

Recording OBD-2 Information

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|---|---|
| What is OBD-2? | 1 |
| Recording OBD-2 Parameters with HEAD Recorder | 2 |
| Configuring an OBD Sensor with HEAD Sensor Explorer | 2 |
| Recording OBD-2 Parameters with HEAD Recorder | 4 |
| Decoding the OBD-2 channel in ArtemiS SUITE | 6 |
| Notes 8 | |

What is OBD-2?

OBD stands for *On-Board Diagnostics* and is a vehicle diagnostics system. It was introduced in 1988 by the *California Air Resources Board* and is used for the continuous monitoring of all systems in a vehicle that have an influence on the exhaust gas. Any occurring problems are reported to the driver by means of warning lights and can be read out via standardized interfaces using standardized codes. After its introduction, the OBD system was developed further. The second generation is called OBD-2. In Europe, OBD-2 became mandatory for new vehicles with gasoline engines in 2001 with the Euro-3 standard. New diesel cars must be equipped with an OBD-2 system since 2003, trucks since 2005.

The interface is a 16-pin socket, which must be accessible within a radius of 1 meter from the driver's seat. Via special OBD-2 cables, the data available at the socket can be accessed. Figure 1 shows how such a cable is connected.



Figure 1: Using an OBD-2 cable

With the OBD-2 system, vehicles provide an interface which also allows current operational data to be polled. This includes, for example, the current engine revolution speed and the vehicle speed. Since these data are subject to standardization, they are always encoded in the same way regardless of the manufacturer. This allows users easy access without requiring manufacturer-specific information to read out the data. Polling the OBD-2 data removes the necessity to equip the vehicle with RPM sensors or to use the manufacturer-specific DBC databases for reading out the CAN bus signals.

You can easily record data from an OBD-2 system (via CAN according to ISO 15765-4) with a HEAD*lab* or SQuadriga II front end. SQuadriga II can record OBD-2 data in stand-alone mode. In front-end mode with both HEAD*lab* and SQuadriga II, you need the Data Acquisition Module of the ArtemiS SUITE (ASM 04, HEAD Recorder) and the Data Preparation Module (ASM 24).

Please note that depending on the vehicle manufacturer, OBD-2 parameters may be updated less frequently than the data of the CAN bus. If the revolution speed varies quickly, the RPM curve can appear stepped. Such a curve can be smoothed by the analysis software ArtemiS SUITE while decoding.

Recording OBD-2 Parameters with HEAD Recorder

Configuring an OBD Sensor with HEAD Sensor Explorer

OBD-2 data are recorded with a predefined OBD sensor. The following explains how to create such a sensor in HEAD Sensor Explorer 3¹.

After starting the software, open a new Sensor List (keyboard shortcut [Ctrl]+[N]) or an existing Sensor List (keyboard shortcut [Ctrl]+[O]) to which to add the OBD sensor. Then right-click on the list to create a new OBD sensor via the context menu (see figure 2).

