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Event Data Recorder (EDR) Performance Elements Appropriate for Adoption in 1958 and 1998 Agreements

UNITED NATIONS

I. Proposal

Guidance on Event Data Recorder (EDR) Performance Elements Appropriate for Adoption in 1958 and 1998 Agreement Resolutions or Regulations

0. Foreword

0.1 The performance elements contained in this document provide guidance and/or specifications for vehicles equipped with Event Data Recorders (EDRs) concerning the minimum collection, storage, and crash survivability of motor vehicle crash event data. These performance elements do not include specifications for data retrieval tools and methods as that is subject to national/regional level requirement.

0.2 The purpose of these performance elements 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.

0.3 Contracting parties may but are not required to make EDR requirements mandatory for M1 or N1 vehicles.

1. Scope

1.1 This document applies to all passenger cars and light duty vehicles (i.e., 1958 agreement M1 and N1 vehicle categories and Category 1-1 vehicles and Category 2 vehicles).

1.2. This document is without prejudice to requirements of national or regional laws.

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 [potential data elements tbd].

1.4 Nothing in these performance elements applies to retro-fitted or aftermarket systems. Nothing in these performance elements requires the fitment of sensors or systems not currently present in the vehicle, as manufactured, or activation of sensors or systems that are inactive at the time of manufacture.

1.5 If systems or sensors from which the data required to be recorded and stored under section 3 would originate are not fitted in the vehicle or inactive at the time of manufacture, this document requires neither recording of such data nor fitting or activating such systems or sensors. However, if the vehicle is

equipped with such a sensor or system, then it is mandatory to record the data element in the specified format when the sensor or system is activated.

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.x ["active/inactive"]

2.2 "Capture" means the process of buffering EDR data in a temporary, volatile storage where it is continuously updated at regular time intervals.

2.3 "Delta-V, lateral" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the lateral axis, starting from crash time zero and ending at 0.25 seconds, recorded every 0.01 seconds.

2.4 "Delta-V, longitudinal" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the longitudinal axis, starting from crash time zero and ending at 0.25 seconds, recorded every 0.01 seconds.

2.5 "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.

2.6 "Disposal" means the deployment command of the second (or higher, if present) stage of a frontal air bag for the purpose of disposing the propellant from the air bag device.

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:

(1) For vehicles powered by internal combustion engines, the number of revolutions per minute of the main crankshaft of the vehicle's engine, and

(2) 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

(3) 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 do 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 "Front air bag warning lamp status" means whether the warning lamp required by national air bag regulations (if any) is on or off.]

2.14 "Ignition cycle, crash" means the number (count) of power cycles applied to the recording device 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 cycles applied to the recording device 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.x "Mandatory, if equipped" [means it is mandatory to record the data element if the vehicle is equipped with the relevant sensors or system is fitted to the vehicle and, if applicable, has been [unlocked by the manufacturer for use]. Data elements from optional fit systems are also mandatory to record if those systems have been selected by the driver.]

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, starting from crash time zero and ending at 0.3 seconds.

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, starting from crash time zero and ending at 0.3 seconds.

2.20 "Maximum delta–V, resultant" means the time-correlated maximum value of the cumulative change in velocity, as recorded by the EDR or processed during data download, along the vector-added longitudinal and lateral axes.

[2.x "Memory locking" means that event data elements recorded in the EDR, corresponding to a specific event will be prevented from being overwritten by subsequent events].

2.21 "Multi-event crash" means the occurrence 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 and is zero when the accelerometer is at rest.

2.24 “Occupant position classification” means the classification indicating that the seating posture of a front outboard occupant (both driver and right front passenger) is determined as being out-of-position.

2.25 “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.

2.26 “Pretensioner” means a device that is activated by a vehicle's crash sensing system and removes slack from a vehicle safety belt system.

2.27 “Record” means the process of saving captured EDR data into a non-volatile storage for subsequent retrieval.

2.28 “Safety belt status” means the feedback from the safety system that is used to determine that an occupant's safety belt (for both driver and right front passenger) is fastened or unfastened.

