

20 March 2023

Agreement

Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations*

(Revision 3, including the amendments which entered into force on 14 September 2017)

Addendum 159 – UN Regulation No. 160

Amendment 1

Supplement 1 to the original version of the Regulation – Date of entry into force:
22 April 2022

Uniform provisions concerning the approval of motor vehicles with regard to the Event Data Recorder

This document is meant purely as documentation tool. The authentic and legal binding text is:
ECE/TRANS/WP.29/2021/58.



UNITED NATIONS

* Former titles of the Agreement:

Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958 (original version);
Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, done at Geneva on 5 October 1995 (Revision 2).

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0. Introduction

- 0.1. The intention of this Regulation is to establish uniform provisions concerning the approval of motor vehicles of the Categories M₁ and N₁ with regard to their Event Data Recorders (EDRs).
- 0.2. The provisions concern the minimum collection, storage and crash survivability of motor vehicle crash event data. It does not include specifications for data retrieval tools and methods as that is subject to national/regional level requirement.
- 0.3. The purpose of these provisions is to ensure that EDRs record, in a readily usable manner, data valuable for effective crash investigations and for analysis of safety equipment performance (e.g., advanced restraint systems). These data will help provide a better understanding of the circumstances in which crashes and injuries occur and will facilitate the development of safer vehicle designs.

1. Scope

- 1.1. This Regulation applies to the approval of vehicles of categories M₁ and N₁¹ with regard to their Event Data Recorder (EDR).
- 1.2. This Regulation is without prejudice to requirements of national or regional laws related to privacy, data protection and personal data processing.
- 1.3. The following data elements are excluded from the scope: VIN, associated vehicle details, location/positioning data, information of the driver, and date and time of an event.
- 1.4. If there is no system or sensor designed to provide the data element to be recorded and stored under section 3, in the format (range, resolution, and sample rate) indicated in Annex 4. "DATA ELEMENTS" or it is not operational at the time of recording, this document requires neither recording of such data nor fitting or making such systems or sensors operational. However, if the vehicle is fitted with an original equipment manufacturer sensor or system designed to provide the data element in the format specified in Annex 4. "DATA ELEMENTS", then it is mandatory to report the data element in the specified format when the sensor or system is operational. In the case the reason for not being operational at the time of recording is a failure of this system or sensor, this failure state shall be recorded by the EDR as defined in the data elements Annex 4. Data elements.

2. Definitions

For the purposes of these performance elements:

- 2.1. "*ABS activity*" means the anti-lock brake system (ABS) is actively controlling the vehicle's brakes.
- 2.2. "*Air bag warning lamp status*" means whether the air bag malfunction warning lamp is on or off.
- 2.3. "*Capture*" means the process of buffering EDR data in a temporary, volatile storage where it is continuously updated at regular time intervals.
- 2.4. "*Delta-V, lateral*" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the lateral axis.

¹ As defined in Section 2 of the Consolidated Resolution on the Construction of Vehicles (R.E.3) (document ECE/TRANS/WP.29/78/Rev.6) – <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions>.

- 2.5. "*Delta-V, longitudinal*" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the longitudinal axis.
- 2.6. "*Deployment time, frontal air bag*" means (for both driver and front passenger) the elapsed time from crash time zero to the deployment command or for multi-staged air bag systems, the deployment command for the first stage.
- 2.7. "*End of event time*" means the moment at which the cumulative delta-V within a 20 ms time period becomes 0.8 km/h or less, or the moment at which the crash detection algorithm of the air bag control unit resets.
- 2.8. "*Engine RPM*" means:
- (a) For vehicles powered by internal combustion engines, the number of revolutions per minute of the main crankshaft of the vehicle's engine, and
 - (b) For vehicles not entirely powered by internal combustion engines, the number of revolutions per minute of the motor shaft at the point at which it enters the vehicle transmission gearbox, and
 - (c) For vehicles not powered by internal combustion engines at all, the number of revolutions per minute of the output shaft of the device(s) supplying motive power.
- 2.9. "*Engine throttle, percent full*" means the driver-requested acceleration as measured by the throttle position sensor on the accelerator control compared to the fully depressed position.
- 2.10. "*Event*" means a crash or other physical occurrence that causes the trigger threshold to be met or exceeded, or any non-reversible deployable restraint to be deployed, whichever occurs first.
- 2.11. "*Event data recorder*" (EDR) means a device or function in a vehicle that records the vehicle's dynamic, time-series data during the time period just prior to an event (e.g., vehicle speed vs. time) or during a crash event (e.g., delta-V vs. time), intended for retrieval after the crash event. For the purposes of this definition, the event data does not include audio and video data.
- 2.12. "*Frontal air bag*" means an inflatable restraint system that requires no action by vehicle occupants and is used to meet the applicable national frontal crash protection requirements.
- 2.13. "*If recorded*" means if data is recorded in non-volatile memory for the purpose of subsequent downloading.
- 2.14. "*Ignition cycle, crash*" means the number (count) of power mode cycles at the time when the crash event occurred since the first use of the EDR.
- 2.15. "*Ignition cycle download*" means the number (count) of power mode cycles at the time when the data was downloaded since the first use of the EDR.
- 2.16. "*Lateral acceleration*" means the component of the vector acceleration of a point in the vehicle in the y-direction. The lateral acceleration is positive from left to right, from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.
- 2.17. "*Longitudinal acceleration*" means the component of the vector acceleration of a point in the vehicle in the x-direction. The longitudinal acceleration is positive in the direction of forward vehicle travel.
- 2.18. "*Maximum delta-V, lateral*" means the maximum value of the cumulative change in velocity, as recorded by the EDR, of the vehicle along the lateral axis.
- 2.19. "*Maximum delta-V, longitudinal*" means the maximum value of the cumulative change in velocity, as recorded by the EDR, of the vehicle along the longitudinal axis.

