DTC	U0100/211	LOST COMMUNICATION WITH ECM/PCM ”A”
DTC	U0100/212	LOST COMMUNICATION WITH ECM/PCM ”A”
DTC	U0100/530	LOST COMMUNICATION WITH ECM/PCM ”A”
DTC	U0111/208	LOST COMMUNICATION WITH BATTERY ENERGY CONTROL MODULE ”A”
DTC	U0111/531	LOST COMMUNICATION WITH BATTERY ENERGY CONTROL MODULE ”A”
DTC	U0129/220	LOST COMMUNICATION WITH BRAKE SYSTEM CONTROL MODULE
DTC	U0129/222	LOST COMMUNICATION WITH BRAKE SYSTEM CONTROL MODULE
DTC	U0129/528	LOST COMMUNICATION WITH BRAKE SYSTEM CONTROL MODULE
DTC	U0129/529	LOST COMMUNICATION WITH BRAKE SYSTEM CONTROL MODULE
DTC	U0131/433	LOST COMMUNICATION WITH POWER STEERING CONTROL MODULE
DTC	U0131/434	LOST COMMUNICATION WITH POWER STEERING CONTROL MODULE
DTC	U0146/435	LOST COMMUNICATION WITH GATEWAY ”A”

cardiagn.com

CIRCUIT DESCRIPTION

The HV control ECU transmits and receives signals to and from the ECM, battery ECU, skid control ECU, power steering ECU, and the gateway ECU via CAN (Controller Area Network) communication.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
U0100	211	CAN communication problem between ECM and HV control ECU (no signal input)	• CAN communication system
U0100	212	CAN communication problem between ECM and HV control ECU (transmission error)	• CAN communication system
U0100	530	CAN communication problem between ECM and HV control ECU (CAN communication system malfunction)	• CAN communication system
U0111	208	CAN communication problem between battery ECU and HV control ECU (no signal input)	• CAN communication system
U0111	531	CAN communication problem between battery ECU and HV control ECU (CAN communication system malfunction)	• CAN communication system
U0129	220	CAN communication problem between skid control ECU and HV control ECU (no signal input)	• CAN communication system
U0129	222	CAN communication problem between skid control ECU and HV control ECU (CAN communication system malfunction)	• CAN communication system
U0129	528	CAN communication problem between skid control ECU and HV control ECU (transmission error)	• CAN communication system
U0129	529	CAN communication problem between skid control ECU and HV control ECU (regenerative torque malfunction)	• CAN communication system
U0131	433	CAN communication problem between power steering ECU and HV control ECU (no signal input)	• CAN communication system
U0131	434	CAN communication problem between power steering ECU and HV control ECU (CAN communication system malfunction)	• CAN communication system
U0146	435	CAN communication problem between gateway ECU and HV control ECU (no signal input)	• CAN communication system

MONITOR DESCRIPTION

If the HV control ECU detects malfunction in CAN communication with the ECM or battery ECU, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

U0100:

Related DTCs	U0100 (INF 211): Communication between ECM and hybrid vehicle control ECU/Receiving check for the specific frame U0100 (INF 212): Communication between ECM and hybrid vehicle control ECU/Sending data check U0100 (INF 530): Communication between ECM and hybrid vehicle control ECU/Receiving check for the all frame
Required sensor/components	Main: ECM Sub: CAN bus line
Frequency of operation	Continuous
Duration	U0100 (INF 211, 212): 0.1 second or more U0100 (INF 530): 1.91 second or more
MIL operation	Immediately
Sequence of operation	None

cardiagn.com

U0111:

Related DTCs	U0111 (INF 208): Communication between battery ECU and hybrid vehicle control ECU/Receiving check for the specific frame U0111 (INF 531): Communication between battery ECU and hybrid vehicle control ECU/Receiving check for the all frame
Required sensor/components	Main: Battery ECU Sub: CAN bus line
Frequency of operation	Continuous
Duration	U0111 (INF 208): 0.1 second or more U0111 (INF 531): 1.6 second or more
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

CAN communication	Communication failure

COMPONENT OPERATING RANGE

ECM	DTC U0100 (INF 211/212/530) is not detected
Battery ECU	DTC U0111 (INF 208/531) is not detected

INSPECTION PROCEDURE

1	READ OUTPUT DTC(CODES ALL)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / CODES ALL.
(e) Read and record CAN communication malfunction DTCs.

Result:

Display (DTC Output)	Proceed to
U0100 (INF 211) or U0129 (INF 220)	A
U0100 (INF 211) and CAN communication malfunction DTCs	B
U0129 (INF 220) and CAN communication malfunction DTCs	B
P3108 (INF 594) and CAN communication malfunction DTCs	B

HINT:

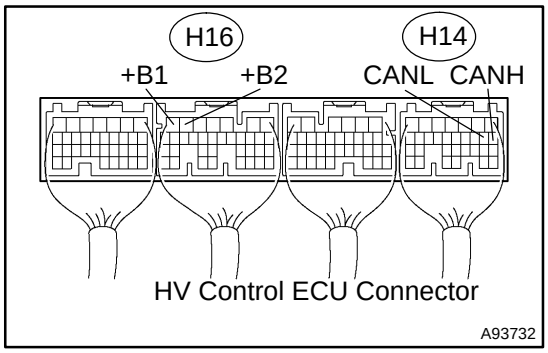
- When DTCs other than CAN communication malfunction DTCs are output simultaneously, first correct the CAN communication problem, and then perform troubleshooting for other DTCs.
- DTC P3108 (INF 594) is one of the DTCs that indicates a CAN communication malfunction.

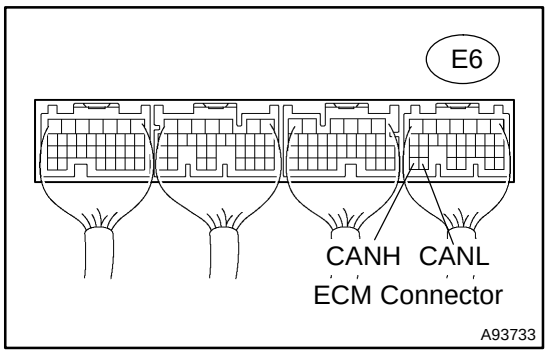
B → **GO TO CAN COMMUNICATION SYSTEM (See page 05–2602)**

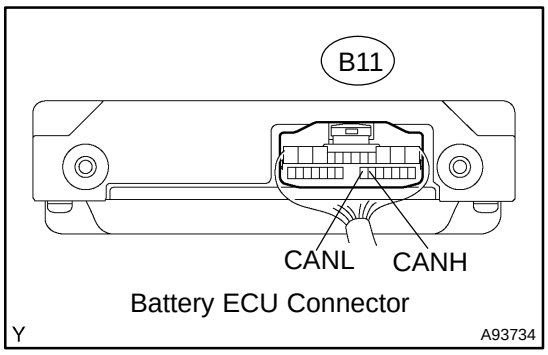
A

cardiagn.com

2 CHECK TERMINAL OF ECM AND ECUS(+B1, +B2, CANH AND CANL TERMINALS)







(a) Check connection condition of each connector of the HV control ECU, ECM and battery ECU, as well as contact condition of each terminal shown in the table below.

Type of ECU	Terminal No.	Symbols
HV control ECU	H16–7	+B1
HV control ECU	H16–6	+B2
HV control ECU	H14–8	CANH
HV control ECU	H14–9	CANL
ECM	E6–31	CANH
ECM	E6–30	CANL
Battery ECU	B11–18	CANH
Battery ECU	B11–19	CANL

OK: Connectors have been connected securely and there is no poor contact on each terminal.

NG → **CONNECT SECURELY**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)

cardiagn.com

DTC	P0336/137	CRANKSHAFT POSITION SENSOR ”A” CIRCUIT RANGE/PERFORMANCE

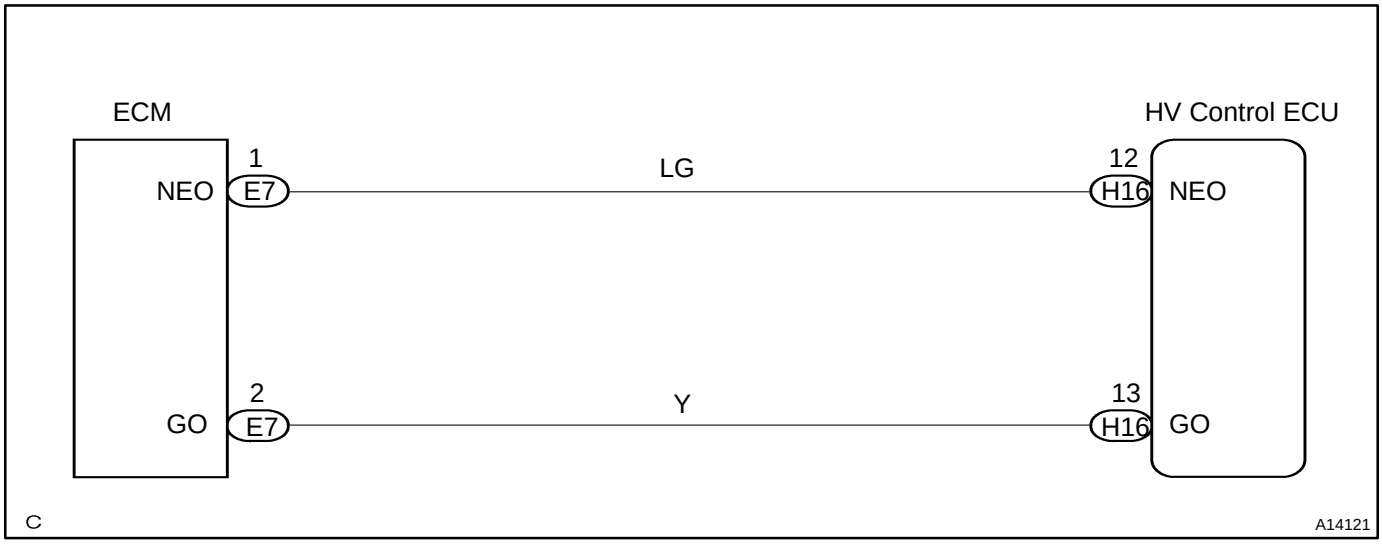
DTC	P0340/532	CAMSHAFT POSITION SENSOR ”A” CIRCUIT

CIRCUIT DESCRIPTION

If there is any malfunction in the communication values or pulse inputs, the HV control ECU detects it by comparing the following three speeds: the engine speed transmitted by the ECM via CAN (Controller Area Network) communication, the engine speed obtained through pulse inputs, and the engine speed calculated from the MG1 and MG2 speeds.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0336	137	Engine speed sensor deviation malfunction (CAN communication)	• Wire harness or connector • Crankshaft position sensor • Camshaft position sensor • HV control ECU
P0340	532	Engine speed sensor deviation malfunction (pulse signal)	• Wire harness or connector • Crankshaft position sensor • Camshaft position sensor • HV control ECU

WIRING DIAGRAM



cardiagn.com

INSPECTION PROCEDURE

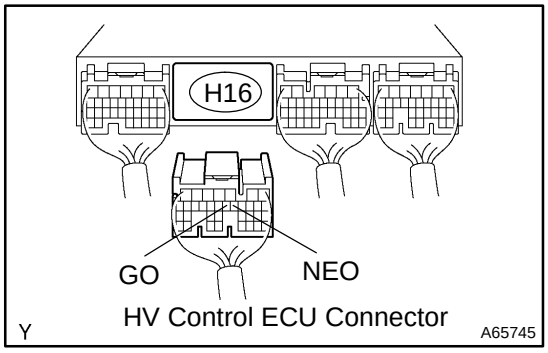
1	READ OUTPUT DTC(ENGINE)

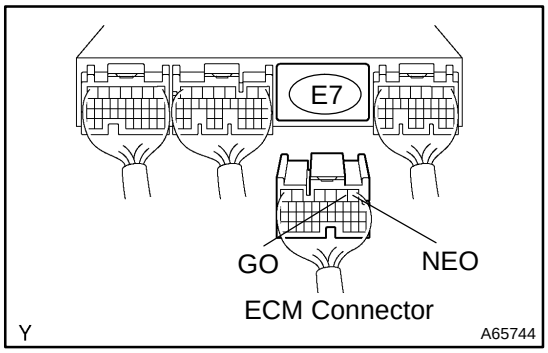
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / ENGINE AND ECT / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–55)**

NO

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – ECM)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the E7 ECM connector.
(c) Check the resistance between the wire harness side connectors.
Standard (Check for open):

Tester Connection	Specified Condition
NEO (H16–12) – NEO (E7–1)	Below 1 Ω
GO (H16–13) – GO (E7–2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
NEO (H16–12) or NEO (E7–1) – Body ground	10 kΩ or higher
GO (H16–13) or GO (E7–2) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	INSPECT CRANKSHAFT POSITION SENSOR (See Page 18–6)

NG → **REPLACE CRANKSHAFT POSITION SENSOR (See page 18–10)**

OK

cardiagn.com

4	INSPECT CAMSHAFT POSITION SENSOR (See page 18–6)

NG → REPLACE CAMSHAFT POSITION SENSOR (See page 18–8)

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0338/600	CRANKSHAFT POSITION SENSOR ”A” CIRCUIT HIGH INPUT

DTC	P0343/601	CAMSHAFT POSITION SENSOR ”A” CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

Refer to DTC P0336 (INF 137) on page 05–459.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0338	600	NEO signal circuit malfunction	• Wire harness or connector • HV control ECU
P0343	601	GO signal circuit malfunction	• Wire harness or connector • HV control ECU

WIRING DIAGRAM

Refer to DTC P0336 (INF 137) on page 05–459.

INSPECTION PROCEDURE

1	READ OUTPUT DTC(ENGINE)

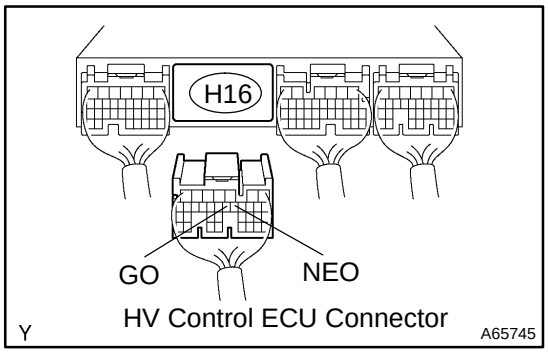
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / ENGINE AND ECT / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

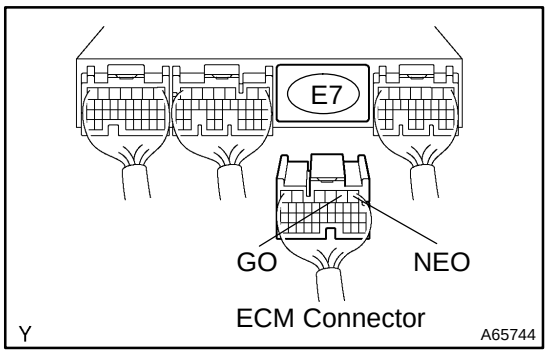
YES → **GO TO RELEVANT DTC CHART (See page 05–55)**

NO

cardiagn.com

2 CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – ECM)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the E7 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
NEO (H16–12) – NEO (E7–1)	Below 1 Ω
GO (H16–13) – GO (E7–2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
NEO (H16–12) or NEO (E7–1) – Body ground	10 kΩ or higher
GO (H16–13) or GO (E7–2) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0560/117 SYSTEM VOLTAGE

CIRCUIT DESCRIPTION

Since the ECU back–up power source is used for DTCs and freeze frame data memory, the back–up power source (BATT) continues to be supplied to the HV control ECU even though the power switch is turned OFF.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0560	117	HV control ECU back–up power source circuit malfunction	• Wire harness or connector • HEV fuse

MONITOR DESCRIPTION

If 3 or more seconds have elapsed with a voltage of 3.3 V or less at the BATT terminal at the HV control ECU, the HV control ECU will determine that a malfunction has occurred in the back–up power supply system, and set a DTC. It will illuminate the MIL the next time the engine is started.

MONITOR STRATEGY

Related DTCs	P0560 (INF 117): Battery signal malfunction
Required sensor/components	Main: Back–up power source circuit Sub: Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	3 seconds
MIL operation	Immediate after next power switch ON (IG)
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
A/D converter	Normal
Auxiliary battery voltage	9.5 V or more

TYPICAL MALFUNCTION THRESHOLDS

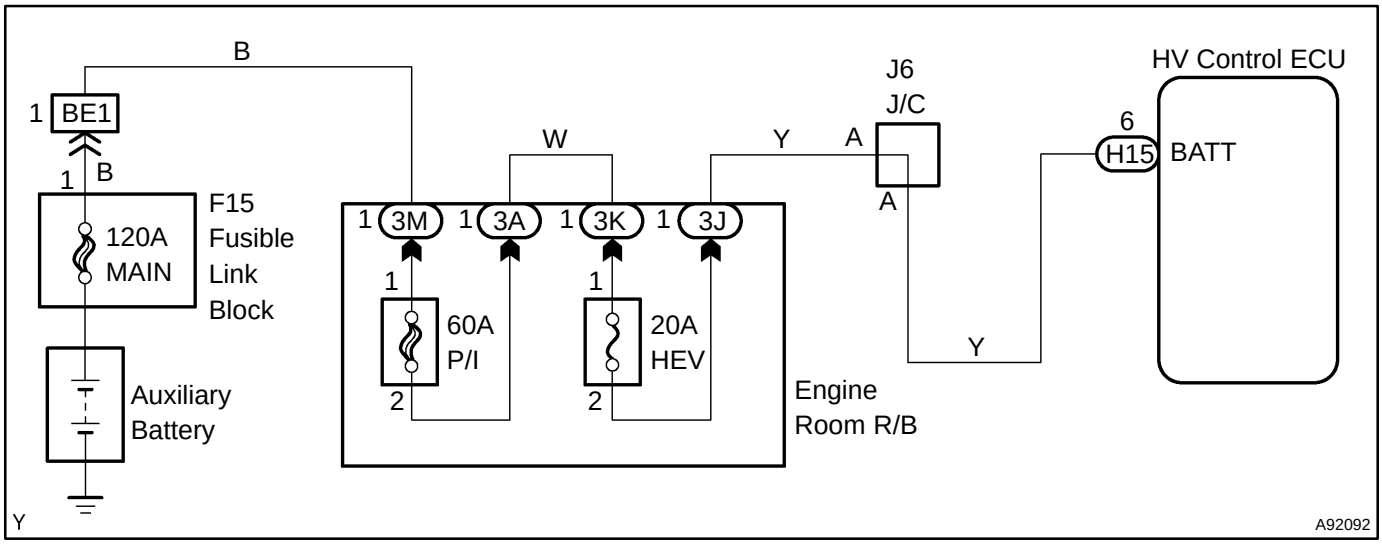
Condition (a) or (b) is met	–
(d) Input voltage for BATT signal	Less than 2.5 V
(e) Abnormal flag for SRAM	ON

COMPONENT OPERATING RANGE

Auxiliary battery voltage	Between 9 and 14 V

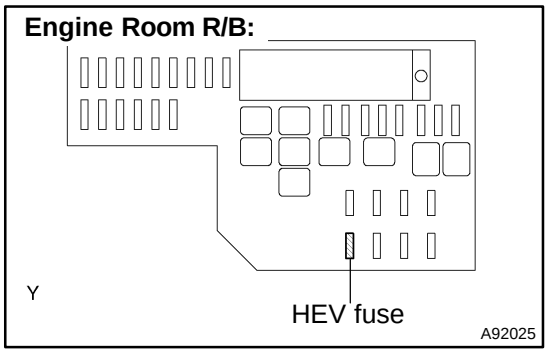
cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK FUSE(HEV 20 A)



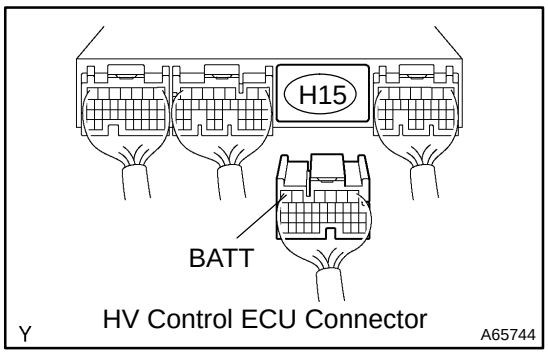
(a) Remove the HEV fuse from the engine room R/B.
(b) Check the resistance in the HEV fuse.
Standard: Below 1 Ω
(c) Reinstall the HEV fuse.

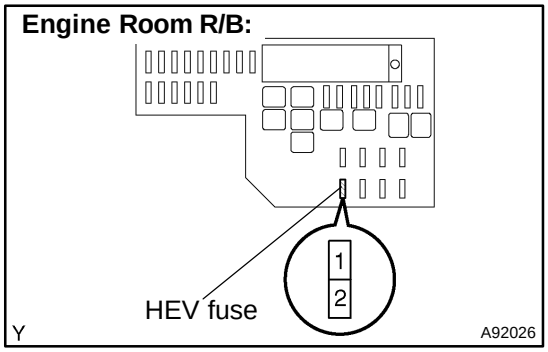
NG → **Go to step 3**

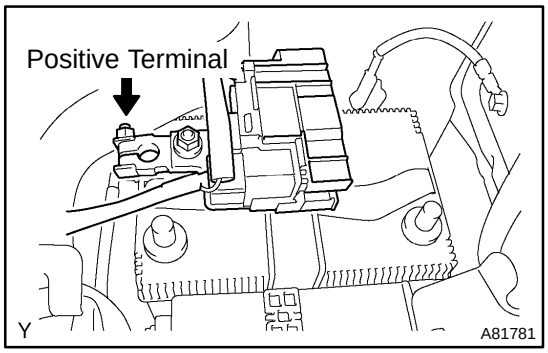
OK

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – AUXILIARY BATTERY)







(a) Disconnect the negative auxiliary battery terminal.
(b) Disconnect the positive auxiliary battery terminal.
(c) Remove the HEV fuse from the engine room R/B.
(d) Disconnect the H15 HV control ECU connector.
(e) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
BATT (H15–6) – HEV fuse (2)	Below 1 Ω

NOTICE:

When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
HEV fuse (1) – positive auxiliary battery terminal	Below 1 Ω

NOTICE:

When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(g) Reconnect the HV control ECU connector.
(h) Reinstall the HEV fuse.
(i) Reconnect the positive auxiliary battery terminal.
(j) Reconnect the negative auxiliary battery terminal.

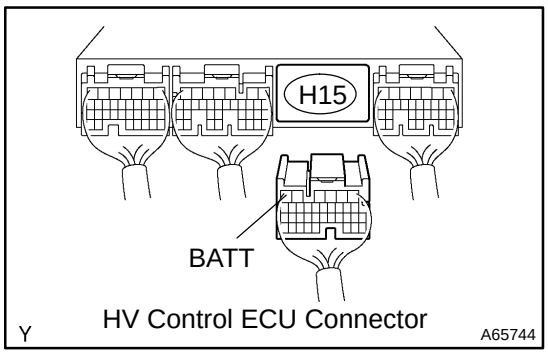
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

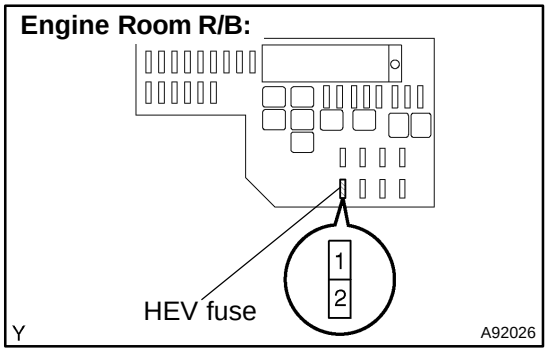
OK

CHECK AND REPAIR CONNECTOR CONNECTION

cardiagn.com

3	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – HEV FUSE)





(a) Disconnect the H15 HV control ECU connector.
(b) Remove the HEV fuse from the engine room R/B.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for short):

Tester Connection	Specified Condition
BATT (H15–6) or HEV fuse (2) – Body ground	10 kΩ or higher

NOTICE:
When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(d) Reinstall the HEV fuse.
(e) Reconnect the HV control ECU connector.

NG → **AFTER REPAIRING OR REPLACING HARNESS OR CONNECTOR, REPLACE FUSE (HEV 20A)**

OK

REPLACE FUSE (HEV 20 A)

cardiagn.com

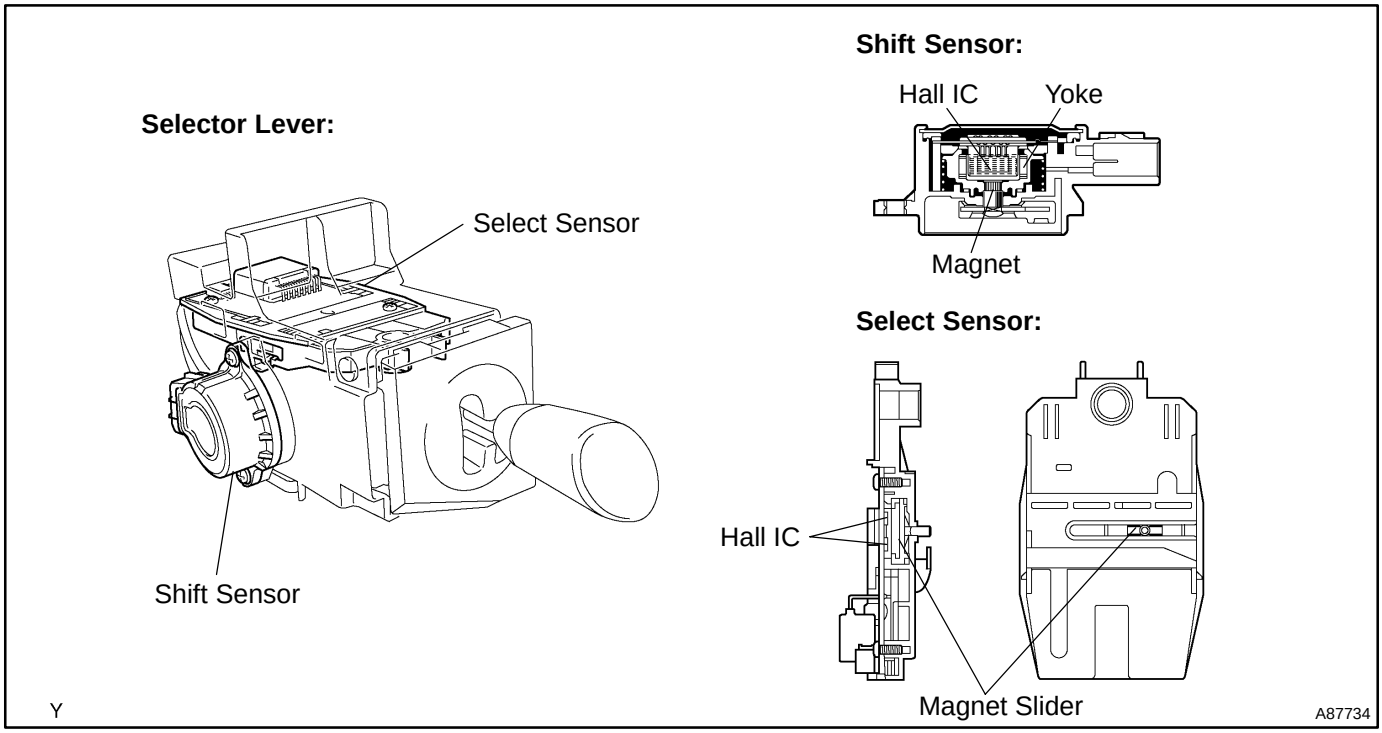
DTC	P0705/571	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/572	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/573	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/574	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/575	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/576	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/577	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/578	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/595	TRANSMISSION RANGE SENSOR CIRCUIT
DTC	P0705/596	TRANSMISSION RANGE SENSOR CIRCUIT

cardiagn.com

HINT:

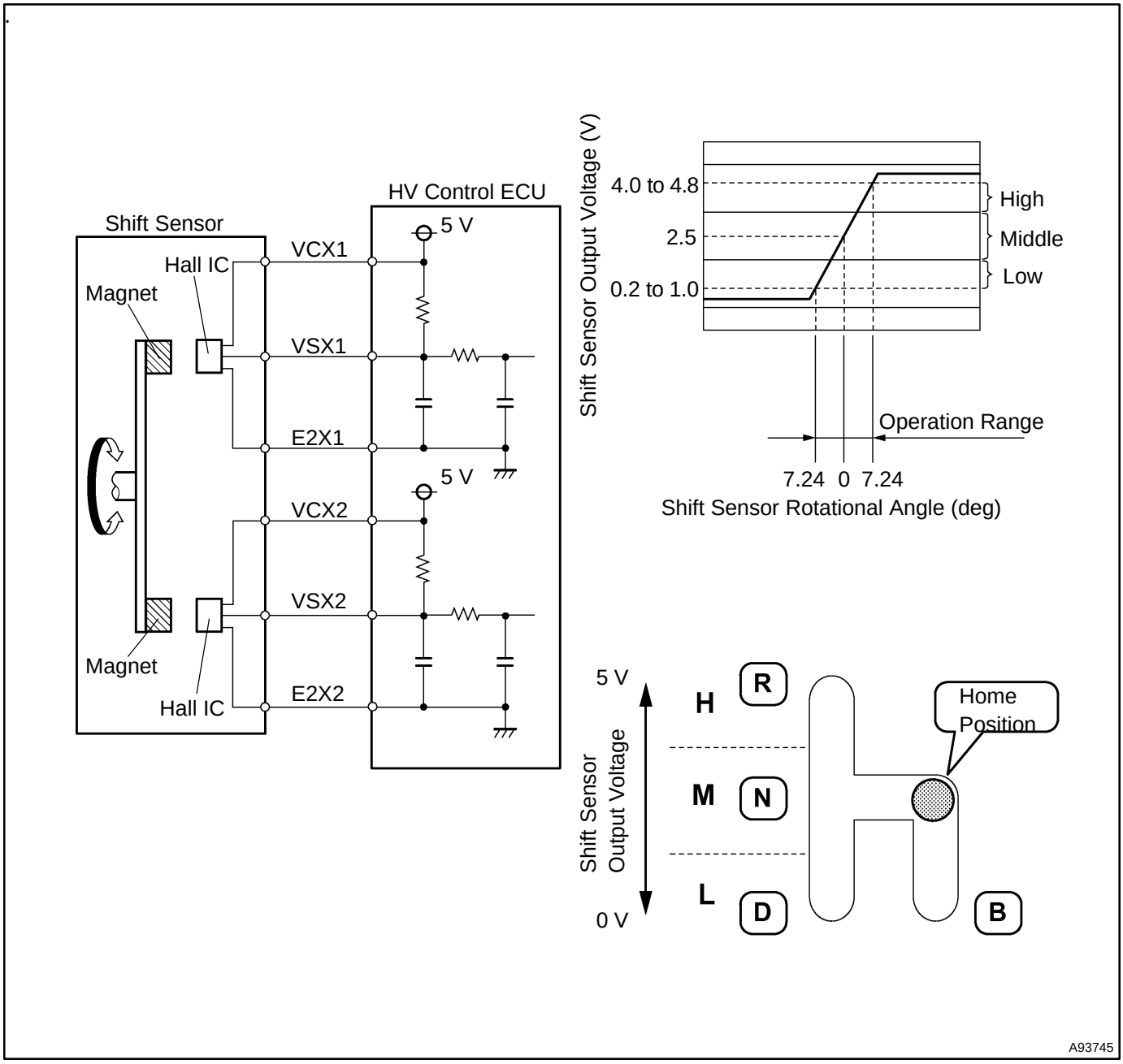
- The shift control system is a linkless type that does not use a shift cable.
- The shift and select sensors are non–contact type.

The selector lever is a momentary type, which returns to its home position by spring reaction as the driver's hand is released from the selector lever after shifting. The selector lever contains a shift sensor and a select sensor to detect the selector lever position (R, N, D or B). Because both sensors are controlled electrically by Hall elements, they can accurately detect shift positions in a reliable manner. Both sensors contain two systems of detection circuits, main and sub.



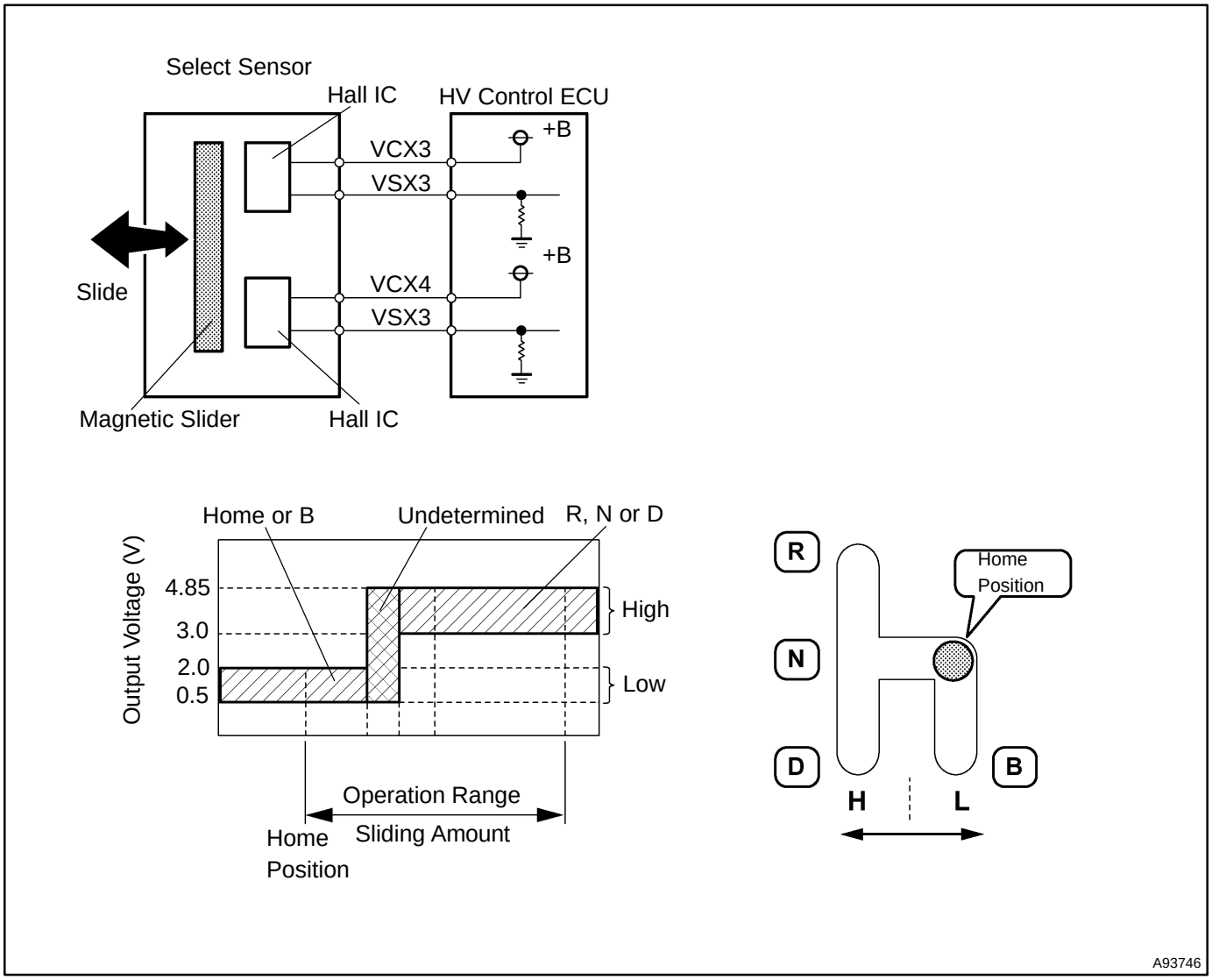
cardiagn.com

The shift sensor outputs voltage, which varies between 0 and 5 V in accordance with the vertical movement of the selector lever, to the HV control ECU. The HV control ECU interprets low level voltage input from the shift sensor as the D or B position, middle level voltage as the home or N position, and high level voltage as the R position.



cardiagn.com

The select sensor outputs voltage, which varies between 0 and 5 V in accordance with the horizontal movement of the selector lever, to the HV control ECU. The HV control ECU interprets low level voltage input from the select sensor as the home or B position, and high level voltage as the R, N, or D position.
The HV control ECU determines the position of the selector lever in accordance with the combination of the signals from the shift sensor and select sensor.



cardiagn.com

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0705	571	Open or GND short in shift main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	572	+B short in shift main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	573	Open or GND short in shift sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	574	+B short in shift sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	575	Open or GND short in select main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	576	+B short in select main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	577	Open or GND short in select sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	578	+B short in select sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU
P0705	595	Difference between shift main sensor value and shift sub sensor value is large	• Wire harness or connector • Selector lever • HV control ECU
P0705	596	Difference between select main sensor value and select sub sensor value is large	• Wire harness or connector • Selector lever • HV control ECU

HINT:

After confirming DTC P0705 (INF 571, 572, 573, or 574), confirm M and S SHIFT SENSOR voltages using the hand–held tester.

M and S SHIFT SENSOR

R Position (Main)	Home or N Position (Main)	D or B Position (Main)	R Position (Sub)	Home or N Position (Sub)	D or B Position (Sub)	Trouble Area
0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	4.0 to 4.8 V	2.0 to 3.0 V	0.2 to 1.0 V	Open in VCX1 circuit
4.0 to 4.8 V	2.0 to 3.0 V	0.2 to 1.0 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	Open in VCX2 circuit
0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	4.0 to 4.8 V	2.0 to 3.0 V	0.2 to 1.0 V	Open or short in VSX1 circuit
4.0 to 4.8 V	2.0 to 3.0 V	0.2 to 1.0 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	Open or short in VSX2 circuit
4.8 to 5.0 V	4.8 to 5.0 V	4.8 to 5.0 V	4.0 to 4.8 V	2.0 to 3.0 V	0.2 to 1.0 V	Open in E2X1 circuit
4.0 to 4.8 V	2.0 to 3.0 V	0.2 to 1.0 V	4.8 to 5.0 V	4.8 to 5.0 V	4.8 to 5.0 V	Open in E2X2 circuit

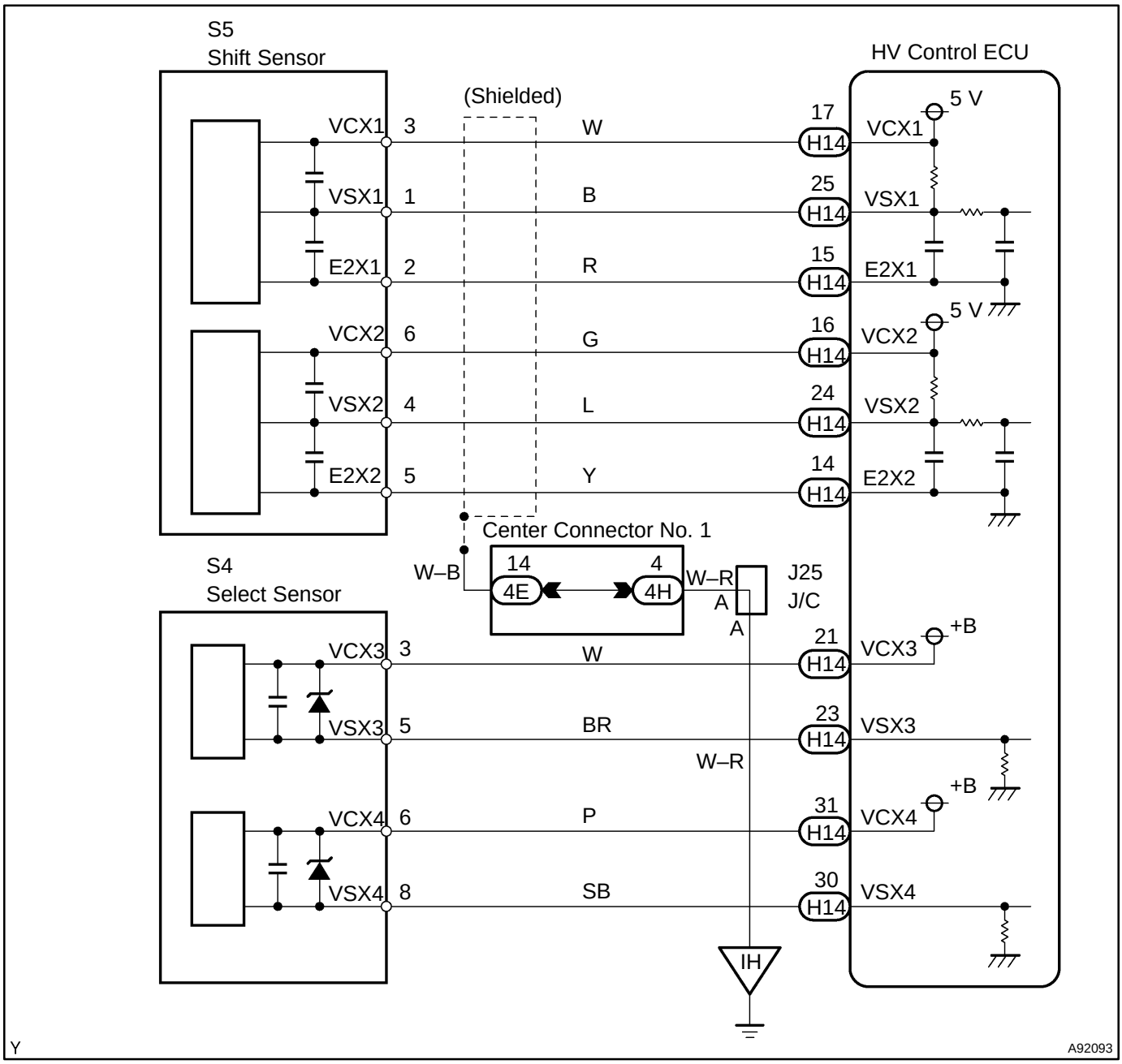
cardiagn.com

HINT:
After confirming DTC P0705 (INF 575, 576, 577, or 578), confirm SM and SS SHIFT SENSOR voltages using the hand–held tester.

SM and SS SHIFT SENSOR

R, N or D Position (Select Main)	Home or B Position (Select Main)	R, N or D Position (Select Sub)	Home or B Position (Select Sub)	Trouble Area
0 to 0.5 V	0 to 0.5 V	3.0 to 4.85 V	0.5 to 2.0 V	Open or GND short in VCX3 or VSX3 circuit
3.0 to 4.85 V	0.5 to 2.0 V	0 to 0.5 V	0 to 0.5 V	Open or GND short in VCX4 or VSX4 circuit

WIRING DIAGRAM



cardiagn.com

INSPECTION PROCEDURE

1	READ VALUE OF HAND–HELD TESTER(M AND S SHIFT SENSOR)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the M and S SHIFT SENSOR voltage values on the hand–held tester.
Result:

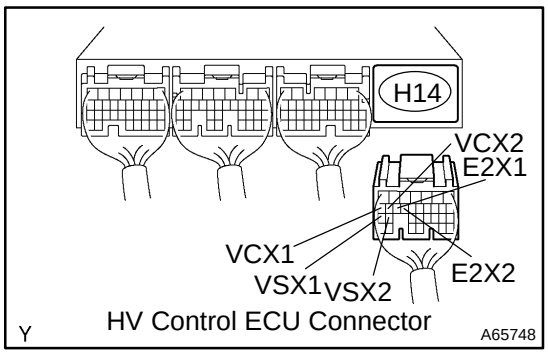
Shift Position	M Shift Sensor	S Shift Sensor
R position	4.0 to 4.8 V	4.0 to 4.8 V
Home or N position	2.0 to 3.0 V	2.0 to 3.0 V
D or B position	0.2 to 1.0 V	0.2 to 1.0 V

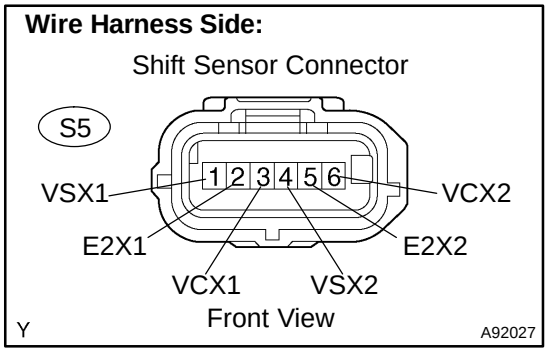
OK → **Go to step 4**

NG

cardiagn.com

2	**CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – SHIFT SENSOR)**





(a) Disconnect the H14 HV control ECU connector.
(b) Disconnect the S5 shift sensor connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VCX1 (H14–17) – Body ground	Below 1 V
VSX1 (H14–25) – Body ground	Below 1 V
E2X1 (H14–15) – Body ground	Below 1 V
VCX2 (H14–16) – Body ground	Below 1 V
VSX2 (H14–24) – Body ground	Below 1 V
E2X2 (H14–14) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VCX1 (H14–17) – VCX1 (S5–3)	Below 1 Ω
VSX1 (H14–25) – VSX1 (S5–1)	Below 1 Ω
E2X1 (H14–15) – E2X1 (S5–2)	Below 1 Ω
VCX2 (H14–16) – VCX2 (S5–6)	Below 1 Ω
VSX2 (H14–24) – VSX2 (S5–4)	Below 1 Ω
E2X2 (H14–14) – E2X2 (S5–5)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VCX1 (H14–17) or VCX1 (S5–3) – Body ground	10 kΩ or higher
VSX1 (H14–25) or VSX1 (S5–1) – Body ground	10 kΩ or higher
E2X1 (H14–15) or E2X1 (S5–2) – Body ground	10 kΩ or higher
VCX2 (H14–16) or VCX2 (S5–6) – Body ground	10 kΩ or higher
VSX2 (H14–24) or VSX2 (S5–4) – Body ground	10 kΩ or higher
E2X2 (H14–14) or E2X2 (S5–5) – Body ground	10 kΩ or higher

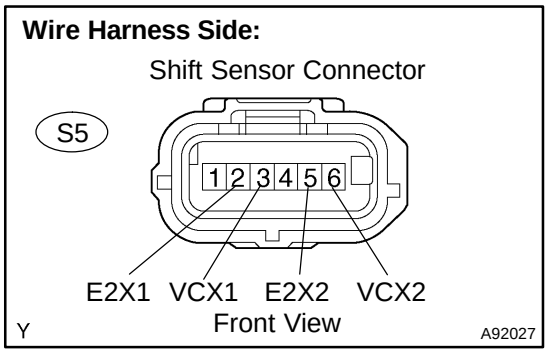
(g) Reconnect the shift sensor connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

3 INSPECT HYBRID VEHICLE CONTROL ECU(VCX1 AND VCX2 VOLTAGE)



(a) Disconnect the S5 shift sensor connector.
(b) Turn the power switch ON (IG).
(c) Measure the voltage between the terminals of the shift sensor connector.
Standard:

Tester Connection	Specified Condition
VCX1 (S5–3) – E2X1 (S5–2)	4.5 to 5.5 V
VCX2 (S5–6) – E2X2 (S5–5)	4.5 to 5.5 V

(d) Reconnect the shift sensor connector.

OK → **Go to step 7**

NG

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

4 READ VALUE OF HAND–HELD TESTER(SM AND SS SHIFT SENSOR)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the SM and SS SHIFT SENSOR voltage values on the hand–held tester.
Result:

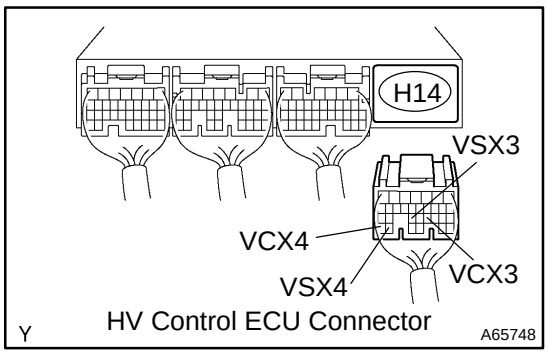
Shift Position	SM Shift Sensor	SS Shift Sensor
R, N or D position	3.0 to 4.85 V	3.0 to 4.85 V
Home or B position	0.5 to 2.0 V	0.5 to 2.0 V

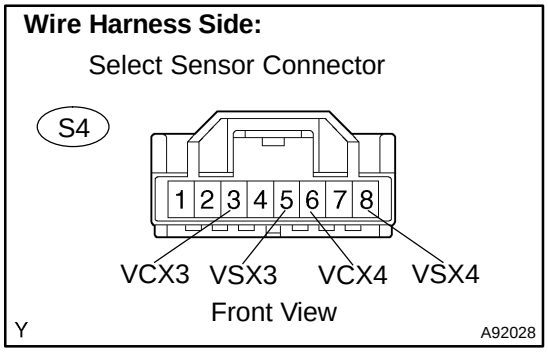
OK → **Go to step 7**

NG

cardiagn.com

5	**CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – SELECT SENSOR)**





(a) Disconnect the H14 HV control ECU connector.
(b) Disconnect the S4 select sensor connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VCX3 (H14–21) – Body ground	Below 1 V
VSX3 (H14–23) – Body ground	Below 1 V
VCX4 (H14–31) – Body ground	Below 1 V
VSX4 (H14–30) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VCX3 (H14–21) – VCX3 (S4–3)	Below 1 Ω
VSX3 (H14–23) – VSX3 (S4–5)	Below 1 Ω
VCX4 (H14–31) – VCX4 (S4–6)	Below 1 Ω
VSX4 (H14–30) – VSX4 (S4–8)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VCX3 (H14–21) or VCX3 (S4–3) – Body ground	10 kΩ or higher
VSX3 (H14–23) or VSX3 (S4–5) – Body ground	10 kΩ or higher
VCX4 (H14–31) or VCX4 (S4–6) – Body ground	10 kΩ or higher
VSX4 (H14–30) or VSX4 (S4–8) – Body ground	10 kΩ or higher

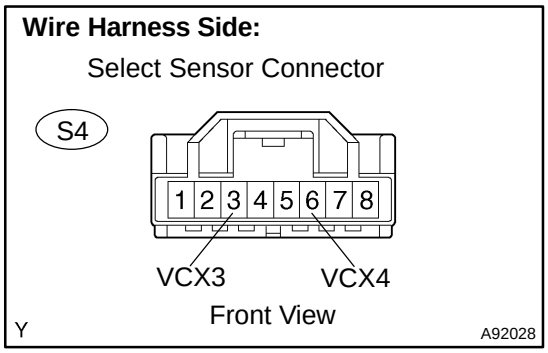
(g) Reconnect the select sensor connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

6 INSPECT HYBRID VEHICLE CONTROL ECU(VCX3 AND VCX4 VOLTAGE)



(a) Disconnect the S4 select sensor connector.
(b) Turn the power switch ON (IG).
(c) Measure the voltage between the terminals of the select sensor connector and body ground.
Standard:

Tester Connection	Specified Condition
VCX3 (S4–3) – Body ground	9 to 14 V
VCX4 (S4–6) – Body ground	9 to 14 V

(d) Reconnect the select sensor connector.

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

OK

7 REPLACE SELECTOR LEVER

GO

8 READ OUTPUT DTC(DTC P0705 IS NOT OUTPUT AGAIN)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / CLEAR CODES.
(e) Perform a simulation test.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(g) Read DTCs.
Result: DTC P0705 is not output again

YES → **SYSTEM OK**

NO

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0851/579	PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW

DTC	P0852/580	PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH

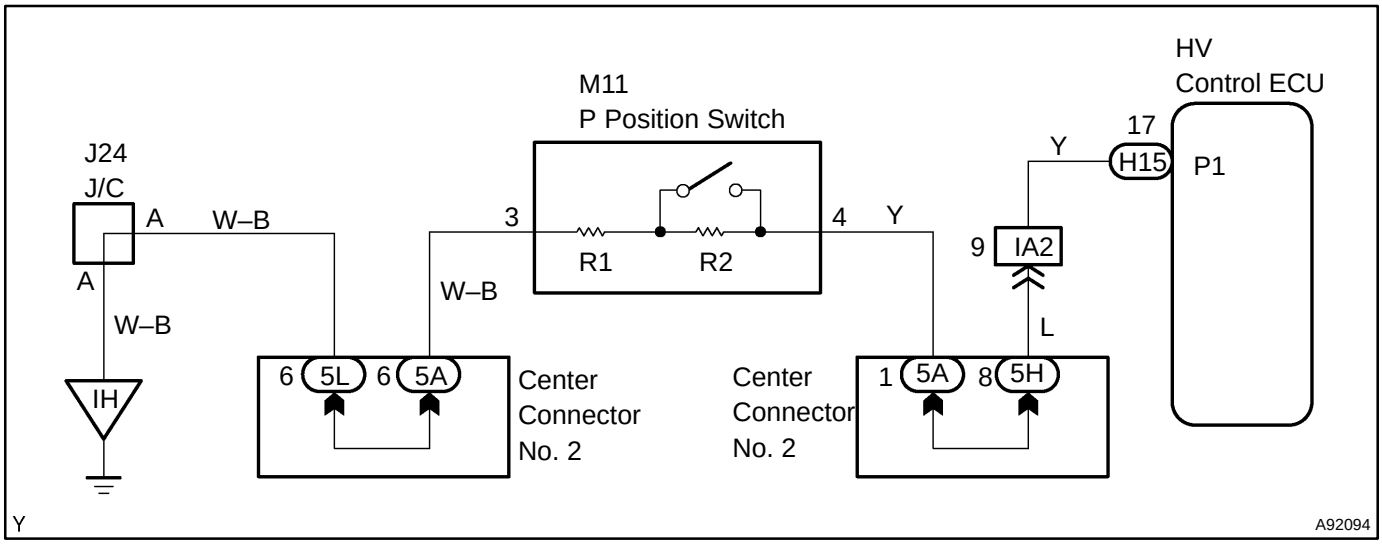
CIRCUIT DESCRIPTION

Instead of having a parking position as one of the positions of the conventional shift lever, a P position switch is provided independently in the upper area of the selector lever. The switch is based on a momentary type operation mode, in which the button does not lock mechanically.

The P position switch contains resistors R1 and R2. When the P position switch is not pressed, the switch provides a combined resistance of R1 and R2; and when the P position switch is pressed, the switch provides only the resistance of R1. The voltage at the P1 terminal of the HV control ECU varies with the changes in the resistance of the switch. The HV control ECU determines the P position switch operation intended by the driver according to this resistance signal.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0851	579	GND short in P position switch circuit	• Wire harness or connector • P position switch • HV control ECU
P0852	580	Open or +B short in P position switch circuit	• Wire harness or connector • P position switch • HV control ECU

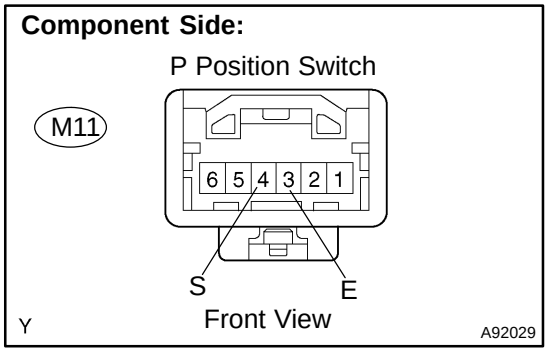
WIRING DIAGRAM



cardiagn.com

INSPECTION PROCEDURE

1 INSPECT P POSITION SWITCH



(a) Remove the P position switch.
(b) Check the resistance between the terminals of the P position switch connector.

Standard:

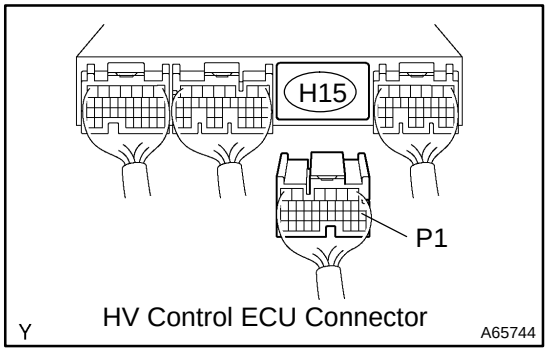
Symbols (Terminal No.)	Condition	Resistance
S (M11–4) – E (M11–3)	Keep switch pressed	680 Ω
S (M11–4) – E (M11–3)	Release switch	4,580 Ω

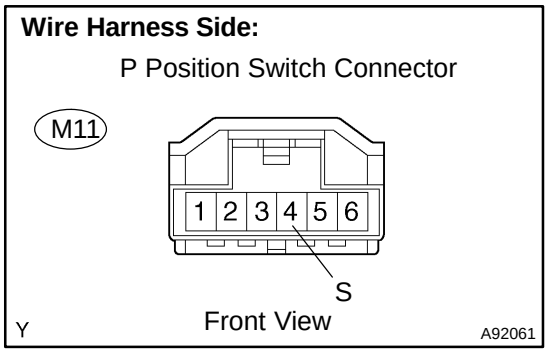
(c) Reinstall the P position switch.

NG → **REPLACE P POSITION SWITCH**

OK

2 CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – P POSITION SWITCH)





(a) Disconnect the H15 HV control ECU connector.
(b) Disconnect the M11 P position switch connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
P1 (H15–17) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
P1 (H15–17) – S (M11–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
P1 (H15–17) or S (M11–4) – Body ground	10 kΩ or higher

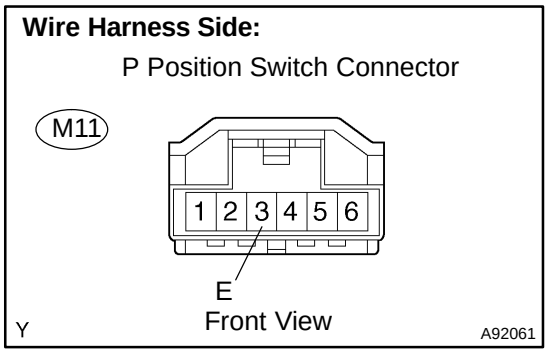
(g) Reconnect the P position switch connector.
(h) Reconnect the the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

3	CHECK HARNESS AND CONNECTOR(P POSITION SWITCH – BODY GROUND)



(a) Disconnect the M11 P position switch connector.
(b) Check the resistance between the terminal of the P position switch connector and body ground.

Standard (Check for open):

Tester Connection	Specified Condition
E (M11–3) – Body ground	Below 1 Ω

(c) Reconnect the P position switch connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A08/264 DC/DC CONVERTER STATUS CIRCUIT

CIRCUIT DESCRIPTION

Refer to DTC P0A09 (INF 265) on page 05–483.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A08	264	DC/DC converter malfunction	• w/ converter inverter assembly

INSPECTION PROCEDURE

When the HV control ECU detects an internal malfunction in the DC/DC converter, it sets DTC P0A08 (INF 264). If the information (INF) code is present, replace the w/ converter inverter assembly.

REPLACE W/ CONVERTER INVERTER ASSY (See page 21–23)

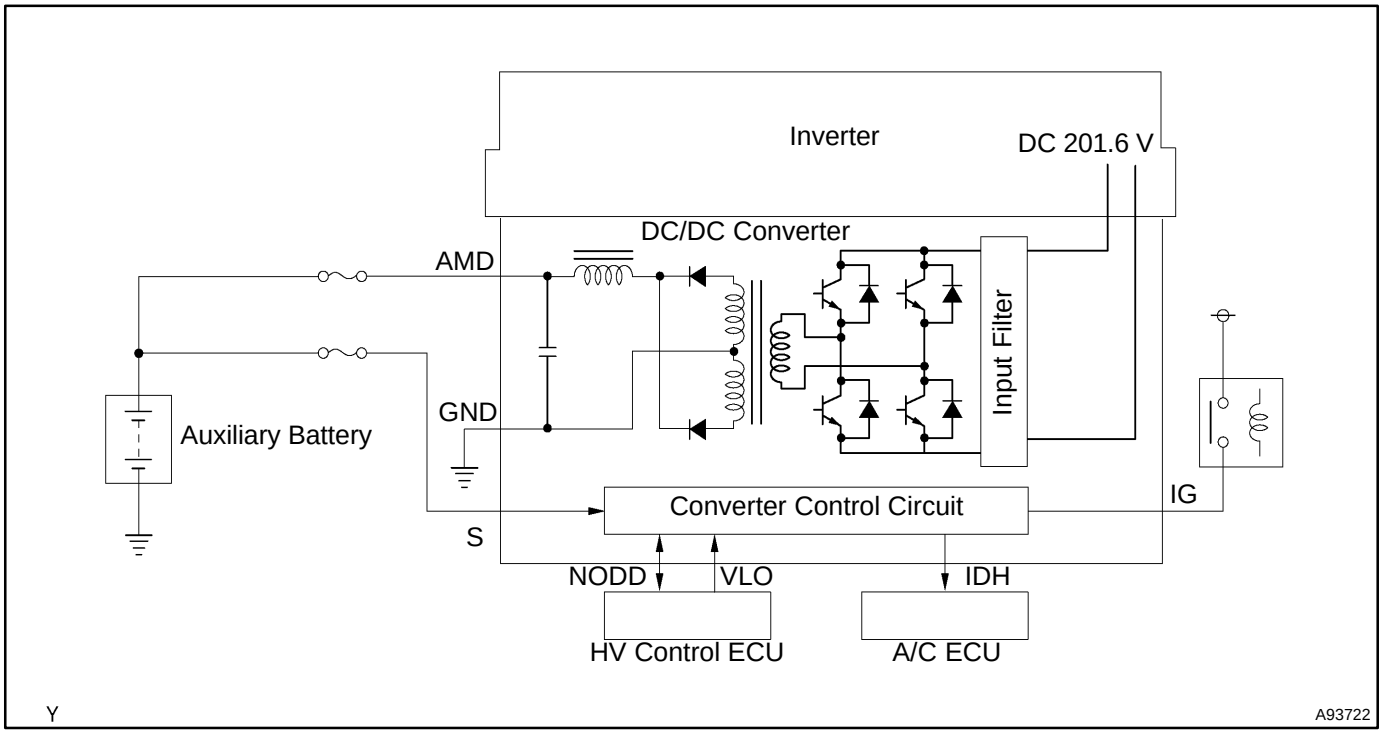
cardiagn.com

DTC	P0A09/265	DC/DC CONVERTER STATUS CIRCUIT LOW INPUT

DTC	P0A10/263	DC/DC CONVERTER STATUS CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

The DC/DC converter converts the DC 201.6 V of the HV battery into DC 12 V in order to supply power to the vehicle's lighting, audio and ECU systems. In addition, it charges the auxiliary battery.
A transistor bridge circuit initially converts DC 201.6 V into alternating current, and a transformer lowers its voltage. Then, it is rectified and smoothed (into DC) and converted into DC 12 V.
The DC/DC converter controls the output voltage in order to keep a constant voltage at the terminals of the auxiliary battery.

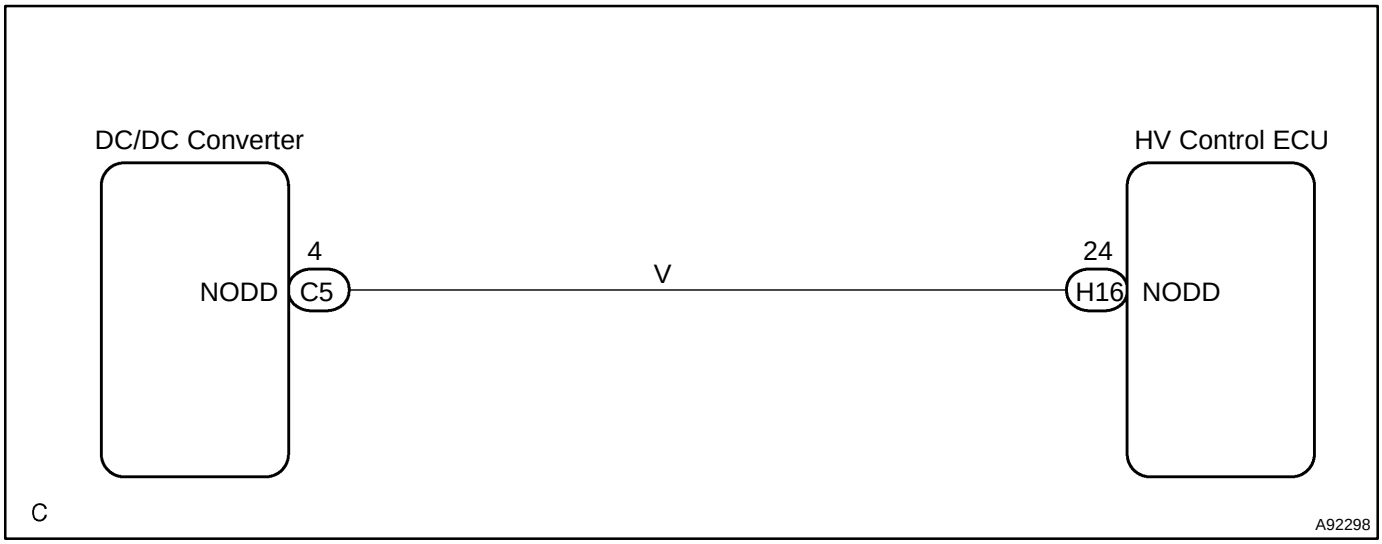


The HV control ECU uses the NODD signal line to transmit a stop command to the DC/DC converter and receive signals indicating the normal or abnormal conditions of the 12 V charging system.
If the vehicle is being driven with an inoperative DC/DC converter, the voltage of the auxiliary battery will drop, which will prevent the continued operation of the vehicle. Therefore, the HV control ECU monitors the operation of the DC/DC converter and alerts the driver if it detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A09	265	Open or GND short in NODD signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly
P0A10	263	+B short in NODD signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly

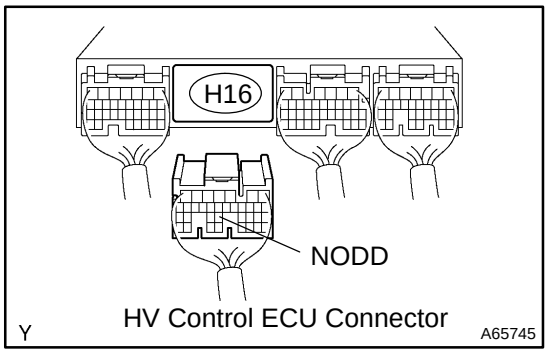
cardiagn.com

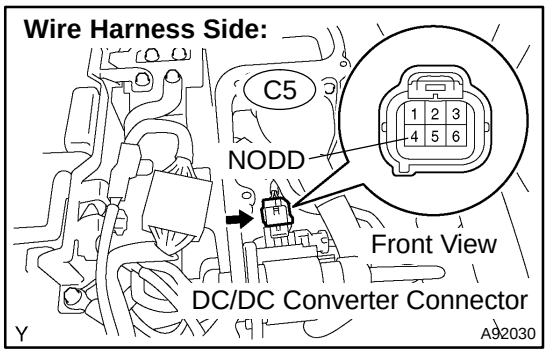
WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – DC/DC CONVERTER)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the C5 DC/DC converter connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
NODD (H16–24) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
NODD (H16–24) – NODD (C5–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
NODD (H16–24) or NODD (C5–4) – Body ground	10 kΩ or higher

(g) Reconnect the DC/DC converter connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A09/591	DC/DC CONVERTER STATUS CIRCUIT LOW INPUT

DTC	P0A10/592	DC/DC CONVERTER STATUS CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

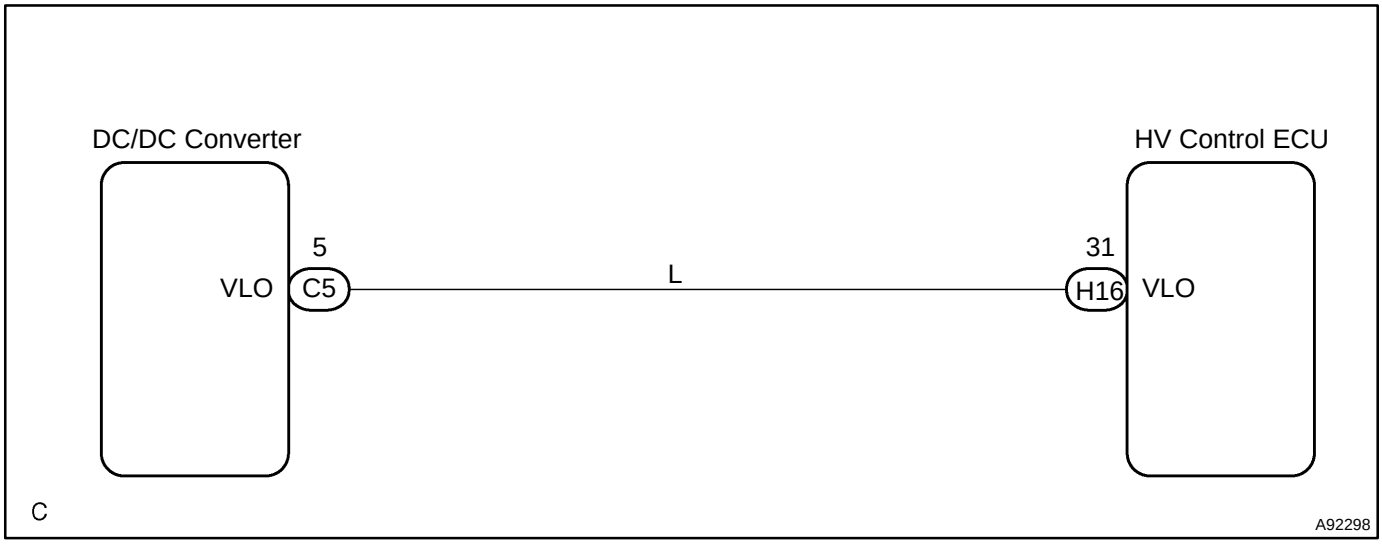
See the description of the DC/DC converter on page 05–483.

The HV control ECU sends the output voltage switch signal to the DC/DC converter via the VLO signal line in order to switch output voltage according to vehicle status.

