United Nations ECE/TRANS/WP.29/GRPE/2011/16

Economic and Social Council

Distr.: General
25 March 2011

Original: English
English and French only

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

Working Party on Pollution and Energy

Sixty-second session
Geneva, 7–10 June 2011
Item 4(e) of the provisional agenda
Heavy duty vehicles –Regulation No. 49
(Emissions of C.I. and P.I. (NG and CNG) engines)

Proposal for an amendment to Regulation No. 49

Submitted by the expert from the European Commission *

The text reproduced below was prepared by the expert from the European Commission (EC) to introduce amendments to Annexes 9 B and 9C of Regulation No. 49. This document proposes amending the provisions of the Regulation to clarify a number of concerns identified by the experts from EC during the preparation of legislation implementing the Euro VI emission levels (i.e. Regulation (EC) 595/2009).

It is noted that the proposed amendments shall be considered in parallel with a separate amendment to global technical regulation No. 5 (see document ECE/TRANS/WP.29/GRPE/2011/15). The modifications to the current text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106 and ECE/TRANS/2010/8, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Annex 9

Paragraph 3.30., amend to read:

"3.30. *"Readiness"* means a status indicating whether a monitor or a group of monitors have run since the last erasing ~~by request of an external OBD scan tool~~ **by an external request or command (for example through an OBD scan-tool)**."

Paragraph 4.2.2.1., amend to read:

"4.2.2.1. Exception to component monitoring

Monitoring of electrical circuit failures, and to the extent feasible, functionality, and rationality failures of the engine system shall not be required if all the following conditions are met:

(a) the failure results in an emission increase of any pollutant of less than 50 per cent of the regulated emission limit, and

(b) the failure does not cause any emission to exceed the regulated emission limit 1/, and

(c) the failure does not affect a component or system enabling the proper performance of the OBD system, **and**

(d) the failure does not substantially delay or affect the ability of the emission control system to operate as originally designed (for example a breakdown of the reagent heating system under cold conditions cannot be considered as an exception).

Determination of the emissions impact shall be performed on a stabilized engine system in an engine dynamometer test cell, according to the demonstration procedures of this annex.

When such a demonstration would not be conclusive regarding criterion (d), the manufacturer shall submit to the approval authority appropriate design elements such as good engineering practice, technical considerations, simulations, test results, etc."

Paragraph 4.2.3., amend to read:

"4.2.3. Monitoring frequency

……

~~When a monitor does~~ **At the request of the manufacturer, the approval authority may approve monitors that do** not run continuously, the manufacturer shall clearly inform the Approval Authority and describe the conditions under which the monitor runs **and justify the proposal by appropriate design elements (such as good engineering practice).**

A monitor shall be regarded as running continuously, if it samples at a rate not less than twice per second **and concludes the presence or the absence of the failure relevant to that monitor within 15 Seconds**. If a computer input or output component is sampled less frequently than twice per second for engine control purpose, a monitor shall also **be** regarded as running continuously, if the ~~signal of the~~ ~~component is evaluated~~ **system concludes the presence or the absence of the failure relevant to that monitor** each time sampling occurs."

Paragraph 4.3., amend to read:

"4.3. Requirements for recording OBD information

……

In case a malfunction with the previously active status occurs again, that malfunction may at the choice of manufacturer be directly given the "Pending DTC " and "confirmed and active DTC" status~~. Without~~ **without** having been given the "potential DTC" status. If that malfunction is given the potential status, it shall also keep the previously active status during the time it is not yet confirmed and active.

……"

Paragraph 4.6.1., amend to read:

"4.6.1 MI specification

The malfunction indicator shall be a visual signal that is perceptible under all lighting conditions. The malfunction indicator shall comprise a yellow ~~(as defined in Annex 5 to UNECE Regulation No. 7)~~ or amber (as defined in Annex 5 to UNECE Regulation No. 37) warning signal identified by the ~~F01~~ **0640** symbol in accordance with ISO standard~~ 2575:2004~~ **7000:2004**.

Paragraph 4.6.3., amend to read:

"4.6.3 MI activation at "engine on"

When the key is placed in the on position and the engine is started (engine on), the MI shall be commanded off unless the provisions of paragraph 4.6.3.1. ~~and/or paragraph 4.6.3.2.~~ have been met."

