**Guidance for the implementation of software modifications by vehicle manufacturers as holders of the type-approval or EU individual vehicle approval (‘Manufacturer software modifications guidance’)**

Existing type-approval regulations (Regulation (EU) 2018/858, Regulation (EU) No 167/2013 and Regulation (EU) No 168/2013) do not provide uniform requirements for software modifications to motor vehicles already approved. The present guidance serves to classify software modifications with regard to existing European type-approval requirements and relevant requirements of the German Road Vehicles Registration and Licensing Regulations (StVZO) and the Regulations for the Registration and Licensing of Road Vehicles (FZV) and is to provide orientation for the provision and implementation of software modifications. In this regard, this guidance is to also help prevent the misuse of software modifications to motor vehicles already approved and is to increase the road safety and environmental compatibility of motor vehicles affected by this guidance. This guidance presents and illustrates in categories I to IV examples of non-approval-relevant and approval-relevant software modifications that have been taken into account in the approval of the vehicle or its extensions or are not relevant and do not lead to the expiry of the operating permit in accordance with section 19 of the StVZO.

This guidance only addresses software modifications provided by the vehicle manufacturer as the holder of the approval.

This guidance covers all approved motor vehicles of categories M, N and O in accordance with Regulation (EU) 2018/858, motor vehicles of categories T, C, R and S in accordance with Regulation (EU) No 167/2013 and motor vehicles of category L in accordance with Regulation (EU) No 168/2013 that have been approved in accordance with the European type-approval regulations within the scope of a type-approval, an EU small series approval or an EU individual vehicle approval, provided that the vehicle manufacturer has created the technical requirements for the implementation of a software modification to these motor vehicles.

For motor vehicles for which the manufacturer has obtained an approval in accordance with UN Regulation No 156, this guidance specifies and supplements the procedures and processes between the manufacturer and the type-approval authority contained therein. For these motor vehicles, the procedures described in UN Regulation No 156 are to be given priority in case of deviations from this guidance. However, an approval in accordance with UN Regulation No 155 or UN Regulation No 156 is no prerequisite for the application of this guidance.

This guidance is to be applied as from the day of its publication in the Federal Ministry for Digital and Transport Gazette.

**Definitions:**

‘Software’ means the part of an electronic system that consists of digital data and instructions.

‘Software modification’ means any modification to the software.

‘Vehicle manufacturer’ is the manufacturer of the vehicle and the authorized provider of software modifications within the meaning of this guidance. The vehicle manufacturer may transfer its authorization to a third party acting on its behalf as a representative with power of representation (in particular importers or branches of the manufacturer).

**Background:**

Modern vehicle technology is more and more influenced by the automation of driving functions and digitalization. Modifications to motor vehicles are no longer limited to mechanical work or the replacement of individual vehicle components. Technical advances make it possible to update certain functions or activate new functions in the motor vehicle by means of software. Such functions may already be built into the motor vehicle before its first registration or be newly installed in the motor vehicle at a later date. This is possible by means of a software modification.

The technology installed in a certain vehicle type intended for series production, including the software, is subject to the authorities’ examination and acceptance within the framework of the type-approval procedure. In the European Union (EU), this procedure is harmonized to a very large extent and is governed for all motor vehicles by the relevant European regulations.

Subsequent modifications to motor vehicles, whether relevant to approval or not, and their impact on the validity of the operating permit of the respective motor vehicle, have to be assessed in accordance with the StVZO and must take into account the type-approval regulations harmonized throughout the EU.

In this regard, software is a vehicle component within the meaning of the provisions of the StVZO that is subject to a functional assessment as a technical unit both in the harmonized and the national approval procedures (cf. section 19 and section 22 (1) of the StVZO).

Accordingly, software modifications are modifications to the vehicle within the meaning of section 19 of the StVZO, which means that their lawfulness has to be assessed in particular in accordance with section 19 (2), (3) and (7) of the StVZO. The software modification categories I to IV presented in the following do not affect the validity of the issued approval (operating permit). The prerequisite for all categories of software modifications presented in the following is that they are implemented after the first registration of the motor vehicle and do not involve modifications to the hardware of the motor vehicle concerned. In this regard, it is irrelevant whether a software modification is implemented by the vehicle manufacturer by wire or wireless (over the air).

Unless legislation provides otherwise, the vehicle keeper has to give consent to the implementation of the software modification.

In any case, the vehicle manufacturer is obliged to document the software modification. The software modification has to be assigned a software number. This software number must be readable using standard tools via the electronic vehicle interface (OBDII) and must be made available by the vehicle manufacturer to authorized bodies (Article 61 of Regulation (EU) 2018/858) and, on request, be provided to the vehicle keeper or the motor vehicle repairer commissioned by him/her or to an authorized specialist company for the inspection of the vehicle with regard to the condition and design of its components, systems and functions.

In addition, it is pointed out that, in accordance with section 19 (2) sentence 3 of the StVZO, manufacturers, importers or business people must not make or commission any modifications that lead to the expiry of the operating permit in accordance with section 19 (2) sentence 2 of the StVZO. This does not apply if a whole-vehicle operating permit within the meaning of section 21 of the StVZO is obtained without delay or if proof within the meaning of section 19 (3) no 1, 2 or 3 of the StVZO is furnished.

