displayed.

EXAMPLE—Acknowledgment from the display that the operator has seen the message from the satellite unit by pressing a key.

MID	PID	DATA	DATA	DATA	DATA	DATA	CKSM	
171	225	04	181	06	01	01	179	Decimal
ab	e1	04	b5	06	01	01	b3	Hexadecimal

message starts in column 1

message starts in row 1

Bits 8-6 reserved - sent as 0

Bit 5 = message OK

Bit 4 = buffers OK

Bit 3 = message displayed

Bit 2 = Operator has pressed a key

Bit 1 = no reply requested

Destination MID = 181

Number of data bytes

APPENDIX D

ELECTRONIC DRIVER INTERFACE UNIT (DIU)

D.1 Introduction—SAE J1587 has acknowledged different means of allowing the driver of an SAE J1708 equipped vehicle to receive information from devices on the SAE J1708 network. From simple status and warning lamps to character mode displays, there have been assigned several PIDs that would allow a device on the network to send a signal or a message to the driver. However, in order to enable the use of graphics type displays and non-volatile storage of preformatted driver messages, PIDs 498 and 499 have been established. Establishment of these PIDs has enabled the development of Driver Interface Units (DIUs) which employ object oriented protocol for displaying information to the driver.

Object oriented approaches to embedded operator interfaces, especially those employing graphic type displays, like their counterparts in the PC world, can present information in a multidimensional format. That is, the information can be presented textually, in a graphic image, or a combination of text and images.

Simple graphical capabilities like font control, character size, borders around certain pieces of information, and icons representing certain actions or icons representing other devices, can make the information more easily noticed, understood, and internalized by the driver.

Through an object oriented visual presentation of information to the driver, the following objectives can be accomplished: faster comprehension, quicker glances at the display for needed information, segmented information allowing development of strategies for simultaneously displaying messages from multiple devices, and many other improvements in device-to-driver communication.

Object oriented driver interfaces can also support text-only displays. The concept of storing objects and forms within the driver interface unit are the same for graphic and text only displays.

D.2 Definitions

D.2.1 Object—An object is a single, autonomous entity residing within the non-volatile memory of the driver interface unit. It can be a text object, a beeper object (e.g., a key click), a GPS (Global Positioning System) handler, an icon, a bitmap, or any of a number of autonomous program entities.

D.2.2 Form—A form is a compilation or aggregation of objects that is commonly repeated. One example would be a driver log-on form made up of softkey label objects, a numeric entry object, a beeper object, and control object for accepting the driver's log-in number.

D.2.3 FID—Form Identification number—The catalog number of the stored form.

D.2.4 OID—Object Identification number—The catalog number of the stored object.

D.2.5 DIU—Driver Interface Unit—An operator interface device for a driver, which includes display and keypad, and which employs an object oriented protocol as described in this Appendix.

D.3 Guidelines—There are network activities involving the Driver Interface Unit (DIU). In order for the Driver Interface Unit to function, it must be able to send and receive information, which can include the following:

a. Receive a message from other network devices.
b. Broadcast the type of DIU.
c. Monitor the network for important data.
d. Send key press data to other specific network devices.
e. Receive a configuration file download (Object and Form data).

The manufacturer or provider of a DIU device must also provide a separate document of guidelines for display of information, interaction with the driver, and interaction with other network devices, as well as configuration downloading instructions. The guidelines document is intended to provide consistent operation of that particular DIU device.

D.4 PID/Message Definitions

D.4.1 Send Keypress Command—Other network devices may require more than an acknowledgment from the DIU. They may require a series of keystrokes. However, there is a requirement that keystrokes be addressed to a specific MID so as not to confuse other network devices. There is an additional requirement that keystrokes be associated with a particular Form ID (FID) since keystrokes of some keys, such as function keys or softkeys, need to be properly identified (since their meaning may change with each displayed form). Only one keystroke per packet is assumed, although up to 14 ASCII characters (also known as a key string) can be sent per keystroke.

Parameter Data Length: Variable
Data Type: Characters 1-2 = Binary bit-mapped
Characters 3^+ = Alphanumeric
Resolution: Characters 1-2 = Binary
Characters 3^+ = ASCII
Maximum Range: 0 to 255
Transmission Update Period: Upon change of status and on request
Message Priority: 6
Format:

PID	Data
498	n a b c c c ...

n— Number of parameter data characters
a— MID of device to receive keystroke data
b— Form ID (FID) of the currently displayed form
c— ASCII character(s) resulting from keystroke (up to 14)

D.4.2 Driver Interface Unit (DIU) Object/Form Command—An object oriented driver interface unit can accept a PID command to display a particular object or form to the driver. The command can be a simple call for a particular canned form or object to be displayed from the DIU memory, with no additional information, e.g., "Low Battery", or the PID message may cause the display of a particular form or object with additional attribute information appended, for instance, a fuel level or engine temperature value, or a text message sent from the satellite unit. Messages can also contain a command to enable physical objects like the beepers and LEDs, if these features are available on the DIU. Tables D1 through D10 list the details of the structure of PID 499.