If the vehicle is being driven with an inoperative DC/DC converter, the voltage of the auxiliary battery will drop, which will prevent the continued operation of the vehicle. Therefore, the HV control ECU monitors the operation of the DC/DC converter and alerts the driver if it detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A09	591	Open or GND short in VLO signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly
P0A10	592	+B short in VLO signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly

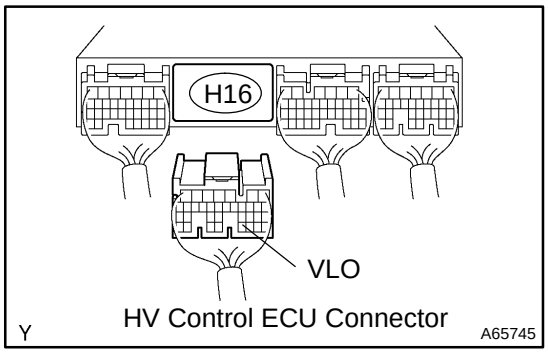
WIRING DIAGRAM

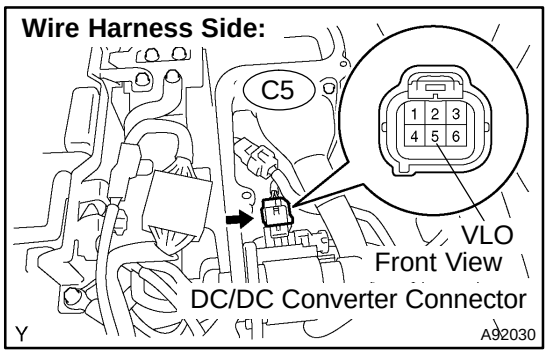


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – DC/DC CONVERTER)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the C5 DC/DC converter connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VLO (H16–31) – Body ground	Below 1V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VLO (H16–31) – VLO (C5–5)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VLO (H16–31) or VLO (C5–5) – Body ground	10 kΩ or higher

(g) Reconnect the DC/DC converter connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A0F/204	ENGINE FAILED TO START

DTC	P0A0F/205	ENGINE FAILED TO START

DTC	P0A0F/533	ENGINE FAILED TO START

DTC	P0A0F/534	ENGINE FAILED TO START

CIRCUIT DESCRIPTION

The HV control ECU performs the fail–safe control, when the ECM detects an error which will affect THS control.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A0F	204	Abnormal signal input from ECM (abnormal engine output)	• ECM • SFI system
P0A0F	205	Abnormal signal input from ECM (engine is unable to start)	• ECM • SFI system
P0A0F	533	Abnormal signal input from ECM (abnormal engine output by running out of fuel)	• ECM • SFI system
P0A0F	534	Abnormal signal input from ECM (engine is unable to start by running out of fuel)	• ECM • SFI system

INSPECTION PROCEDURE

1	READ OUTPUT DTC(ENGINE)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / ENGINE AND ECT / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–55)**

NO

REPLACE ECM (See page 10–24)

cardiagn.com

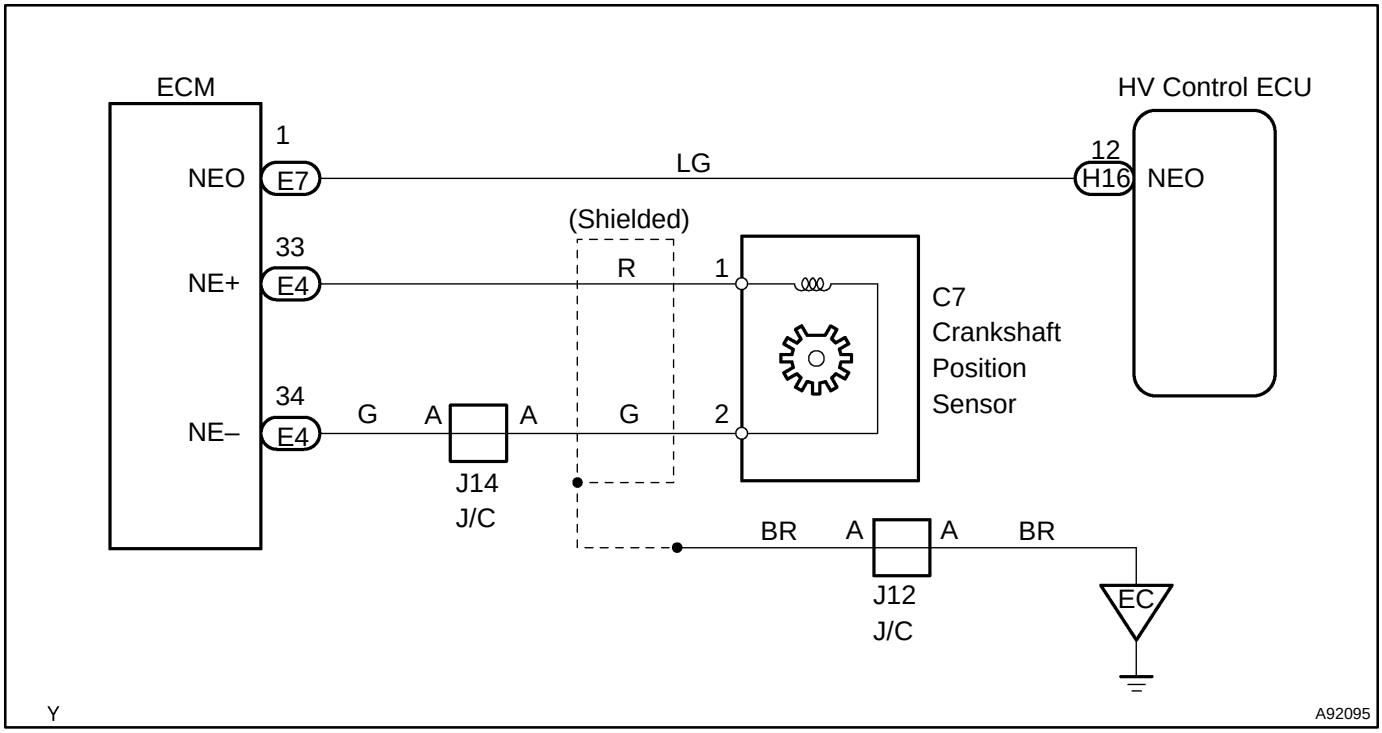
DTC P0A0F/238 ENGINE FAILED TO START

CIRCUIT DESCRIPTION

The HV control ECU detects this DTC and effects fail–safe control if the engine or transaxle gear has seized up, or foreign objects have been caught in either of them.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A0F	238	Engine does not start even though cranking it (transaxle input malfunction [engine system])	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

1	READ OUTPUT DTC(ENGINE)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / ENGINE AND ECT / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES	**GO TO RELEVANT DTC CHART (See page 05–55)**

NO

cardiagn.com

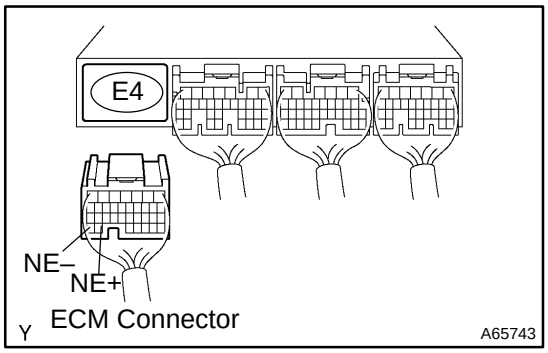
2	CHECK CRANKSHAFT PULLEY REVOLUTION

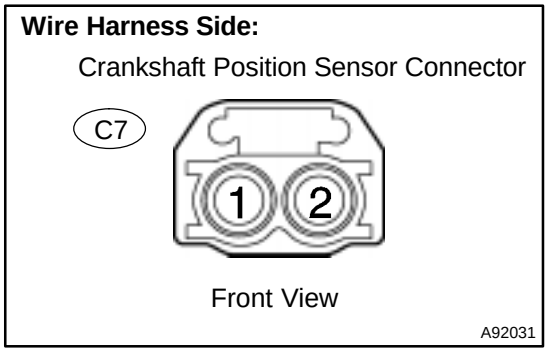
(a) Turn the power switch OFF.
(b) Jack up the vehicle.
(c) Manually turn the crankshaft pulley to check if the crankshaft rotates.
OK: The crankshaft rotates

NG → **Go to step 11**

OK

3	CHECK HARNESS AND CONNECTOR(ECM – CRANKSHAFT POSITION SENSOR)





(a) Disconnect the E4 ECM connector.
(b) Disconnect the C7 crankshaft position sensor connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
NE+ (E4–33) – Crankshaft position sensor (C7–1)	Below 1 Ω
NE– (E4–34) – Crankshaft position sensor (C7–2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
NE+ (E4–33) or Crankshaft position sensor (C7–1) – Body ground	10 kΩ or higher
NE– (E4–34) or Crankshaft position sensor (C7–2) – Body ground	10 kΩ or higher

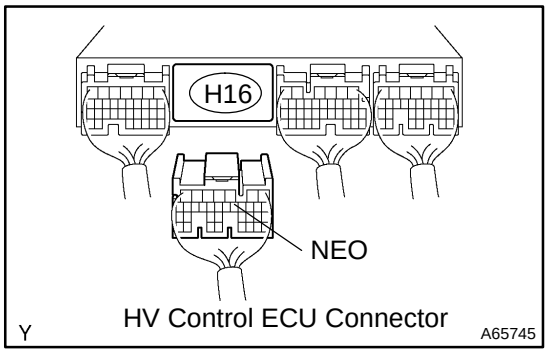
(d) Reconnect the crankshaft position sensor connector.
(e) Reconnect the ECM connector.

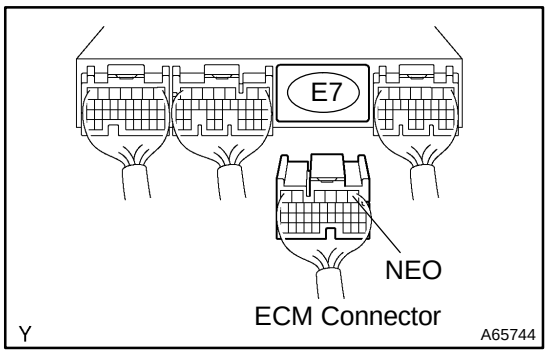
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

4 CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – ECM)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the E7 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
NEO (H16–12) – NEO (E7–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
NEO (H16–12) or NEO (E7–1) –Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

5 CHECK AND CLEAR DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Check and record the DTCs, the freeze frame data, and the information.
(f) Clear the DTCs of HV ECU.

GO

6 CHECK READY LAMP ON

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MG1 REV and ENGINE SPD values.
(f) Turn the power switch ON (READY).

OK: READY lamp turns ON

HINT:

If the READY lamp does not turn ON, and the reading on the hand–held tester shows DTC P0A90 (INF 239) (HV transaxle input malfunction [shaft damaged]), or the MG1 turns but the engine does not crack, replace the hybrid vehicle transaxle assembly.

cardiagn.com

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

OK

7	CHECK ENGINE REV–UP

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MG1 REV and ENGINE SPD values.
(f) With the READY lamp turned ON, depress the accelerator pedal for 10 seconds while the shift position is in the P position.

OK: The engine revs up

HINT:
If the engine does not rev up, and the reading on the hand–held tester shows DTC P0A90 (INF 239) (HV transaxle input malfunction [shaft damaged]), or the MG1 turns but the engine does not crank, replace the hybrid vehicle transaxle assembly.

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

OK

8	CHECK CREEP MOVEMENT

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (READY).
(c) Jack up the vehicle.
(d) Depress the brake pedal, move the selector lever to the D position, and release the brake pedal.

OK: The wheels turn (creep movement)

HINT:
If the wheels do not turn, and the reading on the hand–held tester shows DTC P0A90 (INF 602) (HV transaxle output malfunction), replace the hybrid vehicle transaxle assembly.

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

OK

9	CHECK ENGINE ACCELERATION SPEED

(a) Connect the hand–held tester to the DLC3.
(b) While driving at the vehicle speed of more than 6 mph (10 km/h), fully depress the accelerator pedal to raise the engine speed.

OK: The engine speed increases smoothly

HINT:
If the engine over–revs or the reading on the hand–held tester shows DTC P0A90 (INF 241) (HV transaxle input malfunction [torque limiter slipping]), replace the transmission input damper.

cardiagn.com

NG → REPLACE TRANSMISSION INPUT DAMPER ASSY

OK

10	CHECK CAUSE OF INCREASE IN REVOLUTION RESISTANCE

(a) Investigate what has caused the revolution resistance of the transaxle and engine to become greater.
  (1) Check the engine lubrication system and transaxle lubrication system.
  (2) Check the engine coolant and transaxle coolant.
  (3) Check for any breakdowns in engine itself and transaxle itself.

Result: There is no fault

NO → REPAIR MALFUNCTION PARTS AND COMPONENTS

YES

PERFORM SIMULATION TEST. IF SYMPTOM IS NOT REPRODUCED, REPLACE ENGINE, HV TRANSAXLE AND HV CONTROL ECU

11	CHECK FRONT TIRE REVOLUTION

(a) Turn the power switch ON (IG).
(b) Depress the brake pedal, move the selector lever to the N position.
(c) Jack up the vehicle.
(d) Manually turn the crankshaft pulley to check if the front tires rotate.

OK: The front tires rotate

NG → REPAIR OR REPLACE ENGINE ASSY

OK

REPAIR OR REPLACE HYBRID VEHICLE TRANSAXLE ASSY

cardiagn.com

DTC	P0A1D/134	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/135	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/570	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	134 135 570	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of vehicle systems.
One of these monitors the rationality of internal analog (signal) to digital conversions.
The HV control ECU monitors the internal A/D (Analog/Digital Converter) value. If there is an A/D malfunction, the HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 134/135/570): Hybrid vehicle control ECU/ADC malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 134/135/570) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1D/139 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	139	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of vehicle systems. One of these monitors checks the inside of the HV control ECU for a bad integrated circuit which actuates a relay. If the HV control ECU detects malfunction, it will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 139): Hybrid vehicle control ECU/IG malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 139) is not detected

INSPECTION PROCEDURE

If the above information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1D/140 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	140	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. One of these tests checks for errors after a memory read/write diagnostic test.
If the HV control ECU detects this malfunction inside of the ECU, it will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 140): Hybrid vehicle control ECU/RAM destruction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

All RAM area	Read/write check error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 140) is not detected

INSPECTION PROCEDURE

If the above information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1D/141 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	141	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. One of these tests checks for errors in the ROM (Read Only Memory) circuits of the HV control ECU.
If the HV control ECU detects this malfunction inside of the ECU, it will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 141): Hybrid vehicle control ECU/ROM destruction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 141) is not detected

INSPECTION PROCEDURE

If the above information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

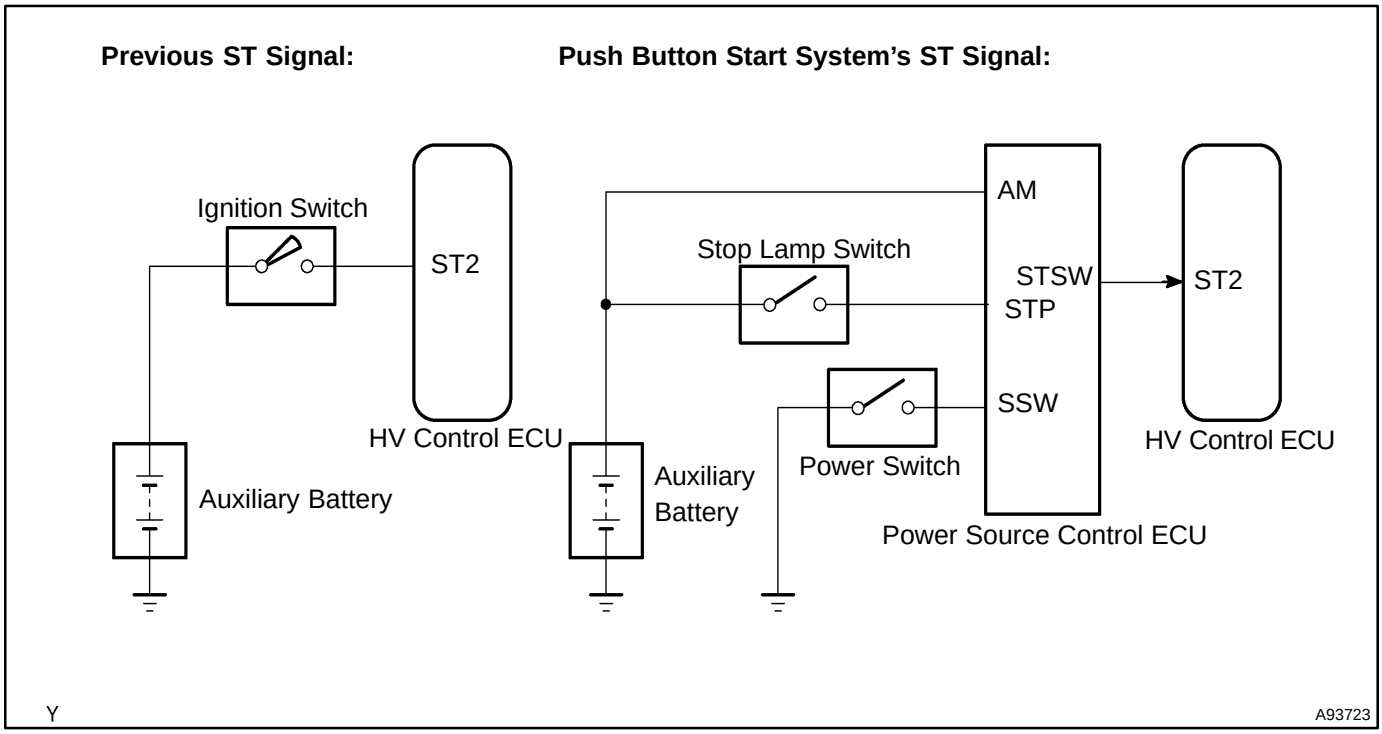
cardiagn.com

DTC P0A1D/142 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

When the ST turned ON at the ignition switch on the previous model, the ignition switch transmitted the ST signal to the HV control ECU.

The new Prius has adopted a push button start system. When the driver pushes on the power switch while depressing the brake pedal, the power source control ECU transmits the ST signal to the HV control ECU.



The HV control ECU monitors the ST signal to detect malfunction. If the ST signal is shorted to the +B power supply, the ST will be constantly ON, which will cause the HV system to start by merely turning the power switch ON (IG). The HV control ECU monitors the ST signal to prevent this from occurring.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	142	ST signal of HV control ECU is ON with power switch OFF	• Wire harness or connector • Power source control ECU

MONITOR DESCRIPTION

The HV control ECU monitors an ST signal input from the power source control ECU. If the ST signal is shorted to the +B power supply, the HV control ECU interprets this as the ST signal error, and then illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF142): Hybrid vehicle control ECU/ST malfunction
Required sensor/components	Power source control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

cardiagn.com

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

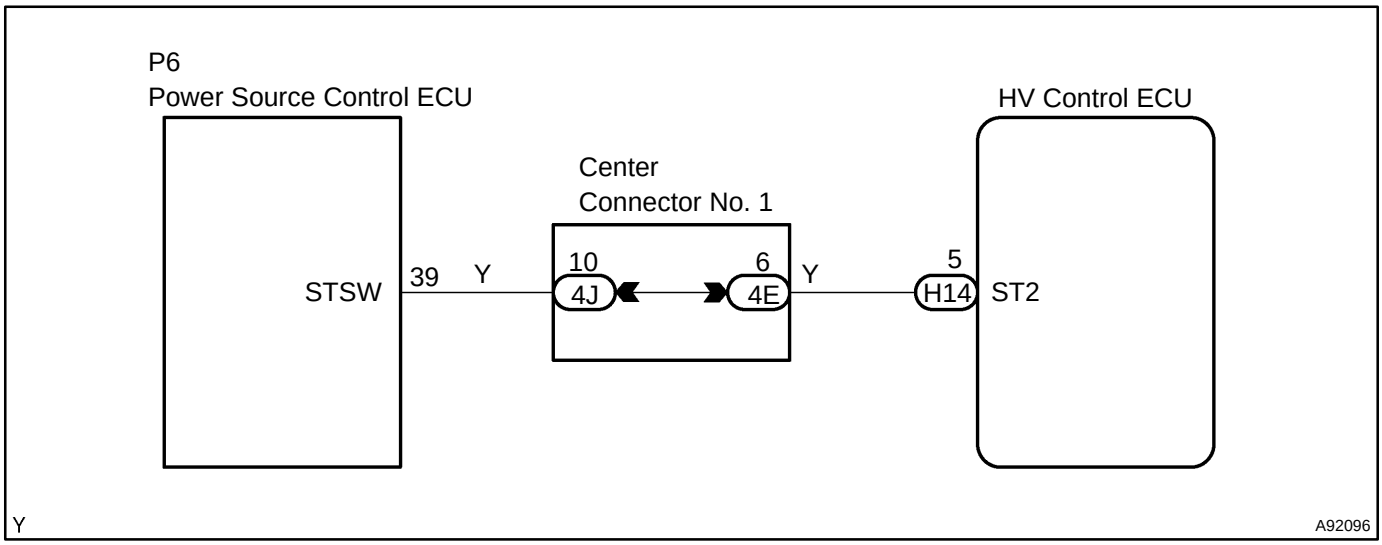
TYPICAL MALFUNCTION THRESHOLDS

ST signal	ON

COMPONENT OPERATING RANGE

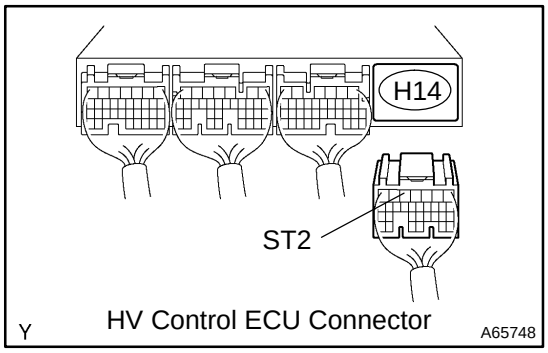
ST signal	OFF (when the power switch OFF)

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT HYBRID VEHICLE CONTROL ECU(ST2 VOLTAGE)



(a) Disconnect the H14 HV control ECU connector.

(b) Measure the voltage between the terminal of the HV control ECU connector and body ground with the power switch turned OFF.

Standard:

Tester Connection	Specified Condition
ST2 (H14–5) – Body ground	Below 1 V

(c) Reconnect the HV control ECU connector.

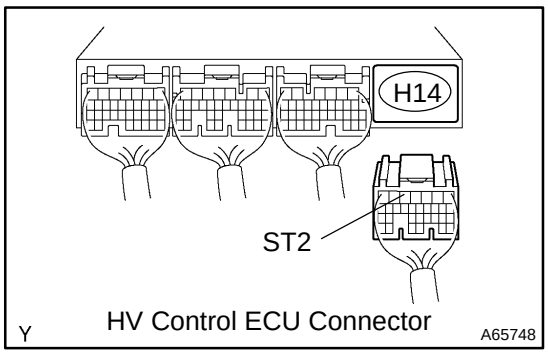
NG → **Go to step 2**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – POWER SOURCE CONTROL ECU)

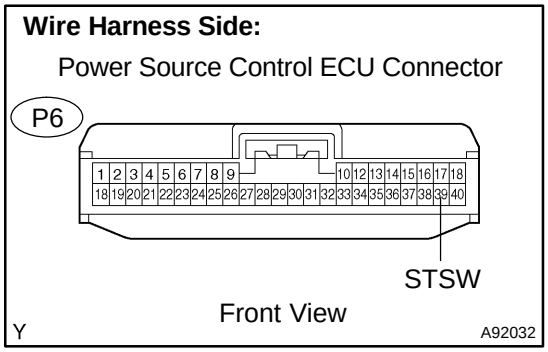


(a) Disconnect the H14 HV control ECU connector.
(b) Disconnect the P6 power source control ECU connector.
(c) Measure the voltage between the terminal of the HV control ECU connector or power source control ECU and body ground with the power switch turned OFF.

Standard:

Tester Connection	Specified Condition
ST2 (H14–5) or STSW (P6–39) – Body ground	Below 1 V

(d) Reconnect the power source control ECU connector.
(e) Reconnect the HV control ECU connector.



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE POWER SOURCE CONTROL ECU

cardiagn.com

DTC P0A1D/143 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	143	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal ECU systems. One of these monitors compares read and write values at the inside of the HV control ECU memory, which have been indicated by the transponder key or the electronic key.
If those two values are inconsistent with each other, the HV control ECU interprets this as an ECU memory failure of the HV control ECU. The HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 143): Hybrid vehicle control ECU/EEPROM malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Immobilizer and electronic key area on the EEPROM	Read/write check error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 143) is not detected

INSPECTION PROCEDURE

If the above information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/144	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/145	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	144 145	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the HV control ECU performs a self–test.
If the HV control ECU detects an internal problem during this self–test, it will conclude that there is an internal malfunction. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 144/145): Hybrid vehicle control ECU/Primary check malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

P0A1D (INF 144):

Reset signal from motor main CPU	Not found

P0A1D (INF 145):

Communication time between internal hybrid vehicle control ECU	Time out

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 144/145) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/148	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/149	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	148 149	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the HV control ECU performs a self–test.
If the HV control ECU detects an internal problem during this self–test, it will conclude that there is an internal malfunction. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 148/149): Hybrid vehicle control ECU/HV CPU malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 148/149) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/150	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/151	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/152	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/155	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/156	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/158	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/564	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	150 151 152 155 156 158 564	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal and external ECU systems. In one of these diagnostics, the HV control ECU checks the result of the generator CPU self–test. If the HV control ECU detects a ”Fail” from the generator CPU self–test, it will conclude that there is an internal malfunction in the generator CPU. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 150/151/152/155/156/158/564): Hybrid vehicle control ECU/Generator CPU malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

cardiagn.com

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 150/151/152/155/156/158/564) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/159	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/160	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	159 160	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal and external ECU systems. In one of these monitors, the HV control ECU checks the motor main CPU serial communication link.

If the HV control ECU detects a failure, it will conclude that there is an internal malfunction involving the HV control ECU to motor main CPU communication link. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 159/160): Hybrid vehicle control ECU/Motor CPU serial communication error
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 159/160) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/163	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/164	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/511	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/512	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	163 164 511 512	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In one of these monitors, the HV control ECU monitors the power supply for the motor main CPU. If the HV control ECU detects a failure in the power supply for the motor main CPU, it will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 163/164/511/512): Hybrid vehicle control ECU/Motor ECU power malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 163/164/511/512) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/165	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/168	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/198	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/199	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	165 168 198 199	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In this diagnostic monitor, the HV control ECU checks for an R/D (Resolver/Digital Converter) malfunction involving the motor resolver.

If the HV control ECU detects an R/D error, it will conclude that there is an internal malfunction involving the motor resolver. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 165/168/198/199): Hybrid vehicle control ECU/Motor R/D malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 165/168/198/199) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/166	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/167	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/197	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/200	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	166 167 197 200	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In this diagnostic monitor, the HV control ECU checks for an R/D (Resolver/Digital Converter) malfunction involving the generator resolver.
If the HV control ECU detects an R/D error, it will conclude that there is an internal malfunction involving the generator resolver. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 166/167/197/200): Hybrid vehicle control ECU/Generator R/D malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 166/167/197/200) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/177	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/178	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/392	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/567	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	177 178 392 567	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal and external ECU systems. In one of these diagnostics, the HV control ECU checks the result of the motor main CPU self–test. If the HV control ECU detects a ”Fail” from the motor main CPU self–test, it will conclude that there is an internal malfunction in the motor main CPU. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 177/178/392/567): Hybrid vehicle control ECU/Motor main CPU malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 177/178/392/567) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/180	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/181	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/182	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/183	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/184	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/185	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/186	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	180 181 182 183 184 185 186	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In this diagnostics monitor, the HV control ECU monitors the output of the rotation angle CPU. If the HV control ECU detects an error in the rotation angle CPU, it will conclude that there is an internal malfunction in the HV control ECU. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 180/181/182/183/184/185/186): Hybrid vehicle control ECU/Rotation angle monitor CPU malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

cardiagn.com

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 180/181/182/183/184/185/186) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1D/187 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	187	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In one of these diagnostics, the HV control ECU monitors the important RAM circuits of the HV control ECU.

If the HV control ECU detects an error in the important RAM circuits, it will conclude that there is an internal malfunction in the HV control ECU. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 187): Hybrid vehicle control ECU/Important RAM error
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Important RAM address	Read/write check error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 187) is not detected

INSPECTION PROCEDURE

If the above information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/188	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/189	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/192	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/193	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/195	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/196	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/565	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	188 189 192 193 195 196 565	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal and external ECU systems. In one of these diagnostics, the HV control ECU checks the result of the motor CPU self–test. If the HV control ECU detects a ”Fail” from the motor CPU self–test, it will conclude that there is an internal malfunction in the motor CPU. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 188/189/192/193/195/196/565): Hybrid vehicle control ECU/Motor CPU malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

cardiagn.com

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 188/189/192/193/195/196/565) is not detected

INSPECTION PROCEDURE

If any of the above information (INF) codes is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1D/390 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	390	Charge control malfunction	• HV control ECU

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result: DTC P0A1D (INF 390) and other DTCs are output

HINT:
If any other codes besides P0A1D (INF 390) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1D/393 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	393	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the HV control ECU performs a self–test.
If the HV control ECU detects an internal problem during this self–test, it will conclude that there is an internal malfunction. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 393): Hybrid vehicle control ECU/HV CPU operation malfunction (routine check)
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle control ECU	Internal error

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 393) is not detected

INSPECTION PROCEDURE

If the above information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A1D/568	HYBRID POWERTRAIN CONTROL MODULE

DTC	P0A1D/569	HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	568 569	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In this diagnostics monitor, the HV control ECU checks the REF signal from the motor main ECU for errors.

If the HV control ECU detects an error in the REF signal, it will conclude that there is a malfunction in the motor main CPU, the REF signal or the HV control ECU. The HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 568/569): Hybrid vehicle control ECU/Motor REF signal malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

REF signal	Abnormal

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 568/569) is not detected

cardiagn.com

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A0F (INF 243), P0A40 (INF 500) or P0A41 (INF 245) for the motor resolver is output

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1D/615 HYBRID POWERTRAIN CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	615	HV control ECU internal error	• HV control ECU

MONITOR DESCRIPTION

The HV control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In this diagnostics monitor, the HV control ECU checks the communication bus off count and the message register of the CAN (Controller Area Network) controller.
If the HV control ECU detects an error in the communication bus off count or message register, it will conclude that there is a malfunction in the HV control ECU. The HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 615): Hybrid vehicle control ECU/CAN communication malfunction
Required sensor/components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Case 1:

Message register of the CAN controller	Read/write check error

Case 2:

Communication bus off count	Designed number or more

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 615) is not detected

INSPECTION PROCEDURE

If the above information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A1F/123 BATTERY ENERGY CONTROL MODULE

CIRCUIT DESCRIPTION

Based on a malfunction signal received from the battery ECU, the HV control ECU alerts the driver and effects fail–safe control.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1F	123	Abnormal signal input from battery ECU (ROMRAM malfunction)	• HV battery system • Battery ECU

MONITOR DESCRIPTION

Upon receiving an abnormal signal input from the battery ECU, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A1F (INF 123): Battery ECU/Rationality
Required sensor/components	Battery ECU, battery current sensor
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

TOYOTA's intellectual property	–

COMPONENT OPERATING RANGE

Battery ECU	Normal

INSPECTION PROCEDURE

HINT:

After repairing the malfunction, restart the system (to turn the READY lamp ON) and recheck the DTC.

1	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–893)**

NO

REPLACE BATTERY ECU ASSY (See page 21–98)

cardiagn.com

DTC P0A1F/129 BATTERY ENERGY CONTROL MODULE

CIRCUIT DESCRIPTION

The battery ECU transmits information on the HV battery voltage to the HV control ECU via CAN communication.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1F	129	HV battery voltage circuit malfunction	• HV battery voltage circuit • Service plug grip • High voltage fuse • Battery plug • Battery ECU

MONITOR DESCRIPTION

The HV control ECU calculates the differences between the received HV battery voltage, boost converter voltage, and inverter voltage. If any of the differences exceed prescribed values, the HV control ECU determines that there is a malfunction in the battery voltage circuit. When the HV control ECU detects a malfunction, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A1F (INF 129): Battery ECU/Voltage (VB) sensor deviation
Required sensor/components	Battery ECU, boost converter, inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

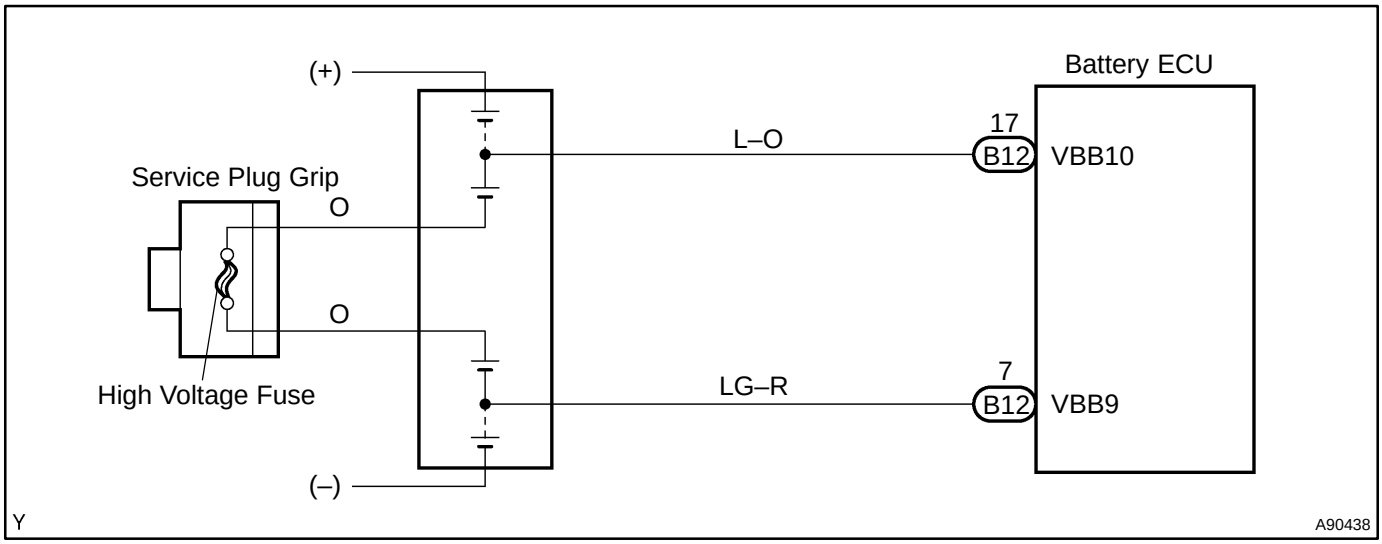
TOYOTA's intellectual property	–

COMPONENT OPERATING RANGE

Battery ECU	Normal

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–893)**

NO

cardiagn.com

2 READ OUTPUT DTC(HV ECU)

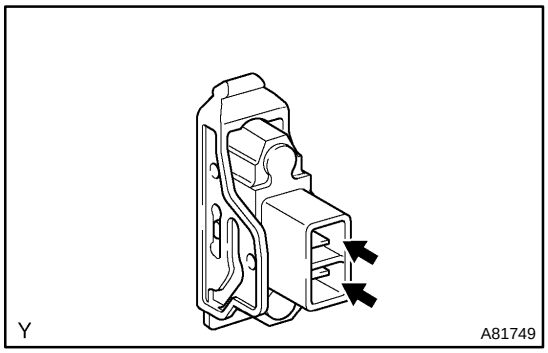
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs listed in the table below are output

DTC No.	INF Code	Detection Item	See Page
P0AA1	226	Hybrid Battery Positive Contactor Circuit Stuck Closed	05–763
P0AA2	227	Hybrid Battery Positive Contactor Circuit Stuck Open	05–763
P0AA4	228	Hybrid Battery Negative Contactor Circuit Stuck Closed	05–767
P0AA5	229	Hybrid Battery Negative Contactor Circuit Stuck Open	05–767

YES → **GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

3 INSPECT SERVICE PLUG GRIP



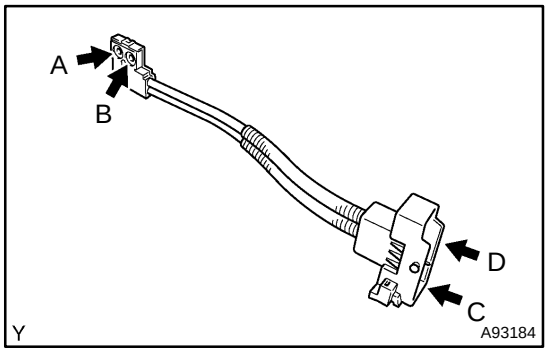
CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Check the resistance between the terminals of the service plug grip.
Standard: Below 1 Ω

NG → **Go to step 5**

OK

cardiagn.com

4 INSPECT BATTERY PLUG



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Remove the HV battery assembly (see page 21–54).
(b) Remove the battery plug (see page 21–77).
(c) Check the resistance between the terminals of the battery plug.
Standard:

Tester Connection	Specified Condition
A – C	Below 1 Ω
B – D	Below 1 Ω

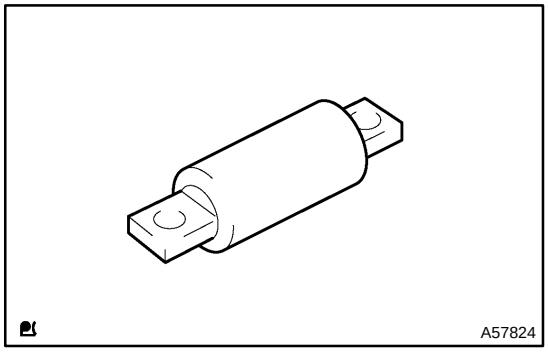
(d) Reinstall the battery plug (see page 21–77).
(e) Reinstall the HV battery assembly (see page 21–54).

NG → **REPLACE BATTERY PLUG**

OK

REPLACE BATTERY ECU ASSY (See page 21–98)

5 INSPECT HIGH VOLTAGE FUSE



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Remove the high voltage fuse (see page 21–116).

HINT:
The high voltage fuse is enclosed in the service plug grip.

(b) Check the resistance between the terminals of the high voltage fuse.
Standard: Below 1 Ω
(c) Reinstall the high voltage fuse (see page 21–116).

NG → **REPLACE HIGH VOLTAGE FUSE**

OK

REPLACE SERVICE PLUG GRIP

cardiagn.com

DTC P0A1F/593 BATTERY ENERGY CONTROL MODULE

CIRCUIT DESCRIPTION

The battery ECU transmits information on the IG2 voltage of the battery ECU to the HV control ECU via CAN communication.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1F	593	IG2 signal circuit of battery ECU malfunction	• Wire harness or connector • Battery ECU

MONITOR DESCRIPTION

When the IG2 voltage of the battery ECU, which is transmitted while the power switch is ON (IG), is low, the HV control ECU determines that a wiring malfunction has occurred at the IG2 terminal of battery ECU. When the HV control ECU detects the malfunction, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A1F (INF 593): Battery ECU/IG2 signal malfunction
Required sensor/components	Battery ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

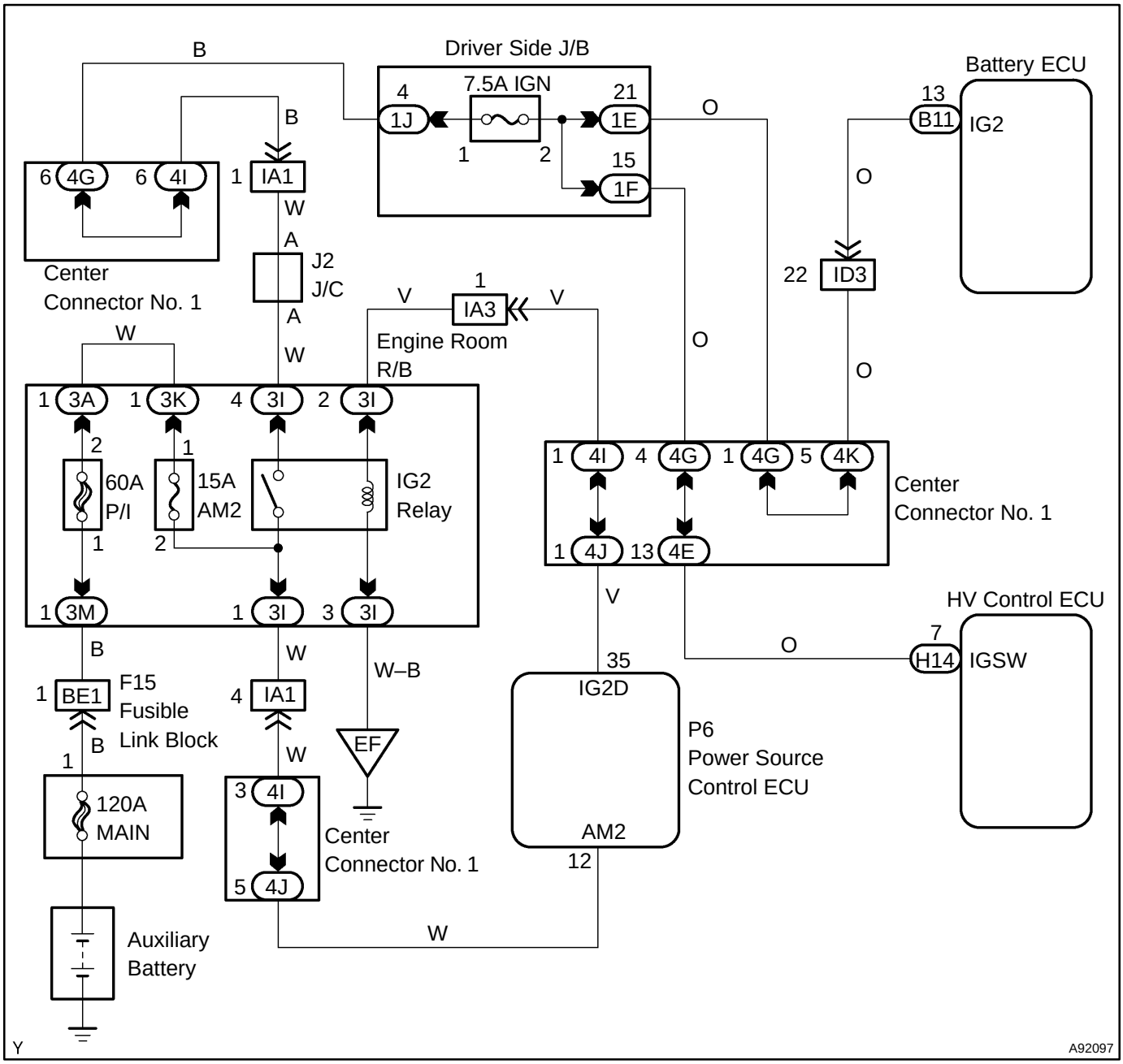
Following conditions are met:	(a) and (b)
(a) IG2 signal status at HV control ECU	ON
(b) IG2 signal status from battery ECU	OFF

COMPONENT OPERATING RANGE

Battery ECU	DTC P0A1F (INF 593) is not detected

cardiagn.com

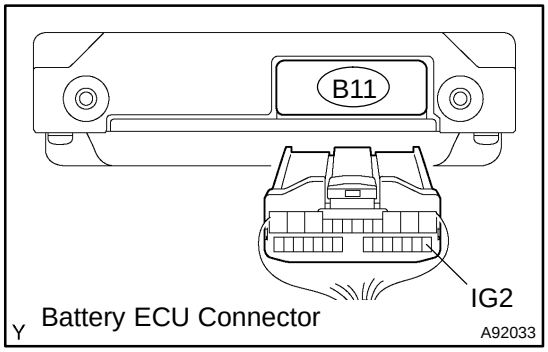
WIRING DIAGRAM

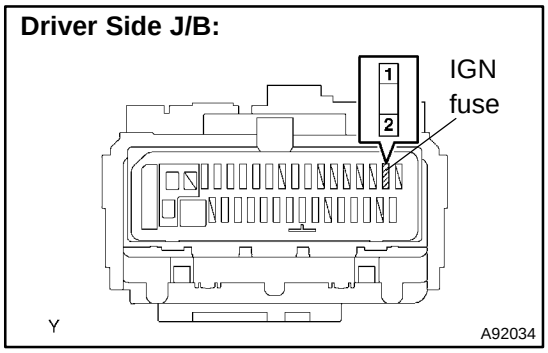


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(BATTERY ECU – IGN FUSE)





(a) Disconnect the B11 battery ECU connector.
(b) Remove the IGN fuse from the driver side J/B.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
IG2 (B11–13) – IGN fuse (2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
IG2 (B11–13) or IGN fuse (2) – Body ground	10 kΩ or higher

NOTICE:

When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(d) Reinstall the IGN fuse.
(e) Reconnect the battery ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE BATTERY ECU ASSY (See page 21–98)

cardiagn.com

DTC	P0A2B/248	DRIVE MOTOR ”A” TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC	P0A2B/250	DRIVE MOTOR ”A” TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A2C (INF 247) on page 05–529.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A2B	248	Motor temperature sensor No. 1 malfunction	• Hybrid vehicle motor
P0A2B	250	Motor temperature sensor No. 1 performance problem	• Hybrid vehicle motor

INSPECTION PROCEDURE

If the information (INF) code 248 or 250 is present, replace the hybrid vehicle motor.
HINT:
The motor temperature sensor No. 1 is unavailable as an individual service part. Therefore, when replacing it, the hybrid vehicle motor must be replaced.

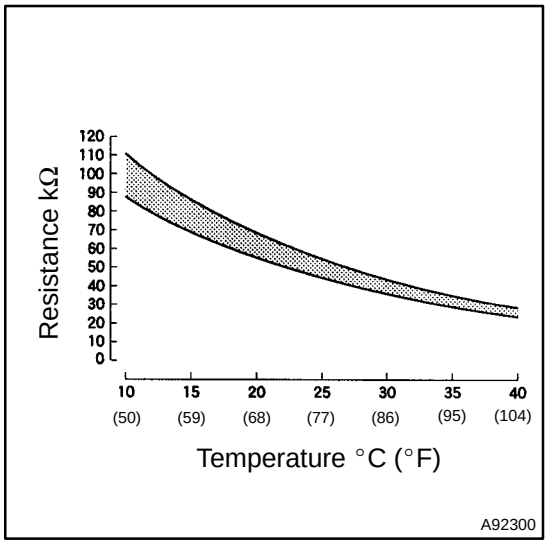
REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

DTC	P0A2C/247	DRIVE MOTOR ”A” TEMPERATURE SENSOR CIRCUIT LOW

DTC	P0A2D/249	DRIVE MOTOR ”A” TEMPERATURE SENSOR CIRCUIT HIGH

CIRCUIT DESCRIPTION



The resistance of the thermistor, which is enclosed in the motor temperature sensor No. 1, changes in accordance with the changes in the temperature of the motor. The lower the motor temperature, the higher the resistance of the thermistor. Conversely, the higher the temperature, the lower the resistance.
The motor temperature sensor No. 1 is connected to the HV control ECU. The power voltage of 5 V is supplied from the MMT terminal of the HV control ECU to the motor temperature sensor No. 1 via resistor R. Because resistor R and the motor temperature sensor No. 1 are connected in series, the resistance changes with the changes in temperature of the motor, which causes the MMT terminal voltage to also change.
Based on this signal, the HV control ECU limits the load in order to prevent the motor from overheating. Furthermore, the HV control ECU checks the motor temperature sensor No. 1 for a wiring malfunction and the sensor for malfunction.

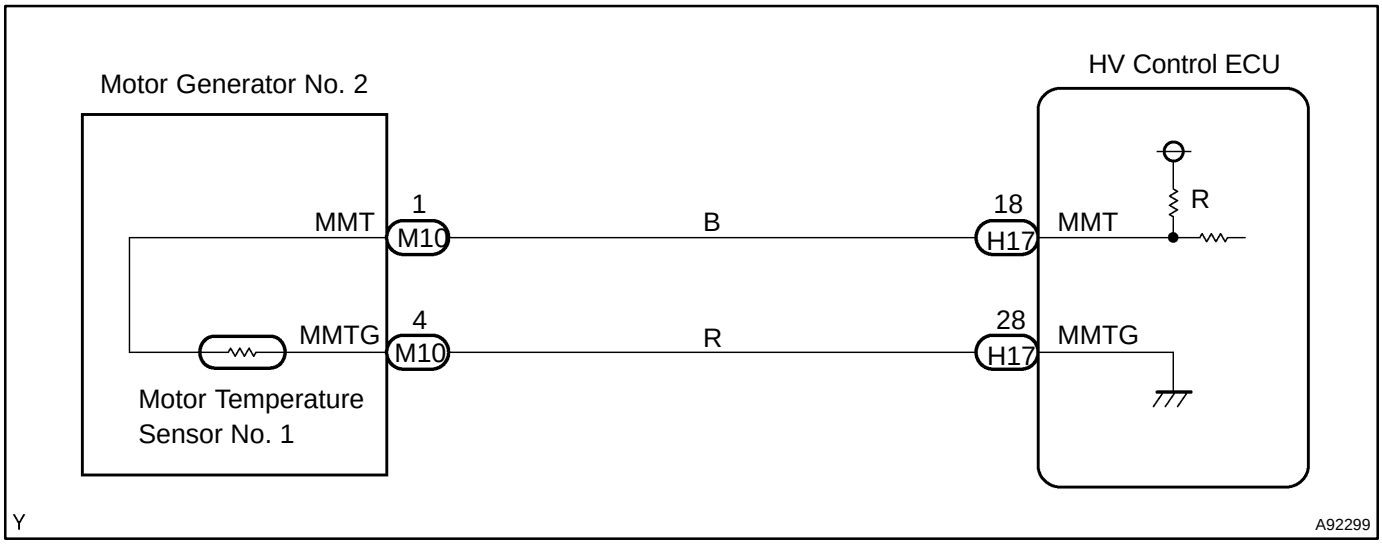
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A2C	247	GND short in motor temperature sensor No. 1 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU
P0A2D	249	Open or +B short in motor temperature sensor No. 1 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU

HINT:
After confirming DTC P0A2C (INF 247) or P0A2D (INF 249), confirm MOTOR 1 TEMP in DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST using the hand–held tester.

Temperature Displayed	Malfunction
–50°C (–58°F)	Open or +B short circuit
205°C (401°F)	GND short circuit

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

1	READ VALUE OF HAND–HELD TESTER(MOTOR 1 TEMP)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MOTOR 1 TEMP value on the hand–held tester.
Result:

Temperature Displayed	Proceed to
–50°C (–58°F)	A
205°C (401°F)	B
–49°C to 204°C (–57°F to 400°F)	C

HINT:
- If there is an open or +B short circuit, the hand–held tester indicates –50°C (–58°F).
- If there is a GND short circuit, the hand–held tester indicates 205°C (401°F).

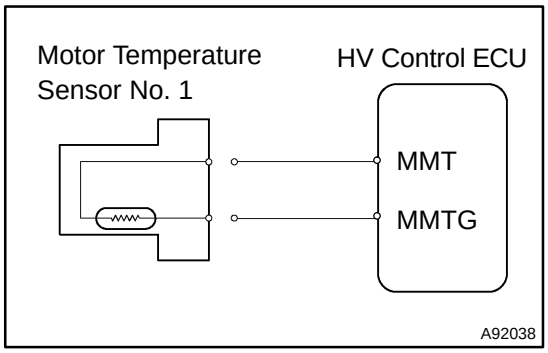
B → **Go to step 5**

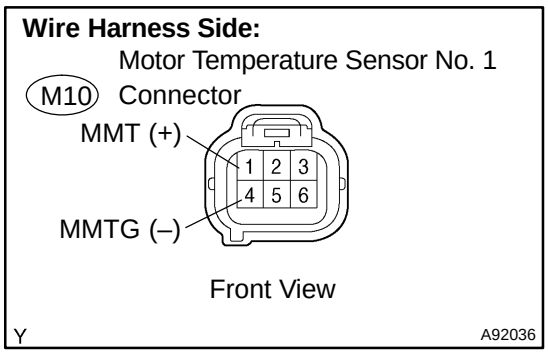
C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)**

A

cardiagn.com

2 INSPECT HYBRID VEHICLE MOTOR ASSY(CHECK FOR OPEN OR +B SHORT)





(a) Disconnect the M10 motor temperature sensor No. 1 connector.

(b) Turn the power switch ON (IG).

(c) Measure the voltage between the terminals of the motor temperature sensor No.1 connector.

Result:

Tester Connection	Voltage	Proceed to
MMT (M10–1) – MMTG (M10–4)	Approximately 5 V	A
MMT (M10–1) – MMTG (M10–4)	9 to 14V	B
MMT (M10–1) – MMTG (M10–4)	Approximately 0 V	C

HINT:

The motor temperature sensor No.1 is unavailable as an individual service part. Therefore, when replacing it, the hybrid vehicle motor must be replaced.

(d) Reconnect the motor temperature sensor No. 1 connector.

B → **Go to step 3**

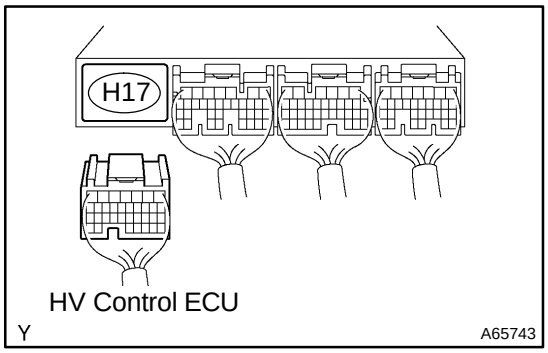
C → **Go to step 4**

A

REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

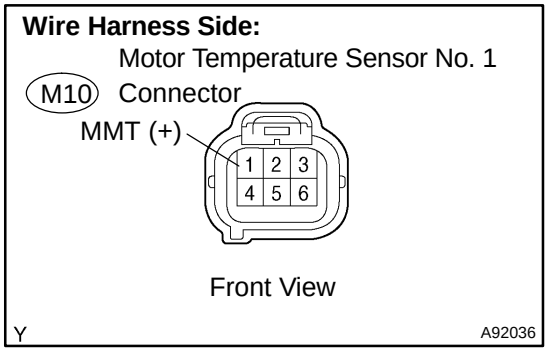
3	CHECK HARNESS AND CONNECTOR(CHECK FOR +B SHORT)



(a) Disconnect the H17 HV control ECU connector.
(b) Disconnect the M10 motor temperature sensor No.1 connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminal of the motor temperature sensor No. 1 connector and body ground.
Standard:

Tester Connection	Specified Condition
MMT (M10–1) – Body ground	Approximately 0 V

(e) Reconnect the HV control ECU connector.
(f) Reconnect the motor temperature sensor No. 1 connector.



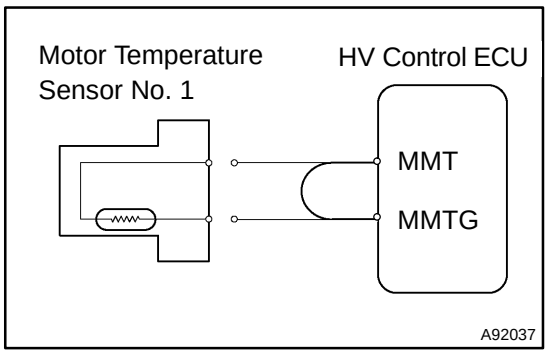
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

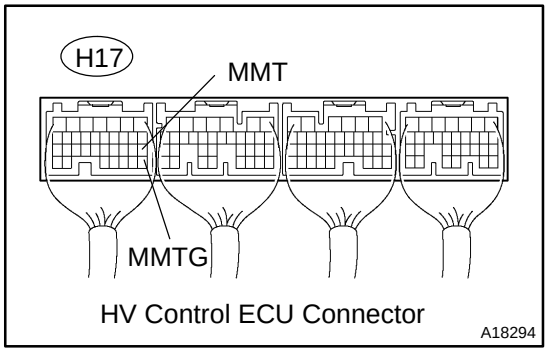
OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

4	READ VALUE OF HAND–HELD TESTER(CHECK FOR OPEN IN HYBRID VEHICLE CONTROL ECU)





(a) Disconnect the M10 motor temperature sensor No. 1 connector.
(b) Connect terminals MMT and MMTG of the H17 HV control ECU connector.
(c) Turn the power switch ON (IG).
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MOTOR 1 TEMP value.
Standard: 205°C (401°F)

HINT:
If the hand–held tester indicates a temperature of –50°C (–58°F), check the connection of the HV control ECU. If it is connected normally, replace the HV control ECU.

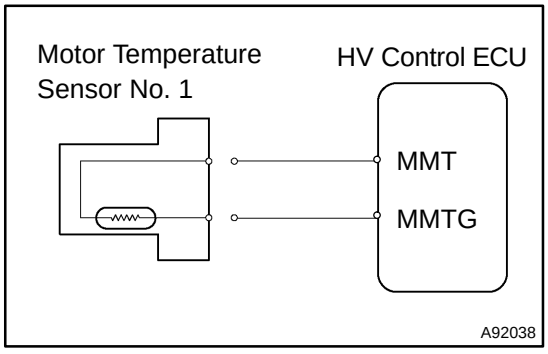
(f) Reconnect the motor temperature sensor No. 1 connector.

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

5	READ VALUE OF HAND–HELD TESTER(CHECK FOR GND SHORT IN WIRE HARNESS)



(a) Disconnect the M10 motor temperature sensor No. 1 connector.
(b) Turn the power switch ON (IG).
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the MOTOR 1 TEMP value.
Standard: –50°C (–58°F)
(e) Reconnect the motor temperature sensor No. 1 connector.

HINT:
The motor temperature sensor No.1 is unavailable as an individual service part. Therefore, when replacing it, the hybrid vehicle motor must be replaced.

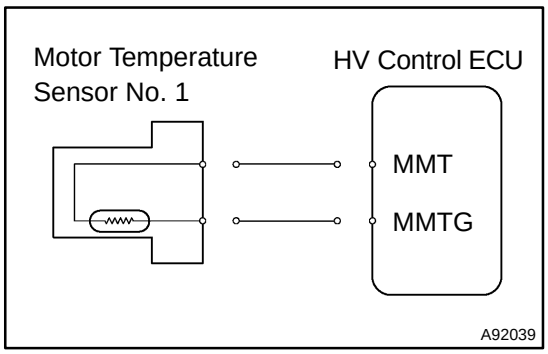
NG → **Go to step 6**

OK

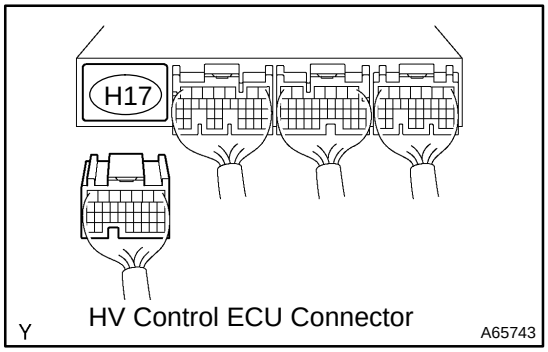
REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

6	READ VALUE OF HAND–HELD TESTER(CHECK FOR GND SHORT IN HYBRID VEHICLE CONTROL ECU)



(a) Disconnect the H17 HV control ECU connector.
(b) Turn the power switch ON (IG).
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the MOTOR 1 TEMP value.
Standard: –50°C (–58°F)
(e) Reconnect the HV control ECU connector.



NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

cardiagn.com

DTC	P0A37/258	GENERATOR TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A38 (INF 257) on page 05–537.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A37	258	Motor temperature sensor No. 2 malfunction	• Hybrid vehicle motor

INSPECTION PROCEDURE

If the information (INF) code 258 is present, replace the hybrid vehicle motor.

HINT:

The motor temperature sensor No. 2 is unavailable as an individual service part. Therefore, when replacing it, the hybrid vehicle motor must be replaced.

REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

DTC	P0A37/260	GENERATOR TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A38 (INF 257) on page 05–537.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A37	260	Motor temperature sensor No. 2 performance problem	• Hybrid vehicle motor • Transaxle fluid leakage • HV transaxle assembly

INSPECTION PROCEDURE

1	CHECK TRANSAXLE FLUID LEVEL (See page 22–1)

(a) Check if the transaxle is filled with fluid to the specified level.

OK: The transaxle is filled with fluid to the specified level

HINT:

The motor temperature sensor No. 2 is unavailable as an individual service part. Therefore, when replacing it, the hybrid vehicle motor must be replaced.

NG → **REPAIR OIL LEAKAGE, OR REPLACE HYBRID VEHICLE TRANSAXLE**

OK ↓

REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

DTC	P0A38/257	GENERATOR TEMPERATURE SENSOR CIRCUIT LOW

DTC	P0A39/259	GENERATOR TEMPERATURE SENSOR CIRCUIT HIGH

CIRCUIT DESCRIPTION

The motor temperature sensor No. 2 detects the temperature of the transaxle fluid. The resistance of the thermistor installed in the motor temperature sensor No. 2 varies with the changes in the transaxle fluid temperature. The construction in the motor temperature sensor No. 2 and how it is connected to the HV control ECU are the same as those of the motor temperature sensor No. 1 (see the circuit description on page 05–529).

Based on the signal provided by the motor temperature sensor No. 2, the HV control ECU limits the load to prevent the motor from overheating. Furthermore, the HV control ECU checks the motor temperature sensor No. 2 for a wiring malfunction and the sensor for malfunction.

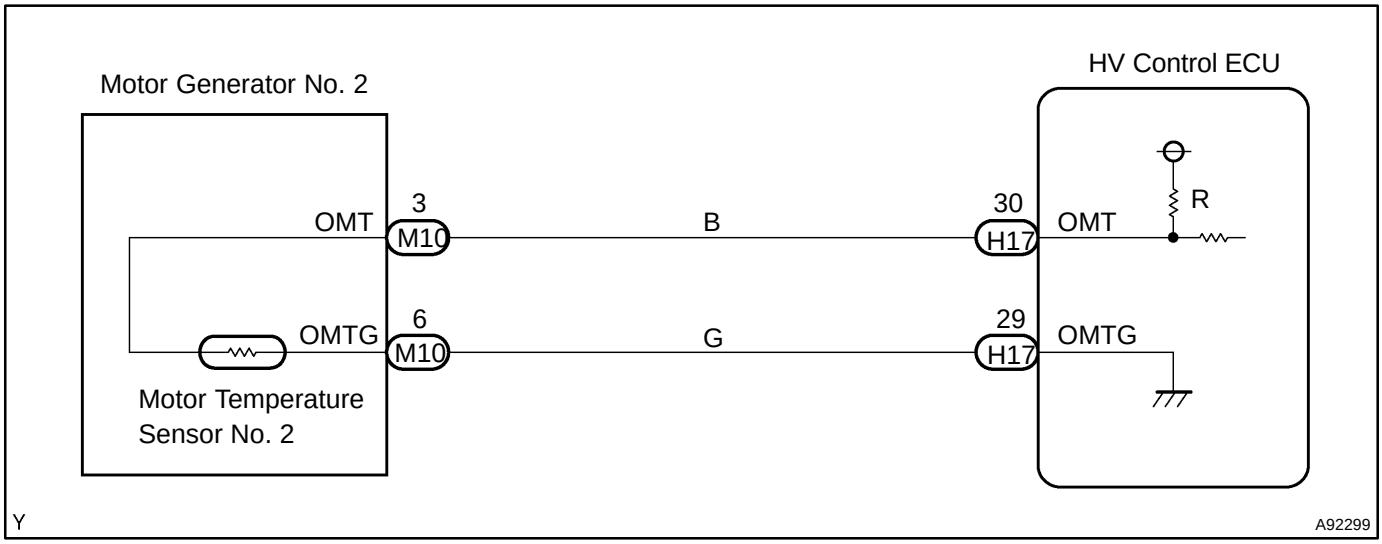
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A38	257	GND short in motor temperature sensor No. 2 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU
P0A39	259	Open or +B short in motor temperature sensor No. 2 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU

HINT:

After confirming DTC P0A38 (INF 257) or P0A39 (INF 259), confirm MOTOR 2 TEMP in DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST using the hand–held tester.

Temperature Displayed	Malfunction
–50°C (–58°F)	Open or +B short circuit
205°C (401°F)	GND short circuit

WIRING DIAGRAM



cardiagn.com

INSPECTION PROCEDURE

1 READ VALUE OF HAND–HELD TESTER(MOTOR 2 TEMP)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MOTOR 2 TEMP value on the hand–held tester.
Result:

Temperature Displayed	Proceed to
–50°C (–58°F)	A
205°C (401°F)	B
–49°C to 204°C (–57°F to 400°F)	C

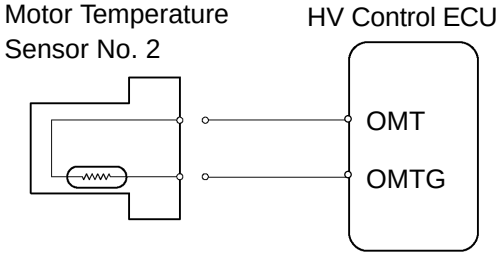
HINT:
- If there is an open or +B short circuit, the hand–held tester indicates –50°C (–58°F).
- If there is a GND short circuit, the hand–held tester indicates 205°C (401°F).

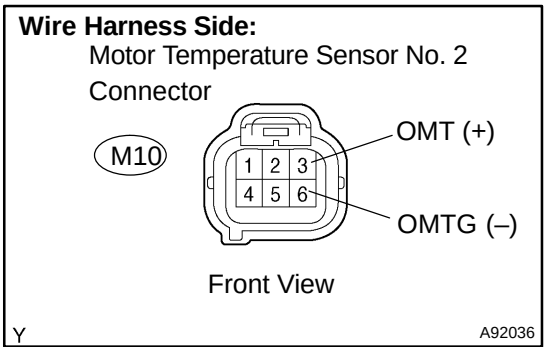
B → **Go to step 5**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)**

A

2 INSPECT HYBRID VEHICLE MOTOR ASSY(CHECK FOR OPEN OR +B SHORT)





(a) Disconnect the M10 motor temperature sensor No. 2 connector.
(b) Turn the power switch ON (IG).
(c) Measure the voltage between the terminals of the motor temperature sensor No. 2 connector.
Result:

Tester Connection	Voltage	Proceed to
OMT (M10–3) – OMTG (M10–6)	Approximately 5 V	A
OMT (M10–3) – OMTG (M10–6)	9 to 14V	B
OMT (M10–3) – OMTG (M10–6)	Approximately 0 V	C

HINT:
The motor temperature sensor No. 2 is unavailable as an individual service part. Therefore, when replacing it, the hybrid vehicle motor must be replaced.
(d) Reconnect the motor temperature sensor No. 2 connector.

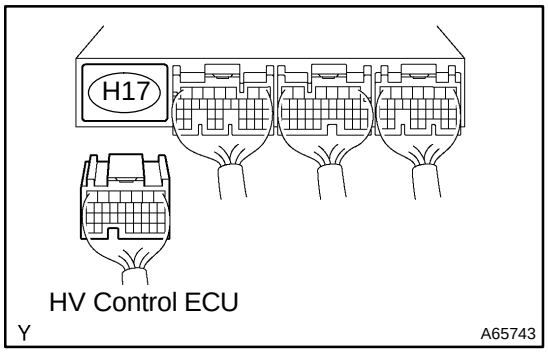
cardiagn.com

B	Go to step 3
C	Go to step 4

A

REPLACE HYBRID VEHICLE MOTOR ASSY

3 CHECK HARNESS AND CONNECTOR(CHECK FOR +B SHORT)

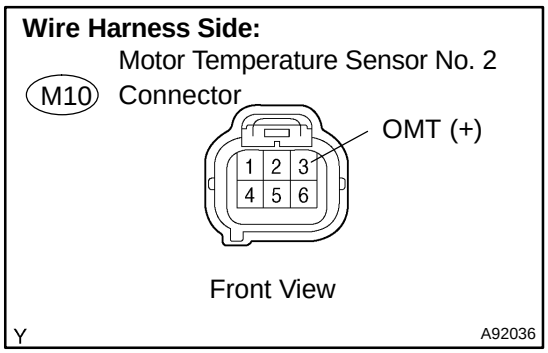


(a) Disconnect the H17 HV control ECU connector.
(b) Disconnect the M10 motor temperature sensor No. 2 connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminal of the motor temperature sensor No. 2 connector and body ground.

Standard:

tester Connection	Specified Condition
OMT (M10–3) – Body ground	Approximately 0 V

(e) Reconnect the HV control ECU connector.
(f) Reconnect the motor temperature sensor No. 2 connector.



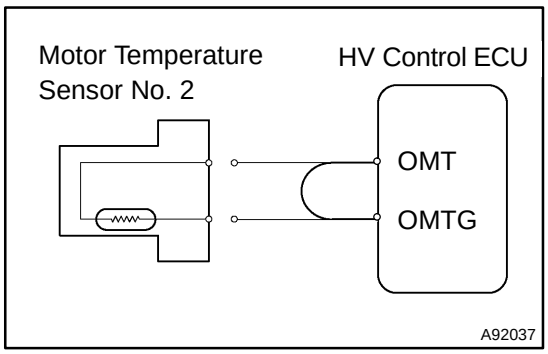
NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

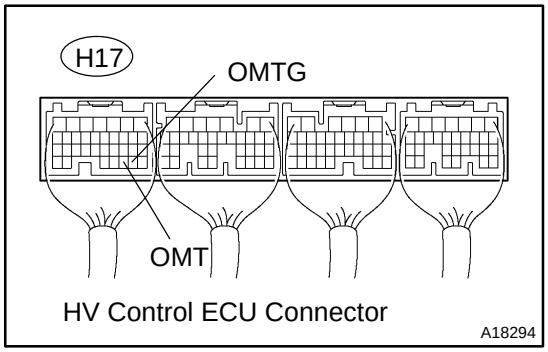
OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

4	READ VALUE OF HAND–HELD TESTER(CHECK FOR OPEN IN HYBRID VEHICLE CONTROL ECU)





(a) Disconnect the M10 motor temperature sensor No. 2 connector.
(b) Connect terminals OMT and OMTG of the H17 HV control ECU connector.
(c) Turn the power switch ON (IG).
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MOTOR 2 TEMP value.
Standard: 205°C (401°F)

HINT:
If the hand–held tester indicates a temperature of –50°C (–58°F), check the connection of the HV control ECU. If it is connected normally, replace the HV control ECU.

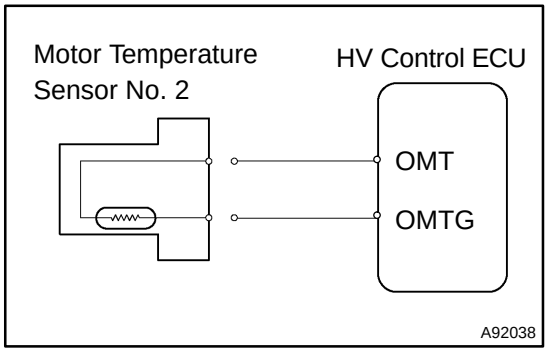
(f) Reconnect the motor temperature sensor No. 2 connector.

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

5	READ VALUE OF HAND–HELD TESTER(CHECK FOR GND SHORT IN WIRE HARNESS)



(a) Disconnect the M10 motor temperature sensor No. 2 connector.
(b) Turn the power switch ON (IG).
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the MOTOR 2 TEMP value.
Standard: –50°C (–58°F)
(e) Reconnect the motor temperature sensor No. 2 connector.

HINT:
The motor temperature sensor No. 2 is unavailable as an individual service part. Therefore, when replacing it, the hybrid vehicle motor must be replaced.

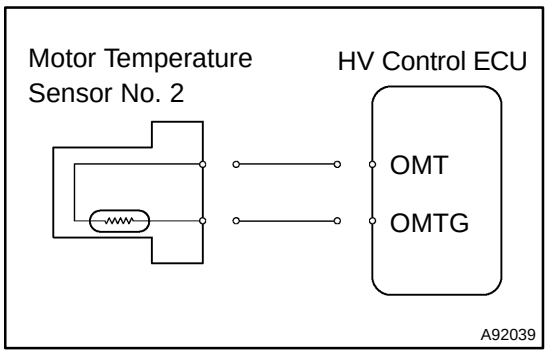
NG → **Go to step 6**

OK

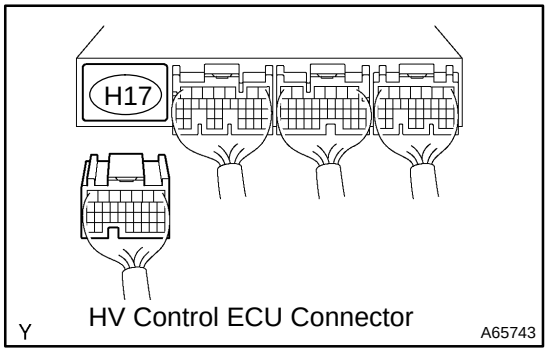
REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

6	READ VALUE OF HAND–HELD TESTER(CHECK FOR GND SHORT IN HYBRID VEHICLE CONTROL ECU)



(a) Disconnect the H17 HV control ECU connector.
(b) Turn the power switch ON (IG).
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the MOTOR 2 TEMP value.
Standard: –50°C (–58°F)
(e) Reconnect the HV control ECU connector.



NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

cardiagn.com

DTC	P0A3F/243	DRIVE MOTOR ”A” POSITION SENSOR CIRCUIT

DTC	P0A40/500	DRIVE MOTOR ”A” POSITION SENSOR CIRCUIT RANGE/PERFORMANCE

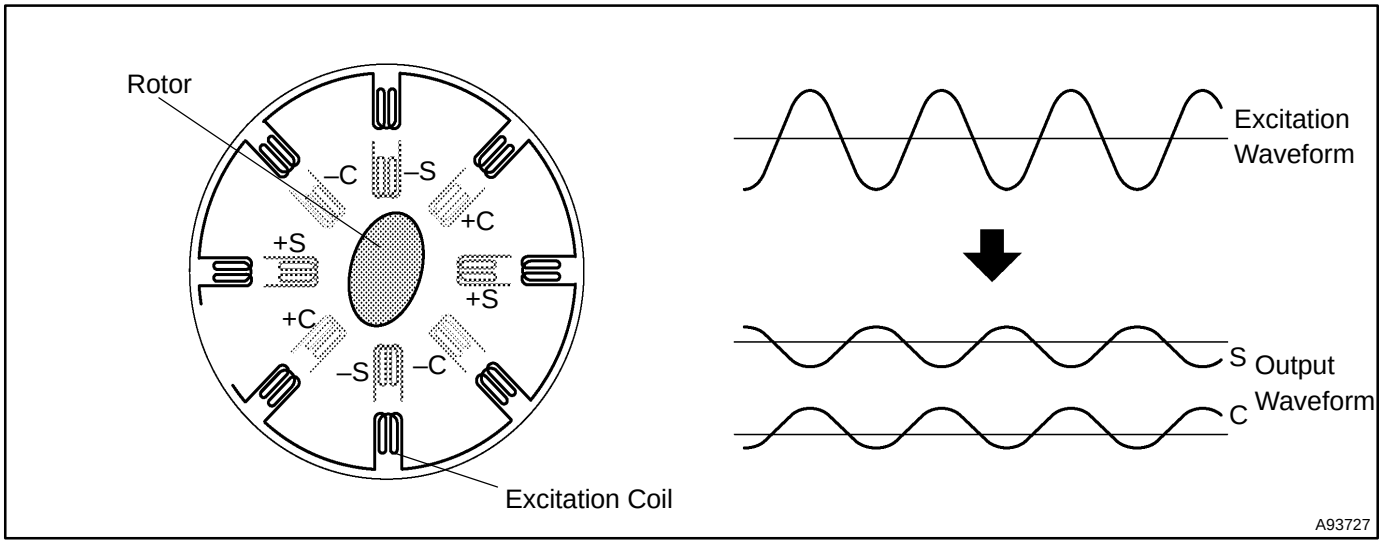
DTC	P0A41/245	DRIVE MOTOR ”A” POSITION SENSOR CIRCUIT LOW

CIRCUIT DESCRIPTION

The motor resolver is a type of sensor that detects the position of the magnetic poles, which are indispensable for ensuring the highly efficient control of the MG1 and MG2.

The stator of the resolver contains an excitation coil and two detection coils. Because the rotor has an oval shape, the gap between the stator and the rotor changes as the rotor turns. An alternating current with a predetermined frequency flows through the excitation coil, and detection coils S and C output alternating currents in accordance with the position of the sensor rotor.

The HV control ECU detects the absolute position of the rotor in accordance with the phases of detection coils S and C and the height of their waveform. Furthermore, the CPU calculates the amount of change in the position within a predetermined length of time, in order to use the resolver as a speed sensor.



The HV control ECU monitors the output signals of the motor resolver and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A3F	243	Interphase short in motor resolver circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU
P0A40	500	Motor resolver output is out of normal range	• Wire harness or connector • Hybrid vehicle motor • HV control ECU
P0A41	245	Open or short in motor resolver circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU

cardiagn.com

MONITOR DESCRIPTION

The HV control ECU monitors the motor resolver output signal. If the HV control ECU detects output signals that are out of the normal range or specification, it will conclude that there is a malfunction of the motor resolver. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A3F (INF 243): Drive motor "A" position sensor circuit malfunction / Short circuit between phases P0A40 (INF 500): Drive motor "A" position sensor circuit malfunction / Range check P0A41(INF 245): Drive motor "A" position sensor circuit malfunction / Circuit discontinuity or short circuit
Required sensor/components	Motor resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

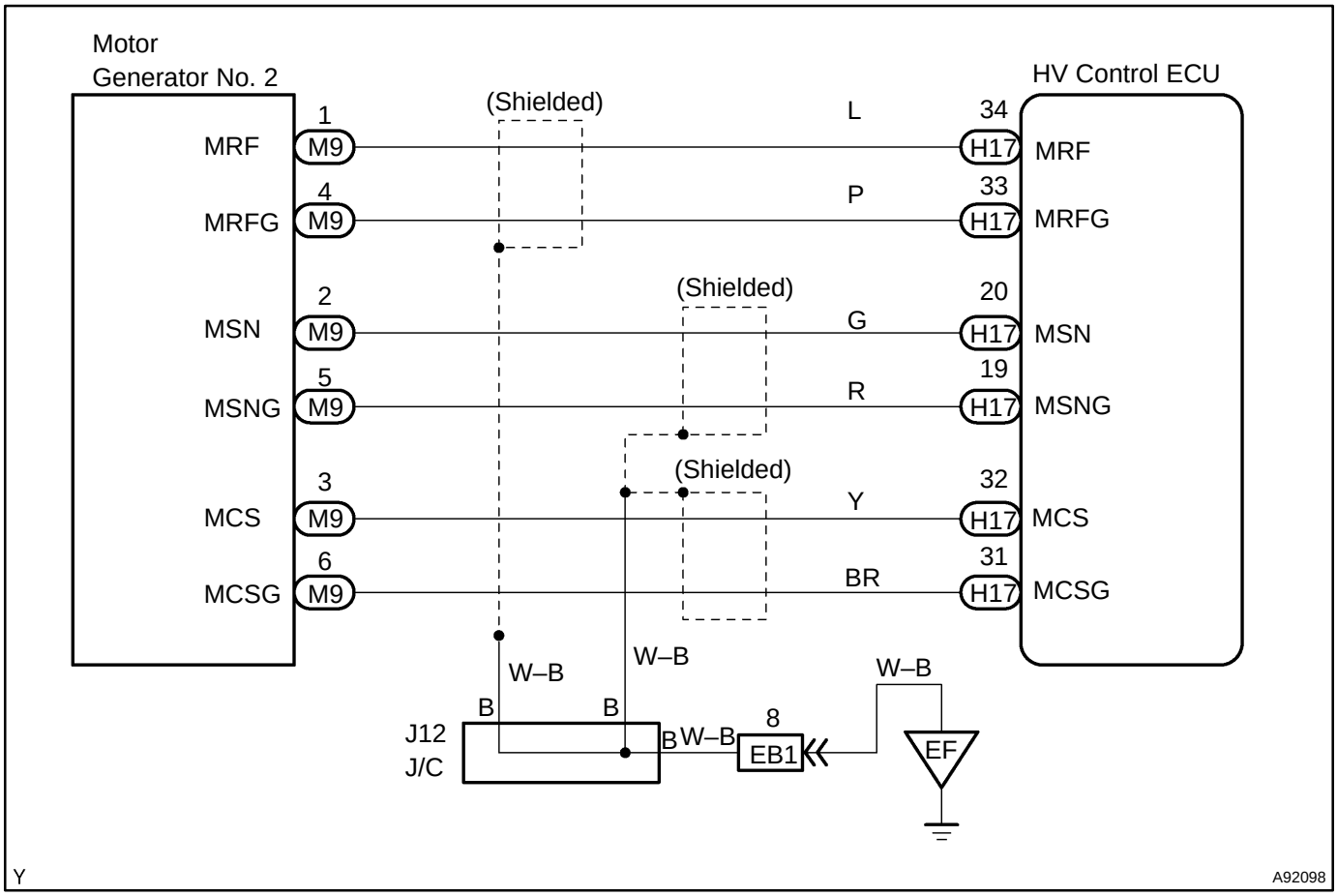
Motor resolver	Circuit malfunction (interphase shot, open or short), or abnormal output

COMPONENT OPERATING RANGE

Motor resolver	DTCs P0A3F (INF 243), P0A40 (INF 500) and P0A41 (INF 245) are not detected

cardiagn.com

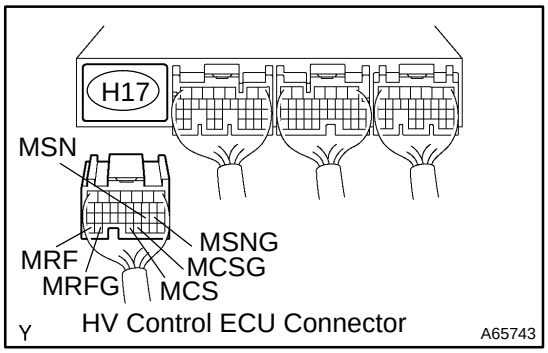
WIRING DIAGRAM

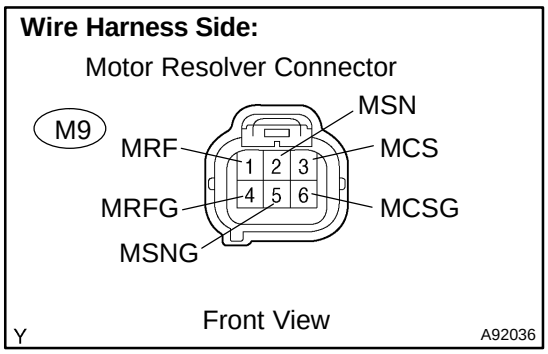


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – MOTOR RESOLVER)





(a) Disconnect the H17 HV control ECU connector.
(b) Disconnect the M9 motor resolver connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
MRF (H17–34) – Body ground	Below 1 V
MRFG (H17–33) – Body ground	Below 1 V
MSN (H17–20) – Body ground	Below 1 V
MSNG (H17–19) – Body ground	Below 1 V
MCS (H17–32) – Body ground	Below 1 V
MCSG (H17–31) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MRF (H17–34) – MRF (M9–1)	Below 1 Ω
MRFG (H17–33) – MRFG (M9–4)	Below 1 Ω
MSN (H17–20) – MSN (M9–2)	Below 1 Ω
MSNG (H17–19) – MSNG (M9–5)	Below 1 Ω
MCS (H17–32) – MCS (M9–3)	Below 1 Ω
MCSG (H17–31) – MCSG (M9–6)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MRF (H17–34) or MRF (M9–1) – Body ground	10 kΩ or higher
MRFG (H17–33) or MRFG (M9–4) – Body ground	10 kΩ or higher
MSN (H17–20) or MSN (M9–2) – Body ground	10 kΩ or higher
MSNG (H17–19) or MSNG (M9–5) – Body ground	10 kΩ or higher
MCS (H17–32) or MCS (M9–3) – Body ground	10 kΩ or higher
MCSG (H17–31) or MCSG (M9–6) – Body ground	10 kΩ or higher

(g) Reconnect the motor resolver connector.
(h) Reconnect the HV control ECU connector.

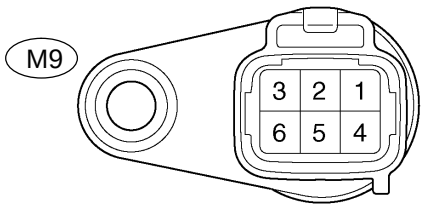
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

2 INSPECT MOTOR RESOLVER

Component Side:
Motor Resolver



Y Front View A92040

(a) Measure the resistance between the terminals of the motor resolver.

Standard:

Tester Connection	Specified Condition
MRF (M9–1) – MRFG (M9–4)	7.65 to 10.2 Ω
MSN (M9–2) – MSNG (M9–5)	12.6 to 16.8 Ω
MCS (M9–3) – MCSG (M9–6)	12.6 to 16.8 Ω
Each terminal listed above – Transaxle housing	10 kΩ or higher

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A4B/253	GENERATOR POSITION SENSOR CIRCUIT

DTC	P0A4C/513	GENERATOR POSITION SENSOR CIRCUIT RANGE/PERFORMANCE

DTC	P0A4D/255	GENERATOR POSITION SENSOR CIRCUIT LOW

CIRCUIT DESCRIPTION

The generator resolver detects the position of the magnetic poles, which are indispensable for ensuring the highly efficient control of the MG1 and MG2. The construction of the generator resolver and how it is connected to the HV control ECU are the same as those of the motor resolver (see the circuit description on page 05–542).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A4B	253	Interphase short in generator resolver circuit	• Wire harness or connector • Hybrid vehicle generator • HV control ECU
P0A4C	513	Generator resolver output is out of normal range	• Wire harness or connector • Hybrid vehicle generator • HV control ECU
P0A4D	255	Open or short in generator resolver circuit	• Wire harness or connector • Hybrid vehicle generator • HV control ECU

MONITOR DESCRIPTION

The HV control ECU monitors the generator resolver output signal. If the HV control ECU detects output signals that are out of the normal range or specification, it will conclude that there is a malfunction of the generator resolver. The HV control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A4B (INF 253): Generator position sensor circuit malfunction / Short circuit between phases P0A4C (INF 513): Generator position sensor circuit malfunction / Range check P0A4D (INF 255): Generator position sensor circuit malfunction / Circuit discontinuity or short circuit
Required sensor/components	Generator resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

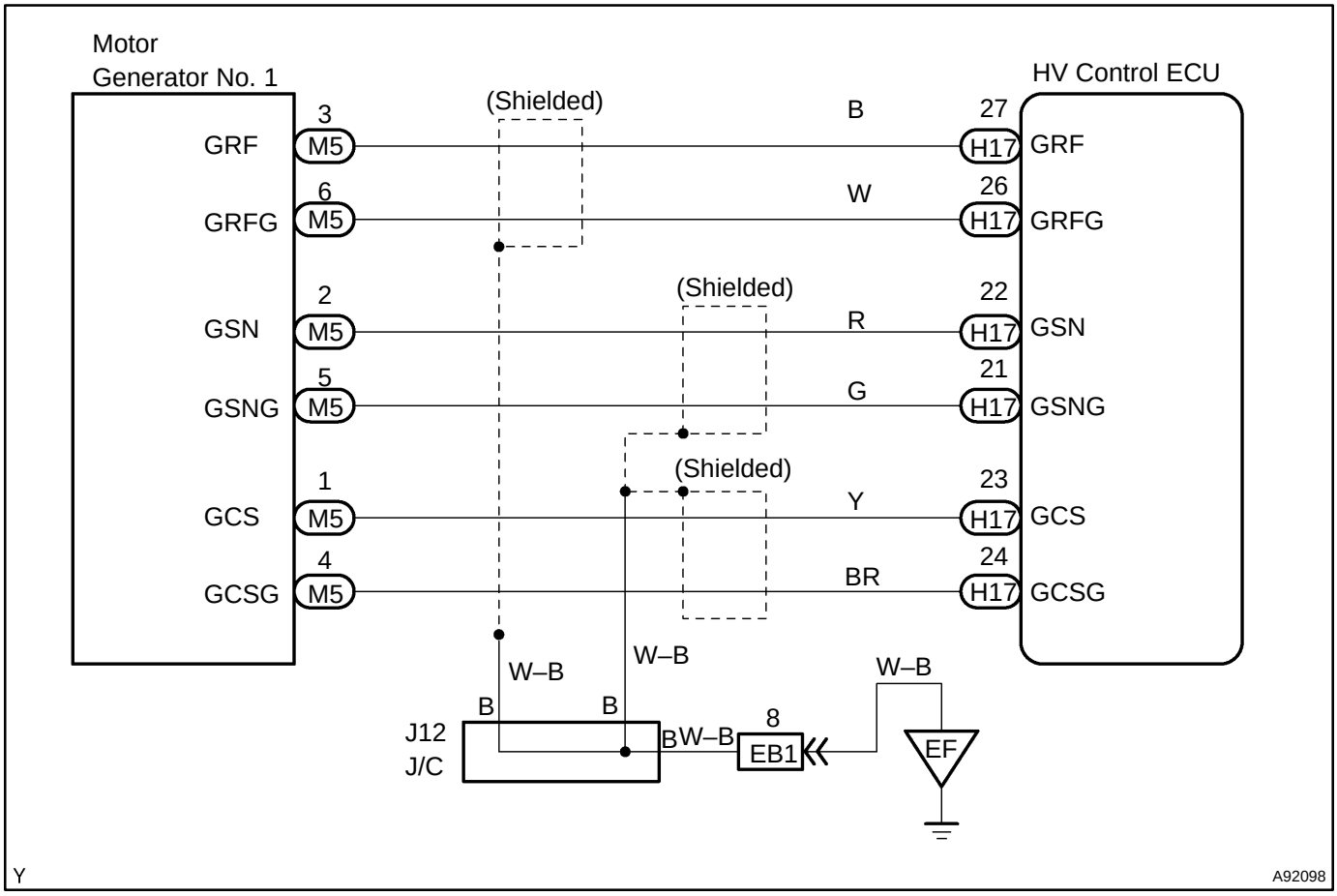
Generator resolver	Circuit malfunction (interphase shot, open or short), or abnormal output

cardiagn.com

COMPONENT OPERATING RANGE

Generator resolver	DTCs P0A4B (INF 253) P0A4C (INF 513) and P0A4D (INF 255) are not detected

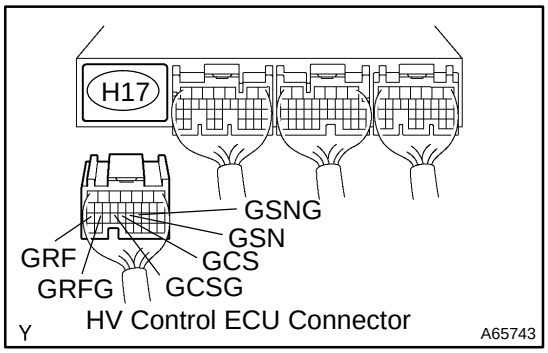
WIRING DIAGRAM

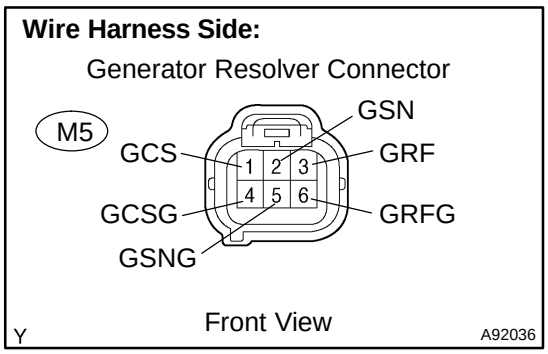


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – GENERATOR RESOLVER)





(a) Disconnect the H17 HV control ECU connector.
(b) Disconnect the M5 generator resolver connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
GRF (H17–27) – Body ground	Below 1 V
GRFG (H17–26) – Body ground	Below 1 V
GSN (H17–22) – Body ground	Below 1 V
GSNG (H17–21) – Body ground	Below 1 V
GCS (H17–23) – Body ground	Below 1 V
GCSG (H17–24) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GRF (H17–27) – GRF (M5–3)	Below 1 Ω
GRFG (H17–26) – GRFG (M5–6)	Below 1 Ω
GSN (H17–22) – GSN (M5–2)	Below 1 Ω
GSNG (H17–21) – GSNG (M5–5)	Below 1 Ω
GCS (H17–23) – GCS (M5–1)	Below 1 Ω
GCSG (H17–24) – GCSG (M5–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GRF (H17–27) or GRF (M5–3) – Body ground	10 kΩ or higher
GRFG (H17–26) or GRFG (M5–6) – Body ground	10 kΩ or higher
GSN (H17–22) or GSN (M5–2) – Body ground	10 kΩ or higher
GSNG (H17–21) or GSNG (M5–5) – Body ground	10 kΩ or higher
GCS (H17–23) or GCS (M5–1) – Body ground	10 kΩ or higher
GCSG (H17–24) or GCSG (M5–4) – Body ground	10 kΩ or higher

(g) Reconnect the generator resolver connector.
(h) Reconnect the HV control ECU connector.

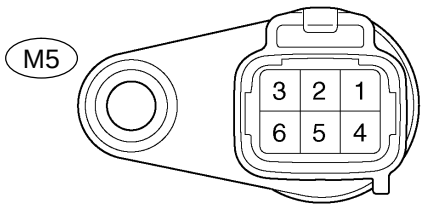
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

2	INSPECT GENERATOR RESOLVER

Component Side:
Generator Resolver



Y Front View A92040

(a) Measure the resistance between the terminals of the generator resolver.

Standard:

Tester Connection	Specified Condition
GCS (M5–1) – GCSG (M5–4)	12.6 to 16.8 Ω
GSN (M5–2) – GSNG (M5–5)	12.6 to 16.8 Ω
GRF (M5–3) – GRFG (M5–6)	7.65 to 10.2 Ω
Each terminal listed above – Transaxle housing	10 kΩ or higher

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A51/174	DRIVE MOTOR ”A” CURRENT SENSOR CIRCUIT

CIRCUIT DESCRIPTION

The HV control ECU performs self–checks to detect an internal operating malfunction in the ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A51	174	HV control ECU internal error	• HV control ECU

INSPECTION PROCEDURE

If the information (INF) code is present, replace the HV control ECU.

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A60/288	DRIVE MOTOR ”A” PHASE V CURRENT
DTC	P0A60/289	DRIVE MOTOR ”A” PHASE V CURRENT
DTC	P0A60/290	DRIVE MOTOR ”A” PHASE V CURRENT
DTC	P0A60/292	DRIVE MOTOR ”A” PHASE V CURRENT
DTC	P0A60/294	DRIVE MOTOR ”A” PHASE V CURRENT
DTC	P0A60/501	DRIVE MOTOR ”A” PHASE V CURRENT
DTC	P0A63/296	DRIVE MOTOR ”A” PHASE W CURRENT
DTC	P0A63/297	DRIVE MOTOR ”A” PHASE W CURRENT
DTC	P0A63/298	DRIVE MOTOR ”A” PHASE W CURRENT
DTC	P0A63/300	DRIVE MOTOR ”A” PHASE W CURRENT
DTC	P0A63/302	DRIVE MOTOR ”A” PHASE W CURRENT
DTC	P0A63/502	DRIVE MOTOR ”A” PHASE W CURRENT

cardiagn.com

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

The motor inverter current sensors detect the amperage that flows through the V and W phase cables between the inverter and MG1/MG2. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the HV control ECU.

The HV control ECU monitors the inverter current sensors to detect a malfunction in the sensor system. Thus, this does not intend detecting a malfunction in the high voltage system.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A60	288	Phase V current sub sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A60	289	Open in phase V current sub sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A60	290	Phase V current main sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A60	292	Open in phase V current main sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A60	294	Phase V current main and sub sensors of motor inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly
P0A60	501	Phase V current main and sub sensors of motor inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A63	296	Phase W current sub sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A63	297	Open in phase W current sub sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A63	298	Phase W current main sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A63	300	Open in phase W current main sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A63	302	Phase W current main and sub sensors of motor inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly
P0A63	502	Phase W current main and sub sensors of motor inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the motor inverter current sensor. If the HV control ECU detects a fault, it will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A60 (INF 288/289/290/292/294/501): Motor inverter current sensor / Phase V current sensor malfunction P0A63 (INF 296/297/298/300/302/502): Motor inverter current sensor / Phase W current sensor malfunction
Required sensor/components	Motor inverter current sensor, motor resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

cardiagn.com

TYPICAL MALFUNCTION THRESHOLDS

Motor inverter current sensor	Abnormal

COMPONENT OPERATING RANGE

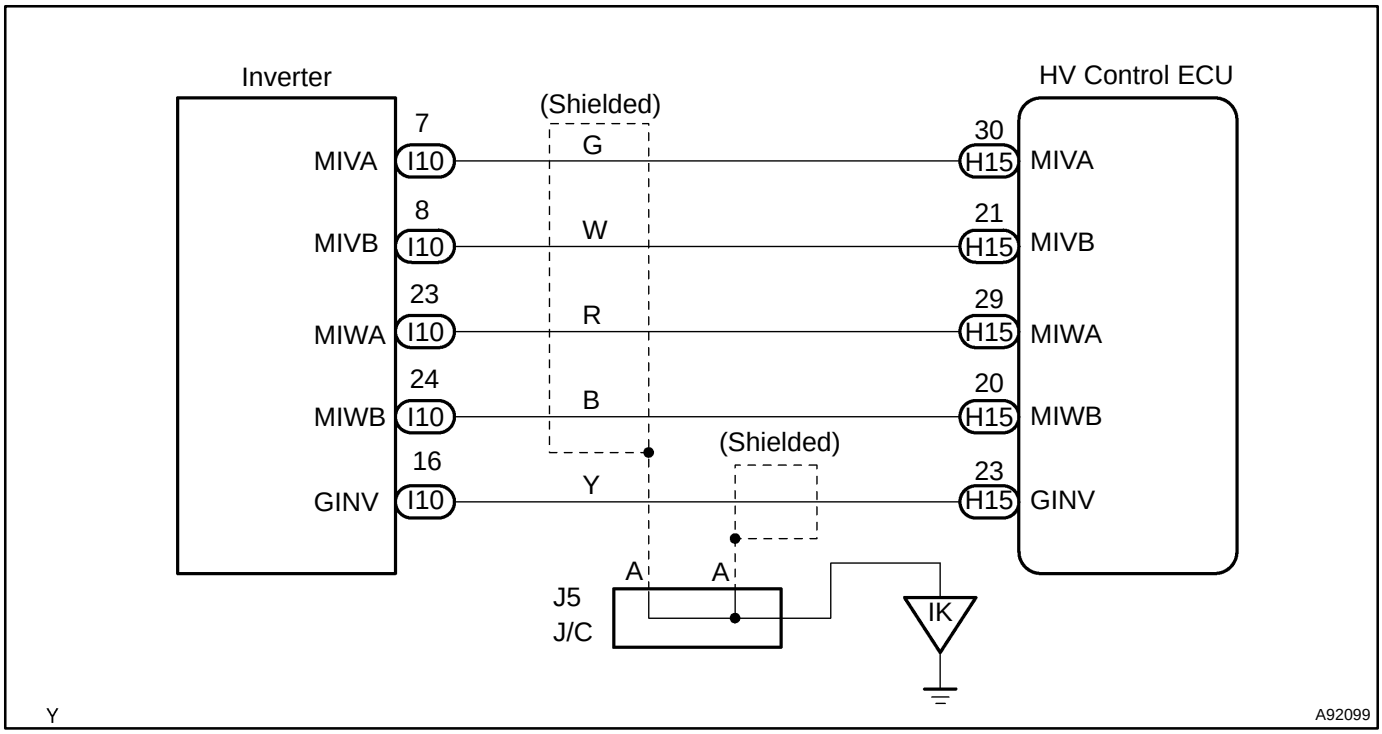
P0A60 (INF 288/289/290/292/294/501):

Motor inverter current sensor	DTC P0A60 (INF 288/289/290/292/294/501) is not detected

P0A63 (INF 296/297/298/300/302/502):

Motor inverter current sensor	DTC P0A63 (INF 296/297/298/300/302/502) is not detected

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

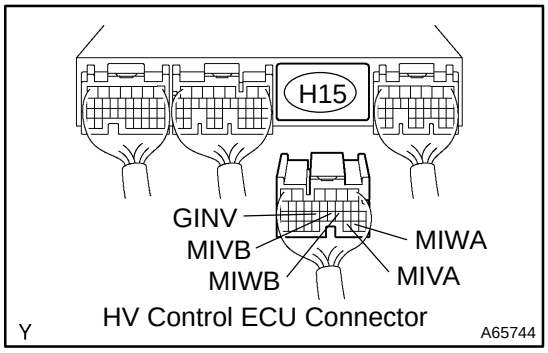
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

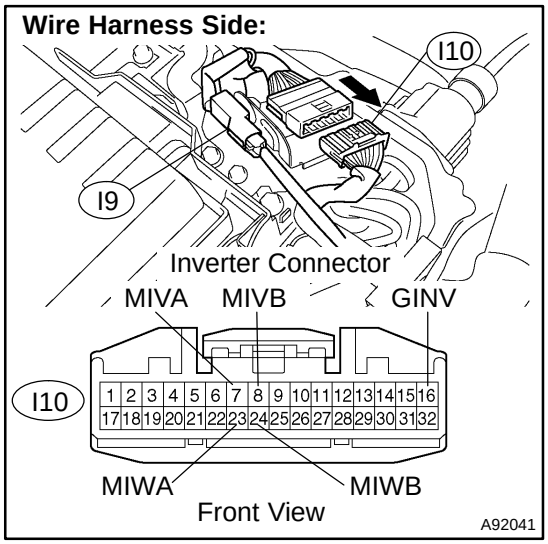
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
MIVA (H15–30) – Body ground	Below 1 V
MIVB (H15–21) – Body ground	Below 1 V
MIWA (H15–29) – Body ground	Below 1 V
MIWB (H15–20) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MIVA (H15–30) – MIVA (I10–7)	Below 1 Ω
MIVB (H15–21) – MIVB (I10–8)	Below 1 Ω
MIWA (H15–29) – MIWA (I10–23)	Below 1 Ω
MIWB (H15–20) – MIWB (I10–24)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MIVA (H15–30) or MIVA (I10–7) – Body ground	10 kΩ or higher
MIVB (H15–21) or MIVB (I10–8) – Body ground	10 kΩ or higher
MIWA (H15–29) or MIWA (I10–23) – Body ground	10 kΩ or higher
MIWB (H15–20) or MIWB (I10–24) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

cardiagn.com

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	**P0A72/326**	**GENERATOR PHASE V CURRENT**
DTC	**P0A72/327**	**GENERATOR PHASE V CURRENT**
DTC	**P0A72/328**	**GENERATOR PHASE V CURRENT**
DTC	**P0A72/330**	**GENERATOR PHASE V CURRENT**
DTC	**P0A72/333**	**GENERATOR PHASE V CURRENT**
DTC	**P0A72/515**	**GENERATOR PHASE V CURRENT**
DTC	**P0A75/334**	**GENERATOR PHASE W CURRENT**
DTC	**P0A75/335**	**GENERATOR PHASE W CURRENT**
DTC	**P0A75/336**	**GENERATOR PHASE W CURRENT**
DTC	**P0A75/338**	**GENERATOR PHASE W CURRENT**
DTC	**P0A75/341**	**GENERATOR PHASE W CURRENT**
DTC	**P0A75/516**	**GENERATOR PHASE W CURRENT**

cardiagn.com

CIRCUIT DESCRIPTION

Refer to DTC P0A60 (INF 288) on page 05–552.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A72	326	Phase V current sub sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A72	327	Open in phase V current sub sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A72	328	Phase V current main sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A72	330	Open in phase V current main sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A72	333	Phase V current main and sub sensors of generator inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly
P0A72	515	Phase V current main and sub sensors of generator inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A75	334	Phase W current sub sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A75	335	Open in phase W current sub sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A75	336	Phase W current main sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly
P0A75	338	Open in phase W current main sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly
P0A75	341	Phase W current main and sub sensors of generator inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly
P0A75	516	Phase W current main and sub sensors of generator inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the generator inverter current sensor. If the HV control ECU detects a fault, it will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A72 (INF 326/327/328/330/333/515): Generator inverter current sensor / Phase V current sensor malfunction P0A75 (INF 334/335/336/338/341/516): Generator inverter current sensor / Phase W current sensor malfunction
Required sensor/components	Generator inverter current sensor, generator resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Generator inverter current sensor	Abnormal

cardiagn.com

COMPONENT OPERATING RANGE

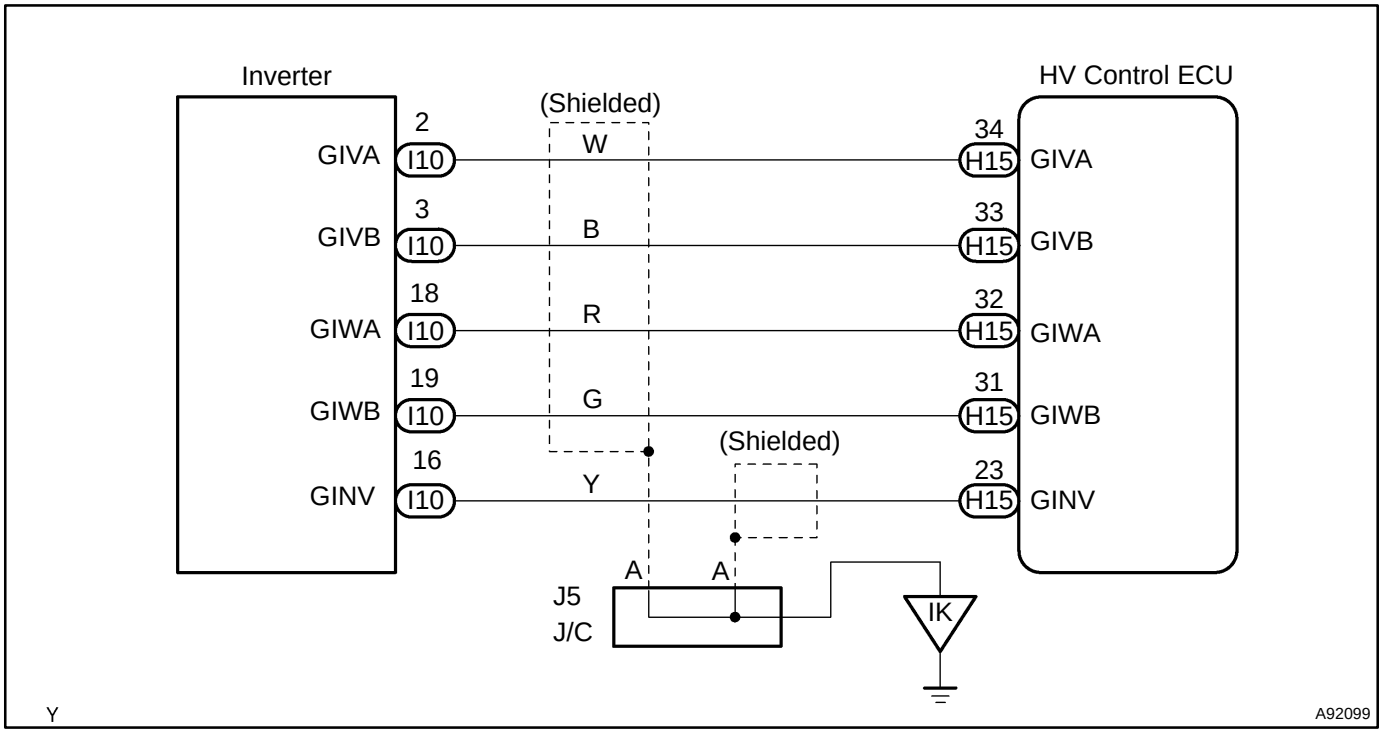
P0A72 (INF 326/327/328/330/333/515):

Generator inverter current sensor	DTC P0A72 (INF 326/327/328/330/333/515) is not detected

P0A75 (INF 334/335/336/338/341/516):

Generator inverter current sensor	DTC P0A75 (INF 334/335/336/338/341/516) is not detected

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

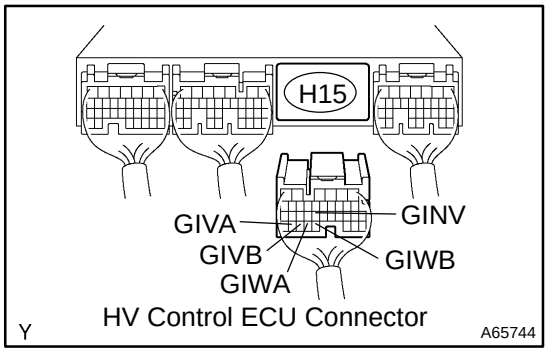
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

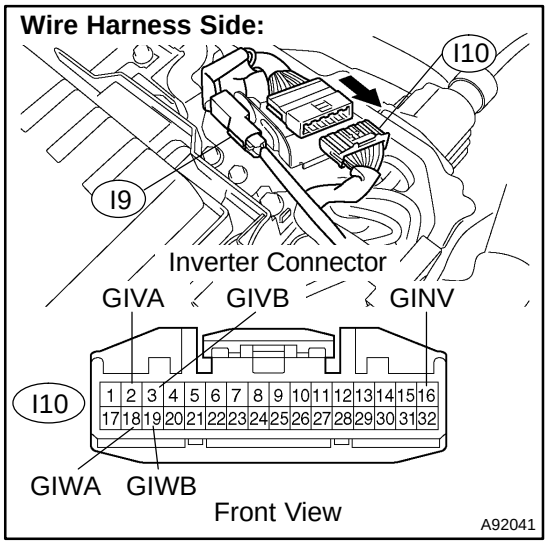
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
GIVA (H15–34) – Body ground	Below 1 V
GIVB (H15–33) – Body ground	Below 1 V
GIWA (H15–32) – Body ground	Below 1 V
GIWB (H15–31) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GIVA (H15–34) – GIVA (I10–2)	Below 1 Ω
GIVB (H15–33) – GIVB (I10–3)	Below 1 Ω
GIWA (H15–32) – GIWA (I10–18)	Below 1 Ω
GIWB (H15–31) – GIWB (I10–19)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GIVA (H15–34) or GIVA (I10–2) – Body ground	10 kΩ or higher
GIVB (H15–33) or GIVB (I10–3) – Body ground	10 kΩ or higher
GIWA (H15–32) or GIWA (I10–18) – Body ground	10 kΩ or higher
GIWB (H15–31) or GIWB (I10–19) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

cardiagn.com

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/266	DRIVE MOTOR ”A” INVERTER PERFORMANCE

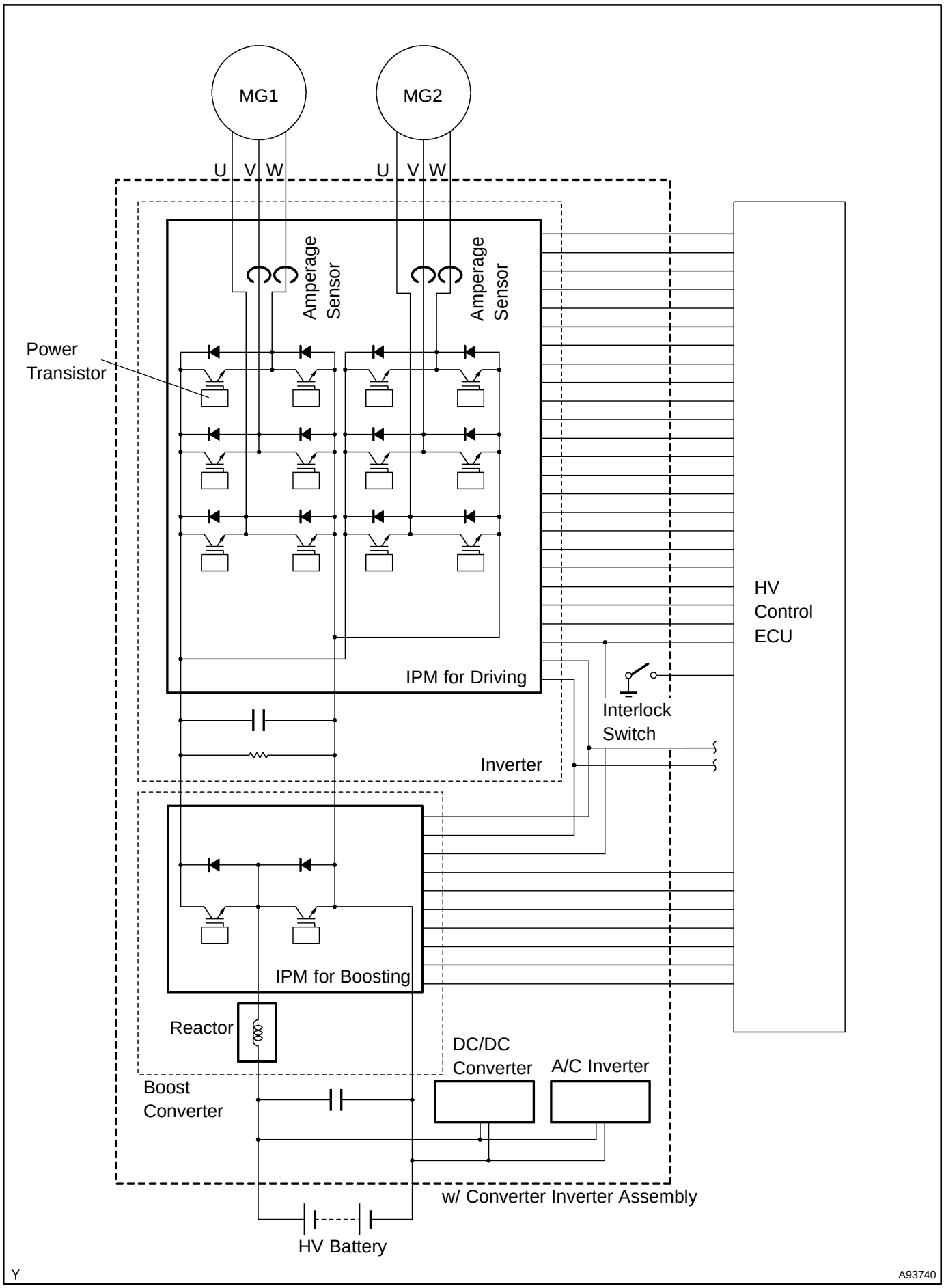
DTC	P0A78/267	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

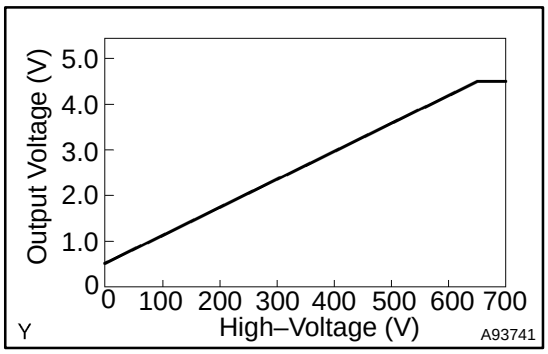
The inverter converts the high–voltage direct current of the HV battery and the alternating current for the MG1/MG2. The inverter contains a three–phase bridge circuit, which consists of six power transistors each for the MG1 and the MG2, in order to convert the direct current and the three–phase alternating current. The HV control ECU controls the actuation of the power transistors.

The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the HV control ECU.

cardiagn.com



cardiagn.com



The HV control ECU uses a voltage sensor, which has been built into the inverter, to detect the high voltage after it is boosted and for boost control.
The inverter voltage sensor outputs a voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.
The HV control ECU monitors the inverter voltage and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	266	Open or GND short in inverter voltage (VH) sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU
P0A78	267	+B short in inverter voltage (VH) sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU

HINT:
After confirming DTC P0A78 (INF 266 or 267), confirm VH in DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST using the hand–held tester.

Voltage Displayed	Malfunction
765 V	+B short circuit
0 V	Open or GND short circuit

MONITOR DESCRIPTION

The HV control ECU monitors the inverter voltage (VH) sensor circuit. If the HV control ECU detects an open or short malfunction of the VH sensor circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 266/267): Motor inverter / VH malfunction
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

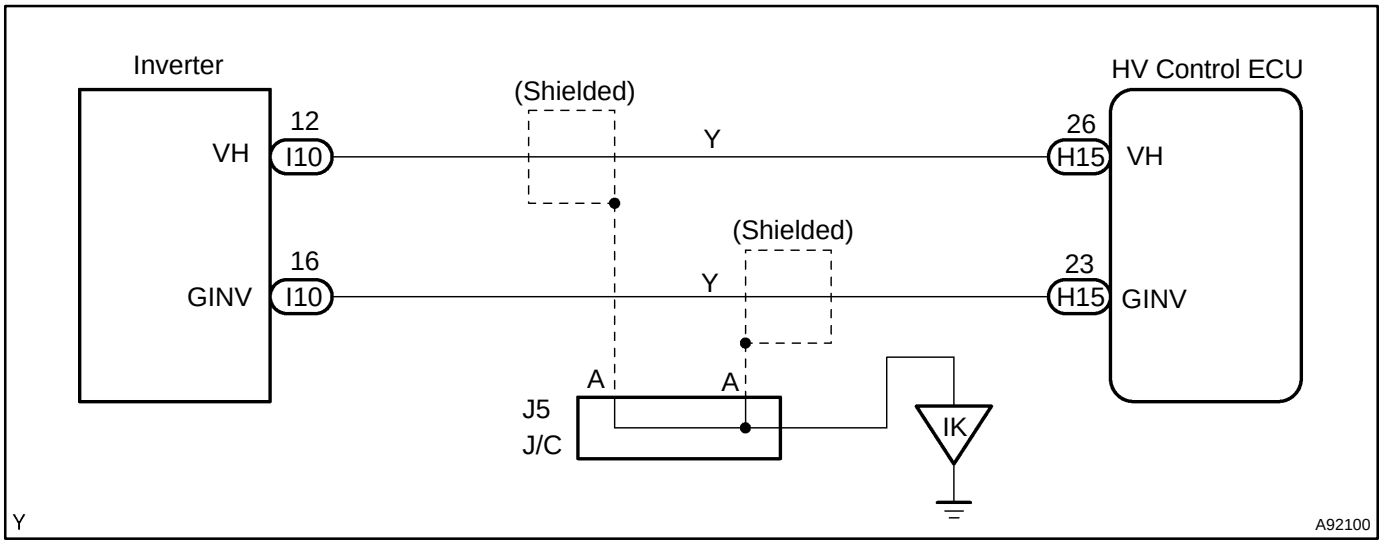
Voltage (VH) sensor circuit	Open or short

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 266/267) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A1D is output

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

cardiagn.com

2	READ VALUE OF HAND–HELD TESTER(VH)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the VH value on the hand–held tester.
Result:

Voltage Displayed	Proceed to
765 V	A
0 V	B
1 to 764 V	C

HINT:
- If there is a +B short circuit, the hand–held tester indicates 765 V.
- If there is an open or GND short circuit, the hand–held tester indicates 0 V.

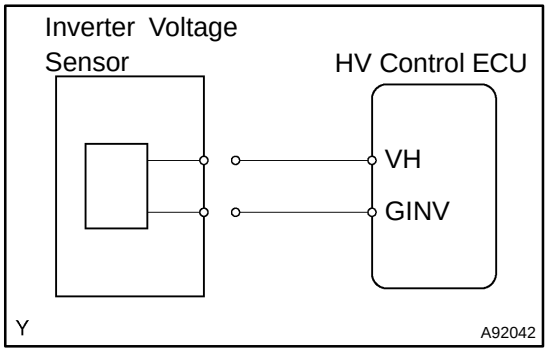
B → **Go to step 5**

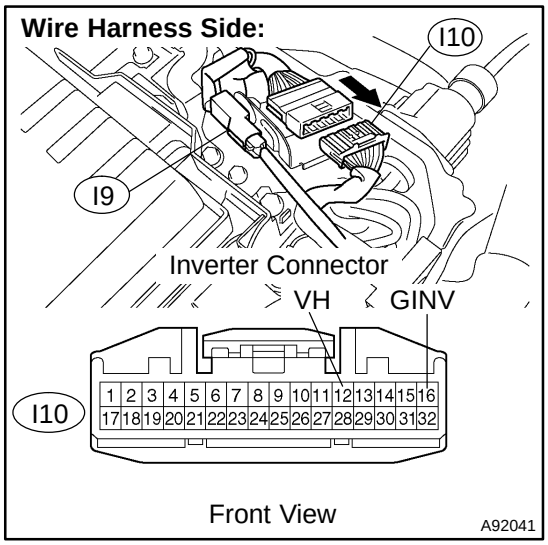
C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)**

A

cardiagn.com

3	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN WIRE HARNESS)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the I10 inverter connector.
(e) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(g) Read the VH value on the hand–held tester.
Standard: 0 V
(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

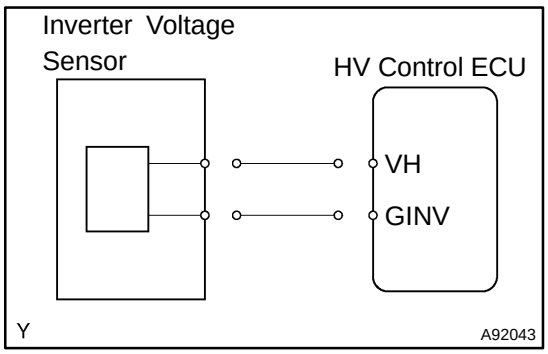
NG → **Go to step 4**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

4	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN HYBRID VEHICLE CONTROL ECU)

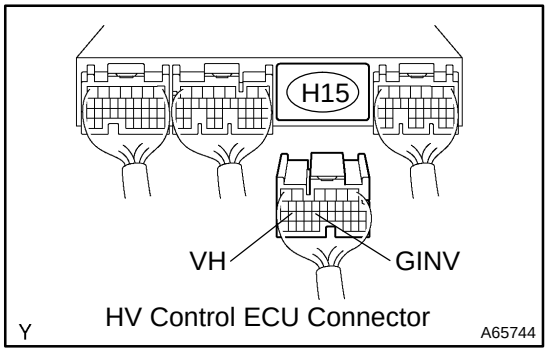


(a) Disconnect the H15 HV control ECU connector.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the VH value on the hand–held tester.
Standard: 0 V
(e) Reconnect the HV control ECU connector.



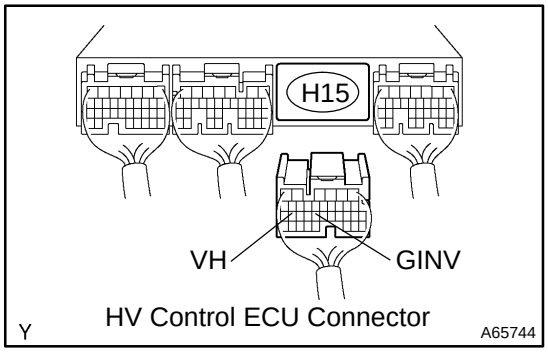
NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

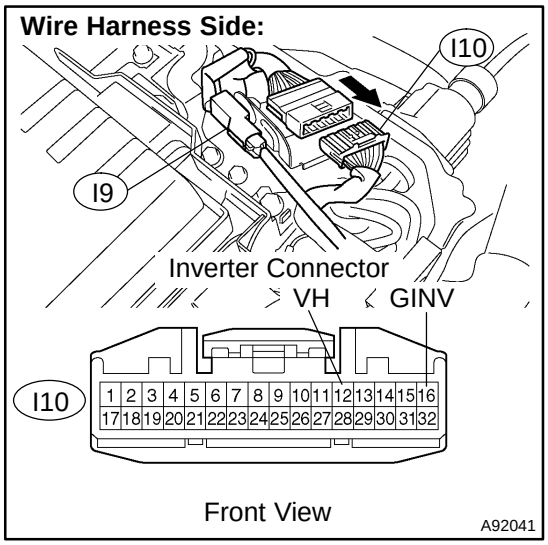
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

cardiagn.com

5	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H15 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VH (H15–26) – VH (I10–12)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VH (H15–26) or VH (I10–12) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

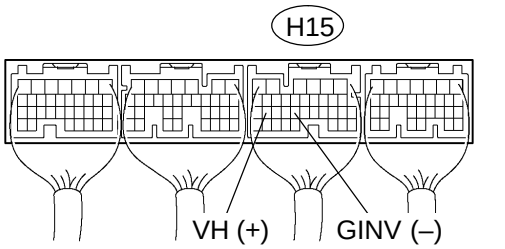
(g) Reconnect the inverter connector.
(h) Reconnect the HV control ECU connector.
(i) Reinstall the inverter cover (see page 21–23).
(j) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

6	INSPECT HYBRID VEHICLE CONTROL ECU(VH VOLTAGE)



HV Control ECU Connector
A18294

(a) Turn the power switch ON (READY).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(b) Measure the voltage between the terminals of the H15 HV control ECU connector.

Standard:

Tester Connection	Specified Condition
VH (H15–26) – GINV (H15–23)	1.6 to 3.8 V

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A78/272	DRIVE MOTOR "A" INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

The inverter switches the power transistors ON and OFF in accordance with power transistor actuation signals received from the HV control ECU, in order to change the direction of the current that flows through the MG1/MG2. Also, the inverter regulates the duration of the switching time through PWM (Pulse Width Modulation) control, in order to control the voltage that is applied to the MG1/MG2.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	272	Abnormality in motor PWM circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the motor PWM circuit. If there is an error in the power transistor actuation signals which are transmitted to the inverter, the HV control ECU interprets this as a malfunction of the motor PWM circuit.

The HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 272): Motor inverter / Motor PWM malfunction
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

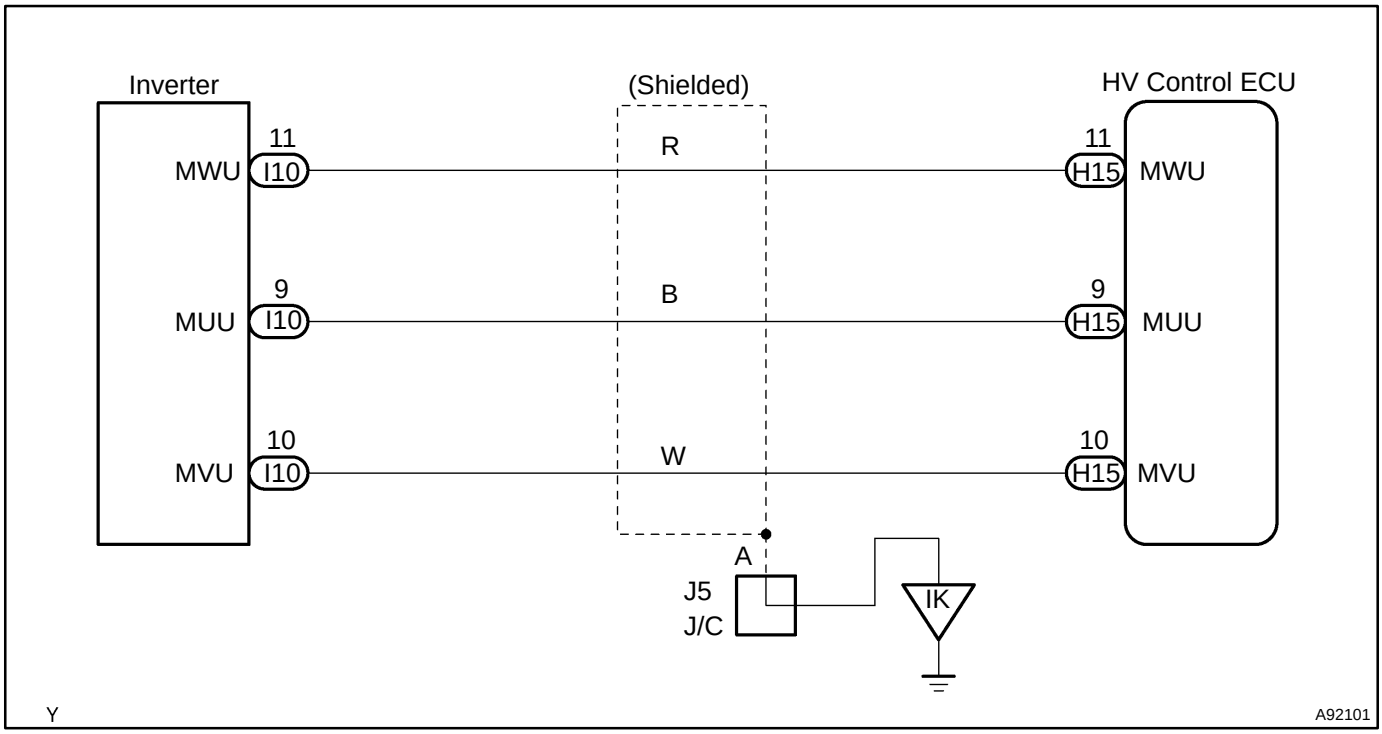
Power transistor actuation signal	Abnormal

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 272) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

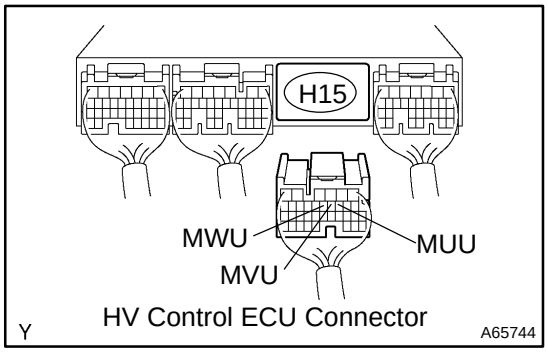
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A1D is output

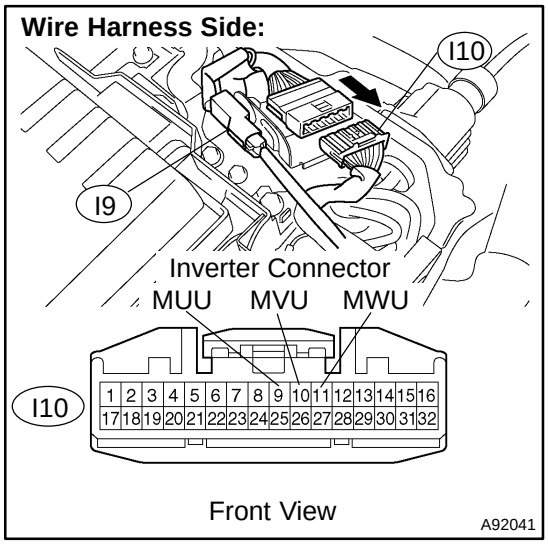
YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MUU (H15–9) – MUU (I10–9)	Below 1 Ω
MVU (H15–10) – MVU (I10–10)	Below 1 Ω
MWU (H15–11) – MWU (I10–11)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MUU (H15–9) or MUU (I10–9) – Body ground	10 kΩ or higher
MVU (H15–10) or MVU (I10–10) – Body ground	10 kΩ or higher
MWU (H15–11) or MWU (I10–11) – Body ground	10 kΩ or higher

(g) Reconnect the inverter connector.
(h) Reconnect the HV control ECU connector.
(i) Reinstall the inverter cover (see page 21–23).
(j) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/278	DRIVE MOTOR "A" INVERTER PERFORMANCE

DTC	P0A78/280	DRIVE MOTOR "A" INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the motor inverter detects a circuit malfunction or over–voltage, the inverter transmits this information to the OVH terminal of the HV control ECU via the motor inverter over–voltage signal line.

The HV control ECU monitors the motor inverter over–voltage signal line to detect the malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	278	+B short in motor inverter over–voltage (OVH) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A78	280	Open or GND short in motor inverter over–voltage (OVH) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the motor inverter over–voltage (OVH) signal line. If the HV control ECU detects an open or short malfunction of the OVH signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 278/280): Motor inverter/Motor inverter Sinv detection
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

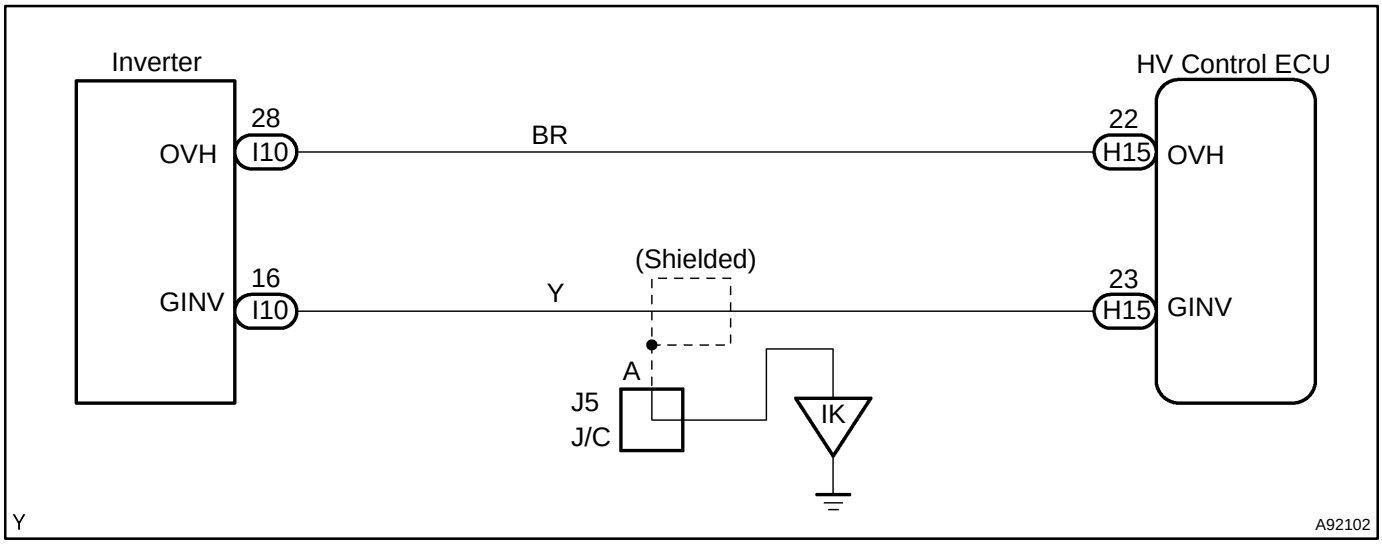
Over–voltage signal circuit	Open or short

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 278/280) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

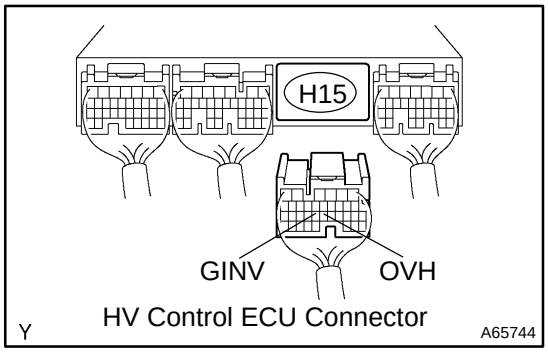
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

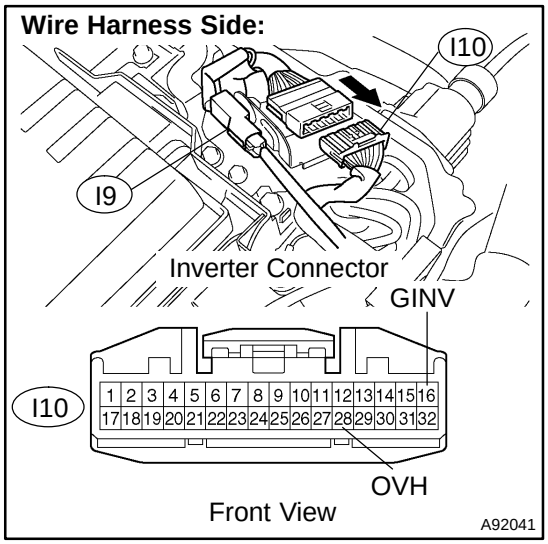
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
OVH (H15–22) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
OVH (H15–22) – OVH (I10–28)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
OVH (H15–22) or OVH (I10–28) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/279	DRIVE MOTOR ”A” INVERTER PERFORMANCE

DTC	P0A78/503	DRIVE MOTOR ”A” INVERTER PERFORMANCE

DTC	P0A78/504	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.
If the motor inverter detects a circuit malfunction or over–voltage, the inverter transmits this information to the OVH terminal of the HV control ECU via the motor inverter over–voltage signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	279	Motor inverter over–voltage (OVH) signal detection (over–voltage by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A78	503	Motor inverter over–voltage (OVH) signal detection (over–voltage by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A78	504	Motor inverter over–voltage (OVH) signal detection (over–voltage by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If the motor inverter detects over–voltage, it transmits an over–voltage signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 279/503/504): Motor inverter/OVH detection over voltage
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

cardiagn.com

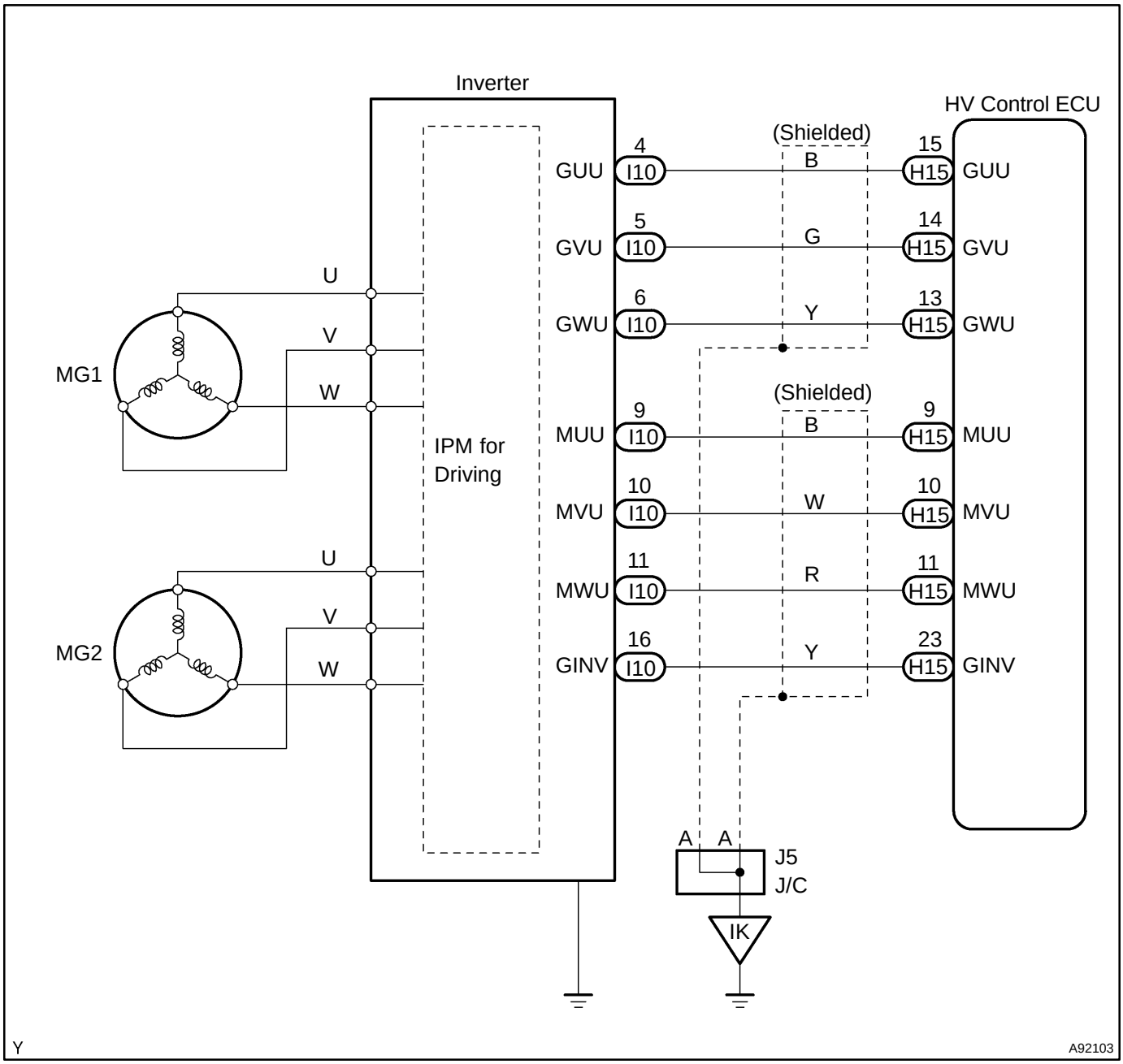
TYPICAL MALFUNCTION THRESHOLDS

Motor inverter	Over–voltage

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 279/503/504) is not detected

WIRING DIAGRAM



cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	CONFIRM INFORMATION(EXCLUSIVE INFO 3)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A78 to display its freeze frame data.
(f) Select the item that has INF code 279, 503, or 504 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 3.
Result: –32 to 32 (during driving without battery power)

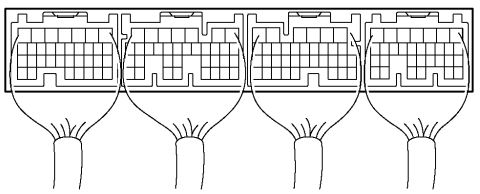
HINT:

If the value is inside the range shown above, DTCs other than P0A78 (INF 279, 503 and 504) have been detected as well. Perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)


A18294

HV Control ECU Connector

(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

cardiagn.com

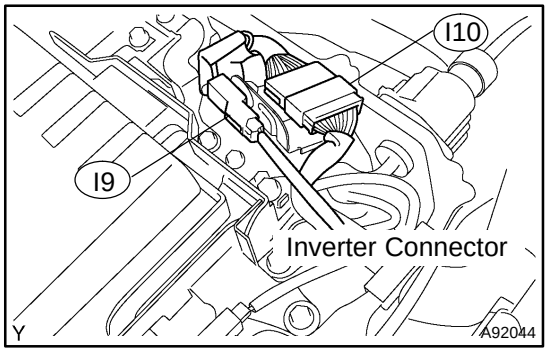
3	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → CONNECT SECURELY

OK

4	CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both the service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A78 to display its freeze frame data.
(f) Select the item that has INF code 279, 503, or 504 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.
Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

cardiagn.com

B	**REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**
C	**REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**
D	**REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)**

A

5 READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both the service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result: DTCs listed in the table below are output

DTC No.	INF Code	Detection Item	See Page
P0A78	266	Drive Motor "A" Inverter Performance	05–562
P0A94	558 or 560	DC/DC Converter Malfunction	05–730
P0A94	588	DC/DC Converter Malfunction	05–730
P0A94	589	DC/DC Converter Malfunction	05–754
P0AA2	227	Hybrid Battery Positive Contactor Circuit Stuck Open	05–763
P0AA5	229	Hybrid Battery Negative Contactor Circuit Stuck Open	05–767
P3000	125	Battery Control System Malfunction	05–777
P3004	131	HIgh Voltage Power Resource Malfunction	05–781

YES	**GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

cardiagn.com

6	INSPECT HYBRID VEHICLE MOTOR ASSY

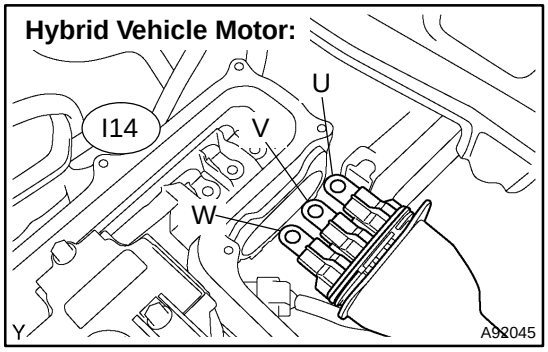
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.
(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.

Hybrid Vehicle Motor:



NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
R20 = Rt ÷ (1 + 0.00393 × (T – 20))
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ
(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

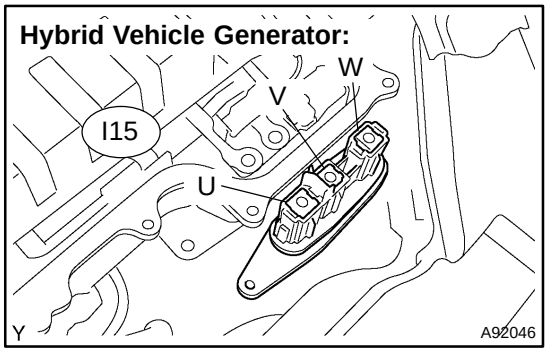
(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

cardiagn.com

7	INSPECT HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.

(b) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.

(c) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.

NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(d) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

(e) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.

Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(f) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

cardiagn.com

8	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

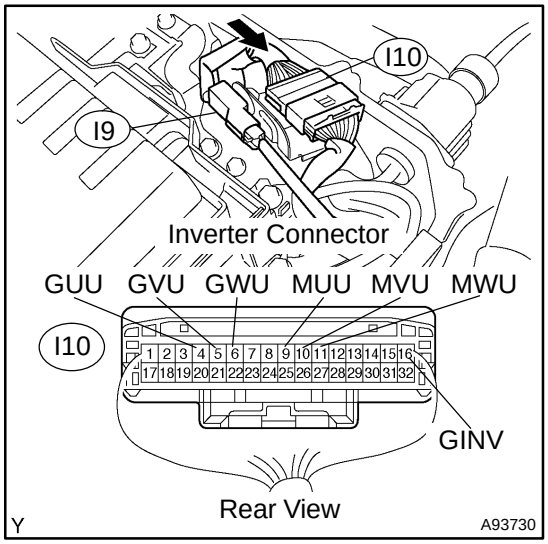
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	12 to 16 V
MVU (I10–10) – GINV (I10–16)	12 to 16 V
MWU (I10–11) – GINV (I10–16)	12 to 16 V
GUU (I10–4) – GINV (I10–16)	12 to 16 V
GVU (I10–5) – GINV (I10–16)	12 to 16 V
GWU (I10–6) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.



