

## Attachment 98 Event data recorder

Refer to: R160 01 Series

### 98.1 Effective date and Scope

98.1.1 Effective date from 2027/1/1, new vehicle types of category M1 and N1 and from 2029/1/1, all vehicle types of category M1 and N1, shall equipped with event data recorder complied with this attachment.

98.1.2 Technical Service can carry out test according to UN Regulations that this direction harmonized with: UN R160 01 Series of amendments and following amendments of above-mentioned regulations.

### 98.2 Definitions

98.2.1 "ABS activity" means the anti-lock brake system (ABS) is actively controlling the vehicle's brakes.

98.2.2 "Air bag warning lamp status" means whether the air bag malfunction warning lamp is on or off.

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

98.2.4 "Delta-V, lateral" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the lateral axis.

98.2.5 "Delta-V, longitudinal" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the longitudinal axis.

98.2.6 "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.

98.2.7 "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.

98.2.8 "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

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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.

98.2.9 "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.

98.2.10 "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.

98.2.11 "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.

98.2.12 "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.

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

98.2.14 "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.

98.2.15 "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.

98.2.16 "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.

98.2.17 "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.

98.2.18 "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.

98.2.19 "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.

98.2.20 "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.

98.2.21 "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.

98.2.22 "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.

98.2.23 "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.

98.2.24 "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.

98.2.25 "Operational" means that the system or sensor, at the time of the event, is active or can be activated/deactivated by the driver.

98.2.26 "Passenger air bag suppression status" means the status of the passenger air bag (suppressed or not suppressed).

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

98.2.28 "Record" means the process of saving captured EDR data into a non-volatile storage for subsequent retrieval.

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- 98.2.29 "Safety belt status" means the feedback from the safety system that the vehicle's safety belt is fastened or unfastened.
- 98.2.30 "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.
- 98.2.31 "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.
- 98.2.32 "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.
- 98.2.33 "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.
- 98.2.34 "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.
- 98.2.35 "Stability control" means any device that complies with national, "Electronic stability control systems".
- 98.2.36 "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).
- 98.2.37 "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.
- 98.2.38 "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.
- 98.2.39 "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.

- 98.2.40 "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.
- 98.2.41 "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).
- 98.2.42 "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).
- 98.2.43 "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.
- 98.2.44 "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).
- 98.2.45 "Time zero" is the time reference for the EDR data timestamps of an event.
- 98.2.46 "Trigger threshold" means the appropriate parameter has met the conditions for recording an EDR event.
- 98.2.47 "Vehicle roll angle" means the angle between the vehicle y-axis and the ground plane as determined by the sensing system.
- 98.2.48 "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.
- 98.2.49 "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.
- 98.2.50 " 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

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positive in the direction of forward vehicle travel.

98.2.51 "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.

98.2.52 "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.

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

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

98.3 The principles of applicable type and scope of EDR shall be as follows:

98.3.1 Same vehicle brand and vehicle type series.

98.3.2 Same 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";

98.3.3 The main characteristics and design of the EDR

98.4 General

98.4.1 This attachment is without prejudice to requirements of national or regional laws related to privacy, data protection and personal data processing.

98.4.2 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.

98.4.3 If there is no system or sensor designed to provide the data element to be recorded and stored, in the format (range, resolution, and

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sample rate) indicated in paragraph 98.6 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 paragraph 98.6, 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 of paragraph 98.6.

#### 98.4.4 Applicants shall provide undermentioned documents:

- 98.4.4.1 A description of the vehicle type with regard to the items specified in paragraph 98.5 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;
- 98.4.4.2 The data elements and format stored in the EDR;
- 98.4.4.3 Instructions for retrieving data from the EDR.

#### 98.5 Requirements

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

##### 98.5.1 Data elements

- 98.5.1.1 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 paragraph 98.6.

##### 98.5.2 Data format

- 98.5.2.1 Each data element recorded shall be reported in accordance with the range, accuracy, and resolution specified in paragraph 98.6.
- 98.5.2.2 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:

- 98.5.2.2.1 The Time Step (TS) that is the inverse of the sampling frequency of the acceleration data and which has units of milliseconds.
- 98.5.2.2.2 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.
- 98.5.2.2.3 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
- 98.5.2.2.4  $NLP - NFP + 1$  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.

### 98.5.3 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 98.5.3.4, at least until they are retrieved in compliance with national or regional legislation or they are overwritten in compliance with paragraph 98.5.3.4.

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 98.5.1 in accordance with the following conditions and circumstances:

#### 98.5.3.1 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:

- 98.5.3.1.1 Change in longitudinal vehicle velocity more than 8 km/h within a 150 ms or less interval.
- 98.5.3.1.2 Change in lateral vehicle velocity more than 8 km/h within a 150 ms or less interval
- 98.5.3.1.3 Activation of Non-reversible occupant restraint system.

#### 98.5.3.1.4 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.

#### 98.5.3.2 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.

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

98.5.3.2.2 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.

#### 98.5.3.2.3 Activation of Vulnerable road user secondary safety system

#### 98.5.3.3 Conditions for establishment of time zero

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

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

98.5.3.3.2 For continuously running algorithms,

98.5.3.3.2.1 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

98.5.3.3.2.2 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

98.5.3.3.3 Deployment of a non-reversible deployable restraint or activation of VRU secondary safety protection system.

#### 98.5.3.4 Overwriting

98.5.3.4.1 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 98.5.3.2., be overwritten by the current event data, on a first-in first-out basis, or according to different strategies decided by the applicant and made available to the relevant authorities and technical service.

98.5.3.4.2 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 98.5.3.2 shall always overwrite any other data that is not locked per 98.5.3.2.

