



Hardware and Software Issues Pertaining to OBD for I/M

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**Presented by Bernard J. Carr
Vetronix Corporation**



Overview

- Inspection and maintenance programs that utilize OBD have been troubled by Test Analyzer System to Vehicle communication problems.
- Some state agencies have been concerned with the operation of I/M equipment
 - BAR 97 OBD equipment is not able to communicate with certain vehicles



Hardware

- Location of SAE J1962 Data Link Connector (DLC) is a concern
 - Time to connect data cable for I/M test equipment
- OBD II ECUs utilizing different legislated communication protocols
 - Engine ECU uses ISO 9141-2 while transmission ECU uses ISO 14230-4
 - Cannot communicate to both at the same time using the same wire
- SAE J1962 DLC not supplying 12v power
 - Pin 16 of DLC does not contain battery voltage



Software

- Problems in this area constitute the majority of issues
- #1: Incorrect physical address assignments & response order
 - OBD test equipment has a tough time identifying the responding ECU.
 - Example: If the vehicle uses a physical address assignment different from those that are specified or those for which we have already made adjustments, we may think we're talking to a transmission instead of an engine, vice-versa, or some undefined ECU
 - OBD test equipment does not reject or filter any responses, but does attempt to identify the ECU for the user based upon the address they send
 - If an undefined ECU responds it gets classified as “Undefined”
 - Responses from multiple OBD II ECUs
 - Example: the transmission ECU may respond before the engine ECU.
 - Either way data from all responding ECUs are evaluated for commanded MIL, DTCs, and On-board Diagnostic Evaluations.



Software

- #2: Incorrect header bytes
 - Some OBD II ECUs respond with a message header byte that is not per industry defined documentation.
 - Example: A scan tool request message header is "68 (or 61) 6A Fx". ECU's are required to respond with header bytes of "48 (or 41) 6B <address>", but some ECU's incorrectly respond with a "68 (or 61) 6B <address>".
 - If the vehicle ECU does not follow industry defined communication practices, the equipment used to connect to the OBD II ECU(s) may not incur a successful communication event. If adjustments are made for this, it's possible that any message will be accepted as a possible response.



Software

- #3: Keyword Protocol (KWP) 2000 Initialization
 - ECUs that use KWP 2000 (ISO 14230-4) communication can wake up using either one of two initialization processes.
 - Example: OBD test equipment initializes communication using init process A and the ECU expects init process B. Once the OBD II ECU is subjected to slow or fast initialization, some vehicles will refuse to respond to the other method. Some tool manufacturers believe that one or the other, not both, is required
 - It's been suggested that tool manufacturers need to spend sufficient time in validating their approach on multiple KWP 2000 equipped vehicles. Currently we wait a prescribed time between communication types so that the ECU can recover from anything we have tried previously. The result is a delay in ECU initialization.
 - Perhaps the car companies, regulators, and ETI can work closer to resolve conflicting industry defined communication practices & procedures.



Software

- #4: Emission system MIL, DTC Count, and On-board Diagnostic Evaluation Request (Mode \$01, PID \$00)
 - Mode \$01 PID \$00 Request may result in non-emission related ECU's incorrectly responding to this request.
 - Example: If an errant ECU wakes up and responds, it will think it has a connection and not try other protocols regardless of the data it sends back. If any ECU responds with actual data we won't continue on to try other protocols. This is true anytime an ECU responds with data.
 - Our assumption, for the purposes of the OBD II test equipment, is that all OBD II ECU's on a vehicle use the same protocol. Therefore, any ECU that communicates and responds with data ends the search for ECUs.



Software

- #5: Incorrect Parameter ID (PID) Support Indication
 - Incorrect PID support indication occurs when an OBD II ECU indicates PIDs as “supported” when they are actually not. Thus, when the specific PID is requested, the vehicle will not respond.
 - Example: If an ECU responds with an indication of which PIDs it supports, the OBD test equipment will use that information to determine which PIDs are supported. Any application using PIDs would then believe that a request for supported PID data is possible.
 - It’s been suggested that OBD test equipment develop a creative way to handle this...well, if the ECU gives the OBD test equipment an indication of which PIDs it supports we really cannot do anything else. It’s a stretch, but the use of s/w calibration and YMME info may help – but now the system is not autonomous.



OBD II System Evaluation Flowchart

- ETI members worked with California ARB to define an OBD II system evaluation flowchart.
 - Work performed June 2001 to March 2002
 - Located at <http://etools.org/public/articles/details.cfm?id=165>
- Flowchart organizes how the OBD II system should be evaluated by a Test Analyzer System
 - Test software should follow this process
- 11 page flowchart define individual processes; together they combine to describe the total OBD for I/M process



OBD II System Evaluation Flowchart

- The 11 “Phases”:
 - Start OBD Test (Visual MIL Bulb Check)
 - Establish Communication (Communication Check)
 - Get PID \$00 Data (Request Indication of Supported Parameters)
 - Vehicle Valid for Inspection (Check OBD Level, Engine Speed)
 - Get PID \$01 Data (Request MIL, DTC Count, On-board Diagnostic Evaluation Status)
 - Process Readiness Data (Determine Status)
 - Get VIN Info (Request VIN)
 - Get Calibration ID/CVN Info (Request Calibration ID and CVN)
 - Process VIN/Calibration ID/CVN Info (Determine VIN, Calibration ID, and CVN)
 - MIL Status Evaluation (Check Commanded MIL, DTC Count, and Number of DTCs read)
 - Pass/Fail Decision (Determine if Vehicle is Not Ready, has Failed, or Passed test)



OBD Reliability

- OBD interface hardware is available today and has field proven reliability
 - Vetronix has deployed OBD Scantool equipment in the field since 1984
- OBD II test equipment used in OEM emission test system equipment
 - Vetronix has deployed OBD I/M equipment in the field since 1996
- Wireless OBD Device used in pilot programs
 - Vetronix has been engineering wireless solutions since 1997



Items to Address...

- Full disclosure by the Automotive manufacturer to provide documentation on their data link interface
 - Including electrical definition, communication, and protocol information for all circuits routed to the DLC
- Support for upcoming ISO 15765-4 Controller Area Network (CAN) legislated communication protocol
- Support for Medium and Heavy Duty Vehicle (MDV, HDV) OBD Systems over SAE J1939
- Vetronix welcomes the opportunity to support OBD for I/M programs
- Thank You