Paragraph 4.6.3.1.4., amend to read:

"4.6.3.1.4. MI de-activation scheme

……

The "short-MI" shall be deactivated if the malfunction is not detected during the 3 subsequent sequential operating sequences **following the operating sequence when the monitor has concluded the absence of the considered malfunction** and the MI is not activated due to another Class A or B malfunction.

Figures 1, 4 and 4bis in Appendix 2 to this annex illustrate respectively the short and continuous MI deactivation in different use-cases."

Paragraph 4.6.4., amend to read:

"4.6.4. MI activation at key-on/engine-off

The MI activation at key-on/engine-off shall consist of two sequences separated by a 5 seconds MI off:

(a) the first sequence is designed to provide an indication of the MI functionality and the readiness of the monitored components;

(b) the second sequence is designed to provide an indication of the presence of a malfunction.

The second sequence is repeated until engine is started [1] (engine-on) or the key is set to the key-off position.

At the request of the manufacturer, this activation may only occur once during an operating sequence (for example in case of start-stop systems)."

Paragraph 4.6.4.2., amend to read:

"4.6.4.2. Presence / absence of a malfunction

Following the sequence described in paragraph 4.6.4.1, the MI shall indicate the presence of a malfunction by a series of flashes or a continuous illumination, depending on the applicable activation mode, as described in the following paragraphs, or absence of a malfunction by a series of single flashes. When applicable, each flash consists of a 1s MI-on followed by a 1s MI-off, and the series of flashes will be followed by a period of ~~5~~ **4 seconds** with the MI off."

Paragraph 4.7.1.5., amend to read:

"4.7.1.5. Readiness

With the exceptions specified in paragraphs 4.7.1.5.1., 4.7.1.5.2. and 4.7.1.5.3., a readiness shall **only** be set to "complete" when a monitor or a group of monitors addressed by this status have run **and concluded the presence (that means stored a confirmed and active DTC) or the absence of the failure relevant to that monitor** since the last erasing by an external request or command (for example through an OBD scan-tool). Readiness shall be set to "not complete" by erasing the fault code memory (see paragraph 4.7.4.) ~~of a monitor or group of monitors~~ by an external request or command (for example through an OBD scan-tool)."

Insert new paragraphs 4.7.1.5.1. to 4.7.1.5.3., to read:

"**4.7.1.5.1.** The manufacturer may request, subject to approval by the Approval Authority, that the ready status for a monitor be set to indicate "complete" **without the monitor having run and concluded the presence or the absence of the failure relevant to that monitor** if monitoring is disabled for a multiple number of operating sequences **(minimum 9 operating sequences or 72 operation hours)** due to the continued presence of extreme operating conditions (e.g. cold ambient temperatures, high altitudes). Any such request must specify the conditions for monitoring system disablement and the number of operating sequences that would pass without monitor completion before ready status would be indicated as "complete". **The extreme ambient or altitude conditions considered in the manufacturer's request shall never be less severe than the conditions specified by this annex for temporary disablement of the OBD system**

4.7.1.5.2. Monitors subject to readiness

Readiness shall be supported for each of the monitors or groups of monitors that are identified in this Annex and that are required when and by referring to this Annex, with the exception of items 11 and 12 of Appendix 3.

[1] **An engine may be considered started during the cranking phase.**

4.7.1.5.3. Readiness for continuous monitors

Readiness of each of the monitors or groups of monitors that are identified in items 1, 7 and 10 of Appendix 3 to this annex, required when and by referring to this annex, and that are considered by this annex as running continuously, shall always indicate "complete".

Paragraph 4.7.3., amend to read:

"4.7.3. Access to OBD information

……

Access to OBD information shall be provided using, at least one of the following series of standards mentioned in Appendix 6:

(a) ~~ISO/PAS 27145~~ **ISO 27145 with ISO 15765-4** (CAN-based)

(b) ISO 27145 **with ISO 13400** (TCP/IP-based)

(c) SAE J1939-71 **and SAE J1939-73**

Manufacturers shall use appropriate ISO or SAE-defined fault codes (for example, P0xxx, P2xxx) whenever possible. If such identification is not possible, the manufacturer may use diagnostic trouble codes according to the relevant clauses in ISO 27145 or SAE J1939. The fault codes must be fully accessible by standardized diagnostic equipment complying with the provisions of this annex.

