In-Vehicle Networking

Lecture 6 Introduction to SAE J1587
BAE 5030 - 003
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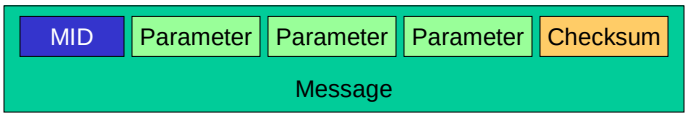
SAE J1587 Scope and Message Format

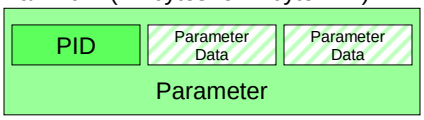
- Defines
  - Message format
  - Data format
- For use with SAE J1708
  - Defines format for messages with MID in the range 128 to 255
  - Messages with MIDs 0 to 127 may or may not conform
- Message format
  - Format
    - MID followed by one or more Parameters, followed by a Checksum



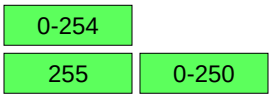
- No two transmitters in the system shall have the same MID
  - Requests for new MID assignments are to SAE Committee

SAE J1587 Parameter Format

- Parameter format
  - Parameter IDentification (PID) -1 or 2 bytes
  - Parameter data
    - length and content defined in parameter definition
    - 18 bytes maximum (17 bytes for 2 byte PID)



  - PID format
    - Case 1 PID < 255
    - Case 2 PID > 255



    - If first byte of PID is 255, add 256 to second byte to get PID
- Data types
  - (Int, Float, Alphanumeric, etc) and lengths are defined

PID value to Data Length Association

- Parameter length associated with PID value
  - Data definition and format assignments made by SAE Committee
  - Parameter ID (PID) to Length association

PID	Length
0-127	1
128-191	2
192-253	>2 and variable
254	Data link escape, followed by destination MID then by manufacturer specific data
255	Extension for PIDs 256-512
256-383	1
384-447	2
448-509	>2 and variable
510	Page 2 data link escape
511	Extension for Page 2 PID

Example PID naming

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

Example parameter definition

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.

J1587 Transport Protocol

- Allows 17 to 239 byte data to be split into 21 byte messages (packets)
- Included as an Application Layer protocol
- Encapsulates other defined PIDs
- One PID per multi-packet message
- Allows multiple multi-packet messages to be sent simultaneously, but only one per source

J1587 Transport Protocol

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

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.

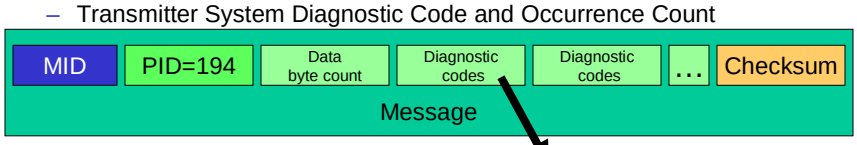
b— The last section number (total number of sections minus ONE) and the current section number. The upper nibble contains the last section number (1 to 15). The lower nibble contains the current section number and is limited to the range 0 to 15. Section numbers are assigned in ascending order.

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.

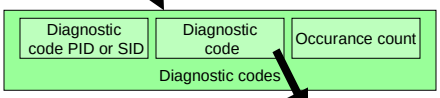
d— Total byte count of the original data. It is the same value as the byte count of the parameter being sectioned. This character is broadcast only in the first packet. The value must be greater than 17 but is limited to 239.

J1587 diagnostics support

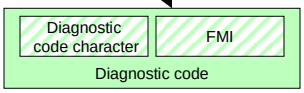
- Defines Subsystem Identification
  - SID
    - Field repairable or replaceable subsystems of a particular MID
    - Up to 255 SIDs per MID
- Defines a “diagnostic code” structure and messages
  - Transmitter System Diagnostic Code and Occurrence Count



  - Diagnostic codes structure
    - See PID 192



  - Diagnostic code structure



Failure Mode Identifiers

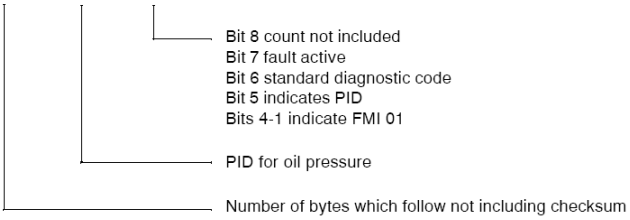
TABLE 7—FAILURE MODE IDENTIFIERS (FMI)

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

Diagnostic code example (See PID 194)

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