- 2.20. "*Maximum delta-V, resultant*" means the time-correlated maximum value of the cumulative change in velocity, as reported by the EDR along the vector-added longitudinal and lateral axis.
- 2.21. "*Multi-event crash*" means the occurrence of a minimum of 2 events, the first and last of which begin not more than 5 seconds apart.
- 2.22. "*Non-volatile memory*" means the memory reserved for maintaining recorded EDR data in a semi-permanent fashion. Data recorded in non-volatile memory is retained after a loss of power and can be retrieved with EDR data extraction tools and methods.
- 2.23. "*Normal acceleration*" means the component of the vector acceleration of a point in the vehicle in the z-direction. The normal acceleration is positive in a downward direction.
- 2.24. "*Occupant size classification*" means, for front passenger, the classification of an occupant as an adult and not a child, and for the driver, the classification of the driver as not being of small stature as indicated in the data format.
- 2.25. "Operational" means that the system or sensor, at the time of the event, is active or can be activated/deactivated by the driver.
- 2.26. "*Passenger air bag suppression status*" means the status of the passenger air bag (suppressed or not suppressed).
- 2.27. "*Pretensioner*" means a device that is activated by a vehicle's crash sensing system and removes slack from a vehicle safety belt system.
- 2.28. "*Record*" means the process of saving captured EDR data into a non-volatile storage for subsequent retrieval.
- 2.29. "*Safety belt status*" means the feedback from the safety system that the vehicle's safety belt is fastened or unfastened.
- 2.30. "*Seat track position switch, foremost, status*" means the status of the switch that is installed to detect whether the seat is moved to a forward position.
- 2.31. "*Service brake, on and off*" means the status of the device that is installed in or connected to the brake pedal system to detect whether the pedal was pressed. The device can include the brake pedal switch or other driver-operated service brake control.
- 2.32. "*Side air bag*" means any inflatable occupant restraint device that is mounted to the seat or side structure of the vehicle interior, and that is designed to deploy in a side impact crash to help mitigate occupant injury and/or ejection.
Note - Side air bags can also deploy in other crash modes as determined by the vehicle manufacturer.
- 2.33. "*Side curtain/tube air bag*" means any inflatable occupant restraint device that is mounted to the side structure of the vehicle interior, and that is designed to deploy in a side impact crash or rollover and to help mitigate occupant injury and/or ejection.
Note - Side curtain/tube air bags can also deploy in other crash modes as determined by the manufacturer.
- 2.34. "*Speed, vehicle indicated*" means the vehicle speed indicated by a manufacturer-designated subsystem designed to indicate the vehicle's ground travel speed during vehicle operation.
- 2.35. "*Stability control*" means any device that complies with national, "Electronic stability control systems".
- 2.36. "*Steering input*" means the angular displacement of the steering wheel measured from the straight-ahead position (position corresponding to zero average steer angle of a pair of steered wheels).
- 2.37. "*Time from event 1 to 2*" means the elapsed time from time zero of the first event to time zero of the second event of a multi-event crash.