The manufacturer shall provide the ISO or SAE standardization body through the appropriate ISO or SAE process with emission-related diagnostic data not specified by ISO 27145 or SAE J1939 but related to this annex."

Paragraph 5.2.2., amend to read:

"5.2.2. Ambient temperature and altitude conditions

Manufacturers may request approval to disable OBD system monitors ~~at ambient engine start temperatures below 266 K (-7 degrees Celsius or 20 degrees Fahrenheit) or above 308 K (35 degrees Celsius or 95 degrees Fahrenheit), or at elevations above 2,500 meters (8,202 feet) above sea level.~~

(a) at ambient engine start temperatures below 266 K (-7 degrees Celsius) in the case where the coolant temperature has not reached a minimum temperature of at least 333 K (60 degrees Celsius), or

(b) at ambient temperatures below 266K (-7 degrees Celsius) in the case of frozen reagent, or

(c) at ambient temperatures above 308 K (35 degrees Celsius), or

(d) at elevations above 2,500 meters above sea level.

A manufacturer may further request approval that an OBD system monitor be **temporarily** disabled at other ambient ~~engine start~~ temperatures **and altitude conditions** upon determining that the manufacturer has demonstrated with data and/or an engineering evaluation that misdiagnosis would occur at those ambient conditions because of its effect on the component itself (e.g. component freezing, **effect on the compatibility with sensor tolerances**).

Notes: ……"

Paragraph 5.2.3., in the table, the text of row (b), amend to read:

"(b) The low fuel pressure in the tank considered for such a disablement shall not exceed 20 per cent of the **usable range of fuel tank pressure**."

Paragraph 6.3.2.1., amend to read:

"6.3.2.1. Procedure for qualifying a deteriorated component used to demonstrate the detection of classes A and B1 malfunctions

Insert new paragraphs 6.3.2.1.1. to 6.3.2.1.3., to read:

"**6.3.2.1.1. Emission threshold monitoring**

In the case the malfunction selected by the Approval Authority results in tailpipe emissions that may exceed an OBD threshold limit, the manufacturer shall demonstrate by an emission test according to paragraph 7. that the deteriorated component or device does not result in the relevant emission exceeding its OTL by more than 20 per cent.

6.3.2.1.2. Performance monitoring

At the request of the manufacturer and with the agreement of the approval authority, in the case of performance monitoring, the OTL may be exceeded by more than 20 per cent. Such request shall be justified on a case by case basis.

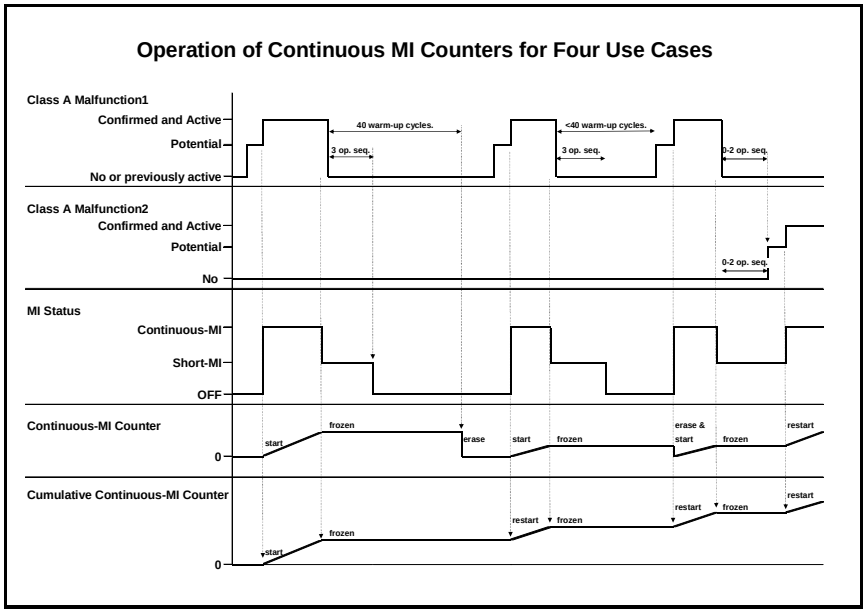
6.3.2.1.3. Component monitoring

In the case of component monitoring, a deteriorated component is qualified without reference to the OTL."