Parameter Data Length: Variable
Data Type: Characters 1-2 = Unsigned Short Integer
Character 3 = Unsigned Integer
Characters 4^{+} = Unsigned Short Integer
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: Upon change of status and on request
Message Priority: 6
Format:

PID	Data
499	n a b c c d1 d2 d3 d4 ...

n— Number of parameter data characters
a— Command type—See Tables D1 and D4
b— Form ID (FID) of the currently displayed form
c— Object ID (OID)—See Tables D2 and D3
d— Data—See Table D4

TABLE D1—COMMAND TYPE DEFINITIONS

Command	Description
0	Create
1	Delete
2	Write to non-volatile memory
3	Read from non-volatile memory
4	Query object
5	Request display type
6	Object attribute assignment
7	Erase object from screen
8	Paint object to screen
9	DIU control
10	Erase Form from screen
11	Paint Form to screen
12-255	Reserved for assignment by SAE

TABLE D2—OBJECT IDS

Object ID	Description
0-63	Reserved for Assignment by SAE
64-65535	Proprietary, open for each device manufacturer to define

TABLE D3—OBJECT CLASSES (EXAMPLES)

Object Class	Description
Message	A text message field, which can be independent of the displayed form, used to display dynamic messages to the operator.
Text	A textual field on a form, having a unique set of attributes.
Key	A handler of key strokes and key strings.
Bitmap	A bitmap field on a form, having a unique set of attributes.
Gauge	A gauge field on a form, having a unique set of attributes.

TABLE D4—DATA DEFINITIONS (COMMANDS 0 THROUGH 11)

Command	FID	OID	Data	Description
a	b	c	d	
0	1-255	0 (not used)	d1 = 0	Create a new form and give it the FID in field b. A default form always exists and is given FID 0.
0	0-255	0-65535	d1 = 1	Create a messaging object and place it in form FID. The new object gets the OID in field c.
0	0-255	0-65535	d1 = 2	Create a text object and place it in form FID. The new object gets the OID in field c.
0	0-255	0-65535	d1 = 3	Create a key handler object and place it in form FID. The new object gets the OID in field c.
0	0-255	0-65535	d1 = 4	Create a bit mapped object and place it in form FID. The new object gets the OID in field c.
0	0-255	0-65535	d1 = 5	Create a font object and place it in form FID. The new object gets the OID in field c.
0	0-255	0-65535	d1 = 6	Create a gauge object and place it in form FID. The new object gets the OID in field c.
1	1-255	0 (not used)	d1 = 0	Delete the form indicated and all objects contained in that form.
1	1-255	0-65535	d1 = 1	Delete the object indicated.
2	0 (not used)	0 (not used)	0 (not used)	Write all forms and objects from RAM into non-volatile memory.
3	0 (not used)	0 (not used)	0 (not used)	Read all forms and objects from non-volatile memory into RAM.
4	0-255	0-65535	0 (not used)	Query object, requests that the status of the object be returned to the owner device.
5	0 (not used)	0 (not used)	0 (not used)	Request display type (text or graphics) and size (in characters or pixels accordingly.)
6			Object class dependent	See Tables D5 through D10, one for each example object class.
7	1-255	0-65535	0 (not used)	Erase the object from the screen.
8	1-255	0-65535	0 (not used)	Paint the object to the screen.
9	0	0	d1 = 0 d2 = 0-1	Beeper control—0 = off, 1 = on.
9	0	0	d1 = 1 d2 = 0-255	Contrast control—0 = completely light, 255 = completely dark.
9	0	0	d1 = 2 d2 = 0-1	Covert microphone control (for transit buses)—0 = off, 1 = on.
9	0	0	d1 = 3 d2 = 0-3	Back light level—0 = off, 1 = on, 2 = up, 3 = down.
10	1-255	0 (not used)	0 (not used)	Erase the Form from the screen.
11	1-255	0 (not used)	0 (not used)	Paint the Form to the screen.

NOTE—If the CREATE command is used to create new forms, the previously existing forms will be overwritten when a WRITE ALL FORMS command is received by the DIU.

TABLE D5—MESSAGE OBJECT DATA DEFINITIONS

Command	FID	OID	Data	Description
6	0-255	0-65535	d1 = 0 d2 = 0-2 d3 = 0-2	Alignment—determines where, with respect to the position, the object will be placed. d2—horizontal (0 = left, 1 = middle, 2 = right) d3—vertical (0 = top, 1 = middle, 2 = bottom)
6	0-255	0-65535	d1 =1 d2-dn	Add message—specifies a new message to be added to the list of messages in this object.
6	0-255	0-65535	d1 = 2 d2 = 0-255	Select font—d2 is the Object ID of a font.
6	0-255	0-65535	d1 = 4 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Set position—set the point that the object will align on. d2 = X position, low byte; d3 = X Position, high byte; d4 = Y Position, low byte; d5 = Y Position, high byte.
6	0-255	0-65535	d1 = 5 d2 = response method d3 = time	Define response type—message is verified in one of the following ways: 0 = operator keypress required, 1 = operator keystroke with time-out, 2=display message for a fixed time. Time is .2 seconds * d3.
6	0-255	0-65535	d1 = 6 d2 = time	Define flash period—for flashing messages, this number gives the flash time where 1 period = .2 seconds * d2.
6	0-255	0-65535	d1 = 7 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Define field size—gives the width and height of the field in characters.
6	0-255	0-65535	d1 = 8	Define text attributes—select 0 = normal, 1 = flash

NOTE—Definitions for the action of character d1 apply differently according to the type of object being operated on.

TABLE D6—TEXT OBJECT DATA DEFINITIONS

Command	FID	OID	Data	Description
6	0-255	0-65535	d1 = 0 d2 = 0-2 d3 = 0-2	Alignment—determines where, with respect to the position, the object will be placed. d2—horizontal (0 = left, 1 = middle, 2 = right) d3—vertical (0 = top, 1 = middle, 2 = bottom)
6	0-255	0-65535	d1 =1 d2-dn	Define text—specifies the text string to be displayed in this field.
6	0-255	0-65535	d1 = 2 d2 = 0-255	Select font—d2 is the Object ID of a font.
6	0-255	0-65535	d1 = 4 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Set position—set the point that the object will align on. d2 = X Position, low byte; d3 = X Position, high byte; d4 = Y Position, low byte; d5 = Y Position, high byte.
6	0-255	0-65535	d1 = 6 d2 = time	Define flash period—for flashing text, this number gives the flash time where 1 period = 0.2 seconds * d2
6	0-255	0-65535	d1 = 7 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Define field size—gives the width and height of the field in characters.
6	0-255	0-65535	d1 = 8	Define text attributes—select 0 = normal, 1 = flash

TABLE D7—KEY OBJECT DATA DEFINITIONS

Command	FID	OID	Data	Description
6	0-255	0-65535	d1 = 1 d2-dn	Define keystring—specifies the string to be sent when the key is pressed.
6	0-255	0-65535	d1 = 4	Select position—specify which "key" on the manual input device will be handled by this object. Note that key translations will depend on which form is currently displayed.

