



U.S. Department
of Transportation

National Highway
Traffic Safety
Administration

**Toyota EDR Software Versions
Used in NHTSA Unintended Acceleration
Field Investigation Cases**

February 2011

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Technical Report Documentation Page

1. Report No. NHTSA-NVS-2011-ETC-SR08		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Toyota EDR Software Versions Used in NHTSA Unintended Acceleration Field Investigation Cases				5. Report Date February 2011	
				6. Performing Organization Code NVS	
7. Author(s)				8. Performing Organization Report No. NHTSA-NVS-2011-ETC-SR08	
9. Performing Organization Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration 1200 New Jersey Ave., S.E. Washington, DC 20590				10. Work Unit No. (TRAVIS)	
				11. Contract or Grant No.	
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration 1200 New Jersey Ave., S.E. Washington, DC 20590				13. Type of Report and Period Covered	
				14. Sponsoring Agency Code	
15. Supplementary Notes This report provides supplementary information to NHTSA Report No. NHTSA-NVS-2011-ETC, "Technical Assessment of Toyota Electronic Throttle Control (ETC) Systems," January 2011.					
16. Abstract					
17. Key Words Sudden acceleration, unintended acceleration, electronic throttle control, "Silver Book,"				18. Distribution Statement	
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages	22. Price

Form DOT F 1700.7 (8-72)

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1.0 Toyota EDR Software Versions (and related items)

1.1 Consistency among the Ten Toyota EDR Readers Obtained by NHTSA

NHTSA assured Toyota EDR reader veracity and consistency by reading (imaging) one of the track tested EDR's¹ from NHTSA's Vehicle Research and Test Center (VRTC) tests with each of the ten EDR Tool kits obtained from Toyota. Data collected was identical among the ten readers and coincided with the data collected by VRTC's instrumentation during the track tests.

1.2 Software Versions

Toyota released multiple versions of its EDR readout software during the time that NHTSA operated its EDR readers. Each successive version was used to image the data contained within EDR CAM4D so as to compare the performance of the different software versions. The software versions supplied are listed below:

- Version 1.1 supplied in March;
- Version 1.3 supplied in April;
- Version 1.3.1.2 supplied in May (introduction of accelerator pedal position voltage availability);
- Version 1.3.1.3 supplied in June; and
- Version 1.4.1 supplied in August

EDR data files retrieved with older versions of the software can be opened with newer versions (forward compatibility) but newer images cannot be opened with older versions of the software.

Throughout this work, EDR CAM4D was imaged over 30 times, all data output was consistent with the exception of the Accelerator Pedal Position Voltage, which was updated at software version 1.3.1.2 (May 2010).

The most significant change noted in the software versions is the improvement in the indicated accelerator pedal position voltage. Prior to tool version 1.3.1.2, the accelerator pedal position displayed as OFF, MIDDLE or FULL- essentially dividing the actual pedal stroke into thirds².

¹ The EDR in question was extracted from a 2007 Toyota Camry, designated "CAM4D"

² In other words, "OFF" can refer to up to a one third accelerator application

The newer software displayed the actual voltage (which was always recorded from the vehicles Controller Area Network (CAN) bus).

Examples of typical accelerator pedal voltages observed during the field inspections would be 0.78 Volts at zero pedal application (OFF) and 3.71 Volts for full pedal application (FULL).

Where appropriate, EDR data collected from the field were reimaged with newer software. With the exception of improved accelerator pedal voltages, the results remained consistent among the different software versions.

A table listing the different software versions used for each case is listed below.