Appendix 2

Figure 4, amend to read:

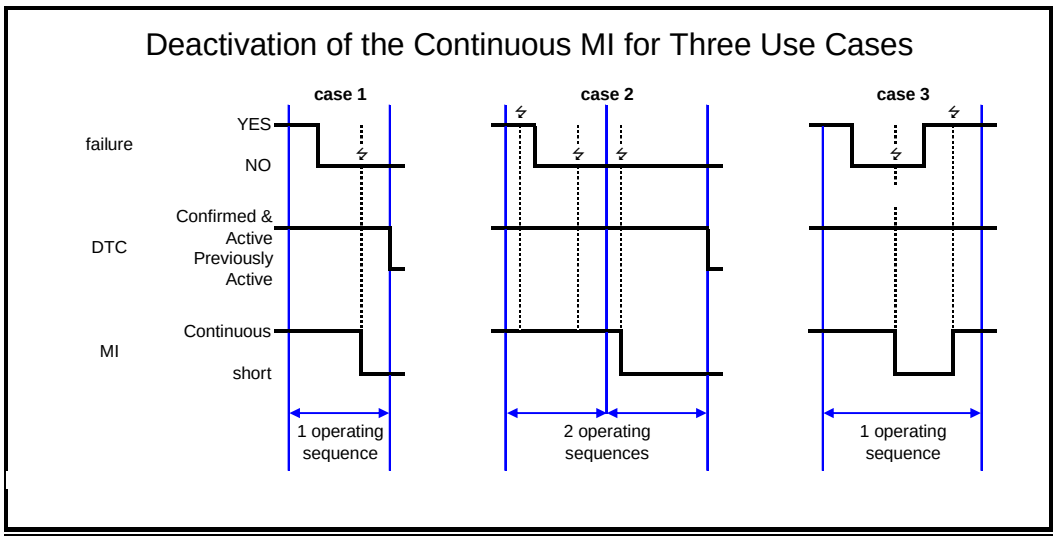
"



Note: Details related to the deactivation of the continuous MI are illustrated in figure 4bis below in the specific case where a potential state is present."

A new figure 4bis is introduced, to read:

"**Figure 4bis: Illustration of the continuous MI deactivation principle**



Notes:

ϟ **means the point where monitoring of the concerned malfunction occurs.**

M **means the operating sequence when the monitor concludes for the first time that a confirmed and active failure is no longer present.**

case 1 **means the case where the monitor does not conclude the presence of failure during the operating sequence M.**

case 2 **means the case where the monitor has previously concluded, during he operating sequence M, the presence of the malfunction.**

case 3 **means the case where the monitor concludes during he operating sequence M the presence of the malfunction after having first concluded to its absence.**"

Appendix 5

Table 3, the text of the second row, amend to read:

"Fuel level **(e.g. percentage of the nominal capacity of the fuel tank)** or tank fuel pressure **(e.g. percentage of the usable range of fuel tank pressure)**, as appropriate"

Appendix 6, amend to read:

"

Reference standard documents

This appendix contains the references to the industry standards that are to be used in accordance to the provisions of this annex to provide the serial communications interface to the vehicle/engine. There are **two allowed solutions identified:**

ISO 15765-4 or SAE J1939-73 or ISO/PAS 27145.

(a) **ISO 27145 with either ISO 15765-4 (CAN based) with either ISO 15765-4 (CAN based) or with ISO 13400 (TCP/IP based),**

(b) SAE J1939-73.

In addition there are other ISO or SAE standards that are applicable in accordance with the provisions of this annex.

Reference by this annex to ISO 27145 means reference to:

(a) ISO 27145-1 Road vehicles — Implementation of WWH-OBD communication requirements — Part 1 — General Information and use case definitions

(b) ISO 27145-2 Road vehicles — Implementation of WWH-OBD communication requirements — Part 2 — Common emissions-related data dictionary;

(c) ISO 27145-3 Road vehicles — Implementation of WWH-OBD communication requirements — Part 3 — Common message dictionary;

(d) ISO 27145-4 Road vehicles — Implementation of WWH-OBD communication requirements — Part 4 — Connection between vehicle and test equipment.