- 2.38. "*Time, maximum delta-V, lateral*" means the time from crash time zero to the point where the maximum value of the cumulative change in velocity is found, as recorded by the EDR, along the lateral axis.
- 2.39. "*Time, maximum delta-V, longitudinal*" means the time from crash time zero to the point where the maximum value of the cumulative change in velocity is found, as recorded by the EDR, along the longitudinal axis.
- 2.40. "*Time, maximum delta-V, resultant*" means the time from crash time zero to the point where the maximum delta-V resultant occurs, as reported by the EDR.
- 2.41. "*Time to deploy, pretensioner*" means the elapsed time from crash time zero to the deployment command for the safety belt pretensioner (for both driver and front passenger).
- 2.42. "*Time to deploy, side air bag/curtain*" means the elapsed time from crash time zero to the deployment command for a side air bag or a side curtain/tube air bag (for both driver and front passenger).
- 2.43. "*Time to first stage*" means the elapsed time between time zero and the time when the first stage of a frontal air bag is commanded to fire.
- 2.44. "*Time to nth stage*" means the elapsed time from crash time zero to the deployment command for the nth stage of a frontal air bag (for both driver and front passenger).
- 2.45. "*Time zero*" is the time reference for the EDR data timestamps of an event.
- 2.46. "*Trigger threshold*" means the appropriate parameter has met the conditions for recording an EDR event.
- 2.47. "*Vehicle roll angle*" means the angle between the vehicle y-axis and the ground plane as determined by the sensing system.
- 2.48. "*Vehicle type with regard to its Event Data Recorder*" means vehicles which do not differ significantly in such essential aspects as:
- (a) The manufacturer's trade name or mark;
 - (b) Vehicle features which significantly influence the performances of the EDR; Addition of new trigger(s), new data (elements), or modification in their format, shall not be considered as "significantly influencing the performance of EDR";
 - (c) The main characteristics and design of the EDR.
- 2.49. "*Volatile memory*" means the memory reserved for buffering of captured EDR data. The memory is not capable of retaining data in a semi-permanent fashion. Data captured in volatile memory is continuously overwritten and is not retained in the event of a power loss or retrievable with EDR data extraction tools.
- 2.50. "*Vulnerable road user secondary safety system*" means a deployable vehicle system outside the occupant compartment designed to mitigate injury consequences to vulnerable road users during a collision.
- 2.51. "*X-direction*" means in the direction of the vehicle's X-axis, which is parallel to the vehicle's longitudinal centerline. The X-direction is positive in the direction of forward vehicle travel.
- 2.52. "*Y-direction*" means in the direction of the vehicle's Y-axis, which is perpendicular to its X-axis and in the same horizontal plane as that axis. The Y-direction is positive from left to right, from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.
- 2.53. "*Z-direction*" means in the direction of the vehicle's Z-axis, which is perpendicular to the X and Y-axes. The Z-direction is positive in a downward direction.

- 2.54. "Vehicle roll rate" means the change in angle over time of the vehicle about its X-axis as determined by the sensing system.
- 2.55. "Vehicle yaw rate" means the change in angle over time of the vehicle about its Z-axis as determined by the sensing system.

3. Application for approval

- 3.1. The application for approval of a vehicle type with regard to its EDR shall be submitted by the vehicle manufacturer or by his authorized representative to the approval authority of the Contracting Party according to the provisions of Schedule 3 of the 1958 Agreement.
- 3.2. It shall be accompanied by the following documentation (a model of the information document is given in Annex 2):
- 3.2.1. A description of the vehicle type with regard to the items specified in paragraph 5 below, in particular related to the location of the EDR in the vehicle, the triggering parameters, storing capacity and the resistance to high deceleration and mechanical stress of a severe impact;
- 3.2.2. The data elements and format stored in the EDR;
- 3.2.3. Instructions for retrieving data from the EDR.
- 3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the approval authority or its designated technical service responsible for conducting the approval tests.

4. Approval

- 4.1. If the vehicle type submitted for approval pursuant to this Regulation meets the requirements of paragraph 5. below, approval of that vehicle type shall be granted.
- 4.2. An approval number shall be assigned to each type approved. Its first two digits (at present 00 for the Regulation in its original form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to another type of vehicle.
- 4.3. Notice of approval or of extension or of refusal or of withdrawal of approval or of production definitively discontinued of a vehicle type pursuant to this Regulation shall be communicated to the Contracting Parties to the Agreement applying this Regulation by means of a form conforming to the model in Annex 1 to this Regulation and documentation supplied by the applicant being in a format not exceeding A4 (210 × 297mm) and on an appropriate scale or electronic format.
- 4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation, an international approval mark conforming to the model described in Annex 3, consisting of either:
- 4.4.1. A circle surrounding the letter "E" followed by:
- (a) The distinguishing number of the country which has granted approval;²
and

² The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.6 - <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions>

- (b) The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in this paragraph;

or

- 4.4.2. An oval surrounding the letters "UI" followed by the Unique Identifier.
- 4.5. The approval mark shall be clearly legible and be indelible.
- 4.6. The approval authority shall verify the existence of satisfactory arrangements for ensuring effective checks on conformity of production before type-approval is granted.

5. Requirements

Requirements for vehicles fitted with an EDR include data elements, data format, data capture, and crash test performance and survivability.

- 5.1. Data elements
- 5.1.1. Each vehicle fitted with an EDR shall record the data elements specified as mandatory and those required under specified minimum conditions during the interval/time and at the sample rate specified in Annex 4, Table 1.
- 5.2. Data format
- 5.2.1. Each data element recorded shall be reported in accordance with the range, accuracy, and resolution specified in Annex 4, Table 1.
- 5.2.2. Acceleration Time-History data and format: the longitudinal, lateral, and normal acceleration time-history data, as applicable, shall be filtered either during the recording phase or during the data downloading phase to include:
- 5.2.2.1. The Time Step (TS) that is the inverse of the sampling frequency of the acceleration data and which has units of milliseconds;
- 5.2.2.2. The number of the first point (NFP), which is an integer that when multiplied by the TS equals the time relative to time zero of the first acceleration data point;
- 5.2.2.3. The number of the last point (NLP), which is an integer that when multiplied by the TS equals the time relative to time zero of the last acceleration data point; and
- 5.2.2.4. $NLP - NFP + 1$ acceleration values sequentially beginning with the acceleration at time $NFP * TS$ and continue sampling the acceleration at TS increments in time until the time $NLP * TS$ is reached.
- 5.3. Data capture
- The EDR shall record the captured data in the vehicle and this data shall remain in the vehicle subject to the provisions of paragraph 5.3.4, at least until they are retrieved in compliance with national or regional legislation or they are overwritten in compliance with paragraph 5.3.4.
- The EDR non-volatile memory buffer shall accommodate the data related to at least three different events.
- The data elements for every event shall be captured and recorded by the EDR, as specified in paragraph 5.1 in accordance with the following conditions and circumstances:
- 5.3.1. Conditions for triggering recording of data
- An event shall be recorded by the EDR if one of the following threshold values is met or exceeded:

