WWH-OBD – made simple!

Implementation of the new Requirements for OEMs and Suppliers

All new vehicle registrations for heavy-duty vehicles must conform to the requirements of the Euro-VI emissions standard starting in 2014. Vehicle manufacturers are obligated to implement a WWH-OBD capable diagnostic system. Even earlier, guidelines for newly developed vehicles take effect; here the deadline is already on 01-01-2013. Consequently, help in testing the implementation with WWH-OBD capable diagnostic tools is very welcome.

On-Board Diagnostics (OBD) in vehicles involves continual self-monitoring of the system. Indicator lights immediately show the results of this self-monitoring. These results are also saved and read-out by an external tester at discrete time points, e.g. during maintenance or in the context of a repair. After some carmakers already began to implement such concepts as proprietary form back in the 1980s – at that time nearly exclusively in the electronic engine management systems – the California environmental authorities (CARB) in the USA formulated registration requirements for new vehicle models. These requirements prescribed, in addition to conformance to specific emission limits, a defined set of self-monitoring functions for emissions-related systems in a vehicle.

Building upon the original OBD version of 1988, legally binding OBD content was defined in subsequent years in the rest of the states in the USA as well as in Europe and Japan. Although these regionally applicable OBD versions all build upon the same foundation – and in some cases are identical in content – they were developed in parallel to OEM-specific diagnostics and use very different methods, services and parameters.

Global Harmonization of Vehicle Diagnostics

In OEM-specific diagnostics, there has been a clear trend over the past decades towards increasing standardization with regard to transport and diagnostic protocols. Meanwhile, a uniform diagnostic interface to external testers (16-pin OBD socket) and the CAN bus as the transmission medium have largely prevailed.

This convergence towards UDSonCAN (Unified Diagnostic Services) makes it attractive to merge the diagnostic protocols of the legally required and the OEM-specific diagnostic contents, which World Wide Harmonized On-Board-Diagnostics (WWH-OBD) should be able to perform.

Standardization is occurring at the urging of the United Nations in the form of a Global Technical Regulation (GTR) and will be specified in the ISO 27145 standard.

The new specification also provides for new and extended functions. For example, the error codes are classified into Severity Classes A, B1, B2 and C, indicating the severity of a failure with regard to its effect on exhaust emissions quality. Errors of the second highest class B1 also switch to the highest class A if they are not corrected within a defined time frame that is monitored by the system, e.g. 200 operating hours. To ensure that emissions-related functional faults and their effects on exhaust emissions immediately recognizable to the driver and to authorities and test organizations, the "Malfunction Indicator Lamp (MIL)" is activated by errors of the different severity classes in different ways.

To also take future requirements and technical progress in vehicle networking into account, the Internet Protocol (IP) is included as a transport medium in standardization in addition to CAN. So, in the future UDSonIP will also be permitted in implementations of WWH-OBD.

In some leading industrial nations, the implementation of WWH-OBD will soon be required as a vehicle registration condition for newly developed models of heavy-duty vehicles. Effective at the beginning of 2014, for example, all newly registered heavy-duty vehicles in the EU must conform to the Euro-VI standards and must therefore be diagnosable via WWH-OBD. Newly developed vehicle models must already fulfill the standards by 01-01-2013.

There are plans to expand the scope of validity of WWH-OBD to passenger cars, vans, self-propelled work machines, etc. Also being discussed is the elimination of limits to exhaust-related systems. For example, it could also be used to monitor safety-related systems such as brake, steering and restraint systems and lighting and examine them in the framework of periodic tests.

Intelligent WWH-OBD-capable Tools

Vehicle OEMs must verify the correctness and completeness of OBD functionality in suitable form for registration authorities. Checking is performed in the framework of homologation and assumes that suitable tools are available for verification.

Both the vehicle OEM and system supplier need suitable diagnostic tools to test OBD functions in advance of homologation, i.e. during development or system integration.

The good news here is that the information exchanged between the vehicle and external tester in the framework of a WWH-OBD is largely identical to the information that is already exchanged in diagnostics per OBD-II or EOBD. Here, the new standard only specifies minor extensions of functionality. What will change is primarily only the way in which these contents are transported.