2.29 “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.x “secondary safety protection system” means a system that helps to mitigate the consequences of a collision, such as an airbag or a pop-up bonnet.]

[2.x “Secondary safety system” means a deployable vehicle system designed to reduce injury consequences by offering protection during a collision, such as a pop-up bonnet or airbag.]

2.30 “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.

2.31 “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.

2.32 “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.

2.33 “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.

2.34 “Stability control” means any device that complies with national, “Electronic stability control systems”.

2.35 “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).

2.36 “Suppression switch status” means the status of the switch indicating whether an air bag suppression system is on or off.

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.

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 recorded by the EDR or processed during data download.

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” means the starting point of an event.]

2.46 “Trigger threshold” means the appropriate physical parameter has met the conditions for recording an EDR event.

[2.x “Unlocked event” means an EDR record that does not meet the locking condition. It may be overwritten by subsequent events.]

2.47 “Vehicle roll angle” means the angle between the vehicle y-axis and the ground plane.

2.48 “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.x “Vulnerable road user (VRU)” means a person using no vehicle, such as a pedestrian, or using a vehicle without protective occupant compartment, such as a pedal cyclist, micro-vehicle user or motorcyclist.]

2.49 “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.

2.50 “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.

2.51 “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.

3. Performance Specifications

Performance specifications for vehicles equipped with an EDR include data elements, data format, data capture, and crash test performance and survivability.

3.1 Data elements

3.1.1 Each vehicle equipped 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 1, Table 1.

3.2 Data format

3.2.1 Each data element recorded shall be reported in accordance with the range, accuracy, and resolution specified in Annex 1, Table 1.

3.2.2 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:

3.2.2.1 The Time Step (TS) that is the inverse of the sampling frequency of the acceleration data and which has units of seconds;

3.2.2.2 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;

3.2.2.3 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

3.2.2.4 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.

3.3 Data capture

The EDR non-volatile memory buffer shall accommodate the data related to at least [two/three] different events.

The data elements for every event shall be captured and recorded by the EDR, as specified in section 3.1 in accordance with the following conditions and circumstances:

3.3.1 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:

3.3.1.1 Change in longitudinal vehicle velocity more than 8 km/h within a 150 ms or less interval.

3.3.1.2 Change in lateral vehicle velocity more than 8 km/h within a 150 ms or less interval

3.3.1.3 Activation of Non-reversible occupant restraint system.

3.3.1.4 Activation of VRU secondary safety protection system

If a vehicle is not equipped with any Vulnerable Road User (VRU) secondary safety protection system, this document requires neither recording of data nor

fitting of such systems. However, if the vehicle is equipped with such a system, then it is mandatory to record the event data following activation of this system whenever the Contracting Party so requires.

3.3.2 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.

3.3.2.1. In all the cases where a non-reversible occupant restraint system is deployed.

3.3.2.2 In the case of a frontal impact, if the vehicle is not equipped 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.

3.3.2.3 [In the case of a rear impact, [if the vehicle is not equipped with a non-reversible restraint system for rear impact], when the vehicle's velocity change in x-axis direction exceeds [xx] km/h within 150ms or less interval. [In circumstances, where a deployable restraint system is present the manufacturer can choose whether to trigger on restraint system deployment or the conditions above.]]

3.3.2.4 Activation of VRU secondary safety protection system

3.3.3 Conditions for establishment of time zero

Time zero is established at the time when any of the following first occurs:

3.3.3.1 For systems with "wake-up" air bag control systems, the time at which the occupant restraint control algorithm is activated; or

3.3.3.2 For continuously running algorithms,

3.3.3.2.1 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

3.3.3.2.2 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

3.3.3.3 Deployment of a non-reversable deployable restraint or activation of VRU secondary safety protection system.

3.3.4 Overwriting

There are three options for overwriting data provisions currently being considered.

Option #1 is harmonized with the current Part 573 requirements and specifies that if there is not any non-volatile buffer available, manufacturers have the choice to overwrite any non-locked elements or chose not to record the current event data.