- 5.3.1.1. Change in longitudinal vehicle velocity more than 8 km/h within a 150 ms or less interval.
- 5.3.1.2. Change in lateral vehicle velocity more than 8 km/h within a 150 ms or less interval
- 5.3.1.3. Activation of Non-reversible occupant restraint system.
- 5.3.1.4. Activation of Vulnerable road user secondary safety system
If a vehicle is not fitted with any Vulnerable Road User (VRU) secondary safety system, this document requires neither recording of data nor fitting of such systems. However, if the vehicle is fitted with such a system, then it is mandatory to record the event data following activation of this system.
- 5.3.2. Conditions for triggering locking of data
In the circumstances provided below, the memory for the event shall be locked to prevent any future overwriting of the data by subsequent event.
 - 5.3.2.1. In all the cases where a non-reversible occupant restraint system is deployed.
 - 5.3.2.2. In the case of a frontal impact, if the vehicle is not fitted with a non-reversible restraint system for front impact, when the vehicle's velocity change in x-axis direction exceeds 25 km/h within 150ms or less interval.
 - 5.3.2.3. Activation of Vulnerable road user secondary safety system
- 5.3.3. Conditions for establishment of time zero
Time zero is established at the time when any of the following first occurs:
 - 5.3.3.1. For systems with "wake-up" air bag control systems, the time at which the occupant restraint control algorithm is activated; or
 - 5.3.3.2. For continuously running algorithms,
 - 5.3.3.2.1. The first point in the interval where a longitudinal, cumulative delta-V of over 0.8 km/h is reached within a 20 ms time period; or
 - 5.3.3.2.2. For vehicles that record "delta-V, lateral," the first point in the interval where a lateral, cumulative delta-V of over 0.8 km/h is reached within a 5 ms time period; or
 - 5.3.3.3. Deployment of a non-reversible deployable restraint or activation of VRU secondary safety protection system.
- 5.3.4. Overwriting
 - 5.3.4.1. If an EDR non-volatile memory buffer void of previous-event data is not available, the recorded data shall, subject to the provisions of paragraph 5.3.2., be overwritten by the current event data, on a first-in first-out basis, or according to different strategies decided by the manufacturer and made available to the relevant authorities of Contracting Parties.
 - 5.3.4.2. Furthermore, if an EDR non-volatile memory buffer void of previous-event data is not available, data originating from non-reversible restraint system or Vulnerable road user secondary safety system deployment events referred to in paragraph 5.3.2 shall always overwrite any other data that is not locked per 5.3.2.
- 5.3.5. Power failure
Data recorded in non-volatile memory is retained after loss of power.
- 5.4. Crash test performance and survivability
 - 5.4.1. Each vehicle subject to the requirements of national or regional frontal crash test regulations, shall conform with the specifications in paragraph 5.4.3.

- 5.4.2. Each vehicle subject to the requirements of national or regional side impact crash test regulations, shall conform with the specifications of paragraph 5.4.3.
- 5.4.3. The data elements required by paragraph 5.1, shall be recorded in the format specified by paragraph 5.2, exist at the completion of the crash test and the complete data recorded element shall read "yes" after the test. Elements that are not operating normally in crash tests (e.g., those related to engine operation, braking, etc.) are not required to meet the accuracy or resolution requirements in these crash tests.
- The data shall be retrievable even after an impact of a severity level set by UN Regulations Nos.94, 95 or 137.
- 5.5. It shall not be possible to deactivate the Event Data Recorder.

6. Modification of vehicle type and extension of approval

- 6.1. Every modification of the vehicle type as defined in paragraph 2.x of this Regulation shall be notified to the approval authority which approved the vehicle type. The approval authority may then either:
- 6.1.1. Consider that the modifications made do not have an adverse effect on the conditions of the granting of the approval and grant an extension of approval;
- 6.1.2. Consider that the modifications made affect the conditions of the granting of the approval and require further tests or additional checks before granting an extension of approval.
- 6.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 4.3. above to the Contracting Parties to the Agreement applying this Regulation.
- 6.3. The approval authority shall inform the other Contracting Parties of the extension by means of the communication form which appears in Annex 1 to this Regulation. It shall assign a serial number to each extension, to be known as the extension number.

