ECUPrint - Supplemental material

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CONCRETE NUMERICAL DATA FOR THE COMPUTED SKEWS AND VOLTAGES

In this supplemental material we provide numerical data for the skews and voltages in each of the vehicles from our experiments. All tables contain specific ID grouped around each ECU. This association is based on the computed physical fingerprints (skews and voltages) to the best we could ascertain based on the methodology in this work. Since our dataset will be made public, we invite future research works to examine this association in more detail and possibly come with amendments.

The hexadecimal value of the frame identifier is presented the **ID** column and the cycle time of the frame in milliseconds, generally taken as a median, is presented in the **Cycle** column. The following columns contain data for the clock skew, $\mathbb{C}_{\text{skew}}$, the extracted mean voltage, $\mathbb{V}_{\text{mean}}$, and maximum voltage, $\mathbb{V}_{\text{max}}$, both measured in Volts, and the identified bit time, $\mathbb{T}_{\text{bit}}$, and plateau time, $\mathbb{T}_{\text{plat}}$, both measured in microseconds, from data collected while the vehicle was running, after it was started.

Table I contains the information for the John Deere truck but omitting IDs IDs 0CFFFF21, 18EAFF21, 18FEE500, 18FFFA21, 18FFFB21, 1CEBFF00, 18FFFF21, 1CECFF00 which are on-event frames and IDs which are used for multi-frame transmission. All omitted IDs for the John Deere tractor can be easily classified on the voltage levels. Table II includes the data for Dacia Duster.

Tables III and IV for the Honda Civic and Ford Fiesta have additional columns, Δ, which contain the deviations compared to the column before for each value obtained from data collected after 60 minutes of driving. Table III contains the measurement data for the 43 IDs from Honda Civic. In Table IV we illustrate the cyclic IDs with the associated information from Ford Fiesta omitting data for IDs 455, 720, 727, 728, 72F, 7A5, 7AD which are on-event (non-cyclic), the last of them occurred only at the car start and was never seen again. Again, these IDs may be classified based on the voltage level.

The highest number of identifiers, i.e. 87 IDs, with their associated data is shown in Table V for Ford Ecosport omitting data for ID 35E which is on-event (non-cyclic). An interesting finding for this vehicle is that IDs 3A8, 3A9, 3AA, 3AB and 3AE have higher $\mathbb{T}_{\text{bit}}$ and $\mathbb{T}_{\text{plat}}$ compared to other IDs from the same ECU, i.e., ECU_1. Information for the Ford Kuga frames where we identified the highest number of ECUs based on voltage separation is contained in Table VI.

Data for Hyundai ix35 is presented in Table VII and for Dacia Logan in Table VIII. Details for Hyundai i20 and Opel Corsa are shown in Tables IX and X.

TABLE I
JOHN DEERE

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	18FFC921	250	1.000082	1.970	1.991	4.515	3.404
2	ECU1	18FEF021	100	1.000082	1.964	1.981	4.516	3.399
3	ECU1	0CFE4421	100	1.000082	1.965	1.981	4.517	3.398
4	ECU1	0CEF0321	100	1.000082	1.968	1.990	4.511	3.405
5	ECU1	0CFDCC21	1000	1.000082	1.966	1.982	4.510	3.400
6	ECU1	0C010321	50	1.000082	1.971	1.991	4.512	3.405
7	ECU1	1CFDDF21	500	1.000082	1.972	1.993	4.510	3.404
8	ECU1	0CFE4321	100	1.000082	1.970	1.989	4.511	3.403
9	ECU1	0CFE4521	100	1.000082	1.969	1.989	4.511	3.404
10	ECU1	18F00621	500	1.000082	1.963	1.977	4.517	3.395
11	ECU1	18FFF821	100	1.000082	1.968	1.984	4.511	3.401
12	ECU1	18FEFC21	1000	1.000082	1.955	1.974	4.513	3.404
13	ECU1	18EF0021	1000	1.000082	1.970	1.989	4.512	3.389
14	ECU1	18EFFF21	500	1.000082	1.971	1.994	4.512	3.406
15	ECU1	18FEF721	1000	1.000082	1.965	1.986	4.521	3.402
16	ECU1	18FEF121	100	1.000082	1.964	1.982	4.515	3.400
17	ECU1	18FEAE21	1000	1.000082	1.978	1.997	4.515	3.403
18	ECU1	04EF0021	20	1.000082	1.968	1.987	4.515	3.401
19	ECU1	18FF9721	100	1.000077	1.969	1.985	4.511	3.399
20	ECU1	18FFBF21	100	1.000077	1.978	2.002	4.512	3.408
21	ECU1	1CFFFF21	1000	1.000077	1.968	1.984	4.511	3.400
22	ECU2	0CF00300	50	1.000018	1.989	1.994	4.490	3.318
23	ECU2	18EFFA00	1000	1.000019	1.988	1.992	4.491	3.315
24	ECU2	18FEF600	500	1.000018	1.986	1.991	4.490	3.316
25	ECU2	18EF2100	100	1.000018	1.990	1.994	4.490	3.314
26	ECU2	18FEF700	1000	1.000018	1.989	1.997	4.491	3.326
27	ECU2	0CF00400	20	1.000018	1.990	1.995	4.490	3.319
28	ECU2	18FEF200	100	1.000018	1.987	1.992	4.490	3.320
29	ECU2	18FEEE00	1000	1.000019	1.986	1.992	4.491	3.327
30	ECU2	18FEEF00	500	1.000019	1.989	1.993	4.490	3.321
31	ECU2	18FEDF00	250	1.000018	1.994	1.998	4.491	3.315
32	ECU3	18F00503	100	1.000044	2.013	2.020	4.515	3.401
33	ECU3	1CFEC303	100	1.000047	2.008	2.015	4.516	3.401