Option #2 adds an additional restriction to Option#1 provisions preventing manufacturers from overwriting "regulated" events with manufacturer specific optional events.

Option #3 specifies that if there is not any non-volatile buffer available, manufacturers must overwrite data chronologically. A second provision provides flexibility for manufacturers to be able to "skip" overwriting a recorded (but not locked) event.

Option #1

[3.3.4.1 If an EDR non-volatile memory buffer void of previous-event data is not available, the manufacturer may choose to either overwrite any previous event data that does not deploy an air bag with the current event data, or to not record the current event data.]

3.3.4.2 EDR buffers containing previous frontal, side, or side curtain/tube air bag deployment-event data shall not be overwritten by the current event data.

Option #2

[3.3.4.1 If an EDR non-volatile memory buffer void of previous-event data is not available, the manufacturer may choose to either overwrite any previous event data that does not deploy an air bag with the current event data, or to not record the current event data. However, in this case, data recorded in at least [two/three event slots] [mandatory event slots referred to in paragraph x] due to any of the trigger thresholds referred to in section 3.3.1 being reached can be overwritten only by data to be recorded due to one of such trigger thresholds being reached and shall always overwrite data that have not been recorded due to any of such trigger thresholds being reached.]

3.3.4.2 EDR buffers containing previous frontal, side, or side curtain/tube air bag deployment-event data shall not be overwritten by the current event data.

Option #3

[3.3.4.1 If an EDR non-volatile memory buffer void of previous-event data is not available, the previous event data that does not meet the trigger threshold of locking memory (3.3.2） shall be overwritten by the current event data chronologically.

3.3.4.2 Manufacturers can specify other rules for overwriting unlocked events. For the event which shall be overwritten will be skipped from overwriting to another event when the event meet the criterion set by manufacturers.]

3.3.4.3 EDR buffers containing previous frontal, side, or side curtain/tube air bag deployment-event data shall not be overwritten by the current event data.

3.3.5 Power failure

Data recorded in non-volatile memory is retained after loss of power.

3.4 Crash test performance and survivability

3.4.1 Each vehicle subject to the requirements of National or regional frontal crash test regulations, shall conform with the specifications in paragraph 3.4.3.

3.4.2 Each vehicle subject to the requirements of National or regional side impact crash test regulations, that meets a trigger threshold or has a [frontal] air bag deployment, shall conform with the specifications of paragraph 3.4.3.

3.4.3 The data elements required by paragraph 3.1, shall be recorded in the format specified by paragraph 3.2, 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-R94, /95 or/137, or other relevant national crash test procedures.

Annex 1

Table 1. Data Elements and Format

Data element	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy[2]	Resolution
Delta-V, longitudinal	Mandatory	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.	±10%	1 km/h.
Maximum delta-V, longitudinal	Mandatory	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.
Time, maximum delta-V	Mandatory	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.
Speed, vehicle indicated	Mandatory	-5.0 to 0 sec	2	0 km/h to 200 km/h	±1 km/h	1 km/h.

[1] 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.)

[2] 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.

Data element	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy[2]	Resolution
Engine throttle, % full (or accelerator pedal, % full)	Mandatory	-5.0 to 0 sec	2	0 to 100%	±5%	1%
Service brake, on/off	Mandatory	-5.0 to 0 sec	2	On or Off	N/A	On or Off.
Ignition cycle, crash	Mandatory	-1.0 sec	N/A	0 to 60,000	±1 cycle	1 cycle.
Ignition cycle, download	Mandatory	At time of download[3]	N/A	0 to 60,000	±1 cycle	1 cycle.
Safety belt status, driver	Mandatory	-1.0 sec	N/A	On or Off	N/A	On or Off.
Frontal air bag warning lamp, on/off[4]	Mandatory	-1.0 sec	N/A	On or Off	N/A	On or Off.
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.

[3] 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.

[4] 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.

