ELECTRIC POWER STEERING (EPS) ON-BOARD DIAGNOSIS

id060200813500

On-Board Diagnostic (OBD) Test Description

- The OBD test inspects the integrity and function of the EPS and outputs the results when requested by the specific tests.
- On-board diagnostic test also:
  - — Provides a quick inspection of the EPS usually performed at the start of each diagnostic procedure.
  - — Provides verification after repairs to ensure that no other faults occurred during service.
- The OBD test is divided into 2 tests:
  - — Read/clear diagnostic results, PID monitor and record.

Read/clear diagnostic results

- This function allows reading or clearing of DTCs in the EPS CM memory.

PID/Data monitor and record

- This function allows access of certain data values, input signals, calculated values, and system status information.

Reading DTCs Procedure

CMDTC self test

1. Connect the M-MDS (IDS) to the DLC-2.
2. After the vehicle is identified, select the following items from the initialization screen of the IDS.
   (1) Select “Self Test”.
   (2) Select “All CMDTCs”.
3. Verify the DTC according to the directions on the screen.
   - If any DTCs are displayed, perform troubleshooting according to the corresponding DTC inspection after recording the snapshot data.
4. After completion of repairs, clear all DTCs stored in the EPS. (See Clearing DTCs Procedure.)

ODDTC self test

1. Connect the M-MDS (IDS) to the DLC-2.
2. After the vehicle is identified, select the following items from the initialization screen of the IDS.
   (1) Select “Self Test”.
   (2) Select “Modules”.
   (3) Select “EPS”.
3. Verify the DTC according to the directions on the screen.
   - If any DTCs are displayed, perform troubleshooting according to the corresponding DTC inspection after recording the snapshot data.
4. After completion of repairs, clear all DTCs stored in the EPS. (See Clearing DTCs Procedure.)

Snapshot Data Access Procedure

1. Connect the M-MDS (IDS) to the DLC-2.
2. After the vehicle is identified, select the following items from the initialization screen of the IDS.
   (1) Select “Self Test”.
   (2) Select “Modules”.
   (3) Select “EPS”.
3. Then, select the “Retrieve CMDTCs” and perform procedures according to directions on the IDS screen.
4. Retrieve the freeze frame PID data according to the directions on the IDS screen.

Note

- Snapshot data appears at the top of the help screen when the displayed DTC is selected.
- Snapshot data stores the currently detected DTC data.

Clearing DTCs Procedure

CMDTC clearing procedure

1. Connect the M-MDS (IDS) to the DLC-2.
2. After the vehicle is identified, select the following items from the initialization screen of the IDS.
   (1) Select “Self Test”.
   (2) Select “All CMDTCs”.
3. Verify the DTC according to the directions on the screen.
4. Press the clear button on the DTC screen to clear the DTC.
5. Switch the ignition OFF.
6. Switch the ignition ON (engine off) and wait for **5 s or more**.
7. Perform DTC inspection. (See Reading DTCs Procedure.)

8. Verify that no DTCs are displayed.

ODDTC clearing procedure
1. Connect the M-MDS (IDS) to the DLC-2.
2. After the vehicle is identified, select the following items from the initialization screen of the IDS.
   (1) Select “Self Test”.
   (2) Select “Modules”.
   (3) Select “EPS”.
3. Verify the DTC according to the directions on the screen.
4. Press the clear button on the DTC screen to clear the DTC.
5. Switch the ignition OFF.
6. Switch the ignition ON (engine off) and wait for **5 s or more**.
7. Perform DTC inspection. (See Reading DTCs Procedure.)
8. Verify that no DTCs are displayed.

PID/Data Monitor and Record Procedure
1. Connect the M-MDS (IDS) to the DLC-2.
2. After the vehicle is identified, select the following items from the initialization screen of the IDS.
   (1) Select “DataLogger”.
   (2) Select “Modules”.
   (3) Select “EPS”.
3. Select the applicable PID from the PID table.
4. Verify the PID data according to the directions on the screen.

Note
- The PID data screen function is used for monitoring the calculated value of input/output signals in the module.Therefore, if the monitored value of the output parts is not within the specification, it is necessary to inspect the monitored value of input parts corresponding to the applicable output part control. In addition, because the system does not display an output part malfunction as an abnormality in the monitored value, it is necessary to inspect the output parts individually.
- When detecting DTCs, PIDs related to a malfunctioning system may not display even if the module is normal. Therefore, if a PID is not displayed, it is necessary to verify the DTC, perform malfunction diagnosis of the DTC that was detected, and do repairs.