7. Conformity of production

- 7.1. Procedures for the conformity of production shall conform to the general provisions defined in Article 2 and Schedule 1 to the Agreement (E/ECE/TRANS/505/Rev.3) and meet the following requirements:
- 7.2. A vehicle approved pursuant to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of paragraph 5. above;
- 7.3. The approval authority which has granted the approval may at any time verify the conformity of control methods applicable to each production unit. The normal frequency of such inspections shall be once every two years.

8. Penalties for non-conformity of production

- 8.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 7. above are not complied with.
- 8.2. If a Contracting Party withdraws an approval it had previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by sending them a communication form conforming to the model in Annex 1 to this Regulation.

9. Production definitively discontinued

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the approval authority which granted the approval, which in turn shall forthwith inform the other Contracting Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

10. Names and addresses of the Technical Services responsible for conducting approval tests and of Type Approval Authorities

The Contracting Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat³ the names and addresses of the technical services responsible for conducting approval tests and of the approval authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval are to be sent.

11. Transitional provisions

- 11.1. As from the official date of entry into force of the 01 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals under this Regulation as amended by the 01 series of amendments.
- 11.2. As from 1 July 2024, Contracting Parties applying this Regulation shall not be obliged to accept type approvals to the original version of this Regulation, first issued after 1 July 2024.
- 11.3. Until 1 July 2026, Contracting Parties applying this Regulation shall accept type approvals to the original version of this Regulation, first issued before 1 July 2024.
- 11.4. As from 1 July 2026, Contracting Parties applying this Regulation shall not be obliged to accept type approvals issued to the original version of this Regulation.
- 11.5. Notwithstanding paragraph 11.4., Contracting Parties applying this Regulation shall continue to accept type approvals issued according to the original version of this Regulation, for vehicles which are not affected by the changes introduced by the 01 Series of amendments.
- 11.6. Contracting Parties applying this Regulation shall not refuse to grant type approvals according to any preceding series of amendments to this Regulation or extensions thereof.

³ Through the online platform ("343 Application") provided by UNECE and dedicated to the exchange of such information: <https://www.unece.org/trans/main/wp29/datasharing.html>

Annex 1

Communication

(Maximum format: A4 (210 x 297 mm))



issued by : (Name of administration)

- Concerning: ²
- Approval granted
 - Approval extended
 - Approval refused
 - Approval withdrawn
 - Production definitively discontinued

of a vehicle type with regard to its Event Data Recorder (EDR) pursuant to UN Regulation No. 160

Approval No.:

Reason(s) for extension (if applicable):

1. Trade name or mark of the vehicle:
2. Vehicle type:
3. Name and address of manufacturer:
4. If applicable, name and address of manufacturer's representative:
5. Brief description of vehicle:
6. Technical service responsible for conducting the approval tests:
- 6.1. Date of report issued by that service:
- 6.2. Number of report issued by that service:
7. Approval granted/refused/extended/withdrawn:²
8. Position of approval mark on the vehicle:
9. Place:.....
10. Date:.....
11. Signature:.....
12. The list of documents deposited with the approval authority which has granted approval is annexed to this communication.

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¹ Distinguishing number of the country which has granted/extended/refused/withdrawn an approval (see approval provisions in this Regulation).

² Strike out what does not apply.

Annex 2

Information document on the type approval of a vehicle type with regard to its Event Data Recorder (EDR)

A list of contents shall be included.

Any drawings shall be supplied in appropriate scale and in sufficient detail on size A4 paper or on a folder of A4 format.

Photographs, if any, shall show sufficient detail.

General

1. Trade name or mark of vehicle:
2. Vehicle type:
3. Means of identification of type, if marked on the vehicle:
4. Location of the marking:.....
5. Location of and method of affixing the approval mark:
6. Category of vehicle:
7. Name and address of manufacturer:.....
8. Address(es) of assembly plant(s):
9. Photograph(s) and/or drawing(s) of a representative vehicle:.....
10. EDR
 - 10.1. Make (trade name of manufacturer):.....
 - 10.2. Type and general commercial description(s):
 - 10.3. Drawing(s) or photographs showing the location and method of attachment of the EDR in the vehicle:.....
 - 10.4. Description of the triggering parameter:
 - 10.5. Description of any other relevant parameter (storing capacity, resistance to high deceleration and mechanical stress of a severe impact, etc.):
 - 10.6. The data elements and data format stored in the EDR:

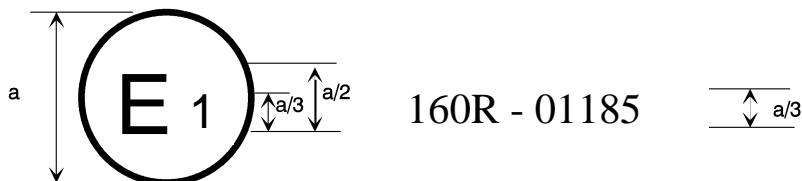
| <i>Data element</i> | <i>Recording interval/time (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy</i> | <i>Resolution</i> |
|---------------------|--|--|----------------------|-----------------|-------------------|
| | | | | | |
| | | | | | |
| | | | | | |

- 10.7. Instructions for retrieving data from the EDR:

Annex 3

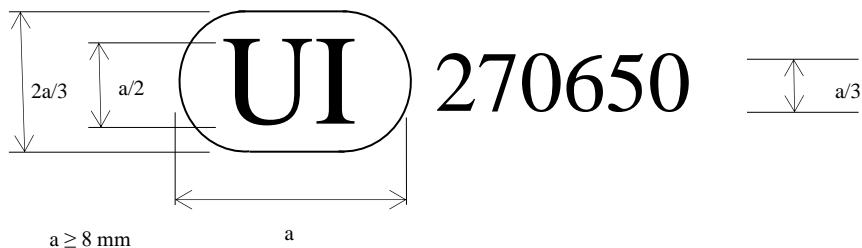
Arrangements of approval marks

(see paragraphs 4.4. to 4.4.2. of this Regulation)



$a = 8 \text{ mm min}$

The above approval mark affixed to a vehicle shows that the vehicle type with regard to its EDR concerned has been approved in Germany (E 1) pursuant to UN Regulation No. 160. The first two digits of the approval number (01) indicate that the approval was granted in accordance with the requirements of the 01 series of amendments to UN Regulation No. 160.



The above Unique Identifier shows that the type concerned has been approved and that the relevant information on that type-approval can be accessed on the UN secure internet database by using 270650 as Unique Identifier. Any leading zeroes in the Unique Identifier may be omitted in the approval marking.

Annex 4

Data elements and format¹

Table 1

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--|--|---|--|---|-----------------------------|-------------------|--|
| Delta-V, longitudinal | Mandatory - not required if longitudinal acceleration recorded at ≥ 500 Hz with sufficient range and resolution to calculate delta-v with required accuracy | 0 to 250 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | 100 | -100 km/h to + 100 km/h. | $\pm 10\%$ | 1 km/h. | Planar |
| Maximum delta-V, longitudinal | Mandatory - not required if longitudinal acceleration recorded at ≥ 500 Hz | 0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | N/A | -100 km/h to + 100 km/h. | $\pm 10\%$ | 1 km/h. | Planar |
| Time, maximum delta-V, longitudinal | Mandatory - not required if longitudinal acceleration recorded at ≥ 500 Hz | 0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | N/A | 0–300 ms, or 0- End of Event Time plus 30 ms, whichever is shorter. | ± 3 ms | 2.5 ms. | Planar |
| Speed, vehicle indicated | Mandatory | -5.0 to 0 sec | 2 | 0 km/h to 250 km/h | ± 1 km/h | 1 km/h. | Planar VRU |
| Engine throttle, % full (or accelerator pedal, % full) | Mandatory | -5.0 to 0 sec | 2 | 0 to 100% | $\pm 5\%$ | 1% | Planar Rollover VRU |
| Service brake, on/off | Mandatory | -5.0 to 0 sec | 2 | On or Off | N/A | On or Off. | Planar VRU Rollover |

¹ Format requirements specified below are minimum requirements and manufacturers can exceed them.

² "Mandatory" is subject to the conditions detailed in Section 1.

³ Pre-crash data and crash data are asynchronous. The sample time accuracy requirement for pre-crash time is -0.1 to 1.0 sec (e.g., T = -1 would need to occur between -1.1 and 0 seconds.)

⁴ Accuracy requirement only applies within the range of the physical sensor. If measurements captured by a sensor exceed the design range of the sensor, the reported element shall indicate when the measurement first exceeded the design range of the sensor.

⁵ "Planar" includes triggered events in sections 5.3.1.1, 5.3.1.2, and 5.3.1.3 and "VRU" includes triggered events in section 5.3.1.4.

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--|--|--|--|------------------------|-----------------------------|------------------------|--|
| Ignition cycle, crash | Mandatory | -1.0 sec | N/A | 0 to 60,000 | ±1 cycle | 1 cycle. | Planar VRU Rollover |
| Ignition cycle, download | Mandatory | At time of download ⁶ | N/A | 0 to 60,000 | ±1 cycle | 1 cycle. | Planar VRU Rollover |
| Safety belt status, driver | Mandatory | -1.0 sec | N/A | Fastened, not fastened | N/A | Fastened, not fastened | Planar Rollover |
| Air bag warning lamp ⁷ , | Mandatory | -1.0 sec | N/A | On or Off | N/A | On or Off. | Planar Rollover |
| Frontal air bag deployment, time to deploy, in the case of a single stage air bag, or time to first stage deployment, in the case of a multi-stage air bag, driver. | Mandatory | Event | N/A | 0 to 250 ms | ±2ms | 1 ms. | Planar |
| Frontal air bag deployment, time to deploy, in the case of a single stage air bag, or time to first stage deployment, in the case of a multi-stage air bag, front passenger. | Mandatory | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar |
| Multi-event crash, number of event | If Recorded ⁸ | Event | N/A | 1 or more | N/A | 1 or more. | Planar VRU Rollover |

⁶ The ignition cycle at the time of download is not required to be recorded at the time of the crash but shall be reported during the download process.

⁷ The frontal air bag warning lamp is the readiness indicator specified in national air bag requirements and may also illuminate to indicate a malfunction in another part of the deployable restraint system.