Data element	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy[2]	Resolution
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.
Multi-event, number of event	Mandatory	Event	N/A	1 or 2	N/A	1 or 2.
Time from event 1 to 2	Mandatory	As needed	N/A	0 to 5.0 sec	0.1 sec	0.1 sec
Complete file recorded (yes, no)	Mandatory	Following other data	N/A	Yes or No	N/A	Yes or No.
Lateral acceleration	If recorded[5]	N/A	N/A	At option of manufacturer.	At option of manufacturer.	At option of manufacturer.
Longitudinal acceleration	If recorded	N/A	N/A	At option of manufacturer.	At option of manufacturer.	At option of manufacturer.
Normal acceleration	If recorded	N/A	N/A	At option of manufacturer.	At option of manufacturer.	At option of manufacturer.
Delta-V, lateral	If recorded	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.

[5] ‘If recorded’’ means if the data is recorded in non-volatile memory for the purpose of subsequent downloading.

Data element	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy[2]	Resolution
Maximum delta-V, lateral	If recorded	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.
Time maximum delta-V, lateral	If recorded	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.
Time for maximum delta-V, resultant.	If recorded	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.
Engine rpm	If recorded	-5.0 to 0 sec	2	0 to 10,000 rpm	±100 rpm[6]	100 rpm.
Vehicle roll angle	If recorded	-1.0 up to 5.0 sec[7]	10	-1080 deg to + 1080 deg.	±10%	10 deg.
ABS activity (engaged, non-engaged).	If recorded	-5.0 to 0 sec	2	On or Off	N/A	On or Off.
Stability control (on, off, or engaged).	If recorded	-5.0 to 0 sec	2	On, Off, or Engaged	N/A	On, Off, or Engaged.
Steering input	If recorded	-5.0 to 0 sec	2	-250 deg CW to + 250 deg CCW.	±5%	±1%.

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

[7] ‘vehicle roll angle’’ may be recorded in any time duration; -1.0 sec to 5.0 sec is suggested.

Data element	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy[2]	Resolution
Safety belt status, right front passenger (buckled, not buckled).	If recorded	-1.0 sec	N/A	On or Off	N/A	On or Off.
Frontal air bag suppression switch status, right front passenger (on, off, or auto).	If recorded	-1.0 sec	N/A	On, Off, or Auto	N/A	On, Off, or Auto.
Frontal air bag deployment, time to nth stage, driver[4].	If equipped with a driver's frontal air bag with a multi-stage inflator.	Event	N/A	0 to 250 ms	±2 ms	1 ms.
Frontal air bag deployment, time to nth stage, front passenger[8].	If equipped with a right front passenger's frontal air bag with a multi-stage inflator.	Event	N/A	0 to 250 ms	±2 ms	1 ms.

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

Data element	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy[2]	Resolution
Frontal air bag deployment, nth stage disposal, driver, Y/N (whether the nth stage deployment was for occupant restraint or propellant disposal purposes).	If recorded	Event	N/A	Yes or No	N/A	Yes or No.
Frontal air bag deployment, nth stage disposal, front passenger, Y/N (whether the nth stage deployment was for occupant restraint or propellant disposal purposes).	If recorded	Event	N/A	Yes or No	N/A	Yes or No.
Side air bag deployment, time to deploy, driver.	If recorded	Event	N/A	0 to 250 ms	±2 ms	1 ms.
Side air bag deployment, time to deploy, front passenger.	If recorded	Event	N/A	0 to 250 ms	±2 ms	1 ms.
Side curtain/tube air bag deployment, time to deploy, driver side.	If recorded	Event	N/A	0 to 250 ms	±2 ms	1 ms.
Side curtain/tube air bag deployment, time to deploy, passenger side.	If recorded	Event	N/A	0 to 250 ms	±2 ms	1 ms.
Pretensioner deployment, time to fire, driver.	If recorded	Event	N/A	0 to 250 ms	±2 ms	1 ms.