DTC Table
×: Applicable
—: Not applicable

DTC M-MDS	Power steering malfunction indicator light illumination status	Diagnosis system component	Fail-safe	Drive cycle	Self test type*1	Memory function	Page
C200B:02	Illuminated	Torque sensor	×	—	C, D	×	(See DTC C200B:02/ C200B:16/C200B:62/ C200B:85.)
C200B:16	Illuminated	Torque sensor	×	—	C, D	×	
C200B:1C	Illuminated	Torque sensor	×	—	C, D	×	(See DTC C200B:1C/ C200C:1C.)
C200B:62	Illuminated	Torque sensor	×	—	C, D	×	(See DTC C200B:02/ C200B:16/C200B:62/ C200B:85.)
C200B:85	Illuminated	Torque sensor	×	—	C, D	×	
C200C: 1C	Illuminated	Torque sensor	×	—	C, D	×	(See DTC C200B:1C/ C200C:1C.)
C200D: 1C	Illuminated	Resolver sensor	×	—	C, D	×	(See DTC C200D:1C/ C200D:64/U2011:19/ U2011:1C/U2011:62/ U2011:72/U2011:92.)
C200D:64	Illuminated	Resolver sensor	×	—	C, D	×	
U0001:88	Illuminated	CAN system communication error	×	—	C, D	×	(See DTC U0001:88/ U0100:00/U0121:00/ U0155:00.)
U0100:00	Illuminated	Communication error to PCM	×	—	C, D	×	
U0121:00	—	Communication error to DSC CM	×	—	C, D	×	
U0155:00	—	Communication error to instrument cluster	×	—	C, D	×	

DTC M-MDS	Power steering malfunction indicator light illumination status	Diagnosis system component	Fail-safe	Drive cycle	Self test type*1	Memory function	Page
U0338:00	—	Signal error from start stop unit	×	—	C, D	×	(See DTC U0338:00/ U0515:00.)
U0401:00	Illuminated	Signal (vehicle speed) error from PCM	×	—	C, D	×	(See DTC U0401:00.)
	—	Signal (engine speed) error from PCM	×	—	C, D	×	
	—	Signal (i-stop status) error from PCM	×	—	C, D	×	
U0415:00	—	Signal error from DSC CM	×	—	C, D	×	(See DTC U0415:00.)
U0515:00	—	Signal error from start stop unit	×	—	C, D	×	(See DTC U0338:00/ U0515:00.)
U2011:19	Illuminated	EPS motor	×	—	C, D	×	(See DTC C200D:1C/ C200D:64/U2011:19/ U2011:1C/U2011:62/ U2011:72/U2011:92.)
U2011:1C	Illuminated	EPS motor	×	—	C, D	×	
U2011:62	Illuminated	EPS motor	×	—	C, D	×	
U2011:72	Illuminated	EPS motor	×	—	C, D	×	
U2011:92	Illuminated	EPS motor	×	—	C, D	×	
U2300:54	—	EPS configuration	×	—	C, D	×	(See DTC U2300:54/ U2300:55/U2300:56.)
U2300:55	Illuminated	EPS configuration	×	—	C, D	×	
U2300:56	—	EPS configuration	×	—	C, D	×	
U3000:16	Illuminated	EPS CM	×	—	C, D	×	(See DTC U3000:16/ U3000:1C/U3000:28/ U3000:41/U3000:46/ U3000:47/U3000:49/ U3000:61/U3000:73/ U3000:96.)
U3000:1C	Illuminated	EPS CM	×	—	C, D	×	
U3000:28	Illuminated	EPS CM	×	—	C, D	×	
U3000:41	Illuminated	EPS CM	×	—	C, D	×	
U3000:46	—	EPS CM	×	—	C, D	×	
U3000:47	Illuminated	EPS CM	×	—	C, D	×	
U3000:49	Illuminated	EPS CM	×	—	C, D	×	
U3000:4B	—	EPS CM	×	—	C, D	×	(See DTC U3000:4B.)
U3000:61	Illuminated	EPS CM	×	—	C, D	×	(See DTC U3000:16/ U3000:1C/U3000:28/ U3000:41/U3000:46/ U3000:47/U3000:49/ U3000:61/U3000:73/ U3000:96.)
U3000:73	Illuminated	EPS CM	×	—	C, D	×	
U3000:96	Illuminated	EPS CM	×	—	C, D	×	
U3003:16	Illuminated	Battery power supply	×	—	C, D	×	(See DTC U3003:16.)
U3003:17	Illuminated	Battery power supply	×	—	C, D	×	(See DTC U3003:17.)