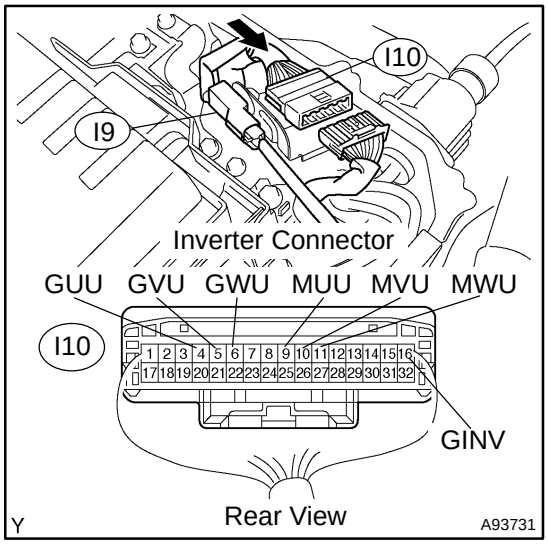
NG → **Go to step 9**

OK

REPLACE HYBRID VEHICLE CONTROL ECU AND W/CONVERTER INVERTER ASSY (See page 21–124 and 21–23)

cardiagn.com

9	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	14 to 16 V
MVU (I10–10) – GINV (I10–16)	14 to 16 V
MWU (I10–11) – GINV (I10–16)	14 to 16 V
GUU (I10–4) – GINV (I10–16)	14 to 16 V
GVU (I10–5) – GINV (I10–16)	14 to 16 V
GWU (I10–6) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A78/282	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the motor inverter detects a circuit malfunction or over–voltage, the inverter transmits this information to the OVH terminal of the HV control ECU via the motor inverter over–voltage signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	282	Motor inverter over voltage (OVH) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

If the motor inverter detects a circuit malfunction, it transmits a motor inverter over–voltage signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 282): Motor inverter/OVH detection circuit malfunction
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA’s intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA’s intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

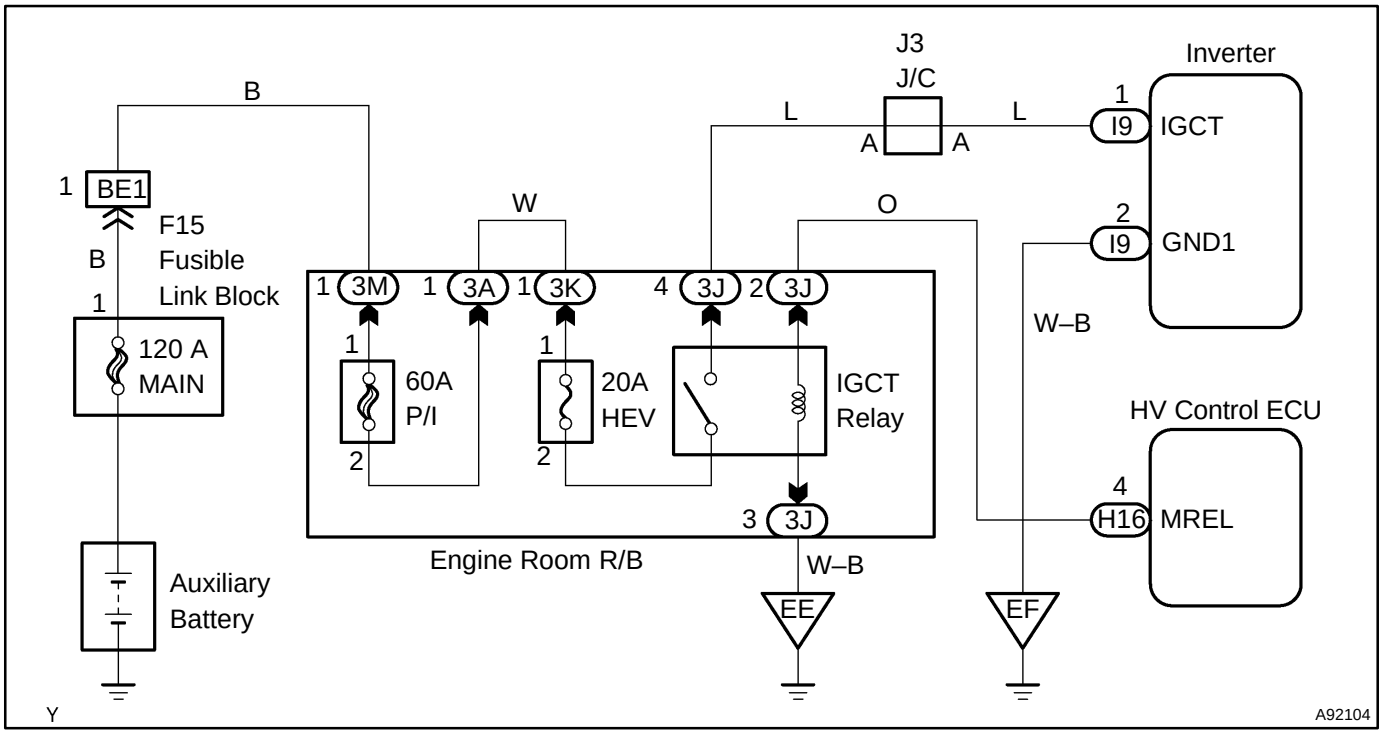
Motor inverter	Circuit malfunction

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 282) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC listed in table below is output

DTC No.	INF Code	Detection Item	See Page
P0A78	278 or 280	Drive Motor "A" Inverter performance	05–574

YES → **GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

cardiagn.com

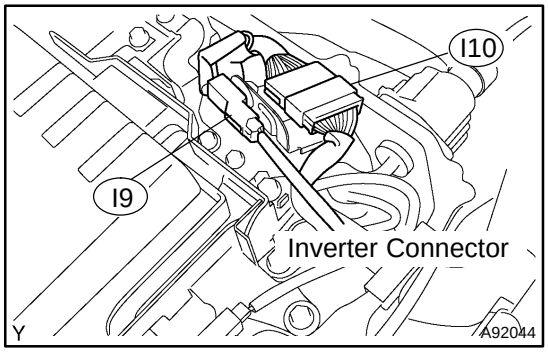
2	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → **CONNECT SECURELY**

OK

3	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs P0A78 (INF 282, 286) and P0A7A (INF 324) (inverter circuit malfunction) are output

NO → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

YES

cardiagn.com

4	INSPECT W/CONVERTER INVERTER ASSY(IGCT VOLTAGE)

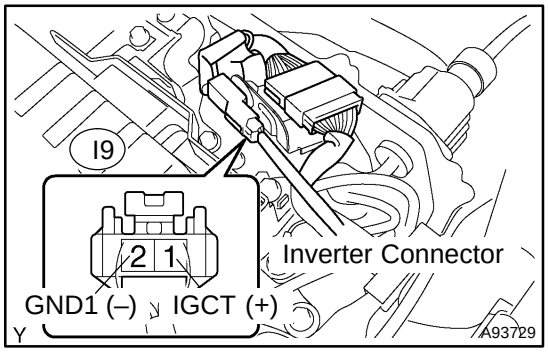
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.



(e) Measure the voltage between the terminals of the inverter connector.

Standard:

Tester Connection	Specified Condition
IGCT (I9–1) – GND1 (I9–2)	8 V or more

(f) Turn the power switch OFF.
(g) Reinstall the inverter cover (see page 21–23).
(h) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/283	DRIVE MOTOR ”A” INVERTER PERFORMANCE

DTC	P0A78/285	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the motor inverter has a circuit malfunction, internal short, or overheats, the inverter transmits this information to the MFIV terminal of the HV control ECU via the motor inverter fail signal line.

The HV control ECU monitors the motor inverter fail signal line and detects a malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	283	+B short in motor inverter fail (MFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A78	285	Open or GND short in motor inverter fail (MFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the motor inverter fail (MFIV) signal line. If the HV control ECU detects an open or short malfunction of the MFIV signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 283/285): Motor inverter/Motor inverter Finv detection
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

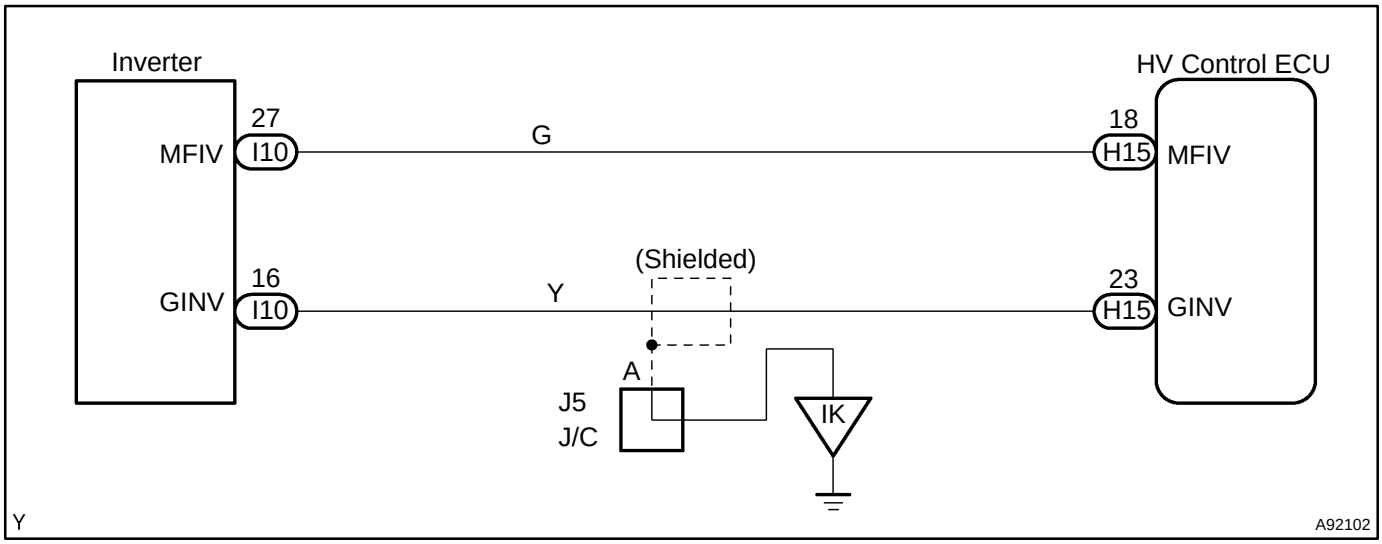
Motor inverter fail signal circuit	Open or short

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 283/285) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

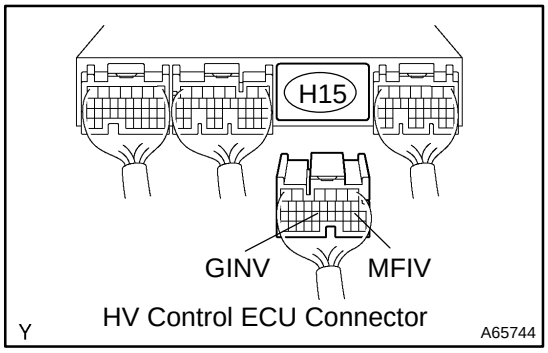
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

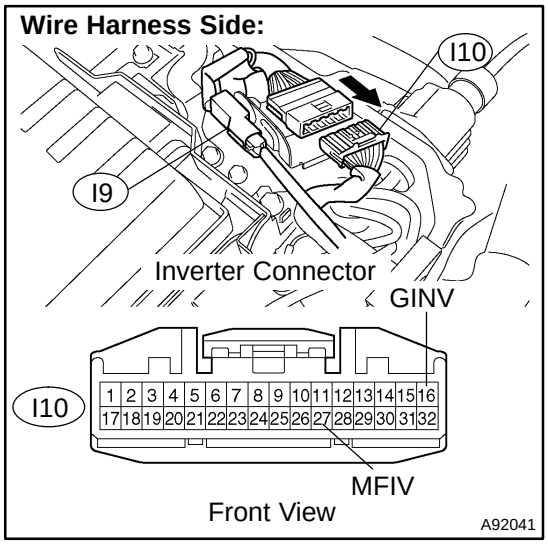
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
MFIV (H15–18) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MFIV (H15–18) – MFIV (I10–27)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MFIV (H15–18) or MFIV (I10–27) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/284	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the motor inverter has a circuit malfunction, internal short, or overheats, the inverter transmits that information to the MFIV terminal of the HV control ECU via the motor inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	284	Motor inverter fail (MFIV) signal detection (inverter overheating)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If the motor inverter overheats, it transmits an inverter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 284): Motor inverter/MFIV detection over heat
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Motor inverter	Overheated

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 284) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 279) on page 05–577.

cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs listed in the table below are output

DTC No.	Relevant Diagnosis
P0A1D	Hybrid Powertrain Control Module
P0A2B, P0A2C or P0A2D	Drive Motor ”A” Temperature Sensor Circuit System
P0A37, P0A38 or P0A39	Generator Temperature Sensor Circuit System
P0A3F, P0A40 or P0A41	Drive Motor ”A” Position Sensor Circuit System
P0A4B, P0A4C or P0A4D	Generator Position Sensor Circuit System
P0A60 or P0A63	Drive Motor ”A” Current Sensor Circuit System
P0A72 or P0A75	Generator Current Sensor Circuit System
P0A78	Drive Motor ”A” Inverter Performance
P0A7A	Generator Inverter Performance
P0A90	Drive Motor ”A” Performance
P0A92	Hybrid Generator Performance
P0A93	Inverter Cooling System Malfunction
P0A94	DC/DC Converter Malfunction
P0AA1, P0AA2, P0AA4 or P0AA5	System Main Relay Circuit System
P3000, P3004, P3009 or P3110	High Voltage System
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit System
P3221	Generator Inverter Temperature Sensor Circuit System
P3226	DC/DC Converter Temperature Sensor Circuit System

YES → **GO TO DTC CHART (See page 05–440). FIND A PAGE NUMBER TO PROCEED TO ITS DIAGNOSTIC TROUBLESHOOTING FLOWCHART**

NO

cardiagn.com

2	CHECK QUANTITY OF HV COOLANT

(a) Check that there is a sufficient amount of coolant for the inverter.
OK: There is a sufficient amount of coolant for the inverter

NG → **ADD HV COOLANT (See page 22–4)**

OK

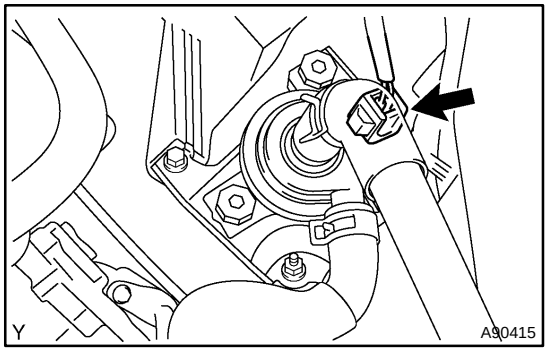
3	CHECK COOLANT HOSE

(a) Check that the hoses of the cooling system are not bent or clogged (see the cooling system on page 05–687).
OK: The hoses of the cooling system are not bent or clogged

NG → **CORRECT TO NORMAL CONDITION**

OK

4	CHECK CONNECTION CONDITION OF WATER PUMP CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the water pump connector.
OK: Connector has been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

5	CHECK WATER W/MOTOR & BRACKET PUMP ASSY

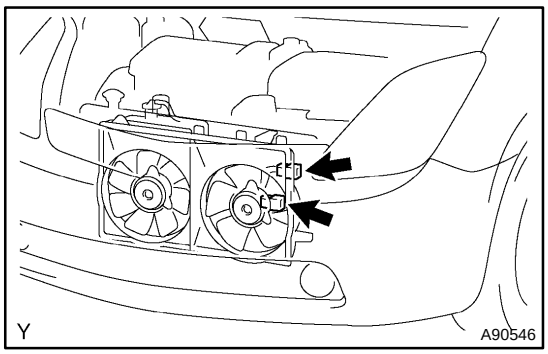
(a) Turn the power switch ON (IG).
(b) Check the operation of the water pump.
OK: Coolant is sloshing in the reservoir tank

NG → **REPLACE WATER W/MOTOR & BRACKET PUMP ASSY**

OK

cardiagn.com

6	CHECK CONNECTION CONDITION OF COOLING FAN MOTOR CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the cooling fan motor connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

7	INSPECT COOLING FAN MOTOR (See page 16–8)

NG → **REPLACE COOLING FAN MOTOR AND ADD ENGINE COOLANT**

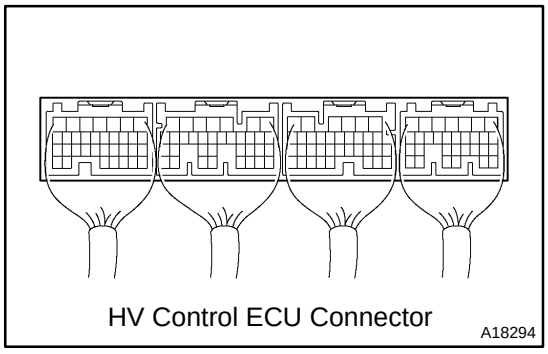
OK

8	INSPECT COOLING FAN MOTOR NO.2 (See page 16–8)

NG → **REPLACE COOLING FAN MOTOR NO. 2 AND ADD ENGINE COOLANT**

OK

9	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

cardiagn.com

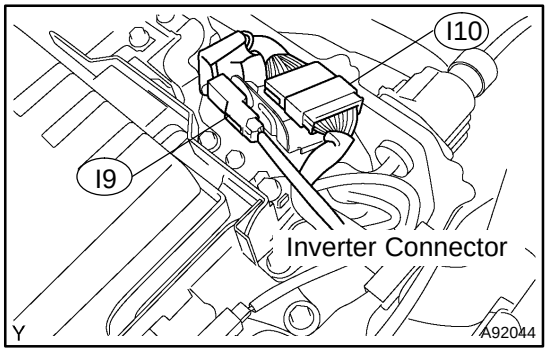
10	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → CONNECT SECURELY

OK

11	CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A78 to display its freeze frame data.
(f) Select the item that has INF code 284 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.
Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

cardiagn.com

B	REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)
C	REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)
D	REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

A

12 INSPECT HYBRID VEHICLE MOTOR ASSY

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.

(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

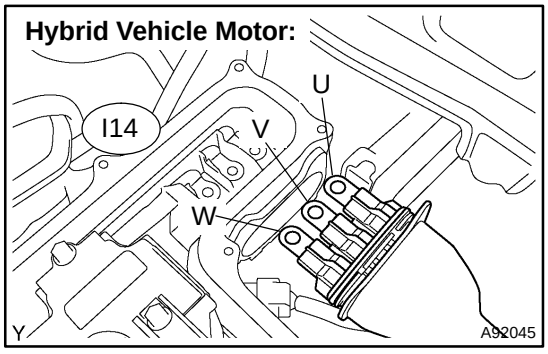
(c) Remove the inverter cover (see page 21–23).

(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.

(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.

NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:



Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

cardiagn.com

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

13 PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

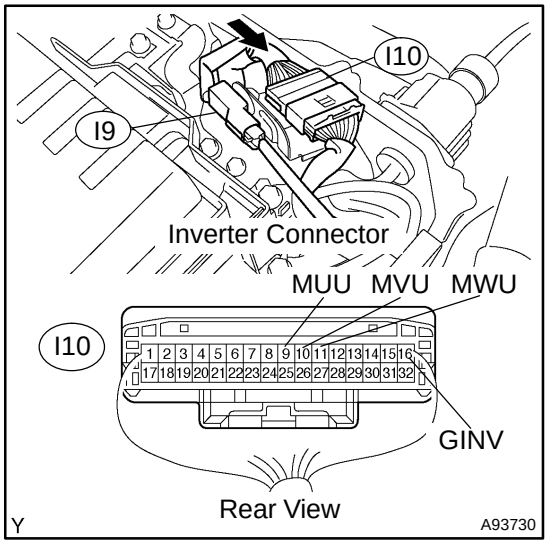
(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.
Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	12 to 16 V
MVU (I10–10) – GINV (I10–16)	12 to 16 V
MWU (I10–11) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.



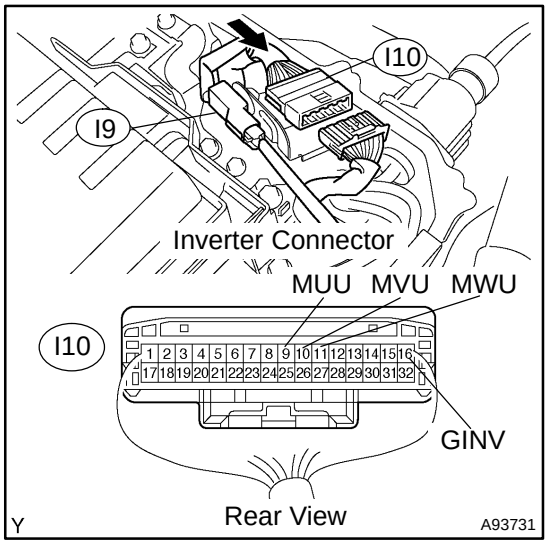
NG → **Go to step 14**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

14	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	14 to 16 V
MVU (I10–10) – GINV (I10–16)	14 to 16 V
MWU (I10–11) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A78/286	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the motor inverter has a circuit malfunction, internal short, or overheats, the inverter transmits that information to the MFIV terminal of the HV control ECU via the motor inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	286	Motor inverter fail (MFIV) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

If the motor inverter detects a circuit malfunction, it transmits a motor inverter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 286): Motor inverter/MFIV detection circuit malfunction
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA’s intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA’s intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Motor inverter	Circuit malfunction

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 286) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 282) on page 05–586.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC listed in the table below is output

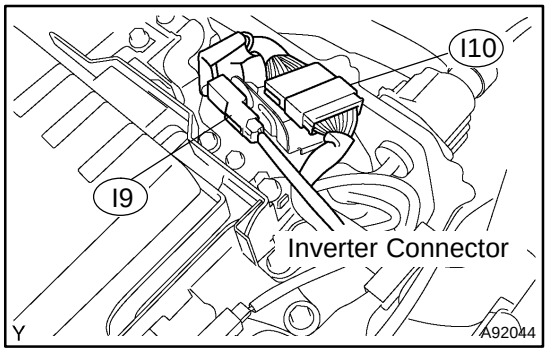
DTC No.	INF Code	Detection Item	See Page
P0A78	283 or 285	Drive Motor ”A” Inverter performance	05–590

YES → **GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

2	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → **CONNECT SECURELY**

OK

cardiagn.com

3	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result: DTCs P0A78 (INF 282, 286) and P0A7A (INF 324) (inverter circuit malfunction) are output

NO → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

YES

4	INSPECT W/CONVERTER INVERTER ASSY(IGCT VOLTAGE)

CAUTION:

Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:

Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Turn the power switch ON (IG).

HINT:

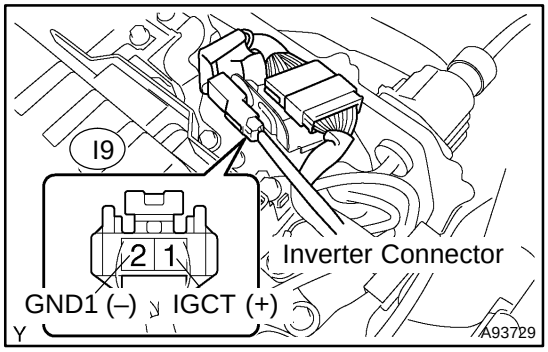
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Measure the voltage between the terminals of the inverter connector.

Standard:

Tester Connection	Specified Condition
IGCT (I9–1) – GND1 (I9–2)	8 V or more

(f) Turn the power switch OFF.
(g) Reinstall the inverter cover (see page 21–23).
(h) Reinstall the service plug grip (see page 21–116).



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/287	DRIVE MOTOR ”A” INVERTER PERFORMANCE

DTC	P0A78/505	DRIVE MOTOR ”A” INVERTER PERFORMANCE

DTC	P0A78/506	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.
If the motor inverter has a circuit malfunction, internal short, or overheats, the inverter transmits that information to the MFIV terminal of the HV control ECU via the motor inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	287	Motor inverter fail (MFIV) signal detection (over current by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly
P0A78	505	Motor inverter fail (MFIV) signal detection (over current by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly
P0A78	506	Motor inverter fail (MFIV) signal detection (over current by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If over–amperage flows through the motor inverter due to an internal short, the motor inverter transmits an inverter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 287/505/506): Motor inverter/MFIV detection over current
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Motor inverter	Over current (internal short)

cardiagn.com

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 287/505/506) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 279) on page 05–577.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs listed in the table below are output

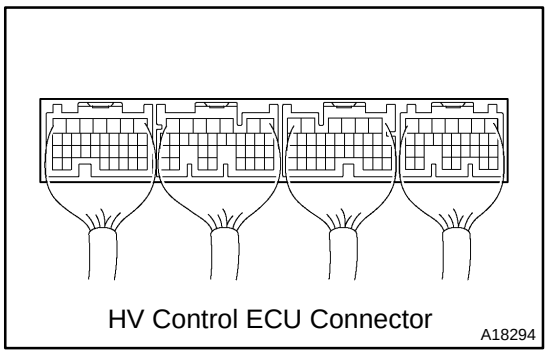
DTC No.	Relevant Diagnosis
P0A1D	Hybrid Powertrain Control Module
P0A2B, P0A2C or P0A2D	Drive Motor ”A” Temperature Sensor Circuit System
P0A37, P0A38 or P0A39	Generator Temperature Sensor Circuit System
P0A3F, P0A40 or P0A41	Drive Motor ”A” Position Sensor Circuit System
P0A4B, P0A4C or P0A4D	Generator Position Sensor Circuit System
P0A60 or P0A63	Drive Motor ”A” Current Sensor Circuit System
P0A72 or P0A75	Generator Current Sensor Circuit System
P0A78	Drive Motor ”A” Inverter Performance
P0A7A	Generator Inverter Performance
P0A90	Drive Motor ”A” Performance
P0A92	Hybrid Generator Performance
P0A93	Inverter Cooling System Malfunction
P0A94	DC/DC Converter Malfunction
P0AA1, P0AA2, P0AA4 or P0AA5	System Main Relay Circuit System
P3000, P3004, P3009 or P3110	High Voltage System
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit System
P3221	Generator Inverter Temperature Sensor Circuit System
P3226	DC/DC Converter Temperature Sensor Circuit System

YES → **GO TO DTC CHART (See page 05–440). FIND A PAGE NUMBER TO PROCEED TO ITS DIAGNOSTIC TROUBLESHOOTING FLOWCHART**

NO

cardiagn.com

2	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)



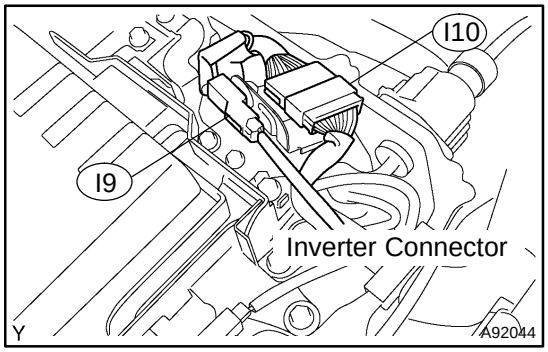
(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

3	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.

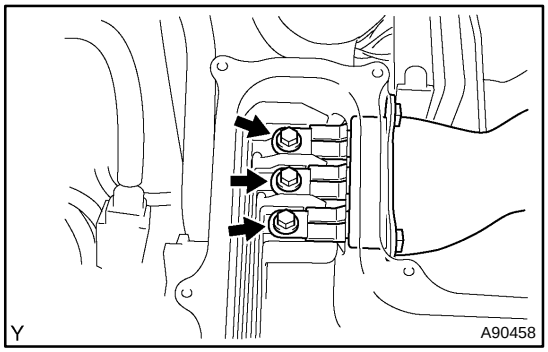


NG → **CONNECT SECURELY**

OK

cardiagn.com

4 CHECK HYBRID VEHICLE MOTOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Check if the three–phase alternating current cable installation bolts on the hybrid vehicle motor are tightened to the specified torque.
Torque: 8.0 N·m (82 kgf·cm 71in.·lbf)
(c) Reinstall the inverter cover (see page 21–23).
(d) Reinstall the service plug grip (see page 21–116).

NG → **TIGHTEN THEM TO SPECIFIED TORQUE**

OK

5 CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A78 to display its freeze frame data.
(f) Select the item that has INF code 287, 505, or 506 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.
Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

B → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

C → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

D → **REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)**

A

cardiagn.com

6 INSPECT HYBRID VEHICLE MOTOR ASSY

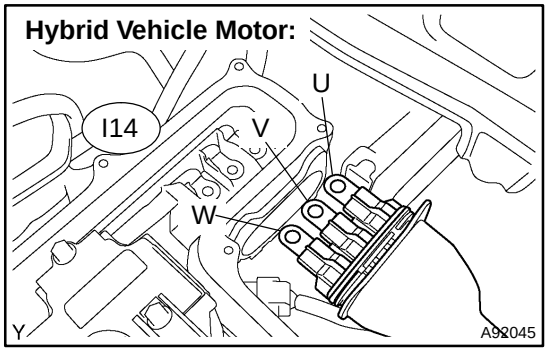
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.
(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.

Hybrid Vehicle Motor:



NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
R20 = Rt ÷ (1 + 0.00393 × (T – 20))
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ
(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

cardiagn.com

7	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

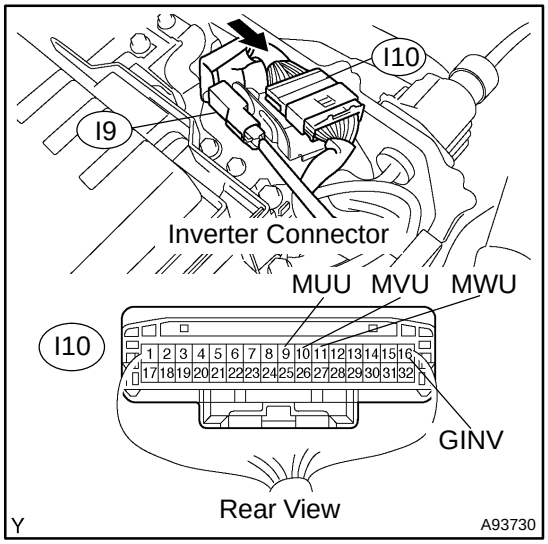
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	12 to 16 V
MVU (I10–10) – GINV (I10–16)	12 to 16 V
MWU (I10–11) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.



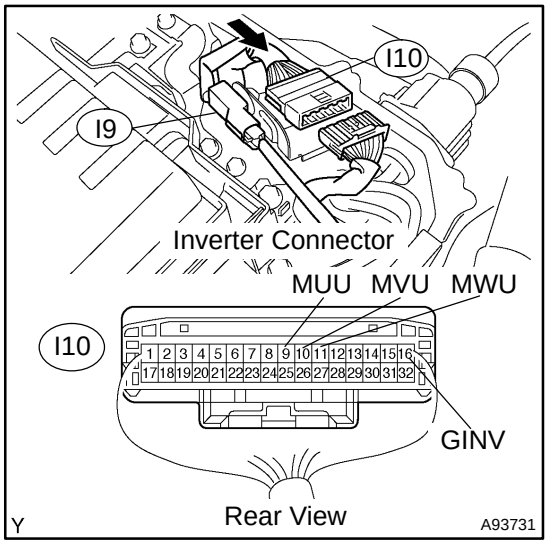
NG → **Go to step 8**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

8	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	14 to 16 V
MVU (I10–10) – GINV (I10–16)	14 to 16 V
MWU (I10–11) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A78/304	DRIVE MOTOR ”A” INVERTER PERFORMANCE

DTC	P0A78/305	DRIVE MOTOR ”A” INVERTER PERFORMANCE

DTC	P0A78/507	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

Upon receiving a motor gate shutdown signal from the HV control ECU, the inverter forcefully stops the operation of the MG2 by turning OFF the power transistors that are actuating the MG2.

The HV control ECU monitors the motor gate shutdown signal line and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	304	Open or +B short in motor gate shutdown (MSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A78	305	GND short in motor gate shutdown (MSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A78	507	Open in motor gate shutdown (MSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the motor gate shutdown (MSDN) signal line. If the HV control ECU detects an open or short malfunction of the MSDN signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 304/305/507): Motor inverter/Motor gate shutdown signal malfunction
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

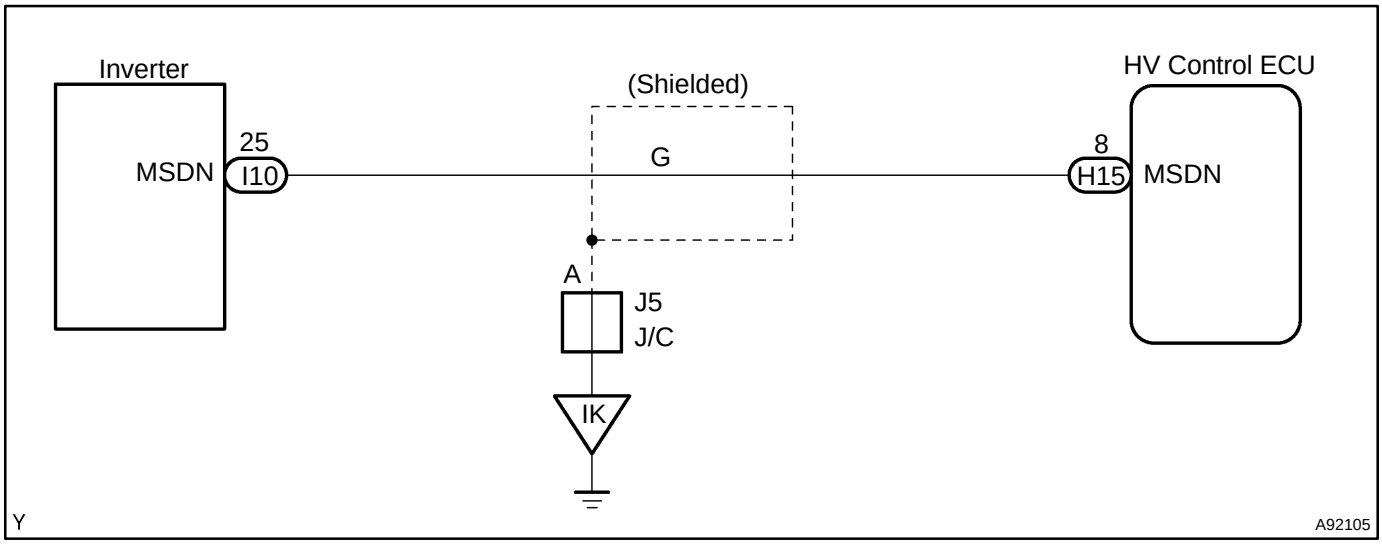
Motor gate shutdown signal circuit	Open or short

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 304/305/507) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

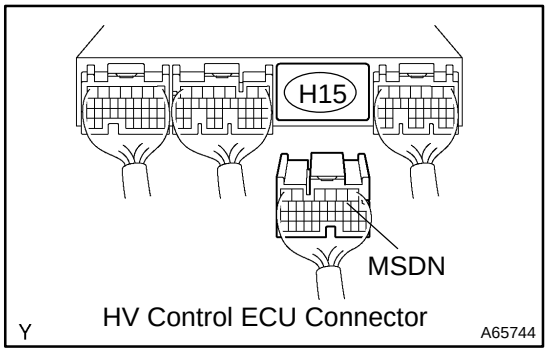
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

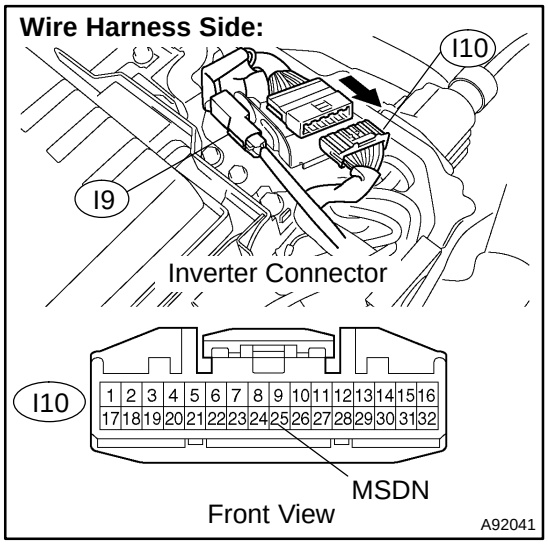
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
MSDN (H15–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MSDN (H15–8) – MSDN (I10–25)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MSDN (H15–8) or MSDN (I10–25) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/306	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

The HV control ECU controls MG2 torque in accordance with the driving condition.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	306	Failure in monitoring MG2 torque performance	• Hybrid vehicle motor • w/ converter inverter assembly

MONITOR DESCRIPTION

If the difference between the requested MG2 torque and the actual MG2 torque exceeds a predetermined value, the HV control ECU determines that there is malfunction in the execution or monitoring of the MG2 torque. Then, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 306): Motor inverter/Discrepancy between motor monitored torque and commanded torque
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Difference between demanded and actual MG2 torque	Exceeds the standard level

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 306) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

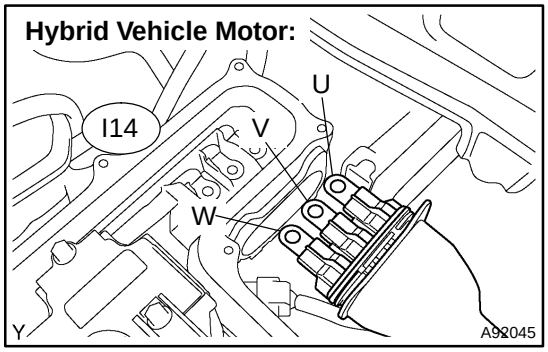
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A78 (INF 306) and other DTCs are output

HINT:
If any other codes besides P0A78 (INF 306) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	INSPECT HYBRID VEHICLE MOTOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.
(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.
NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.
Standard:

Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
$R20 = Rt \div (1 + 0.00393 \times (T - 20))$
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

cardiagn.com

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

(i) Reinstall the inverter cover (see page 21–23).

(j) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/308	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

The HV control ECU receives a collision signal from the airbag ECU and the circuit breaker sensor No. 1 to determine that the vehicle has been damaged. Then, it cuts off the high–voltage system to ensure safety. If the HV control ECU receives the collision signal only from the airbag ECU, it turns OFF the system main relay and the power switch. If the HV control ECU receives the collision signal only from the circuit breaker sensor No. 1, it turns only the system main relay OFF.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	308	Collision signal input from airbag ECU or circuit breaker sensor No. 1	• Supplemental restraint system • Circuit breaker sensor No. 1

INSPECTION PROCEDURE

1	CHECK VEHICLE FOR ANY DAMAGE

(a) Check the vehicle for any damage.
Result: The vehicle is damaged.

YES → **REPAIR VEHICLE**

NO

2	GO TO SUPPLEMENTAL RESTRAINT SYSTEM (See page 05–1391)

(a) Troubleshoot the airbag system.
Result: There is malfunction in the airbag system.

NO → **REPLACE CIRCUIT BREAKER SENSOR NO.1**

YES

REPAIR MALFUNCTION PARTS AND COMPONENTS

cardiagn.com

DTC	P0A78/508	DRIVE MOTOR "A" INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

Upon receiving a motor gate shutdown signal from the HV control ECU, the inverter forcefully stops the operation of the MG2 by turning OFF the power transistors that are actuating the MG2.

The HV control ECU monitors the motor gate shutdown signal and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	508	Motor gate shutdown (MSDN) signal malfunction	• Wire harness or connector • HV control ECU

MONITOR DESCRIPTION

The HV control ECU monitors the motor gate shutdown (MSDN) signal. If the HV control ECU detects a fault in the MSDN signal, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 508): Motor inverter/Motor inverter shutdown signal line malfunction
Required sensor/components	Motor inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Actual status of shutdown command signal and its monitoring result	Inconsistent

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 508) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 304) on page 05–611.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A78 (INF 508) and other DTCs are output

HINT:
If any other codes besides P0A78 (INF 508) are output, perform troubleshooting for those DTCs first.

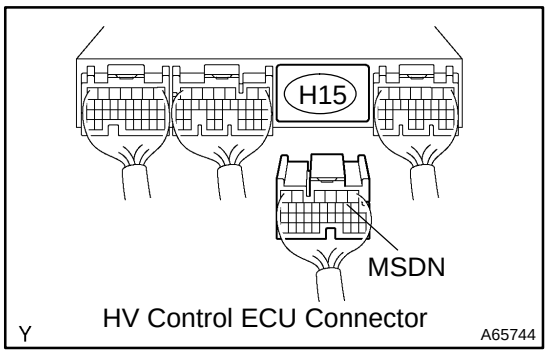
YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

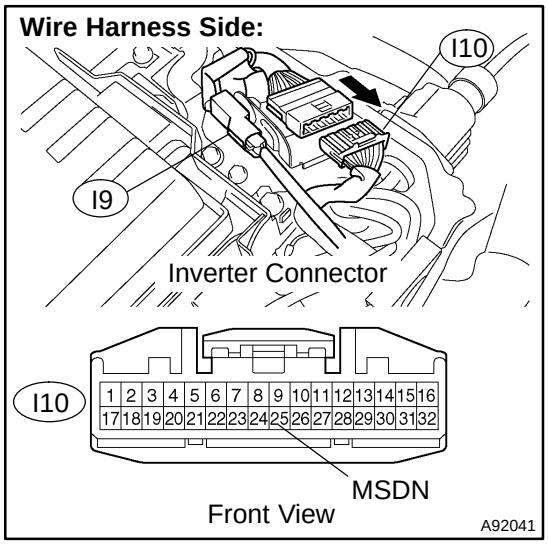
NO

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the H15 HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
MSDN (H15–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MSDN (H15–8) – MSDN (I10–25)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MSDN (H15–8) or MSDN (I10–25) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A78/510	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

Upon receiving a motor gate shutdown signal from the HV control ECU, the inverter forcefully stops the operation of the MG2 by turning OFF the power transistors that are actuating the MG2.

The HV control ECU monitors the motor inverter gate and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	510	Motor inverter gate malfunction	• Wire harness or connector • w/ converter inverter assembly

WIRING DIAGRAM

Refer to DTC P0A78 (INF 304) on page 05–611.

INSPECTION PROCEDURE

CAUTION:

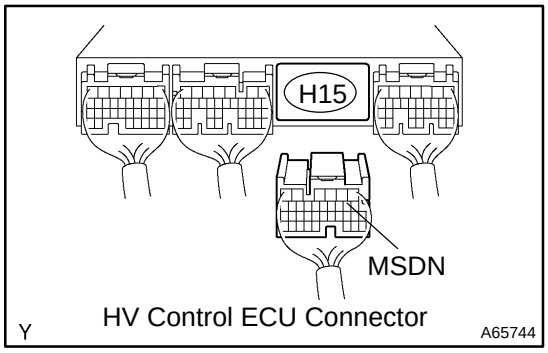
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

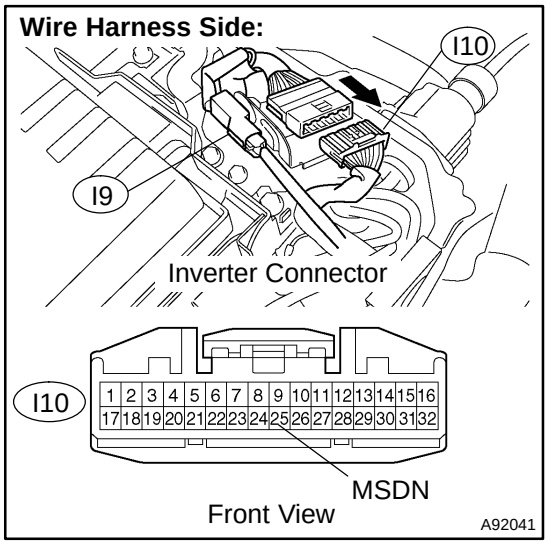
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the H15 HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
MSDN (H15–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MSDN (H15–8) – MSDN (I10–25)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MSDN (H15–8) or MSDN (I10–25) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/523	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A78 (INF 266) on page 05–562.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	523	Inverter voltage (VH) sensor offset malfunction	• System main relay • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the inverter voltage (VH) sensor signal. If the HV control ECU detects a fault in the sensor signal, the HV control ECU interprets this as a VH sensor failure. The HV control ECU then illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 523): Motor inverter/Voltage (VH) malfunction
Required sensor/components	Motor inverter, battery ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Motor inverter	Abnormal

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 523) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A78 (INF 523) and other DTCs are output

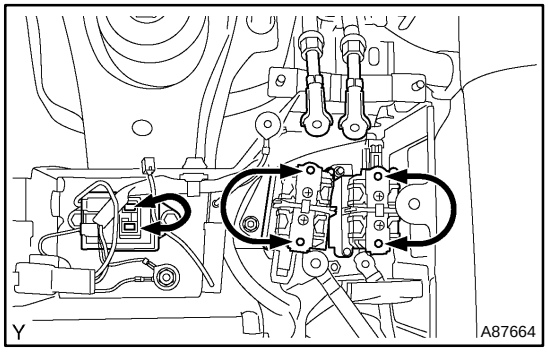
HINT:
If any other codes besides P0A78 (INF 523) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	CHECK SYSTEM MAIN RELAYS FOR STICKING

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.



(c) Disconnect all the high–voltage terminals of the system main relays.
(d) Check the resistance at the switch side of the system main relays.
Standard: 10 kΩ or higher
(e) Connect the high–voltage terminals of the system main relays.
(f) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE STUCK SYSTEM MAIN RELAY**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A78/586	DRIVE MOTOR ”A” INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A78 (INF 266) on page 05–562.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	586	Inverter voltage (VH) sensor performance problem	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the inverter voltage (VH) sensor signal. If the HV control ECU detects a fault in the sensor signal, the HV control ECU interprets this as a VH sensor failure. The HV control ECU then illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 586): Motor inverter/Voltage (VH) sensor deviation
Required sensor/components	Motor inverter, battery ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Motor inverter	Abnormal

COMPONENT OPERATING RANGE

Motor inverter	DTC P0A78 (INF 586) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 266) on page 05–562.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A78 (INF 586) and other DTCs are output

HINT:
If any other codes besides P0A78 (INF 586) are output, perform troubleshooting for those DTCs first.

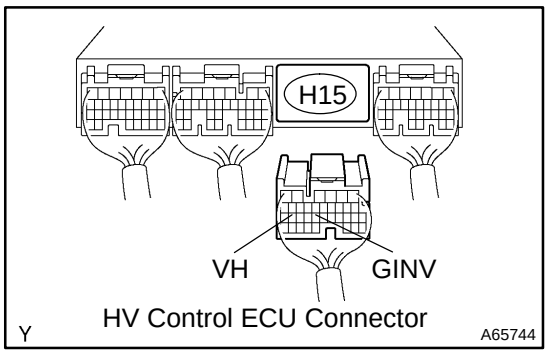
YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

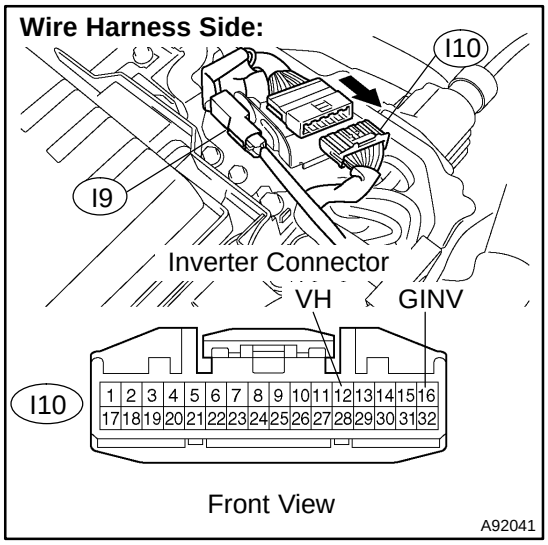
NO

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VH (H15–26) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VH (H15–26) – VH (I10–12)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VH (H15–26) or VH (I10–12) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC P0A7A/309 GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A78 (INF 272) on page 05–571.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	309	Abnormality in generator PWM circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the generator PWM circuit. If there is an error in the power transistor actuation signals which are transmitted to the inverter, the HV control ECU interprets this as a malfunction of the generator PWM circuit.
The HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 309): Generator inverter / Generator PWM malfunction
Required sensor/components	Generator inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

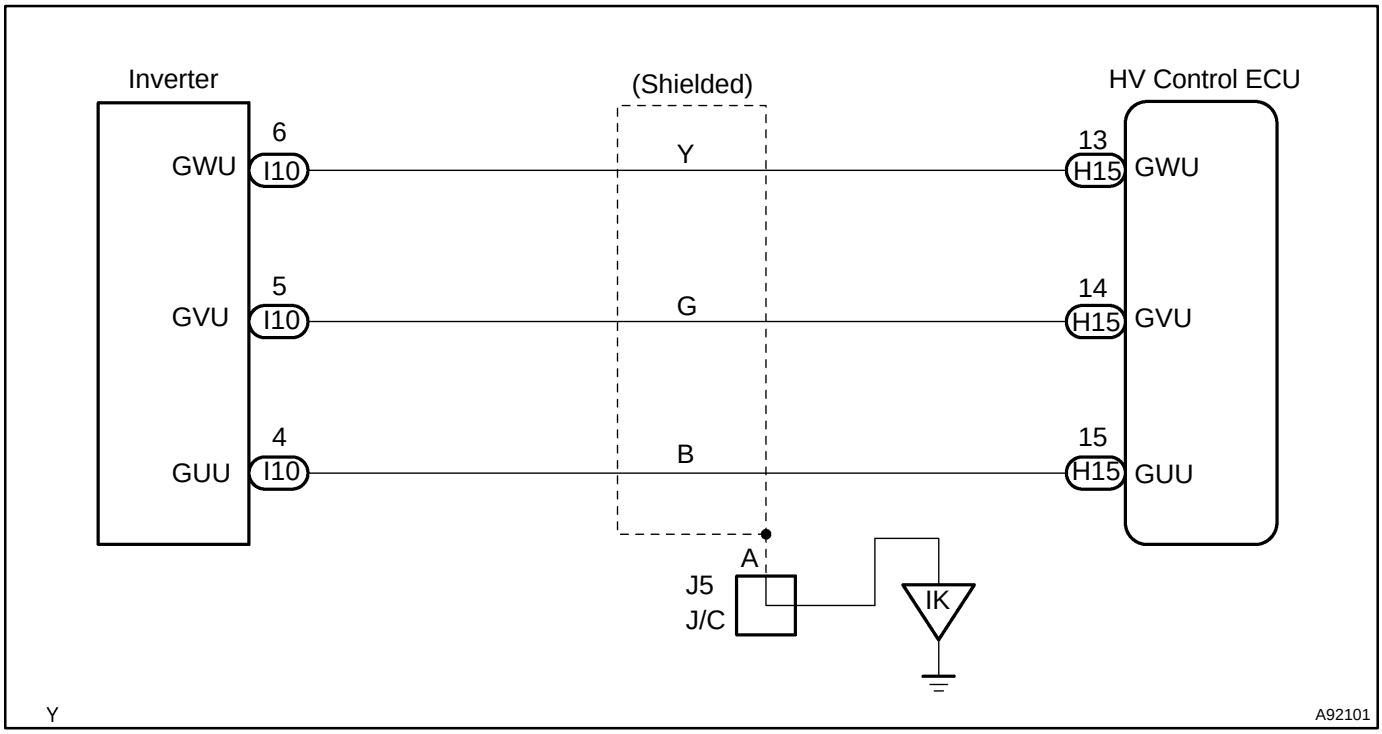
Power transistor actuation signal	Abnormal

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 309) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

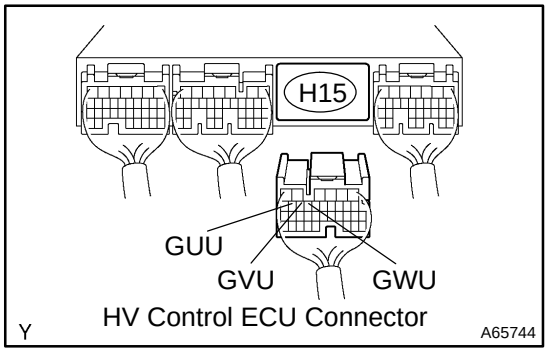
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A1D is output

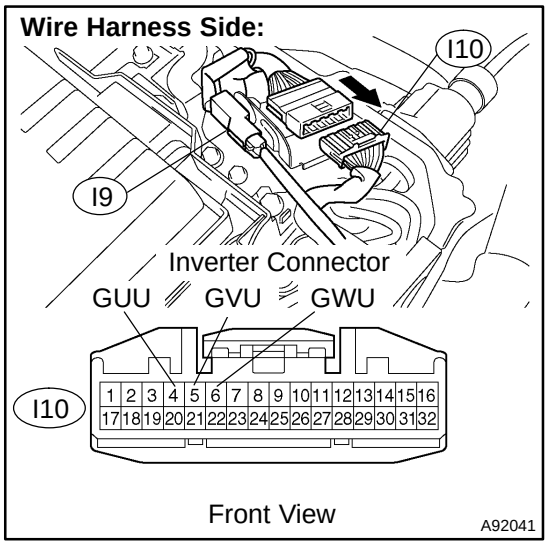
YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H15 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GUU (H15–15) – GUU (I10–4)	Below 1 Ω
GVU (H15–14) – GVU (I10–5)	Below 1 Ω
GWU (H15–13) – GWU (I10–6)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GUU (H15–15) or GUU (I10–4) – Body ground	10 kΩ or higher
GVU (H15–14) or GVU (I10–5) – Body ground	10 kΩ or higher
GWU (H15–13) or GWU (I10–6) – Body ground	10 kΩ or higher

(g) Reconnect the inverter connector.
(h) Reconnect the HV control ECU connector.
(i) Reinstall the inverter cover (see page 21–23).
(j) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A7A/321	GENERATOR INVERTER PERFORMANCE

DTC	P0A7A/323	GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the generator inverter has a circuit malfunction, internal short, or overheats, the inverter transmits that information to the GFIV terminal of the HV control ECU via the generator inverter fail signal line.

The HV control ECU monitors the generator inverter fail signal line and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	321	+B short in generator inverter fail (GFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A7A	323	Open or GND short in generator inverter fail (GFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the generator inverter fail (GFIV) signal line. If the HV control ECU detects an open or short malfunction of the GFIV signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 321/323): Generator inverter/Generator inverter Finv detection
Required sensor/components	Generator Inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

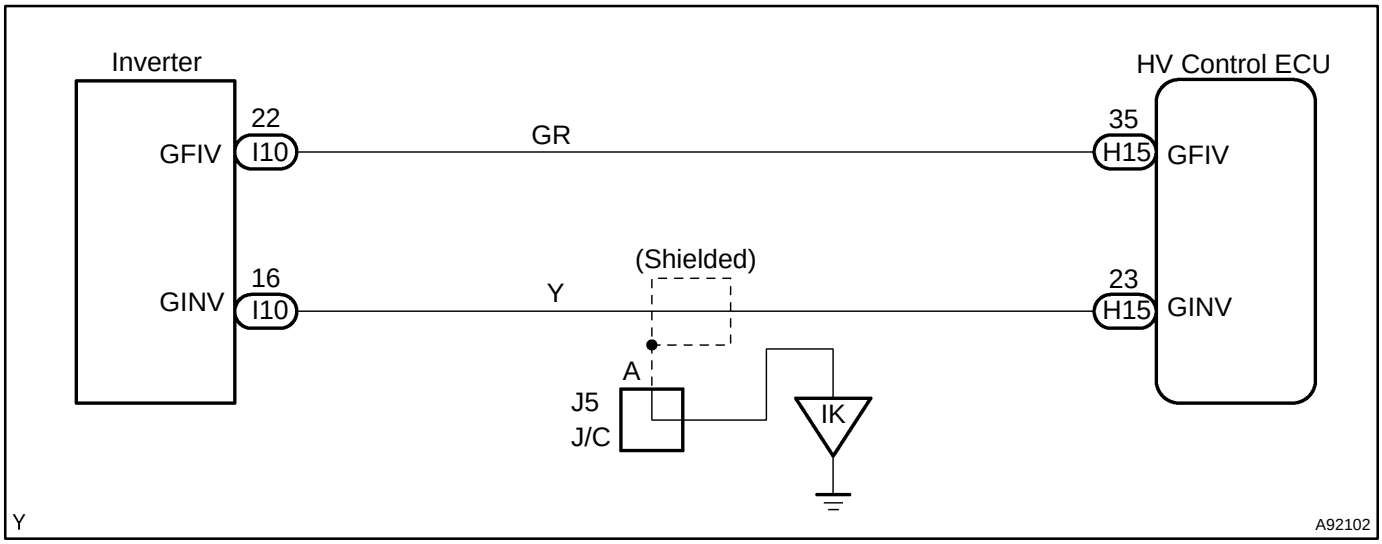
Generator inverter fail signal circuit	Open or short

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 321/323) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

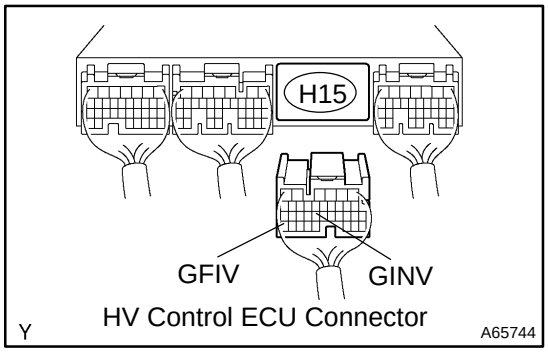
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

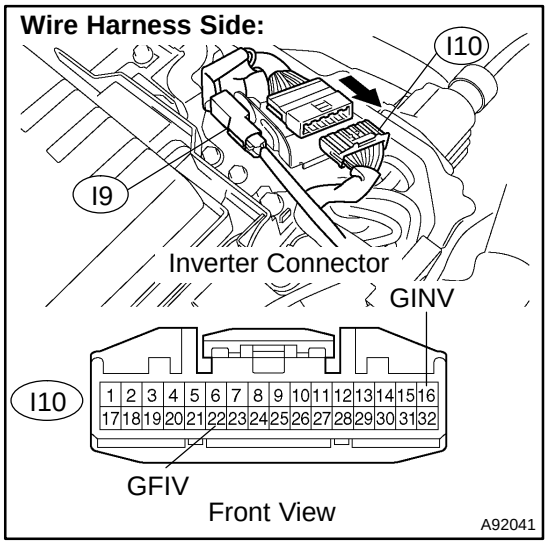
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
GFIV (H15–35) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GFIV (H15–35) – GFIV (I10–22)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GFIV (H15–35) or GFIV (I10–22) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC P0A7A/322 GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the generator inverter has a circuit malfunction, internal short, or overheats, the inverter transmits that information to the GFIV terminal of HV control ECU via the generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	322	Generator inverter fail (GFIV) signal detection (inverter overheating)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If the generator inverter overheats, it transmits an inverter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 322): Generator inverter/GFIV detection over heat
Required sensor/components	Generator inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Generator inverter	Overheated

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 322) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 279) on page 05–577.

cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs listed in the table below are output

DTC No.	Relevant Diagnosis
P0A1D	Hybrid Powertrain Control Module
P0A2B, P0A2C or P0A2D	Drive Motor ”A” Temperature Sensor Circuit System
P0A37, P0A38 or P0A39	Generator Temperature Sensor Circuit System
P0A3F, P0A40 or P0A41	Drive Motor ”A” Position Sensor Circuit System
P0A4B, P0A4C or P0A4D	Generator Position Sensor Circuit System
P0A60 or P0A63	Drive Motor ”A” Current Sensor Circuit System
P0A72 or P0A75	Generator Current Sensor Circuit System
P0A78	Drive Motor ”A” Inverter Performance
P0A7A	Generator Inverter Performance
P0A90	Drive Motor ”A” Performance
P0A92	Hybrid Generator Performance
P0A93	Inverter Cooling System Malfunction
P0A94	DC/DC Converter Malfunction
P0AA1, P0AA2, P0AA4 or P0AA5	System Main Relay Circuit System
P3000, P3004, P3009 or P3110	High Voltage System
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit System
P3221	Generator Inverter Temperature Sensor Circuit System
P3226	DC/DC Converter Temperature Sensor Circuit System

YES → **GO TO DTC CHART (See page 05–440). FIND A PAGE NUMBER TO PROCEED TO ITS DIAGNOSTIC TROUBLESHOOTING FLOWCHART**

NO

cardiagn.com

2	CHECK QUANTITY OF HV COOLANT

(a) Check that there is a sufficient amount of coolant for the inverter.
OK: There is a sufficient amount of coolant for the inverter

NG → **ADD HV COOLANT (See page 22–4)**

OK

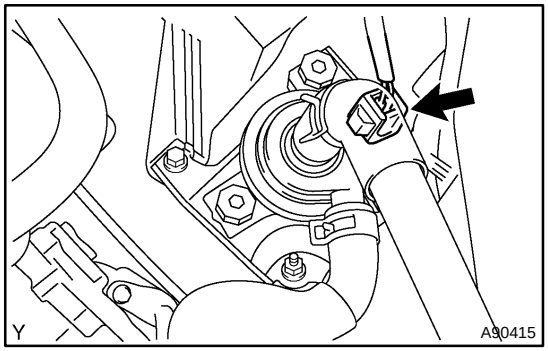
3	CHECK COOLANT HOSE

(a) Check that the hoses of the cooling system are not bent or clogged (see the cooling system on page 05–687).
OK: The hoses of the cooling system are not bent or clogged

NG → **CORRECT TO NORMAL CONDITION**

OK

4	CHECK CONNECTION CONDITION OF WATER PUMP CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the water pump connector.
OK: Connector has been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

5	CHECK WATER W/MOTOR & BRACKET PUMP ASSY

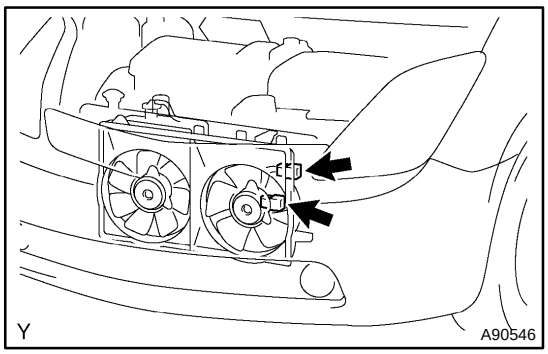
(a) Turn the power switch ON (IG).
(b) Check the operation of the water pump.
OK: Coolant is sloshing in the reservoir tank

NG → **REPLACE WATER W/MOTOR & BRACKET PUMP ASSY**

OK

cardiagn.com

6	CHECK CONNECTION CONDITION OF COOLING FAN MOTOR CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the cooling fan motor connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

7	INSPECT COOLING FAN MOTOR (See page 16–8)

NG → **REPLACE COOLING FAN MOTOR AND ADD ENGINE COOLANT**

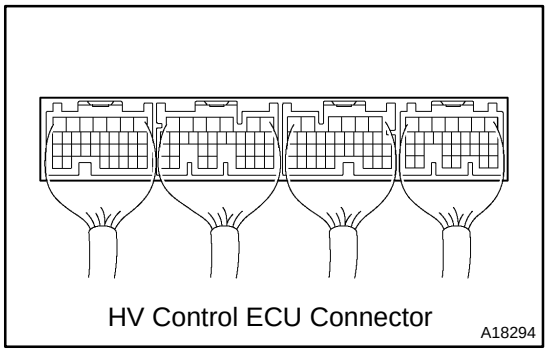
OK

8	INSPECT COOLING FAN MOTOR NO.2 (See page 16–8)

NG → **REPLACE COOLING FAN MOTOR NO. 2 AND ADD ENGINE COOLANT**

OK

9	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

cardiagn.com

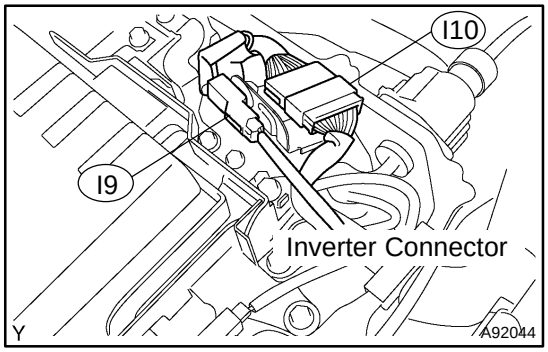
10	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → CONNECT SECURELY

OK

11	CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A7A to display its freeze frame data.
(f) Select the item that has INF code 322 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.
Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

cardiagn.com

B	REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)
C	REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)
D	REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

A

12 INSPECT HYBRID VEHICLE GENERATOR ASSY

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.

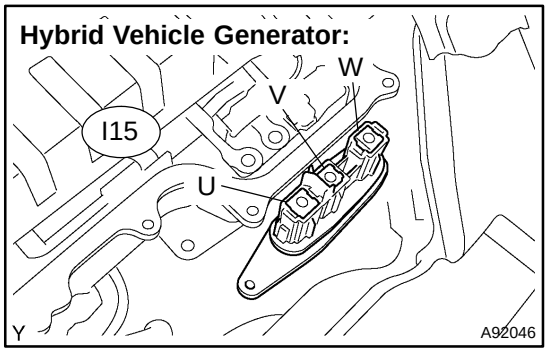
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).

(d) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.

(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.



NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

cardiagn.com

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.
Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

13 PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

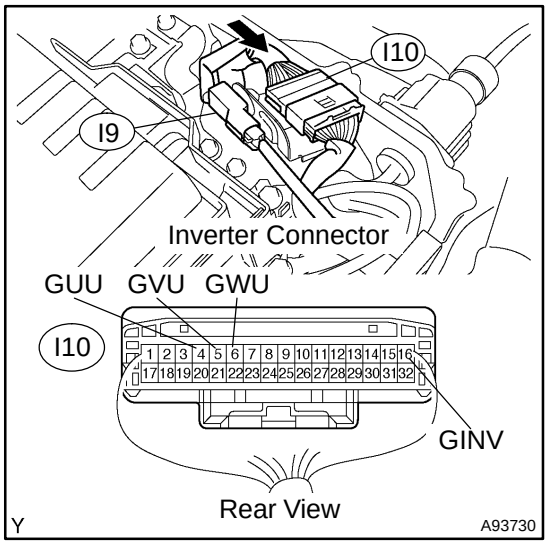
(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.
Standard:

Tester Connection	Specified Condition
GUU (I10–4) – GINV (I10–16)	12 to 16 V
GVU (I10–5) – GINV (I10–16)	12 to 16 V
GWU (I10–6) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.



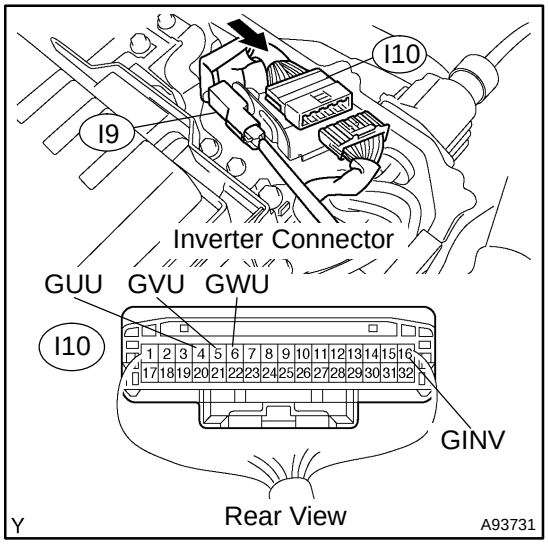
cardiagn.com

NG → Go to step 14

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

14	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
GUU (I10–4) – GINV (I10–16)	14 to 16 V
GVU (I10–5) – GINV (I10–16)	14 to 16 V
GWU (I10–6) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A7A/324 GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the generator inverter has a circuit malfunction, internal short, or overheats, the inverter transmits that information to the GFIV terminal of HV control ECU via generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	324	Generator inverter fail (GFIV) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

If the generator inverter detects a circuit malfunction, it transmits an inverter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 324): Generator inverter/GFIV detection circuit malfunction
Required sensor/components	Generator inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Generator inverter	Circuit malfunction

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 324) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 282) on page 05–586.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC listed in the table below is output

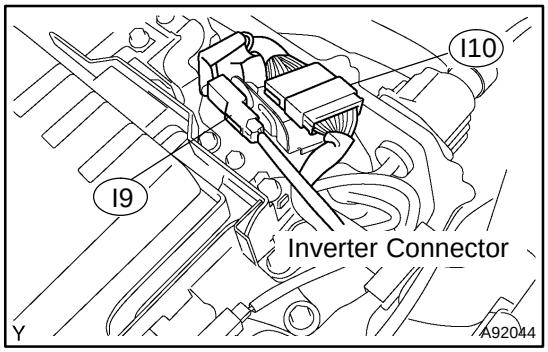
DTC No.	INF Code	Detection Item	See Page
P0A7A	321 or 323	Generator Inverter Performance	05–631

YES → **GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

2	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → **CONNECT SECURELY**

OK

cardiagn.com

3	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs P0A78 (INF 282, 286) and P0A7A (INF 324) (inverter circuit malfunction) are output

NO → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

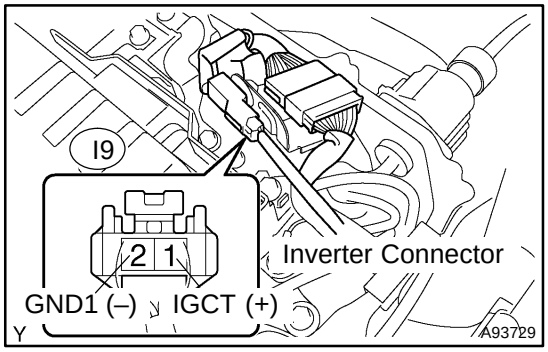
YES

4	INSPECT W/CONVERTER INVERTER ASSY(IGCT VOLTAGE)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Turn the power switch ON (IG).
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.
(e) Measure the voltage between the terminals of the inverter connector.
Standard:

Tester Connection	Specified Condition
IGCT (I9–1) – GND1 (I9–2)	8 V or more

(f) Turn the power switch OFF.
(g) Reinstall the inverter cover (see page 21–23).
(h) Reinstall the service plug grip (see page 21–116).



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A7A/325	GENERATOR INVERTER PERFORMANCE

DTC	P0A7A/517	GENERATOR INVERTER PERFORMANCE

DTC	P0A7A/518	GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

If the generator inverter has a circuit malfunction, internal short, or overheats, the inverter transmits that information to the GFIV terminal of HV control ECU via the generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	325	Generator inverter fail (GFIV) signal detection (over current by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A7A	517	Generator inverter fail (GFIV) signal detection (over current by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A7A	518	Generator inverter fail (GFIV) signal detection (over current by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If over–amperage flows through the generator inverter due to an internal short, the generator inverter transmits an inverter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 325/517/518): Generator inverter/GFIV detection over current
Required sensor/components	Generator inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Generator inverter	Over current (internal short)

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 325/517/518) is not detected

cardiagn.com

WIRING DIAGRAM

Refer to DTC P0A78 (INF 279) on page 05–577.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs listed in the table below are output

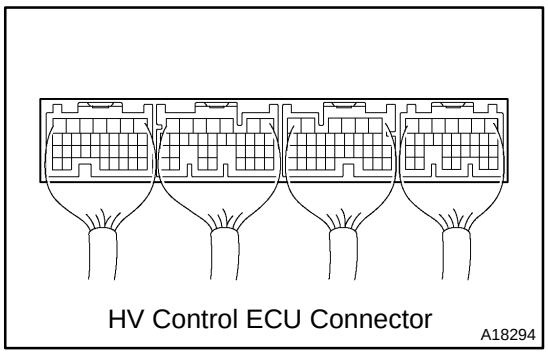
DTC No.	Relevant Diagnosis
P0A1D	Hybrid Powertrain Control Module
P0A2B, P0A2C or P0A2D	Drive Motor ”A” Temperature Sensor Circuit System
P0A37, P0A38 or P0A39	Generator Temperature Sensor Circuit System
P0A3F, P0A40 or P0A41	Drive Motor ”A” Position Sensor Circuit System
P0A4B, P0A4C or P0A4D	Generator Position Sensor Circuit System
P0A60 or P0A63	Drive Motor ”A” Current Sensor Circuit System
P0A72 or P0A75	Generator Current Sensor Circuit System
P0A78	Drive Motor ”A” Inverter Performance
P0A7A	Generator Inverter Performance
P0A90	Drive Motor ”A” Performance
P0A92	Hybrid Generator Performance
P0A93	Inverter Cooling System Malfunction
P0A94	DC/DC Converter Malfunction
P0AA1, P0AA2, P0AA4 or P0AA5	System Main Relay Circuit System
P3000, P3004, P3009 or P3110	High Voltage System
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit System
P3221	Generator Inverter Temperature Sensor Circuit System
P3226	DC/DC Converter Temperature Sensor Circuit System

YES → **GO TO DTC CHART (See page 05–440). FIND A PAGE NUMBER TO PROCEED TO ITS DIAGNOSTIC TROUBLESHOOTING FLOWCHART**

NO

cardiagn.com

2	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)



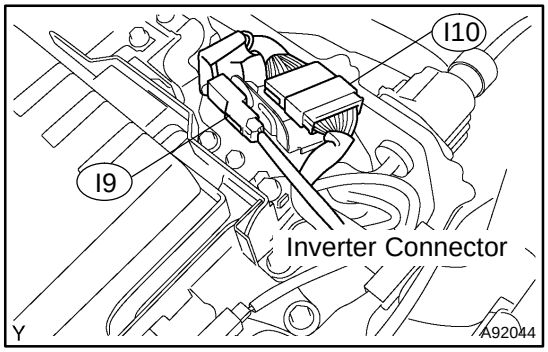
(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

3	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.