TABLE II
DACIA DUSTER

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	161	10	0.999967	2.464	2.535	2.477	1.452
2	ECU1	181	10	0.999967	2.464	2.535	2.477	1.452
3	ECU1	1F9	10	0.999967	2.463	2.534	2.477	1.452
4	ECU1	511	100	0.999967	2.462	2.527	2.478	1.450
5	ECU1	65C	100	0.999967	2.464	2.533	2.477	1.451
6	ECU1	5DD	100	0.999967	2.463	2.534	2.477	1.452
7	ECU1	551	100	0.999967	2.462	2.532	2.477	1.452
8	ECU2	284	20	0.999975	1.932	1.952	2.555	1.526
9	ECU2	285	20	0.999975	1.936	1.959	2.554	1.530
10	ECU2	244	20	0.999975	1.935	1.956	2.555	1.530
11	ECU2	354	40	0.999975	1.936	1.959	2.555	1.531
12	ECU3	1A5	10	1.000220	2.084	2.084	2.547	1.404

TABLE III
HONDA CIVIC

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	Δ	$\mathbb{V}_{\text{mean}}$	Δ	$\mathbb{V}_{\text{max}}$	Δ	$\mathbb{T}_{\text{bit}}$	Δ	$\mathbb{T}_{\text{plat}}$	Δ
1	ECU1	039	40	1.000220	0.000007	1.871	0.014	1.870	0.014	2.591	0.011	1.400	-0.015
2	ECU1	305	100	1.000220	0.000007	1.884	0.013	1.883	0.012	2.590	0.011	1.399	-0.011
3	ECU1	401	300	1.000220	0.000007	1.882	0.016	1.881	0.016	2.591	0.010	1.399	-0.003
4	ECU2	1A6	20	1.000240	0.000005	1.997	-0.047	2.017	-0.050	2.575	0.003	1.473	-0.003
5	ECU2	21E	40	1.000240	0.000005	1.996	-0.044	2.016	-0.047	2.575	0.003	1.473	-0.003
6	ECU2	221	40	1.000240	0.000005	1.994	-0.042	2.014	-0.044	2.575	0.004	1.473	-0.003
7	ECU2	294	40	1.000240	0.000005	1.997	-0.045	2.018	-0.048	2.576	0.002	1.473	-0.003
8	ECU2	295	40	1.000240	0.000005	1.996	-0.044	2.015	-0.047	2.576	0.002	1.473	-0.004
9	ECU2	309	100	1.000240	0.000005	2.001	-0.048	2.020	-0.051	2.575	0.005	1.472	-0.003
10	ECU2	372	100	1.000240	0.000005	1.996	-0.047	2.016	-0.050	2.574	0.004	1.473	-0.003
11	ECU2	374	100	1.000240	0.000005	1.997	-0.048	2.018	-0.052	2.575	0.000	1.473	-0.002
12	ECU2	377	100	1.000240	0.000005	1.994	-0.049	2.013	-0.051	2.575	0.002	1.472	-0.003
13	ECU2	378	100	1.000240	0.000005	1.995	-0.048	2.015	-0.050	2.575	0.002	1.473	-0.003
14	ECU2	386	100	1.000240	0.000005	1.994	-0.041	2.014	-0.043	2.576	0.005	1.473	-0.003
15	ECU2	405	300	1.000240	0.000005	1.991	-0.040	2.011	-0.041	2.576	0.002	1.472	-0.002
16	ECU2	428	300	1.000240	0.000005	1.987	-0.040	2.004	-0.040	2.575	0.005	1.472	-0.003
17	ECU2	42D	300	1.000240	0.000004	1.991	-0.040	2.011	-0.042	2.575	0.004	1.472	-0.003
18	ECU2	42E	300	1.000240	0.000004	1.993	-0.040	2.012	-0.041	2.576	0.004	1.473	-0.004
19	ECU3	18E	10	0.999994	0.000010	2.003	0.059	2.029	0.058	2.631	0.010	1.508	-0.003
20	ECU4	091	10	0.999969	0.000011	2.018	0.002	2.027	0.004	2.617	0.010	1.422	0.002
21	ECU4	19B	10	0.999968	0.000012	2.019	-0.002	2.028	-0.001	2.617	0.010	1.422	0.002
22	ECU4	1A4	20	0.999968	0.000012	2.018	0.003	2.028	0.004	2.617	0.010	1.422	0.002
23	ECU4	1AA	20	0.999968	0.000012	2.016	0.004	2.026	0.004	2.617	0.011	1.422	0.002
24	ECU4	1B0	20	0.999968	0.000012	2.020	0.002	2.029	0.003	2.617	0.012	1.422	0.002
25	ECU4	1D0	20	0.999968	0.000012	2.020	0.002	2.030	0.003	2.617	0.011	1.422	0.002
26	ECU4	1EA	20	0.999968	0.000015	2.019	0.002	2.028	0.003	2.617	0.013	1.421	0.002
27	ECU4	255	40	0.999968	0.000015	2.018	0.003	2.027	0.003	2.618	0.010	1.422	0.001
28	ECU4	3D9	200	0.999966	0.000018	2.018	0.005	2.028	0.006	2.616	0.014	1.422	0.001
29	ECU4	406	300	0.999965	0.000019	2.017	0.004	2.027	0.002	2.618	0.013	1.422	-0.003
30	ECU5	13C	10	0.999860	0.000023	2.107	0.035	2.155	0.035	2.635	0.010	1.528	0.001
31	ECU5	158	10	0.999860	0.000023	2.108	0.034	2.155	0.035	2.635	0.010	1.528	0.002
32	ECU5	17C	10	0.999860	0.000023	2.107	0.036	2.154	0.037	2.636	0.010	1.528	0.001
33	ECU5	1DC	20	0.999861	0.000023	2.105	0.035	2.153	0.036	2.635	0.008	1.528	0.001
34	ECU5	1ED	20	0.999861	0.000023	2.103	0.038	2.151	0.038	2.635	0.009	1.529	0.001
35	ECU5	320	100	0.999861	0.000023	2.105	0.040	2.152	0.044	2.636	0.011	1.528	0.001
36	ECU5	324	100	0.999861	0.000024	2.105	0.039	2.153	0.036	2.635	0.008	1.528	-0.001
37	ECU5	328	100	0.999861	0.000024	2.107	0.035	2.155	0.035	2.636	0.006	1.528	0.001
38	ECU5	3D7	200	0.999862	0.000023	2.109	0.039	2.157	0.040	2.636	0.020	1.529	0.001
39	ECU5	400	300	0.999861	0.000023	2.107	0.039	2.155	0.037	2.636	0.008	1.529	-0.001
40	ECU5	40C	300	0.999861	0.000023	2.105	0.037	2.153	0.036	2.635	0.012	1.529	0.001
41	ECU5	454	300	0.999860	0.000024	2.105	0.039	2.154	0.038	2.636	0.009	1.528	0.001
42	ECU5	465	300	0.999860	0.000024	2.105	0.037	2.152	0.038	2.635	0.010	1.528	0.002
43	ECU6	156	10	1.000030	0.000017	2.194	0.007	2.204	0.005	2.637	0.016	1.430	-0.013