Data element	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy[2]	Resolution
Pretensioner deployment, time to fire, front passenger.	If recorded	Event	N/A	0 to 250 ms	±2 ms	1 ms.
Seat track position switch, foremost, status, driver.	If recorded	-1.0 sec	N/A	Yes or No	N/A	Yes or No.
Seat track position switch, foremost, status, front passenger.	If recorded	-1.0 sec	N/A	Yes or No	N/A	Yes or No.
Occupant size classification, driver	If recorded	-1.0 sec	N/A	5th percentile female or larger.	N/A	Yes or No.
Occupant size classification, front passenger.	If recorded	-1.0 sec	N/A	Child	N/A	Yes or No.
Occupant position classification, driver.	If recorded	-1.0 sec	N/A	Out of position	N/A	Yes or No.
Occupant position classification, front passenger.	If recorded	-1.0 sec	N/A	Out of position	N/A	Yes or No.

Open Issues for Continued Work Post July 1 GRSG Submission

The following section details the remaining "open" issues that still require resolution and are not a formal part of this EDR common technical requirements document.

The following items are provisions that the SG-EDR WG will continue to work on after the July 1st submission to GRSG with the goal of resolving them in time for integration into the document before submission to WP.29

Date capture

The EDR non-volatile memory buffer shall accommodate the data related to at least [two]/[three] different events.

3.3.2.2 In the case of a frontal impact, if the vehicle is not equipped 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.

Test procedures

3.4.1 Crash test

Vehicles subject to the requirements of UN Regulation No. 94, 95, 137 or national or regional crash regulations or standards. After the crash test, the following requirement shall be met:

-The complete data recorded element must read "yes" after the impact test.

-The acquired (or computed) longitudinal (or lateral) delta-V data shall be within the tolerance of [±10 km/h] when compared with the laboratory reference longitudinal (or lateral) delta-V.

-Delta-V data shall not produce clipping, or acceleration data shall not exceed range of acceleration sensor.

3.4.2 Driving operation data test

3.4.2.1 The threshold can be triggered by adopting the following four methods or other methods during test:

-The vehicle is impacted to trigger the threshold;

-The vehicle is fixed on the trolley, then the trolley is impacted to trigger the threshold;

-The EDR system is triggered physically.

-The EDR system is triggered by inputting signal

3.4.2.2 The test method shall test the following data elements: "Engine throttle, percent full", "Accelerator pedal, percent full", "ABS activity (on, off, engaged)", "Stability control (on, off engaged)", "Steering input", "Engine

RPM", "Service brake, on/off", Safety belt buckle and other vehicle electronic/electric system can be set ON/OFF by the driver, etc.

3.4.2.3 After test, the data that EDR recorded shall be identical with the setting before test.

3.4.3 Bench test

The manufacturer shall provide the test box used for connecting with EDR controller, this test box is used to simulate the real vehicle peripheral signals and loads for EDR controller. The test box shall meet following requirements:

-- The test box shall be capable of sending simulated real bus signals to the EDR controller;

-- The test box shall be equipped with necessary peripheral sensors, loads and hardwire connected accessories, to guarantee the normal operation of the EDR controller;

-- The power supply for EDR controller shall be provided by the test bench (thruster) rather than the test box.

The EDR controller and its accessories are installed on the thruster as the connection status on real vehicles. Then the EDR controller is connected with the test box, and powered on by the test bench.

The simulation signals and loads provided by the test box shall be preset and confirmed. The corresponding device of simulation signals that is working or triggered to working under certain logic when the vehicle is operating shall be preset as activated.

3.4.3.1 EDR system trigger test

Prior to test, the EDR controller shall have enough storage space to record at least 1 complete event.

Thrust the EDR controller in longitudinal direction in accordance with the specified impact waveform by the testbench (thruster). The actual longitudinal acceleration is measured by lab accelerometers.

The EDR controller shall be triggered, the event data recorded shall be identical with the data which is pre-set.

3.4.3.2 Test of number of storage events

Prior to test, EDR controller shall have enough storage space to record at least 3 complete events.

Thrust the EDR controller in longitudinal direction in accordance with the specified impact waveform. The actual longitudinal acceleration is measured by lab accelerometers.

Conduct 3 thrust tests with each test interval more than 5s.

EDR controller shall be triggered and shall record the latest 3 events, the event data recorded shall be identical with the data which is pre-set, and at least 3 events are recorded in EDR controller.

