CAN Bus Messages

Below are details of all the CAN bus messages used to obtain the data from the vehicles.

Nissan LEAF AZE-0

The Nissan LEAF CAN messages all follow the big-endian representation. That is, the most significant byte is displayed first, in the earliest memory location. All data is presented in hexadecimal form.

EV CAN

The ‘EV CAN’ values must be sniffed. The ‘EV CAN’ bus does not support diagnostic tools. Any diagnostic questions must be sent through the ‘Car CAN’ bus. The tables show each value used on the ‘1da’ and ‘1db’ messages, with the calibration of each message.

1da

Table 1: Table depicting the individual bits of the '1da' EV CAN message and its contents.

	Bit Position							
Byte Number	7	6	5	4	3	2	1	0
0								
1								
2								
3								
4								
5								
6								
7								

Table 2: Table describing each value on the '1da' message, along with the calibration and resolution of the values.

Shading	Description	Calibration	Resolution
	Motor input voltage	Convert to decimal, multiply by 2.	2 V
	Motor Torque	Convert to decimal using Two’s Complement representation. Divide by 2	0.5 Nm
	Motor RPM	Convert to decimal using Two’s Complement representation.	1 RPM

1db

Table 3: Table depicting the individual bits of the '1db' EV CAN message and its contents.

	Bit Position							
Byte Number	7	6	5	4	3	2	1	0
0								
1								
2								
3								
4								
5								
6								
7								

Table 4: Table describing each value on the '1db' message, along with the calibration and resolution of the values.

Shading	Description	Calibration	Resolution
	Battery Current	Convert to decimal using Two's Complement representation. Divide by 2	0.5 A
	Battery Voltage	Convert to decimal, divide by 2.	0.5 V
	SOC	Convert to decimal.	1%

Car CAN

Diagnostic questions were sent on the 'Car CAN' bus. The bytes in bold are the ones containing the data of interest. The format provided shows the questions that must be sent by the diagnostic tool or Arduino, and the responses from the vehicle ECU.

Odometer reading:

Table 5: Questions and replies on Car CAN corresponding to the odometer reading.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	743	02	21	01	00	00	00	00	00
Reply	763	10	82	61	01	00	00	00	00
Question	743	30	00	00	00	00	00	00	00
Reply	763	21	00	00	00	**FF**	**FF**	**FF**	00

Calibration: Convert to decimal. Resolution is 1 km.

Battery current:

Table 6: Questions and replies on Car CAN corresponding to the battery current.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	797	03	22	12	48	00	00	00	00
Reply	79A	05	62	12	48	**FF**	**FF**	00	00

Calibration: Convert to decimal using Two's Complement representation and divide by two. Resolution is 0.5 A.

Battery temperature:

Table 7: Questions and replies on Car CAN corresponding to the battery temperature.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	79B	02	21	04	00	00	00	00	00
Reply	7BB	10	10	61	04	01	CF	**FF**	1
Question	79B	30	00	00	00	00	00	00	00
Reply	7BB	21	CC	19	FF	FF	FF	01	D3
Reply	7BB	22	18	18	00	FF	FF	FF	FF

Calibration: Convert to decimal. Resolution is $1^{O}C$.

Brake pedal position:

Table 8: Questions and replies on Car CAN corresponding to the brake pedal position.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	70E	02	21	01	00	00	00	00	00
Reply	70F	10	13	61	01	54	53	5F	AC
Question	70E	30	00	00	00	00	00	00	00
Reply	70F	21	03	48	35	3F	03	57	35
Reply	70F	22	5E	**0F**	**FF**	03	01	80	FF

Calibration: Convert to decimal. To match Bosch diagnostic tool, multiply by $^{1.3}/_{256}$.

Brake Pressure:

Table 9: Questions and replies on Car CAN corresponding to the brake pressure.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	740	03	22	12	09	00	00	00	00
Reply	760	05	62	12	09	**FF**	**FF**	00	00

Calibration: Convert to decimal. To match Bosch diagnostic tool, divide by 1.536.

Vehicle speed (km/h):

Table 10: Questions and replies on Car CAN corresponding to the vehicle speed in km/h.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	797	03	22	11	02	00	00	00	00
Reply	79A	04	62	11	02	**00**	00	00	00

Calibration: Convert to decimal. Resolution is 1 km/h.

Hyundai KONA Electric

The Hyundai KONA Electric uses a scheme where several answers are sent simultaneously from the same diagnostic question, as shown below. Sniffing was not used with the KONA, due to the CAN buses not being accessible on the Type-A connector, as they are blocked by a gateway.
Most controllers in the KONA Electric use big-endian representation. However, a few use the little-endian notation. Unless stated otherwise, big-endian notation is to be assumed.