TABLE D8—BITMAP OBJECT DATA DEFINITIONS

Command	FID	OID	Data	Description
6	0-255	0-65535	d1 = 0 d2 = 0-2 d3 = 0-2	Alignment—determines where, with respect to the position, the object will be placed. d2—horizontal (0 = left, 1 = middle, 2 = right) d3—vertical (0 = top, 1 = middle, 2 = bottom)
6	0-255	0-65535	d1 =1 d2-dn	Define pixels—specifies byte by byte, row by row, the pixels (1 = on, low bit = left-most)
6	0-255	0-65535	d1 = 4 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Set position—set the point that the object will align on. d2 = X Position, low byte; d3 = X Position, high byte; d4 = Y Position, low byte; d5 = Y Position, high byte.
6	0-255	0-65535	d1 = 7 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Define field size—gives the width and height of the field in pixels.

TABLE D9—GAUGE OBJECT DATA DEFINITIONS

Command	FID	OID	Data	Description
6	0-255	0-65535	d1 = 0 d2 = 0-2 d3 = 0-2	Alignment—determines where, with respect to the position, the object will be placed. d2—horizontal (0 = left, 1 = middle, 2 = right) d3—vertical (0 = top, 1 = middle, 2 = bottom)
6	0-255	0-65535	d1 =1 d2 = 0-255	Set value—sets a percentage such that 0 = 0% and 255 = 100%.
6	0-255	0-65535	d1 = 3 d2 = Alow d3 = Ahigh	Set orientation—set the angle that the gauge is painted at. d2 = angle, low byte; d3 = angle, high byte. (0 = horizontal)
6	0-255	0-65535	d1 = 4 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Set position—set the point that the object will align on. d2 = X Position, low byte; d3 = X Position, high byte; d4 - Y Position, low byte; d5 = Y Position, high byte.
6	0-255	0-65535	d1 = 7 d2 = Xlow d3 = Xhigh d4 = Ylow d5 = Yhigh	Define gauge size—gives the width and height of the gauge in pixels (characters for text displays).

D.4.2.1 RECEIVE DIU CONFIGURATION FILE DOWNLOAD—Objects and forms reside within the non-volatile memory of the DIU. Therefore, there must exist a means of downloading and upgrading this file of objects and forms.

Table D10 describes the command that is used to invoke this transfer. A PID 499 packet with CMD=6 and d1=10 is sent to indicate the beginning of an extended data definition (i.e., a definition for data that will not fit into a single SAE J1708 packet). This packet alerts the DIU that SAE J1587 Transport Protocol will be used to transfer the data. Fields d2-d5 are used to send the total number of bytes that will be transmitted via Transport Protocol, LSB first. The FID and OID of this packet is determined by the manufacturer of the DIU in the case of a complete configuration file download, or is the FID/OID for the specific Form or Object data being downloaded.

The host then initiates a Transport Protocol session by sending a Request To Send to the DIU. The DIU responds with a Clear To Send, and the data portion of the object definition is then transacted per standard Transport Protocol procedure. If the data is larger than 3825 bytes, then multiple consecutive Transport Protocol sessions may be initiated by the host until all data is transmitted.

When all data has been transmitted, the host sends a PID 499 packet with Command=6, FID and OID same as the initiating packet, and a d1 value of 11. This d1 value informs the DIU that all object definition data has been transmitted; it effectively ends the transport protocol session.

Two physical methods of file downloading should exist for any DIU device. First, a factory procedure should enable the manufacturer of the DIU, or OEM of a system which includes a DIU, to load the non-volatile memory with forms and objects for devices on the network. Second, there should exist a procedure by which upgrades can be made in the field, preferably within the vehicle. The structure of PID 499 assumes that configuration download can occur over the SAE J1708 network, using PID 499 with the Transport Protocol, as described previously. Within PID 499, a save command (see Table D4) will indicate that the data will be saved to non-volatile memory, or will not be saved.

TABLE D10—USING THE TRANSPORT PROTOCOL TO SEND FORM/OBJECT CONFIGURATION DATA TO THE DIU

Command	FID	OID	Data	Description
6	1-255	1-65535	d1 = 10 d2-d5	A transport protocol data transfer will occur next and will be composed of d2-d5 bytes of data.
6	1-255	1-65535	d1 = 11	All data has been transmitted, transport protocol transfer is complete.

APPENDIX E

E.1 Anti-Theft Request—The information communicated via this message are end-user based requests to a component. This message is always received by the component, and never sent by the component. The component processes this message and sends out a response message, Anti-Theft Status Report. For the purpose of this specification, 'component' refers to the entity that receives this message, and 'interfacing device' refers to the entity that sends this message.