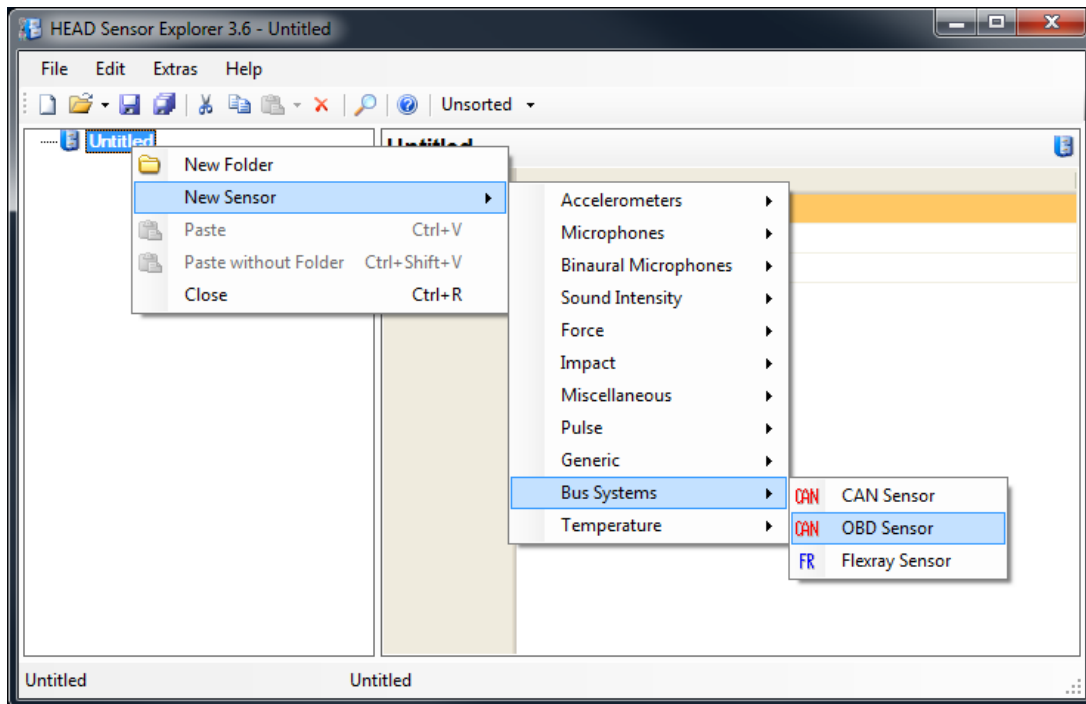


Figure 2: Selecting the predefined OBD sensor

For a newly created sensor, the two options **EngineRPM** and **VehicleSpeed** are activated by default for being read out (see figure 3).

¹ As of ArtemiS SUITE 7.0 you can also create OBD sensors in a Sensor Library (see section "Setting up a CAN sensor" in the Help System of ArtemiS SUITE). Before you can use a Sensor Library created with ArtemiS SUITE in the Channel List of the HEAD Recorder (as of version 7.0) you have to import the library

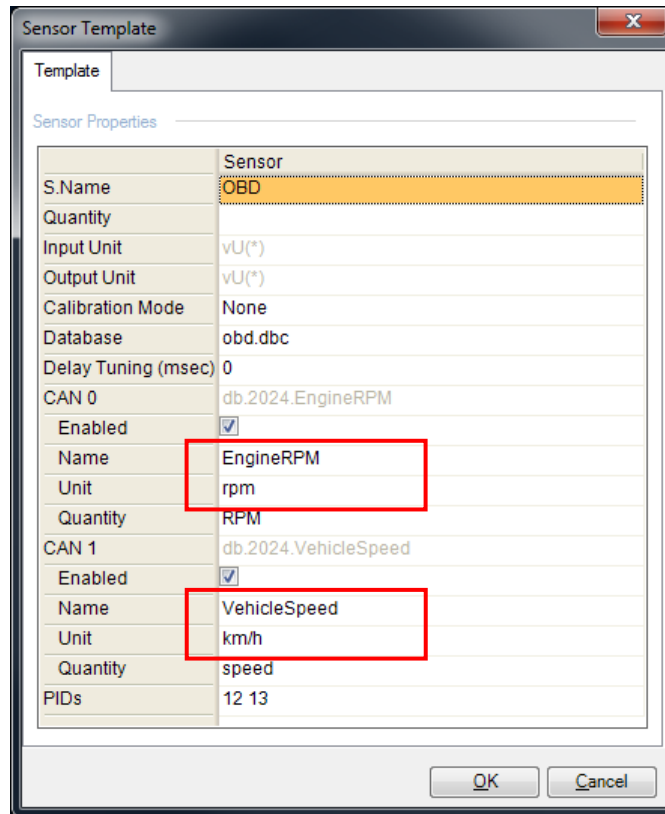


Figure 3: Properties of the OBD sensor

In the sensor template, click on **OK** to create the sensor. Now you can activate additional parameters to be recorded. To do so, open the **Properties** dialog via the context menu of the OBD sensor (right-click on the sensor name in the list on the left, see figure 4).