⁸ "If recorded" means if the data is recorded in non-volatile memory for the purpose of subsequent downloading.

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--|---|--|--|--------------------------|-----------------------------|-------------------|--|
| Time from event 1 to 2 | Mandatory | As needed | N/A | 0 to 5.0 sec | ±0.1 sec | 0.1 sec. | Planar Rollover |
| Complete file recorded (yes, no) | Mandatory | Following other data | N/A | Yes or No | N/A | Yes or No. | Planar VRU Rollover |
| Lateral acceleration (post-crash) | If Recorded | 0–250 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | 500Hz | -50 to +50g | +/- 10% | 1 g | Planar Rollover |
| Longitudinal acceleration (post-crash) | If Recorded | 0–250 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | 500Hz | -50 to +50g | +/- 10% | 1 g | Planar |
| Normal acceleration (post-crash) | If recorded | -1.0 to 5.0 sec ⁹ | 10 Hz | -5 g to +5 g | ± 10% | 0.5 g | Rollover |
| Delta-V, lateral | Mandatory - not required if lateral acceleration recorded at ≥500 Hz and with sufficient range and resolution to calculate delta-v with required accuracy | 0–250 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | 100 | -100 km/h to + 100 km/h. | ±10% | 1 km/h. | Planar |
| Maximum delta-V, lateral | Mandatory - not required if lateral acceleration recorded at ≥500 Hz | 0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | N/A | -100 km/h to + 100 km/h. | ±10% | 1 km/h. | Planar |

⁹ May be recorded in any time duration; -1.0 to 5.0 sec is suggested

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--------------------------------------|---|--|--|---|-----------------------------|---|--|
| Time maximum delta-V, lateral | Mandatory - not required if lateral acceleration recorded at ≥ 500 Hz | 0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | N/A | 0–300 ms, or 0- End of Event Time plus 30 ms, whichever is shorter. | ± 3 ms | 2.5 ms. | Planar |
| Time for maximum delta-V, resultant. | Mandatory - not required if relevant acceleration recorded at ≥ 500 Hz | 0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter. | N/A | 0–300 ms, or 0- End of Event Time plus 30 ms, whichever is shorter. | ± 3 ms | 2.5 ms. | Planar |
| Engine rpm | Mandatory | -5.0 to 0 sec | 2 | 0 to 10,000 rpm | ± 100 rpm ¹⁰ | 100 rpm. | Planar Rollover |
| Vehicle roll angle | If recorded | -1.0 up to 5.0 sec ⁹ | 10 | -1080 deg to + 1080 deg. | $\pm 10\%$ | 10 deg. | Rollover |
| Vehicle roll rate | Mandatory if fitted and used for rollover protection system control algorithm | -1.0 up to 5.0 sec ¹¹ | 10 | -240 to + 240 deg/sec | +/- 10% ¹² | 1 deg/sec | Rollover |
| ABS activity | Mandatory | -5.0 to 0 sec | 2 | Faulted, Active, Intervening ¹³ | N/A | Faulted, Active, Intervening ¹² | Planar VRU Rollover |
| Stability control | Mandatory | -5.0 to 0 sec | 2 | Faulted, On, Off, Intervening ¹² | N/A | Faulted, On, Off, Intervening ¹² | Planar VRU Rollover |
| Steering input | Mandatory | -5.0 to 0 sec | 2 | -250 deg CW to + 250 deg CCW. | $\pm 5\%$ | $\pm 1\%$. | Planar VRU Rollover |
| Safety belt status, front passenger | Mandatory | -1.0 sec | N/A | Fastened, not fastened | N/A | Fastened, not fastened | Planar Rollover |

¹⁰ These elements do not need to meet the accuracy and resolution requirements in specified crash tests.

¹¹ "vehicle roll angle" may be recorded in any time duration; -1.0 sec to 5.0 sec is suggested.

¹² Relative to the full range of the sensor

¹³ Manufacturers can include other system states

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--|---|--|--|------------------------------|-----------------------------|------------------------------|--|
| Passenger air bag suppression status, front | Mandatory | -1.0 sec | N/A | Suppressed or not suppressed | N/A | Suppressed or not suppressed | Planar Rollover |
| Frontal air bag deployment, time to nth stage, driver ⁴ . | Mandatory if fitted with a driver's frontal air bag with a multi-stage inflator. | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar |
| Frontal air bag deployment, time to nth stage, front passenger ¹⁴ . | Mandatory if fitted with a front passenger's frontal air bag with a multi-stage inflator. | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar |
| Side air bag deployment, time to deploy, driver. | Mandatory | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar |
| Side air bag deployment, time to deploy, front passenger. | Mandatory | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar |
| Side curtain/tube air bag deployment, time to deploy, driver side. | Mandatory | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar Rollover |
| Side curtain/tube air bag deployment, time to deploy, passenger side. | Mandatory | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar Rollover |
| Pretensioner deployment, time to fire, driver. | Mandatory | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar Rollover |

¹⁴ List this element n - 1 times, once for each stage of a multi-stage air bag system.