#### 98.5.3.5 Power failure

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

#### 98.5.4 Crash test performance and survivability

98.5.4.1 Each vehicle subject to the requirements of national or regional frontal crash test regulations, shall conform with the specifications in paragraph 98.5.4.3 of attachment "The protection of the occupants in the event of a frontal collision".

98.5.4.2 Each vehicle subject to the requirements of national or regional side impact crash test regulations, shall conform with the specifications of paragraph 98.5.4.3 of attachment "The protection of the occupants in the event of a lateral collision".

98.5.4.3 The data elements required by paragraph 98.5.1, shall be recorded in the format specified by paragraph 98.5.2, 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 attachment "The protection of the occupants in the event of a frontal collision" and "The protection of the occupants in the event of a lateral collision".

98.5.5 5.5. It shall not be possible to deactivate the Event Data Recorder.

## 98.6 Data elements and format

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

Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
Delta-V, longitudinal	Mandatory - not required if longitudinal acceleration recorded at $\geq 500$ 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 $\geq 500$ 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 $\geq 500$ 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.	$\pm 3$ ms	2.5 ms.	Planar
Speed, vehicle indicated	Mandatory	-5.0 to 0 sec	2	0 km/h to 250 km/h	$\pm 1$ km/h	1 km/h.	Planar VRU

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
Engine throttle, % full (or accelerator pedal, % full)	Mandatory	-5.0 to 0 sec	2	0 to 100%	±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
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 <sup>6</sup>	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 <sup>7</sup>	Mandatory	-1.0 sec	N/A	On or Off	N/A	On or Off.	Planar Rollover

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
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 events	If Recorded <sup>8</sup>	Event	N/A	1 or more	N/A	1 or more.	Planar VRU Rollover
Time from event 1 to 2	Mandatory	As needed	N/A	0 to 5.0 sec	±0.1 sec	0.1 sec.	Planar Rollover

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
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.	500	-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.	500	-50 to +50g	+/- 10%	1 g	Planar
Normal acceleration (post-crash)	If recorded	-1.0 to 5.0 sec <sup>9</sup>	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

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
Maximum delta-V, lateral	Mandatory - not required if lateral acceleration recorded at $\geq 500$ 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, lateral	Mandatory - not required if lateral acceleration recorded at $\geq 500$ 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.	$\pm 3$ ms	2.5 ms.	Planar
Time for maximum delta-V, resultant.	Mandatory - not required if relevant acceleration recorded at $\geq 500$ 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.	$\pm 3$ ms	2.5 ms.	Planar
Engine rpm	Mandatory	-5.0 to 0 sec	2	0 to 10,000 rpm	$\pm 100$ rpm <sup>10</sup>	100 rpm.	Planar Rollover
Vehicle roll angle	If recorded	-1.0 up to 5.0 sec <sup>9</sup>	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 <sup>11</sup>	10	-240 to + 240 deg/sec	+/- 10% <sup>12</sup>	1 deg/sec	Rollover

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
ABS activity	Mandatory	-5.0 to 0 sec	2	Faulted, Active, Intervening <sup>13</sup>	N/A	Faulted, Active, Intervening <sup>12</sup>	Planar VRU Rollover
Stability control	Mandatory	-5.0 to 0 sec	2	Faulted, On, Off, Intervening <sup>12</sup>	N/A	Faulted, On, Off, Intervening <sup>12</sup>	Planar VRU Rollover
Steering input	Mandatory	-5.0 to 0 sec	2	-250 deg CW to + 250 deg CCW.	±5%	±1%.	Planar Rollover VRU
Safety belt status, front passenger	Mandatory	-1.0 sec	N/A	Fastened, not fastened	N/A	Fastened, not fastened	Planar Rollover
Passenger air bag suppression status	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 <sup>4</sup> .	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

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
Frontal air bag deployment, time to nth stage, front passenger. <sup>14</sup>	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

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
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

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
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
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

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
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 <sup>15</sup>	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
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	

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
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	

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
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	
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	

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Data element	Condition for requirement <sup>2</sup>	Recording interval/time <sup>3</sup> (relative to time zero)	Data sample rate (samples per second)	Minimum range	Accuracy <sup>4</sup>	Resolution	Event(s) recorded for <sup>5</sup>
Accident emergency call system status	Mandatory	Event	N/A	N/A	N/A	Faulted, On emergency call but not automatically triggered, On – Emergency call automatically triggered	

<sup>1</sup> "Mandatory" is subject to the conditions detailed in paragraph 98.4.

<sup>2</sup> 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.)

<sup>3</sup> 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.

<sup>4</sup> "Planar" includes triggered events in sections 98.5.3.1.1, 98.5.3.1.2, and 98.5.3.1.3 and "VRU" includes triggered events in section 98.5.3.1.4.

<sup>5</sup> 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.

<sup>6</sup> The 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.

<sup>7</sup> "If recorded" means if the data is recorded in non-volatile memory for the purpose of subsequent downloading.

<sup>8</sup> May be recorded in any time duration; -1.0 to 5.0 sec is suggested <sup>10</sup> These elements do not need to meet the accuracy and resolution requirements in specified crash tests.

<sup>9</sup> These elements do not need to meet the accuracy and resolution requirements in specified crash tests.

<sup>10</sup> "vehicle roll angle" may be recorded in any time duration; -1.0 sec to 5.0 sec is suggested.

<sup>11</sup> Relative to the full range of the sensor

<sup>12</sup> Manufacturers can include other system states

<sup>13</sup> List this element n - 1 times, once for each stage of a multi-stage air bag system.

<sup>14</sup> Multiple safety system status indications can be combined into the air bag warning indicator.

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