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SURFACE VEHICLE RECOMMENDED PRACTICE

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Powertrain Control Interface for Electronic Controls Used in Medium- and Heavy-Duty Diesel On-Highway Vehicle Applications

Foreword—Electronic controls for engines, transmissions, braking systems, and retarders need to share common measured parameters and have a method for interaction. To eliminate the need for redundant sensors and possible conflicting data, a method of communicating information between electronic controls is required. By sharing information, the vehicle installation costs can be reduced and performance enhanced with interactive control features.

A method of communicating control parameters between engine, transmission, antilock braking system (ABS)/ traction control, and retarder systems is required. A long- and short-term approach has been taken to resolve the problem. This document addresses the short-term need. The SAE Truck and Bus Control and Communications Network Subcommittee is developing a controls communication network document (draft SAE J1939) that will use a high-speed data link, which will address the long-term need.

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1. ***Scope*—**This SAE Recommended Practice provides a development or possibly interim production communication protocol between engine, transmission, ABS/traction control, and retarder systems until higher speed communication links are established.

2. References

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

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

SAE J1708 NOV89—Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications
SAE J1587 NOV89—Joint SAE/TMC Electronic Data Interchange Between Microcomputer Systems in Heavy-Duty Vehicle Applications
SAE J1843 JUN89—Accelerator Pedal Position Sensor for Use With Electronic Controls in Medium- and Heavy-Duty Diesel On-Highway Vehicle Applications

3. Definitions—Parameter Definitions

3.1 Percent Torque Value—A percent value for torque which is a percent of the peak engine torque as indicated by byte 18 of the engine to powertrain initialization message (see 5.7.1). Percent torque value is broadcast as a signed short integer (two's complement).

Resolution: 1%/bit
Range: +127% peak engine torque
–128% peak engine torque

3.2 Percent Accelerator Pedal (AP) Position—This signal always reflects the percent AP position as interpreted by the engine. This value shall never reflect override states, the equivalent cruise control value, nor the road speed limiting value. The value is a scaled value such that 0% AP position is represented by 0, and 100% AP position is represented by 255. Additionally, the value of AP position shall be 0% during a fault condition of the AP.

Resolution: 0.392%/bit
Range: 0 to 100%

3.3 Engine Parameter Change—This bit indicates that one of the parameters sent to the transmission in the last initialization message has changed (i.e., idle speed has changed, available torque has changed, etc.). This bit shall remain set until the powertrain has requested a new initialization message, and it has been sent by the engine.

Resolution: Not applicable
Range: Not applicable
Binary bit mapped: 1 = A parameter has changed since last initialization message was sent
0 = No change since last transmission of the initialization message

3.4 Engine's Desired RPM—An indication by the engine to the transmission of the optimal operating speed of the engine for the currently existing conditions. These conditions may include torques generated to accommodate powertrain demand, such as cruise control or vehicle speed governors. Dynamic commands from functions such as smoke control or shift control are excluded from this calculation.

Resolution: 16 RPM/bit
Range: 0 to 4080 RPM

3.5 Engine's Desired RPM Asymmetry Adjustment—This byte is utilized in transmission gear selection routines and indicates the engine's preference of lower versus higher engine speeds should its desired RPM not be achievable. This is a scaled ratio such that 128 represents an equal preference for a RPM lower or higher than the engine's indicated desired RPM. The higher the asymmetry adjustment value is above 128, the more the engine prefers to be operated at or above its indicated desired RPM. Conversely, the lower the asymmetry adjustment value is below 128, the more the engine prefers to operate at or below its indicated desired RPM. Typically, the engine's asymmetry adjustment will be predicated on fuel consumption considerations, and under these situations, the method for computing the asymmetry adjustment is indicated in Appendix A. It should be noted there may be times the engine will deviate from an asymmetry adjustment computation based solely on fuel consumption considerations as done in Appendix A. The engine may include other factors into its asymmetry adjustment calculation such as temperatures, pressures, and other operating parameters.

Resolution: Not applicable
Range: Not applicable

Ratio calculated and scaled per the previous discussion and in Appendix A.

3.6 Desired Engine Speed Value—An actual engine speed requested by the transmission for shift control or the ABS/traction controls.

Resolution: 0.0625 RPM/bit
Range: 0 to 4096 RPM

3.7 Maximum Engine Override Speed—The maximum engine RPM above high idle allowed by the engine control during a momentary high idle override.

Resolution:	16 RPM/bit
Range:	0 to 4080 RPM

3.8 Current Engaged Gear Number—The number assigned to the transmission gear ratios in the transmission to powertrain initialization message by the order of the data. Reverse gear numbers are denoted by negative numbers with the more negative number representing the gear that permits the highest vehicle speed in reverse. The current engaged gear number is broadcast as a signed short integer (two's complement). The current engaged gear number has a value of zero when the transmission is in neutral.

Resolution:	1 gear/bit
Range:	+127 forward gears
	– 128 reverse gears

3.9 AP Kickdown Position—Same as kickdown state in SAE J1843.

Resolution:	Not applicable
Range:	Not applicable
Binary bit mapped:	1 = In kickdown position
	0 = Not in kickdown position

3.10 AP Low Idle Position—Same as low idle state in SAE J1843.

Resolution:	Not applicable
Range:	Not applicable
Binary bit mapped:	1 = In low idle position
	0 = Not in low idle position

4. Powertrain Interface—A dedicated SAE J1708 data link shall be used to communicate the following parameters between engine, transmission, ABS/traction control, and retarder systems. The protocol to transfer information is similar to SAE J1587. Variable length message formats shall be used to communicate data between the control devices. The data will be formatted order specific to minimize the data link utilization. In order to have synchronization of broadcast data, it is recommended that the update timer in each device be re-initialized to a fixed time interval (based on the fastest update rate of the data in the message) every time the device gains access to the data link. This method of broadcasting is an attempt to minimize the number of possible collisions.

5. Message Formats—Table 1, Message Identification (MID), was reserved in SAE J1708 MID assignment list in January of 1989. The use of these MIDs will be discussed in detail throughout the rest of Section 5. Message formats adhere to SAE J1708 requirements.

TABLE 1—MESSAGE IDENTIFICATION (MID) TABLE

MID	Description
69	Engine to Powertrain Message
70	Engine to Powertrain Initialization Message
71	Engine to Powertrain Initialization Request Message
72	Engine to Transmission Current Gear Request Message
73	Engine, Reserved
74	Transmission to Powertrain Message
75	Transmission to Powertrain Initialization Message
76	Transmission to Powertrain Initialization Request Message
77	Transmission to Powertrain Current Gear Number Message
78	Transmission, Reserved
79	ABS/Traction Control to Powertrain Message
80	ABS/Traction Control to Powertrain Initialization Message
81	ABS/Traction Control to Powertrain Initialization Request Message
82	ABS/Traction Control, Reserved
83	Retarder to Powertrain Message
84	Retarder to Powertrain Initialization Message
85	Retarder to Powertrain Initialization Request Message
86	Retarder, Reserved

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