TABLE IV
FORD FIESTA

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	Δ	$\mathbb{V}_{\text{mean}}$	Δ	$\mathbb{V}_{\text{max}}$	Δ	$\mathbb{T}_{\text{bit}}$	Δ	$\mathbb{T}_{\text{plat}}$	Δ
1	ECU1	023	100	0.999861	-0.000145	2.117	0.020	2.158	0.023	2.705	0.009	1.475	-0.004
2	ECU1	04A	100	0.999861	-0.000145	2.113	0.019	2.154	0.021	2.701	0.009	1.476	0.001
3	ECU1	04B	100	0.999861	-0.000145	2.113	0.018	2.152	0.020	2.699	0.007	1.475	0.003
4	ECU1	460	100	0.999862	-0.000147	2.108	0.025	2.148	0.029	2.699	0.013	1.479	-0.001
5	ECU2	073	10	0.999948	0.000013	2.154	0.011	2.173	0.011	2.725	0.028	1.458	-0.001
6	ECU2	090	10	0.999948	0.000013	2.151	0.011	2.168	0.011	2.725	0.024	1.458	0.000
7	ECU2	20E	10	0.999948	0.000015	2.155	0.010	2.173	0.010	2.725	0.028	1.458	-0.001
8	ECU2	20F	10	0.999948	0.000015	2.155	0.010	2.174	0.009	2.725	0.027	1.458	-0.001
9	ECU2	211	10	0.999948	0.000015	2.152	0.010	2.169	0.010	2.725	0.018	1.458	0.000
10	ECU2	212	100	0.999946	0.000017	2.150	0.015	2.167	0.015	2.723	0.023	1.457	0.000
11	ECU2	213	20	0.999948	0.000015	2.156	0.009	2.175	0.008	2.725	0.032	1.458	0.000
12	ECU2	215	20	0.999946	0.000017	2.150	0.010	2.167	0.010	2.725	0.015	1.458	0.000
13	ECU2	216	20	0.999946	0.000017	2.150	0.010	2.168	0.010	2.727	0.016	1.458	0.000
14	ECU2	2C3	1000	0.999946	0.000019	2.160	0.009	2.180	0.008	2.726	0.012	1.458	-0.001
15	ECU2	4B0	10	0.999948	0.000017	2.155	0.010	2.175	0.009	2.725	0.029	1.458	0.001
16	ECU3	150	25	1.000000	0.000009	2.182	0.003	2.200	0.004	2.691	0.004	1.444	0.000
17	ECU4	190	20	1.002000	-0.000119	2.212	0.020	2.234	0.017	2.753	0.017	1.421	-0.007
18	ECU4	275	100	1.001990	-0.000118	2.214	0.017	2.236	0.015	2.755	0.002	1.422	-0.005
19	ECU4	400	100	1.001990	-0.000118	2.214	0.017	2.236	0.014	2.749	0.019	1.420	-0.005
20	ECU4	405	100	1.002000	-0.000119	2.208	0.021	2.228	0.020	2.753	0.017	1.417	-0.002
21	ECU4	430	100	1.002000	-0.000119	2.212	0.020	2.234	0.017	2.756	0.016	1.421	-0.005
22	ECU4	432	100	1.002000	-0.000113	2.218	0.014	2.240	0.010	2.762	0.010	1.421	-0.006
23	ECU4	433	100	1.001990	-0.000108	2.212	0.019	2.235	0.015	2.751	0.018	1.423	-0.009
24	ECU4	4E3	30	1.002000	-0.000118	2.210	0.020	2.232	0.018	2.754	0.013	1.420	-0.005
25	ECU4	2C1	1000	1.001990	-0.000106	2.211	0.013	2.233	0.014	2.753	0.007	1.420	-0.002
26	ECU4	4F2	1000	1.001990	-0.000116	2.209	0.023	2.229	0.022	2.748	0.019	1.421	-0.007
27	ECU5	0FD	20	0.999908	0.000019	2.242	0.022	2.312	0.020	2.705	0.008	1.480	-0.002
28	ECU5	200	10	0.999908	0.000020	2.243	0.021	2.312	0.019	2.705	0.009	1.480	-0.002
29	ECU5	201	10	0.999908	0.000020	2.241	0.022	2.311	0.021	2.705	0.008	1.480	-0.002
30	ECU5	203	30	0.999908	0.000020	2.245	0.020	2.314	0.018	2.706	0.008	1.480	-0.002
31	ECU5	205	10	0.999908	0.000020	2.241	0.023	2.311	0.021	2.705	0.006	1.480	-0.002
32	ECU5	228	25	0.999908	0.000019	2.242	0.023	2.312	0.021	2.705	0.000	1.480	-0.002
33	ECU5	231	10	0.999908	0.000022	2.238	0.024	2.308	0.022	2.704	0.007	1.480	-0.002
34	ECU5	232	10	0.999908	0.000019	2.243	0.022	2.313	0.021	2.705	0.011	1.480	-0.002
35	ECU5	261	50	0.999908	0.000022	2.246	0.019	2.315	0.019	2.709	0.002	1.479	0.000
36	ECU5	268	10	0.999908	0.000022	2.242	0.022	2.311	0.020	2.705	0.007	1.480	0.002
37	ECU5	280	50	0.999908	0.000022	2.243	0.023	2.312	0.021	2.706	0.004	1.479	0.002
38	ECU5	2BA	100	0.999906	0.000025	2.244	0.022	2.313	0.020	2.706	0.001	1.480	-0.003
39	ECU5	360	10	0.999908	0.000022	2.243	0.022	2.313	0.020	2.705	0.007	1.480	-0.002
40	ECU5	364	30	0.999908	0.000022	2.242	0.021	2.312	0.020	2.705	0.010	1.480	-0.002
41	ECU5	420	100	0.999909	0.000013	2.242	0.021	2.312	0.020	2.705	0.012	1.480	-0.001
42	ECU5	424	100	0.999910	0.000017	2.243	0.021	2.313	0.020	2.706	0.003	1.480	-0.002
43	ECU5	428	100	0.999906	0.000025	2.243	0.021	2.312	0.020	2.705	0.001	1.480	-0.003
44	ECU5	4F1	1000	0.999905	0.000028	2.240	0.019	2.311	0.019	2.710	0.017	1.480	-0.001
45	ECU6	080	15	0.956060	-0.000290	2.433	0.016	2.450	0.012	2.681	-0.002	1.370	-0.013
46	ECU6	240	10	0.956059	-0.000270	2.433	0.015	2.449	0.013	2.681	-0.003	1.368	-0.007