Parameter Data Length: Variable
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: Transmission of this message is interrupt driven. This message is also transmitted upon power-up of the interfacing device sending this message.
Message Priority: 8
Format:

PID	Data
221	n a b c c c c c c c

n— Byte count = 9
a— MID of device to which request is directed
b Status
- Bits 8-6: command state machine bit

  command _states

000	Add_Password
001	Delete_Password
010	Change_Password
011	Lock_or_Unlock
100	Check_Status
101	Login
110	not defined
111	not defined

- bits 5-4: desired exit mode machine bits

  desired_exit_mode

00	Lock_Upon_Operator_Request
01	Lock_When_Key_Off
10	not defined
11	Not_Available

- bits 3-2: encryption_indicator state machine bits

  encryption_indicator states

00	Encryption_Seed_Request
01	Encrypted_Code_Present
10	not defined
11	Not_Available

- bit 1: not defined

c— password_representation (this is a 7 byte numeric code generated based on an encryption seed)

E.1.1 Command_States—This parameter is used to identify the specific requests being sent to the component.

E.1.1.1 Add_Password—This state represents a request to the component to add a password to the list of passwords that the component has stored as valid codes. This command will not be performed if the component has already stored the maximum number of passwords that it is capable of storing. The Login command must precede this command.

E.1.1.2 DELETE_PASSWORD—This state represents a request to the component to delete the password (the same one used when the end-user logged in). See E.2.1.3 for limitations.

E.1.1.3 Change_Password—This state represents a request to the component to change the password (the same one that the end-user logged in with) to a different password, which is to be specified by the end user. The Login command must precede this command.

E.1.1.4 Lock_Or_Unlock—This state represents a request to the component to change from the Locked state to the Unlocked state or from the Unlocked state to the Locked state.

E.1.1.5 Check_Status—This state represents a request to check to see if the component is in the Locked or Unlocked state.

E.1.1.6 Login—This state represents a request to validate the end user before performing commands such as Add_Password and Change_Password.

E.1.2 Desired_Exit_Mode—This parameter is used to specify the desired triggers that are to be used by the component in deciding when to transition to the Locked state.

E.1.2.1 Lock_Upon_Operator_Request—This state is used to indicate that the end user would have to manually enter a password to Lock the engine.

E.1.2.2 Lock_When_Keyoff—This state is used to indicate that the component would automatically transition to the Locked state when the end user turns off the engine (i.e., without the end user being required to manually enter the password).

E.1.2.3 Not_Available—This state indicates that the option is not selectable or changeable by the operator via using current tool.

E.1.3 Encryption_Indicator—This parameter is used to indicate if a random number seed is being requested, or if an encrypted password is being provided to the component.

E.1.3.1 Encryption_Seed_Request—This state represents a request to the component to provide a random number seed.

E.1.3.2 Encrypted_Code_Present—This state is used to indicate that an encrypted password is being provided to the component.

E.1.3.3 Not_Available—This state is used to indicate that a random number is NOT being requested nor is an encrypted password being provided to the component.

E.1.4 Password_Representation—This parameter is the numeric code (i.e., 'encrypted password' or 'key') that is generated based on (1) the encryption algorithm, (2) the password supplied by the end user, and (3) the random number seed given by the component. For requests or other messages where the Password_Representation parameter is not used, these seven bytes must be transmitted, but will be ignored by the receiver and thus their content does not matter.

E.2 Anti-Theft Status Report—The information communicated via this message is always in response to an Anti-Theft Request message. This message is always sent by the component and never received by the component. This message is the means by which the component gives information and feedback to the end user via the interfacing device.

Parameter Data Length: Variable
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period:This message is transmitted in response to an Anti-Theft Request message. This message is also sent when the component has an abnormal power interruption. In this situation, the Anti-Theft Status Report is sent without the Anti-Theft Request.
Message Priority: 8
Format:

PID	Data
222	n a b c c c c c c c

n— Byte count = 9
a— MID of device to which request is directed
b Status
bits 8-7: modify password state machine bits

status_of_request

00	Ok
01	'Full_Of_Passwords'
10	'Empty_Of_Passwords'
11	Not_Valid

bits 6-5: engine status state machine bits

component_status

00	Unlocked
01	Locked
10	Blocked
11	not defined

bits 4-3: state machine bits for 'Password_Valid' discrete parameter
bits 2-1: state machine bits for 'Encryption_Seed_Present' discrete parameter
NOTE—The 'Password_Valid' and 'Encryption_Seed_Present' discrete parameters are defined by the following mode state table:

discrete parameter states:

00	False
01	True
10	not defined
11	not defined

c—Random_Number (a seven byte random numeric code)

E.2.1 Status_of_Request—This parameter is used to indicate whether a request was successfully performed, or if the request could not be performed due to system constraints or if the request was not a valid request.

E.2.1.1 Ok—This state indicates that the request was successfully performed.

E.2.1.2 Full_Of_Passwords—This state indicates that the component can NOT store any additional passwords in the memory.

E.2.1.3 Empty_Of_Passwords—This state indicates that the component would be empty of passwords (an unacceptable condition) if the password under which the end user is logged in, is deleted. Thus the delete password command is not successfully executed.

Note that if the Delete_Password command is sent to a component that does not currently have a password the Empty_Of_Passwords state indicator shall be used.

E.2.1.4 Not_Valid—This state indicates that the request is not a valid one.

E.2.2 Component_Status

E.2.2.1 Unlocked—This state indicates that the component can be started without the end user being required to enter a password.

E.2.2.2 Locked—This state indicates that the component can NOT be started (i.e., Unlocked) without the end user being required to enter a password.

E.2.2.3 Blocked—This state indicates that a Lock or Unlock command cannot be executed because some other algorithm or command of higher priority is commanding differently.

E.2.3 Password_Valid—This parameter indicates if the password is a validated password.

E.2.3.1 False—This state indicates that the password is NOT a validated password.

E.2.3.2 True—This state indicates that the password is a validated password.

E.2.4 Encrypted_Code_Present

E.2.4.1 False—This state indicates that a random number is NOT present.

E.2.4.2 True—This state indicates that a random number is present.

E.2.5 Encryption_Seed—This parameter is a 7-byte numeric code that is pseudorandomly generated. For requests or other messages where the Encryption_Seed parameter is not used, these seven bytes must be transmitted, but will be ignored by the receiver and thus their content does not matter.