**Category I**

Category I includes software modifications aimed at restoring the conformity of a motor vehicle or vehicle type with the underlying approval. These modifications might have to be implemented by order of the approval or market surveillance authority. As a rule, they affect approval components that are relevant to safety or emissions. A practical use case is, for example, an improved parametrization of a radar sensor resulting in the technical condition of the motor vehicle before the adjustment not being in conformity with its type-approved condition.

In such a case, the manufacturer itself is obliged, in accordance with Article 14 (1) of Regulation (EU) 2018/858 or Article 9 (1) of Regulation (EU) No 167/2013 or Article 10 (1) of Regulation (EU) No 168/2013, to immediately take corrective actions necessary to restore conformity with the underlying approval. The approval authority must be informed by the manufacturer of the non-conformity and of any actions taken in this respect. The manufacturer implements the software modification to restore conformity with the approval or regulation. The approval authority accepts the actions proposed by the manufacturer or orders further action, if necessary. The implementation of such a software modification is documented by the manufacturer.

This does not affect the validity of the issued approvals, as the motor vehicle receives software for which the underlying approval has been originally issued or could have been issued.

Also the registration of the motor vehicle within the meaning of the Vehicle Registration and Licensing Regulations (FZV) remains unaffected. The vehicle keeper is not obliged to notify the competent registration authority, since data within the meaning of section 13 (1) of the FZV, which must be entered in the registration documents, are not affected.

Category I also includes software modifications, ordered by the authorities or voluntary, that serve to improve approval-relevant parameters, for example the emissions performance of the vehicle, and for which the manufacturer has obtained an approval (operating permit) from the competent authority in accordance with national law.

**Category II**

Category II includes software modifications that modify the function(s) or system(s) of a motor vehicle but are not relevant to safety, the environment or approval. A practical use case is the activation of a new convenience function, for example a massage function for the rear row of seats, or special interior lighting. These functions make use of hardware already installed in the motor vehicle and do not need to be included in the information folder within the meaning of Article 24 of Regulation (EU) 2018/858 or Article 22 of Regulation (EU) No 167/2013 or Article 27 of Regulation (EU) No 168/2013 or in the extended documentation package. Such software modifications do not require approval if no other functions relevant to approval and/or safety are affected. If the legal examination of the manufacturer in accordance with the requirements in Article 33 of Regulation (EU) 2018/858 and section 19 of the StVZO shows that the type-approval authority does not need to be involved, this can be omitted.

In accordance with section 19 (2) sentence 2 of the StVZO, these software modifications also do not affect the validity of the issued approval (operating permit), since no components relevant to safety or emissions are affected, nor is the vehicle type changed.

The registration of the motor vehicle also remains unaffected. The vehicle keeper is not obliged to notify the competent registration authority, since data within the meaning of section 13 (1) of the FZV, which must be entered in the registration documents, are not affected.

**Category III**

Category III includes software modifications to activate additional approval-relevant functions that have already been approved by the approval authority within the scope of a valid system type-approval but had not yet been activated by the vehicle manufacturer in the respective vehicle, even though they were already part of the approval.

Approval-relevant functions or parameters may be functions or parameters that have been approved for the motor vehicle, for example a maximum authorized speed or a certain maximum power. Before the software modification is implemented, the vehicle actually delivered would thus have parameters that are below the maximum parameters of the approval as set out in the certificate of conformity for the vehicle concerned and the corresponding information in parts I and II of the registration certificate. The prerequisite for this is that the vehicle keeper has been informed in advance by the manufacturer of the lower parameter (for example, the lower maximum speed actually available or the lower power actually available) and that it is documented that he/she has received this information. One option would be to store the information in the motor vehicle’s on-board computer and display it when the motor vehicle is started.

When the function is activated, existing hardware might be used (for example, sensors) that, prior to the activation, had already been in use for other functions or had been deactivated. The vehicle manufacturer must ensure that the additional use of the hardware (for example, sensors) does not impair existing functions.

A prerequisite for software modifications within the meaning of this guidance is that, at the time the software modification is implemented, the vehicle is in a condition that otherwise is in conformity with the type-approval. Any modifications to the vehicle implemented by the vehicle keeper after its registration have to be taken into account.

A practical use case is, for example, the active lane keeping assistant, which is included in the system type-approval in accordance with UN Regulation No 79-02, but was only included as a deactivated system in the vehicle software at the time the vehicle was first registered. Further practical use cases are the subsequent modification of the power or maximum speed of electrically powered motor vehicles within the maximum approved parameters specified in the underlying approval, provided this does not result in an assignment to another vehicle category or vehicle type (for example, L3e-A2 in L3e-A3).

The implementation of such software modifications is documented by the vehicle manufacturer in accordance with the requirements of this guidance and does not affect the validity of the issued approval (operating permit) in accordance with section 19 (3) sentence 1 no 2 of the StVZO, as the modifications activate functions or change parameters in the vehicle that are already covered by the underlying approval. A prerequisite is that, at the time the software modification is implemented, the vehicle is in a condition that otherwise is in conformity with the requirements of the original approval. Any modifications to the motor vehicle implemented by the vehicle keeper after its registration have to be taken into account. A practical use case could be digital communication with the vehicle keeper about the current state of the vehicle.