TABLE V
FORD ECOSPORT

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	447	1000	0.965410	1.906	1.916	2.647	1.417
2	ECU1	041	20	0.982994	1.901	1.913	2.647	1.420
3	ECU1	331	500	0.996618	1.899	1.911	2.648	1.420
4	ECU1	3B3	500	0.978530	1.904	1.915	2.651	1.420
5	ECU1	084	1000	0.999990	1.905	1.917	2.643	1.419
6	ECU1	3A9	20	0.997814	1.907	1.909	2.738	1.470
7	ECU1	3A8	20	0.997814	1.906	1.908	2.718	1.471
8	ECU1	3AB	200	0.997813	1.907	1.909	2.716	1.471
9	ECU1	3AA	200	0.997813	1.906	1.908	2.717	1.472
10	ECU1	40A	197	0.997962	1.903	1.915	2.648	1.421
11	ECU1	3B7	250	0.982993	1.904	1.915	2.647	1.421
12	ECU1	3B6	250	0.982993	1.901	1.913	2.646	1.420
13	ECU1	3AE	1000	0.997806	1.911	1.911	2.725	1.466
14	ECU1	581	1000	0.982989	1.901	1.913	2.648	1.421
15	ECU1	3B4	1000	0.982993	1.893	1.906	2.650	1.421
16	ECU1	3E3	1000	0.983002	1.903	1.915	2.646	1.421
17	ECU1	3EB	1000	0.983003	1.900	1.912	2.648	1.420
18	ECU1	43C	1000	0.983003	1.903	1.914	2.652	1.420
19	ECU1	3B1	1000	0.983001	1.904	1.917	2.654	1.422
20	ECU1	3C7	1000	0.982992	1.901	1.913	2.646	1.421
21	ECU1	3C3	1000	0.982993	1.903	1.914	2.649	1.420
22	ECU1	38D	1000	0.983001	1.909	1.918	2.654	1.418
23	ECU1	3B8	500	0.983004	1.901	1.913	2.646	1.422
24	ECU1	3B5	500	0.982994	1.902	1.914	2.645	1.421
25	ECU1	42C	50	0.982992	1.899	1.912	2.647	1.421
26	ECU1	242	39	1.008200	1.902	1.914	2.648	1.420
27	ECU2	3E2	1000	0.999998	2.116	2.131	2.668	1.405
28	ECU2	3EA	1000	0.999998	2.122	2.135	2.671	1.402
29	ECU2	455	100	0.999998	2.114	2.127	2.670	1.404
30	ECU3	43D	50	0.999999	2.196	2.234	2.682	1.478
31	ECU3	43E	50	0.999996	2.196	2.235	2.684	1.478
32	ECU3	42F	30	0.999998	2.196	2.235	2.684	1.478
33	ECU3	171	30	1.000000	2.195	2.236	2.686	1.478
34	ECU3	421	100	1.000000	2.197	2.236	2.684	1.478
35	ECU3	424	100	1.000000	2.197	2.236	2.681	1.477
36	ECU3	41F	100	1.000000	2.193	2.231	2.682	1.478
37	ECU3	42D	100	1.000000	2.194	2.233	2.679	1.478
38	ECU3	230	20	1.000000	2.193	2.232	2.682	1.479
39	ECU3	595	1000	1.000000	2.188	2.228	2.679	1.478
40	ECU3	202	20	1.000000	2.194	2.233	2.684	1.478
41	ECU3	179	100	1.000000	2.196	2.234	2.683	1.479
42	ECU3	200	20	1.000000	2.194	2.233	2.683	1.478
43	ECU3	178	100	1.000000	2.195	2.234	2.684	1.478