7E4/7EC

Table 11: Formulation of the 7E4 question and 7EC response, with shaded cells indicating the bytes used.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	7E4	03	22	01	01	00	00	00	00
Reply	7EC	10	3E	62	01	01	FF	F7	E7
Question	7E4	30	00	00	00	00	00	00	00
Reply	7EC	21	FF	FF	00	00	00	00	83
Reply	7EC	22	FF	FF	FF	FF	1D	1C	1C
Reply	7EC	23	FF	FF	FF	00	00	1F	BC
Reply	7EC	24	59	C	07	00	00	93	00
Reply	7EC	25	02	38	B0	00	02	30	74
Reply	7EC	26	00	00	D1	D9	00	00	CB
Reply	7EC	27	16	01	8A	74	00	0D	01
Reply	7EC	28	71	00	00	00	00	0B	B8

Table 12: Parameters used from the 7E4 and 7EC question and response, along with the calibration and resolution for each parameter.

Shading	Description	Calibration	Resolution
	SOC	Convert to decimal, divide by 2.	0.5%
	Battery current	Convert to decimal, divide by 10.	0.1 A
	Battery voltage	Convert to decimal, divide by 10.	0.1 V
	Battery Temperature	Each byte represents a different sensor. Convert each byte separately to decimal.	$1^{O}C$

7E2/7EA

The controller responding to the 7E2 question uses a little-endian notation. Therefore, the high byte comes after the low byte.

Table 13: Formulation of the 7E2 question and 7EA response, with shaded cells indicating the bytes used.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	7E2	02	21	01	00	00	00	00	00
Reply	7EA	10	18	61	01	FF	F8	00	00
Question	7E2	30	00	00	00	00	00	00	00
Reply	7EA	21	09	21	5A	13	06	1B	03
Reply	7EA	22	00	FF	FF	FF	06	77	34
Reply	7EA	23	04	20	20	05	00	00	00

Table 14: Parameters used from the 7E2 and 7EA question and response, along with the calibration and resolution for each parameter.

Shading	Description	Calibration	Resolution
	Accelerator pedal position	Convert to decimal, divide by 2.	0.5%
	Vehicle speed	Convert to decimal, divide by 64.	$^1/_{64}\ km/h$

7D1/7D9

Table 15: Formulation of the 7D1 question and 7D9 response, with shaded cells indicating the bytes used.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	7D1	03	22	01	04	00	00	00	00
Reply	7D9	10	2D	62	01	04	FF	FF	EF
Question	7D1	30	00	00	00	00	00	00	00
Reply	7D9	21	F8	00	00	00	00	01	E9
Reply	7D9	22	00	00	00	00	FF	FF	FF
Reply	7D9	23	B1	FF	Ee	15	11	00	F0
Reply	7D9	24	D5	00	00	00	55	10	00
Reply	7D9	25	13	F5	00	00	00	00	00
Reply	7D9	26	00	FF	00	05	AA	AA	AA

Table 16: Parameters used from the 7D1 and 7D9 question and response, along with the calibration and resolution for each parameter.

Shading	Description	Calibration	Resolution
	Brake pressure	Convert to decimal using Two's Complement representation. Divide by 100.	0.01 kPa
	Brake pedal position	Convert to decimal. Divide by 10.	0.1 mm

7C6/7CE

Table 17: Formulation of the 7C6 question and 7CE response, with shaded cells indicating the bytes used.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	7C6	03	22	B0	02	00	00	00	00
Reply	7CE	10	0F	62	B0	02	60	00	00
Question	7C6	30	00	00	00	00	00	00	00
Reply	7CE	21	00	00	B8	FF	FF	FF	00
Reply	7CE	22	00	00	AA	AA	AA	AA	AA

Table 18: Parameter used from the 7C6 and 7CE question and response, along with the calibration and resolution for the parameter.

Shading	Description	Calibration	Resolution
	Odometer reading	Convert to decimal.	1 km

7E3/7EB

The controller responding to the 7E3 question uses a little-endian notation. Therefore, the high byte comes after the low byte.

Table 19: Formulation of the 7E3 question and 7EB response, with shaded cells indicating the bytes used.

Byte No.	PID	7	6	5	4	3	2	1	0
Question	7E3	02	21	02	00	00	00	00	00
Reply	7EB	10	3A	61	02	07	FF	FF	FF
Question	7E3	30	00	00	00	00	00	00	00
Reply	7EB	21	FF	FF	00	00	FF	FF	1C
Reply	7EB	22	00	10	13	10	10	FF	FF
Reply	7EB	23	01	00	A3	13	CD	AB	C2
Reply	7EB	24	CD	CC	00	12	3B	43	00
Reply	7EB	25	AD	D7	13	27	BF	E6	C1
Reply	7EB	26	CD	06	00	E1	32	00	00
Reply	7EB	27	00	00	00	00	00	00	00
Reply	7EB	28	00	00	00	00	00	00	00

Table 20: Parameters used from the 7E3 and 7EB question and response, along with the calibration and resolution for each parameter.

Shading	Description	Calibration	Resolution
	Motor RPM	Convert to decimal using Two's Complement representation.	1 RPM
	Motor Torque	Convert to decimal using Two's Complement representation. Divide by 10.	0.1 Nm