Also the registration of the motor vehicle within the meaning of the Vehicle Registration and Licensing Regulations (FZV) remains unaffected. The vehicle keeper is not obliged to notify the competent registration authority of the modification. This also applies to the aforementioned modification of the power output or maximum speed within a vehicle category/type. Maximum speed or maximum power output is data whose modifications generally have to be entered in the registration documents in accordance with section 13 (1) no 3 and 4 of the FZV. However, the (maximum) values in the registration documents refer to the data of the underlying approval for the motor vehicle. If the modifications to the motor vehicle are within the maximum parameters specified in the underlying approval as set out in the certificate of conformity for the vehicle concerned, this modification is not relevant to registration.

**Category IV**

Category IV includes software modifications to activate additional approval-relevant functions that were not covered by the underlying approval when the vehicle was registered for the first time. Due to further development of series and technical advances, optimized versions of functions (for example, the adaptation of system limits) or new functions may become available that can be covered subsequently by the originally issued type-approval and its extensions in accordance with Articles 33 and 34 of Regulation (EU) 2018/858 or Article 30 of Regulation (EU) No 167/2013 or Article 35 of Regulation (EU) No 168/2013 by means of a revision or extension of the underlying type-approval. These functions offer the driver a higher level of convenience, for example, but can also be relevant to safety or the environment. Practical use cases can include the following functions:

* Emergency corridor assistant as part of the steering and lane keeping assistant and thus additional function within the scope of UN Regulation No 79. In the case of traffic jams, the emergency corridor assistant automatically forms an emergency corridor without the driver first having to deactivate the steering and lane keeping assistant.
* Extension of the motorway pilot function (ALKS) within the scope of improved data, for example, so that it can be used for speeds of up to 60 km/h instead of 50 km/h or when visibility is poor, taking into account section 3 (1) of the German Road Traffic Regulations (StVO) (‘Speed’).

For a revision or extension of the type-approval originally issued, the manufacturer must apply to the approval authority in accordance with the provisions of the respective Regulation mentioned above. After the software modification has been implemented, the manufacturer must provide the vehicle keeper with the extended approval documentation (if necessary, in excerpts) in an appropriate form, for example, in electronic form. The vehicle manufacturer must document in a traceable way that the extended approval documentation has been made available to the vehicle keeper.

The implementation of the software modification does not affect the validity of the existing approval (operating permit), even if safety-relevant functions within the meaning of section 19 (2) sentence 2 no 2 or 3 of the StVZO are modified. If these functions have been approved by the responsible approval authority as a revision or extension of the type-approval originally issued, the conditions for a transfer to already approved motor vehicles within the meaning of section 19 (3) sentence 1 no 2 of the StVZO are met.

A prerequisite for software modifications within the meaning of this guidance is that, at the time the software modification is implemented, the vehicle is in a condition that otherwise is in conformity with the type-approval. Any modifications to the vehicle implemented by the vehicle keeper after its registration have to be taken into account. In this case, the approval authority specifies the conditions under which the software modification may be implemented at the time of issuing the extension or the revision of the type-approval. The conditions may include that

* a verification of adequate configuration is not necessary;
* the vehicle keeper has to carry out and confirm the verification of adequate configuration.

The approval authority may also decide that the requested extension or revision of the type-approval is to cover new vehicles only.

The registration of the motor vehicle remains unaffected. The vehicle keeper is not obliged to notify the competent registration authority if the data within the meaning of section 13 (1) of the FZV, which have to be entered in the registration documents, are not affected. This is usually the case. However, the motor vehicle driver should carry the extended approval documentation as proof of his/her authorization and hand it over to relevant persons upon request. The data concerned may also be stored in the on-board computer of the respective vehicle.

Category V

Category V includes software modifications that require a revision or extension of the underlying type-approval comparable to category IV but also affect registration-relevant motor vehicle data. Practical use cases may include the following:

* Adjustment of maximum net power/maximum power output of the engine (permanently or for a limited time only);
* Modification of vehicle dynamics control with optimization of trailer load stabilization and associated increase in the permissible towing weight;
* Adjustment of the technologically possible maximum speed of the vehicle. This can concern both the indication of the maximum speed and the description of the tyres.
* Modification/increase in the battery capacity by software optimizations, for example, of thermal management.

These modifications usually affect road safety, the environmental compatibility of the motor vehicle or the vehicle type and therefore require a detailed individual procedure in accordance with applicable regulations. The modifications are subject to testing and validation of the fitness for purpose of the motor vehicle, the documentation of the software modifications, the documentation of the vehicle keeper’s knowledge of the modifications and the amendment of parts I and II of the registration certificate. Without appropriate legal amendments, it can be assumed that such modifications will generally lead to an expiry of the operating permit. These modifications can only be approved by means of the procedure in accordance with section 21 or 22 of the StVZO.