44	ECU3	17C	100	1.000000	2.197	2.236	2.684	1.478
45	ECU3	156	100	1.000000	2.196	2.234	2.683	1.478
46	ECU3	166	100	1.000000	2.195	2.233	2.683	1.478
47	ECU3	167	10	1.000000	2.193	2.232	2.683	1.479
48	ECU3	204	10	1.000000	2.195	2.233	2.683	1.478
49	ECU3	047	20	1.000000	2.197	2.236	2.684	1.479
50	ECU3	165	20	1.000000	2.194	2.233	2.683	1.478
51	ECU4	332	100	0.999078	2.225	2.238	2.694	1.393
52	ECU4	333	100	0.999183	2.229	2.242	2.695	1.390
53	ECU4	439	1000	0.999614	2.227	2.239	2.695	1.390
54	ECU4	43A	1000	0.999614	2.227	2.239	2.694	1.390
55	ECU4	437	1000	0.999614	2.227	2.240	2.696	1.391
56	ECU4	438	1000	0.999614	2.227	2.241	2.695	1.391
57	ECU4	091	20	0.999611	2.224	2.237	2.694	1.391
58	ECU4	23A	100	0.999612	2.223	2.236	2.694	1.391
59	ECU4	430	100	0.999612	2.227	2.240	2.694	1.393
60	ECU4	434	100	0.999612	2.227	2.240	2.695	1.392
61	ECU4	2F1	1000	0.999612	2.231	2.242	2.686	1.384
62	ECU4	092	100	0.999612	2.228	2.241	2.694	1.392
63	ECU4	59E	1000	0.999612	2.223	2.237	2.693	1.392
64	ECU4	435	100	0.999613	2.227	2.240	2.695	1.392
65	ECU4	386	1000	0.999613	2.224	2.236	2.696	1.389
66	ECU4	07E	20	0.999613	2.225	2.238	2.694	1.390
67	ECU4	217	10	0.999927	2.227	2.240	2.694	1.392
68	ECU4	4B0	20	0.999926	2.226	2.239	2.694	1.392
69	ECU4	415	20	0.999925	2.224	2.237	2.694	1.392
70	ECU4	049	20	0.999926	2.227	2.240	2.694	1.393
71	ECU4	077	20	0.999926	2.224	2.237	2.694	1.392
72	ECU4	07D	20	0.999926	2.226	2.239	2.694	1.392
73	ECU4	07F	20	0.999926	2.224	2.237	2.695	1.392
74	ECU4	214	20	0.999925	2.227	2.240	2.694	1.391
75	ECU4	216	20	0.999925	2.226	2.240	2.694	1.392
76	ECU4	213	20	0.999925	2.223	2.236	2.694	1.391
77	ECU4	076	500	0.999926	2.228	2.240	2.694	1.391
78	ECU4	416	100	0.999930	2.225	2.238	2.695	1.391
79	ECU4	083	100	0.999930	2.222	2.237	2.693	1.395
80	ECU4	326	100	0.999940	2.228	2.240	2.694	1.391
81	ECU4	3DA	1000	0.999990	2.227	2.240	2.692	1.391
82	ECU4	3E0	1000	0.999993	2.229	2.241	2.696	1.389
83	ECU4	3C8	1000	0.999993	2.229	2.242	2.695	1.391
84	ECU4	04A	100	1.000080	2.225	2.239	2.694	1.392
85	ECU4	04B	100	1.000080	2.227	2.240	2.694	1.392
86	ECU4	04C	100	1.000080	2.225	2.238	2.694	1.391
87	ECU4	082	19	1.006160	2.227	2.240	2.694	1.391