Figures E1 through E6 are schematic examples of what data relays between the interfacing device and the component may be like.

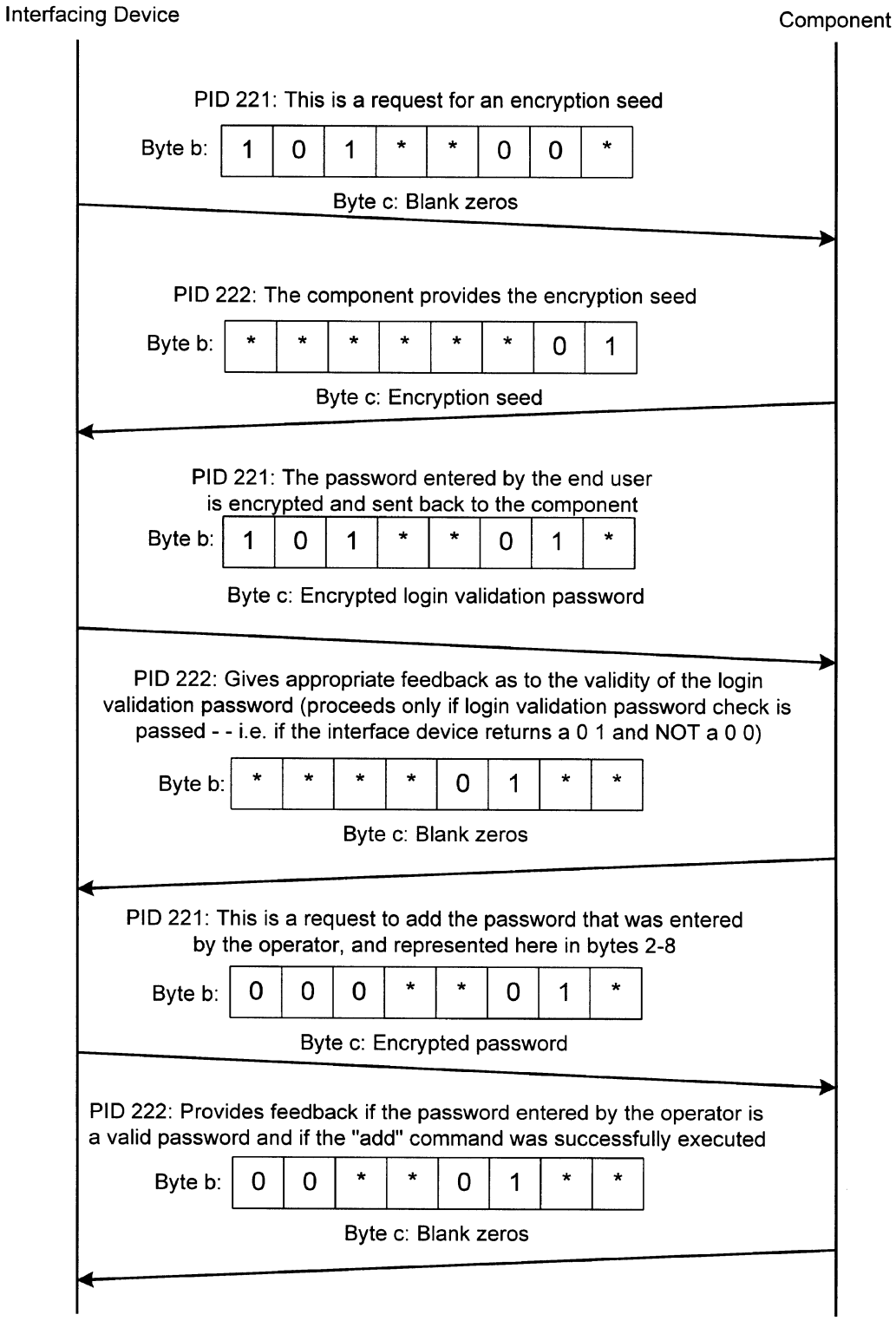


FIGURE E1—EXAMPLE 1: OPERATOR DESIRES TO ADD A PASSWORD TO THE COMPONENT'S PASSWORD STRUCTURE

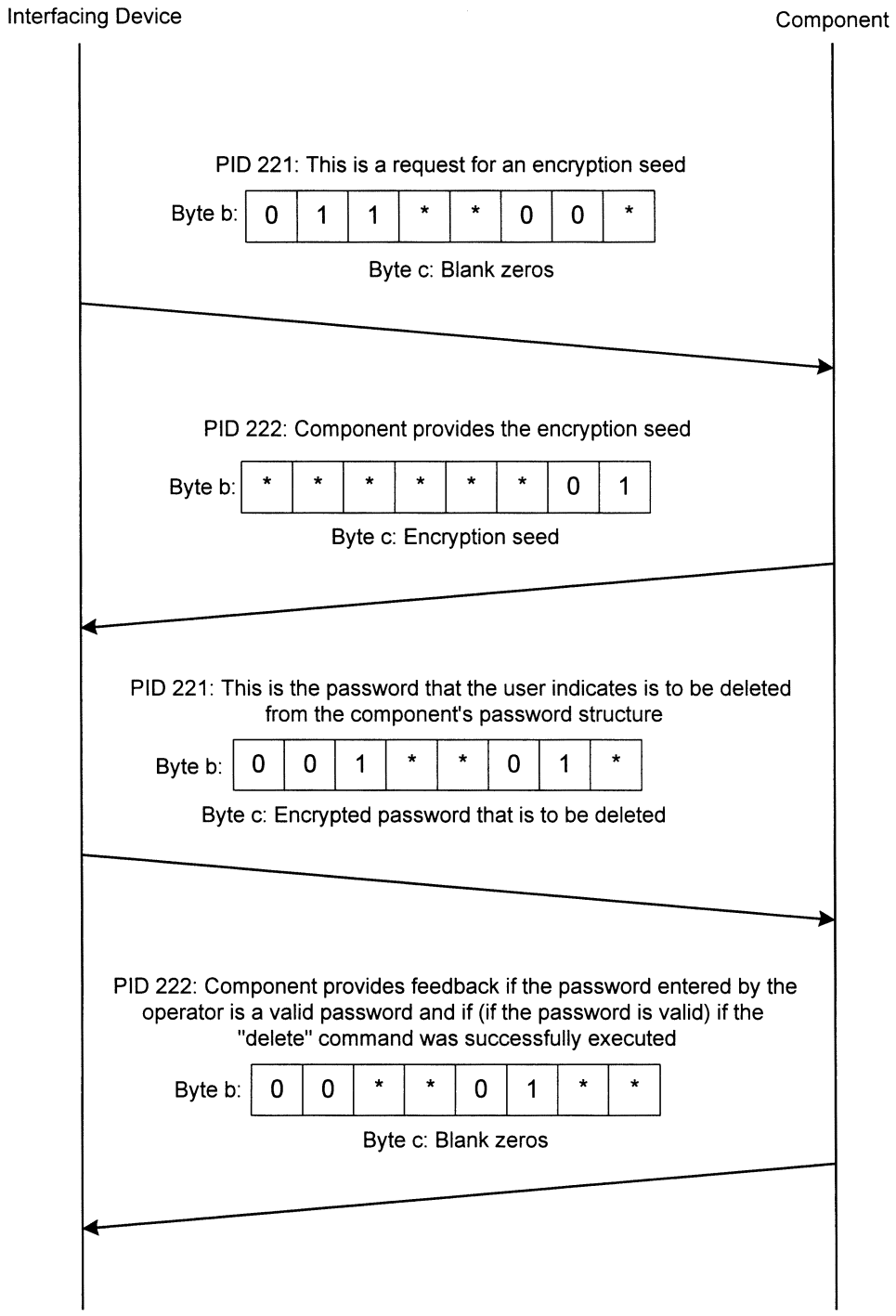