*1 : C: CMDTC self test, D: ODDTC self test

Fail-safe Function Table

DTC M-MDS	Fail-safe control status
C200B:02	Control disabled
C200B:16	Control disabled
C200B:1C	Control disabled
C200B:62	Control disabled
C200B:85	Control disabled
C200C:1C	Control disabled
C200D:1C	Control disabled
C200D:64	Control disabled
U0001:88	Control enabled
U0100:00	Control is maintained by gradually changing the controlled vehicle speed and setting it to **120 km/h {74.6 mph}**
U0121:00	Control enabled
U0155:00	Control enabled
U0338:00	Control enabled

DTC M-MDS	Fail-safe control status
U0401:00	• Vehicle speed signal malfunction — Control is maintained by gradually changing the controlled vehicle speed and setting it to **120 km/h {74.6 mph}** • Engine speed signal malfunction — Control enabled • i-stop status signal malfunction — EPS i-stop control is not operated, and normal control is maintained
U0415:00	Control enabled
U0515:00	Control enabled
U2011:19	Control disabled
U2011:1C	Control disabled
U2011:62	Control disabled
U2011:72	• Phase 1 open circuit malfunction is detected in the EPS motor — Control is maintained in the backup control • Other malfunction detected in EPS motor internal circuit — Control disabled
U2011:92	Control disabled
U2300:54	Control enabled
U2300:55	Control enabled
U2300:56	Control enabled
U3000:16	Control disabled
U3000:1C	Control disabled
U3000:28	Control disabled
U3000:41	Control disabled
U3000:46	Control is maintained in fail mode
U3000:47	Control disabled
U3000:49	Control disabled
U3000:4B	Control is maintained in fail mode
U3000:61	Control disabled
U3000:73	Control disabled
U3000:96	Control disabled
U3003:16	Control is maintained by gradually decreasing the motor control current However, control is inhibited if the power supply voltage is the specified value of less.
U3003:17	Control disabled

PID/DATA Monitor Table

Note

- If the PID/data monitor value “STR_ANG” is inspected, perform the following procedure before inspecting.
  1. Switch the ignition to OFF, and maintain this condition for **approx. 3 s**.
  2. Set the vehicle wheels in the straight-ahead position.
  3. Switch the ignition ON (engine off or on).

PID name (definition) M-MDS display	Unit/Operation	Operation Status (Reference)	Inspection item(s)	EPS control module terminal
CEN_TRQ_S	Nm	• Torque sensor neutral position: Near 0 Nm	• Steering column replacement (See STEERING WHEEL AND COLUMN REMOVAL/ INSTALLATION.)	—
ECU_IN_TMP	°C, °F	• Displays temperature of board in EPS control module: -40°C—+215°C {-40°F—419°F}	• EPS CM replacement (See STEERING WHEEL AND COLUMN REMOVAL/ INSTALLATION.)	—
ENG_RPM	RPM	• Engine stopped: 0 RPM • Engine rotating at **3,000 RPM**: 3,000 RPM	• PCM inspection (See PCM INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See PCM INSPECTION [SKYACTIV-D 2.2].)	—

PID name (definition) M-MDS display	Unit/Operation	Operation Status (Reference)	Inspection item(s)	EPS control module terminal
MT_CURRENT	A	• When not steered: Near 0 A • Steered: Changes to positive or negative	• EPS CM replacement (See STEERING WHEEL AND COLUMN REMOVAL/ INSTALLATION.)	—
OH_CR_C	Yes/No	• Is the overheating prevention control (Complete) operating?	—	—
OH_CR_M	Yes/No	• Is the overheating prevention control (Middle) operating?	—	—
OH_HIST_C	Yes/No	• Has the overheating prevention control (Complete) operated before?	—	—
OH_HIST_M	Yes/No	• Has the overheating prevention control (Middle) operated before?	—	—
OH_IG_CNT_C	—	• History of overheating prevention control (Complete) • Number of times vehicle is driven (ignition switched ON (engine off or on)) after overheating prevention control operates	—	—
OH_IG_CNT_M	—	• History of overheating prevention control (Middle) • Number of times vehicle is driven (ignition switched ON (engine off or on)) after overheating prevention control operates	—	—