TABLE VI
FORD KUGA

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	140	20	0.999661	1.943	1.968	2.871	1.436
2	ECU1	0B0	20	0.999661	1.940	1.965	2.871	1.436
3	ECU2	455	100	0.999995	2.115	2.127	2.893	1.342
4	ECU2	3EA	1000	0.999995	2.115	2.127	2.892	1.346
5	ECU2	3E2	1000	0.999995	2.121	2.131	2.890	1.339
6	ECU3	2B0	40	1.000010	2.104	2.183	2.840	1.470
7	ECU3	06A	20	1.000010	2.105	2.186	2.840	1.471
8	ECU3	050	10	1.000010	2.106	2.187	2.840	1.471
9	ECU3	0E0	20	1.000010	2.106	2.186	2.839	1.470
10	ECU3	0D0	20	1.000010	2.105	2.185	2.840	1.470
11	ECU3	0F0	10	1.000010	2.104	2.185	2.840	1.470
12	ECU3	0F5	10	1.000010	2.106	2.184	2.840	1.470
13	ECU3	100	20	1.000010	2.106	2.187	2.840	1.470
14	ECU4	435	300	0.999983	2.134	2.178	2.905	1.400
15	ECU4	40A	125	0.999983	2.134	2.178	2.903	1.403
16	ECU4	581	1000	0.999980	2.130	2.175	2.905	1.401
17	ECU4	360	150	0.999982	2.135	2.178	2.901	1.401
18	ECU4	310	100	0.999983	2.136	2.179	2.903	1.401
19	ECU4	260	25	0.999982	2.135	2.178	2.904	1.402
20	ECU4	150	20	0.999982	2.135	2.179	2.903	1.401
21	ECU4	0C8	20	0.999982	2.134	2.177	2.904	1.401
22	ECU4	030	10	0.999983	2.134	2.179	2.903	1.405
23	ECU4	17E	100	0.999983	2.135	2.179	2.902	1.404
24	ECU4	290	30	0.999983	2.136	2.180	2.904	1.401
25	ECU4	400	250	0.999983	2.135	2.178	2.905	1.403
26	ECU4	380	300	0.999984	2.137	2.181	2.902	1.402
27	ECU4	3B4	300	0.999984	2.135	2.178	2.898	1.400
28	ECU4	420	600	0.999984	2.135	2.178	2.899	1.398
29	ECU4	405	250	1.028590	2.135	2.178	2.903	1.401
30	ECU5	090	10	1.000010	2.134	2.208	2.872	1.460
31	ECU5	060	15	1.000010	2.135	2.211	2.873	1.459
32	ECU5	2F0	90	1.000010	2.135	2.207	2.871	1.458
33	ECU5	280	30	1.000010	2.134	2.207	2.872	1.459
34	ECU5	200	25	1.000010	2.133	2.207	2.873	1.459
35	ECU5	270	30	1.000010	2.134	2.208	2.873	1.459
36	ECU5	0A0	15	1.000010	2.134	2.207	2.871	1.460
37	ECU5	1A0	20	1.000010	2.133	2.207	2.872	1.460
38	ECU5	1B0	30	1.000010	2.134	2.208	2.873	1.459
39	ECU5	130	20	1.000010	2.133	2.207	2.873	1.460
40	ECU5	138	20	1.000010	2.132	2.206	2.871	1.460
41	ECU5	080	20	1.000010	2.132	2.206	2.871	1.460
42	ECU5	120	20	1.000010	2.134	2.208	2.873	1.460
43	ECU5	070	20	1.000010	2.133	2.207	2.870	1.460
44	ECU5	0C0	20	1.000010	2.133	2.208	2.872	1.459
45	ECU5	0F8	20	1.000010	2.134	2.208	2.871	1.460
46	ECU5	2D8	60	1.000010	2.136	2.210	2.873	1.459
47	ECU5	340	120	1.000020	2.140	2.212	2.878	1.457
48	ECU6	2D0	40	0.999957	2.158	2.170	2.885	1.388
49	ECU6	218	30	0.999956	2.160	2.172	2.884	1.387
50	ECU6	252	20	0.999957	2.158	2.170	2.884	1.387
51	ECU6	190	10	0.999956	2.155	2.167	2.884	1.387
52	ECU6	2D4	60	0.999956	2.154	2.165	2.884	1.387
53	ECU6	180	20	0.999956	2.155	2.167	2.884	1.387
54	ECU6	1C0	20	0.999956	2.155	2.167	2.884	1.388
55	ECU6	1D0	20	0.999956	2.154	2.166	2.883	1.388
56	ECU6	1E0	20	0.999956	2.159	2.172	2.885	1.388
57	ECU6	210	20	0.999956	2.158	2.170	2.884	1.387
58	ECU6	160	20	0.999956	2.157	2.169	2.884	1.388
59	ECU6	213	20	0.999956	2.153	2.165	2.883	1.387
60	ECU6	388	801	1.000930	2.159	2.169	2.905	1.397
61	ECU6	208	25	1.002190	2.156	2.169	2.911	1.401
62	ECU6	2E0	70	1.000940	2.157	2.176	2.902	1.365
63	ECU7	2A0	40	0.999600	2.163	2.180	2.891	1.410
64	ECU7	2A5	40	0.999600	2.164	2.181	2.890	1.410
65	ECU7	229	40	0.999600	2.167	2.185	2.890	1.410
66	ECU7	170	20	0.999600	2.165	2.182	2.889	1.410
67	ECU7	04A	1000	1.002190	2.163	2.174	2.906	1.396
68	ECU7	04B	1000	1.002190	2.161	2.173	2.910	1.397
69	ECU8	010	10	0.999997	2.181	2.193	2.897	1.341
70	ECU9	269	30	1.000530	2.169	2.201	2.902	1.396