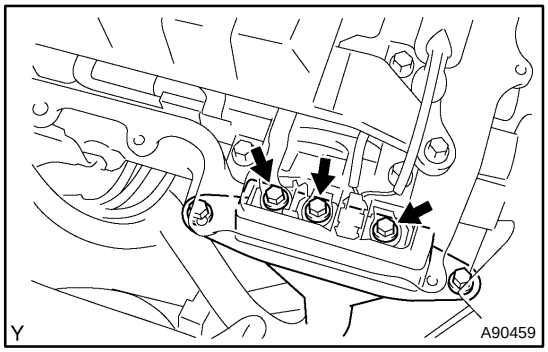


NG → **CONNECT SECURELY**

OK

cardiagn.com

4 CHECK HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Check if the three–phase alternating current cable installation bolts on the hybrid vehicle generator are tightened to the specified torque.
Torque: 8.0 N·m (82 kgf·cm 71in.·lbf)
(c) Reinstall the inverter cover (see page 21–23).
(d) Reinstall the service plug grip (see page 21–116).

NG → **TIGHTEN THEM TO SPECIFIED TORQUE**

OK

5 CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A7A to display its freeze frame data.
(f) Select the item that has INF code 325, 517, or 518 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.
Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

B → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

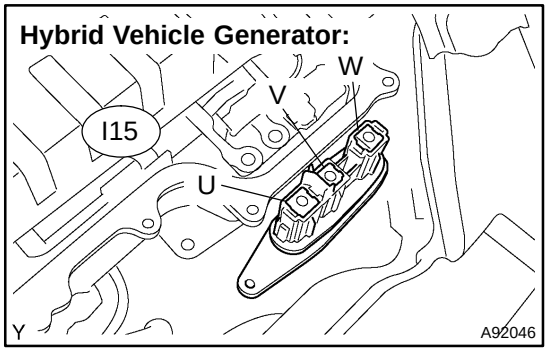
C → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

D → **REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)**

A

cardiagn.com

6 INSPECT HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.

(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).

(d) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.

(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.

NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.

Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

cardiagn.com

NG	REPLACE HYBRID VEHICLE GENERATOR ASSY

OK

7	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

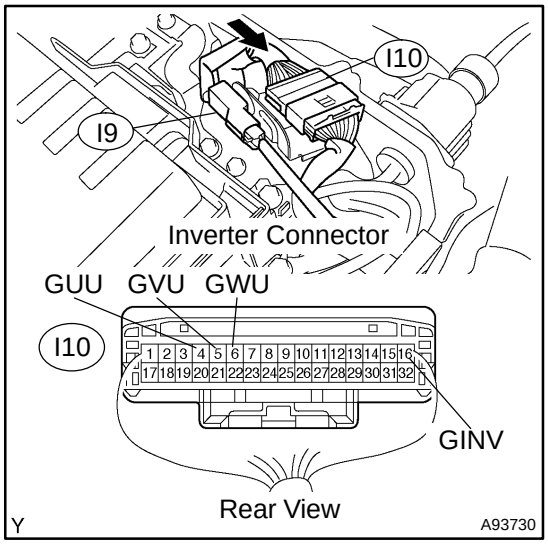
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
GUU (I10–4) – GINV (I10–16)	12 to 16 V
GVU (I10–5) – GINV (I10–16)	12 to 16 V
GWU (I10–6) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.



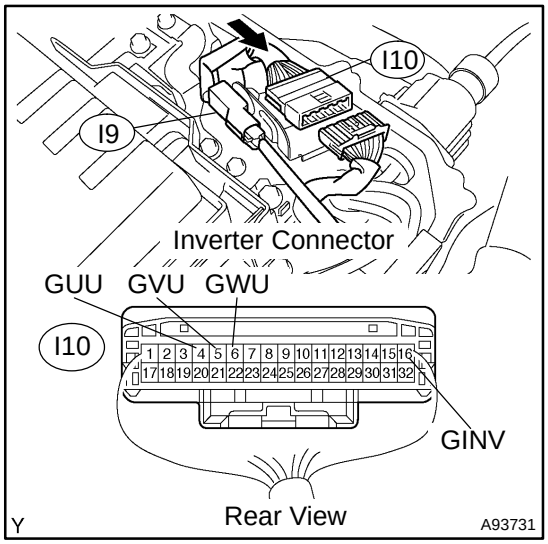
NG	Go to step 8

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

8	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
GUU (I10–4) – GINV (I10–16)	14 to 16 V
GVU (I10–5) – GINV (I10–16)	14 to 16 V
GWU (I10–6) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A7A/342	GENERATOR INVERTER PERFORMANCE

DTC	P0A7A/343	GENERATOR INVERTER PERFORMANCE

DTC	P0A7A/519	GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

Upon receiving a generator gate shutdown signal from the HV control ECU, the inverter forcefully stops the operation of the MG1 by turning OFF the power transistors that are actuating the MG1.

The HV control ECU monitors the generator gate shutdown signal line and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	342	Open or +B short in generator gate shutdown (GSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A7A	343	GND short in generator gate shutdown (GSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A7A	519	Open in generator gate shutdown (GSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the generator gate shutdown (GSDN) signal line. If the HV control ECU detects an open or short malfunction of the GSDN signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 342/343/519): Generator inverter/Generator gate shutdown signal malfunction
Required sensor/components	Generator inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

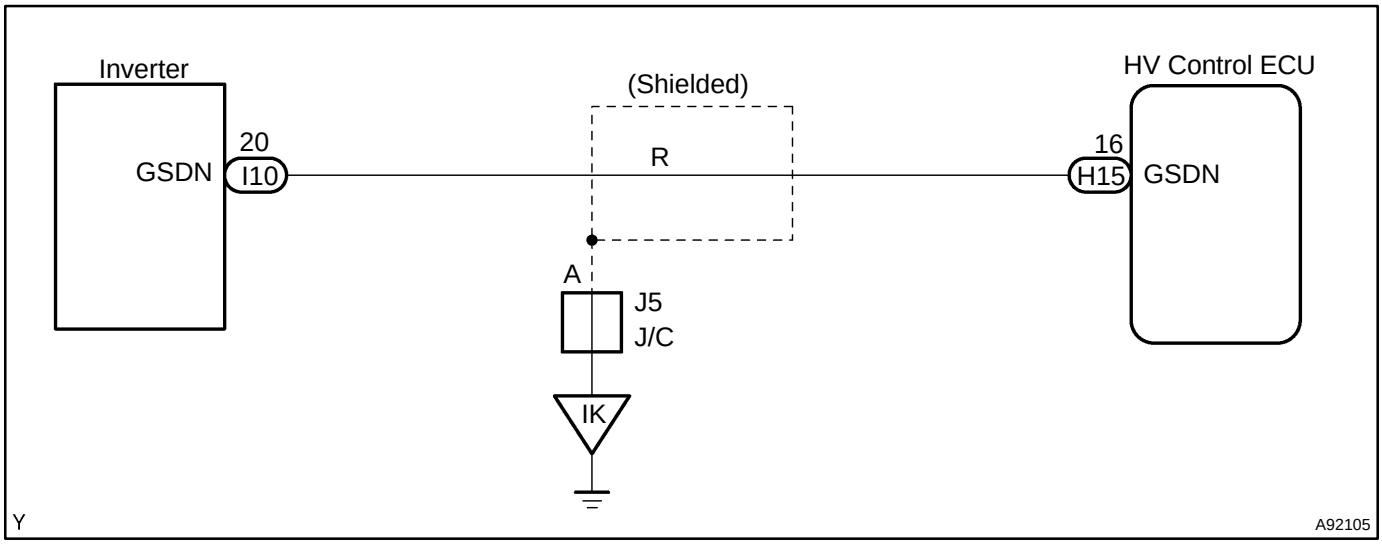
Generator gate shutdown signal circuit	Open or short

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 342/343/519) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

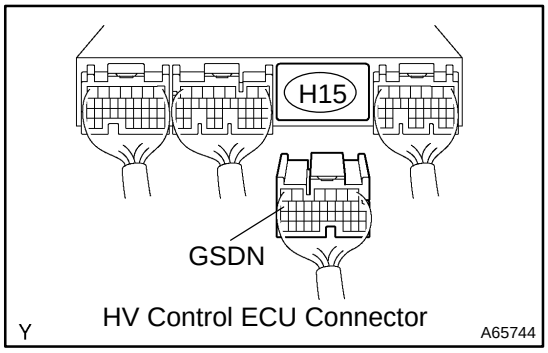
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

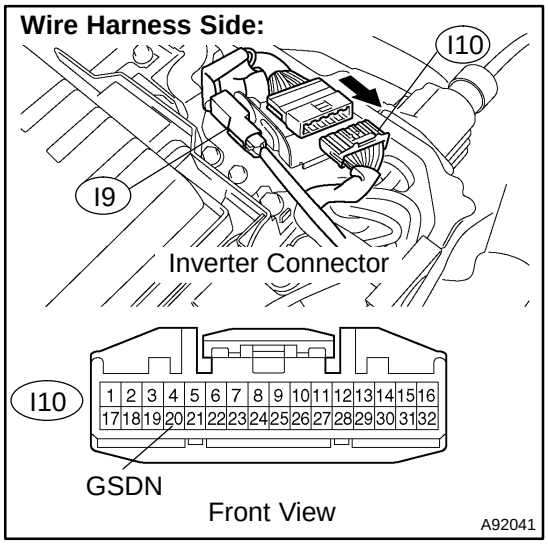
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
GSDN (H15–16) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GSDN (H15–16) – GSDN (I10–20)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GSDN (H15–16) or GSDN (I10–20) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC P0A7A/344 GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

The HV control ECU controls MG1 torque in accordance with the driving condition.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	344	Failure in monitoring MG1 torque performance	• Hybrid vehicle generator • w/ converter inverter assembly

MONITOR DESCRIPTION

If the difference between the requested MG1 torque and the actual MG1 torque exceeds a predetermined value, the HV control ECU determines that there is a malfunction in the execution or monitoring of the MG1 torque. Then, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 344): Generator inverter/Discrepancy between generator monitored torque and commanded torque
Required sensor/components	Generator inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Difference between demanded and actual MG1 torque	Exceeds the standard level

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 344) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

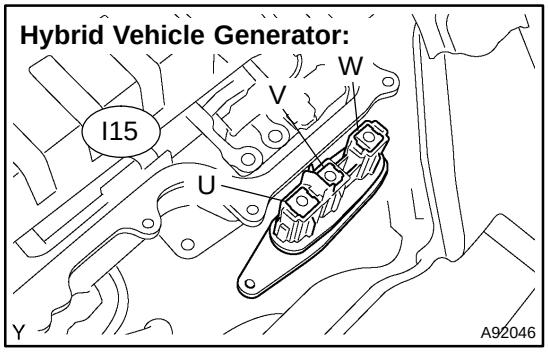
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A7A (INF 344) and other DTCs are output

HINT:
If any other codes besides P0A7A (INF 344) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	INSPECT HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.
(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.
NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.
Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
$R20 = Rt \div (1 + 0.00393 \times (T - 20))$
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

cardiagn.com

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.
Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

(i) Reinstall the inverter cover (see page 21–23).

(j) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC P0A7A/520 GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

Upon receiving a generator gate shutdown signal from the HV control ECU, the inverter forcefully stops the operation of the MG1 by turning OFF the power transistors that are actuating the MG1.

The HV control ECU monitors the generator gate shutdown signal and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	520	Generator gate shutdown (GSDN) signal malfunction	• Wire harness or connector • HV control ECU

MONITOR DESCRIPTION

The HV control ECU monitors the generator gate shutdown (GSDN) signal. If the HV control ECU detects a fault in the GSDN signal, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 520): Generator inverter/Generator inverter shutdown signal line malfunction
Required sensor/components	Generator inverter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Actual status of shutdown command signal and its monitoring result	Inconsistent

COMPONENT OPERATING RANGE

Generator inverter	DTC P0A7A (INF 520) is not detected

WIRING DIAGRAM

Refer to DTC P0A7A (INF 342) on page 05–652.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A7A (INF 520) and other DTCs are output

HINT:
If any other codes besides P0A7A (INF 520) are output, perform troubleshooting for those DTCs first.

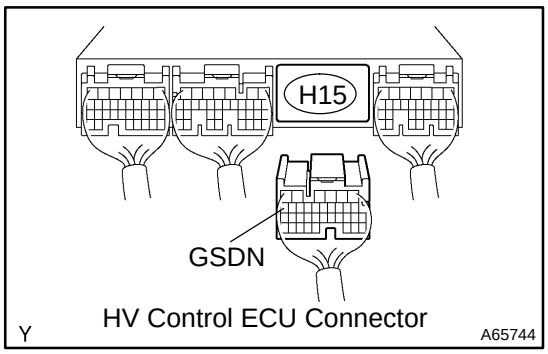
YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

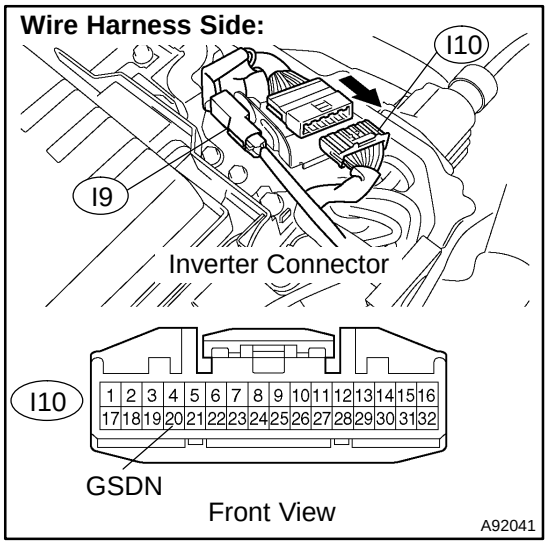
NO

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
GSDN (H15–16) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GSDN (H15–16) – GSDN (I10–20)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GSDN (H15–16) or GSDN (I10–20) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A7A/522 GENERATOR INVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the inverter on page 05–562.

Upon receiving a generator gate shutdown signal from the HV control ECU, the inverter forcefully stops the operation of the MG1 by turning OFF the power transistors that are actuating the MG1.

The HV control ECU monitors the generator inverter gate and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	522	Generator inverter gate malfunction	• Wire harness or connector • w/ converter inverter assembly

WIRING DIAGRAM

Refer to DTC P0A7A (INF 342) on page 05–652.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	**CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)**

CAUTION:

Wear insulated gloves before performing the following operation.

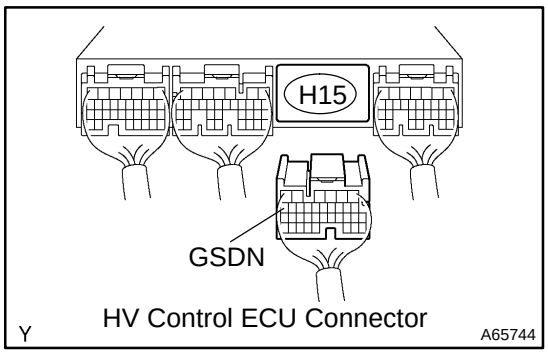
(a) Turn the power switch OFF.

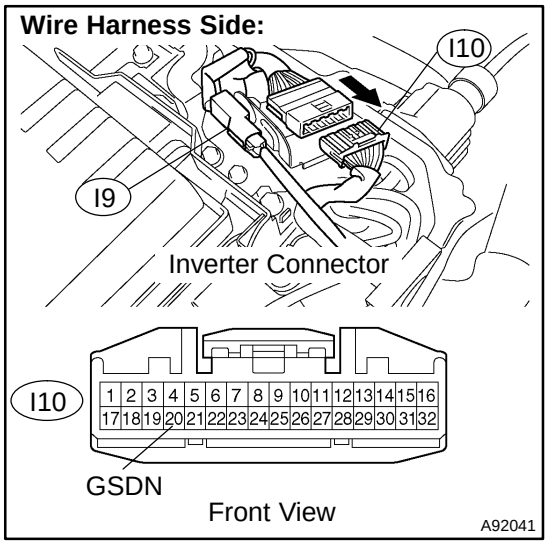
(b) Remove the service plug grip (see page 21–116).

NOTICE:

Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H15 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
GSDN (H15–16) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GSDN (H15–16) – GSDN (I10–20)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GSDN (H15–16) or GSDN (I10–20) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A90/239	DRIVE MOTOR ”A” PERFORMANCE

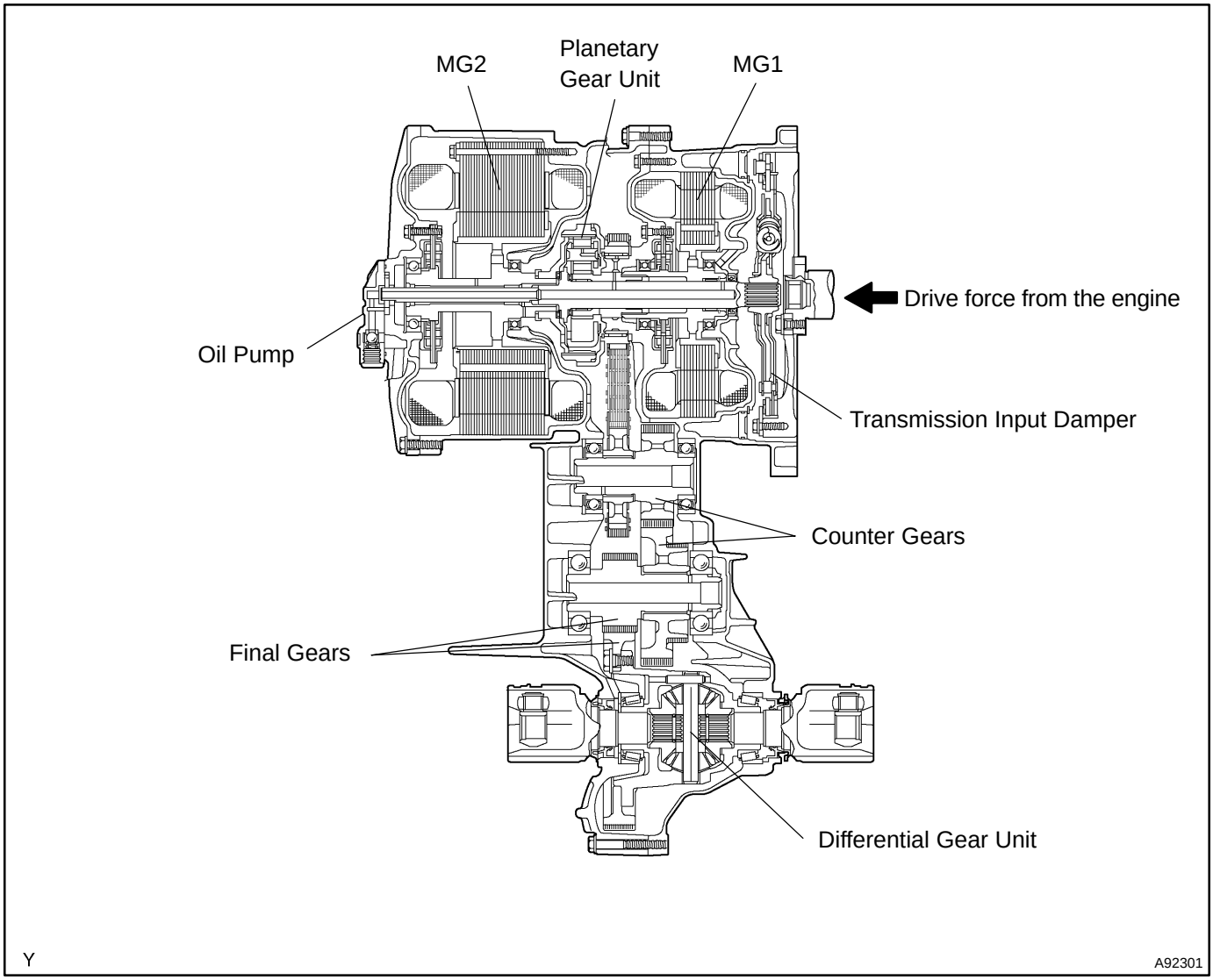
DTC	P0A90/241	DRIVE MOTOR ”A” PERFORMANCE

DTC	P0A90/602	DRIVE MOTOR ”A” PERFORMANCE

CIRCUIT DESCRIPTION

The HV transaxle consists of a planetary gear unit, MG1, and MG2.
A gear unit uses the planetary gear to split engine output in accordance with a driving request during driving the vehicle or charging its internal HV battery.
The MG2 provides assist to the engine output while increasing the drive force of the vehicle. Furthermore, the MG2 effects regenerative braking by converting the energy (which is consumed in the form of heat during normal braking) into electrical energy and recovering it into the HV battery. Through regenerative braking, as well as decelerating the vehicle, the MG2 generates high–voltage electrical power which is used for the purpose of charging the HV battery.
The MG1 supplies electrical power, which is used for charging the HV battery or for driving the MG2. It also has a stepless transmission function to control the transaxle by regulating the amount of generation of electrical energy, which effectively varies the MG1 speed. In addition, the MG1 is used as a starter motor to start the engine.
The transmission input damper absorbs the shock that accompanies transmission of the drive force from the engine.

cardiagn.com



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	239	HV transaxle input malfunction (shaft damaged)	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU
P0A90	241	HV transaxle input malfunction (torque limiter slipping)	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU
P0A90	602	HV transaxle output malfunction	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU

WIRING DIAGRAM

Refer to DTC P0A0F (INF 238) on page 05–488.

cardiagn.com

INSPECTION PROCEDURE

1	READ OUTPUT DTC(ENGINE)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / ENGINE AND ECT / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–55)**

NO

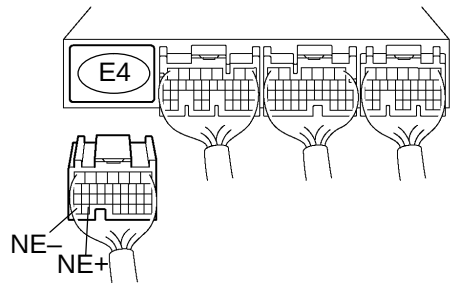
2	CHECK CRANKSHAFT PULLEY REVOLUTION

(a) Turn the power switch OFF.
(b) Jack up the vehicle.
(c) Manually turn the crankshaft pulley to check if the crankshaft rotates.
OK: The crankshaft rotates

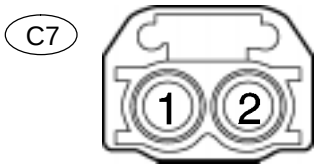
NG → **Go to step 10**

OK

3	CHECK HARNESS AND CONNECTOR(ECM – CRANKSHAFT POSITION SENSOR)



Wire Harness Side:
Crankshaft Position Sensor Connector



(a) Disconnect the E4 ECM connector.
(b) Disconnect the C7 crankshaft position sensor connector.
(c) Check the resistance between the wire harness side connectors.
Standard (Check for open):

Tester Connection	Specified Condition
NE+ (E4–33) – Crankshaft position sensor (C7–1)	Below 1 Ω
NE– (E4–34) – Crankshaft position sensor (C7–2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
NE+ (E4–33) or Crankshaft position sensor (C7–1) – Body ground	10 kΩ or higher
NE– (E4–34) or Crankshaft position sensor (C7–2) – Body ground	10 kΩ or higher

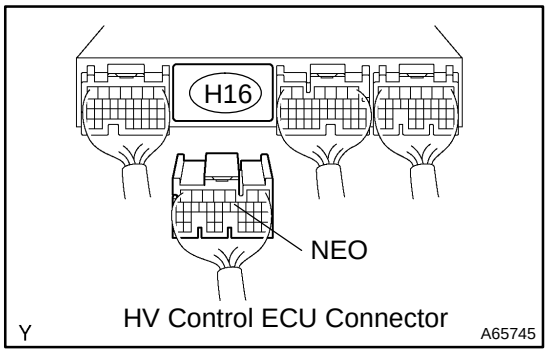
(d) Reconnect the crankshaft position sensor connector.
(e) Reconnect the ECM connector.

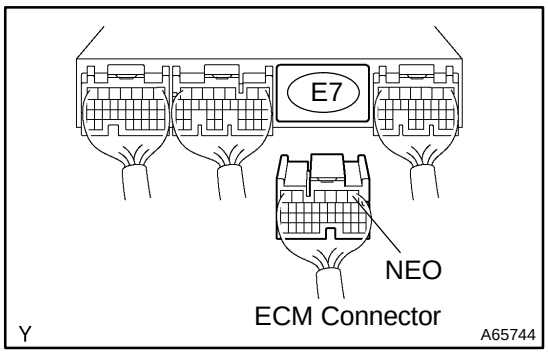
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

4 CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – ECM)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the E7 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
NEO (H16–12) – NEO (E7–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
NEO (H16–12) or NEO (E7–1) –Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

5 CHECK AND CLEAR DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Check and record the DTCs, the freeze frame data, and the information.
(f) Clear the DTCs of HV ECU.

GO

6 CHECK READY LAMP ON

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MG1 REV and ENGINE SPD values.
(f) Turn the power switch ON (READY).

OK: READY lamp turns ON

HINT:

If the READY lamp does not turn ON, and the reading on the hand–held tester shows DTC P0A90 (INF 239) (HV transaxle input malfunction [shaft damaged]), or the MG1 turns but the engine does not crack, replace the hybrid vehicle transaxle assembly.

cardiagn.com

NG	REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

OK

7	CHECK ENGINE REV–UP

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MG1 REV and ENGINE SPD values.
(f) With the READY lamp turned ON, depress the accelerator pedal for 10 seconds while the shift position is in the P position.

OK: The engine revs up

HINT:
If the engine does not rev up, and the reading on the hand–held tester shows DTC P0A90 (INF 239) (HV transaxle input malfunction [shaft damaged]), or the MG1 turns but the engine does not crank, replace the hybrid vehicle transaxle assembly.

NG	REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

OK

8	CHECK CREEP MOVEMENT

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (READY).
(c) Jack up the vehicle.
(d) Depress the brake pedal, move the selector lever to the D position, and release the brake pedal.

OK: The wheels turn (creep movement)

HINT:
If the wheels do not turn, and the reading on the hand–held tester shows DTC P0A90 (INF 602) (HV transaxle output malfunction), replace the hybrid vehicle transaxle assembly.

NG	REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

OK

cardiagn.com

9	CHECK ENGINE ACCELERATION SPEED

(a) Connect the hand–held tester to the DLC3.
(b) While driving at the vehicle speed of more than 6 mph (10 km/h), fully depress the accelerator pedal to raise the engine speed.
OK: The engine speed increases smoothly

HINT:
If the engine over–revs or the reading on the hand–held tester shows DTC P0A90 (INF 241) (HV transaxle input malfunction [torque limiter slipping]), replace the transmission input damper.

NG → **REPLACE TRANSMISSION INPUT DAMPER ASSY**

OK

PERFORM SIMULATION TEST. IF SYMPTOM IS NOT REPRODUCED, REPLACE HV TRANSAXLE AND HV CONTROL ECU

10	CHECK FRONT TIRE REVOLUTION

(a) Turn the power switch ON (IG).
(b) Depress the brake pedal, move the selector lever to the N position.
(c) Jack up the vehicle.
(d) Manually turn the crankshaft pulley to check if the front tires rotate.
OK: The front tires rotate

NG → **REPAIR OR REPLACE ENGINE ASSY**

OK

REPAIR OR REPLACE HYBRID VEHICLE TRANSAXLE ASSY

cardiagn.com

DTC P0A90/240 DRIVE MOTOR "A" PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A90 (INF 239) on page 05–663.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	240	Generator locked	• Hybrid vehicle generator

INSPECTION PROCEDURE

If the information (INF) code is present, replace the hybrid vehicle generator.

REPLACE HYBRID VEHICLE GENERATOR ASSY

cardiagn.com

DTC P0A90/242 DRIVE MOTOR ”A” PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A90 (INF 239) on page 05–663.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	242	Planetary gear locked	• HV transaxle assembly

INSPECTION PROCEDURE

If the information (INF) code is present, replace the HV transaxle assembly.

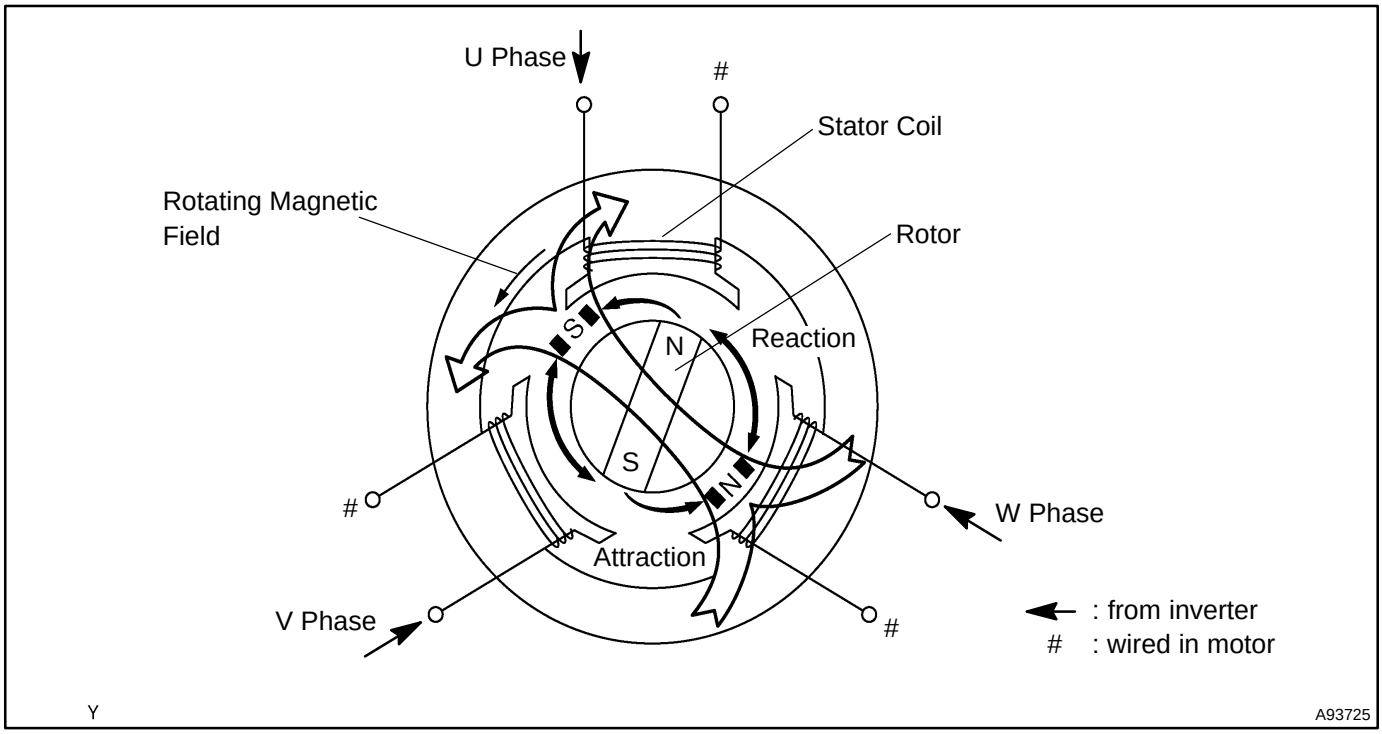
REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

cardiagn.com

DTC P0A90/251 DRIVE MOTOR "A" PERFORMANCE

CIRCUIT DESCRIPTION

When three–phase alternating current flows through the three–phase windings of the stator coil, a rotating magnetic field is generated in the motor. The system controls the rotating magnetic field in accordance with the rotating position and speed of the rotor. As a result, the permanent magnets provided on the rotor are pulled in the rotating direction, which cause the generation of torque.
The generated torque is practically proportionate to the amount of current. Therefore, the system controls the speed of the motor by regulating the frequency of the alternating current. Furthermore, the system properly controls the rotating magnetic field and the angle of the rotor magnets in order to generate high torque in an efficient manner, even at high speeds.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	251	MG2 magnetic force deterioration or same phase short circuit	• Hybrid vehicle motor

MONITOR DESCRIPTION

The HV control ECU monitors the hybrid vehicle motor (MG2). If the HV control ECU detects a reduction in the magnetic force of the MG2 or an in–phase short, it interprets this as a MG2 failure. The HV control ECU then illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A90 (INF 251): Hybrid vehicle motor/Magnetic force deterioration, same phase short circuit
Required sensor/components	Hybrid vehicle motor, inverter, motor resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

cardiagn.com

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle motor	Magnetic force deterioration, or same phase short

COMPONENT OPERATING RANGE

Hybrid vehicle motor	DTC P0A90 (INF 251) is not detected

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A90 (INF 251) and other DTCs are output

HINT:
If any other codes besides P0A90 (INF 251) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

DTC P0A90/509 DRIVE MOTOR "A" PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the MG1/MG2 on page 05–671.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	509	MG2 system malfunction	• Hybrid vehicle motor • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the hybrid vehicle motor (MG2) system. If the HV control ECU detects a malfunction in the MG2 system, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A90 (INF 509): Hybrid vehicle motor/Motor system malfunction
Required sensor/components	Hybrid vehicle motor, inverter, motor resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle motor	Abnormal

COMPONENT OPERATING RANGE

Hybrid vehicle motor	DTC P0A90 (INF 509) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

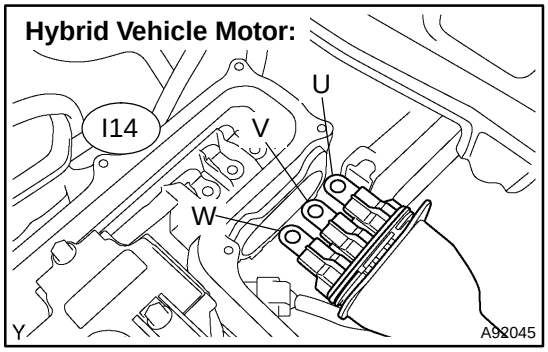
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A90 (INF 509) and other DTCs are output

HINT:
If any other codes besides P0A90 (INF 509) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	INSPECT HYBRID VEHICLE MOTOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.
(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.
NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.
Standard:

Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
$R20 = Rt \div (1 + 0.00393 \times (T - 20))$
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

cardiagn.com

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

(i) Reinstall the inverter cover (see page 21–23).

(j) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A90/604	DRIVE MOTOR ”A” PERFORMANCE

DTC	P0A90/605	DRIVE MOTOR ”A” PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the MG1/MG2 on page 05–671.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	604	MG2 power balance malfunction (small power balance)	• Battery current sensor • Hybrid vehicle motor
P0A90	605	MG2 power balance malfunction (large power balance)	• Battery current sensor • Hybrid vehicle motor

MONITOR DESCRIPTION

The HV control ECU monitors the energy balance of the hybrid vehicle motor (MG2) system. If the HV control ECU detects a malfunction in the amount of electrical energy while the MG2 charges or discharges electricity, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A90 (INF 604/605): Hybrid vehicle motor/Power balance malfunction
Required sensor/components	Hybrid vehicle motor, motor resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle motor (power balance)	Small or large

COMPONENT OPERATING RANGE

Hybrid vehicle motor	DTC P0A90 (INF 604/605) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–893)**

NO

2	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A90 (INF 604 or 605) and other DTCs are output

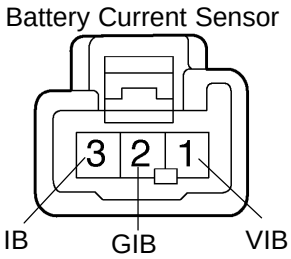
HINT:
If any other codes besides P0A90 (INF 604 or 605) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

3	INSPECT BATTERY CURRENT SENSOR

Component Side:



(a) Remove the battery current sensor (see page 21–95).
(b) Measure the resistance between terminals 1 (VIB) and 2 (GIB).
Standard:

Tester Connection	Resistance
Positive probe to terminal 1 (VIB) Negative probe to terminal 2 (GIB)	3.5 to 4.5 kΩ
Positive probe to terminal 2 (GIB) Negative probe to terminal 1 (VIB)	5 to 7 kΩ or more

(c) Measure the resistance between terminals 1 (VIB) and 3 (IB).
Standard:

Tester Connection	Resistance
Positive probe to terminal 1 (VIB) Negative probe to terminal 3 (IB)	3.5 to 4.5 kΩ
Positive probe to terminal 3 (IB) Negative probe to terminal 1 (VIB)	5 to 7 kΩ or more

cardiagn.com

(d) Measure the resistance between terminals 2 (GIB) and 3 (IB).

Standard: 0.2 kΩ or less

NOTICE:

Even if the probes are changed around, the resistance will not vary.

(e) Reinstall the battery current sensor (see page 21–95).

NG → **REPLACE BATTERY CURRENT SENSOR (See page 21–95)**

OK

REPLACE HYBRID VEHICLE MOTOR ASSY

cardiagn.com

DTC P0A92/261 HYBRID GENERATOR PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the MG1/MG2 on page 05–671.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A92	261	MG1 magnetic force deterioration or same phase short circuit	• Hybrid vehicle generator

MONITOR DESCRIPTION

The HV control ECU monitors the hybrid vehicle generator (MG1). If the HV control ECU detects a reduction in the magnetic force of the MG1 or an in–phase short, it interprets this as a MG1 failure. The HV control ECU then illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A92 (INF 261): Hybrid vehicle generator/Magnetic force deterioration, same phase short circuit
Required sensor/components	Hybrid vehicle generator, inverter, generator resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle generator	Abnormal

COMPONENT OPERATING RANGE

Hybrid vehicle generator	DTC P0A92 (INF 261) is not detected

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A92 (INF 261) and other DTCs are output

HINT:
If any other codes besides P0A92 (INF 261) are output, perform troubleshooting for those DTCs first.

cardiagn.com

YES → GO TO RELEVANT DTC CHART (See page 05–440)

NO → REPLACE HYBRID VEHICLE GENERATOR ASSY

cardiagn.com

DTC P0A92/521 HYBRID GENERATOR PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the MG1/MG2 on page 05–671.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A92	521	MG1 system malfunction	• Hybrid vehicle generator • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the hybrid vehicle generator (MG1) system. If the HV control ECU detects a malfunction in the MG1 system, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A92 (INF 521): Hybrid vehicle generator/Generator system malfunction
Required sensor/components	Hybrid vehicle generator, inverter, generator resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle generator	Abnormal

COMPONENT OPERATING RANGE

Hybrid vehicle generator	DTC P0A92 (INF 521) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

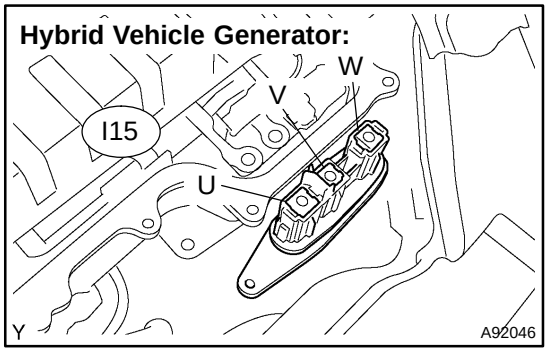
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A92 (INF 521) and other DTCs are output

HINT:
If any other codes besides P0A92 (INF 521) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	INSPECT HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.
(e) Using milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.
NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.
Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
$R20 = Rt \div (1 + 0.00393 \times (T - 20))$
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

cardiagn.com

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.
Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

(i) Reinstall the inverter cover (see page 21–23).

(j) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A92/606	HYBRID GENERATOR PERFORMANCE

DTC	P0A92/607	HYBRID GENERATOR PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the MG1/MG2 on page 05–671.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A92	606	MG1 power balance malfunction (small power balance)	• Battery current sensor • Hybrid vehicle generator
P0A92	607	MG1 power balance malfunction (large power balance)	• Battery current sensor • Hybrid vehicle generator

MONITOR DESCRIPTION

The HV control ECU monitors the energy balance of the hybrid vehicle generator (MG1) system. If the HV control ECU detects a malfunction in the amount of electrical energy while the MG1 charges or discharges electricity, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A92 (INF 606/607): Hybrid vehicle generator/Power balance malfunction
Required sensor/components	Hybrid vehicle generator, generator resolver
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Hybrid vehicle generator (power balance)	Small or large

COMPONENT OPERATING RANGE

Hybrid vehicle generator	DTC P0A92 (INF 606/607) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–893)**

NO

2	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A92 (INF 606 or 607) and other DTCs are output

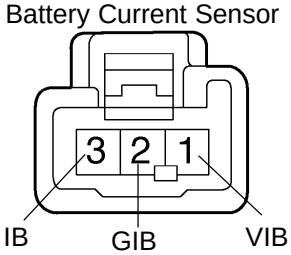
HINT:
If any other codes besides P0A92 (INF 606 or 607) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

3	INSPECT BATTERY CURRENT SENSOR

Component Side:
Battery Current Sensor



Y A77580

(a) Remove the battery current sensor (see page 21–95).
(b) Measure the resistance between terminals 1 (VIB) and 2 (GIB).
Standard:

Tester Connection	Resistance
Positive probe to terminal 1 (VIB) Negative probe to terminal 2 (GIB)	3.5 to 4.5 kΩ
Positive probe to terminal 2 (GIB) Negative probe to terminal 1 (VIB)	5 to 7 kΩ or more

(c) Measure the resistance between terminals 1 (VIB) and 3 (IB).
Standard:

Tester Connection	Resistance
Positive probe to terminal 1 (VIB) Negative probe to terminal 3 (IB)	3.5 to 4.5 kΩ
Positive probe to terminal 3 (IB) Negative probe to terminal 1 (VIB)	5 to 7 kΩ or more

cardiagn.com

(d) Measure the resistance between terminals 2 (GIB) and 3 (IB).

Standard: 0.2 kΩ or less

NOTICE:

Even if the probes are changed around, the resistance will not vary.

(e) Reinstall the battery current sensor (see page 21–95).

NG → **REPLACE BATTERY CURRENT SENSOR (See page 21–95)**

OK

REPLACE HYBRID VEHICLE GENERATOR ASSY

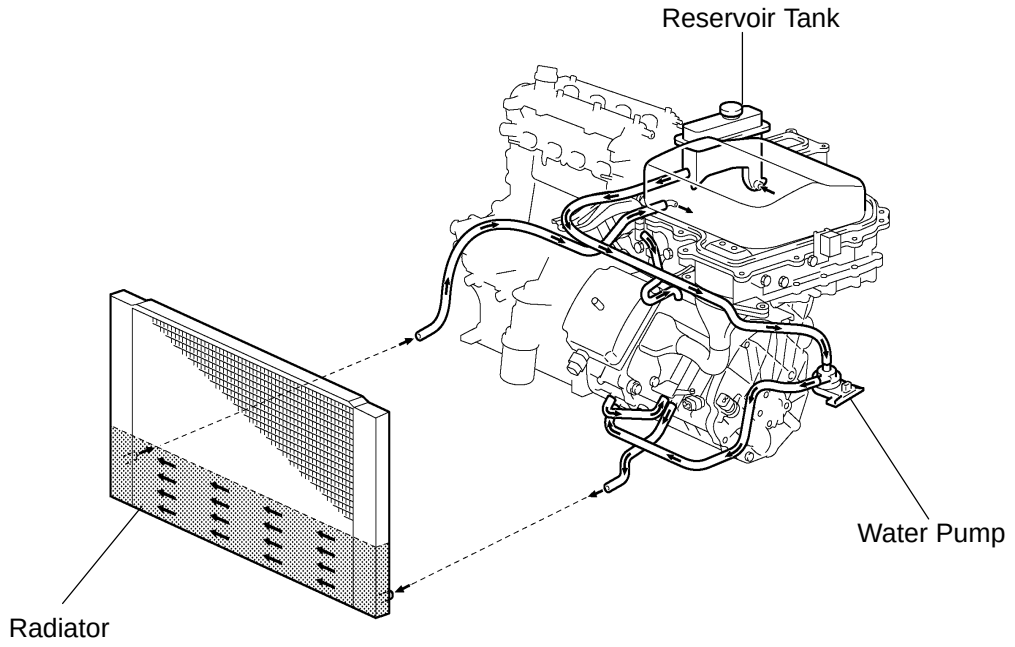
cardiagn.com

DTC	P0A93/346	INVERTER COOLING SYSTEM PERFORMANCE

DTC	P0A93/347	INVERTER COOLING SYSTEM PERFORMANCE

CIRCUIT DESCRIPTION

The inverter converts the high–voltage direct current of the HV battery into the alternating current for the MG1 and the MG2. The inverter generates heat during the conversion process, and this heat could damage the inverter if a cooling system is unavailable. Therefore, similar to the MG1 and the MG2, the inverter is cooled by a dedicated cooling system, which consists of an electric water pump, cooling fan, and radiator. This cooling system is independent of the engine cooling system.



The HV control ECU monitors the electric water pump, cooling fan and cooling system, and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A93	346	Inverter cooling system malfunction (water pump system malfunction)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly
P0A93	347	Inverter cooling system malfunction (electric cooling fan system malfunction)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly

cardiagn.com

MONITOR DESCRIPTION

If the HV control ECU detects malfunction in the electric water pump, fan, or radiator, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A93 (INF 346/347): Inverter cooling system performance/Inverter cooling system
Required sensor/components	Water pump, radiator fan, inverter, boost converter, DC/DC converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

TOYOTA's intellectual property	–

COMPONENT OPERATING RANGE

Water pump Radiator fan	DTC P0A93 (INF 346/347) is not detected

INSPECTION PROCEDURE

1	CHECK QUANTITY OF HV COOLANT

(a) Check that there is a sufficient amount of coolant for the inverter.
OK: There is a sufficient amount of coolant for the inverter

NG → **ADD HV COOLANT (See page 22–4)**

OK

2	CHECK COOLANT HOSE

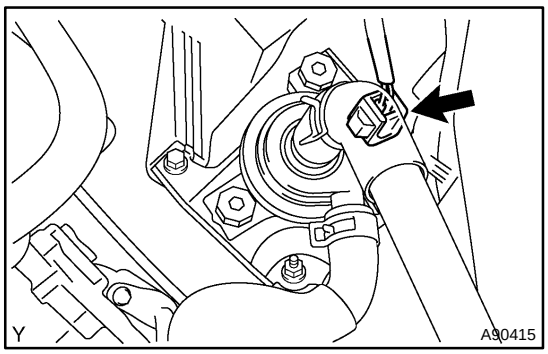
(a) Check that the hoses of the cooling system are not bent or clogged (see the cooling system on page 05–687).
OK: The hoses of the cooling system are not bent or clogged

NG → **CORRECT TO NORMAL CONDITION**

OK

cardiagn.com

3	CHECK CONNECTION CONDITION OF WATER PUMP CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the water pump connector.
OK: Connector has been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

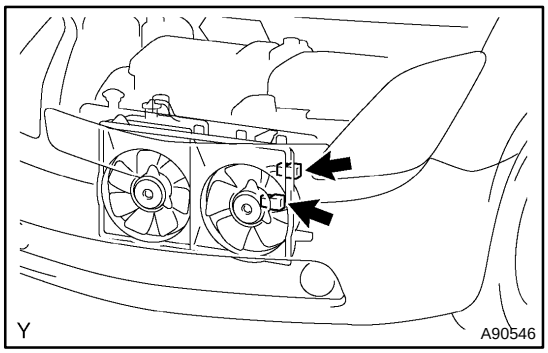
4	CHECK WATER W/MOTOR & BRACKET PUMP ASSY

(a) Turn the power switch ON (IG).
(b) Check the operation of the water pump.
OK: Coolant is sloshing in the reservoir tank

NG → **REPLACE WATER W/MOTOR & BRACKET PUMP ASSY**

OK

5	CHECK CONNECTION CONDITION OF COOLING FAN MOTOR CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the cooling fan motor connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

6	INSPECT COOLING FAN MOTOR (See page 16–8)

NG → **REPLACE COOLING FAN MOTOR AND ADD ENGINE COOLANT**

OK

cardiagn.com

7	INSPECT COOLING FAN MOTOR NO.2 (See page 16–8)

NG → REPLACE COOLING FAN MOTOR NO. 2 AND ADD ENGINE COOLANT

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

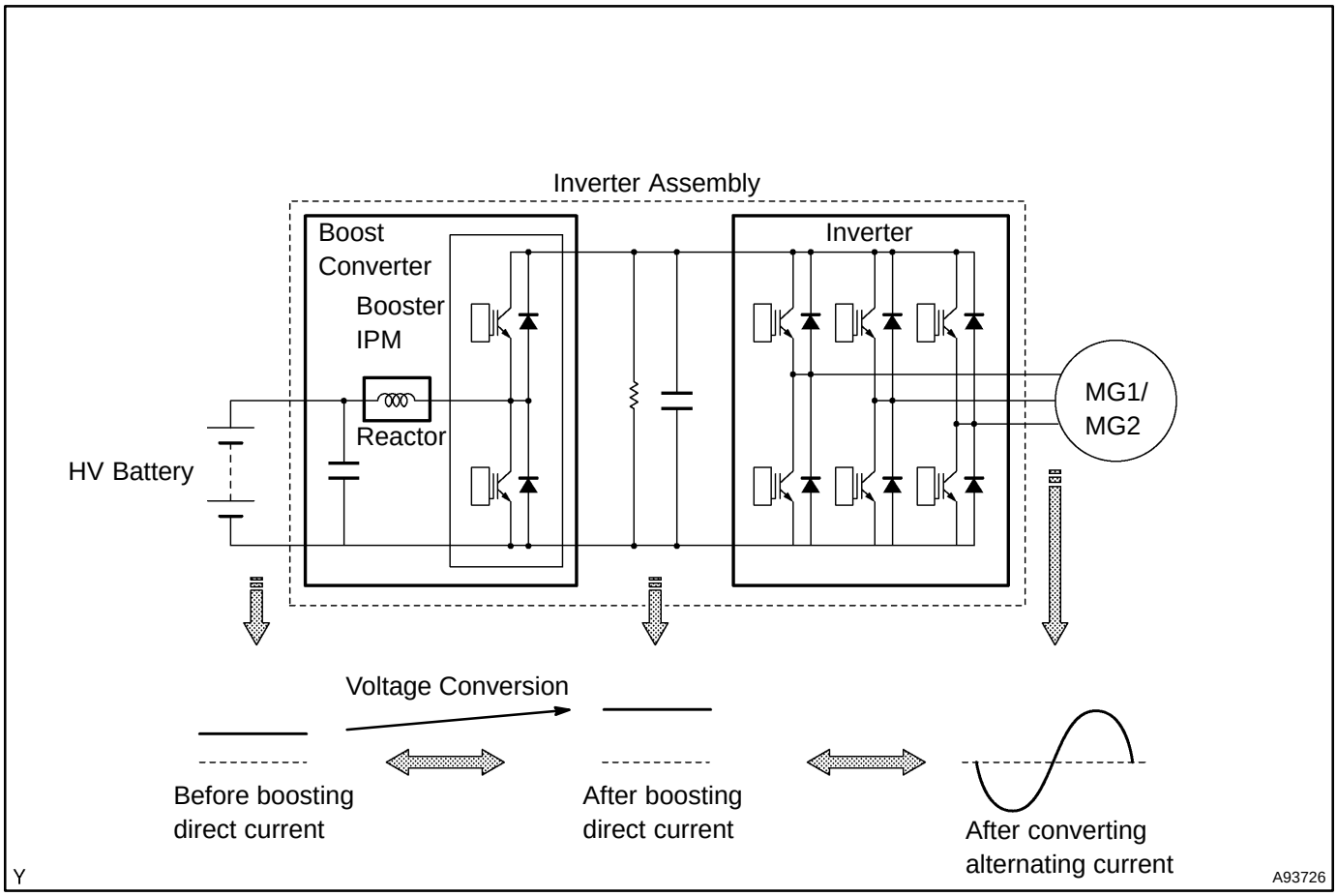
cardiagn.com

DTC P0A94/442 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

The boost converter contains a booster IPM (Intelligent Power Module), which includes an IGBT (Insulated Gate Bipolar Transistor) and a reactor. The HV control ECU actuates the IGBT, which controls the current in the reactor.

The boost converter boosts the high–voltage direct current rated at 201.6 V to an approximate direct current voltage of 500 V. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving the MG1/MG2. When the MG1/MG2 operates as a generator, the alternating current of approximately 500 V from the MG1/MG2 is converted into direct current by the inverter. Then, the boost converter drops this voltage to a direct current voltage rated at 201.6 V in order to charge the HV battery.



The HV control ECU uses a voltage sensor that is built into the boost converter to detect the high voltage (VL) before it is boosted. Also, it uses a voltage sensor that is built into the inverter to detect the high voltage (VH) after it has been boosted.

Based on the voltage before and after it has been boosted, the HV control ECU boosts it to a target voltage by controlling the operation of the boost converter.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	442	Abnormal voltage execution value	• w/ converter inverter assembly

cardiagn.com

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A94 (INF 442) and other DTCs are output

HINT:
If any other codes besides P0A94 (INF 442) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A94/545	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/546	DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.

If the boost converter detects a circuit malfunction or over–voltage, the boost converter transmits this information to the OVL terminal of the HV control ECU via the boost converter over–voltage signal line.

The HV control ECU monitors the boost converter over–voltage signal line and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	545	Open or GND short in boost converter over–voltage (OVL) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A94	546	+B short in boost converter over–voltage (OVL) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter over–voltage (OVL) signal line. If the HV control ECU detects an open or short malfunction of the OVL signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 545/546): Boost converter/Converter Sinv detection
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

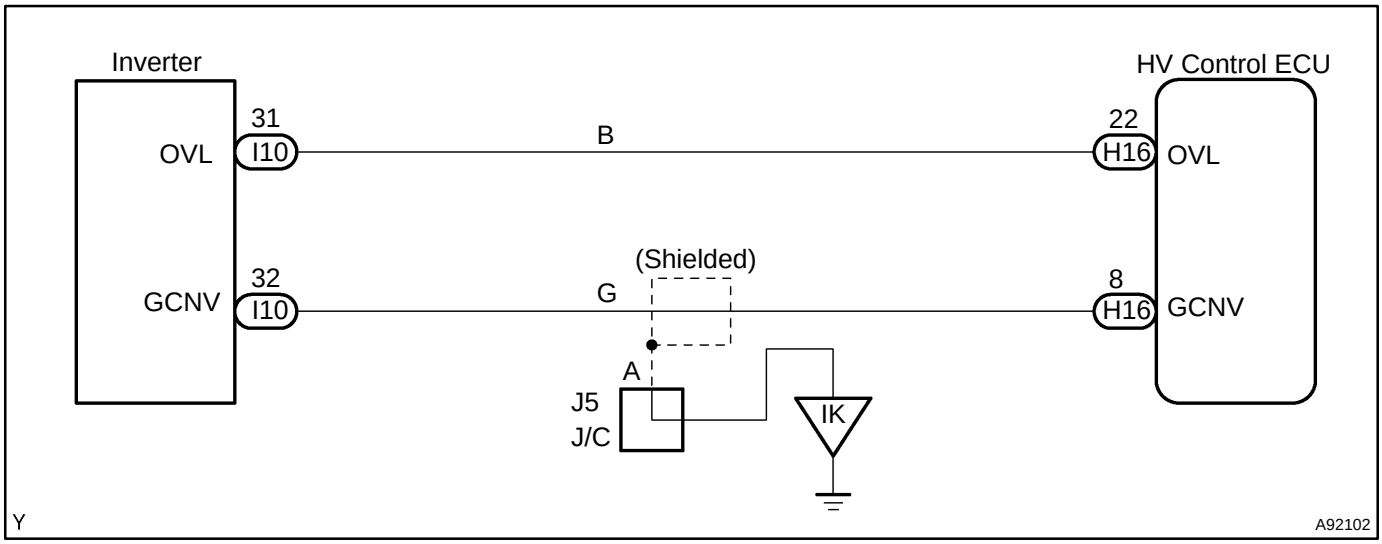
Boost converter over–voltage signal circuit	Open or short

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 545/546) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

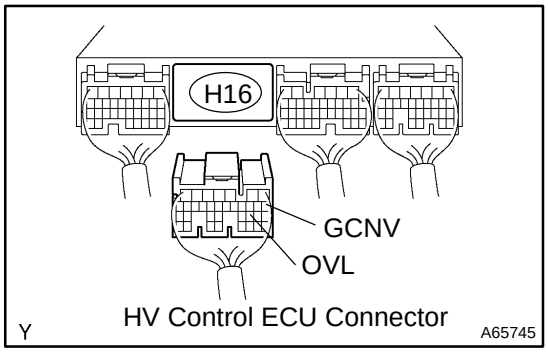
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

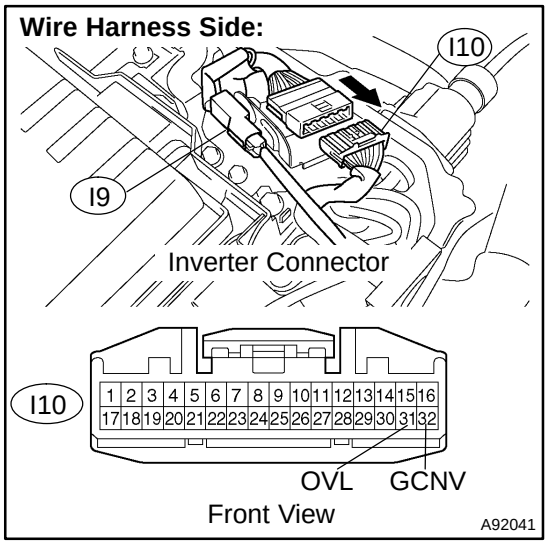
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H16 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
OVL (H16–22) – Body ground	Below 1 V
GCNV (H16–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
OVL (H16–22) – OVL (I10–31)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
OVL (H16–22) or OVL (I10–31) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A94/547	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/548	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/549	DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of booster converter on page 05–691.

If the boost converter detects a circuit malfunction or over–voltage, the boost converter transmits that information to the OVL terminal of the HV control ECU via the boost converter over–voltage signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	547	Boost converter over–voltage (OVL) signal detection (over–voltage by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A94	548	Boost converter over–voltage (OVL) signal detection (over–voltage by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A94	549	Boost converter over–voltage (OVL) signal detection (over–voltage by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If the boost converter detects over–voltage, it transmits a boost converter over–voltage signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 547/548/549): Boost converter/OVL detection over–voltage
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Boost converter	Over–voltage

cardiagn.com

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 547/548/549) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 279) on page 05–577.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	CONFIRM INFORMATION(EXCLUSIVE INFO 3)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A94 to display its freeze frame data.
(f) Select the item that has INF code 547, 548, or 549 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 3.
Result: –32 to 32 (during driving without battery power)

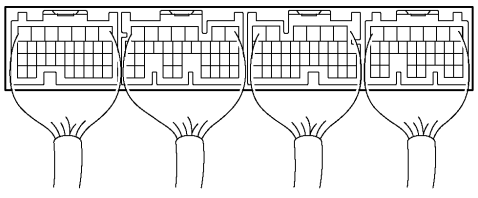
HINT:

If the value is inside the range shown above, DTCs other than P0A78 (INF 547, 548 and 549) have been detected as well. Perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)



HV Control ECU Connector

A18294

(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

cardiagn.com

NG → CONNECT SECURELY

OK

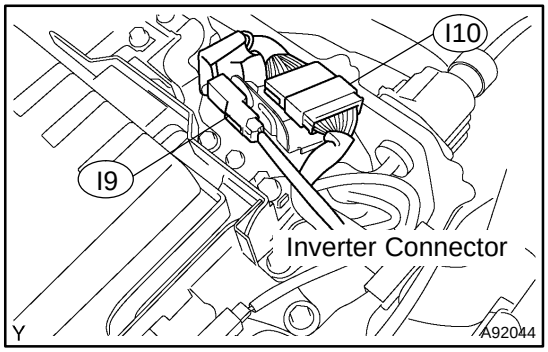
3	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → CONNECT SECURELY

OK

4	CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A94 to display its freeze frame data.
(f) Select the item that has INF code 547, 548, or 549 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.
Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

cardiagn.com

B	**REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**
C	**REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**
D	**REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)**

A

5 READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result: DTCs listed in the table below are output

DTC No.	INF Code	Detection Item	See Page
P0A78	266	Drive Motor "A" Inverter Performance	05–562
P0A94	558 or 560	DC/DC Converter Malfunction	05–730
P0A94	588	DC/DC Converter Malfunction	05–751
P0A94	589	DC/DC Converter Malfunction	05–754
P0AA2	227	Hybrid Battery Positive Contactor Circuit Stuck Open	05–763
P0AA5	229	Hybrid Battery Negative Contactor Circuit Stuck Open	05–767
P3000	125	Battery Control System Malfunction	05–777
P3004	131	HIgh Voltage Power Resource Malfunction	05–781

YES	**GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

cardiagn.com

6 INSPECT HYBRID VEHICLE MOTOR ASSY

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.

(b) Remove the service plug grip (see page 21–116).

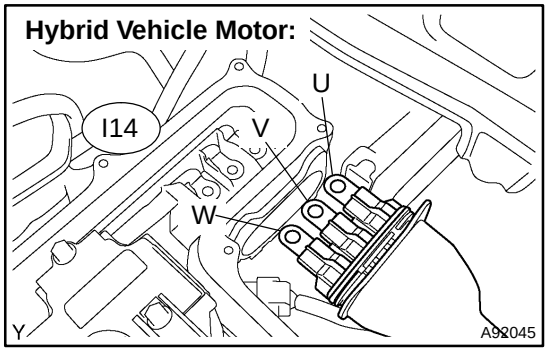
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).

(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.

(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.

Hybrid Vehicle Motor:



NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.

Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

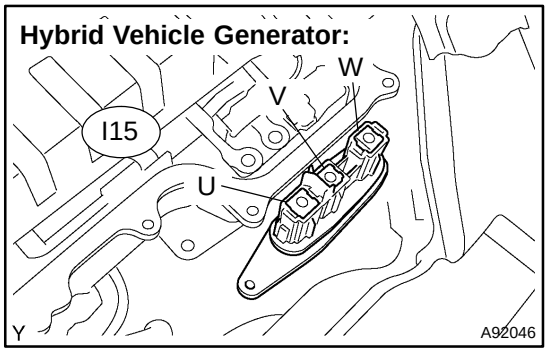
(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

cardiagn.com

7	INSPECT HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.

(b) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.

(c) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.

NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(d) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

(e) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.

Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(f) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

cardiagn.com

8	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

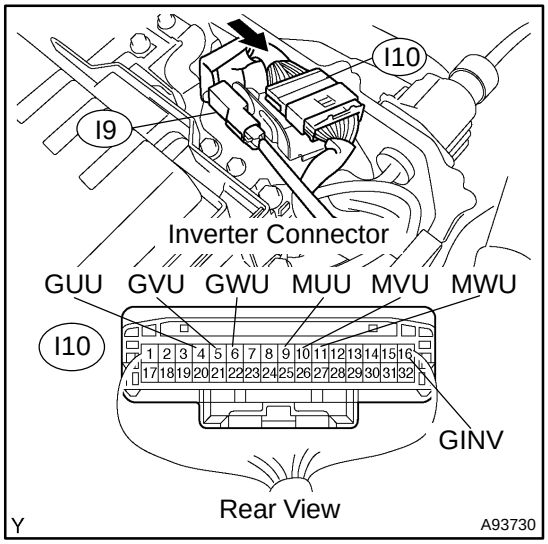
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	12 to 16 V
MVU (I10–10) – GINV (I10–16)	12 to 16 V
MWU (I10–11) – GINV (I10–16)	12 to 16 V
GUU (I10–4) – GINV (I10–16)	12 to 16 V
GVU (I10–5) – GINV (I10–16)	12 to 16 V
GWU (I10–6) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.



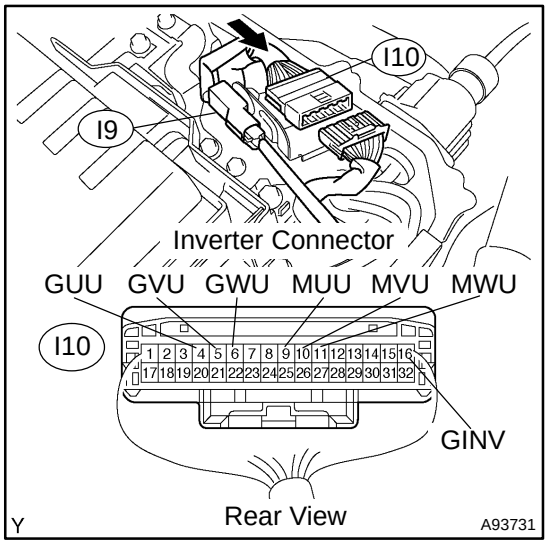
NG → **Go to step 9**

OK

REPLACE HYBRID VEHICLE CONTROL ECU AND W/CONVERTER INVERTER ASSY (See page 21–124 and 21–23)

cardiagn.com

9	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	14 to 16 V
MVU (I10–10) – GINV (I10–16)	14 to 16 V
MWU (I10–11) – GINV (I10–16)	14 to 16 V
GUU (I10–4) – GINV (I10–16)	14 to 16 V
GVU (I10–5) – GINV (I10–16)	14 to 16 V
GWU (I10–6) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A94/550 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of boost converter on page 05–691.

If the boost converter detects a circuit malfunction or over–voltage, the boost converter transmits that information to the OVL terminal of the HV control ECU via the boost converter over–voltage signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	550	Boost converter over–voltage (OVL) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

If the boost converter detects a circuit malfunction, it transmits a boost converter over–voltage signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 550): Boost converter/OVL detection circuit malfunction
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Boost converter	Circuit malfunction

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 550) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 282) on page 05–586.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC listed in the table below is output

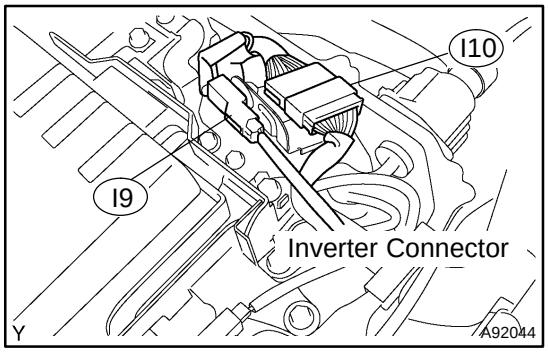
DTC No.	INF Code	Detection Item	See Page
P0A94	545 or 546	DC/DC Converter Malfunction	05–693

YES → **GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

2	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → **CONNECT SECURELY**

OK

cardiagn.com

3	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs P0A78 (INF 282, 286) and P0A7A (INF 324) (inverter circuit malfunction) are output

NO → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

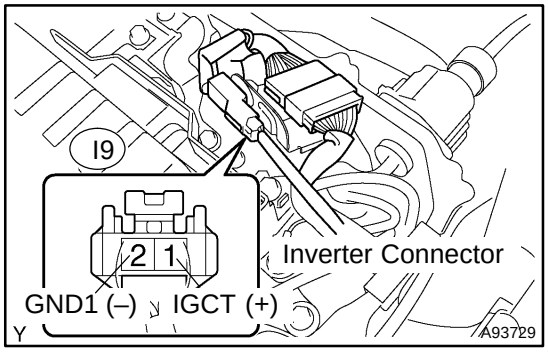
YES

4	INSPECT W/CONVERTER INVERTER ASSY(IGCT VOLTAGE)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Turn the power switch ON (IG).
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.
(e) Measure the voltage between the terminals of the inverter connector.
Standard:

Tester Connection	Specified Condition
IGCT (I9–1) – GND1 (I9–2)	8 V or more

(f) Turn the power switch OFF.
(g) Reinstall the inverter cover (see page 21–23).
(h) Reinstall the service plug grip (see page 21–116).



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A94/551	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/552	DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.

If the boost converter has a circuit malfunction, or internal short, or overheats, the boost converter transmits this information to the FCV terminal of the HV control ECU via the boost converter fail signal line.

The HV control ECU monitors the boost converter fail signal line and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	551	Open or GND short in boost converter fail (FCV) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A94	552	+B short in boost converter fail (FCV) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter fail (FCV) signal line. If the HV control ECU detects an open or short malfunction of the FCV signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 551/552): Boost converter/Converter Finv detection
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

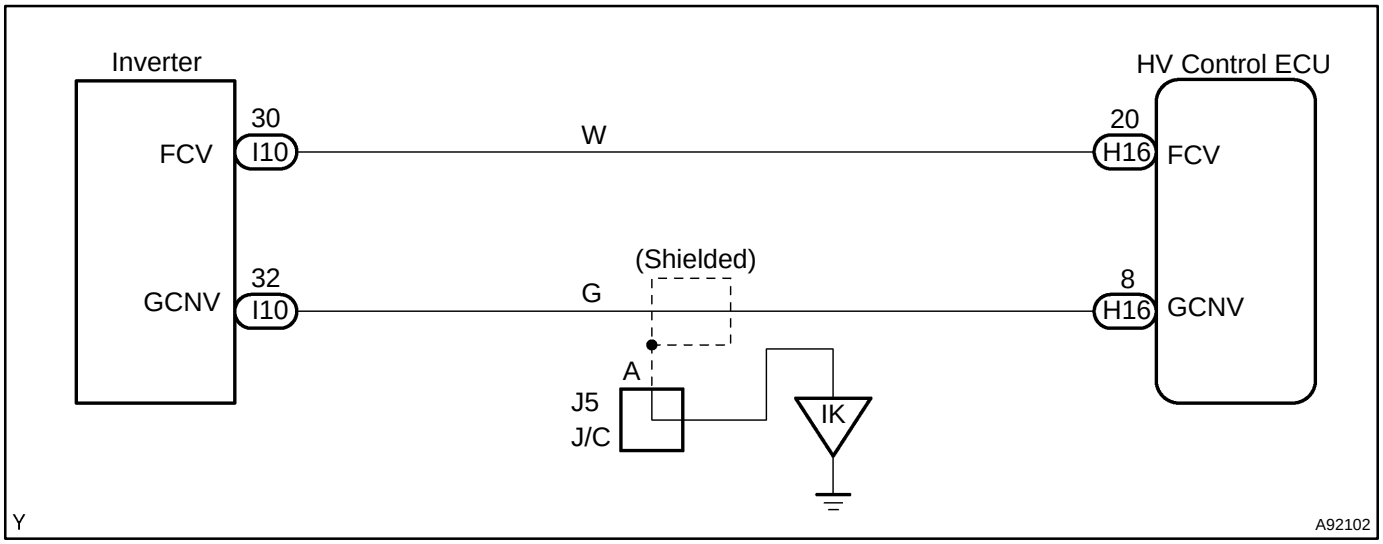
Boost converter fail signal circuit	Open or short

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 551/552) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

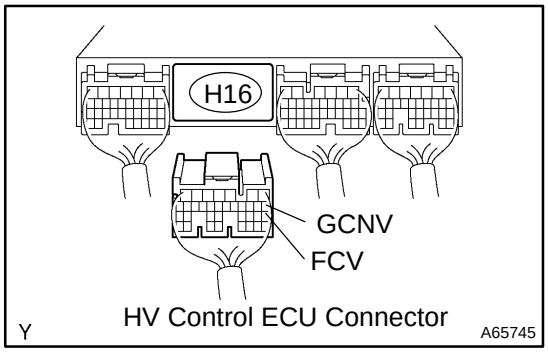
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

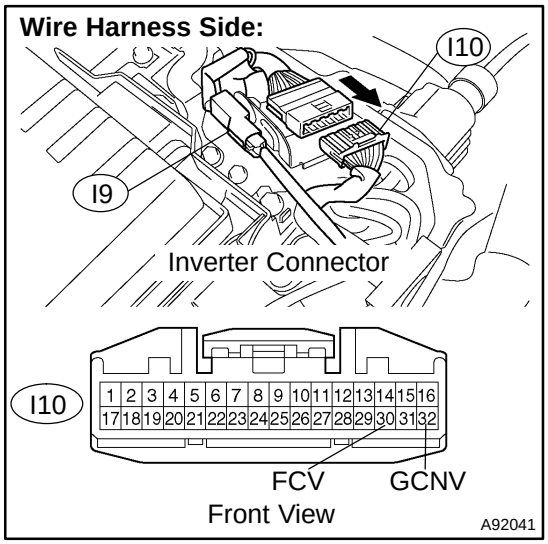
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H16 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
FCV (H16–20) – Body ground	Below 1 V
GCNV (H16–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
FCV (H16–20) – FCV (I10–30)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
FCV (H16–20) or FCV (I10–30) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC P0A94/553 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.