FIGURE E2—EXAMPLE 2: OPERATOR DESIRES TO DELETE A PASSWORD FROM THE COMPONENT'S PASSWORD STRUCTURE

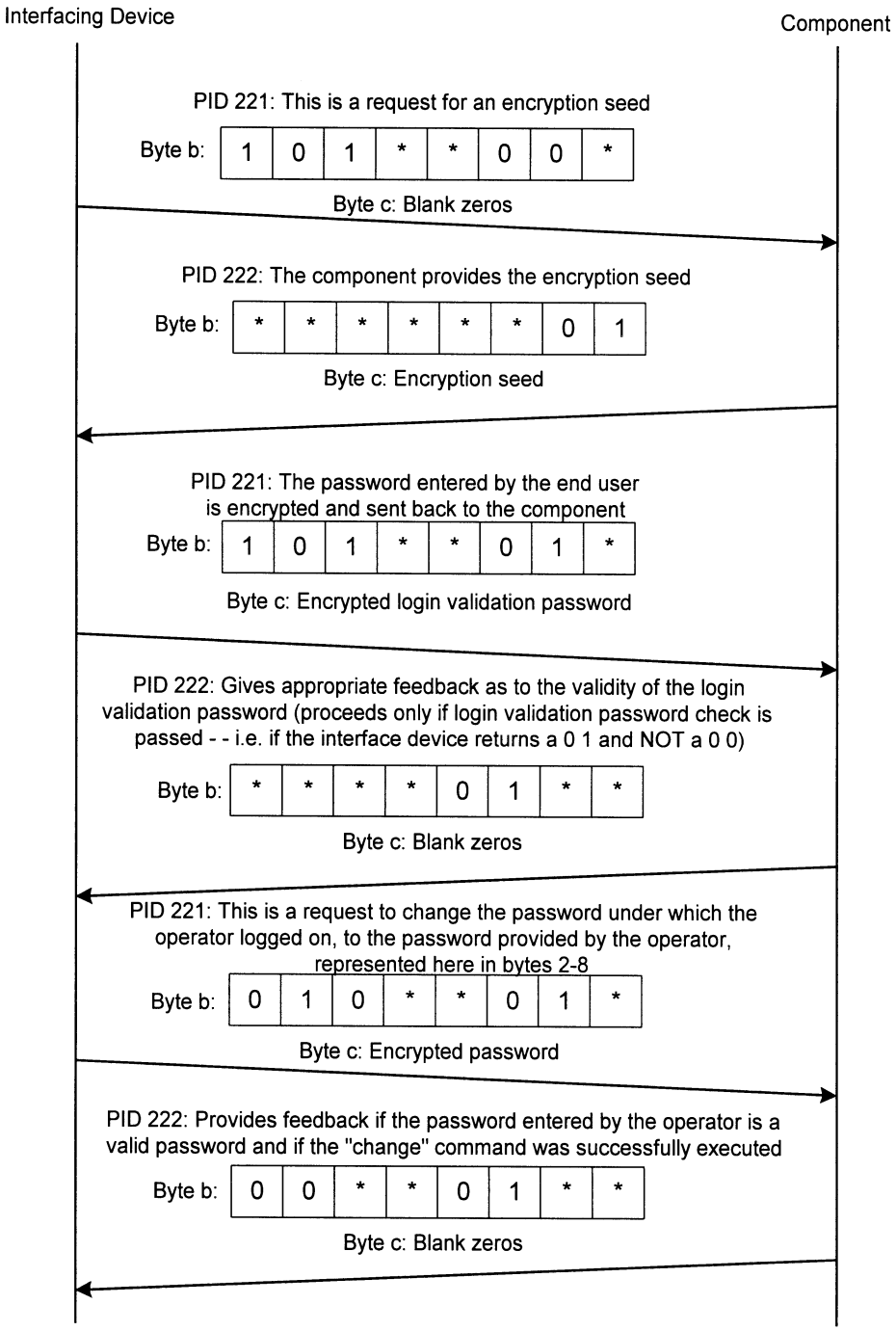


FIGURE E3—EXAMPLE 3: OPERATOR DESIRES TO CHANGE A PASSWORD WITHIN THE COMPONENT'S PASSWORD STRUCTURE

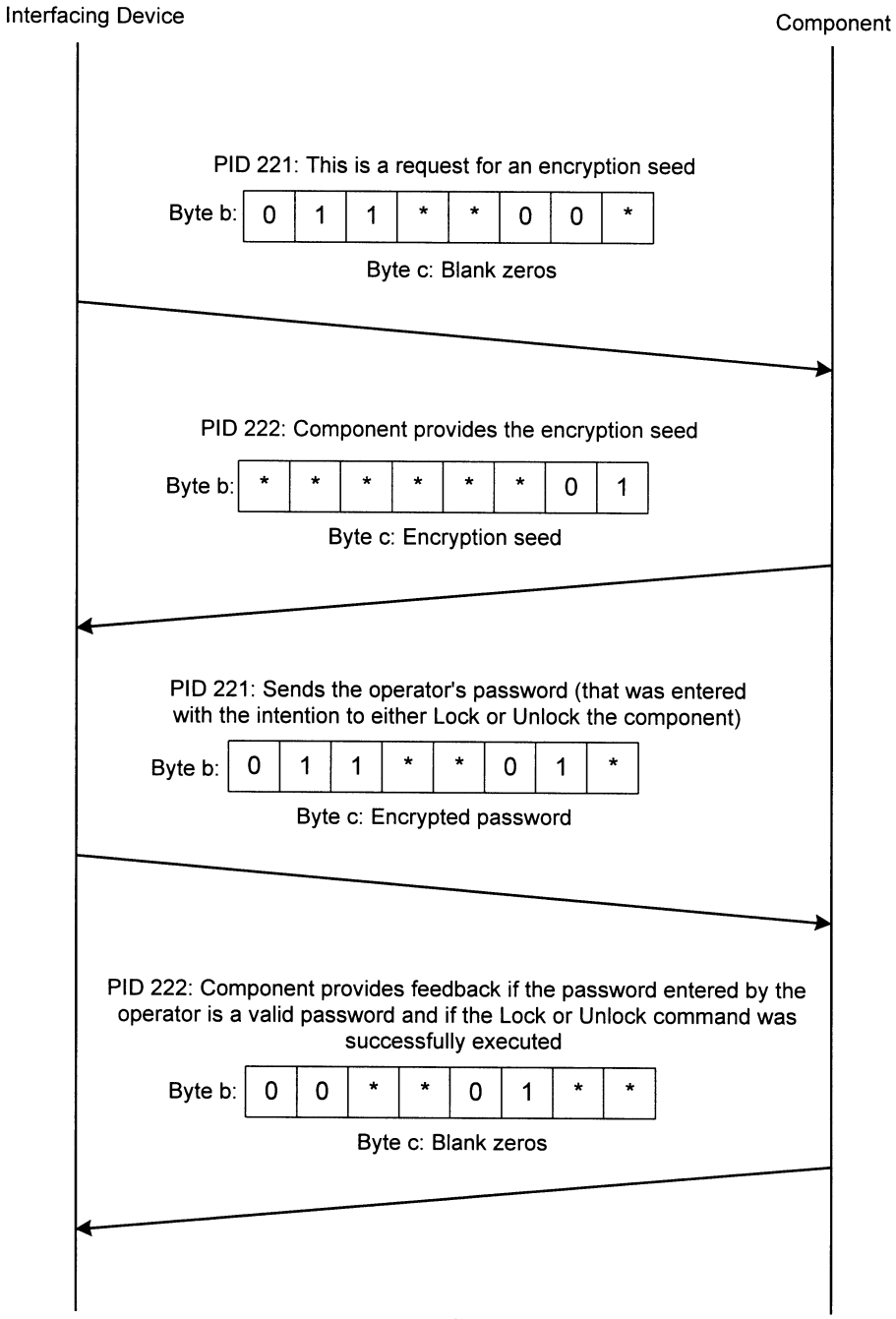


FIGURE E4—EXAMPLE 4: OPERATOR DESIRES TO LOCK OR UNLOCK THE COMPONENT

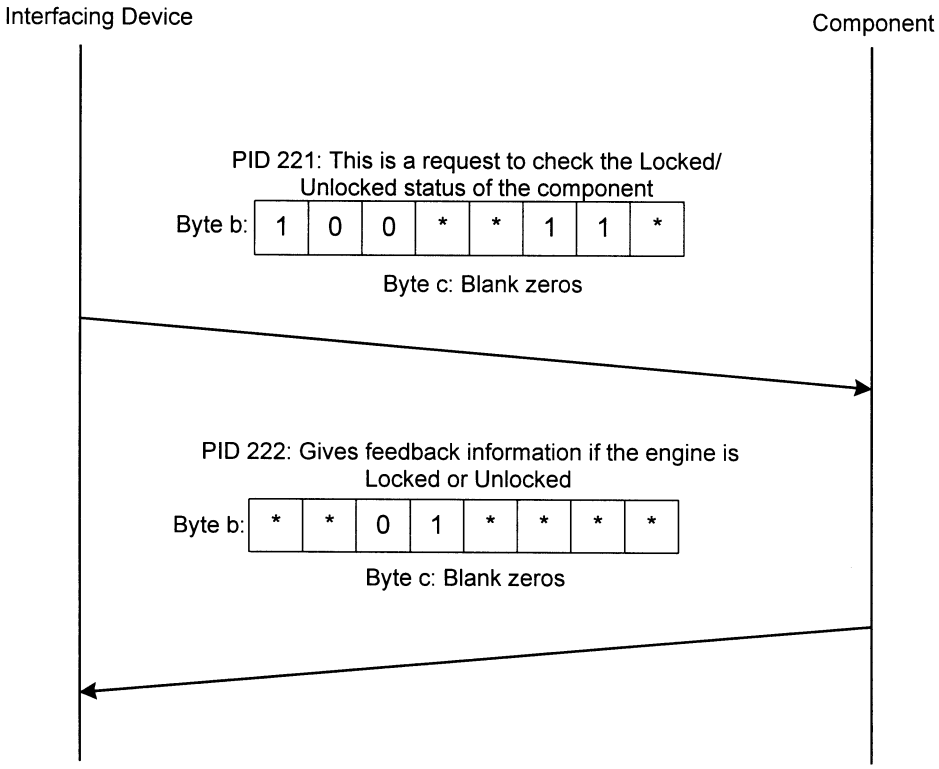