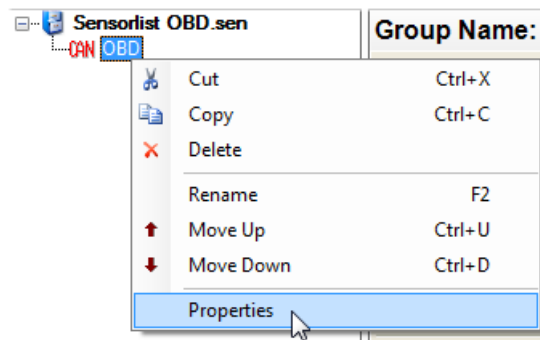


Figure 4: Context menu of the OBD sensor

The Properties dialog shows a selection of the OBD-2 parameters relevant for NVH diagnostics. By clicking on the checkboxes, you can select up to seven different parameters to be decoded during the recording. Besides the *Engine RPM* and the *Vehicle Speed* (see figure 5), these can include, for example, the *Throttle Position*.

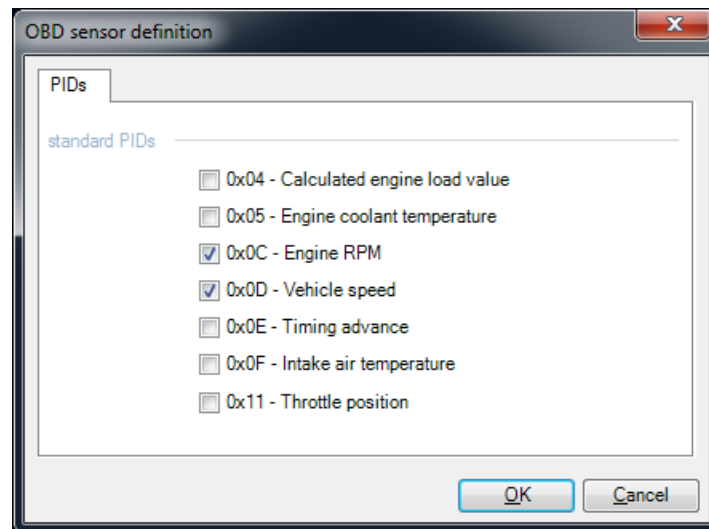


Figure 5: Selecting the parameters to be decoded

The parameters selected here are recorded jointly in an encoded OBD-2 channel and can be decoded later in ArtemiS SUITE. In addition, the parameters are decoded by HEAD Recorder while recording and can be used, for example, for triggering the recording.


After selecting the desired parameters, click **OK**. Afterwards, you must save the new Sensor List in order to use the OBD sensor in HEAD Recorder.


Recording OBD-2 Parameters with HEAD Recorder

First start HEAD Recorder and open the Channel List (keyboard shortcut [Ctrl]+[L]). In the Channel List, you can now connect the OBD sensor to a CAN channel and afterwards enter the required settings. Please note that you have to de-activate the **Listen Only Mode** for the OBD sensor in the corresponding column of the Channel List.² For recording OBD-2 data, the **Listen Only Mode** must be turned off, because the front end needs to actively communicate with the bus in order to request the desired OBD-2 parameters. After connecting the OBD sensor in the Channel List and disabling the **Listen Only Mode**, you can close the Channel List with the **Update&Close**³ button.

An OBD sensor configured as described above in combination with the required hardware (OBD-2 cable and recording front end) allows both the recording of the parameters selected in the Properties dialog and the use of these parameters for triggering a recording. Furthermore, the selected channels can be viewed in real time during the recording with the **Online Monitor** of HEAD Recorder (select the analysis **RPM vs. time**), or with the **Tachometer**.

If you want to use one of the OBD-2 parameters as a trigger signal, open the Trigger window of HEAD Recorder (keyboard shortcut [Ctrl]+[T]). In this window, you can select one of the parameters preselected during the sensor definition in the HEAD Sensor Explorer (e.g. **EngineRPM**) as the trigger channel. Afterwards, you can configure the desired trigger settings (see figure 6).

² It may be necessary to enable this column by clicking on the  button. In case of a SQuadriga II front end this column cannot be displayed, therefore the **Listen Only Mode** must be disabled directly on the SQuadriga II via the display. Please refer to the document „SQuadriga II – Configurations and Utilizations“ for a detailed description.