Reference by this annex to J1939-73 means reference to:

J1939-73 "APPLICATION LAYER - DIAGNOSTICS", dated on year 2011.

Reference by this annex to ISO 13400 means reference to:

ISO 13400: [information on date, "exact title", several parts etc. shall be added]

Annex 9C

Paragraph 5.2., amend to read:

"5.2. Requirements for incrementing the numerator

……

(c) For monitors which are used for failure identification and that run only after a potential DTC has been stored, the numerator and denominator ~~shall~~ **may** be the same as those of the monitor detecting the original malfunction.

……"

Paragraph 7.1., add to read

"7.1. Information about in-use performance data

……

(f) confirmed and active DTCs for Class A malfunctions

(g) confirmed and active DTCs for Class B (B1 and B2) malfunctions."

II. Justification

1. References to ISO and SAE standards regarding OBD Communication protocols, Module A - paragraph 4.7.3. and Appendix 6:

(a) Reference to the temporary ISO/PAS document will become obsolete when the ISO document will be issued (third Quarter of 2011).

Reference to SAE J1939-71 should be completed by reference to SAE J1939-73 because SAE J1939-71 is the vehicle application layer, while SAE J1939-73 is the diagnostic / scan tool layer.

(b) The concerned paragraphs require the manufacturer to use one of the listed standards. However it does not require the manufacturer to only use the DTC's defined in these standards and permits, when allowed by these standards, to use without further limitation manufacturer specific DTC's.

In the United States' rules, it is described when and how the certification authority may permit such an usage:

"The lack of available SAE-defined fault codes, uniqueness of the diagnostic or monitored component, expected future usage of the diagnostic or component, and estimated usefulness in providing additional diagnostic and repair information to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code may not be used to represent two different failure modes) across a manufacturer's entire product line".

It is proposed to require from the manufacturer to use first the standardized codes, and, when such a code is not available refer to the concerned standardization body, in view of possibly creating a new code. This measure aims at avoiding non-harmonized durable interpretation and at restricting to a limited period of time an extensive usage of manufacturer specific codes.

(c) Referring to ISO 15765-4 as a third implementation option would lead to the assumption that solely by implementing ISO 15765-4 WWH-OBD access to OBD information requirements can be fulfilled. However, the requirements in this GTR cannot be fulfilled by implementing ISO 15765-4 only. To be able to fulfil the requirements established by this annex it is obligatory to implement ISO 27145 (parts 1-4). Options for implementing ISO 27145 are either ISO 27145 on CAN, for this use case ISO 15765-4 would apply in addition, or ISO 27145 on DoIP (TCP/IP), for this use case ISO 13400 would apply in addition.

Due to the fact that the 2006's PAS specifications are no longer available, it is proposed to refer to the corresponding ISO standards.

2. Elements concerning readiness, Module B, paragraph 3.30. and paragraph 4.7.1.5.

It is not sufficient enough that the monitor has run for setting the readiness to "complete". It should arrive to a conclusion. Not allowing the readiness be set to complete by e.g. radio turn on is also necessary.

Paragraph 4.7.4 stipulates that it is not allowed to clear the fault code memory of a specific monitor or a specific group of monitors by means of a scan tool or maintenance tool. Only "all DTCs" may be (simultaneously) erased. It is common practice to apply this requirement.

In that respect, the last sentence of paragraph 4.7.1.5 needs to be amended for ensuring consistency in the requirements. By deleting the words "of a monitor or group of monitors" the problem would be solved.

New paragraphs are added to improve the world harmonized character of the gtr by adapting the Californian requirements for 2013 that states (CARB 1971.1).

3. Temporary OBD disablement, paragraph 5.2.2., paragraph 5.2.3. and Appendix 5

(a) Amendment to paragraph 5.2.2. aims at solving the case of an engine cold start with frozen reagent that is shut down after a short time with a still frozen reagent (i.e. before the 70 min when severe inducement would occur) and then started again.

In that case the "ambient engine start temperature" for the second start is relatively high, because the engine compartment has been warmed-up during the first engine run. In this situation, paragraph 5.2.2. does not allow disabling monitors even that the AdBlue is frozen leading to misdiagnosis.