3.4.3.3 Storage overwrite mechanism test

3.4.3.3.1 Overwriting of unlocked memory test

Prior to test, EDR controller shall have no sufficient storage space to record a complete event, and in the last three events recorded, there is one event record which is stored in the unlocked memory.

Thrust the EDR controller in longitudinal direction in accordance with the specified impact waveform by the testbench (thruster). The actual longitudinal acceleration is measured by lab accelerometers.

EDR controller shall be triggered. The event data shall override the existing unlocked event data, and shall be identical with the data which is preset in.

3.4.3.3.1 Overwriting of locked memory test

Prior to test, EDR controller shall have no sufficient storage space to record a complete event, and all the stored events data are locked in the memory.

Thrust the EDR controller in longitudinal direction in accordance with the specified impact waveform. The actual longitudinal acceleration is measured by lab accelerometers.

The data record of the EDR controller is consistent with that before the test.

3.4.3.4 Power failure test

Prior to test, EDR controller shall have enough storage space to record at least 1 event.

Thrust the EDR controller in longitudinal direction in accordance with the specified impact waveform by the testbench (thruster). The actual longitudinal acceleration is measured by lab accelerometers.

At the same time of thrust, cut off the power supply to EDR controller.

EDR controller shall be triggered, the event data recorded shall be identical with the data which is pre-set.

Malfunction

Possible insertion of language to consider special case for vehicles with EDR but not an airbag ECU (China).

Potential Step 2 Provisions

The following section details potential provisions to be considered in the Step 2 EDR common technical requirements document and are not a formal part of the Step 1 EDR common technical requirements document. Inclusion of a provision on this list simply means that it is scheduled for Step 2 consideration and does not mean that it will ultimately be incorporated into the Step 2 EDR common technical requirements documents.

Triggering of recording

For systems with “wake-up” rollover occupant protection control algorithms, the time at which the rollover occupant protection control algorithm is activated.

For continuously running rollover occupant protection control algorithms, the time at which the event is determined to have started as defined by the specific Original Equipment Manufacturer (OEM) and occupant protection control system supplier (for example, accumulated angle or angular rate).

Conditions for triggering locking of data

For systems with “wake-up” rollover occupant protection control algorithms, the time at which the rollover occupant protection control algorithm is activated.

For continuously running rollover occupant protection control algorithms, the time at which the event is determined to have started as defined by the specific Original Equipment Manufacturer (OEM) and occupant protection control system supplier (for example, accumulated angle or angular rate).

Warning for buffer overflow

If all EDR non-volatile memory buffers are locked, the host module should store a non-erasable error explaining that the module should be replaced and should light the MIL for that module.

Power failure

In case of occurrence of collision, if power supply circuit of vehicle cannot supply power normally due to the impact event, the EDR system itself shall have the power supply capability. This power supply capability shall be enough for all relevant firing loops (if available) are fully deployed within (150 ± 10) ms after power failure (or cut-off), and the EDR system shall record all data before T_0 and the data from T_0 to (150 ± 10) ms after power failure (or cut-off).

Crash test performance and survivability

The complete data recorded element must read “yes” after the impact test.

The acquired (or computed) longitudinal (or lateral) delta-V data shall be within the tolerance of [±10km/h] when compared with the laboratory reference longitudinal (or lateral) delta-V.

Delta-V data shall not produce clipping, or acceleration data shall not exceed range of acceleration sensor.

Data retrieval tools

Each manufacturer of a motor vehicle equipped with an EDR shall ensure by licensing agreement or other means that a tool(s) is commercially available that is capable of accessing and retrieving the data stored in the EDR that are required by this part. The tool(s) shall be commercially available not later than 90 days after the first sale of the motor vehicle for purposes other than resale.]

Also consider parallel language from DSSAD below:

The data shall be retrievable even after an impact of a severity level set by UN-R94, /95 or/137, or other relevant national crash test procedures. If the main on-board vehicle power supply is not available, it shall still be possible to retrieve all data recorded on the DSSAD, as required by national and regional law.