³ This button is not shown, if a SQuadriga II is connected. In this case you can close the Channel List by clicking on the  button after you have completed all the settings.

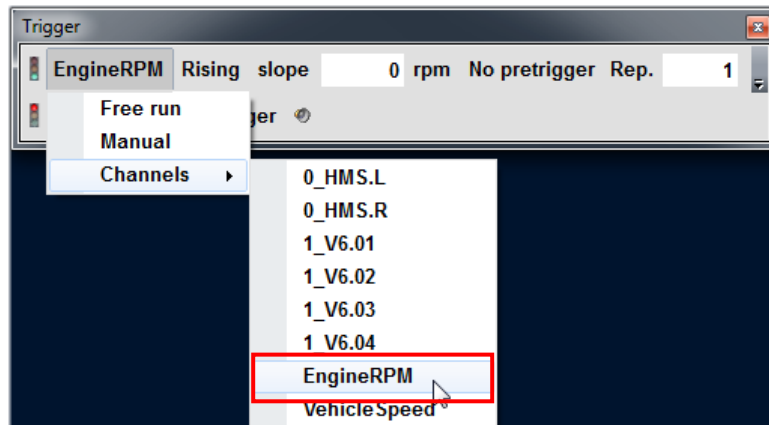


Figure 6: Configuring the trigger settings in HEAD Recorder

All OBD-2 parameters selected in the sensor properties are written to an encoded OBD-2 channel by HEAD Recorder. This channel can be decoded later with ArtemiS SUITE. In addition, the selected parameters can also be saved to separate channels during recording. To do so, open **Tools -> Options -> Application -> File generation** and activate the function **Save decoded channels from pulse channels or CAN in recorded file**, see figure 7.

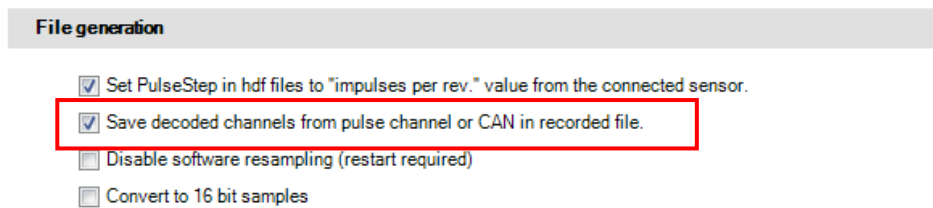


Figure 7: Application options in HEAD Recorder

Decoding the OBD-2 channel in ArtemiS SUITE⁴

The channel with the encoded OBD-2 parameters can be decoded after recording using a Decoder Project in ArtemiS SUITE. A standardized database with OBD-2 parameters is provided for decoding. In ArtemiS SUITE, first open via **Start -> New** a new **Decoder Project**. In this project, you will find three pools with a structure similar to a Pool Project. In the Source Pool on the left side, insert the time domain signals containing the encoded OBD-2 channel. In a Decoder Project, all input signals are always active. The middle pool, comparable to the Analysis Pool, you insert the OBD decoder and configure the decoding. In the Destination Pool on the right, you can specify the format in which the new file with the decoded OBD-2 channels is to be saved. The available export formats are HDF, ATFX and UFF. Click on **Insert OBD Decoder** in the Decoder Pool. In response ArtemiS SUITE opens a window showing a list with OBD-2 parameters (see figure 8). Select here the parameters you want to decode by clicking on the corresponding check box. In order to ensure that the selected parameter is actually contained in the file you should only select parameters you also activated when defining the sensor.