PID name (definition) M-MDS display	Unit/Operation	Operation Status (Reference)	Inspection item(s)	EPS control module terminal
STR_ANG	°	• Steering wheel position when ignition is switched ON (engine off or on): **0°** • Steered left: Changes to **0°—Positive** • Steered right: Changes to **0°—Negative** **Note** • The signal displayed in this item is a steering angle (relative angle) signal.	Perform the DTC inspection for the PCM, DSC HU/CM, and EPS CM. If a DTC is displayed after performing the DTC inspection for the PCM, DSC HU/CM, and EPS CM, repair the malfunctioning part according to the applicable DTC troubleshooting. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-D 2.2].) (See ON-BOARD DIAGNOSIS [DYNAMIC STABILITY CONTROL (DSC)].) (See EPS CONTROL MODULE INSPECTION.) After performing the DTC inspection, perform the following procedures: • Switch the ignition off and maintain condition for approx. **3 s**. • Set the vehicle wheels straight-ahead. • Switch the ignition ON (engine off or on). If an abnormal value is indicated after verifying the value of the STR_ANG again, replace the EPS CM.	—
STR_ROT_SPD	°/s	• Not steered: Near 0 °/s • Steered: Changes according to steering speed	• EPS CM replacement (See STEERING WHEEL AND COLUMN REMOVAL/ INSTALLATION.)	—
STR_TRQ_S_M	Nm	• Not steered: Near 0 Nm • Steered left: Changes to 0 Nm—Positive • Steered right: Changes to 0 Nm—Negative	• EPS CM replacement (See STEERING WHEEL AND COLUMN REMOVAL/ INSTALLATION.)	—
STR_TRQ_S_S	Nm	• Not steered: Near 0 Nm • Steered left: Changes to 0 Nm—Positive • Steered right: Changes to 0 Nm—Negative	• EPS CM replacement (See STEERING WHEEL AND COLUMN REMOVAL/ INSTALLATION.)	—
VPWR	V	• Engine stopped: Approx. **12 V** • Idling: Approx. **14 V**	• Battery inspection (See BATTERY INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See BATTERY INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5 (WITHOUT i-stop)].) (See BATTERY INSPECTION [SKYACTIV-D 2.2].) • Power supply circuit inspection (ignition switch, fuses)	1B
VSPD	KPH, MPH	• Vehicle stopped: 0 KPH, 0 MPH • Vehicle speed **20 km/h {12 mph}**: 20 KPH, 12 MPH	• PCM inspection (See PCM INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See PCM INSPECTION [SKYACTIV-D 2.2].)	—

Snapshot Data Table

Note

- The EPS CM stores the following two types of information when a DTC is detected and displays snap shot data in the M-MDS.
  - — Vehicle information detected by EPS CM
  - — Vehicle information detected by instrument cluster and received by start stop unit via CAN signal
- Refer to PID monitor table for confirm the EPS system operation status while the EPS does not store the DTC. (See PID/DATA Monitor Table.)
- Snapshot data items are not displayed, according to detected DTC.

Snapshot data item	Unit	Data contents	Data read/use method	Corresponding data monitor items
AAT	°C, °F	Ambient air temperature	Not applicable	Not applicable
APP_STATUS	Accelerator Pedal Off/ Under 20%/ Over 20%/ FAIL	Accelerator pedal position	Not applicable	Not applicable
CEN_TRQ_S	Nm	Center value of torque sensor	CEN_TRQ_S	CEN_TRQ_S
CFG_STATUS	Config Complete/ Not Configured/ Config Error	Instrument cluster configuration status	Not applicable	Not applicable
ECT_STATUS	Under 0 degrees C/ 0 - Under 80 degrees C/ Over 80 degrees C/ FAIL	Engine coolant temperature status	Not applicable	Not applicable
ECU_IN_TMP	°C, °F	ECU internal temperature	ECU_IN_TMP	ECU_IN_TMP
ENG_RPM	RPM	Engine speed	ENG_RPM	ENG_RPM
IC_VPWR	V	Instrument cluster power supply	• The EPS CM constantly receives the power supply voltage value of the instrument cluster sent via CAN signal from the instrument cluster. • If a DTC is detected, the EPS CM records the power supply voltage of the instrument cluster when the DTC was detected, and it is displayed in the M-MDS.	VPWR*2