Engine start refers to the engine-warm-up that is defined through definition 3.35., that states:

"3.35. "Warm-up cycle" means sufficient engine operation such that the coolant temperature has risen by at least 22 K (22 °C / 40 °F) from engine starting and reaches a minimum temperature of 333 K (60 °C / 140 °F)."

(b) The nominal fuel tank pressure may be understood as the maximum pressure allowed in the tank according to legal requirements and good engineering practice.

In fact, the technologies used by the engine manufacturer and by the compressed gas supplier leads to a usable tank pressure that is usually below the nominal one. This is the value that needs to be taken into account when evaluating the relative residual pressure in the tank and when necessary request the necessary monitoring disablement.

4. MI deactivation scheme, paragraph 4.6.3.1.4. and Annex 2

(a) The second paragraph of paragraph 4.6.3.1.4 may be understood as if the short MI should be switched off after three complete operating sequences with no failure detected, even if the failure was present and not detected in most of that sequence. This understanding is in contradiction with common interpretation as illustrated in figures 1 and 4 of Annex 2.

The amendment aims at avoiding this misinterpretation.

Reference to the figures in Annex 2 is recommended for understanding the meaning of this paragraph.

(b) The continuous MI is deactivated as soon as the monitor has concluded the absence of the malfunction. On the contrary, the status of the malfunction changes from confirmed and active to previously active at the end of the operating sequence.

Details of this mechanism are illustrated in a new figure 4bis, but figure 4 needs to be modified accordingly.

This new figure aims at illustrating the continuous MI deactivation scheme in 3 typical cases and at reinforcing the consistency between the figures and paragraph 4.6.3.1.4.

5. Key-on – Engine-off display, paragraph 4.6.4.

(a) In order not to unnecessarily disturb the driver, repeated starting by start-stop systems shall not automatically generate the activation of the display.

(b) When a malfunction has been detected by the system, the principle of the display requested in paragraph 4.6.4.2 is based on an illumination code where the illumination is either continuous, or periodic.

In case of a periodic illumination, each illumination sequence consists of a series of flashes separated by a MI-off period. To avoid any confusion, the duration of this periodic MI-off period was determined to be the same as the duration of the MI-off period between the readiness display and the malfunction display that is 5 second. This principle is correctly illustrated in figure B2.

The current text needs to be corrected because it indicates that the duration shall be 5 + 1 second due to the fact that the first second is counted twice!

6. Procedure for failure qualification, paragraph 6.3.2.1.

(a) In the case of performance monitoring, no correlation to actual emissions is required (paragraph 4.2.1.1.). Accordingly, the 20 per cent maximum value may not always be applicable to performance monitoring, depending on the type of monitoring. For example, monitoring lack of reagent dosing (which is typically a performance monitoring) may lead to increased emissions (higher than 20 per cent).

(b) Component monitoring may result in emissions that are not correlated to the OTL. Accordingly, the 20 per cent maximum value may not be applicable to component monitoring.

7. Continuous monitor, paragraph 4.2.3.

In principle the certification authority should maintain the right not to accept a manufacturer's proposal that could not be justified.

The current wording of paragraph 4.2.3. may lead to an abusive interpretation where a monitor could sample at a frequency greater than 2 Hz, have a relatively high evaluation time (e.g. 2 minutes) and still be considered as running continuously.

On the other side the current text wisely addresses the fact that the technology development does permit, in many cases, a monitor that could sample and evaluate that sample at a frequency greater than 2 Hz.

Paragraph 4.2.3. proposes to limit the evaluation time of a continuous monitor to a feasible value such as 15 seconds.

8. Component monitoring, paragraph 4.2.2.1.

Avoid the loop-hole saying that such devices like the urea heating system do not need to be monitored.

9. Editorial errors, paragraphs 4.3., 4.6.1. and 4.6.3.

10. IUPR –Annex 9C

(a) Paragraph 5.2. is amended to preserve commonality with United States' solutions.

(b) Paragraph 7.1. is completed to permit the Type Approval Authority to easily retrieve all information necessary in the case of a too low ratio without being forced to look into the OBD information package (different and specific use-cases).

(c) This may immediately permit to discriminate e.g. an ambient temperature sensor malfunctioning causing a severe enabling problem from a real monitoring performance issue.