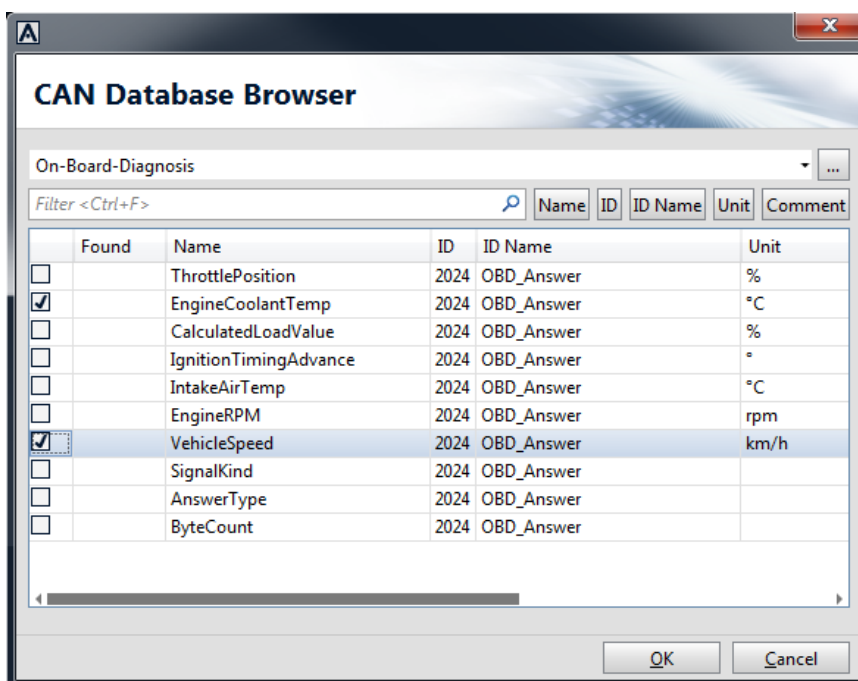


Figure 8: Selecting OBD-2 quantities for decoding

Clicking on the **OK** button closes the window. The Decoder Pool now displays the parameters you selected. If you need to add additional parameters subsequently, click on the **+** icon to open the list of available OBD-2 parameters again.

The names of the OBD-2 parameters can be edited in the Decoder Pool and are later used as channel names for the new channels with the decoded parameters. The order of the decoded channels in the result file depends on the order of the parameters in the Decoder Pool. You can drag and drop the items in the Decoder Pool to arrange the order of channels according to you needs.

Figure 9 shows an example of a decoder project. The left column contains five recordings. In the middle column, the two parameters *EngineRPM* and *VehicleSpeed* are selected for decoding. In the third column, HDF is selected as the target format.

⁴ The descriptions in this Application Note refer to version 8.0. The general procedures also apply to other versions. However, the scope of functionality and the user interface may differ.