Snapshot data item	Unit	Data contents	Data read/use method	Corresponding data monitor items
IG-ON_TIMER	hh:mm:ss*1	Elapsed time since ignition was switched ON **Note** • The instrument cluster records the elapsed time since the ignition was switched ON.	• The EPS CM constantly receives the elapsed time since the ignition was switched ON sent via CAN signal from the instrument cluster. • If a DTC is detected, the EPS CM records the elapsed time since the ignition was switched ON when the DTC was detected, and it is displayed in the M-MDS.	Not applicable
MT_CURRENT	A	Motor current	MT_CURRENT	MT_CURRENT
OH_CR_C	No/Yes	Current complete overheat protection	OH_CR_C	OH_CR_C
OH_CR_M	No/Yes	Current middle overheat protection	OH_CR_M	OH_CR_M
OH_HIST_C	No/Yes	History of complete overheat protection	OH_HIST_C	OH_HIST_C
OH_HIST_M	No/Yes	History of middle overheat protection	OH_HIST_M	OH_HIST_M
OH_IG_CNT_C	—	IG ON counter after complete overheat protection	OH_IG_CNT_C	OH_IG_CNT_C
OH_IG_CNT_M	—	IG ON counter after middle overheat protection	OH_IG_CNT_M	OH_IG_CNT_M
PWR_MODE_KEY	Key Out/ Key Recently Out/ Key Approved (Position 0)/ Post Accessory (Position 0)/ Accessory (Position 1)/ Post Ignition (Position 1)/ Ignition On (Position 2)/ Running (Position 2)/ Running - Starting In Progress (Position 2)/ Crank (Position 3)	• Key Out: Ignition switched to off • Key Recently Out (Position 0): Elapsed time **within 3 s** since ignition was switched to off • Accessory (Position 1): Ignition is switched to ACC • Post Ignition (Position 2): Elapsed time **within 3 s** since ignition was switched ON • Ignition On (Position 2): Ignition switched ON (engine off) • Running (Position 2): Ignition switched ON (engine on) • Running - Starting: Cranking condition	• The EPS CM constantly receives the ignition switch status sent via CAN signal from the instrument cluster. • If a DTC is detected, the EPS CM records the ignition switch status when the DTC was detected, and it is displayed in the M-MDS.	Not applicable
RPM_STATUS	Engine Stop/ Under 1500rpm/ Over 1500rpm/ FAIL	Engine RPM status	• The EPS CM constantly receives the ignition switch status sent via CAN signal from the instrument cluster. • If a DTC is detected, the EPS CM records the ignition switch status when the DTC was detected, and it is displayed in the M-MDS.	TACHOMTR*2

Snapshot data item	Unit	Data contents	Data read/use method	Corresponding data monitor items
SHIFT_STATUS	P/N D/ R/ FAIL	Shift position status	• The EPS CM constantly receives the selector lever position sent via CAN signal from the instrument cluster. • If a DTC is detected, the EPS CM records the selector lever position when the DTC was detected, and it is displayed in the M-MDS.	Not applicable
STR_ANG	°	Steering wheel angle	STR_ANG	STR_ANG
STR_ROT_SPD	°/s	Steering wheel rotation speed	STR_ROT_SPD	STR_ROT_SPD
STR_TRQ_S_M	Nm	Steering shaft torque (Main)	STR_TRQ_S_M	STR_TRQ_S_M
STR_TRQ_S_S	Nm	Steering shaft torque (Sub)	STR_TRQ_S_S	STR_TRQ_S_S
TOTAL_DIST	km, ft, mi	Accumulated total traveled distance from completion of vehicle until EPS CM detects DTC (Odometer value in instrument cluster)	The distance traveled when the EPS CM detected a DTC can be calculated by performing the following procedure. 1. Verify the odometer value in the instrument cluster. 2. Verify the snap shot data item TOTAL_DIST. 3. Subtract 2 from 1.	Not applicable
TOTAL_TIME	hh:mm:ss*1	Accumulated total elapsed time since vehicle completion until EPS CM detects a DTC **Note** • When the ROOM removed, and the ignition is switched to off, the time is not included in the elapsed time.	The elapsed time when the EPS CM detected a DTC can be calculated by performing the following procedure. 1. Verify the PID item TOTAL_TIME of the instrument cluster. 2. Verify the snap shot data item TOTAL_TIME. 3. Subtract 2 from 1.	TOTAL_TIME*2
VPWR	V	Power supply	VPWR	VPWR
VSPD	KPH, MPH	Vehicle speed	VSPD	VSPD
VSPD_STATUS	Stop/ 0 - 10km/h/ Over 10km/h/ FAIL	Vehicle speed status	• The EPS CM constantly receives the vehicle speed sent via CAN signal from the instrument cluster. • If a DTC is detected, the EPS CM records the vehicle speed when the DTC was detected, and it is displayed in the M-MDS.	SPEEDOMTR*2

*1 : The seconds may be indicated after the decimal point.
*2 : Instrument cluster PID (See PID/DATA MONITOR TABLE [INSTRUMENT CLUSTER].)