If the boost converter has a circuit malfunction, internal short, or overheats, the boost converter transmits that information to the FCV terminal of the HV control ECU via the boost converter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	553	Boost converter fail (FCV) signal detection (boost converter overheating)	• Wire harness or connector • Inverter cooling system • water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If the boost converter is overheated, it transmits a boost converter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 553): Boost converter/FCV detection over heat
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Boost converter	Overheated

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 553) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 279) on page 05–577.

cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs listed in the table below are output

DTC No.	Relevant Diagnosis
P0A1D	Hybrid Powertrain Control Module
P0A2B, P0A2C or P0A2D	Drive Motor ”A” Temperature Sensor Circuit System
P0A37, P0A38 or P0A39	Generator Temperature Sensor Circuit System
P0A3F, P0A40 or P0A41	Drive Motor ”A” Position Sensor Circuit System
P0A4B, P0A4C or P0A4D	Generator Position Sensor Circuit System
P0A60 or P0A63	Drive Motor ”A” Current Sensor Circuit System
P0A72 or P0A75	Generator Current Sensor Circuit System
P0A78	Drive Motor ”A” Inverter Performance
P0A7A	Generator Inverter Performance
P0A90	Drive Motor ”A” Performance
P0A92	Hybrid Generator Performance
P0A93	Inverter Cooling System Malfunction
P0A94	DC/DC Converter Malfunction
P0AA1, P0AA2, P0AA4 or P0AA5	System Main Relay Circuit System
P3000, P3004, P3009 or P3110	High Voltage System
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit System
P3221	Generator Inverter Temperature Sensor Circuit System
P3226	DC/DC Converter Temperature Sensor Circuit System

YES → **GO TO DTC CHART (See page 05–440). FIND A PAGE NUMBER TO PROCEED TO ITS DIAGNOSTIC TROUBLESHOOTING FLOWCHART**

NO

cardiagn.com

2	CHECK QUANTITY OF HV COOLANT

(a) Check that there is a sufficient amount of coolant for the inverter.
OK: There is a sufficient amount of coolant for the inverter

NG → **ADD HV COOLANT (See page 22–4)**

OK

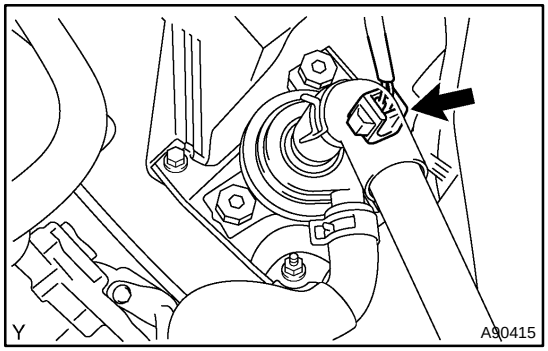
3	CHECK COOLANT HOSE

(a) Check that the hoses of the cooling system are not bent or clogged (see the cooling system on page 05–687).
OK: The hoses of the cooling system are not bent or clogged

NG → **CORRECT TO NORMAL CONDITION**

OK

4	CHECK CONNECTION CONDITION OF WATER PUMP CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the water pump connector.
OK: Connector has been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

5	CHECK WATER W/MOTOR & BRACKET PUMP ASSY

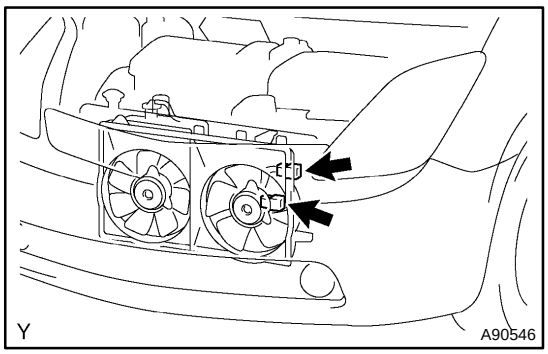
(a) Turn the power switch ON (IG).
(b) Check the operation of the water pump.
OK: Coolant is sloshing in the reservoir tank

NG → **REPLACE WATER W/MOTOR & BRACKET PUMP ASSY**

OK

cardiagn.com

6	CHECK CONNECTION CONDITION OF COOLING FAN MOTOR CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the cooling fan motor connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

7	INSPECT COOLING FAN MOTOR (See page 16–8)

NG → **REPLACE COOLING FAN MOTOR AND ADD ENGINE COOLANT**

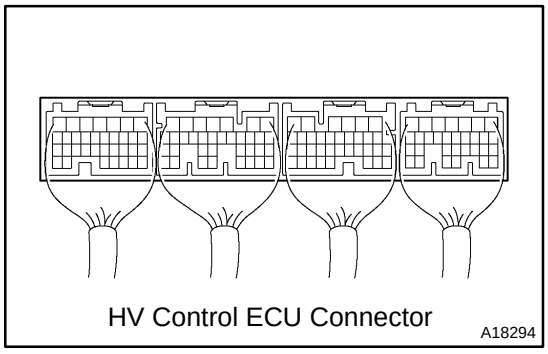
OK

8	INSPECT COOLING FAN MOTOR NO.2 (See page 16–8)

NG → **REPLACE COOLING FAN MOTOR NO. 2 AND ADD ENGINE COOLANT**

OK

9	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

cardiagn.com

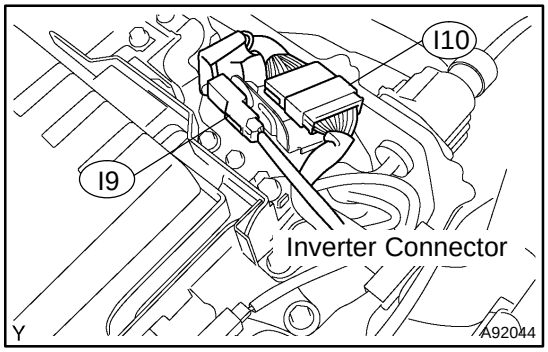
10	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → CONNECT SECURELY

OK

11	CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A94 to display its freeze frame data.
(f) Select the item that has INF code 553 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.
Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

cardiagn.com

B	REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)
C	REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)
D	REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)

A

12	INSPECT HYBRID VEHICLE MOTOR ASSY

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.

(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

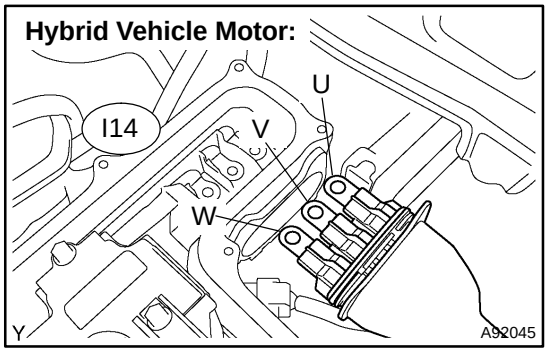
(c) Remove the inverter cover (see page 21–23).

(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.

(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.

NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:



Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

cardiagn.com

(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.
Standard:

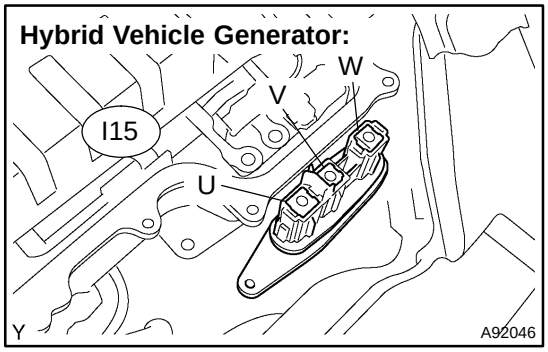
Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

13 INSPECT HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.
(c) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.

NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.
Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
$R20 = Rt \div (1 + 0.00393 \times (T - 20))$
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

(d) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ

cardiagn.com

(e) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.
Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(f) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

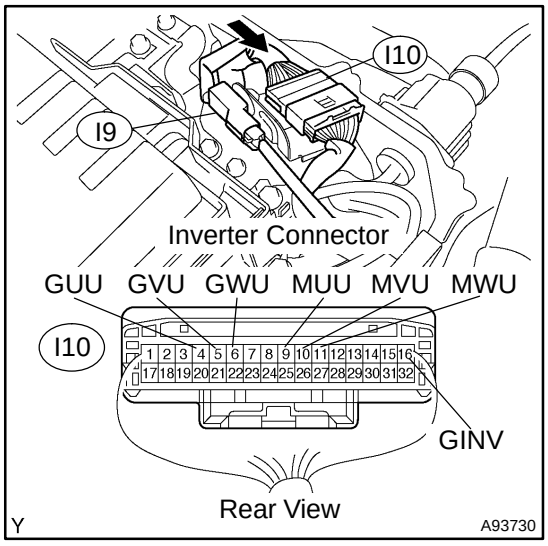
14 PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.
Standard:



Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	12 to 16 V
MVU (I10–10) – GINV (I10–16)	12 to 16 V
MWU (I10–11) – GINV (I10–16)	12 to 16 V
GUU (I10–4) – GINV (I10–16)	12 to 16 V
GVU (I10–5) – GINV (I10–16)	12 to 16 V
GWU (I10–6) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.

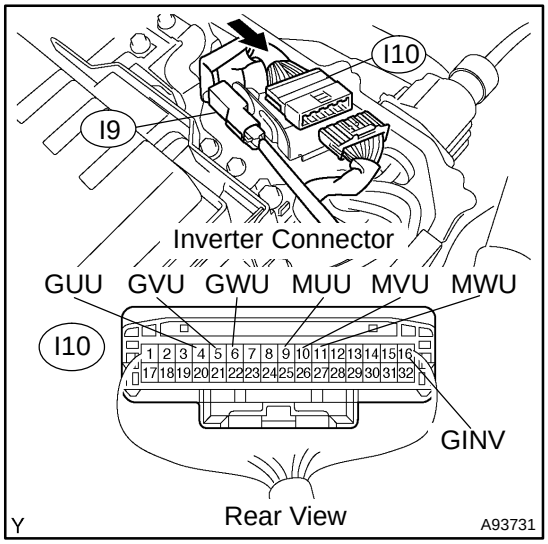
cardiagn.com

NG → Go to step 15

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

15	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	14 to 16 V
MVU (I10–10) – GINV (I10–16)	14 to 16 V
MWU (I10–11) – GINV (I10–16)	14 to 16 V
GUU (I10–4) – GINV (I10–16)	14 to 16 V
GVU (I10–5) – GINV (I10–16)	14 to 16 V
GWU (I10–6) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0A94/554	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/555	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/556	DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.

If the boost converter has a circuit malfunction, internal short, or overheats,the boost converter transmits that information to the FCV terminal of the HV control ECU via the boost converter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	554	Boost converter fail (FCV) signal detection (over current by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A94	555	Boost converter fail (FCV) signal detection (over current by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly
P0A94	556	Boost converter fail (FCV) signal detection (over current by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly

MONITOR DESCRIPTION

If over–amperage flows through the boost converter due to an internal short, the boost converter transmits a boost converter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 554/555/556): Boost converter/FCV detection over current
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Boost converter	Over current (internal short)

cardiagn.com

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 554/555/556) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 279) on page 05–577.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs listed in the table below are output

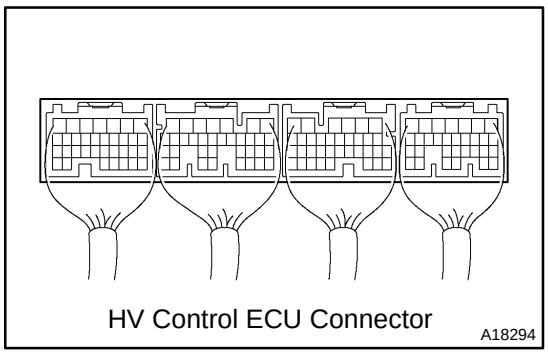
DTC No.	Relevant Diagnosis
P0A1D	Hybrid Powertrain Control Module
P0A2B, P0A2C or P0A2D	Drive Motor ”A” Temperature Sensor Circuit System
P0A37, P0A38 or P0A39	Generator Temperature Sensor Circuit System
P0A3F, P0A40 or P0A41	Drive Motor ”A” Position Sensor Circuit System
P0A4B, P0A4C or P0A4D	Generator Position Sensor Circuit System
P0A60 or P0A63	Drive Motor ”A” Current Sensor Circuit System
P0A72 or P0A75	Generator Current Sensor Circuit System
P0A78	Drive Motor ”A” Inverter Performance
P0A7A	Generator Inverter Performance
P0A90	Drive Motor ”A” Performance
P0A92	Hybrid Generator Performance
P0A93	Inverter Cooling System Malfunction
P0A94	DC/DC Converter Malfunction
P0AA1, P0AA2, P0AA4 or P0AA5	System Main Relay Circuit System
P3000, P3004, P3009 or P3110	High Voltage System
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit System
P3221	Generator Inverter Temperature Sensor Circuit System
P3226	DC/DC Converter Temperature Sensor Circuit System

YES → **GO TO DTC CHART (See page 05–440). FIND A PAGE NUMBER TO PROCEED TO ITS DIAGNOSTIC TROUBLESHOOTING FLOWCHART**

NO

cardiagn.com

2	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)



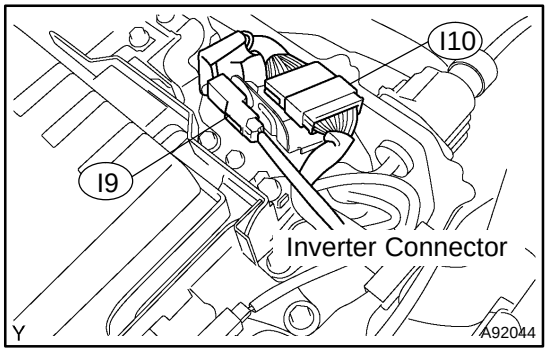
(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

3	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.



NG → **CONNECT SECURELY**

OK

cardiagn.com

4	CONFIRM INFORMATION(EXCLUSIVE INFO 4)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select DTC P0A94 to display its freeze frame data.
(f) Select the item that has INF code 554, 555, or 556 from among INFORMATION 1 to 5, and press ENTER.
(g) Read EXCLUSIVE INFO 4.

Result:

Displayed in Exclusive Information 4	Proceed to
–127 to –120, –95 to –88, –63 to –56, –31 to –24, 1 to 8, 33 to 40, 65 to 72, 97 to 104	A
–119 to –112, –87 to –80, –55 to –48, –23 to –16, 9 to 16, 41 to 48, 73 to 80, 105 to 112	B
–111 to –104, –79 to –72, –47 to –40, –15 to –8, 17 to 24, 49 to 56, 81 to 88, 113 to 120	C
–103 to –96, –71 to –64, –39 to –32, –7 to 0, 25 to 32, 57 to 64, 89 to 96, 121 to 127	D

B → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

C → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

D → **REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)**

A

cardiagn.com

5	INSPECT HYBRID VEHICLE MOTOR ASSY

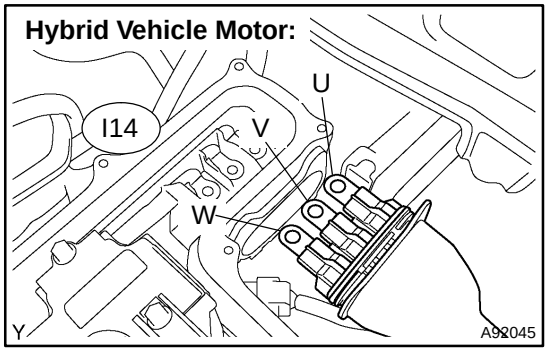
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cable for the hybrid vehicle motor from the inverter.
(e) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor.

Hybrid Vehicle Motor:



NOTICE:
If the motor temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I14–1) – V (I14–2)	Below 135 mΩ at 20°C
V (I14–2) – W (I14–3)	Below 135 mΩ at 20°C
W (I14–3) – U (I14–1)	Below 135 mΩ at 20°C

*: Apply the formula given below to correct the resistance.
R20 = Rt ÷ (1 + 0.00393 × (T – 20))
R20: Resistance converted to 20 °C (mΩ)
Rt: Resistance between measured lines (mΩ)
T: Ambient air temperature during measurement (°C)

(f) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.
Standard: Below 2 mΩ
(g) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle motor and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher

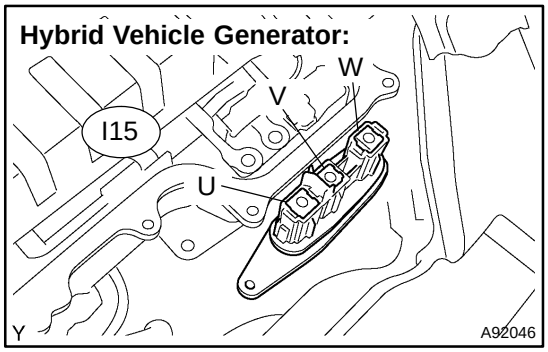
(h) Reconnect the three–phase alternating current cable for the hybrid vehicle motor.

NG → **REPLACE HYBRID VEHICLE MOTOR ASSY**

OK

cardiagn.com

6	INSPECT HYBRID VEHICLE GENERATOR ASSY



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.

(b) Disconnect the three–phase alternating current cable for the hybrid vehicle generator from the inverter.

(c) Using a milliohm meter, measure the resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator.

NOTICE:
If the generator temperature is too high, the resistance varies considerably, which hinders determining malfunction. Therefore, measure the resistance at a minimum 8 hours after the vehicle has been stopped.

Standard:

Tester Connection	Specified Condition*
U (I15–1) – V (I15–2)	Below 109 mΩ at 20°C
V (I15–2) – W (I15–3)	Below 109 mΩ at 20°C
W (I15–3) – U (I15–1)	Below 109 mΩ at 20°C

*: Apply the formula given below to correct the resistance.

$R20 = Rt \div (1 + 0.00393 \times (T - 20))$

R20: Resistance converted to 20 °C (mΩ)

Rt: Resistance between measured lines (mΩ)

T: Ambient air temperature during measurement (°C)

(d) Calculate the difference between the maximum and minimum resistance between terminals U – V, V – W, and W – U.

Standard: Below 2 mΩ

(e) Using a megohmmeter, check the insulation resistance between the three–phase alternating current cable terminals of the hybrid vehicle generator and the body ground.

Standard:

Tester Connection	Specified Condition
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher

(f) Reconnect the three–phase alternating current cable for the hybrid vehicle generator.

NG → **REPLACE HYBRID VEHICLE GENERATOR ASSY**

OK

cardiagn.com

7	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the power switch ON (IG).

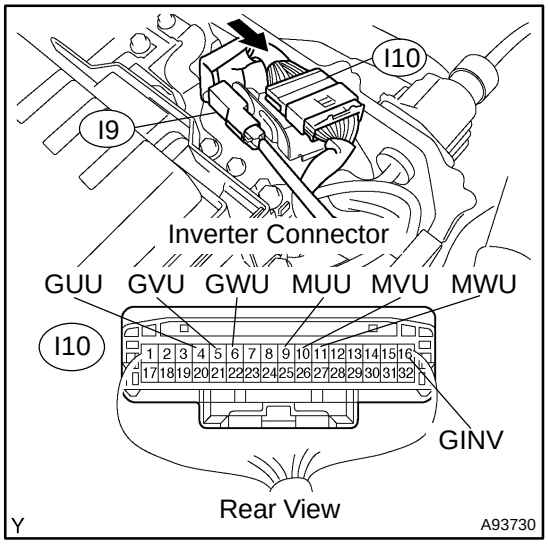
HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(d) Turn the hand–held tester ON.
(e) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(f) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	12 to 16 V
MVU (I10–10) – GINV (I10–16)	12 to 16 V
MWU (I10–11) – GINV (I10–16)	12 to 16 V
GUU (I10–4) – GINV (I10–16)	12 to 16 V
GVU (I10–5) – GINV (I10–16)	12 to 16 V
GWU (I10–6) – GINV (I10–16)	12 to 16 V

(g) Turn the power switch OFF.



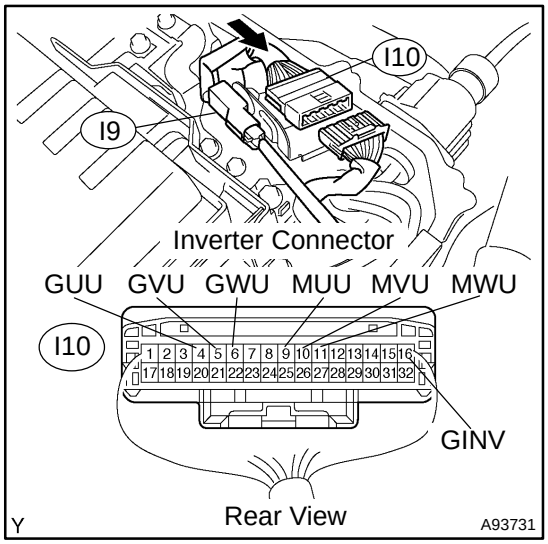
NG → **Go to step 8**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

8	PERFORM ACTIVE TEST BY HAND–HELD TESTER(INVERTER STOP)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I10 inverter connector.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Turn the hand–held tester ON.
(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(g) Measure the voltage between the terminals of the inverter connector while effecting INVERTER STOP.

Standard:

Tester Connection	Specified Condition
MUU (I10–9) – GINV (I10–16)	14 to 16 V
MVU (I10–10) – GINV (I10–16)	14 to 16 V
MWU (I10–11) – GINV (I10–16)	14 to 16 V
GUU (I10–4) – GINV (I10–16)	14 to 16 V
GVU (I10–5) – GINV (I10–16)	14 to 16 V
GWU (I10–6) – GINV (I10–16)	14 to 16 V

(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A94/557 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of booster converter on page 05–691.

If the boost converter has a circuit malfunction, internal short, or overheats, the boost converter transmits that information to the FCV terminal of the HV control ECU via the boost converter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	557	Boost converter fail (FCV) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

If the boost converter detects a circuit malfunction, it transmits a boost converter fail signal to the HV control ECU. Upon receiving this signal, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 557): Boost converter/FCV detection circuit malfunction
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Boost converter	Circuit malfunction

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 557) is not detected

WIRING DIAGRAM

Refer to DTC P0A78 (INF 282) on page 05–586.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC listed in the table below is output

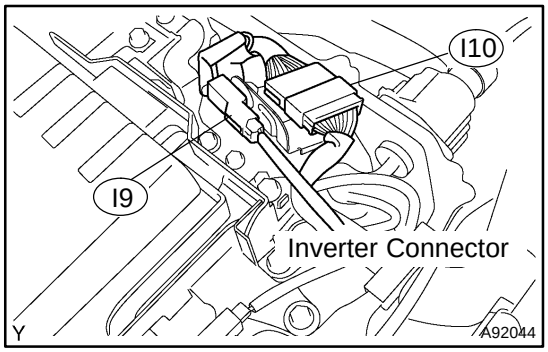
DTC No.	INF Code	Detection Item	See Page
P0A94	551 or 552	DC/DC Converter Malfunction	05–707

YES → **GO TO THE PAGE NUMBER SHOWN IN THE TABLE ABOVE**

NO

2	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.
(e) Reinstall the inverter cover (see page 21–23).
(f) Reinstall the service plug grip (see page 21–116).



NG → **CONNECT SECURELY**

OK

cardiagn.com

3	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result: DTCs P0A78 (INF 282, 286) and P0A7A (INF 324) (inverter circuit malfunction) are output

NO → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

YES

4	INSPECT W/CONVERTER INVERTER ASSY(IGCT VOLTAGE)

CAUTION:

Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:

Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Turn the power switch ON (IG).

HINT:

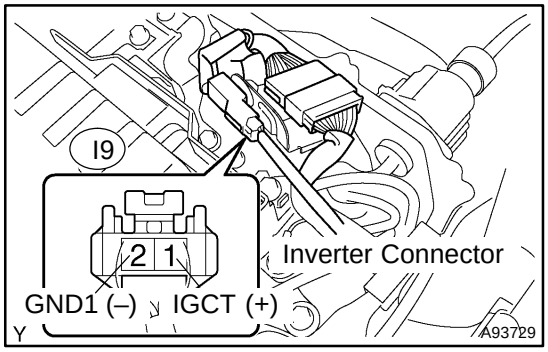
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Measure the voltage between the terminals of the inverter connector.

Standard:

Tester Connection	Specified Condition
IGCT (I9–1) – GND1 (I9–2)	8 V or more

(f) Turn the power switch OFF.
(g) Reinstall the inverter cover (see page 21–23).
(h) Reinstall the service plug grip (see page 21–116).



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P0A94/558	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/559	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/560	DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.

Upon receiving a boost converter gate shutdown signal from the HV control ECU, the boost converter forcefully stops the operation of the boost converter by turning OFF the power transistors that are actuating the boost converter.

The HV control ECU monitors the boost converter gate shutdown signal line and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	558	GND short in boost converter gate shutdown (CSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A94	559	Open or +B short in boost converter gate shutdown (CSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly
P0A94	560	Open in boost converter gate shutdown (CSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter gate shutdown (CSDN) signal line. If the HV control ECU detects an open or short malfunction of the CSDN signal circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 558/559/560): Boost converter/Converter gate shutdown signal malfunction
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

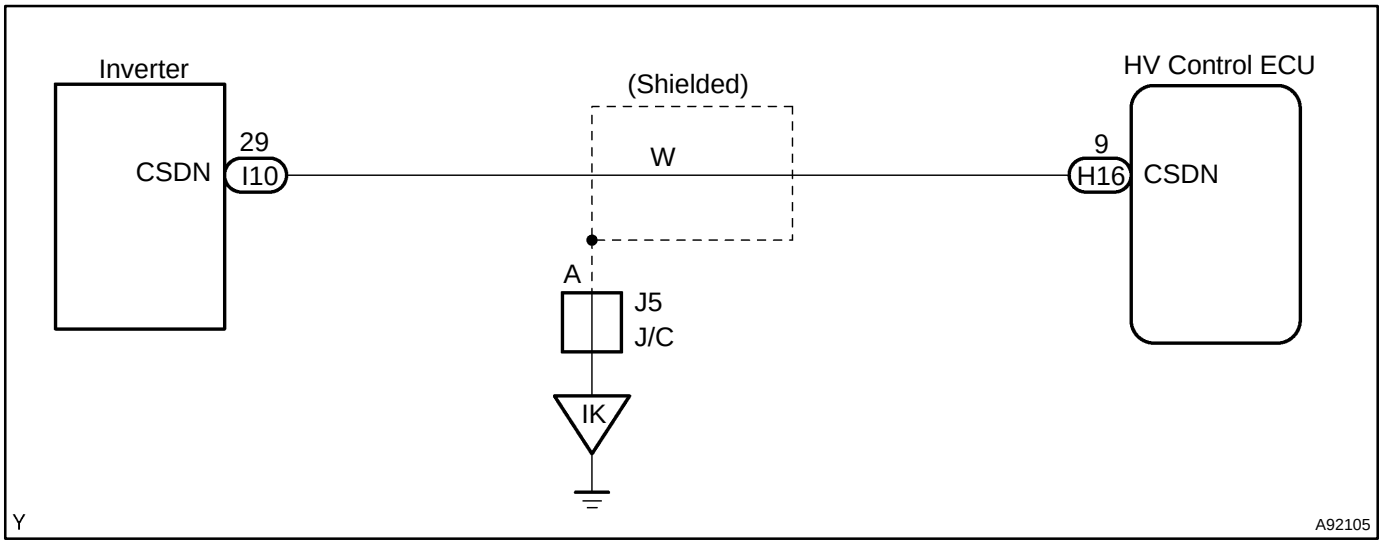
Boost converter gate shutdown signal circuit	Open or short

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 558/559/560) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	**CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)**

CAUTION:

Wear insulated gloves before performing the following operation.

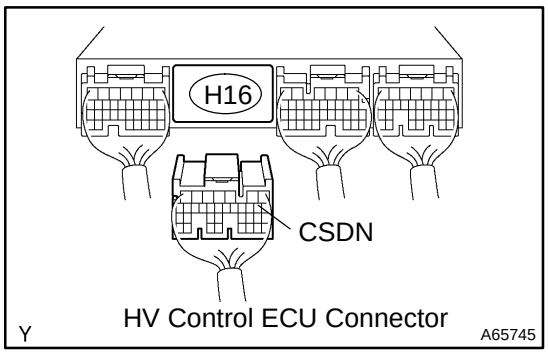
(a) Turn the power switch OFF.

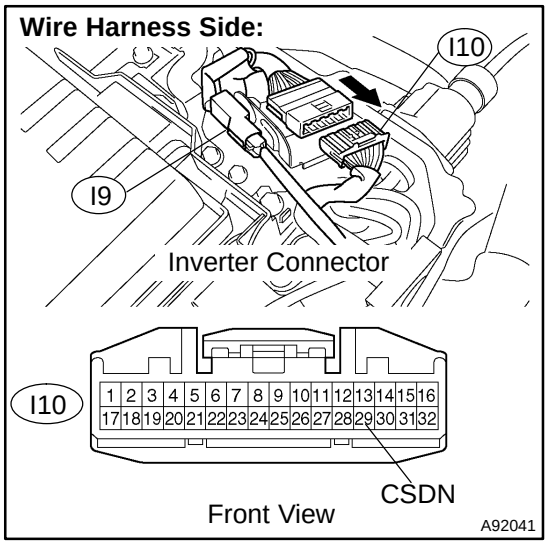
(b) Remove the service plug grip (see page 21–116).

NOTICE:

Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H16 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
CSDN (H16–9) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CSDN (H16–9) – CSDN (I10–29)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CSDN (H16–9) or CSDN (I10–29) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC P0A94/561 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.

Upon receiving a boost converter gate shutdown signal from the HV control ECU, the boost converter forcefully stops the operation of the boost converter by turning OFF the power transistors that are actuating the boost converter.

The HV control ECU monitors the boost converter gate shutdown signal and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	561	Abnormal boost converter gate shutdown (CSDN) signal	• Wire harness or connector • HV control ECU

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter gate shutdown (CSDN) signal. If the HV control ECU detects an abnormality in the CSDN signal, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 561): Boost converter/Converter shutdown signal line malfunction
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Actual status of shutdown command signal and its monitoring result	Inconsistent

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 561) is not detected

WIRING DIAGRAM

Refer to DTC P0A94 (INF 558) on page 05–730.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A94 (INF 561) and other DTCs are output

HINT:
If any other codes besides P0A94 (INF 561) are output, perform troubleshooting for those DTCs first.

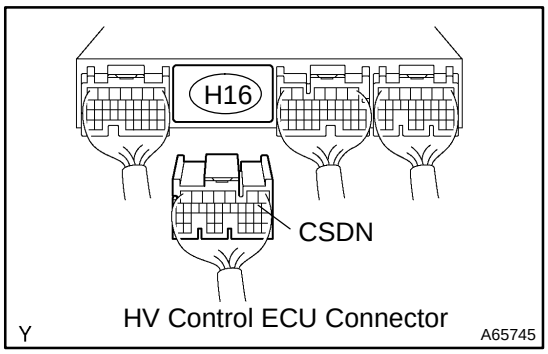
YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

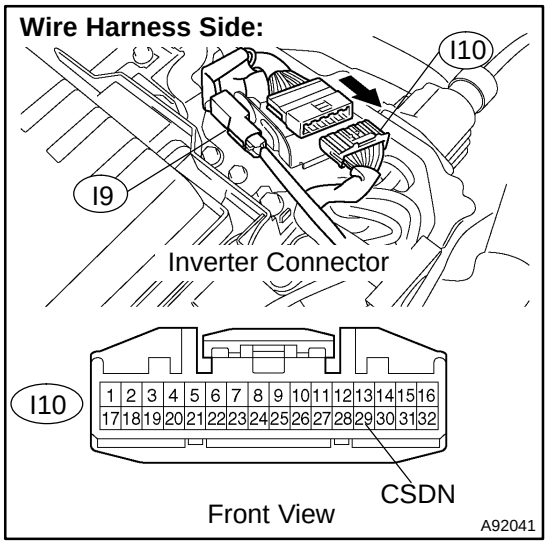
NO

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H16 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
CSDN (H16–9) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CSDN (H16–9) – CSDN (I10–29)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CSDN (H16–9) or CSDN (I10–29) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

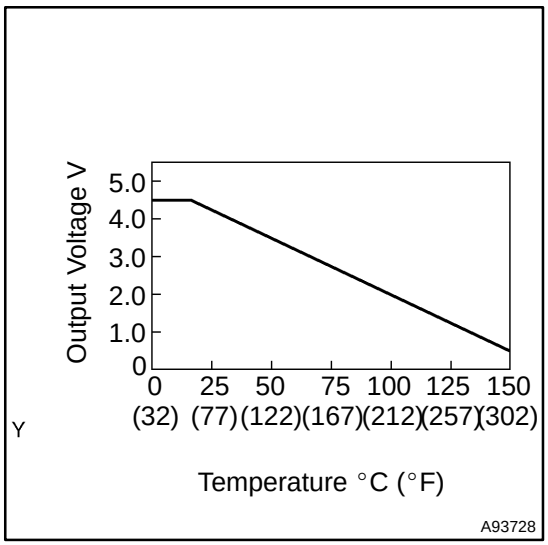
cardiagn.com

DTC	P0A94/583	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/584	DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.



The HV control ECU uses a temperature sensor, which is built into the boost converter, to detect the temperature of the boost converter.

The boost converter temperature sensor outputs a voltage, which varies between 0 and 5 V in accordance with the changes in the temperature. The higher the boost converter temperature, the lower the output voltage. Conversely, the lower the temperature, the higher the output voltage.

The HV control ECU limits the load based on the signals transmitted by the boost converter temperature sensor, in order to prevent the boost converter from overheating. Furthermore, the HV control ECU detects malfunction in the wiring of the boost converter temperature sensor, as well as in the sensor itself.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	583	Open or GND short in boost converter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU
P0A94	584	+B short in boost converter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU

HINT:

After confirming DTC P0A94 (INF 583 or 584), confirm CONVERTER TEMP in DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST using the hand–held tester.

Temperature Displayed	Malfunction
–50°C (–58°F)	+B short circuit
205°C (401°F)	Open or GND short circuit

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter temperature sensor circuit. If the HV control ECU detects an open or short malfunction of the sensor circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 583/584): Boost converter/Converter temperature sensor malfunction
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

cardiagn.com

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

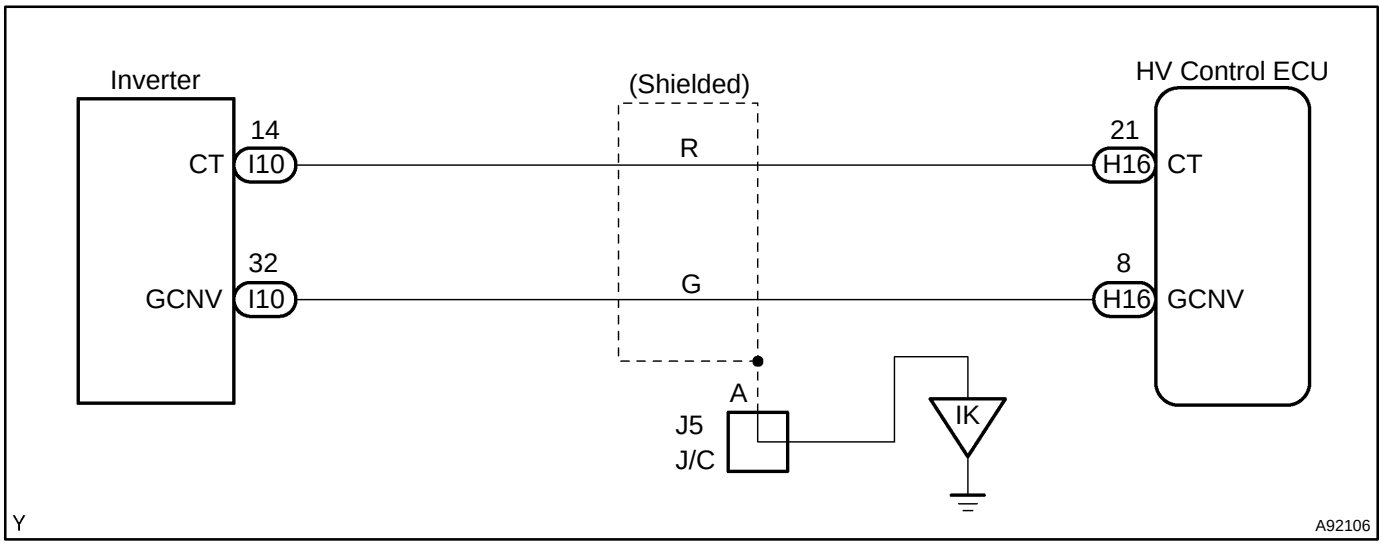
TYPICAL MALFUNCTION THRESHOLDS

Boost converter temperature sensor circuit	Open or short

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 583/584) is not detected

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ VALUE OF HAND–HELD TESTER(CONVERTER TEMP)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the CONVERTER TEMP value on the hand–held tester.
Result:

Temperature Displayed	Proceed to
–50°C (–58°F)	A
205°C (401°F)	B
–49°C to 204°C (–57°F to 400°F)	C

HINT:
- If there is a +B short circuit, the hand–held tester indicates –50°C (–58°F).
- If there is an open or GND short circuit, the hand–held tester indicates 205°C (401°F).

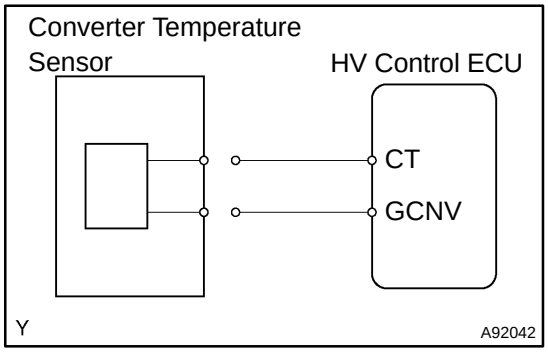
B → **Go to step 4**

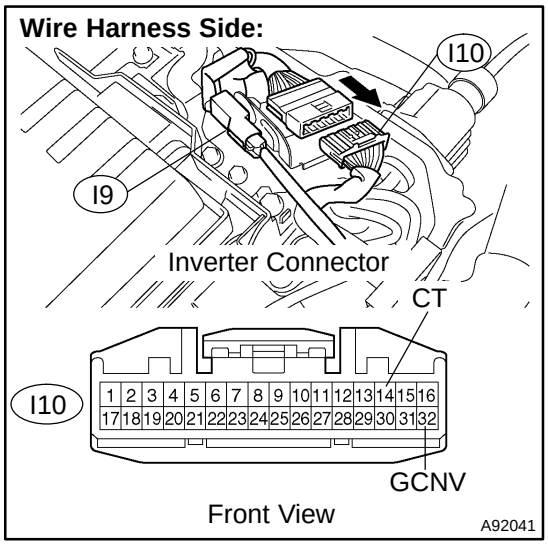
C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)**

A

cardiagn.com

2	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN WIRE HARNESS)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the I10 inverter connector.
(e) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(g) Read the CONVERTER TEMP value on the hand–held tester.
Standard: 205°C (401°F)
(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

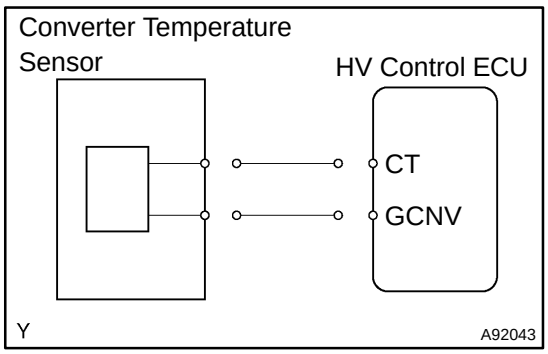
NG → **Go to step 3**

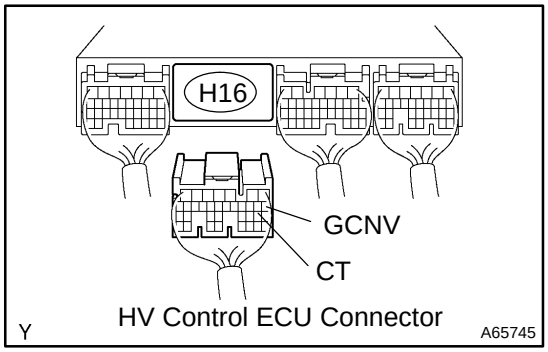
OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

3	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN HYBRID VEHICLE CONTROL ECU)





(a) Disconnect the H16 HV control ECU connector.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the CONVERTER TEMP value on the hand–held tester.

Standard: 205°C (401°F)

(e) Reconnect the HV control ECU connector.

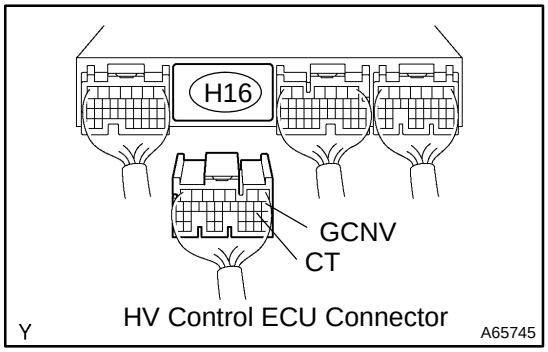
NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

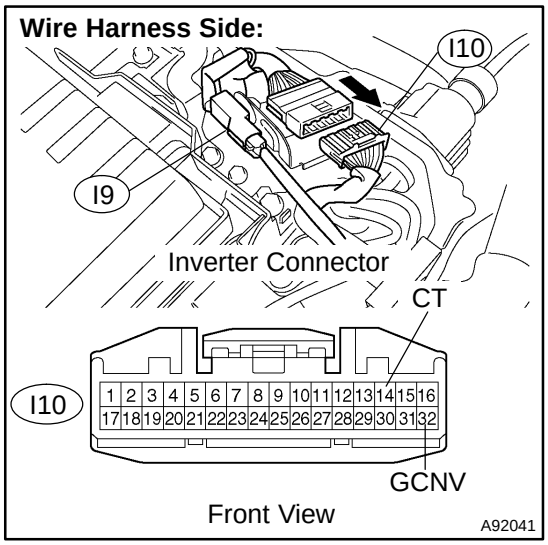
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

cardiagn.com

4	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





OK

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H16 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CT (H16–21) – CT (I10–14)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

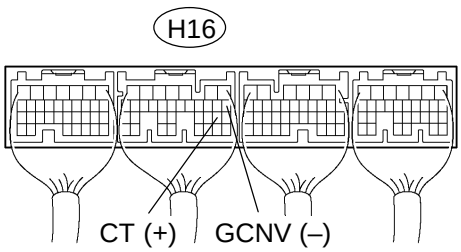
Tester Connection	Specified Condition
CT (H16–21) or CT (I10–14) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(g) Reconnect the inverter connector.
(h) Reconnect the HV control ECU connector.
(i) Reinstall the inverter cover (see page 21–23).
(j) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

cardiagn.com

5	INSPECT HYBRID VEHICLE CONTROL ECU(CT VOLTAGE)



HV Control ECU Connector
A93719

(a) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(b) Measure the voltage between the terminals of the H16 HV control ECU connector.

Standard:

Tester Connection	Specified Condition
CT (H16–21) – GCNV (H16–8)	2.0 to 4.5 V

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC P0A94/585 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P0A94 (INF 589) on page 05–754.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	585	Boost converter voltage (VL) sensor performance problem	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter voltage sensor signal. If the HV control ECU detects an abnormality in the sensor signal, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 585): Boost converter/Voltage (VL) sensor deviation
Required sensor/components	Boost converter, inverter, battery ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Boost converter voltage sensor	Abnormal

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 585) is not detected

WIRING DIAGRAM

Refer to DTC P0A94 (INF 589) on page 05–754.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A94 (INF 585) and other DTCs are output

HINT:
If any other codes besides P0A94 (INF 585) are output, perform troubleshooting for those DTCs first.

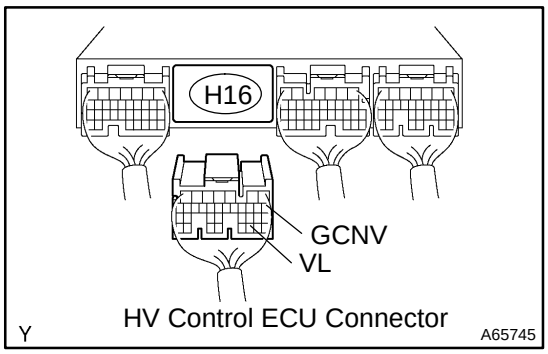
YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

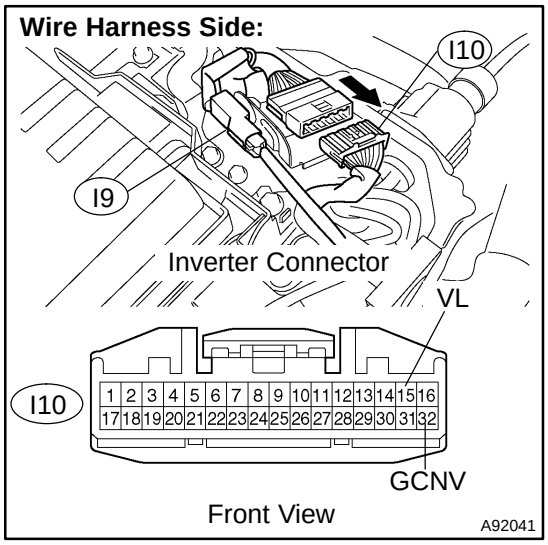
NO

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H16 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VL (H16–30) – Body ground	Below 1 V
GCNV (H16–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VL (H16–30) – VL (I10–15)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VL (H16–30) or VL (I10–15) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC P0A94/587 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–746.

The HV control ECU uses two voltage sensors, VL and VB, to detect voltage levels. The VL sensor that has been built into the boost converter is used to detect the high voltage before it is boosted. The VB sensor that has been built into the battery ECU is used to detect voltage of the HV battery.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	587	Difference between voltages from HV battery voltage (VB) sensor and boost converter voltage (VL) sensor is large	• Wire harness or connector • w/ converter inverter assembly • Service plug grip • High voltage fuse • Battery ECU

MONITOR DESCRIPTION

The HV control ECU monitors signals of HV battery voltage (VB) and boost converter voltage (VL) sensors. When a large difference occurs between the voltages from the VB and VL sensors, the HV control ECU interprets this as a failure of either of the sensors. The HV control ECU then illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 587): Boost converter/Voltage (VB or VL) sensor deviation
Required sensor/components	Boost converter, battery ECU
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

Difference between the voltages of HV battery and boost converter voltage sensors	Exceeds the standard level

COMPONENT OPERATING RANGE

Boost converter Battery ECU	DTC P0A94 (INF 587) is not detected

WIRING DIAGRAM

Refer to DTC P0A94 (INF 589) on page 05–754.

cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result:

Display (DTC Output)	Proceed to
Only DTC P0A94 (INF 587)	A
DTCs P0A94 (INF 587), and P0A1F (INF 129) (HV battery voltage circuit malfunction)	B
DTCs P0A94 (INF 587), and P0A94 (INF 442) (Abnormal voltage execution value)	C
DTCs P0A94 (INF 587), and P0A94 (INF 585) (Boost converter voltage (VL) sensor performance problem)	D
DTCs other than above	E

B → **GO TO DTC P0A1F/129 (See page 05–521)**

C → **Go to step 4**

D → **GO TO DTC P0A94/585 (See page 05–743)**

E → **AFTER PERFORMING STEP 4, GO TO RELEVANT DTC CHART (See page 05–440)**

A

2	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

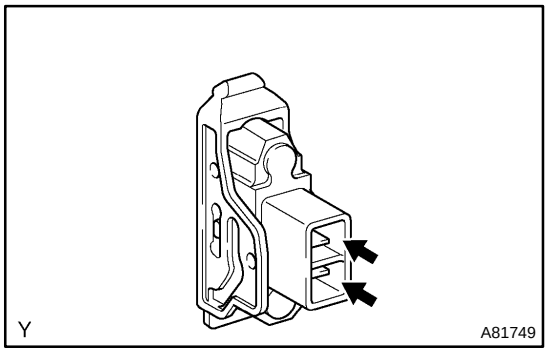
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–893)**

NO

cardiagn.com

3	INSPECT SERVICE PLUG GRIP



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Check the resistance between the terminals of the service plug grip.
Standard: Below 1 Ω
(d) Reinstall the service plug grip (see page 21–116).

NG → **Go to step 6**

OK

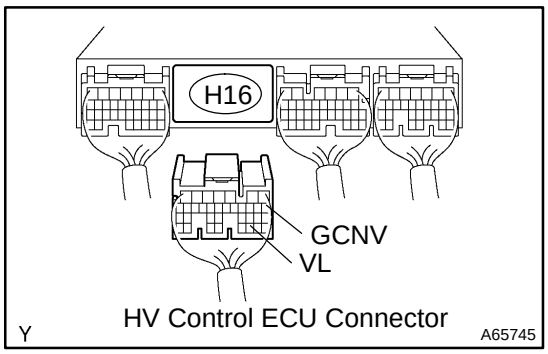
4	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)

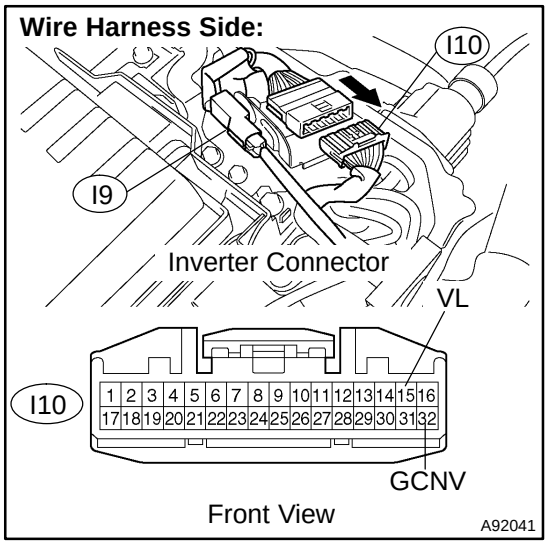
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com





(c) Disconnect the H16 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VL (H16–30) – Body ground	Below 1 V
GCNV (H16–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VL (H16–30) – VL (I10–15)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VL (H16–30) or VL (I10–15) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

5 CHECK OUTPUT DTC

(a) Proceed to A if only DTC P0A94 (INF 587) is output as a result of DTC reading in step 1.
(b) Proceed to B if DTCs P0A94 (INF 587) and P0A94 (INF 442) are output as a result of DTC reading in step 1.

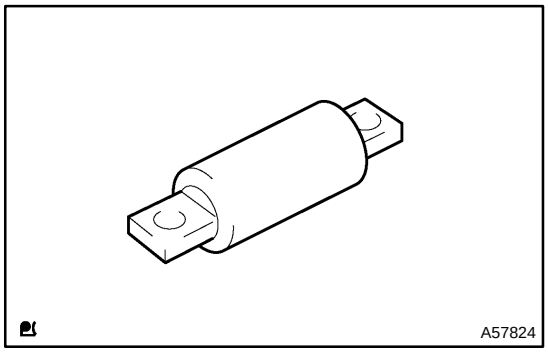
B → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

A

REPLACE W/CONVERTER INVERTER ASSY AND BATTERY ECU ASSY (See page 21–23 and 21–98)

cardiagn.com

6	INSPECT HIGH VOLTAGE FUSE



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Remove the high voltage fuse (see page 21–116).

HINT:

The high voltage fuse is enclosed in the service plug grip.

(b) Check the resistance between the terminals of the high voltage fuse.
Standard: Below 1 Ω

(c) Reinstall the high voltage fuse (see page 21–116).

NG → **REPLACE HIGH VOLTAGE FUSE**

OK

REPLACE SERVICE PLUG GRIP

cardiagn.com

DTC P0A94/588 DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.

The boost converter switches the power transistors ON and OFF in accordance with the power transistor actuation signals received from the HV control ECU, in order to change the current that flows into the reactor. Also, the boost converter regulates the duration of the switching time through PWM (Pulse Width Modulation) control, in order to control the boosting voltage.

The HV control ECU monitors the boost converter PWM circuit and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	588	Abnormality in boost converter PWM circuit	• Wire harness or connector • w/ converter inverter assembly

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter PWM circuit. If there is an error in the power transistor actuation signals which are transmitted to the boost converter, the HV control ECU interprets this as a malfunction of the boost converter PWM circuit.

The HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 588): Boost converter/Converter PWM malfunction
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

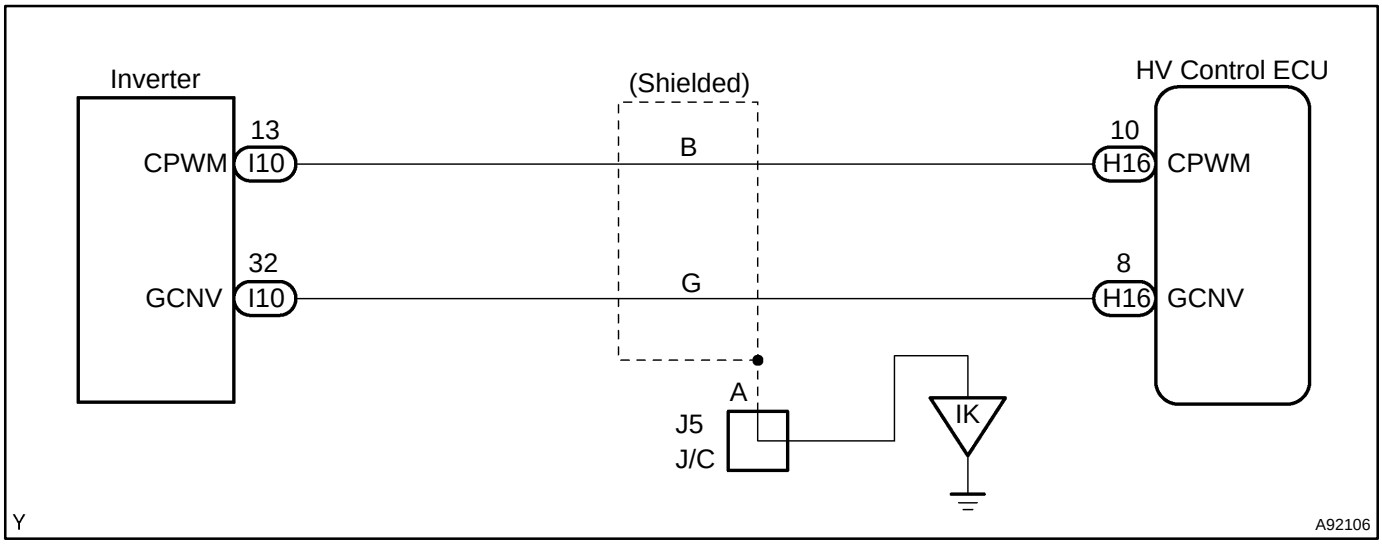
Power transistor actuation signal	Abnormal

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 588) is not detected

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

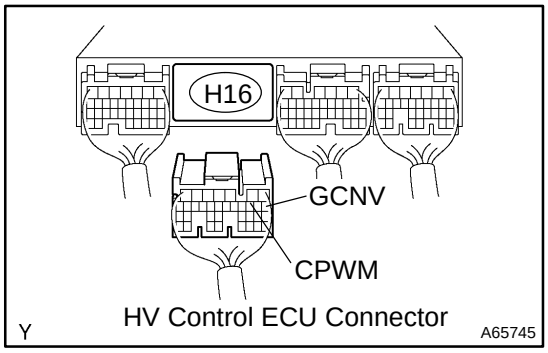
- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

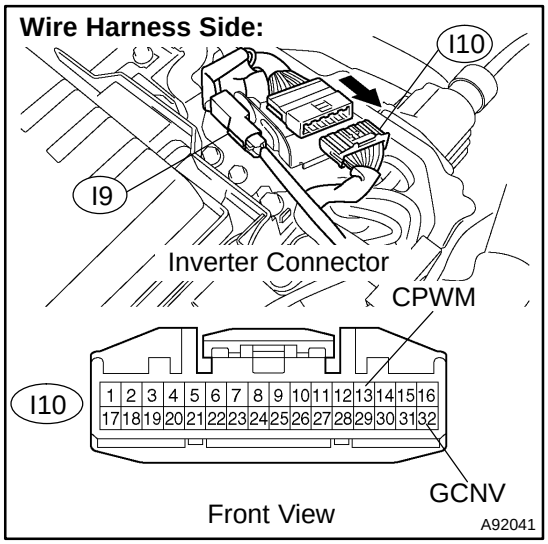
HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H16 HV control ECU connector.
(d) Remove the inverter cover (see page 21–23).
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
CPWM (H16–10) – Body ground	Below 1 V
GCNV (H16–8) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CPWM (H16–10) – CPWM (I10–13)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CPWM (H16–10) or CPWM (I10–13) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

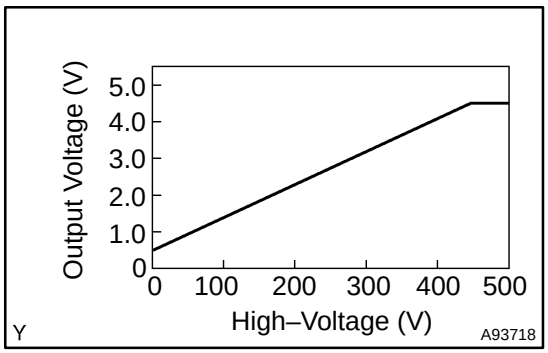
cardiagn.com

DTC	P0A94/589	DC/DC CONVERTER PERFORMANCE

DTC	P0A94/590	DC/DC CONVERTER PERFORMANCE

CIRCUIT DESCRIPTION

See the description of the boost converter on page 05–691.



The HV control ECU uses a voltage sensor, which has been built into the boost converter, to detect the high voltage before it is boosted and for boost control.

The boost converter voltage sensor outputs a voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The HV control ECU monitors a signal line of the boost converter voltage sensor and detects malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	589	Open or GND short in boost converter voltage (VL) sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU
P0A94	590	+B short in boost converter voltage (VL) sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU

HINT:

After confirming DTC P0A94 (INF 589 or 590), confirm VL in DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST using the hand–held tester.

Voltage Displayed	Malfunction
510 V	+B short circuit
0 V	Open or GND short circuit

MONITOR DESCRIPTION

The HV control ECU monitors the boost converter voltage (VL) sensor circuit. If the HV control ECU detects an open or short malfunction of the VL sensor circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 589/590): Boost converter/VL malfunction
Required sensor/components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
No other condition	–

TYPICAL MALFUNCTION THRESHOLDS

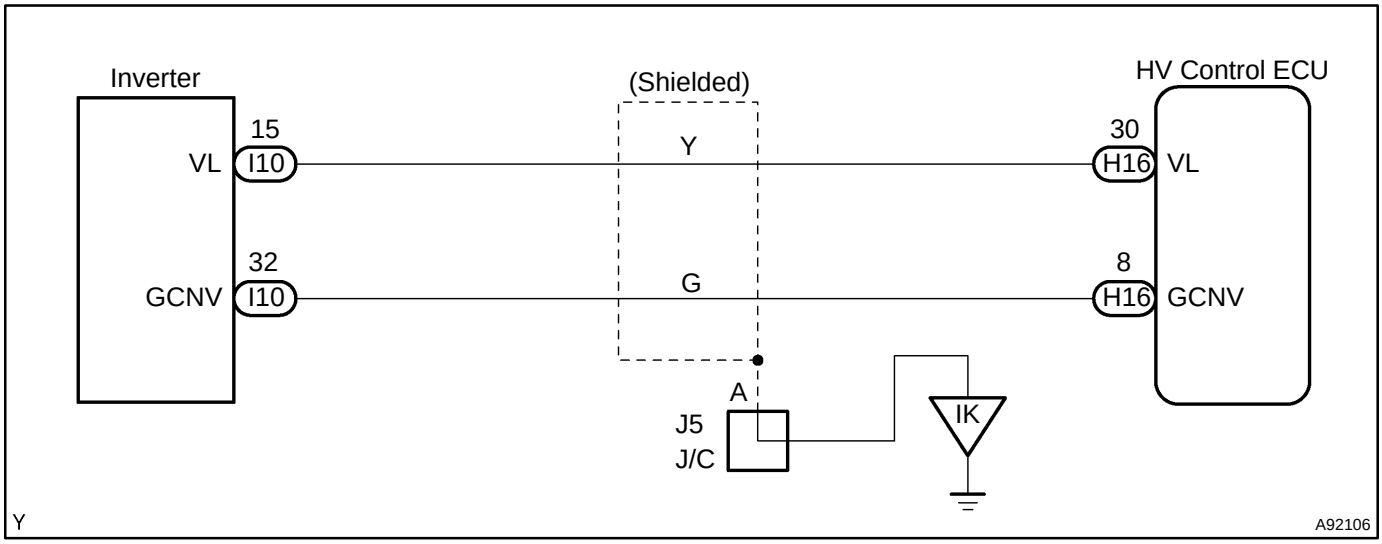
Boost converter voltage sensor circuit	Open or short

cardiagn.com

COMPONENT OPERATING RANGE

Boost converter	DTC P0A94 (INF 589/590) is not detected

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ VALUE OF HAND–HELD TESTER(VL)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the VL value on the hand–held tester.

Result:

Voltage Displayed	Proceed to
510 V	A
0 V	B
1 to 509 V	C

HINT:

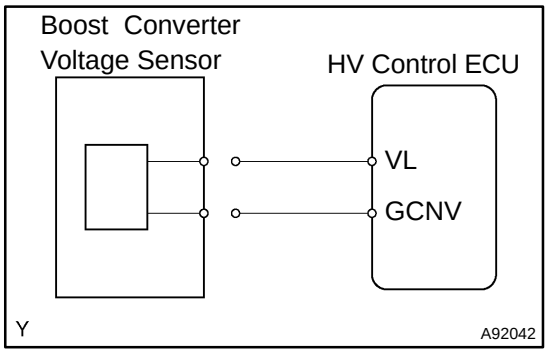
- If there is a +B short circuit, the hand–held tester indicates 510 V.
- If there is an open GND short circuit, the hand–held tester indicates 0 V.

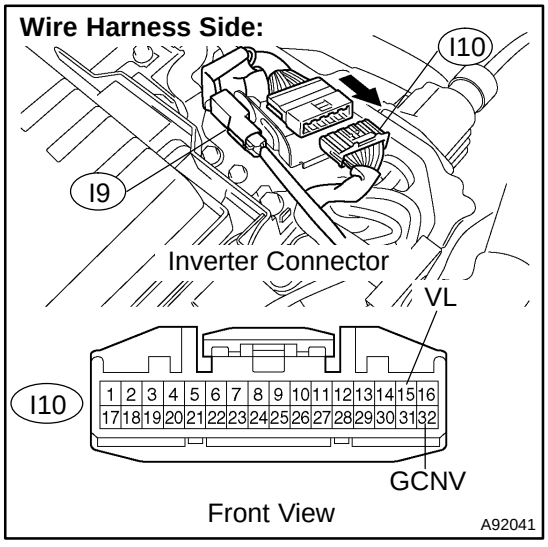
cardiagn.com

B	Go to step 4
C	CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)

A

2	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN WIRE HARNESS)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the I10 inverter connector.
(e) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(g) Read the VL value on the hand–held tester.
Standard: 0 V
(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

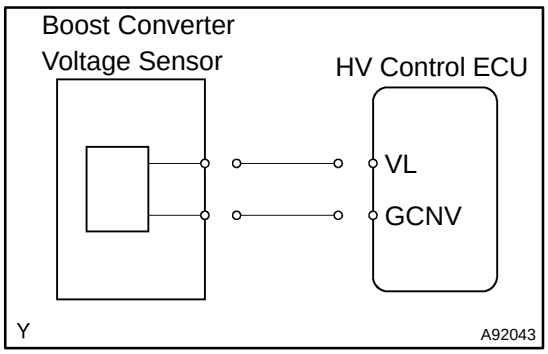
NG	Go to step 3

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

3	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN HYBRID VEHICLE CONTROL ECU)

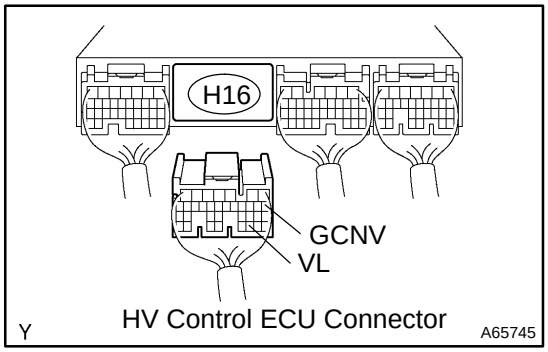


(a) Disconnect the H16 HV control ECU connector.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the VL value on the hand–held tester.
Standard: 0 V
(e) Reconnect the HV control ECU connector.



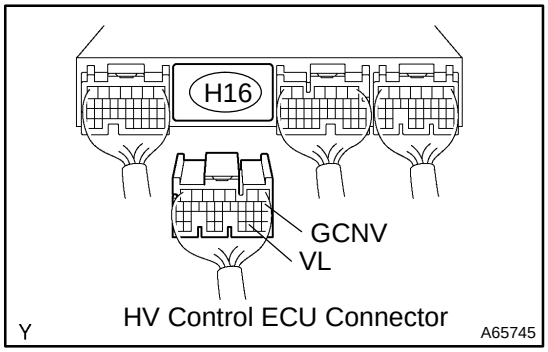
NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

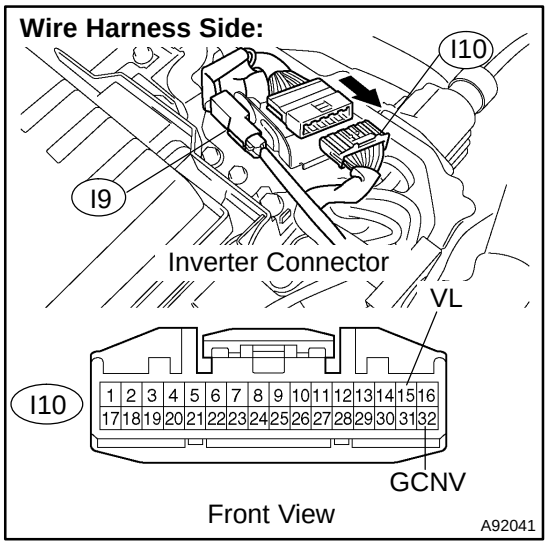
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

cardiagn.com

4	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





OK

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H16 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VL (H16–30) – VL (I10–15)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

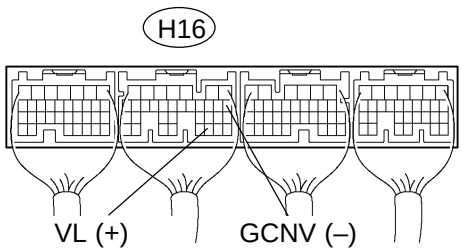
Tester Connection	Specified Condition
VL (H16–30) or VL (I10–15) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(g) Reconnect the inverter connector.
(h) Reconnect the HV control ECU connector.
(i) Reinstall the inverter cover (see page 21–23).
(j) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

cardiagn.com

5	INSPECT HYBRID VEHICLE CONTROL ECU(VL VOLTAGE)



(a) Turn the power switch ON (READY).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(b) Measure the voltage between the terminals of the H16 HV control ECU connector.

Standard:

Tester Connection	Specified Condition
VL (H16–30) – GCNV (H16–8)	1.9 to 3.4 V

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

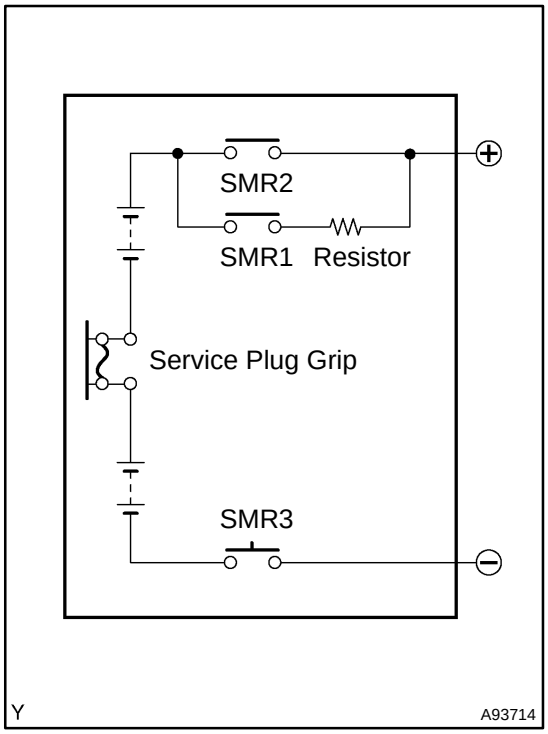
REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0AA1/224	HYBRID BATTERY POSITIVE CONTACTOR CIRCUIT STUCK CLOSED

DTC	P0AA2/225	HYBRID BATTERY POSITIVE CONTACTOR CIRCUIT STUCK OPEN

CIRCUIT DESCRIPTION



The SMRs (System Main Relays) connect and disconnect the high–voltage power supply circuit in accordance with requests from the HV control ECU. To ensure a reliable operation, they consists of a total of three relays (one for the negative side and two for the positive side).