TABLE VII
HYUNDAI IX35

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	350	10	0.999534	1.937	1.934	2.664	1.332
2	ECU2	5E4	100	0.999966	2.115	2.130	2.744	1.532
3	ECU2	165	10	0.999966	2.120	2.132	2.747	1.527
4	ECU2	2B0	10	0.999966	2.112	2.127	2.746	1.535
5	ECU3	4F0	20	0.998440	2.136	2.147	2.667	1.415
6	ECU3	690	100	0.998440	2.138	2.148	2.669	1.409
7	ECU4	430	21	1.000070	2.137	2.165	2.639	1.455
8	ECU4	4B1	21	1.000070	2.133	2.162	2.638	1.456
9	ECU4	4D0	21	1.000070	2.133	2.161	2.638	1.454
10	ECU4	153	7	1.000070	2.122	2.154	2.637	1.456
11	ECU4	164	7	1.000070	2.137	2.165	2.637	1.456
12	ECU4	220	7	1.000070	2.134	2.162	2.637	1.455
13	ECU4	1F1	21	1.000070	2.138	2.165	2.637	1.456
14	ECU5	316	10	1.000010	2.165	2.213	2.673	1.480
15	ECU5	0A1	10	1.000010	2.165	2.212	2.673	1.481
16	ECU5	0A0	10	1.000010	2.164	2.212	2.673	1.481
17	ECU5	18F	10	1.000010	2.166	2.213	2.673	1.481
18	ECU5	329	10	1.000010	2.165	2.213	2.673	1.481
19	ECU5	260	10	1.000010	2.166	2.213	2.673	1.481
20	ECU5	2A0	10	1.000010	2.165	2.214	2.673	1.481
21	ECU5	545	10	1.000020	2.165	2.213	2.673	1.480
22	ECU6	429	20	0.999900	2.198	2.205	2.666	1.428
23	ECU6	428	20	0.999900	2.191	2.195	2.640	1.417
24	ECU6	5A0	1000	0.999921	2.201	2.212	2.674	1.445
25	ECU6	5A2	1000	0.999921	2.204	2.213	2.673	1.443
26	ECU6	5A1	1005	0.999920	2.197	2.206	2.648	1.442

TABLE VIII
DACIA LOGAN

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	500	100	0.997246	1.940	1.941	2.734	1.451
2	ECU1	1B0	20	0.999574	1.940	1.941	2.734	1.452
3	ECU1	552	100	0.999574	1.940	1.941	2.735	1.452
4	ECU1	657	100	0.999574	1.941	1.942	2.734	1.452
5	ECU1	2BC	100	0.999574	1.940	1.941	2.734	1.451
6	ECU1	69F	1000	0.999574	1.941	1.941	2.729	1.451
7	ECU1	4DE	100	0.999574	1.942	1.940	2.736	1.448
8	ECU1	55D	100	0.999574	1.940	1.940	2.735	1.451
9	ECU1	5DE	100	0.999574	1.940	1.941	2.733	1.452
10	ECU1	575	100	0.999574	1.940	1.941	2.734	1.451
11	ECU1	45C	100	0.999574	1.940	1.942	2.733	1.451
12	ECU1	5DF	100	0.999574	1.941	1.942	2.734	1.451
13	ECU1	350	100	0.999574	1.940	1.941	2.735	1.452
14	ECU1	4AC	100	0.999574	1.941	1.941	2.734	1.451
15	ECU2	217	20	0.999974	2.046	2.050	2.655	1.428
16	ECU2	2C6	20	0.999974	2.044	2.048	2.655	1.428
17	ECU2	2A9	20	0.999974	2.044	2.049	2.654	1.427
18	ECU2	18A	10	0.999974	2.045	2.050	2.655	1.428
19	ECU2	186	10	0.999974	2.044	2.048	2.654	1.428
20	ECU2	66A	100	0.999974	2.045	2.048	2.655	1.427
21	ECU2	511	100	0.999974	2.043	2.046	2.652	1.428
22	ECU2	1F6	10	0.999974	2.045	2.049	2.655	1.428
23	ECU2	5DA	100	0.999974	2.043	2.046	2.653	1.428
24	ECU2	648	100	0.999974	2.043	2.046	2.653	1.428
25	ECU2	65C	100	0.999974	2.042	2.045	2.653	1.428
26	ECU2	41A	100	0.999974	2.044	2.047	2.652	1.427
27	ECU2	41D	100	0.999974	2.046	2.049	2.657	1.427
28	ECU3	090	10	0.999973	2.118	2.128	2.679	1.459
29	ECU3	0C6	10	0.999973	2.116	2.126	2.681	1.459
30	ECU3	666	100	0.999973	2.124	2.133	2.674	1.458
31	ECU3	352	40	0.999973	2.117	2.128	2.677	1.460
32	ECU3	29C	20	0.999973	2.119	2.129	2.678	1.459
33	ECU3	12E	10	0.999973	2.117	2.128	2.680	1.459
34	ECU3	242	20	0.999973	2.116	2.127	2.680	1.460
35	ECU3	354	40	0.999973	2.122	2.133	2.678	1.459
36	ECU3	2B7	20	0.999973	2.118	2.129	2.680	1.459
37	ECU3	29A	20	0.999973	2.118	2.128	2.679	1.460
38	ECU3	5D7	100	0.999973	2.118	2.128	2.682	1.459
39	ECU4	1A0	100	1.000530	2.190	2.222	2.676	1.492
40	ECU4	62B	100	1.000530	2.192	2.225	2.677	1.492
41	ECU5	4F8	100	0.999507	2.201	2.222	2.739	1.415
42	ECU5	646	500	0.999507	2.200	2.222	2.742	1.414
43	ECU5	3B7	100	0.999507	2.199	2.220	2.738	1.415
44	ECU5	6FB	3000	0.999507	2.200	2.220	2.740	1.415
45	ECU6	564	100	1.000510	2.221	2.237	2.739	1.439
46	ECU6	653	100	1.000510	2.229	2.246	2.743	1.439