The graphic in **Figure 1** illustrates the difference in OBD communication based on the previous standard and the

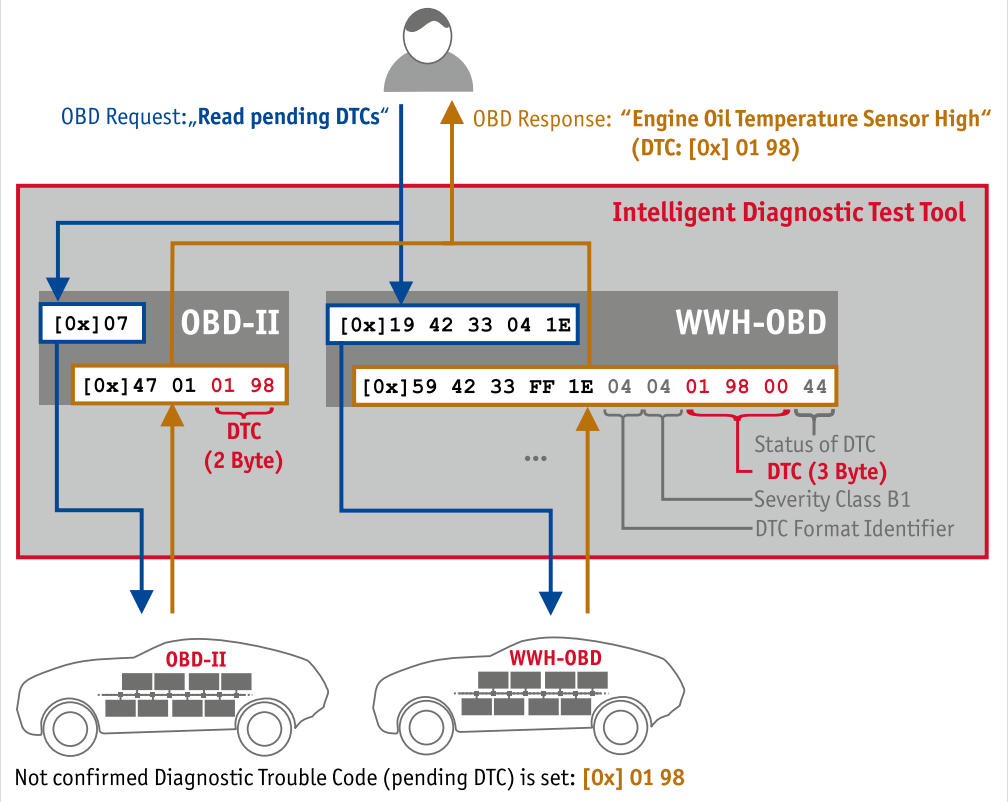

Figure 1: Advantage for the user in diagnostic access: Intelligent tools automatically detect which standard is being used, and they automatically adapt to it and deliver the results.

new WWH-OBD standard. What is displayed is the read-out of currently existing but not yet confirmed Diagnostic Trouble Codes (DTC), i.e. the "pending DTC". In both cases, the vehicle transmits the same error P0198 "Engine Oil Temperature Sensor High" to the scan tool. In the case of WWH-OBD, however, additional information, such as the severity of the error in terms of emissions behavior, as well as its complete status information is also transmitted and displayed.

When the byte contents of requests and responses are examined, it becomes clear that their structure appears different in WWH-OBD than it does in OBD-II: First, it is apparent that the length of error codes in the WWH-OBD is specified as three bytes compared to two bytes for OBD-II, where the first two bytes from SAE J2012 or ISO 15031-5 continue to be used.

The older OBD version reads out the DTCs separate from their status in different OBD modes, i.e. with:

> Service $03 — Request Emission-Related Diagnostic Trouble Codes for confirmed DTC,
> Service $07 — Request Emission-Related Diagnostic Trouble Codes Detected During Current or Last Completed Driving Cycle for pending DTC and
> Service $0A — Request Emission-Related Diagnostic Trouble Codes with Permanent Status for permanent DTC),

WWH-OBD, on the other hand, uses the protocol service ReadDTCInformation [0x19] with the sub-function reportWWHOBDDTCByStatusMask [0x42] and a bit field in Byte 4 of the request to specify the status of the error codes which are to be reported.

An intelligent test system, such as Indigo from Vector, is able to independently recognize the standard upon which the test is based, provide the relevant functions for the pertinent OBD standard and in the process make the protocol-specific differences transparent to the user. This lets users focus on the contents in their work. If necessary, the user can also delve into the depths of the protocol and analyze the raw data. This is useful, for example, in determining the causes of errors, if the ECU does not provide the expected response to an OBD Request.

Summary

Modern high-performance diagnostic tools must offer full support of the new WWH-OBD standard – and they must do so immediately. They can very well help to achieve compliance to regulations within the rapidly approaching deadlines of the beginning of 2013 and the beginning of 2014. They fit seamlessly into existing tool chains and make the migration to WWH-OBD especially simple for vehicle OEMs and suppliers. Experience has shown that it is best to rely on the most efficient and practice-proven solutions. Vector offers the easy-to-use diagnostic test tool Indigo, which already supports the WWH-OBD standard today. To ensure that the change to WWH-OBD is made very simply!

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