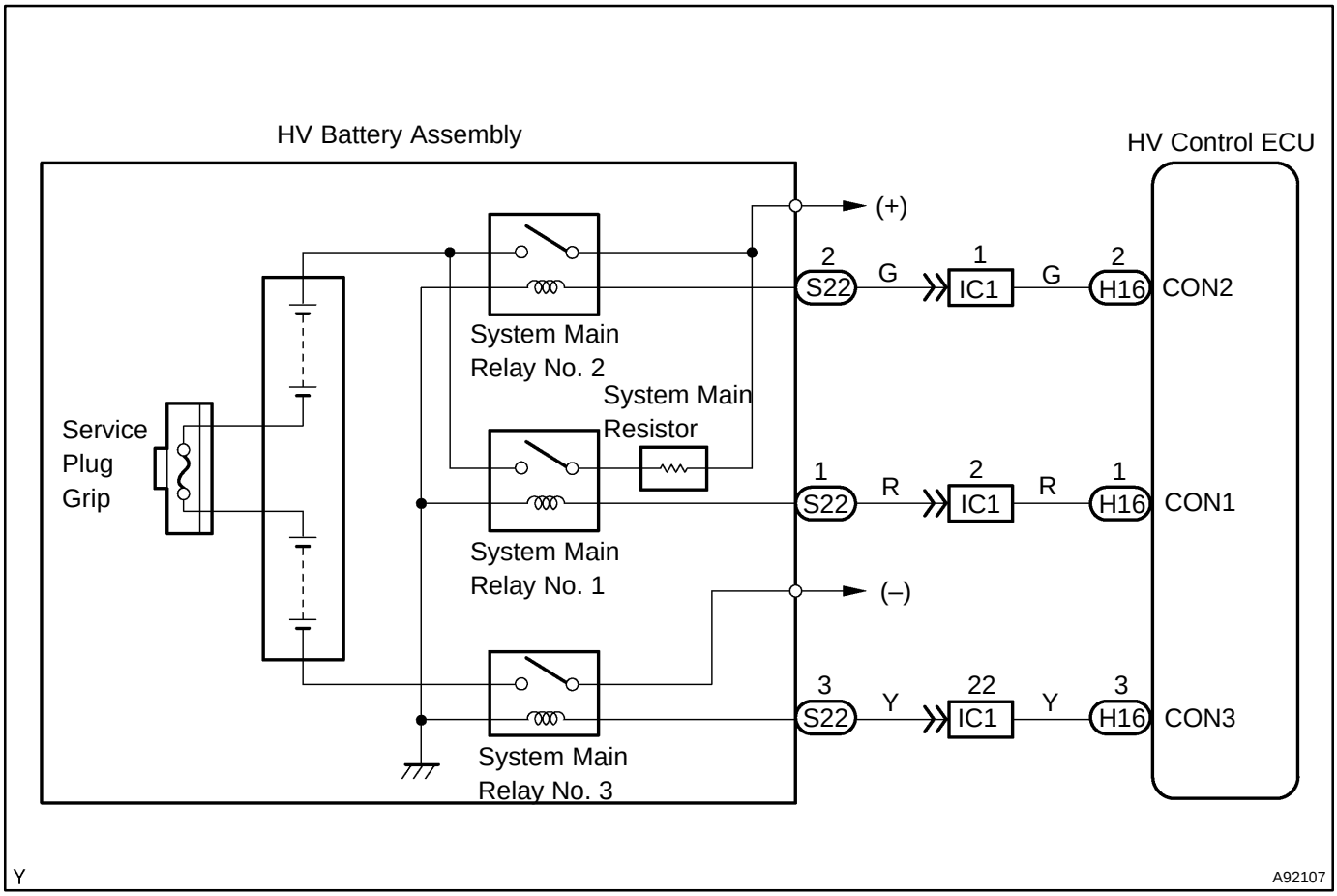
To connect, SMR1 and SMR3 turn ON initially. Then, SMR2 turns ON and SMR1 turns OFF. This process protects the circuit from the high–voltage surge current by allowing the limit current to flow via the resistor. To disconnect, SMR2 and SMR3 turn OFF in that order. The HV control ECU checks that the relays have turned OFF properly.

The HV control ECU monitors the proper operation of the SMRs (CON1, CON2 and CON3) to check for malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AA1	224	Open or +B short in system main relay No. 1 circuit	• Wire harness or connector • System main relay No. 1 • HV control ECU
P0AA2	225	GND short in system main relay No. 1 circuit	• Wire harness or connector • System main relay No. 1 • HV control ECU

cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

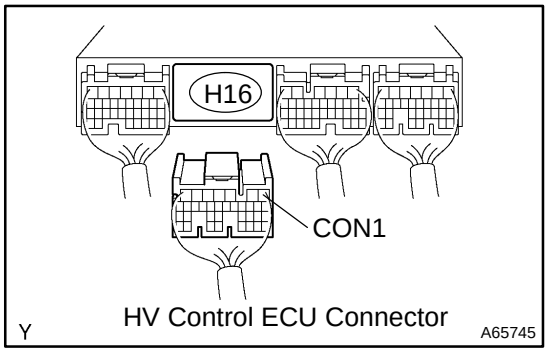
1	**INSPECT SYSTEM MAIN RELAY NO.1 (See page 21–40)**

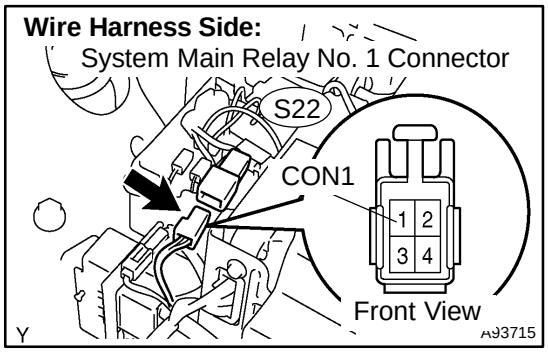
NG → **REPLACE SYSTEM MAIN RELAY NO.1 (See page 21–83)**

OK

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – SYSTEM MAIN RELAY NO.1)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H16 HV control ECU connector.
(d) Disconnect the S22 system main relay No. 1 connector.
(e) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with the service plug grip removed.

(f) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
CON1 (H16–1) – Body ground	Below 1 V

(g) Turn the power switch OFF.
(h) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CON1 (H16–1) – CON1 (S22–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CON1 (H16–1) or CON1 (S22–1) – Body ground	10 kΩ or higher

(i) Reconnect the system main relay No. 1 connector.
(j) Reconnect the HV control ECU connector.
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0AA1/226	HYBRID BATTERY POSITIVE CONTACTOR CIRCUIT STUCK CLOSED

DTC	P0AA2/227	HYBRID BATTERY POSITIVE CONTACTOR CIRCUIT STUCK OPEN

CIRCUIT DESCRIPTION

Refer to DTC P0AA1 (INF 224) on page 05–760.

The HV control ECU monitors the proper operation of the system main relay No. 2 (CON2) to check for malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AA1	226	Open or +B short in system main relay No. 2 circuit	• Wire harness or connector • System main relay No. 2 • HV control ECU
P0AA2	227	GND short in system main relay No. 2 circuit	• Wire harness or connector • System main relay No. 2 • HV control ECU

WIRING DIAGRAM

Refer to DTC P0AA1 (INF 224) on page 05–760.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

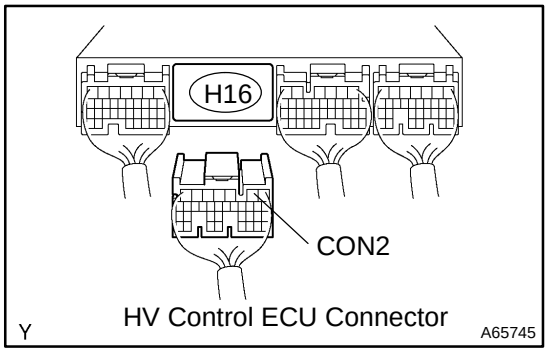
1	INSPECT SYSTEM MAIN RELAY NO.2 (See page 21–40)

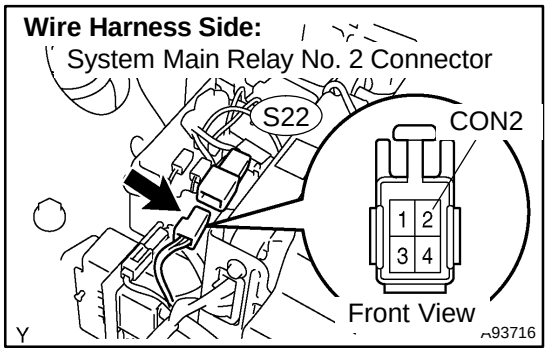
NG → REPLACE SYSTEM MAIN RELAY NO.2 (See page 21–87)

OK

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – SYSTEM MAIN RELAY NO. 2)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H16 HV control ECU connector.
(d) Disconnect the S22 system main relay No. 2 connector.
(e) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with the service plug grip removed.

(f) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
CON2 (H16–2) – Body ground	Below 1 V

(g) Turn the power switch OFF.
(h) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CON2 (H16–2) – CON2 (S22–2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CON2 (H16–2) or CON2 (S22–2) – Body ground	10 kΩ or higher

(i) Reconnect the system main relay No. 2 connector.
(j) Reconnect the HV control ECU connector.
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0AA1/231	HYBRID BATTERY POSITIVE CONTACTOR CIRCUIT STUCK CLOSED

CIRCUIT DESCRIPTION

Refer to DTC P0AA1 (INF 224) on page 05–760.

Because it might be impossible to shut off the high–voltage system if either of the system main relay No. 1 and No. 2 becomes stuck, the HV control ECU monitors the two relays and stops the system if malfunction is found in either relay.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AA1	231	System main relay terminal of HV battery positive side stuck closed	• System main relay No. 1 • System main relay No. 2

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	INSPECT SYSTEM MAIN RELAY NO.1 (See page 21–40)

NG → **REPLACE SYSTEM MAIN RELAY NO.1 (See page 21–83)**

OK

REPLACE SYSTEM MAIN RELAY NO.2 (See page 21–87)

cardiagn.com

DTC	P0AA1/233	HYBRID BATTERY POSITIVE CONTACTOR CIRCUIT STUCK CLOSED

CIRCUIT DESCRIPTION

Refer to DTC P0AA1 (INF 224) on page 05–760.

Because it might be impossible to shut off the high–voltage system if any one of the system main relay No. 1 to No. 3 becomes stuck, the HV control ECU monitors the three relays and stops the system if malfunction is found in either relay.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AA1	233	System main relay terminals of HV battery positive and negative sides stuck closed	• System main relay No. 1 • System main relay No. 2 • System main relay No. 3

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	INSPECT SYSTEM MAIN RELAY NO.1 (See page 21–40)

NG → REPLACE SYSTEM MAIN RELAY NO.1 (See page 21–83)

OK

2	INSPECT SYSTEM MAIN RELAY NO.2 (See page 21–40)

NG → REPLACE SYSTEM MAIN RELAY NO.2 (See page 21–87)

OK

REPLACE SYSTEM MAIN RELAY NO.3 (See page 21–90)

cardiagn.com

DTC	P0AA4/228	HYBRID BATTERY NEGATIVE CONTACTOR CIRCUIT STUCK CLOSED

DTC	P0AA5/229	HYBRID BATTERY NEGATIVE CONTACTOR CIRCUIT STUCK OPEN

CIRCUIT DESCRIPTION

Refer to DTC P0AA1 (INF 224) on page 05–760.

The HV control ECU monitors the proper operation of the system main relay No. 3 (CON3) to check for malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AA4	228	Open or +B short in system main relay No. 3 circuit	• Wire harness or connector • System main relay No. 3 • HV control ECU
P0AA5	229	GND short in system main relay No. 3 circuit	• Wire harness or connector • System main relay No. 3 • HV control ECU

MONITOR DESCRIPTION

DTC P0AA4 (INF 228):

The HV control ECU monitors the proper operation of the system main relay No. 3 (CON3). If the HV control ECU detects an open or short malfunction of the relay circuit, the HV control ECU illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0AA4 (INF 228): SMR circuit/Rationality (cont3 malfunction)
Required sensor/components	System main relay No.3
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

System main relay No. 3 circuit	Open or short

COMPONENT OPERATING RANGE

System main relay No.3	DTC P0AA4 (INF 228) is not detected

WIRING DIAGRAM

Refer to DTC P0AA1 (INF 224) on page 05–760.

cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

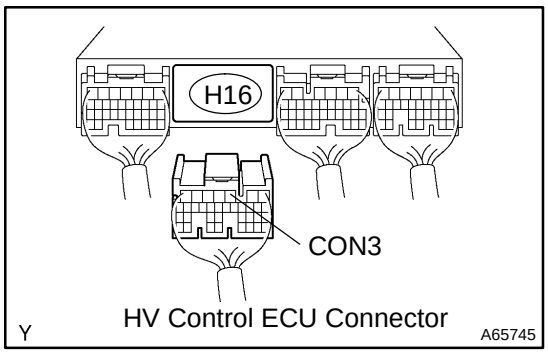
At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

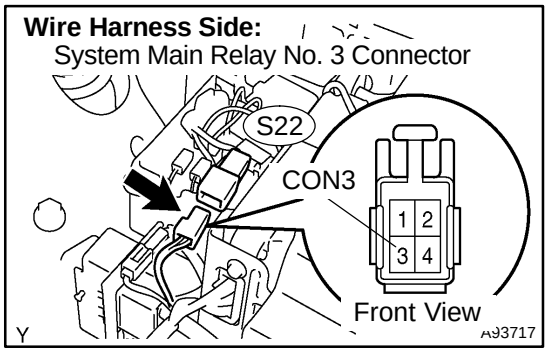
1	**INSPECT SYSTEM MAIN RELAY NO.3 (See page 21–40)**

NG → **REPLACE SYSTEM MAIN RELAY NO.3 (See page 21–90)**

OK

2	**CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – SYSTEM MAIN RELAY NO. 3)**





CAUTION:

Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.

(b) Remove the service plug grip (see page 21–116).

NOTICE:

Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the H16 HV control ECU connector.

(d) Disconnect the S22 system main relay No. 3 connector.

(e) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with the service plug grip removed.

(f) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
CON3 (H16–3) – Body ground	Below 1 V

(g) Turn the power switch OFF.

(h) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CON3 (H16–3) – CON3 (S22–3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CON3 (H16–3) or CON3 (S22–3) – Body ground	10 kΩ or higher

cardiagn.com

(i) Reconnect the system main relay No. 3 connector.
(j) Reconnect the HV control ECU connector.
(k) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P0AA4/232	HYBRID BATTERY NEGATIVE CONTACTOR CIRCUIT STUCK CLOSED

CIRCUIT DESCRIPTION

Refer to DTC P0AA1 (INF 224) on page 05–760.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AA4	232	System main relay terminal of HV battery negative side stuck closed	• System main relay No. 3

MONITOR DESCRIPTION

The HV control ECU monitors the system main relay No. 3, because shutting off the high–voltage system might be impossible if the relay terminal becomes stuck. If the HV control ECU detects that the relay terminal has stuck closed, it illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0AA4 (INF 232): SMR circuit/ ”–” side stuck
Required sensor/components	System main relay No.3
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	–

TYPICAL MALFUNCTION THRESHOLDS

System main relay No. 3	Stuck closed

COMPONENT OPERATING RANGE

System main relay No. 3	DTC P0AA4 (INF 232) is not detected

INSPECTION PROCEDURE

If the information (INF) code is present, replace the system main relay No. 3.

REPLACE SYSTEM MAIN RELAY NO. 3 (See page 21–90)

cardiagn.com

DTC	P2120/111	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT

DTC	P2121/106	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT RANGE/PERFORMANCE

DTC	P2121/114	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT RANGE/PERFORMANCE

DTC	P2125/112	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT

DTC	P2126/109	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT RANGE/PERFORMANCE

DTC	P2138/110	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D”/”E” VOLTAGE CORRELATION

HINT:
This is the repair procedure for the accelerator pedal position sensor.

CIRCUIT DESCRIPTION

Refer to DTC P2122 (INF 104) on page 05–772.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P2120	111	Accelerator pedal position main sensor value does not change while its sub sensor value changes	• Accelerator pedal rod assembly
P2121	106	Internal error of accelerator pedal position main sensor	• Accelerator pedal rod assembly
P2121	114	Accelerator pedal not smoothly returning to its original position	• Accelerator pedal rod assembly
P2125	112	Accelerator pedal position sub sensor value does not change while its main sensor value changes	• Accelerator pedal rod assembly
P2126	109	Internal error of accelerator pedal position sub sensor	• Accelerator pedal rod assembly
P2138	110	Difference between main sensor value and sub sensor value is large	• Accelerator pedal rod assembly

INSPECTION PROCEDURE

If any of the above information (INF) code is present, replace the accelerator pedal rod assembly.

REPLACE ACCELERATOR PEDAL ROD ASSY (See page 21–128)

cardiagn.com

DTC	P2122/104	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT LOW INPUT

DTC	P2123/105	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT HIGH INPUT

DTC	P2127/107	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT LOW INPUT

DTC	P2128/108	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT HIGH INPUT

HINT:
This is the repair procedure for the accelerator pedal position sensor.

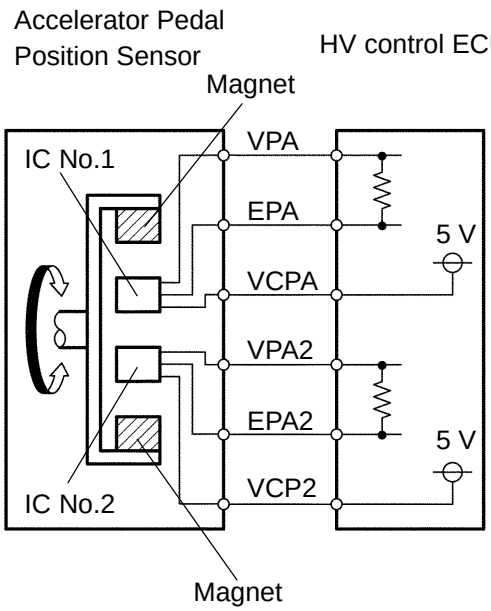
CIRCUIT DESCRIPTION

HINT:

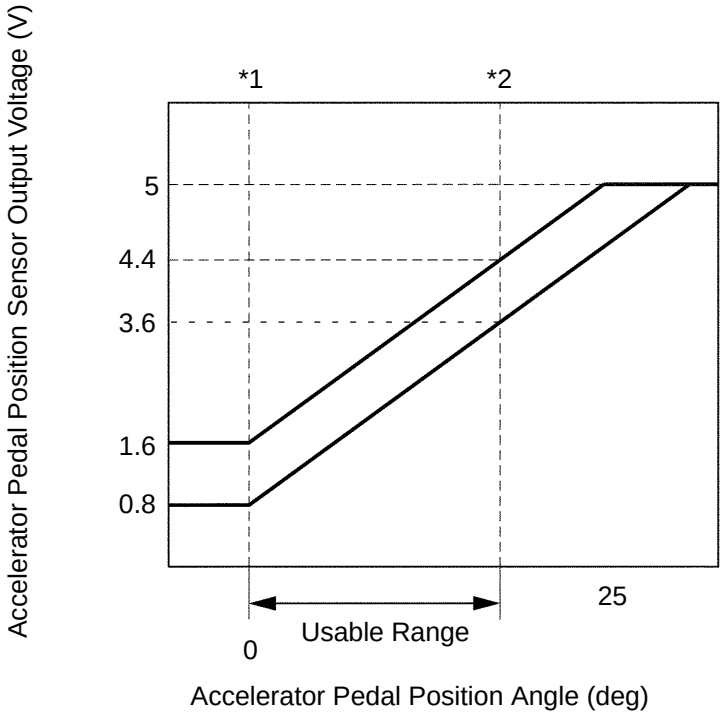
- This electrical throttle system does not use a throttle cable.
- This accelerator pedal position sensor is a non–contact type.

The accelerator pedal position sensor is mounted on the accelerator pedal to detect how much it is depressed. It has 2 sensor terminals (VPA and VPA2) to detect the accelerator pedal position and a malfunction of the accelerator pedal position sensor itself. Since this sensor is electronically controlled with hall elements, accurate control and reliability can be obtained.
In the accelerator pedal position sensor, the voltage applied to terminals VPA and VPA2 of the HV control ECU changes between 0 V and 5 V in proportion to the degree of depressing the accelerator pedal. The VPA is a signal to indicate the actual accelerator pedal position angle which is used for the HV system control, and the VPA2 is a signal to indicate the actual accelerator pedal position angle which is used for detecting a malfunction of the sensor itself (terminal VPA).
The HV control ECU judges how much the accelerator pedal is being depressed from the VPA and VPA2 signals, and controls the HV system based on the signals.

cardiagn.com



A19694



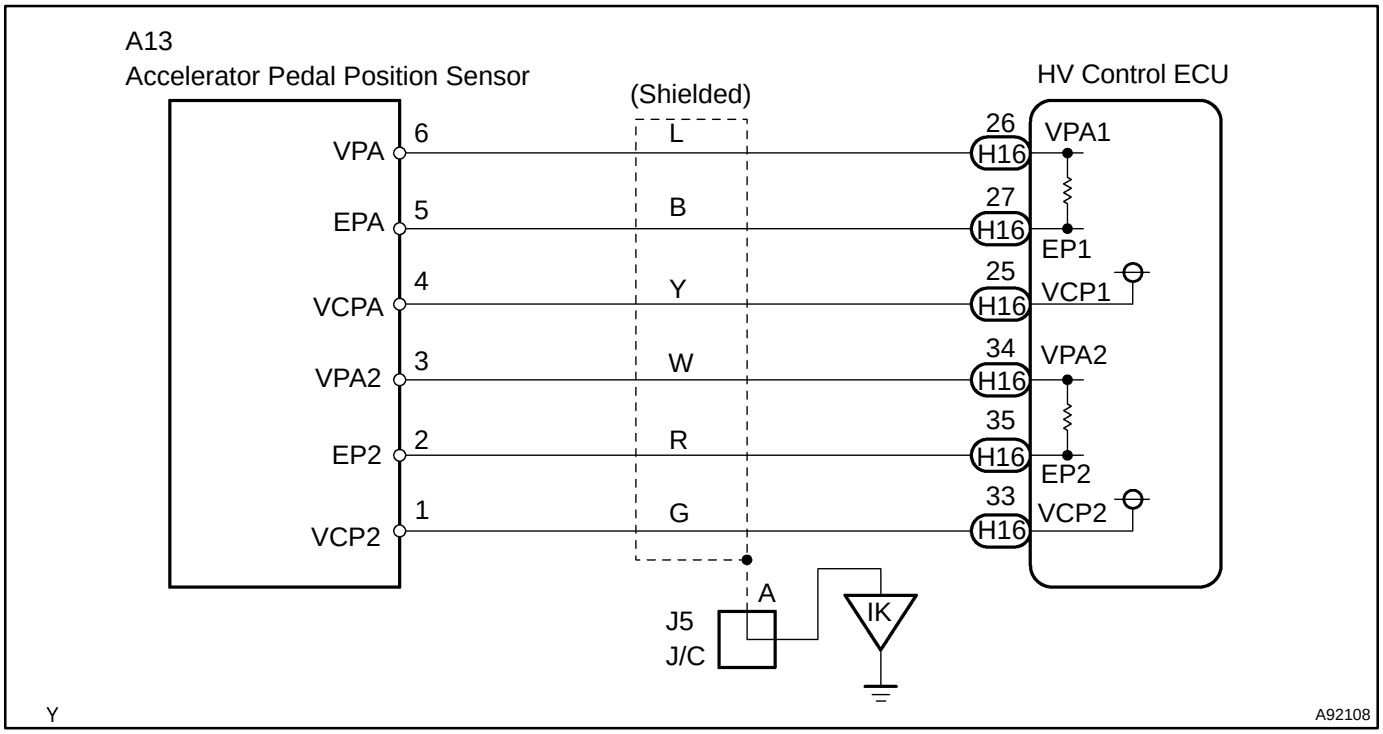
*1: Accelerator Pedal Released
*2: Accelerator Pedal Fully Depressed

A19803

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P2122	104	Open or GND short in accelerator pedal position main sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU
P2123	105	+B short in accelerator pedal position main sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU
P2127	107	Open or GND short in accelerator pedal position sub sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU
P2128	108	+B short in accelerator pedal position sub sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU

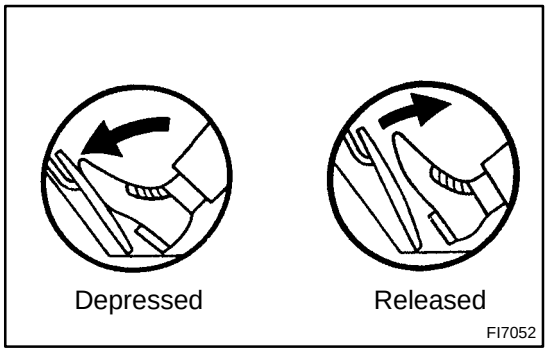
cardiagn.com

WIRING DIAGRAM



INSPECTION PROCEDURE

1	READ VALUE OF HAND–HELD TESTER(ACCEL POS #1 AND #2)



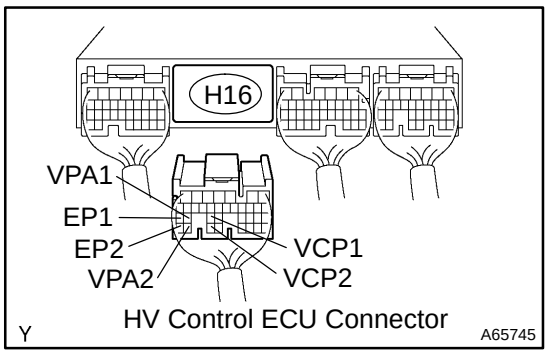
(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the ACCEL POS #1 and #2 values on the hand–held tester with the engine stopped.
OK: Changes with accelerator pedal pressure

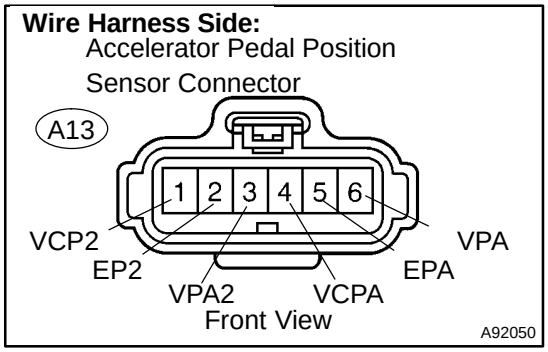
OK	Go to step 5

NG

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – ACCELERATOR PEDAL POSITION SENSOR)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the A13 accelerator pedal position sensor connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VPA1 (H16–26) – Body ground	Below 1 V
VCP1 (H16–25) – Body ground	Below 1 V
EP1 (H16–27) – Body ground	Below 1 V
VPA2 (H16–34) – Body ground	Below 1 V
VCP2 (H16–33) – Body ground	Below 1 V
EP2 (H16–35) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VPA1 (H16–26) – VPA (A13–6)	Below 1 Ω
VCP1 (H16–25) – VCPA (A13–4)	Below 1 Ω
EP1 (H16–27) – EPA (A13–5)	Below 1 Ω
VPA2 (H16–34) – VPA2 (A13–3)	Below 1 Ω
VCP2 (H16–33) – VCP2 (A13–1)	Below 1 Ω
EP2 (H16–35) – EP2 (A13–2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VPA1 (H16–26) or VPA (A13–6) – Body ground	10 kΩ or higher
VCP1 (H16–25) or VCPA (A13–4) – Body ground	10 kΩ or higher
EP1 (H16–27) or EPA (A13–5) – Body ground	10 kΩ or higher
VPA2 (H16–34) or VPA2 (A13–3) – Body ground	10 kΩ or higher
VCP2 (H16–33) or VCP2 (A13–1) – Body ground	10 kΩ or higher
EP2 (H16–35) or EP2 (A13–2) – Body ground	10 kΩ or higher

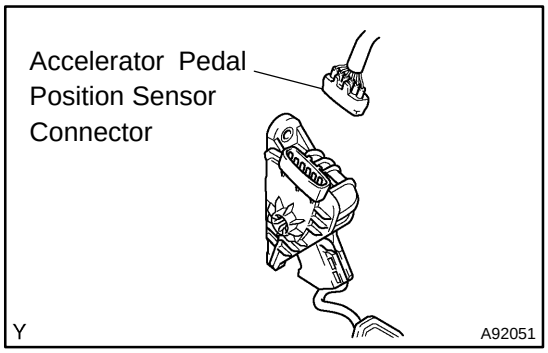
(g) Reconnect the accelerator pedal position sensor connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

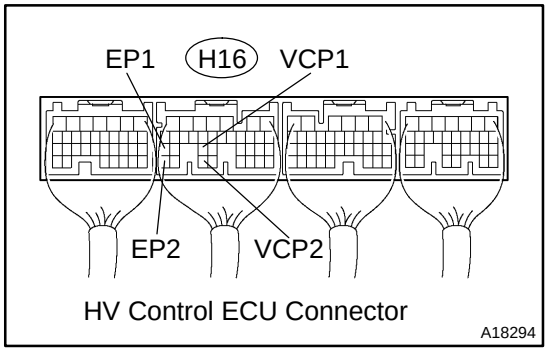
3	INSPECT HYBRID VEHICLE CONTROL ECU(VCP1 OR VCP2 VOLTAGE)



(a) Disconnect the A13 accelerator pedal position sensor connector.
(b) Turn the power switch ON (IG).
(c) Measure the voltage between the terminals of the HV control ECU connector.
Standard:

Tester Connection	Specified Condition
VCP1 (H16–25) – EP1 (H16–27)	4.5 to 5.5 V
VCP2 (H16–33) – EP2 (H16–35)	4.5 to 5.5 V

(d) Reconnect the accelerator pedal position sensor connector.



NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

OK

4	REPLACE ACCELERATOR PEDAL ROD ASSY (See page 21–128)

GO

5	CHECK IF DTC OUTPUT RECURS(DTC P2122, P2123, P2127 OR P2128)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Perform a simulation test.
(f) Read DTCs.
Result: DTC P2122, P2123, P2127 or P2128 is not output again

YES → **SYSTEM OK**

NO

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P3000/123	BATTERY CONTROL SYSTEM MALFUNCTION

DTC	P3000/125	BATTERY CONTROL SYSTEM MALFUNCTION

DTC	P3000/603	BATTERY CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION

The HV control ECU gives warning to the driver and performs the fail–safe control, according to the abnormal signal received from the battery ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3000	123	Abnormal signal input from battery ECU (HV battery system malfunction)	• HV battery system • Battery ECU
P3000	125	Abnormal signal input from battery ECU (High voltage fuse blown out)	• HV battery system • Battery ECU
P3000	603	Abnormal signal input from battery ECU (HV battery cooling system malfunction)	• HV battery system • Battery ECU

INSPECTION PROCEDURE

HINT:

After repairing the malfunction, restart the system (to turn the READY lamp ON) and recheck the DTCs.

1	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–893)**

NO →

REPLACE BATTERY ECU ASSY (See page 21–98)

cardiagn.com

DTC	P3000/388	BATTERY CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION

Based on the malfunction signal received from the battery ECU, the system alerts the driver and effects fail–safe control.

This DTC is output when the SOC (state of charge) of the HV battery decreases as a result of leaving the vehicle in the N position, running out of fuel, or malfunction in the HV control system.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3000	388	Abnormal signal input from battery ECU (discharge inhibition control malfunction)	• HV control system • Fuel shortage • HV battery assembly

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P3000 (INF 388) and other DTCs are output

HINT:
If any other codes besides P3000 (INF 388) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

2	CHECK AMOUNT OF GASOLINE

(a) Turn the power switch ON (IG).
(b) Check the amount of gasoline with the fuel gauge in the meter.
OK: Appropriate amount of gasoline

NG → **REFUEL GASOLINE**

OK

3	CHECK IF ENGINE STARTS

(a) Turn the power switch ON (READY).
(b) Check if the engine starts.
OK: The engine starts

cardiagn.com

NO → **REPLACE HV SUPPLY BATTERY ASSY (See page 21–54)**

YES

LEAVE VEHICLE IN P POSITION, AND CHARGE HV BATTERY IN IDLE STATUS UNTIL IDLING STOPS

cardiagn.com

DTC	P3000/389	BATTERY CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION

Based on the malfunction signal received from the battery ECU, the system alerts the driver and effects fail–safe control.
This DTC is output if the HV battery is depleted or the HV control system has malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3000	389	Abnormal signal input from battery ECU (drop of high voltage)	• HV control system • HV battery assembly

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P3000 (INF 389) and other DTCs are output

HINT:
If any other codes besides P3000 (INF 389) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See Page 05–440)**

NO

2	CHECK IF ENGINE STARTS

(a) Turn the power switch ON (READY).
(b) Check if the engine starts.
OK: The engine starts

NG → **REPLACE HV SUPPLY BATTERY ASSY (See page 21–54)**

OK

LEAVE VEHICLE IN P POSITION, AND CHARGE HV BATTERY IN IDLE STATUS UNTIL IDLING STOPS

cardiagn.com

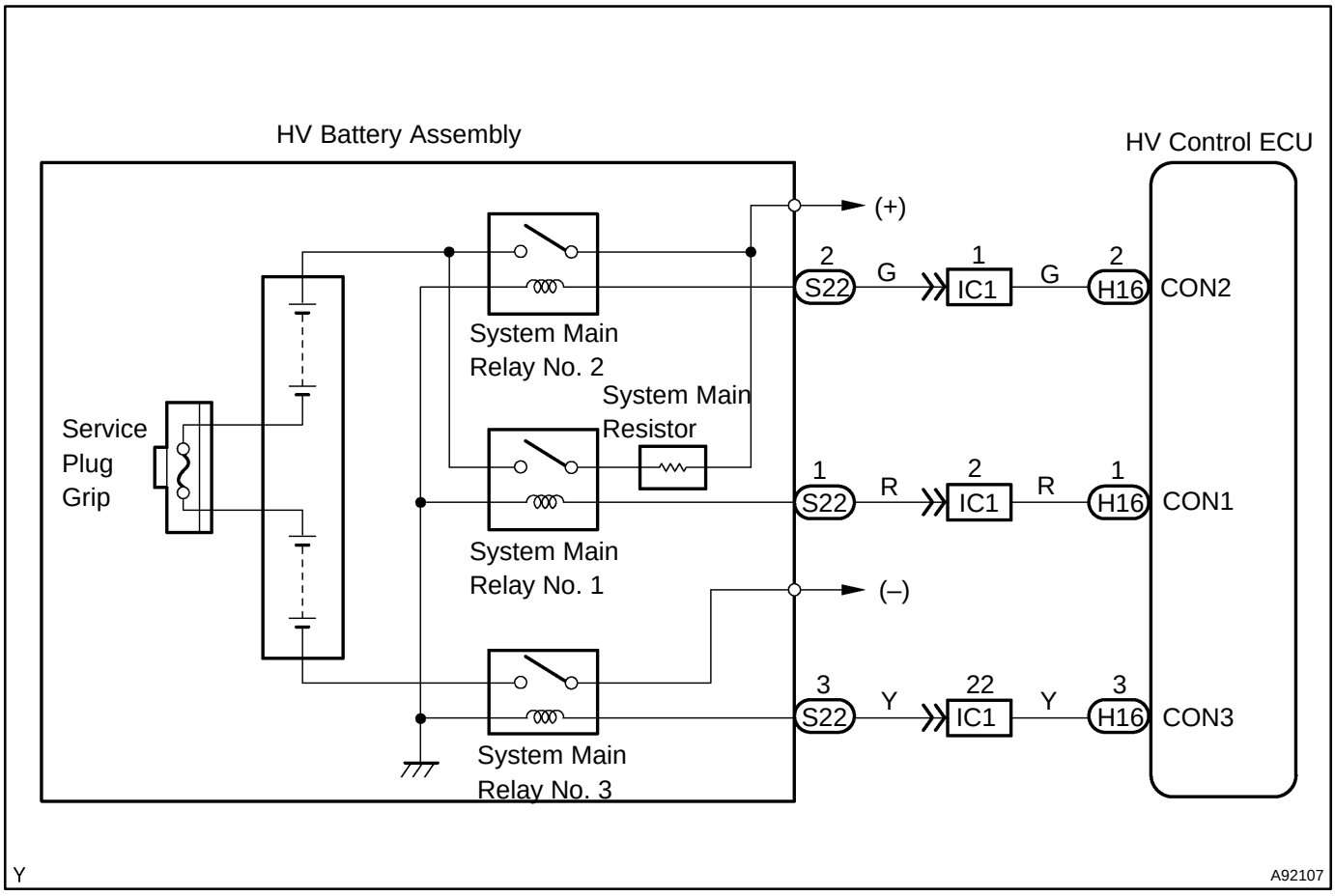
DTC	P3004/131	HIGH VOLTAGE POWER RESOURCE MALFUNCTION

CIRCUIT DESCRIPTION

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3004	131	High voltage fuse has blown out, service plug grip is disconnected or limiter resistance is cut off	• HV battery system • System main resistor • System main relay No. 1 • System main relay No. 3 • Main battery cable • Main battery cable No. 2 • Frame wire • w/ converter inverter assembly • HV control ECU

WIRING DIAGRAM

Refer to DTC P0A78 (INF 266) on page 05–562.



cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

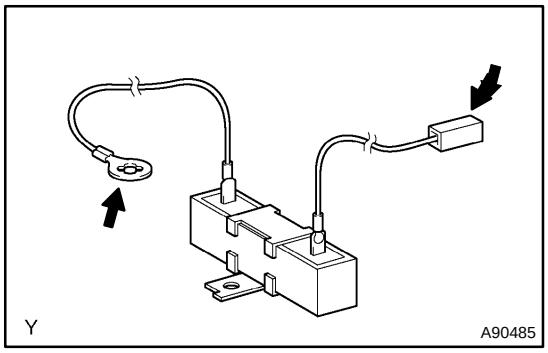
1	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P0A95 is output

YES → **GO TO DTC P0A95 (See page 05–917)**

NO

2	INSPECT SYSTEM MAIN RESISTOR



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Remove the system main resistor (see page 21–92).
(b) Measure the resistance between the terminals.
Standard: 18 to 22 Ω
(c) Reinstall the system main resistor (see page 21–92).

NG → **REPLACE SYSTEM MAIN RESISTOR (See page 21–92)**

OK

3	INSPECT SYSTEM MAIN RELAY NO.1 (See page 21–40)

NG → **REPLACE SYSTEM MAIN RELAY NO.1 (See page 21–83)**

OK

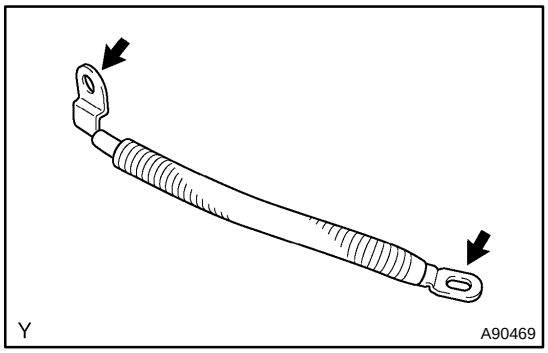
cardiagn.com

4	INSPECT SYSTEM MAIN RELAY NO.3 (See page 21–40)

NG → REPLACE SYSTEM MAIN RELAY NO.3 (See page 21–90)

OK

5	INSPECT MAIN BATTERY CABLE



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Remove the HV battery assembly (see page 21–54).
(b) Remove the main battery cable (see page 21–66).
(c) Check the resistance between the terminals of the main battery cable.
Standard: Below 1 Ω

NG → REPLACE MAIN BATTERY CABLE

OK

6	INSPECT MAIN BATTERY CABLE

CAUTION:
Wear insulated gloves and goggles before performing the following operation.

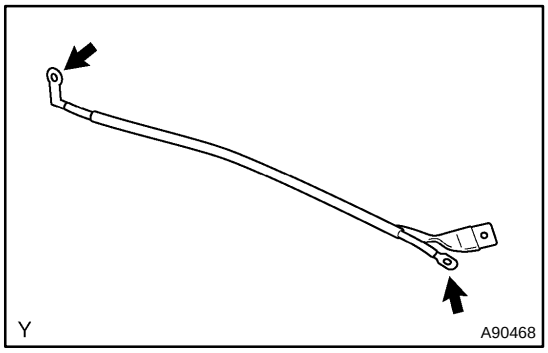
(a) Check the cover and terminals of the main battery cable for any abnormality.
OK: No abnormality is found on the cover and terminals.
(b) Check the terminals of the HV battery and the system main relay, which are to be connected to the main cable, for any abnormality.
OK: No abnormality is found on the terminals of the HV battery and system main relay.

NG → REPLACE MAIN BATTERY CABLE. IF NECESSARY, REPLACE HV BATTERY OR SYSTEM MAIN RELAY

OK

cardiagn.com

7	INSPECT MAIN BATTERY CABLE NO.2



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Remove the main battery cable No. 2 with the HV battery assembly removed (see page 21–70).

(b) Check the resistance between the terminals of the main battery cable No. 2.
Standard: Below 1 Ω

NG → **REPLACE MAIN BATTERY CABLE NO.2**

OK

8	INSPECT MAIN BATTERY CABLE NO.2

CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Check the cover and terminals of the main battery cable No. 2 for any abnormality.
OK: No abnormality is found on the cover and terminals.

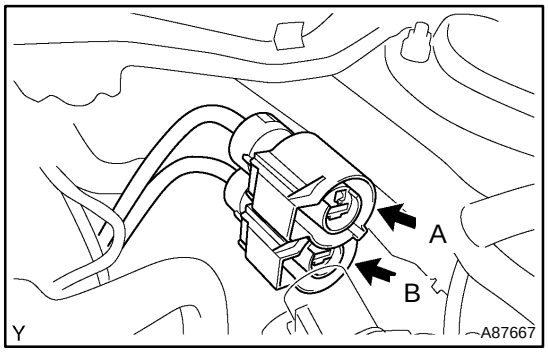
(b) Check the terminals of the HV battery and the system main relay, which are to be connected to the main battery cable No. 2, for any abnormality.
OK: No abnormality is found on the terminals of the HV battery and system main relay.

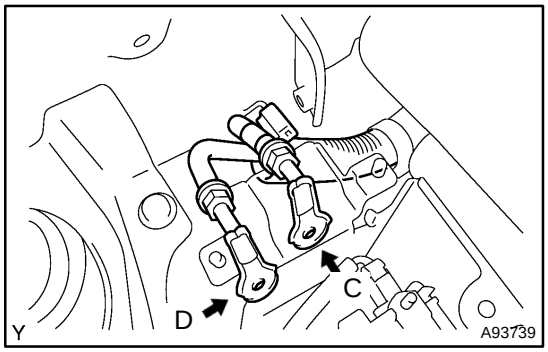
NG → **REPLACE MAIN BATTERY CABLE NO. 2. IF NECESSARY, REPLACE HV BATTERY OR SYSTEM MAIN RELAY**

OK

cardiagn.com

9	INSPECT FRAME WIRE





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Disconnect the frame wire from the w/ converter inverter.
(b) Check that the frame wire has been disconnected from the system main relay.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the frame wire and body ground.
Standard:

Tester Connection	Specified Condition
A – Body ground	10 MΩ or higher
B – Body ground	10 MΩ or higher

(d) Check the resistance between the terminals of the frame wire.
Standard:

Tester Connection	Specified Condition
A – C	Below 1 Ω
B – D	Below 1 Ω

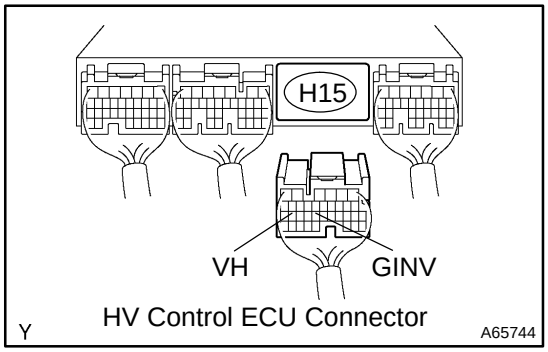
(e) Reinstall the HV battery assembly (see page 21–54).
(f) Reconnect the frame wire.

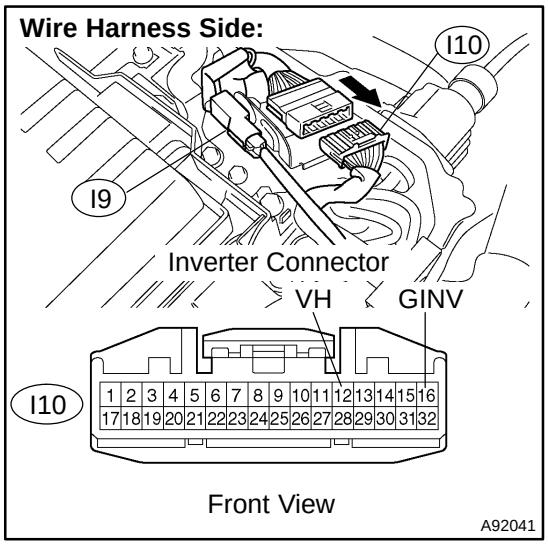
NG → **REPLACE FRAME WIRE**

OK

cardiagn.com

10	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H15 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VH (H15–26) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for short):

Tester Connection	Specified Condition
VH (H15–26) or VH (I10–12) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

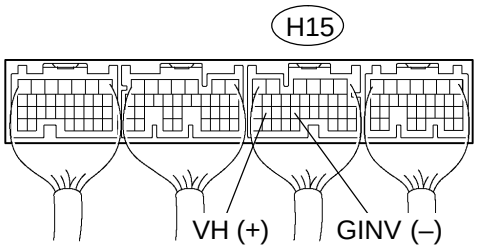
(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

11	INSPECT HYBRID VEHICLE CONTROL ECU(VH VOLTAGE)



HV Control ECU Connector
A18294

(a) Turn the power switch ON (READY).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(b) Measure the voltage between the terminals of the H15 HV control ECU connector.

Standard:

Tester Connection	Specified Condition
VH (H15–26) – GINV (H15–23)	1.6 to 3.8 V

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P3004/132	HIGH VOLTAGE POWER RESOURCE MALFUNCTION

CIRCUIT DESCRIPTION

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3004	132	Inverter voltage sensor malfunction, or limiter resistance increases	• HV control system • System main resistor • System main relay No. 1 • System main relay No. 3 • Main battery cable • Main battery cable No. 2 • Frame wire • w/ converter inverter assembly • HV control ECU

WIRING DIAGRAM

Refer to DTC P3004 (INF 131) on page 05–781.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTC P3004 (INF 132) and other DTCs are output

HINT:

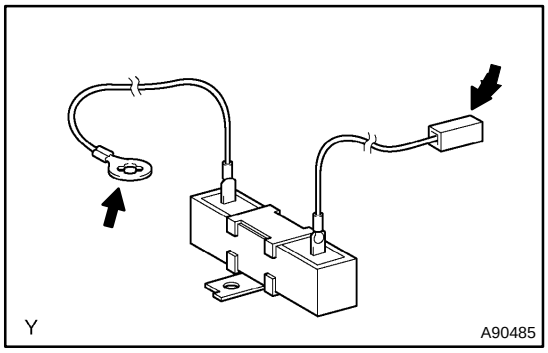
If any other codes besides P3004 (INF 132) are output, perform troubleshooting for those DTCs first.

YES → **GO TO RELEVANT DTC CHART (See page 05–440)**

NO

cardiagn.com

2	INSPECT SYSTEM MAIN RESISTOR



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Remove the system main resistor (see page 21–92).
(b) Measure the resistance between the terminals.
Standard: 18 to 22 Ω
(c) Reinstall the system main resistor (see page 21–92).

NG → **REPLACE SYSTEM MAIN RESISTOR (See page 21–92)**

OK

3	INSPECT SYSTEM MAIN RELAY NO.1 (See page 21–40)

NG → **REPLACE SYSTEM MAIN RELAY NO.1 (See page 21–83)**

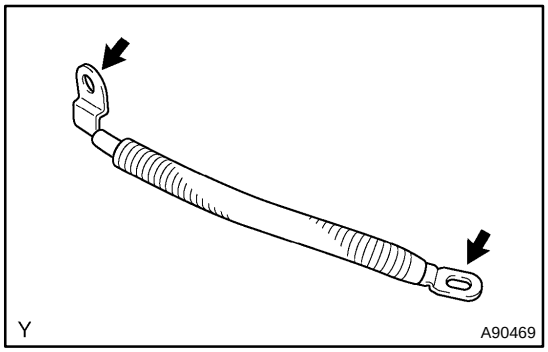
OK

4	INSPECT SYSTEM MAIN RELAY NO.3 (See page 21–40)

NG → **REPLACE SYSTEM MAIN RELAY NO.3 (See page 21–90)**

OK

5	INSPECT MAIN BATTERY CABLE



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Remove the HV battery assembly (see page 21–54).
(b) Remove the main battery cable (see page 21–66).
(c) Check the resistance between the terminals of the main battery cable.
Standard: Below 1 Ω

NG → **REPLACE MAIN BATTERY CABLE**

OK

cardiagn.com

6	INSPECT MAIN BATTERY CABLE

CAUTION:
Wear insulated gloves and goggles before performing the following operation.

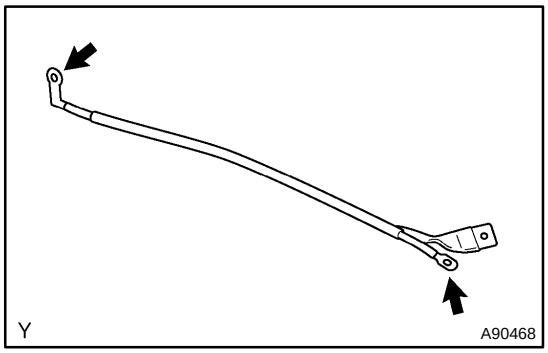
(a) Check the cover and terminals of the main battery cable for any abnormality.
OK: No abnormality is found on the cover and terminals.

(b) Check the terminals of the HV battery and the system main relay, which are to be connected to the main cable, for any abnormality.
OK: No abnormality is found on the terminals of the HV battery and system main relay.

NG → **REPLACE MAIN BATTERY CABLE. IF NECESSARY, REPLACE HV BATTERY OR SYSTEM MAIN RELAY**

OK

7	INSPECT MAIN BATTERY CABLE NO.2



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Remove the main battery cable No. 2 with the HV battery assembly removed (see page 21–70).

(b) Check the resistance between the terminals of the main battery cable No. 2.
Standard: Below 1 Ω

NG → **REPLACE MAIN BATTERY CABLE NO.2**

OK

8	INSPECT MAIN BATTERY CABLE NO.2

CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Check the cover and terminals of the main battery cable No. 2 for any abnormality.
OK: No abnormality is found on the cover and terminals.

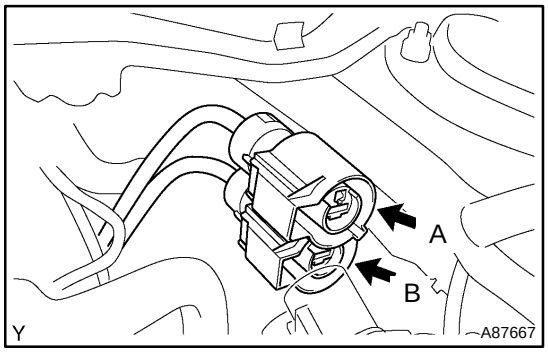
(b) Check the terminals of the HV battery and the system main relay, which are to be connected to the main battery cable No. 2, for any abnormality.
OK: No abnormality is found on the terminals of the HV battery and system main relay.

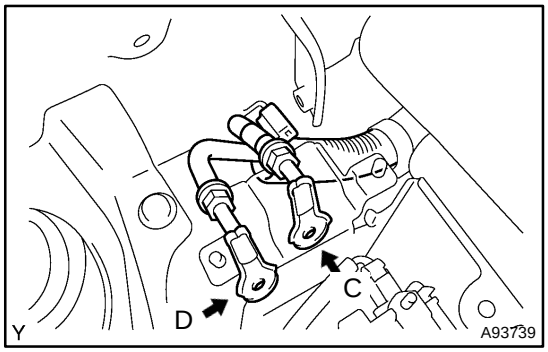
NG → **REPLACE MAIN BATTERY CABLE NO. 2. IF NECESSARY, REPLACE HV BATTERY OR SYSTEM MAIN RELAY**

OK

cardiagn.com

9	INSPECT FRAME WIRE





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Disconnect the frame wire from the w/ converter inverter.
(b) Check that the frame wire has been disconnected from the system main relay.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the frame wire and body ground.
Standard:

Tester Connection	Specified Condition
A – Body ground	10 MΩ or higher
B – Body ground	10 MΩ or higher

(d) Check the resistance between the terminals of the frame wire.
Standard:

Tester Connection	Specified Condition
A – C	Below 1 Ω
B – D	Below 1 Ω

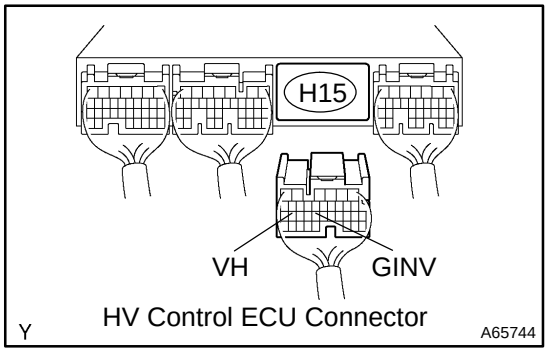
(e) Reinstall the HV battery assembly (see page 21–54).
(f) Reconnect the frame wire.

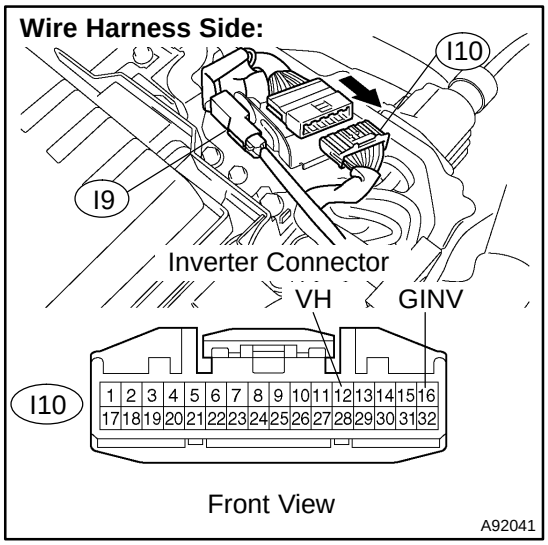
NG → **REPLACE FRAME WIRE**

OK

cardiagn.com

10	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H15 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(g) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
VH (H15–26) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(h) Turn the power switch OFF.
(i) Check the resistance between the wire harness side connectors.

Standard (Check for short):

Tester Connection	Specified Condition
VH (H15–26) or VH (I10–12) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

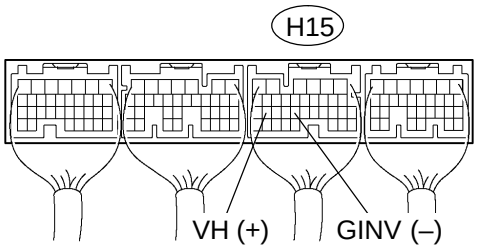
(j) Reconnect the inverter connector.
(k) Reconnect the HV control ECU connector.
(l) Reinstall the inverter cover (see page 21–23).
(m) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

11	INSPECT HYBRID VEHICLE CONTROL ECU(VH VOLTAGE)



HV Control ECU Connector
A18294

(a) Turn the power switch ON (READY).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(b) Measure the voltage between the terminals of the H15 HV control ECU connector.

Standard:

Tester Connection	Specified Condition
VH (H15–26) – GINV (H15–23)	1.6 to 3.8 V

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P3004/133	HIGH VOLTAGE POWER RESOURCE MALFUNCTION

CIRCUIT DESCRIPTION

The HV control ECU gives warning to the driver and performs the fail–safe control, according to the abnormal signal received from the battery ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3004	133	Abnormal signal input from battery ECU	• HV battery system • Battery ECU

INSPECTION PROCEDURE

1	READ OUTPUT DTC(HV BATTERY)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV BATTERY / DTC INFO / TROUBLE CODES.
(e) Read DTCs.
Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–893)**

NO

REPLACE BATTERY ECU ASSY (See page 21–98)

cardiagn.com

DTC	P3009/526	HIGH VOLTAGE POWER SHORT CIRCUIT

DTC	P3009/611	HIGH VOLTAGE POWER SHORT CIRCUIT

DTC	P3009/612	HIGH VOLTAGE POWER SHORT CIRCUIT

DTC	P3009/613	HIGH VOLTAGE POWER SHORT CIRCUIT

DTC	P3009/614	HIGH VOLTAGE POWER SHORT CIRCUIT

CIRCUIT DESCRIPTION

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3009	526 *1	Insulation resistance of high voltage circuit and body is low	• Frame wire • System main relay • System main resistor • HV battery assembly • w/ motor compressor assembly • Battery ECU • HV transaxle assembly • w/ converter inverter assembly • Main battery cable • Main battery cable No. 2 • Battery plug • Frame wire No. 2 • Junction block assembly
P3009	611 *2	Insulation resistance of A/C compressor motor or A/C inverter is low	• w/ motor compressor assembly • w/ converter inverter assembly
P3009	612 *2	Insulation resistance of HV battery, battery ECU, system main relay, or system main resistor is low	• HV battery assembly • Battery ECU • System main relay • System main resistor • Main battery cable • Main battery cable No. 2 • Battery plug • Frame wire No. 2 • Junction block assembly
P3009	613 *2	Insulation resistance of HV transaxle or motor and generator inverters is low	• HV transaxle assembly • w/ converter inverter assembly
P3009	614 *2	Insulation resistance of motor and generator inverters, A/C inverter, system main relay, system main resistor, or frame wire is low	• Frame wire • System main relay • System main resistor • HV battery assembly • w/ converter inverter assembly • Main battery cable • Main battery cable No. 2 • Battery plug • Frame wire No. 2 • Junction block assembly

HINT:

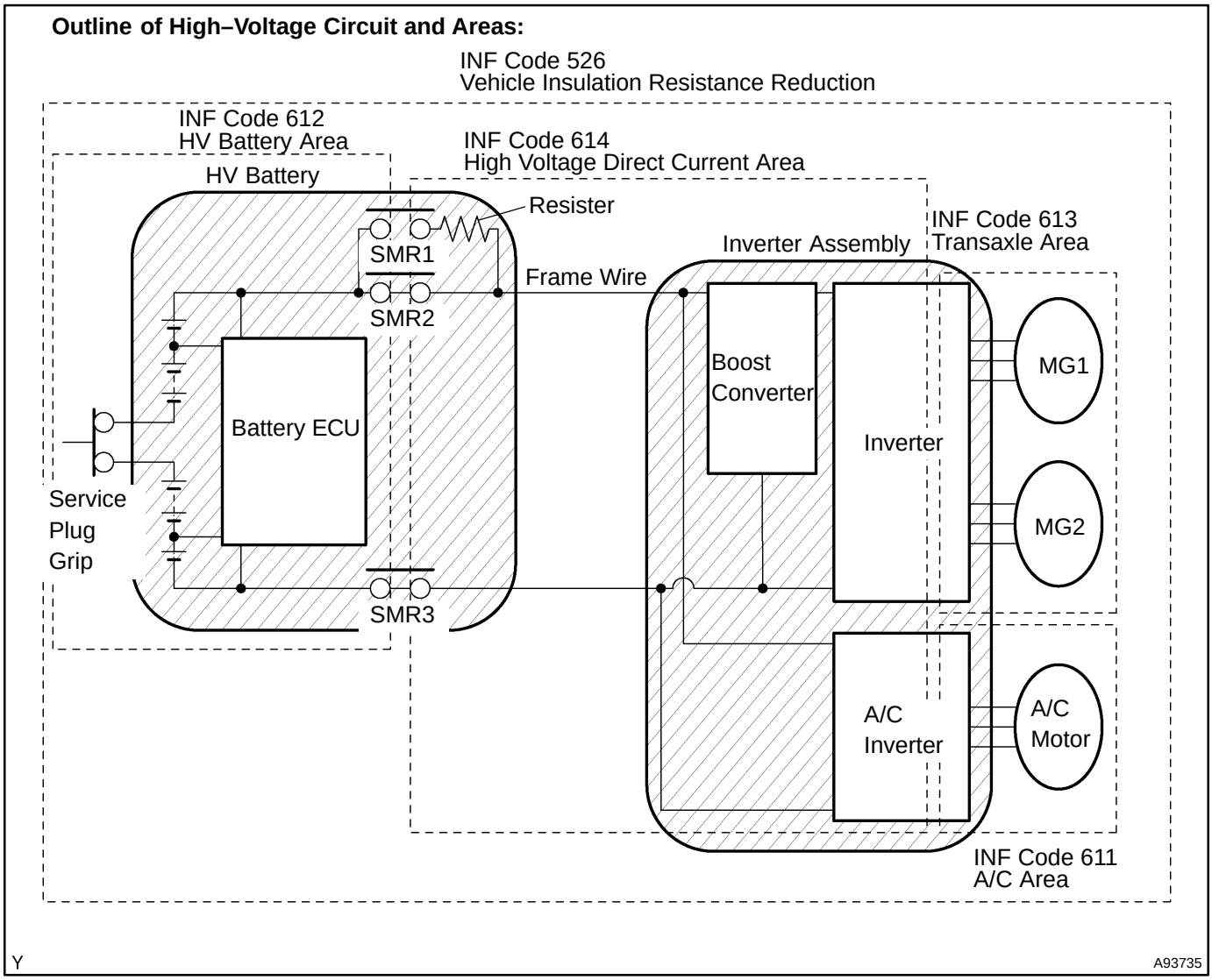
*1: Stored simultaneously when DTC P3009 is set.

*2: Stored when a malfunction area has been identified.

cardiagn.com

WIRING DIAGRAM

Outline of High–Voltage Circuit and Areas:



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

cardiagn.com

1	READ OUTPUT DTC(HV ECU)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result:

Display (DTC Output)	Proceed to
DTC P3009	A
DTCs P3009 and P0A1D (HV control ECU malfunction)	B
DTCs P3009 and P0A1F (Battery ECU malfunction)	C
DTCs P3009 and P0A78 or P0A7A (Inverter system malfunction)	D

B → **GO TO DTC CHART (See page 05–440). FIND DTC P0A1D TO PROCEED TO ITS TROUBLE-SHOOTING FLOWCHART**

C → **GO TO DTC CHART (See page 05–440). FIND DTC P0A1F TO PROCEED TO ITS TROUBLE-SHOOTING FLOWCHART**

D → **GO TO DTC CHART (See page 05–440). FIND DTC P0A78 OR P0A7A TO PROCEED TO ITS TROUBLESHOOTING FLOWCHART**

A

2	READ OUTPUT INF CODE

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Display the freeze frame data for DTC P3009 and check its information (INF) code.

Result:

Display (INF Code Output)	Proceed to
Only 526 (Insulation resistance of high voltage circuit and body is low)	A
526 and 611 (Insulation resistance of A/C area is low)	B
526 and 612 (Insulation resistance of HV battery area is low)	C
526 and 613 (Insulation resistance of transaxle area is low)	D
526 and 614 (Insulation resistance of high voltage direct current area is low)	E

cardiagn.com

B	Go to step 18
C	Go to step 5
D	Go to step 20
E	Go to step 21

A

3	CHECK W/MOTOR COMPRESSOR ASSY

CAUTION:
Wear insulated gloves before performing the following operation.

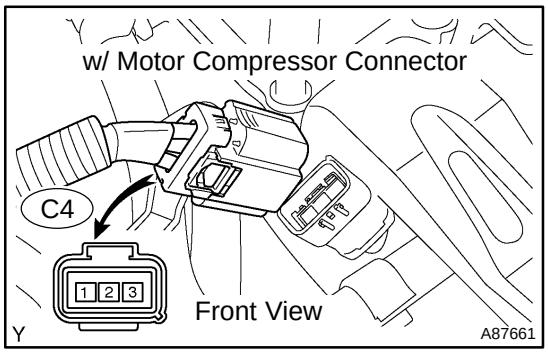
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the C4 w/ motor compressor connector.
(d) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the w/ motor compressor connector and the body ground.

Standard:

Tester Connection	Specified Condition
C4–1 – Body ground	3.0 MΩ or higher
C4–2 – Body ground	3.0 MΩ or higher
C4–3 – Body ground	3.0 MΩ or higher

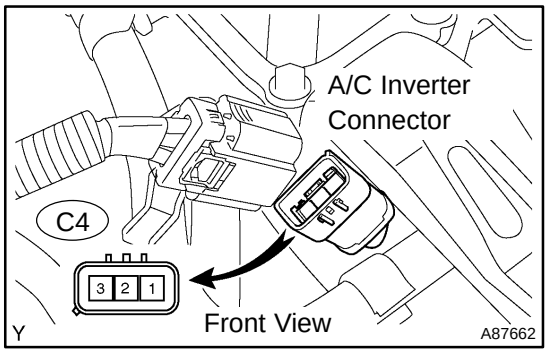


NG	REPLACE W/MOTOR COMPRESSOR ASSY (See page 55–34)

OK

cardiagn.com

4	CHECK INSULATION RESISTANCE(INVERTER, TRANSAXLE AND FRAME WIRE)



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Check that the w/ motor compressor connector has been disconnected.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the A/C inverter connector and the body ground.

Standard:

Tester Connection	Specified Condition
C4–1 – Body ground	2.0 MΩ or higher
C4–2 – Body ground	2.0 MΩ or higher
C4–3 – Body ground	2.0 MΩ or higher

NG → **Go to step 15**

OK

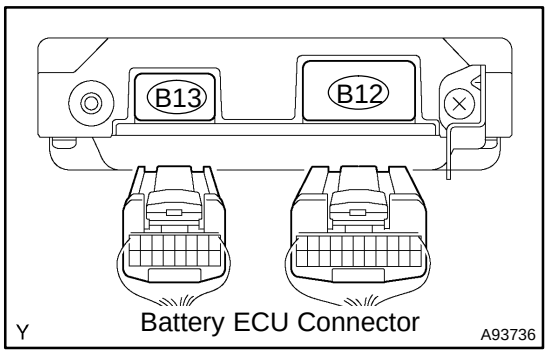
5	CHECK HV BATTERY AREA

CAUTION:
Wear insulated gloves before performing the following operation.

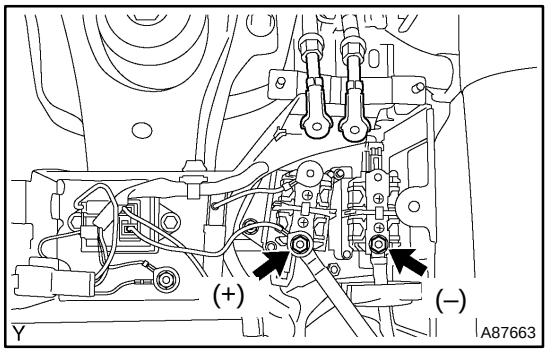
(a) Turn the power switch OFF.
(b) Check that the service plug grip has been detached. If not, remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

cardiagn.com



(c) Disconnect the B12 and B13 battery ECU connectors.
(d) Disconnect the main battery cables from the system main relays.
(e) Using a megohmmeter, check the insulation resistance between the positive terminal on the HV battery side of the system main relay and the body ground.
Standard: 10 MΩ or higher
(f) Using a megohmmeter, check the insulation resistance between the negative terminal on the HV battery side of the system main relay and the body ground.
Standard: 10 MΩ or higher



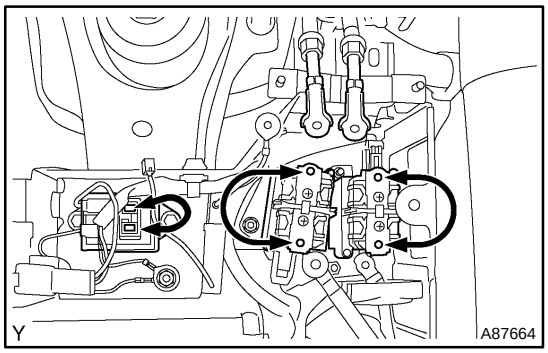
NG → **Go to step 6**

OK

REPLACE BATTERY ECU ASSY (See page 21–98)

6 CHECK SYSTEM MAIN RELAYS FOR STICKING

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Check that the service plug grip has been detached.
(b) Disconnect all the high–voltage terminals of the system main relays.
(c) Check the resistance at the switch side of the system main relays.
Standard: Below 1 Ω



NG → **GO TO STEP 4 AFTER REPLACE STUCK SYSTEM MAIN RELAY**

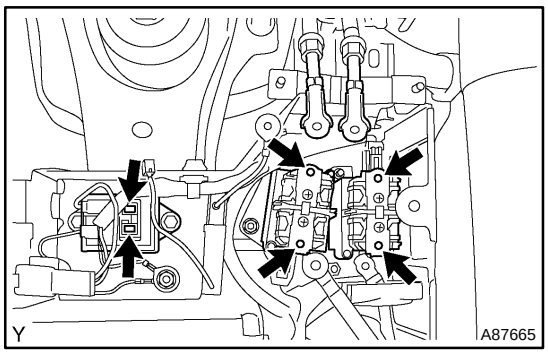
OK

cardiagn.com

7	CHECK SYSTEM MAIN RELAYS FOR INSULATION

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Check that all the high–voltage terminals of the system main relays have been disconnected.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the system main relays and the body ground.
Standard: 10 MΩ or higher



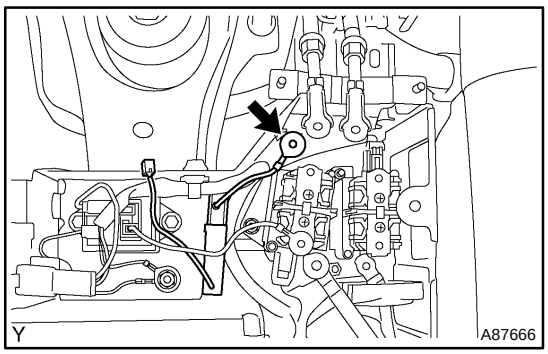
NG	REPLACE SYSTEM MAIN RELAY WITH REDUCED INSULATION RESISTANCE

OK

8	CHECK SYSTEM MAIN RESISTOR FOR INSULATION

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Check that both terminals of the system main resistor have been disconnected.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminal of the system main resistor and the body ground.
Standard: 10 MΩ or higher

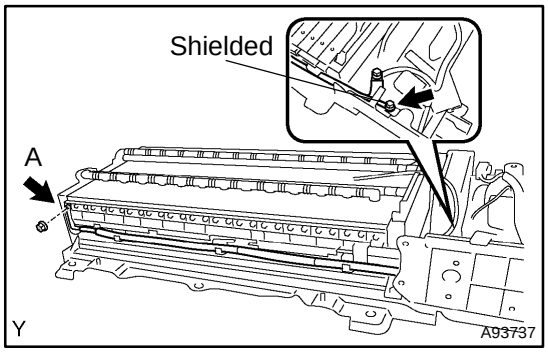


NG	REPLACE SYSTEM MAIN RESISTOR

OK

cardiagn.com

9	INSPECT MAIN BATTERY CABLE



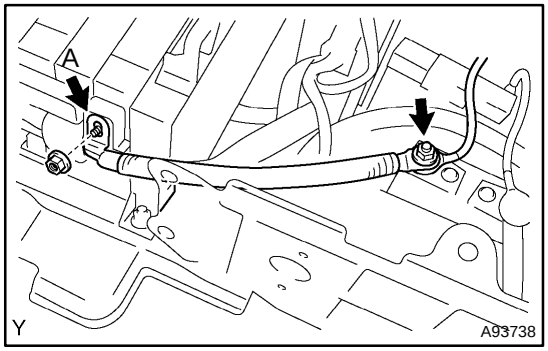
CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Remove the HV battery assembly (see page 21–54).
(b) Remove the battery cover (see page 21–54).
(c) Check if the main battery cable cover is not damaged or internal electrical leads are not in contact with the battery case or body.
OK: Electrical leads are not in contact with the battery case or body
(d) Remove the terminal (A in the illustration) on the battery module side of the main battery cable only.
(e) Using a megohmmeter, check the insulation resistance between each terminal of the main battery cable and shield ground.
Standard: 10 MΩ or higher

NG	REPLACE MAIN BATTERY CABLE

OK

10	INSPECT MAIN BATTERY CABLE NO.2



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

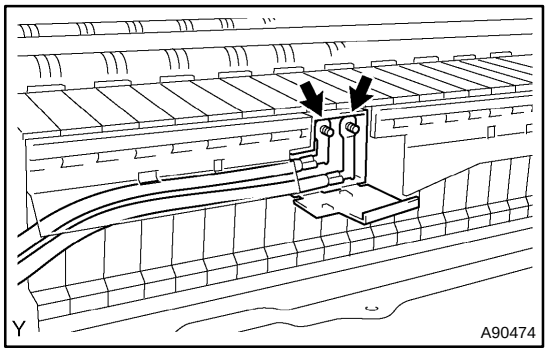
(a) Following the previous step, check if the main battery cable No. 2 cover is not damaged or internal electrical leads are not in contact with the battery case or body.
OK: Electrical leads are not in contact with the battery case or body
(b) Remove the terminal (A in illustration) on the battery module side of the main battery cable No. 2 only.
(c) Using a megohmmeter, check the insulation resistance between each terminal of the main battery cable No. 2 and shield ground.
Standard: 10 MΩ or higher

NG	REPLACE MAIN BATTERY CABLE NO.2

OK

cardiagn.com

11	INSPECT BATTERY PLUG



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, disconnect only the connecting terminal of the battery plug.