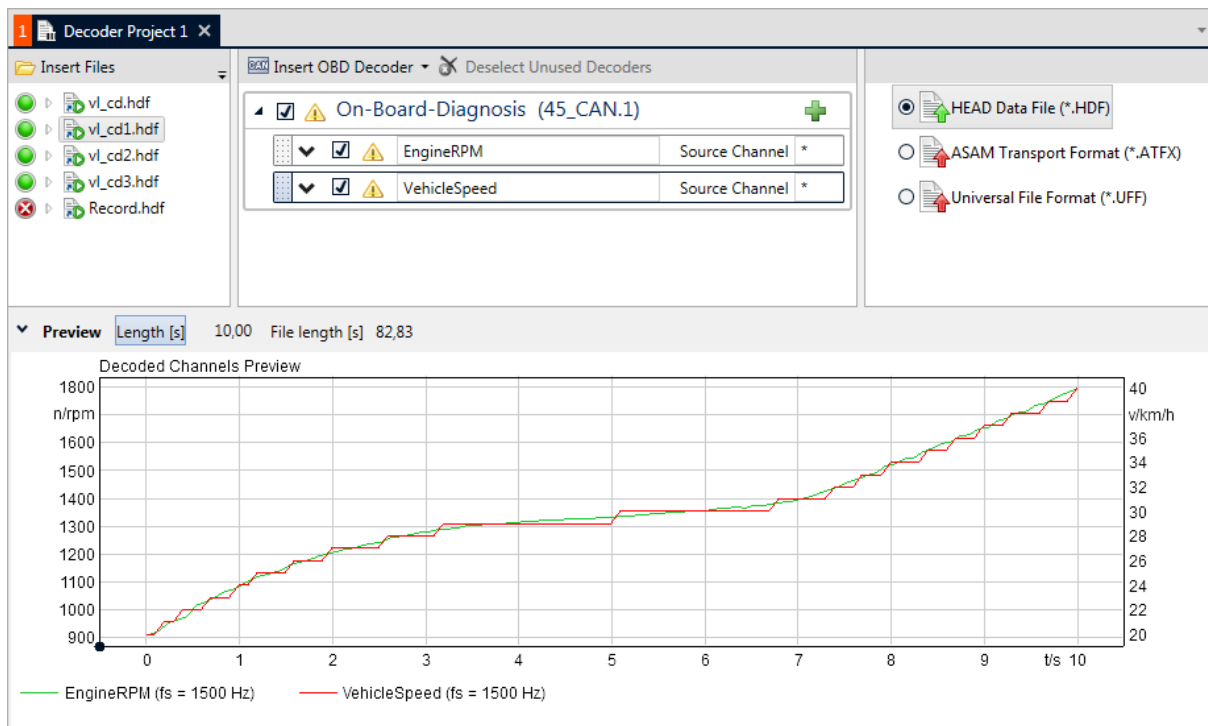


Figure 9: Example of a decoder project

ArtemiS SUITE checks immediately whether the selected parameters are available in the source files and indicates this with a green “LED” icon next to the file name in the source file pool. If decoding is not possible, a red “LED” with an X is displayed. The same applies to the active items in the Decoder Pool. Here, too, a red “LED” appears if none of the source files contain the desired parameter.

Before you can start decoding, any unsuitable source files or decoders must be removed with the commands **Remove Unused Files** and **Deselect Unused Decoders** in the context menu.

If decoding is not possible for all source files or with all decoders, a warning triangle with an exclamation mark is displayed (see figure 9, Decoder Pool). The decoding process can be started nevertheless.

In the **Preview** (lower part of figure 9), ArtemiS SUITE displays a graphical preview of the first 10 seconds of the OBD-2 channels of the active source file for a quick check of your settings. Depending on your needs, you can change the length of the preview in the **Length** field or display the whole file length by clicking on the **File Length** button. The data decoded for the preview only serve for checking the settings, but are not stored.

For each OBD-2 parameter in the Decoder Pool, you can specify additional properties after clicking on the **▼** button. These include, for example, the interpolation type and the physical unit. Set the interpolation mode to **OBD** (see figure 10) to smooth a stepped curve of the OBD-2 parameter, as shown in the preview window in figure 9. Detailed instructions can be found in the Help System of ArtemiS SUITE in the section “OBD Decoder”.

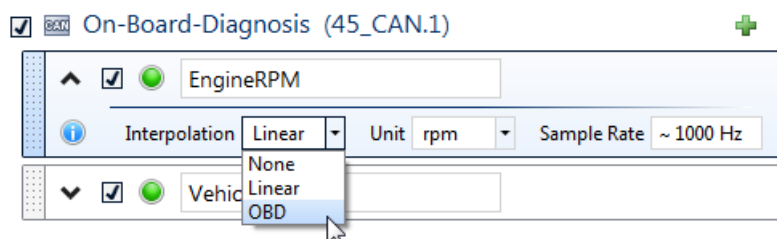



Figure 10: Interpolation of OBD-2 signals

To start decoding, click on the abacus button or double-click on the corresponding Destination Pool item. During the decoding process, ArtemiS SUITE creates a new file containing both the encoded OBD-2 channel and the selected OBD-2 parameters as separate channels. In the Properties dialog of the Destination Pool item, you can specify where the new file is to be saved and how the file name should be created. In order to re-use your configurations of the OBD decoder for further decodings save your Decoder Project, e.g., by clicking the  button.

Notes

For the applications presented in this Application Note, you need the following ArtemiS SUITE modules: **ASM 00** ArtemiS SUITE Basic Framework (code 5000), **ASM 04** ArtemiS SUITE Data Acquisition Module (code 5004) and **ASM 24** ArtemiS SUITE Data Preparation Module (code 5024). For exporting the decoded data to the UFF format you additionally need **ASM 23** Advanced Import & Export Module (code 5023).

Do you have any questions or remarks? Please write to:

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We look forward to receiving your response!