Table 1 – Software Version Used per Case

Case #	Original EDR tool version used	Latest EDR Tool Version	Case #	Original EDR tool version used	Latest EDR Tool Version
1	1.1	1.4.1.1	30	1.3	1.4.1.1
2	1.3.1.2	1.3.1.2	31	1.3	1.3.1.3
3	1.3	1.4.1.1	32	1.3.1.2	1.4.1.1
4	1.1	1.4.1.1	33	1.3	1.4.1.1
5	1.1	1.4.1.1	34	1.3.1.3	1.3.1.3
6	1.3.1.2	1.3.1.2	35	1.3.1.2	1.3.1.2
7	1.1	1.4.1.1	36	1.3.1.2	1.4.1.1
8	1.3.1.2	1.3.1.2	37	1.3.1.2	1.3.1.2
9	1.3.1.2	1.4.1.1	38	1.3.1.2	1.3.1.2
10	1.1	1.4.1.1	39	1.3	1.4.1.1
11	1.3.1.2	1.3.1.2	40	1.3	1.4.1.1
12	1.1	1.4.1.1	41	1.3.1.2	1.3.1.2
13	1.3	1.4.1.1	42	1.3.1.2	1.3.1.2
14	1.3.1.2	1.4.1.1	43	1.3	1.4.1.1
15	1.3.1.2	1.3.1.2	44	1.3.1.3	1.3.1.3
16	1.3.1.2	1.4.1.1	45	1.3.1.2	1.3.1.2
17	1.3.1.3	1.4.1.1	46	1.3	1.4.1.1
18	1.3.1.3	1.4.1.1	47	1.3	1.4.1.1
19	1.3.1.3	1.4.1.1	48	1.3	1.4.1.1
20	1.3.1.3	1.4.1.1	49	1.3.1.3	1.3.1.3
21	1.3.1.3	1.4.1.1	50	1.3.1.2	1.3.1.2
22	1.3.1.3	1.3.1.3	51	1.3	1.3.1.2
23	1.3.1.3	1.4.1.1	A1	1.1	1.4.1.1
24	1.3.1.3	1.4.1.1	B1	1.3.1.3	1.3.1.3
25	1.4.1.0	1.4.1.1	B2	1.3.1.2	1.3.1.2
26	1.3.1.3	1.4.1.1	B3	1.3.1.2	1.3.1.2
27	1.3	1.4.1.1	B4	1.3.1.3	1.3.1.3
28	1.3.1.2	1.4.1.1	B5	1.3.1.2	1.3.1.2
29	1.3	1.4.1.1	B6	1.3.1.3	1.3.1.3

1.3 Case A1: Accelerator Pedal “FALSE” Readings

At the time of NHTSA’s August 2010 release of preliminary EDR results to Congress, Case A1 remained under review. This section describes the reasons for this distinction and the actions taken to resolve the concern.

Case A1 involved a 2009 Toyota Corolla which was decelerating to a commercial driveway on a four lane roadway. Concurrent with the deceleration maneuver, the driver reported that the Toyota accelerated unexpectedly. As a result of the reported acceleration the driver steered to the right to avoid striking a nearby vehicle, at which point the subject vehicle departed the roadway, struck multiple fixed objects, overturned after making contact with a turning vehicle, and came to rest on its roof in a parking lot after striking a parked vehicle.

The vehicle accident was originally selected for research by the National Automotive Sampling System’s (NASS) Crashworthiness Data System (CDS). Special Crash Investigations (SCI) performed a field investigation to attempt to determine the cause. The SCI team completed a case summary including photograph, scene analysis, damage assessment, and retrieval of the Toyota’s EDR data file.

The EDR readout as- presented after initial download displayed plausible accelerator pedal position voltage readings along with atypical translations of the pedal position:

- -5 sec 0.78 MIDDLE
- -4 sec 0.78 MIDDLE
- -3 sec 1.91 FULL
- -2 sec 3.20 FALSE
- -1 sec 2.85 FALSE

The accelerator pedal position voltages along with the readings for brake, engine rpm, and indicated vehicle speed all appeared consistent with incident circumstances. However, the atypical position translations and the two FALSE readings had never been seen before, leading to questions about the validity of the data.

Additional review of the incident was undertaken that included contacting Toyota for clarification, re-imaging the EDR file with multiple readout software versions, and verifying that

the EDR file was properly downloaded. Once these activities were complete, NHTSA purchased the Toyota so as to obtain the EDR and to test the controls (accelerator, brake, etc) for proper operation.

The vehicle was purchased and immediately sent to VRTC for analysis. Per instructions from the reviewing team VRTC engineers performed circuit integrity checks on the accelerator pedal and the brake switch along with checking the vehicle for mechanical difficulties. All driver input control devices were verified for proper working order. In contrast to the EDR download performed by the original inspection team, VRTC removed the airbag control module from the vehicle and downloaded the EDR file directly. When the VRTC team re-imaged the EDR file the accelerator pedal position voltage and other data remained the same as the original. However, the position translation labels became plausible and the FALSE terminology was removed.

Further investigation found that the first EDR imaging included an incorrectly inputted determinate voltage scaling value of 2 volts. When this occurred, all voltage readings of 2.01 or greater were read as outside the set parameters and therefore indicated as FALSE.

To ensure best practice with all EDR data files the reviewing team re-imaged every vehicles file to ensure that this issue was an isolated incident. Toyota, (the manufacturer of the EDR imaging software) was made aware of the issue and has since removed the possibility of a user being able to input a determinate voltage value.