TABLE IX
HYUNDAI I20

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	593	200	0.999477	1.950	1.949	2.718	1.374
2	ECU2	043	1000	0.999163	1.966	1.965	2.693	1.351
3	ECU2	044	1000	0.999163	1.968	1.963	2.691	1.355
4	ECU2	383	20	0.999163	1.970	1.968	2.706	1.357
5	ECU3	2B0	10	1.001009	1.987	1.996	2.678	1.399
6	ECU3	381	20	1.001009	1.991	2.000	2.679	1.398
7	ECU3	251	10	1.001009	1.991	2.001	2.680	1.397
8	ECU4	549	100	1.000030	2.160	2.173	2.731	1.447
9	ECU4	5CE	100	1.000030	2.157	2.172	2.729	1.449
10	ECU4	5CF	100	1.000032	2.158	2.171	2.731	1.446
11	ECU4	547	100	1.000036	2.160	2.173	2.732	1.446
12	ECU4	1BF	10	1.000031	2.156	2.172	2.730	1.447
13	ECU4	316	10	1.000031	2.155	2.169	2.729	1.448
14	ECU4	18F	10	1.000031	2.159	2.173	2.729	1.448
15	ECU4	260	10	1.000032	2.158	2.171	2.730	1.447
16	ECU4	329	10	1.000033	2.159	2.173	2.730	1.447
17	ECU4	4E5	100	1.000031	2.156	2.169	2.733	1.447
18	ECU4	4E6	100	1.000031	2.160	2.174	2.732	1.447
19	ECU4	545	100	1.000036	2.158	2.172	2.728	1.448
20	ECU4	4E7	100	1.000031	2.158	2.171	2.731	1.448
21	ECU4	200	10	1.000032	2.158	2.172	2.728	1.447
22	ECU4	492	50	1.000031	2.160	2.172	2.731	1.446
23	ECU4	556	100	1.000031	2.156	2.171	2.727	1.450
24	ECU4	557	100	1.000033	2.156	2.170	2.727	1.448
25	ECU5	164	10	0.999958	2.199	2.210	2.710	1.472
26	ECU5	220	10	0.999958	2.199	2.210	2.710	1.471
27	ECU5	153	10	0.999958	2.198	2.210	2.706	1.472
28	ECU5	387	20	0.999958	2.199	2.209	2.713	1.471
29	ECU5	386	20	0.999958	2.199	2.211	2.709	1.472
30	ECU5	507	100	0.999958	2.199	2.211	2.707	1.472
31	ECU6	500	100	0.999542	2.294	2.297	2.800	1.419
32	ECU6	5A0	1000	0.999543	2.298	2.300	2.827	1.422
33	ECU6	5A1	1000	0.999543	2.298	2.299	2.804	1.418
34	ECU7	4F1	20	0.999936	2.392	2.395	2.669	1.411
35	ECU7	50C	100	0.999936	2.393	2.398	2.671	1.412
36	ECU7	50E	200	0.999936	2.389	2.395	2.671	1.413
37	ECU7	541	100	0.999937	2.393	2.397	2.668	1.411
38	ECU7	52A	200	0.999937	2.396	2.400	2.668	1.411
39	ECU7	553	200	0.999937	2.389	2.396	2.669	1.413
40	ECU7	5B0	1000	0.999936	2.390	2.395	2.667	1.412

TABLE X
OPEL CORSA

No.	ECU	ID	Cycle	$\mathbb{C}_{\text{skew}}$	$\mathbb{V}_{\text{mean}}$	$\mathbb{V}_{\text{max}}$	$\mathbb{T}_{\text{bit}}$	$\mathbb{T}_{\text{plat}}$
1	ECU1	361	100	0.997619	2.443	2.466	2.582	1.447
2	ECU1	460	100	0.997619	2.438	2.462	2.582	1.447
3	ECU1	1F1	100	0.997619	2.441	2.465	2.582	1.446
4	ECU1	1E1	30	0.997618	2.439	2.463	2.582	1.447
5	ECU1	0F1	10	0.997619	2.441	2.465	2.582	1.447
6	ECU1	3F1	250	0.997617	2.439	2.463	2.581	1.448
7	ECU1	440	1000	0.997619	2.440	2.464	2.582	1.447
8	ECU2	265	1000	0.999940	2.027	2.031	2.666	1.520
9	ECU2	2F9	50	0.999940	2.025	2.032	2.666	1.522
10	ECU2	1C9	20	0.999939	2.022	2.030	2.666	1.522
11	ECU2	1E9	20	0.999939	2.020	2.029	2.666	1.523
12	ECU2	0C1	10	0.999939	2.024	2.031	2.666	1.522
13	ECU2	363	100	0.999940	2.023	2.030	2.667	1.522
14	ECU2	0C5	10	0.999939	2.024	2.031	2.666	1.522
15	ECU2	530	1000	0.999940	2.027	2.031	2.670	1.521
16	ECU3	370	500	0.999998	1.946	1.949	2.606	1.378
17	ECU3	1E5	10	0.999998	1.951	1.951	2.605	1.381
18	ECU4	3F9	250	1.000060	2.200	2.269	2.612	1.508
19	ECU4	772	1000	1.000060	2.196	2.263	2.613	1.507
20	ECU4	4C1	500	1.000060	2.195	2.262	2.616	1.509
21	ECU4	4D1	500	1.000060	2.196	2.262	2.614	1.509
22	ECU4	3E9	100	1.000060	2.198	2.266	2.612	1.508
23	ECU4	3D1	100	1.000060	2.198	2.264	2.612	1.508
24	ECU4	2C5	50	1.000060	2.199	2.266	2.614	1.508
25	ECU4	1BD	50	1.000060	2.199	2.265	2.613	1.508
26	ECU4	1BC	10	1.000060	2.198	2.264	2.611	1.507
27	ECU4	0C9	10	1.000060	2.199	2.266	2.613	1.508
28	ECU4	1C1	20	1.000060	2.199	2.266	2.613	1.508
29	ECU4	1F5	20	1.000060	2.201	2.267	2.612	1.508