PRINCIPIA

AUTOMOBILE BLACK BOX FACT SHEET

What is the black box?

The black box is a computer that records data which can help determine precisely what happened in a motor vehicle accident. It records technical vehicle and occupant information for a brief period of time (seconds, not minutes) before, during and after a crash. For instance, Event Data Recorders (EDRs) may record (1) pre-crash vehicle motion and system status, (2) driver inputs, (3) vehicle crash motion, (4) restraint usage and airbag deployment status, and (5) post-crash data such as the activation of an automatic collision notification system. Of particular use for the accident reconstructionist is the vehicle's motion data during the time period just prior to a crash event and during the collision.

What does it do?

The black box collects data such as vehicle and engine speeds, throttle position, brake pedal application, velocity changes (delta-V), seat belt and airbag status, and the time elapsed from impact to airbag deployment. The newest generation includes yaw rates (related to a vehicle's spin) and steering wheel angle. Other data that may be recorded include longitudinal, lateral and normal acceleration, lateral delta-V, roll angle and roll rate, and Antilock Braking System status.

The initial regulatory mandate in the 1980s was to verify the performance of airbag safety systems. Beginning in 1993, the Environmental Protection Agency tightened emissions requirements for diesel engines in commercial motor vehicles. In response, engine manufacturers began using electronic engine control units. These computers enhanced the precision of injector timing, the fuel and air mixture, and other mechanical factors, creating more efficient and cleaner engines.

As computer hardware prices dropped, design engineers could incorporate more features into these Engine Control Modules (ECMs). ECMs then began to monitor data that were of interest to logistics, safety, and maintenance professionals. By 1995, most ECMs monitored data such as fuel economy, time at idle, active fault codes (problems in the engine), and the amount of time that a truck spent in various speed bands, including how often it exceeded a pre-set maximum-tolerable speed.

In 1997, the National Transportation Safety Board recommended that the National Highway Traffic Safety Adminsitration (NHTSA) should "pursue gathering crash information from EDRs." In late 1997 and early 1998, EDR capability became a standard feature in several heavy vehicle ECMs. These EDRs can store data about wheel speed, brake status, cruise control, and several other factors. Most EDRs are set to record these data when a sudden change in wheel speed is detected.

On June 14, 2004, NHTSA published a notice of proposed rulemaking proposing requirements for EDRs voluntarily installed by light vehicle manufacturers (69 FR 32932). The proposal required light vehicles voluntarily equipped with an EDR to meet uniform, national requirements for the collection, storage, and retrievability of onboard motor vehicle crash event data.

How is the data accessed?

To read data recorded by an EDR, special equipment is required, and access to the vehicle or the EDR is needed. In addition to the vehicle manufacturer, other parties such as accident reconstruction engineers that have the special equipment can read the information if they have access to the vehicle or the EDR. One tool that is commercially available is the Bosch Crash Data Retrieval tool, which includes software and hardware to access passenger car EDRs. It is not used for heavy truck ECMs.

Where is the black box placed in the vehicle?

The box is usually located in a well-protected area of the vehicle, such as beneath the center console, under the driver's seat, or under the right front passenger's seat. Locations vary depending on the automobile manufacturer. Downloading an airbag module in most vehicles is best accomplished by connecting the appropriate scanning tool to the Diagnostic Link Connector usually found under the vehicle's dashboard near the driver's knees. For heavy vehicles, a six- or nine-pin data port connector can be found on the dash or cab wall.

What is the current regulatory requirement for EDR support by manufacturers?

NHTSA required that all manufacturers make their EDR data publicly available. As of October 2009, only General Motors, Ford and Daimler Chrysler had released their EDR data to be publicly read. In the August 2006 ruling, NHTSA set an initial timetable for all vehicle manufacturers to be in compliance with the new EDR standards. The compliance date was originally set for all vehicles manufactured after September 1, 2010. NHTSA has since updated its ruling (49 CFR Part 563 Update) requiring that vehicles manufactured after September 1, 2012 be in compliance with the original ruling.

California has consumer protection statutes that require an owner's consent to download EDR data.

How and when is the data captured?

Federal Regulation 49 CFR 563 requires data to be captured in the event of an airbag deployment or a non-deployment crash where the delta-V is greater than 5 mph (8 km/h) over 150 ms. The data is to be captured at regular intervals for 5 seconds before impact to the time of impact. For delta-V, the data sample rate is required to be 0.01 seconds from the time of impact to 0.25 seconds after impact.

How long is the data stored on the box before it's lost?

The federal regulations stipulate survivability requirements for EDR data when the vehicle is crash tested under existing Federal Motor Vehicle Safety Standard testing requirements, and it also requires that the data be retrievable by the methodology specified by the vehicle manufacturer for not less than 10 days after the test. In an airbag deployment crash, the data related to the deployment must be recorded, and the memory must be locked in order to prevent any future overwriting of these data. In an airbag non-deployment crash that meets the trigger threshold, manufacturers may capture data from the previous two most recent events, if memory buffer capcity remains to capture new events. They may also choose to not capture new events if the memory buffer is full.

What do they look like?

Black Box

Bosch Crash Data Retrieval Tool

Principia's Capabilities

We own the latest Bosch Crash Data Retrieval tool and software. We can access, save and interpret the data for accident reconstruction. Getting the data off only takes 1-3 hours once we are at the vehicle, depending on the state of the damage to the vehicle.