FIGURE E5—EXAMPLE 5: CHECKING STATUS OF THE COMPONENT

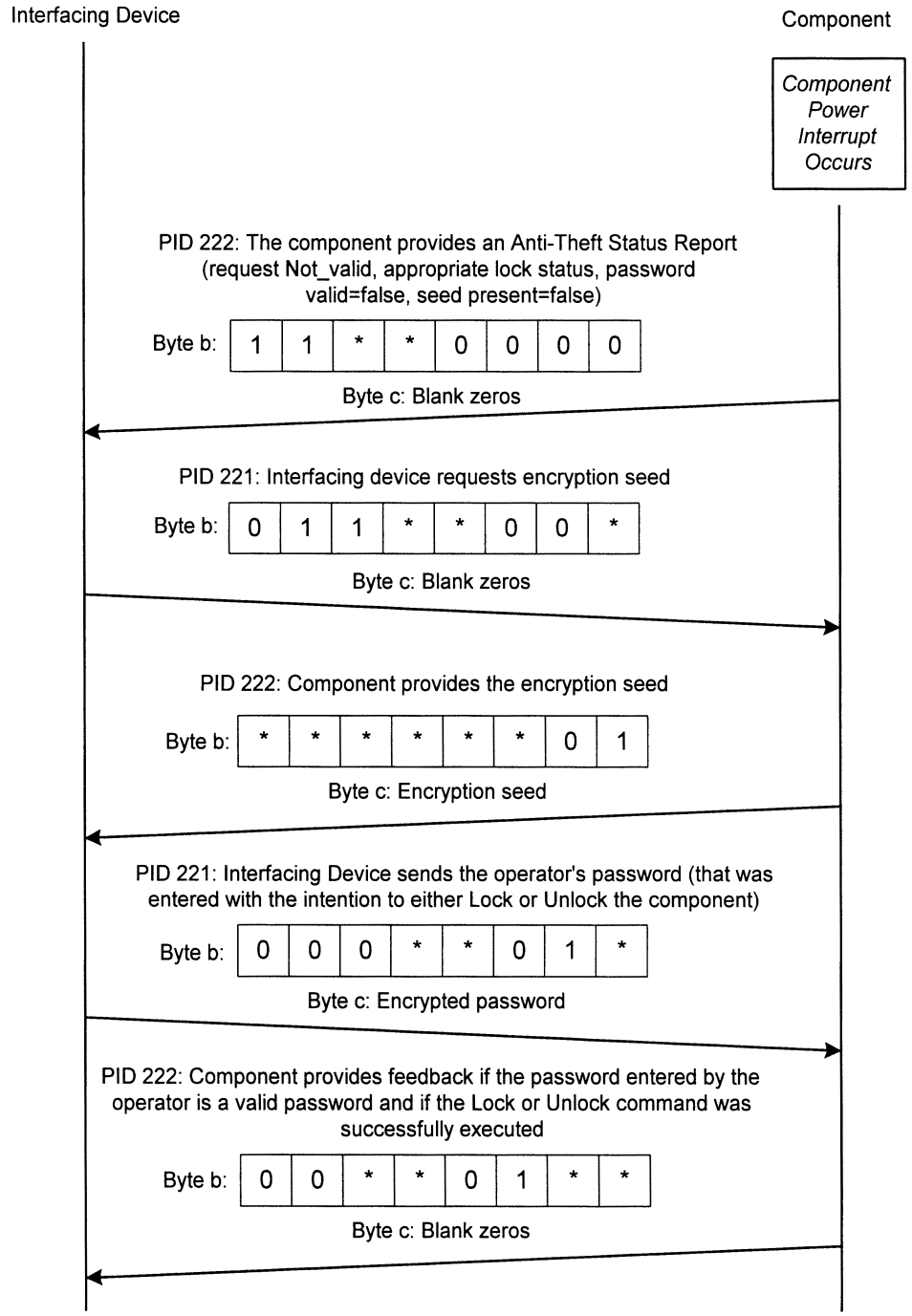


FIGURE E6—EXAMPLE 6: ABNORMAL COMPONENT POWER INTERRUPTION (INTERFACING DEVICE POWER IS NOT INTERRUPTED)

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 SAE Truck and Bus Low Speed Communications Network 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

SAEJ1455—Recommended Environmental Practices for Electrical Equipment Design (Heavy-Duty Trucks)

SAEJ1708—Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications.

EIARS-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 Low Speed Communications Network Subcommittee

Sponsored by the SAE Truck and Bus Electrical/Electronic Committee