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--|--|--|--|--|---------------------------------------|------------------------|--|
| Pretensioner deployment, time to fire, front passenger. | Mandatory | Event | N/A | 0 to 250 ms | ±2 ms | 1 ms. | Planar Rollover |
| Seat track position switch, foremost, status, driver. | Mandatory if fitted and used for deployment decision | -1.0 sec | N/A | Yes or No | N/A | Yes or No. | Planar Rollover |
| Seat track position switch, foremost, status, front passenger. | Mandatory if fitted and used for deployment decision | -1.0 sec | N/A | Yes or No | N/A | Yes or No. | Planar Rollover |
| Occupant size classification, driver | If recorded | -1.0 sec | N/A | 5th percentile female or larger. | N/A | Yes or No. | Planar Rollover |
| Occupant size classification, front passenger | If recorded | -1.0 sec | N/A | 6yr old HIII US ATD or Q6 ATD or smaller | N/A | Yes or No. | Planar Rollover |
| Safety belt status, rear passengers | Mandatory | -1.0 sec | N/A | Fastened, not fastened | N/A | Fastened, not fastened | Planar Rollover |
| Tyre Pressure Monitoring System (TPMS) Warning Lamp Status | Mandatory | -1.0 second relative to time zero | N/A | N/A | N/A | On, Off | Planar Rollover |
| Longitudinal acceleration (pre – crash) | Mandatory | -5.0 to 0 second relative to time zero | 2 Hz | -1.5g to +1.5g | +/- 10% | 0.1g | Planar VRU |
| Lateral acceleration (pre – crash) | Mandatory | -5.0 to 0 second relative to time zero | 2 Hz | -1.0g to +1.0g | +/- 10% | 0.1g | Planar |
| Yaw Rate | Mandatory | -5 to 0 seconds relative to time zero | 2 | -75 to +75 degrees / second | ± 10% of the full range of the sensor | 0.1 | Planar Rollover |

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--|--|--|--|------------------------|-----------------------------|---|--|
| Traction Control Status | Mandatory if not fitted with ESC | -5.0 to 0 second relative to time zero | 2 | N/A | N/A | Actively controlling, Faulted, Commanded Off, or On but Not Controlling | Planar Rollover |
| AEBS status | Mandatory | -5.0 to 0 second relative to time zero | 2 | N/A | N/A | Actively Warning, Actively Engaged, Faulted, Off, Not Active | Planar VRU Rollover |
| Cruise Control System | Mandatory | -5.0 to 0 second relative to time zero | 2 | N/A | N/A | Actively Controlling, Faulted, Commanded Off, On but Not Controlling | Planar VRU Rollover |
| Adaptive Cruise Control Status (driving automation system level 1) | Mandatory | -5.0 to 0 second relative to time zero | 2 | N/A | N/A | Actively Controlling, Faulted, Commanded Off, On but Not Controlling | Planar VRU Rollover |
| VRU secondary safety system deployment, time to deploy | Mandatory | Event | N/A | 0 to 250 ms | ± 2 ms | 1 ms | VRU |
| VRU secondary safety system warning indicator status ¹⁵ | Mandatory | -1.1 to 0 relative to time zero | N/A | N/A | N/A | On or Off | VRU |
| Safety belt status mid-position front | Mandatory | -1.0 sec | N/A | Fastened, not fastened | N/A | Fastened, not fastened | Planar Rollover |
| Far side impact center airbag | Mandatory | Event | N/A | 0 to 250 ms | +/-2 ms | 1 ms | Planar Rollover |

¹⁵ Multiple safety system status indications can be combined into the air bag warning indicator

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|---|--|--|--|----------------------|-----------------------------|---|--|
| Lane departure warning system status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not warning, On – Warning left, On – Warning right | |
| Corrective steering function (CSF) status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not intervening, On – Actively intervening | |
| Emergency steering function (ESF) status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not intervening, On – Actively intervening | |
| Automatically commanded steering function (ACSF) category A status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not controlling, On – Actively controlling | |
| Automatically commanded steering function (ACSF) category B1 status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not controlling, On – Actively controlling | |
| Automatically commanded steering function (ACSF) category B2 status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not controlling, On – Actively controlling | |
| Automatically commanded steering function (ACSF) category C status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not controlling, On – Actively controlling | |

| <i>Data element</i> | <i>Condition for requirement²</i> | <i>Recording interval/time³ (relative to time zero)</i> | <i>Data sample rate (samples per second)</i> | <i>Minimum range</i> | <i>Accuracy⁴</i> | <i>Resolution</i> | <i>Event(s) recorded for⁵</i> |
|--|--|--|--|----------------------|-----------------------------|---|--|
| Automatically commanded steering function (ACSF) category D status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not controlling, On – Actively controlling | |
| Automatically commanded steering function (ACSF) category E status | Mandatory | -5.0 to 0 sec | 2 | N/A | N/A | Faulted, Off, On but not controlling, On – Actively controlling | |
| Accident emergency call system status | Mandatory | Event | N/A | N/A | N/A | Faulted, On but emergency call not automatically triggered, On – Emergency call automatically triggered | |