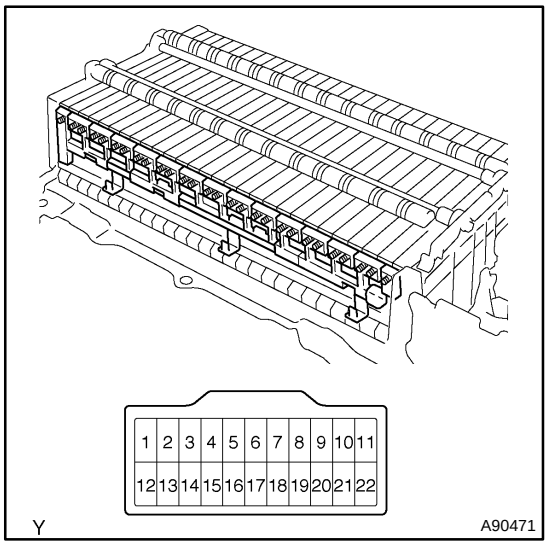
NOTICE:
Do not reinstall the service plug grip.

(b) Using a megohmmeter, check the insulation resistance between each terminal of the battery plug wire harness and body ground.
Standard: 10 MΩ or higher

NG	REPLACE BATTERY PLUG

OK

12	INSPECT FRAME WIRE NO.2



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, check if the frame wire No. 2 cover is not damaged or internal electrical leads are not in contact with the battery case or body.
OK: Electrical leads are not in contact with the battery case or body.

(b) Remove all the terminals on the battery module side of the frame wire No. 2.

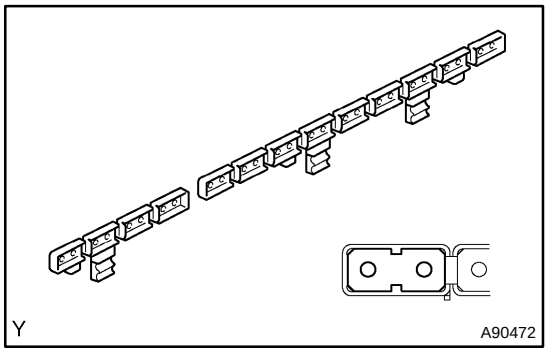
(c) Using a megohmmeter, check the insulation resistance between each terminal of the frame wire No. 2 connector and the battery case.
Standard: 10 MΩ or higher

NG	REPLACE FRAME WIRE NO.2

OK

cardiagn.com

13	INSPECT JUNCTION BLOCK ASSY



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

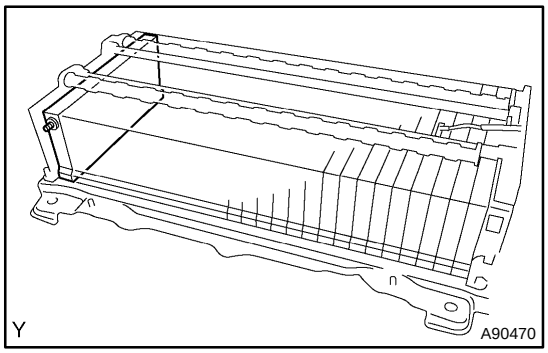
(a) Following the previous step, remove the junction block assembly.

(b) Visually check the junction block assembly for any damage.
OK: No crack or damage

NG → **REPLACE JUNCTION BLOCK ASSY**

OK

14	INSPECT HV BATTERY ASSY



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, check the insulation resistance between each terminal (either the positive and negative side) of each battery module of the HV battery assembly and the battery case using a megohmmeter.
Standard: Some of the battery modules have continuity of below 10 MΩ

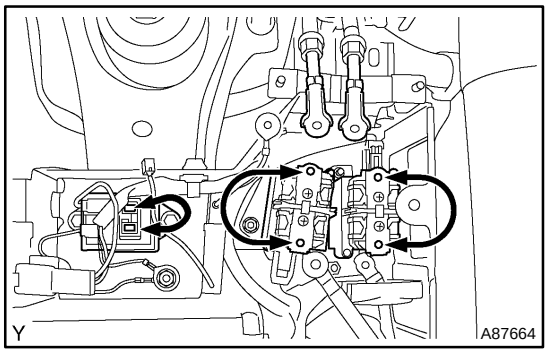
NG → **REPLACE BATTERY ECU ASSY (See page 21–98)**

OK

REPLACE HV SUPPLY BATTERY ASSY (See page 21–54)

cardiagn.com

15	CHECK SYSTEM MAIN RELAYS FOR STICKING



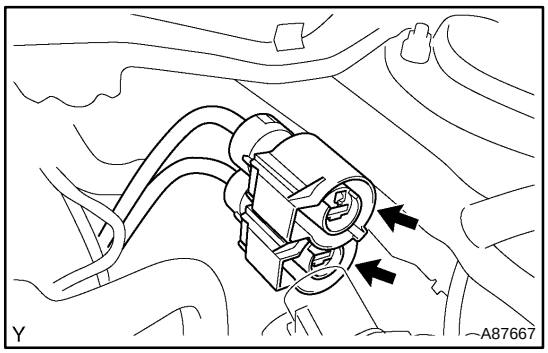
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Disconnect all the high–voltage terminals of the system main relays.
(c) Check the resistance at the switch side of the system main relays.
Standard: Below 1 Ω

NG → **GO TO STEP 4 AFTER REPLACE STUCK SYSTEM MAIN RELAY**

OK

16	CHECK FRAME WIRE FOR INSULATION



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Disconnect the frame wire from the inverter.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the frame wire and the body ground.
Standard: 10 MΩ or higher

NG → **REPLACE FRAME WIRE (See page 21–107)**

OK

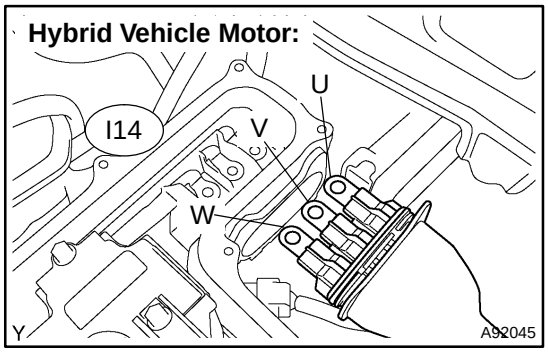
cardiagn.com

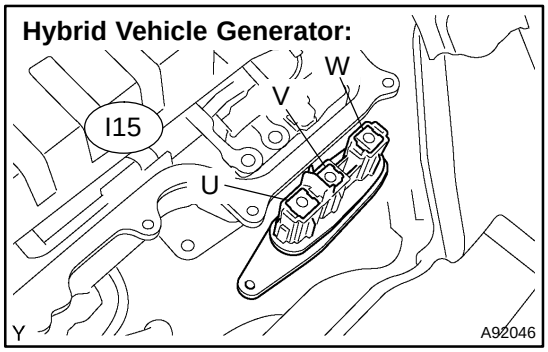
17	CHECK HV TRANSAXLE ASSY FOR INSULATION

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Remove the inverter cover (see page 21–23).
(c) Disconnect the three–phase alternating current cables for the motor and generator from the inverter.
(d) Using a megohmmeter, check the insulation resistance between the six terminals of the three–phase alternating current cables on the transaxle side and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher



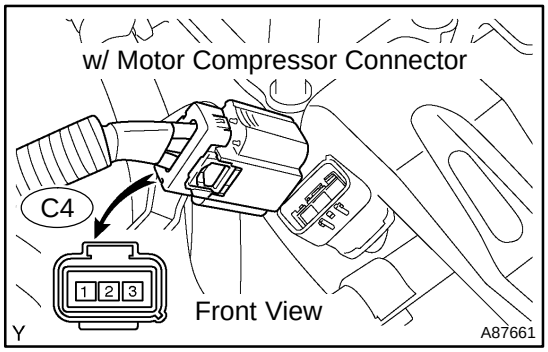


NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)**

OK → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

cardiagn.com

18 CHECK A/C AREA FOR INSULATION



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Disconnect the C4 w/ motor compressor connector.
(d) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the w/ motor compressor connector and the body ground.

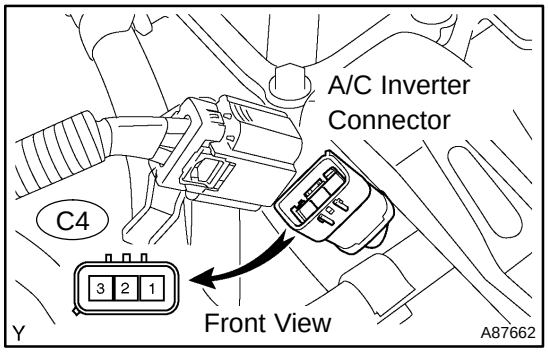
Standard:

Tester Connection	Specified Condition
C4–1 – Body ground	3.0 MΩ or more
C4–2 – Body ground	3.0 MΩ or more
C4–3 – Body ground	3.0 MΩ or more

NG → **REPLACE W/MOTOR COMPRESSOR ASSY (See page 55–34)**

OK

19 CHECK INVERTER FOR INSULATION



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Check that the w/ motor compressor connector has been disconnected.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the A/C inverter connector and the body ground.

Standard:

Tester Connection	Specified Condition
C4–1 – Body ground	2.0 MΩ or more
C4–2 – Body ground	2.0 MΩ or more
C4–3 – Body ground	2.0 MΩ or more

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE W/MOTOR COMPRESSOR ASSY (See page 55–34)

cardiagn.com

20	CHECK HV TRANSAXLE AREA FOR INSULATION

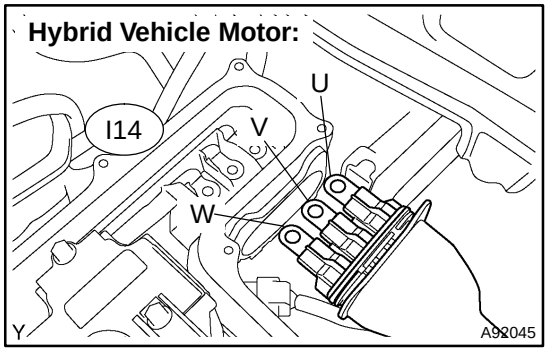
CAUTION:
Wear insulated gloves before performing the following operation.

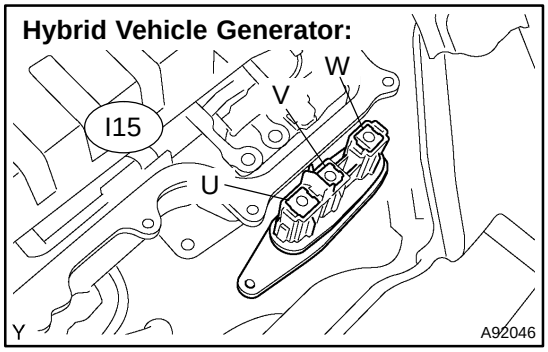
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the three–phase alternating current cables for the motor and generator from the inverter.
(e) Using a megohmmeter, check the insulation resistance between the six terminals of the three–phase alternating current cables on transaxle side and the body ground.
Standard:

Tester Connection	Specified Condition
U (I14–1) – Body ground	10 MΩ or higher
V (I14–2) – Body ground	10 MΩ or higher
W (I14–3) – Body ground	10 MΩ or higher
U (I15–1) – Body ground	10 MΩ or higher
V (I15–2) – Body ground	10 MΩ or higher
W (I15–3) – Body ground	10 MΩ or higher



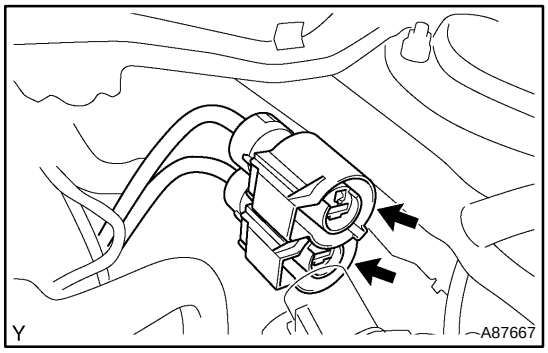


NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSY (See page 22–11)**

OK → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

cardiagn.com

21	CHECK HIGH VOLTAGE DIRECT CURRENT AREA FOR INSULATION



CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

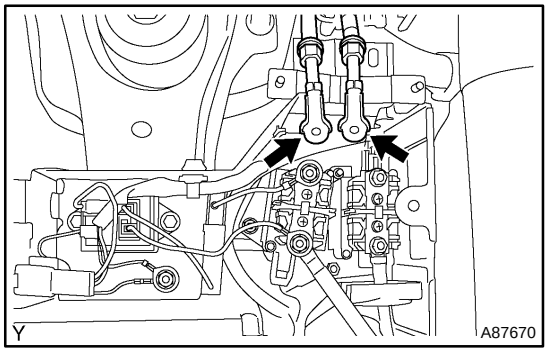
(c) Disconnect the frame wire from the inverter.
(d) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the frame wire and the body ground.
Standard: 10 MΩ or higher

NG	Go to step 22

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

22	CHECK FRAME WIRE FOR INSULATION



CAUTION:
Wear insulated gloves before performing the following operation.

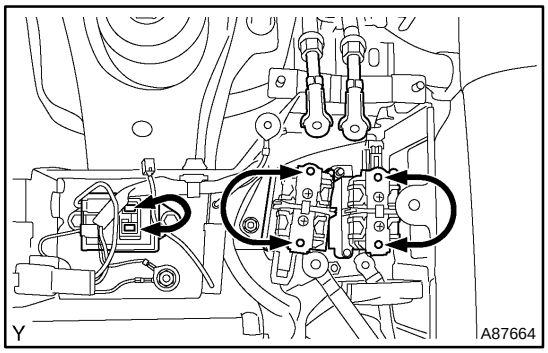
(a) Check that the service plug grip has been detached.
(b) Disconnect the frame wire from the system main relays.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the frame wire and the body ground.
Standard: 10 MΩ or higher

NG	REPLACE FRAME WIRE (See page 21–107)

OK

cardiagn.com

23	CHECK SYSTEM MAIN RELAYS FOR STICKING



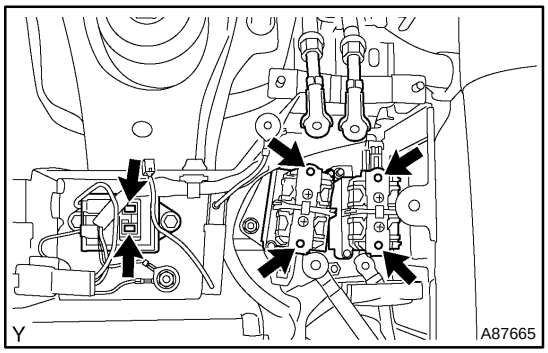
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Disconnect all the high–voltage terminals of the system main relays.
(c) Check the resistance at the switch side of the system main relays.
Standard: Below 1 Ω

NG → **GO TO STEP 4 AFTER REPLACE STUCK SYSTEM MAIN RELAY**

OK

24	CHECK SYSTEM MAIN RELAYS FOR INSULATION



CAUTION:
Wear insulated gloves before performing the following operation.

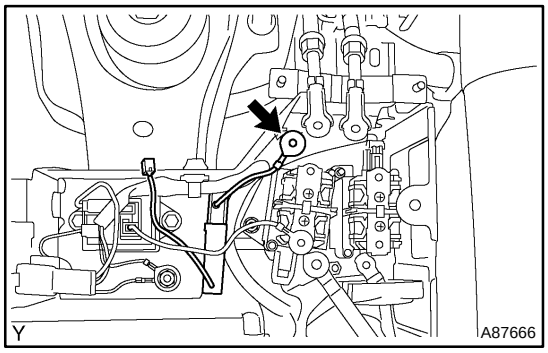
(a) Check that the service plug grip has been detached.
(b) Check that all the high–voltage terminals of the system main relays have been disconnected.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminals of the system main relays and the body ground.
Standard: 10 MΩ or higher

NG → **REPLACE SYSTEM MAIN RELAY WITH REDUCED INSULATION RESISTANCE**

OK

cardiagn.com

25	CHECK SYSTEM MAIN RESISTOR FOR INSULATION



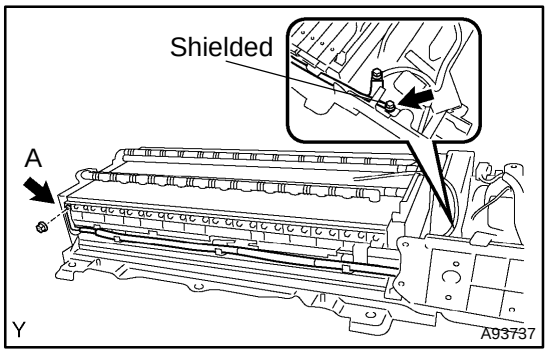
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip has been detached.
(b) Check that both terminals of the system main resistor have been disconnected.
(c) Using a megohmmeter, check the insulation resistance between the high–voltage terminal of the system main resistor and the body ground.
Standard: 10 MΩ or higher

NG → **REPLACE SYSTEM MAIN RESISTOR**

OK

26	INSPECT MAIN BATTERY CABLE



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

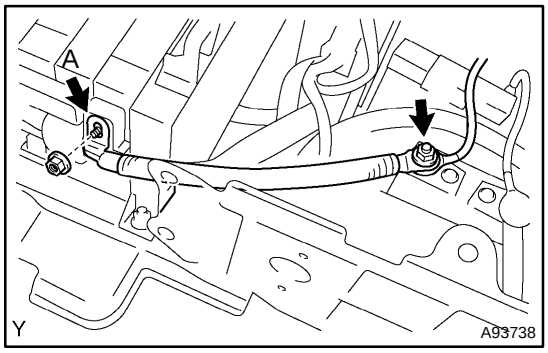
(a) Remove the HV battery assembly (see page 21–54).
(b) Remove the battery cover (see page 21–54).
(c) Check if the main battery cable cover is not damaged or internal electrical leads are not in contact with the battery case or body.
OK: Electrical leads are not in contact with the battery case or body
(d) Remove the terminal (A in the illustration) on the battery module side of the main battery cable only.
(e) Using a megohmmeter, check the insulation resistance between each terminal of the main battery cable and shield ground.
Standard: 10 MΩ or higher

NG → **REPLACE MAIN BATTERY CABLE**

OK

cardiagn.com

27	INSPECT MAIN BATTERY CABLE NO.2



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, check if the main battery cable No. 2 cover is not damaged or internal electrical leads are not in contact with the battery case or body.
OK: Electrical leads are not in contact with the battery case or body

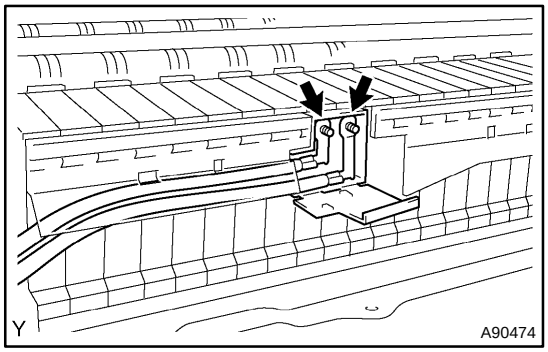
(b) Remove the terminal (A in illustration) on the battery module side of the main battery cable No. 2 only.

(c) Using a megohmmeter, check the insulation resistance between each terminal of the main battery cable No. 2 and shield ground.
Standard: 10 MΩ or higher

NG	REPLACE MAIN BATTERY CABLE NO.2

OK

28	INSPECT BATTERY PLUG



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, disconnect only the connecting terminal of the battery plug.

NOTICE:
Do not reinstall the service plug grip.

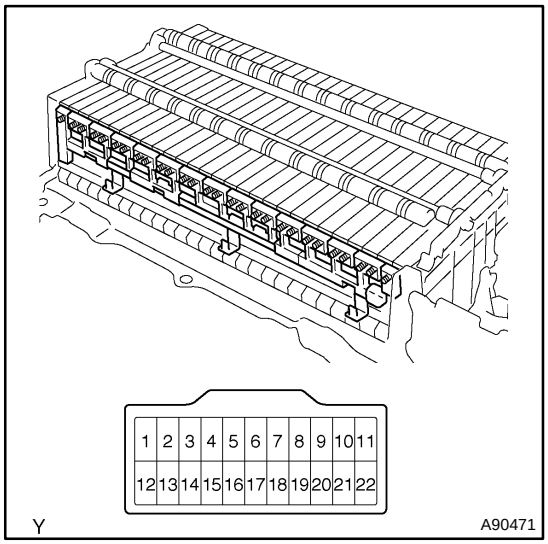
(b) Using a megohmmeter, check the insulation resistance between each terminal of the battery plug wire harness and body ground.
Standard: 10 MΩ or higher

NG	REPLACE BATTERY PLUG

OK

cardiagn.com

29	INSPECT FRAME WIRE NO.2



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, check if the frame wire No. 2 cover is not damaged or internal electrical leads are not in contact with the battery case or body.
OK: Electrical leads are not in contact with the battery case or body.

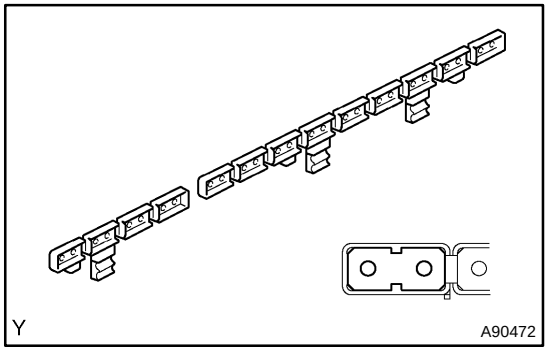
(b) Remove all the terminals on the battery module side of the frame wire No. 2.

(c) Using a megohmmeter, check the insulation resistance between each terminal of the frame wire No. 2 connector and the battery case.
Standard: 10 MΩ or higher

NG → **REPLACE FRAME WIRE NO.2**

OK

30	INSPECT JUNCTION BLOCK ASSY



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, remove the junction block assembly.

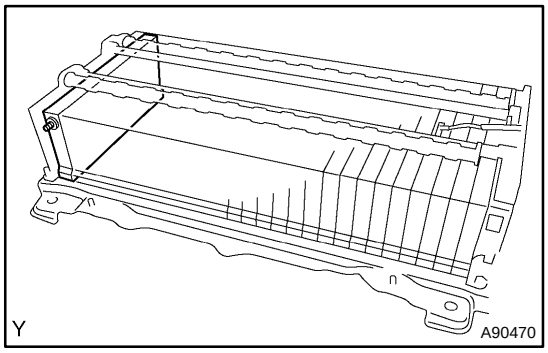
(b) Visually check the junction block assembly for any damage.
OK: No crack or damage

NG → **REPLACE JUNCTION BLOCK ASSY**

OK

cardiagn.com

31	INSPECT HV BATTERY ASSY



CAUTION:
Wear insulated gloves and goggles before performing the following operation.

(a) Following the previous step, check the insulation resistance between each terminal (either the positive and negative side) of each battery module of the HV battery assembly and the battery case using a megohmmeter.
Standard: Some of the battery modules have continuity of below 10 MΩ

NG → **REPLACE BATTERY ECU ASSY (See page 21–98)**

OK

REPLACE HV SUPPLY BATTERY ASSY (See page 21–54)

cardiagn.com

DTC	P3102/524	TRANSMISSION CONTROL ECU MALFUNCTION

DTC	P3102/525	TRANSMISSION CONTROL ECU MALFUNCTION

DTC	P3102/581	TRANSMISSION CONTROL ECU MALFUNCTION

DTC	P3102/582	TRANSMISSION CONTROL ECU MALFUNCTION

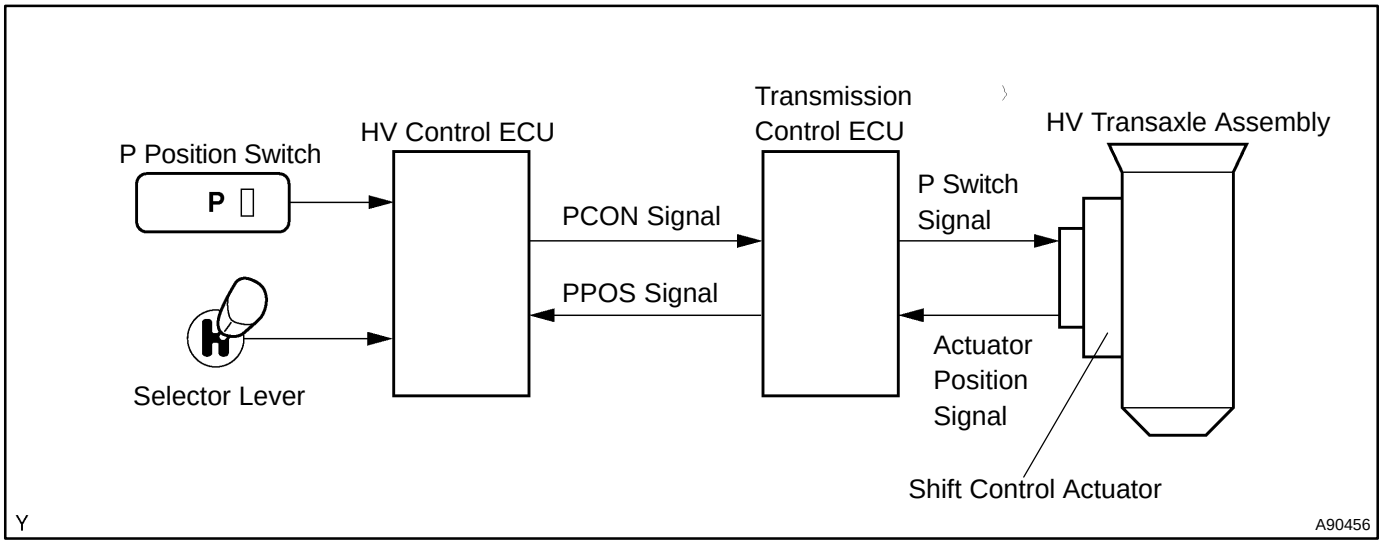
DTC	P3102/597	TRANSMISSION CONTROL ECU MALFUNCTION

DTC	P3102/598	TRANSMISSION CONTROL ECU MALFUNCTION

DTC	P3102/599	TRANSMISSION CONTROL ECU MALFUNCTION

CIRCUIT DESCRIPTION

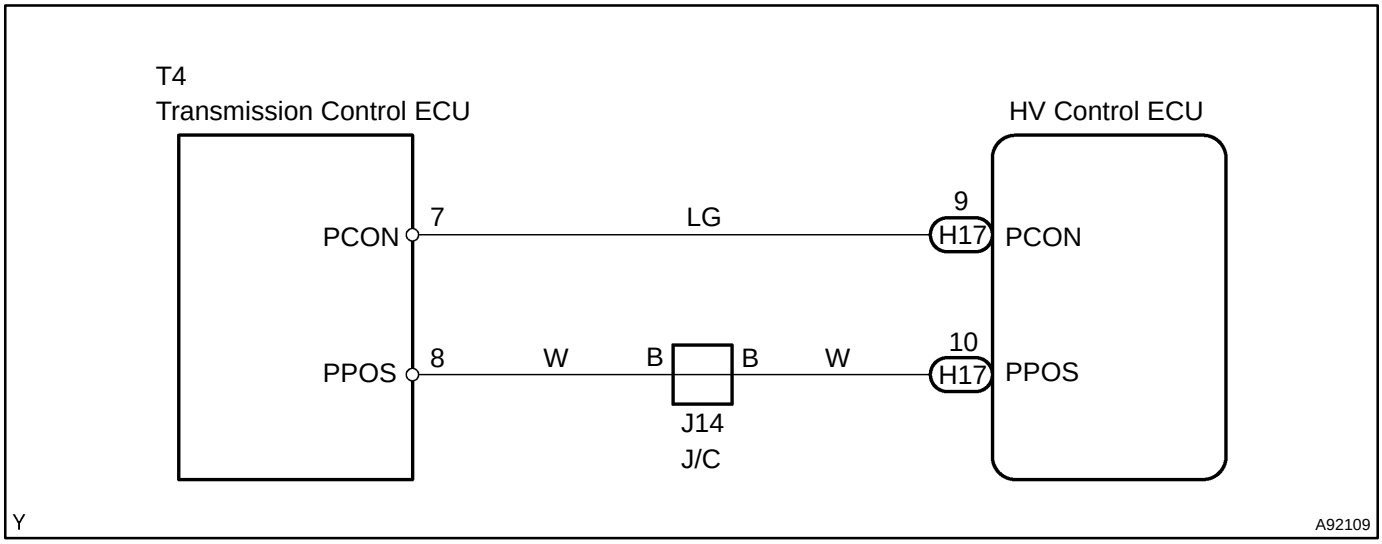
When a signal is input from the P position switch or selector lever, the HV control ECU transmits a P position control (PCON) signal to the transmission control ECU. Based on this signal, the transmission control ECU actuates the shift control actuator in order to mechanically lock or unlock the counter drive gear in the HV transaxle assembly. If the shift control actuator is in the P position, the transmission control ECU transmits a P position (PPOS) signal to the HV control ECU.



cardiagn.com

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3102	524	BEAN communication problem of transmission control ECU	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU
P3102	525	Transmission control ECU IG OFF command malfunction	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU
P3102	581	Transmission control ECU malfunction	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU
P3102	582	P position (PPOS) signal is logically inconsistent	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU
P3102	597	GND short in P position (PPOS) signal circuit	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU
P3102	598	+B short in P position (PPOS) signal circuit	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU
P3102	599	P position (PPOS) signal malfunction (output pulse is abnormal)	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU

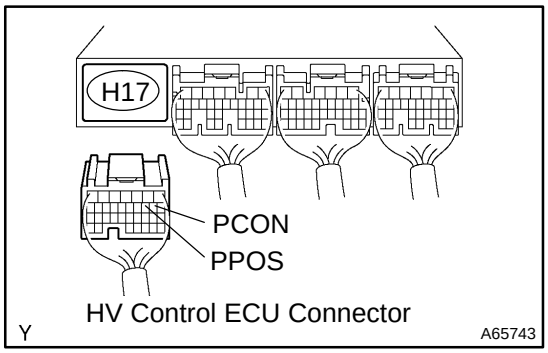
WIRING DIAGRAM

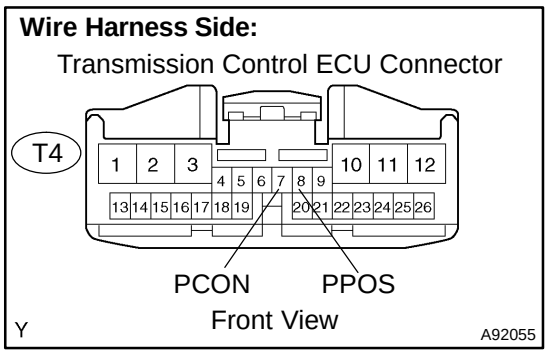


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – TRANSMISSION CONTROL ECU)





(a) Disconnect the H17 HV control ECU connector.
(b) Disconnect the T4 transmission control ECU connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
PCON (H17–9) – Body ground	Below 1 V
PPOS (H17–10) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
PCON (H17–9) – PCON (T4–7)	Below 1 Ω
PPOS (H17–10) – PPOS (T4–8)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
PCON (H17–9) or PCON (T4–7) – Body ground	10 kΩ or higher
PPOS (H17–10) or PPOS (T4–8) – Body ground	10 kΩ or higher

(g) Reconnect the transmission control ECU connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

2	READ OUTPUT DTC(P CTRL)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / P CTRL / DTC INFO / TROUBLE CODES.
(e) Read DTCs.

Result: DTCs are output

YES → **GO TO RELEVANT DTC CHART (See page 05–1159)**

NO

REPLACE HV CONTROL ECU, TRANSMISSION CONTROL ECU AND POWER SOURCE CONTROL ECU

cardiagn.com

DTC	P3107/213	LOST COMMUNICATION WITH AIRBAG SYSTEM CONTROL MODULE

DTC	P3107/214	LOST COMMUNICATION WITH AIRBAG SYSTEM CONTROL MODULE

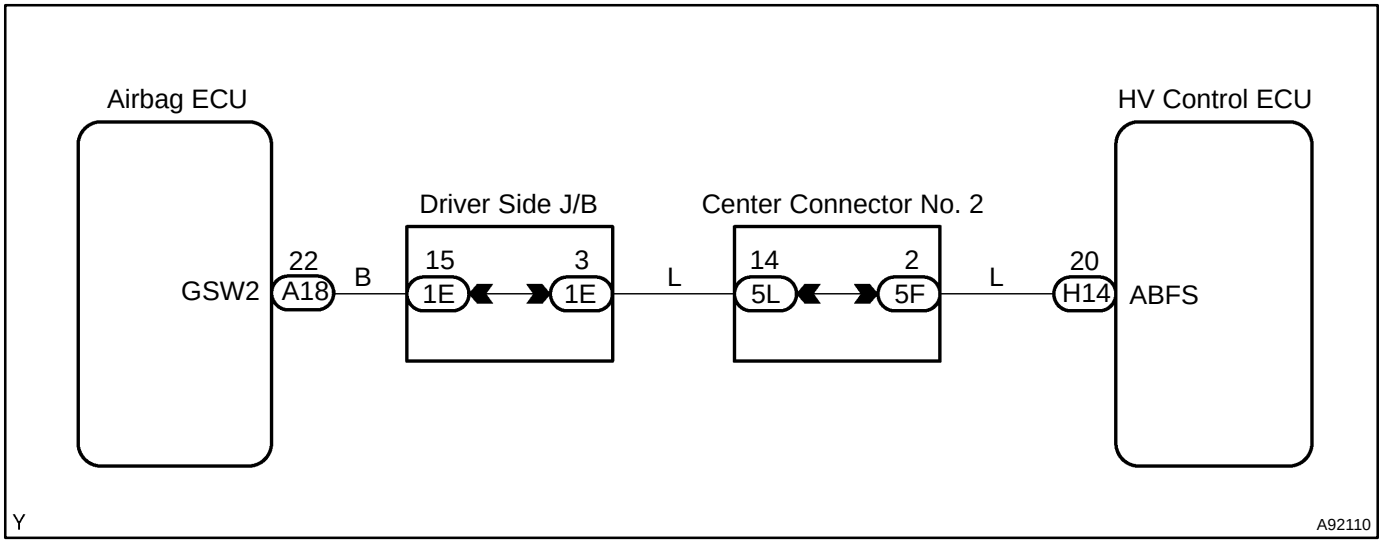
DTC	P3107/215	LOST COMMUNICATION WITH AIRBAG SYSTEM CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU detects a malfunction of the collision signal circuit from the airbag ECU and gives warning to the driver.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3107	213	GND short in communication circuit between airbag ECU and HV control ECU	• Wire harness or connector • Airbag ECU
P3107	214	Open or +B short in communication circuit between airbag ECU and HV control ECU	• Wire harness or connector • Airbag ECU
P3107	215	Abnormal communication signals between airbag ECU and HV control ECU	• Wire harness or connector • Airbag ECU

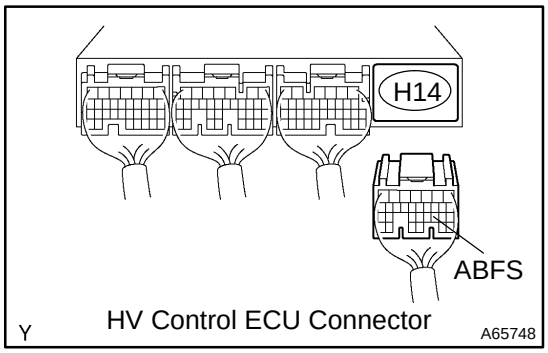
WIRING DIAGRAM

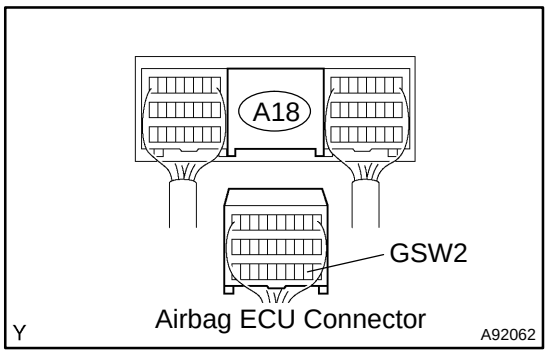


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – AIRBAG ECU)





(a) Disconnect the H14 HV control ECU connector.
(b) Disconnect the A18 airbag ECU connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminal of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
ABFS (H14–20) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
ABFS (H14–20) – GSW2 (A18–22)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
ABFS (H14–20) or GSW2 (A18–22) – Body ground	10 kΩ or higher

(g) Reconnect the airbag ECU connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE AIR BAG ECU ASSY (See page 60–54)

cardiagn.com

DTC	P3108/535	LOST COMMUNICATION WITH A/C SYSTEM CONTROL MODULE

DTC	P3108/536	LOST COMMUNICATION WITH A/C SYSTEM CONTROL MODULE

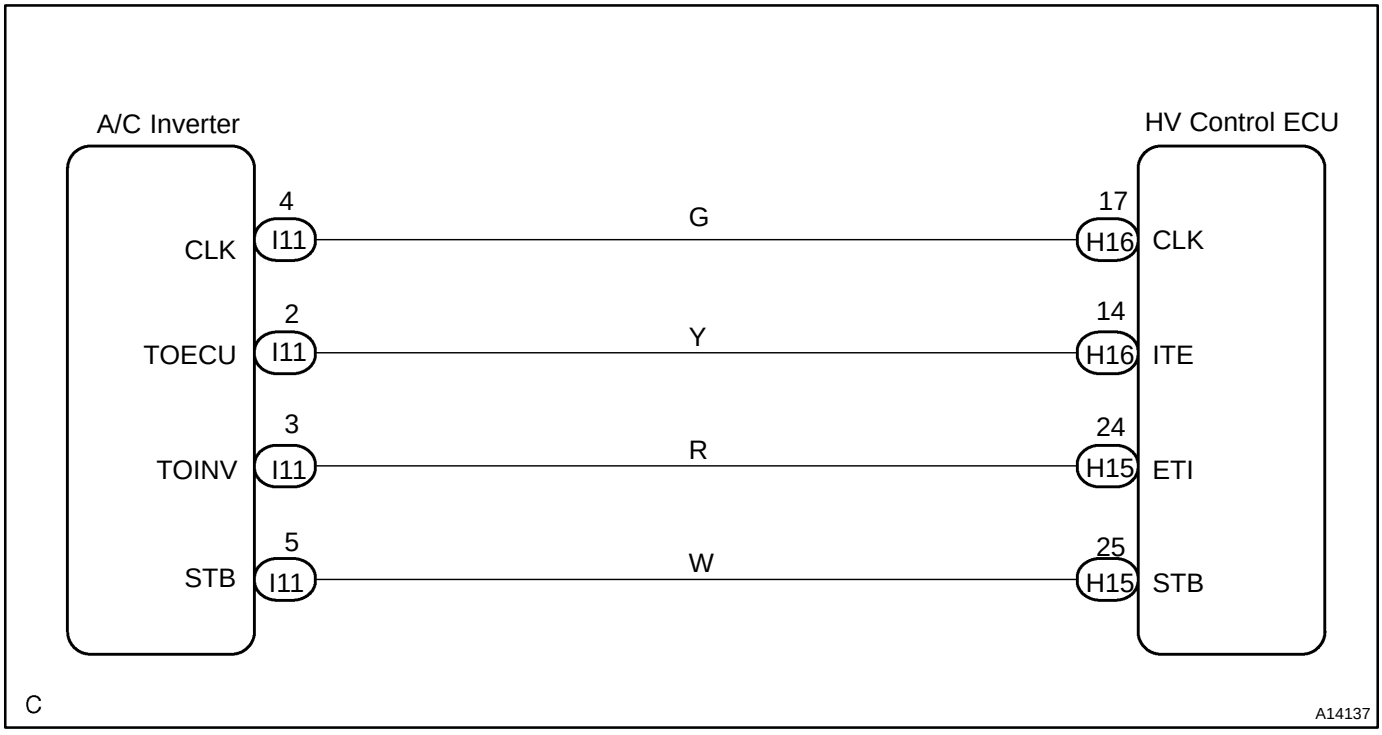
DTC	P3108/538	LOST COMMUNICATION WITH A/C SYSTEM CONTROL MODULE

CIRCUIT DESCRIPTION

The HV control ECU detects a wiring malfunction in the serial communication line of the A/C inverter.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3108	535	Serial communication malfunction	• Wire harness or connector • w/ converter inverter assembly
P3108	536	A/C inverter malfunction	• Wire harness or connector • w/ converter inverter assembly
P3108	538	Open in STB signal circuit	• Wire harness or connector • w/ converter inverter assembly

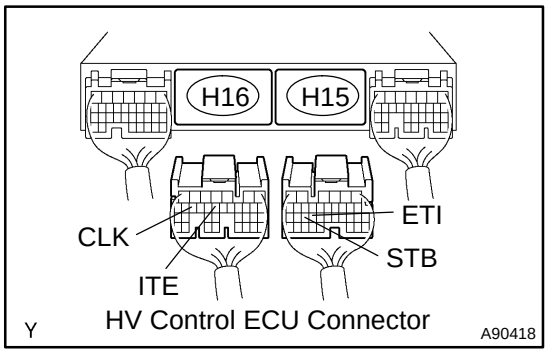
WIRING DIAGRAM

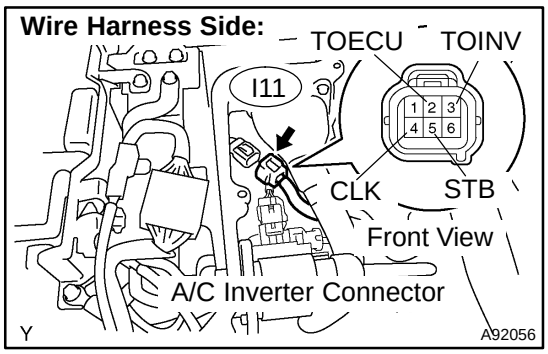


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – A/C INVERTER)





(a) Disconnect the H15 and H16 HV control ECU connectors.
(b) Disconnect the I11 A/C inverter connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
CLK (H16–17) – Body ground	Below 1 V
ITE (H16–14) – Body ground	Below 1 V
ETI (H15–24) – Body ground	Below 1 V
STB (H15–25) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
CLK (H16–17) – CLK (I11–4)	Below 1 Ω
ITE (H16–14) – TOECU (I11–2)	Below 1 Ω
ETI (H15–24) – TOINV (I11–3)	Below 1 Ω
STB (H15–25) – STB (I11–5)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CLK (H16–17) or CLK (I11–4) – Body ground	10 kΩ or higher
ITE (H16–14) or TOECU (I11–2) – Body ground	10 kΩ or higher
ETI (H15–24) or TOINV (I11–3) – Body ground	10 kΩ or higher
STB (H15–25) or STB (I11–5) – Body ground	10 kΩ or higher

(g) Reconnect the A/C inverter connector.
(h) Reconnect the HV control ECU connectors.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P3108/537	LOST COMMUNICATION WITH A/C SYSTEM CONTROL MODULE

CIRCUIT DESCRIPTION

Refer to DTC 3108 (INF 535) on page 05–820.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3108	537	A/C amplifier malfunction	• A/C amplifier

INSPECTION PROCEDURE

If the information (INF) code is present, replace the A/C amplifier.

REPLACE A/C AMPLIFIER

cardiagn.com

DTC	P3108/594	LOST COMMUNICATION WITH A/C SYSTEM CONTROL MODULE

CIRCUIT DESCRIPTION

HINT:

DTC P3108 (INF 594) is one of the DTCs that indicate CAN communication malfunction.

Since the A/C amplifier is connected to BEAN (Body Electronics Area Network), the HV control ECU communicates with it using CAN (Controller Area Network) communication via the gateway ECU.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3108	594	CAN communication malfunction	• CAN communication system

INSPECTION PROCEDURE

1	READ OUTPUT DTC(CODES ALL)

(a) Connect the hand–held tester to the DLC3.

(b) Turn the power switch ON (IG).

(c) Turn the hand–held tester ON.

(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / CODES ALL.

(e) Read and record CAN communication malfunction DTCs.

HINT:

When DTCs other than CAN communication malfunction DTCs are output simultaneously, first correct the CAN communication problem, and then perform troubleshooting for other DTCs.

GO

GO TO CAN COMMUNICATION SYSTEM (See page 05–2602)

cardiagn.com

DTC	P3110/223	HV MAIN RELAY MALFUNCTION

DTC	P3110/527	HV MAIN RELAY MALFUNCTION

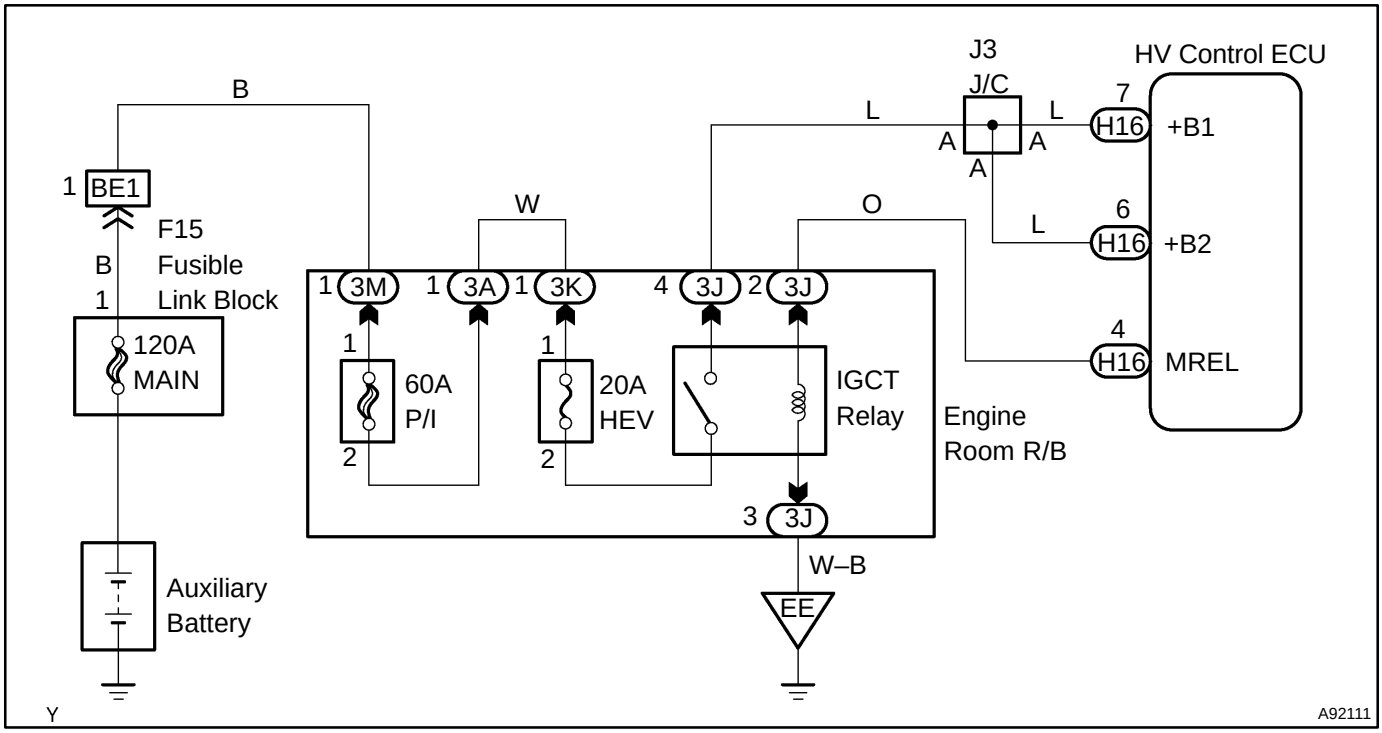
CIRCUIT DESCRIPTION

The HV control ECU monitors the IGCT relay and IG2 relay to detect malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3110	223	IGCT relay is always closed	• Wire harness or connector • Integration relay (IGCT relay)
P3110	527	IG2 logical inconsistency	• Wire harness or connector • Integration relay (IG2 relay)

WIRING DIAGRAM

Refer to the wiring diagram for the IG2 relay on page 05–525.



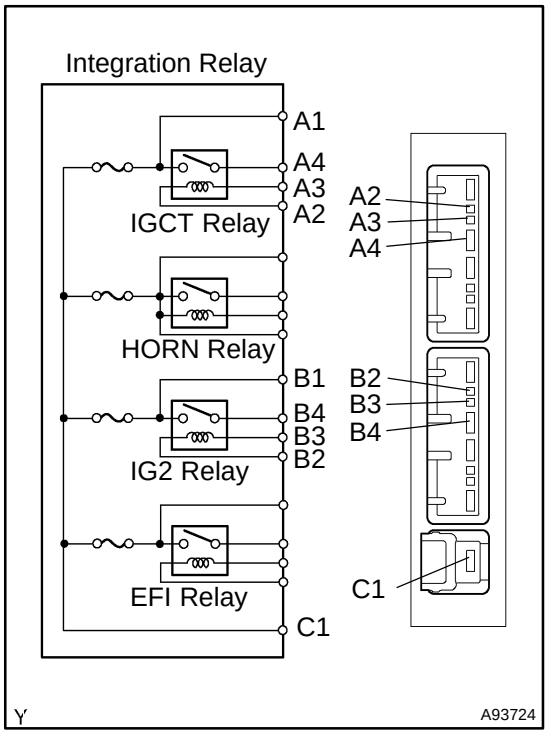
cardiagn.com

INSPECTION PROCEDURE

HINT:

If there is a battery voltage at the +B, MREL or IGSW terminal of the HV control ECU even though the power switch is turned OFF, the circuit is shorted to the +B power supply.

1	INSPECT INTEGRATION RELAY(IGCT RELAY AND IG2 RELAY)



(a) Remove the integration relay from the engine room R/B.

(b) Inspect the IGCT relay.

(1) Check the resistance between the terminals of the integration relay.

Standard:

Tester Connection	Specified Condition
A4 – C1	10 kΩ or higher
A4 – C1 (Apply battery voltage to terminals A2 and A3)	Below 1 Ω

(c) Inspect the IG2 relay.

(1) Check the resistance between the terminals of the integration relay.

Standard:

Tester Connection	Specified Condition
B4 – C1	10 kΩ or higher
B4 – C1 (Apply battery voltage to terminals B2 and B3)	Below 1 Ω

NG → **REPLACE INTEGRATION RELAY (IGCT RELAY OR IG2 RELAY)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR AFTER INSPECTION (HV CONTROL ECU – INTEGRATION RELAY)

cardiagn.com

DTC	P3137/348	COLLISION SENSOR LOW INPUT

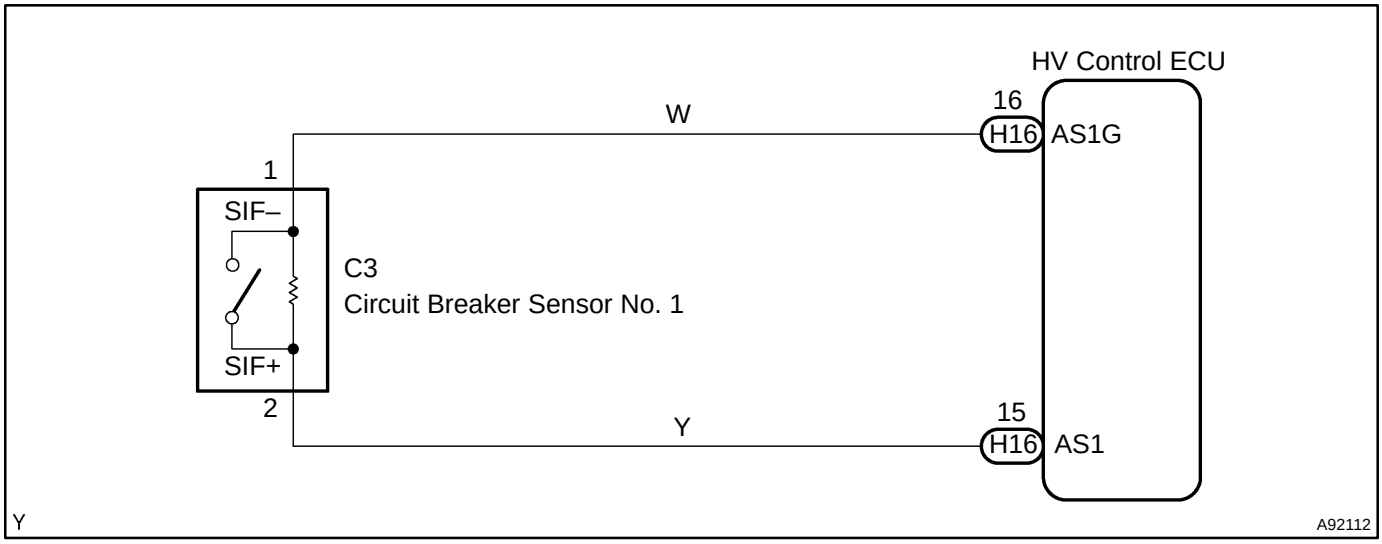
DTC	P3138/349	COLLISION SENSOR HIGH INPUT

CIRCUIT DESCRIPTION

The HV control ECU checks the line connection of the circuit breaker sensor (collision sensor) signal and gives warning to the driver if malfunction is detected.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3137	348	GND short in circuit breaker sensor No. 1 circuit	• Wire harness or connector • Circuit breaker sensor No. 1
P3138	349	Open or +B short in circuit breaker sensor No. 1 circuit	• Wire harness or connector • Circuit breaker sensor No. 1

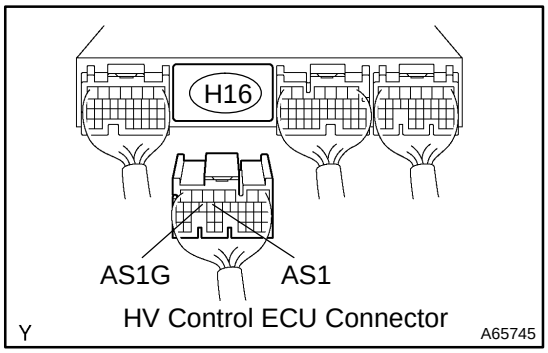
WIRING DIAGRAM

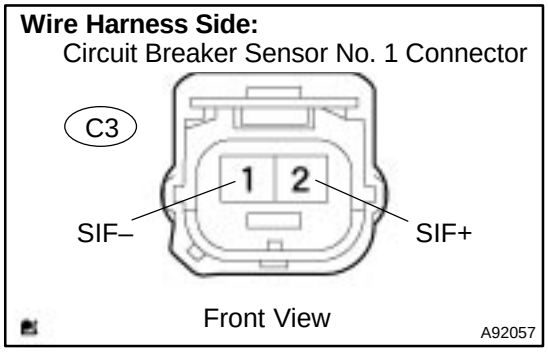


cardiagn.com

INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – CIRCUIT BREAKER SENSOR NO. 1)





(a) Disconnect the H16 HV control ECU connector.
(b) Disconnect the C3 circuit breaker sensor No. 1 connector.
(c) Turn the power switch ON (IG).
(d) Measure the voltage between the terminals of the HV control ECU connector and body ground.

Standard:

Tester Connection	Specified Condition
AS1 (H16–15) – Body ground	Below 1 V
AS1G (H16–16) – Body ground	Below 1 V

(e) Turn the power switch OFF.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
AS1 (H16–15) – SIF+ (C3–2)	Below 1 Ω
AS1G (H16–16) – SIF– (C3–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
AS1 (H16–15) or SIF+ (C3–2) – Body ground	10 kΩ or higher
AS1G (H16–16) or SIF– (C3–1) – Body ground	10 kΩ or higher

(g) Reconnect the circuit breaker sensor No. 1 connector.
(h) Reconnect the HV control ECU connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE CIRCUIT BREAKER SENSOR NO.1

cardiagn.com

DTC P3140/350 HV INTERLOCK SWITCH OPERATION

CIRCUIT DESCRIPTION

If the HV control ECU detects the operation of the safety devices (removal of the service plug grip and inverter cover) while the vehicle is stopped (vehicle speed below 3 mph [5 km/h]), it will shut down the system main relays. If the safety devices are correctly reinstalled, it will resume the normal operation after the power source is supplied again. If it does not, there is a possibility of an open circuit, so perform the same inspection as the DTC P3143 (INF 351).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3140	350	Operating safety devices with vehicle stopped (ILK signal is ON)	• Service plug grip installation • Inverter cover installation

INSPECTION PROCEDURE

1	CHECK SERVISE PLUG GRIP INSTALLATION

(a) Check that the service plug grip has been installed properly.
Standard: The service plug grip has been installed properly

NG → **CORRECTLY REINSTALL**

OK

2	CHECK INVERTER COVER INSTALLATION

(a) Check that the inverter cover has been installed properly.
Standard: The Inverter cover has been installed properly

NG → **CORRECTLY REINSTALL**

OK

GO TO DTC P3143/351 (See page 05–829)

cardiagn.com

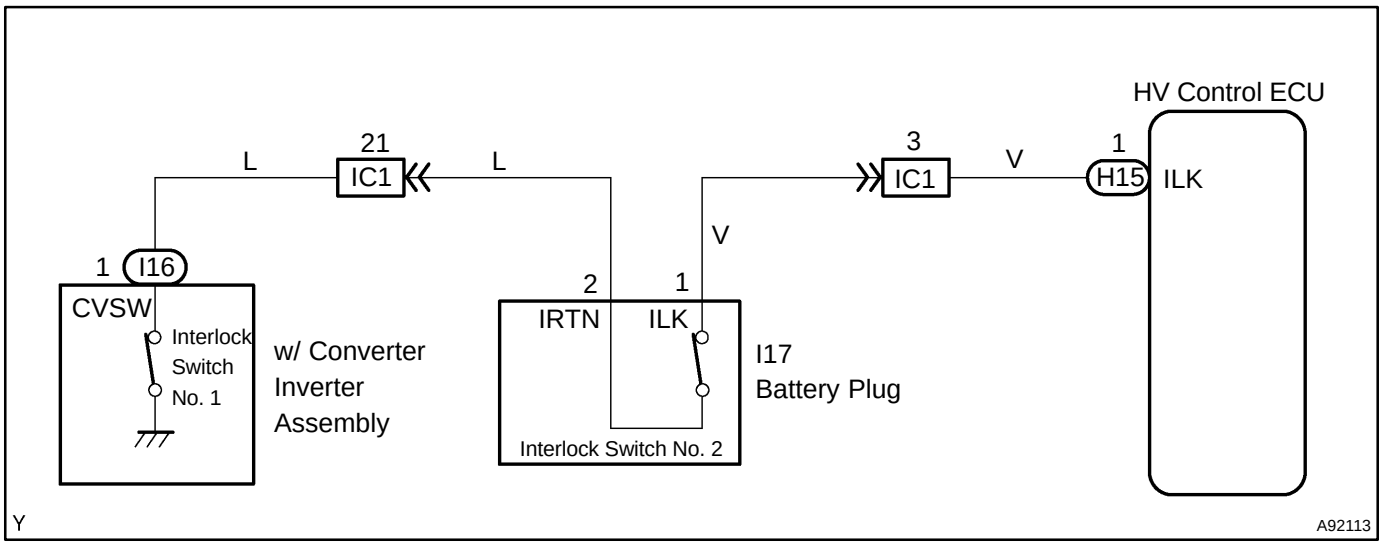
DTC P3143/351 HV INTERLOCK SWITCH OPEN/SHORT

CIRCUIT DESCRIPTION

A short pin for the interlock switch is provided on the service plug grip and the inverter cover. Therefore, the interlock signal line circuit opens when the service plug grip or the inverter cover is removed.
If the HV control ECU detects an open circuit in the interlock signal line while the vehicle is in motion (vehicle speed above 3 mph [5 km/h]), it stores the information (INF) code 351 in its memory and alerts the driver. While the vehicle is in motion, the HV control ECU will not shut down the high–voltage system even if an open circuit in the interlock system is detected.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3143	351	Open in interlock signal circuit while vehicle is running	• Wire harness or connector • Battery plug (interlock switch No. 2) • w/ converter inverter assembly (interlock switch No. 1)

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:
At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	CHECK INVERTER COVER INSTALLATION

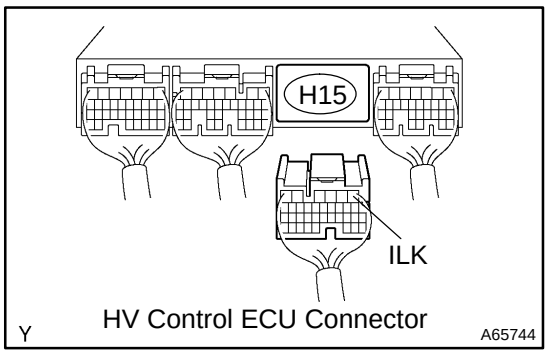
(a) Check that the inverter cover has been installed properly.
Standard: The inverter cover has been installed properly

NG → **CORRECTLY REINSTALL**

OK

cardiagn.com

2	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INTERLOCK SWITCH NO. 2)



(a) Disconnect the H15 HV control ECU connector.
(b) Disconnect the I17 interlock switch No. 2 connector.
(c) Check the resistance between the wire harness side connectors.

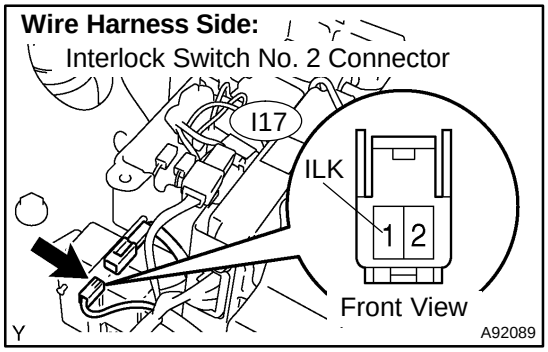
Standard (Check for open):

Tester Connection	Specified Condition
ILK (H15–1) – ILK (I17–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
ILK (H15–1) or ILK (I17–1) – Body ground	10 kΩ or higher

(d) Reconnect the interlock switch No. 2 connector.
(e) Reconnect the HV control ECU connector.



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK HARNESS AND CONNECTOR(INTERLOCK SWITCH NO. 1 – INTERLOCK SWITCH NO. 2)

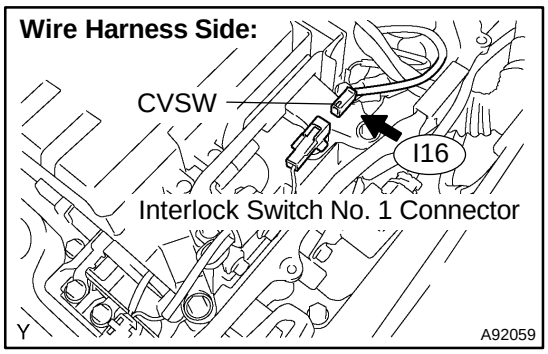
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).

cardiagn.com



(d) Disconnect the I16 interlock switch No. 1 connector.
(e) Disconnect the I17 interlock switch No. 2 connector.
(f) Check the resistance between the wire harness side connectors.

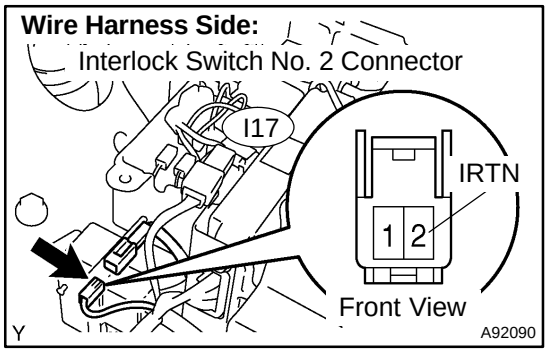
Standard (Check for open):

Tester Connection	Specified Condition
CVSW (I16–1) – IRTN (I17–2)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CVSW (I16–1) or IRTN (I17–2) – Body ground	10 kΩ or higher

(g) Reconnect the interlock switch No. 1 connector.
(h) Reconnect the interlock switch No. 2 connector.



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4 INSPECT W/CONVERTER INVERTER ASSY

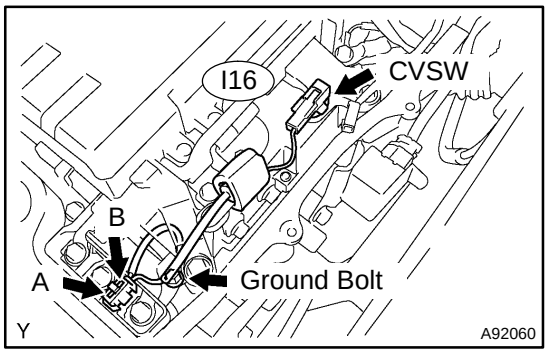
CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the I16 interlock switch No. 1 connector.
(c) Check that the ground bolt for the interlock switch is tightened to the specified torque.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)
(d) Connect terminals A and B as shown in the illustration.
(e) Check the resistance between the I16 interlock switch No. 1 connector and body ground.

Standard:

Tester Connection	Specified Condition
CVSW (I16–1) – Body ground	Below 1 V

(f) Reconnect the interlock switch No. 1 connector.
(g) Reinstall the inverter cover (see page 21–23).
(h) Reinstall the service plug grip (see page 21–116).



NG → **REPAIR WIRE HARNESS OR CONNECTOR, OR REPLACE W/ CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE BATTERY PLUG (See page 21–77)

cardiagn.com

DTC	P3211/276	DRIVE MOTOR ”A” INVERTER TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC	P3211/277	DRIVE MOTOR ”A” INVERTER TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P3212 (INF 275) on page 05–837.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3211	276	Sudden change in motor inverter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly
P3211	277	Motor inverter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly

WIRING DIAGRAM

Refer to DTC P3212 (INF 275) on page 05–837.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	CHECK QUANTITY OF HV COOLANT

(a) Check that there is a sufficient amount of coolant for the inverter.
OK: There is a sufficient amount of coolant for the inverter

NG → **ADD HV COOLANT (See page 22–4)**

OK

2	CHECK COOLANT HOSE

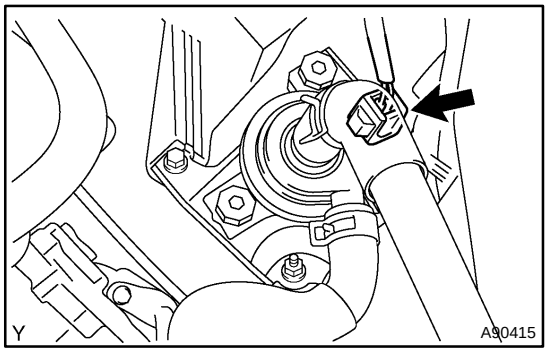
(a) Check that the hoses of the cooling system are not bent or clogged (see the cooling system on page 05–687).
OK: The hoses of the cooling system are not bent or clogged

cardiagn.com

NG → **CORRECT TO NORMAL CONDITION**

OK

3	CHECK CONNECTION CONDITION OF WATER PUMP CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the water pump connector.
OK: Connector has been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

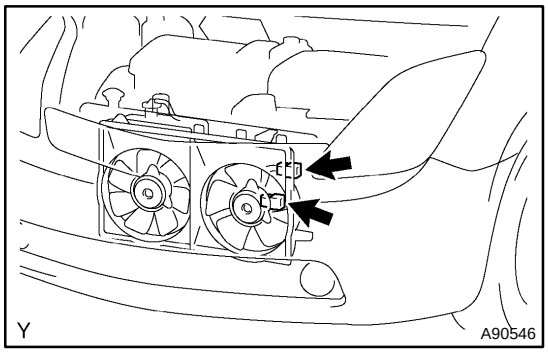
4	CHECK WATER W/MOTOR & BRACKET PUMP ASSY

(a) Turn the power switch ON (IG).
(b) Check the operation of the water pump.
OK: Coolant is sloshing in the reservoir tank

NG → **REPLACE WATER W/MOTOR & BRACKET PUMP ASSY**

OK

5	CHECK CONNECTION CONDITION OF COOLING FAN MOTOR CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the cooling fan motor connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

cardiagn.com

6	INSPECT COOLING FAN MOTOR (See page 16–8)

NG → REPLACE COOLING FAN MOTOR AND ADD ENGINE COOLANT

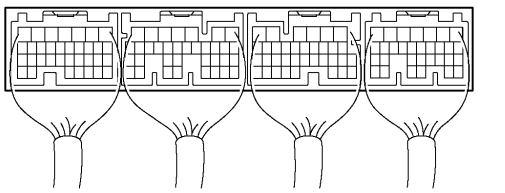
OK

7	INSPECT COOLING FAN MOTOR NO.2 (See page 16–8)

NG → REPLACE COOLING FAN MOTOR NO. 2 AND ADD ENGINE COOLANT

OK

8	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)


HV Control ECU Connector
A18294

(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

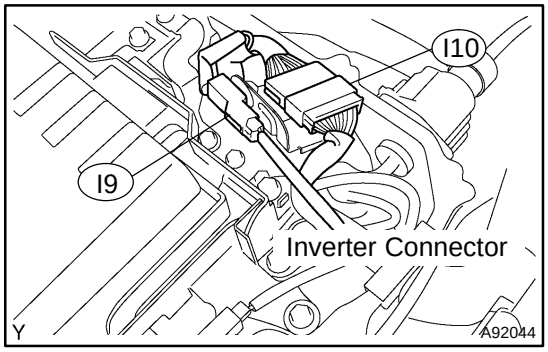
NG → CONNECT SECURELY

OK

9	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).

cardiagn.com

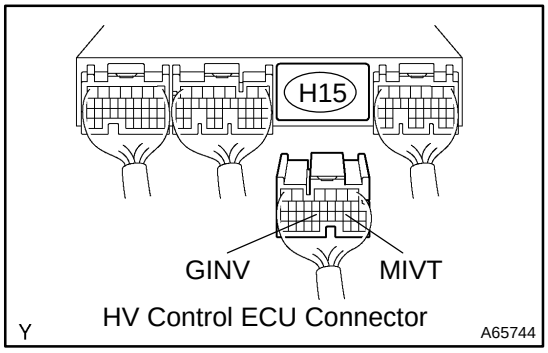


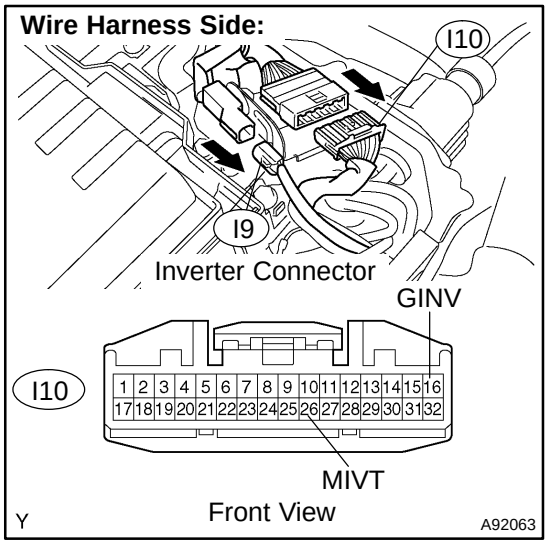
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

10	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the H15 HV control ECU connector.
(c) Disconnect the I9 and I10 inverter connectors.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Measure the voltage between the terminals of the HV control ECU connector and body ground.
Standard:

Tester Connection	Specified Condition
MIVT (H15–19) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(f) Turn the power switch OFF.
(g) Check the resistance between the wire harness side connectors.
Standard (Check for open):

Tester Connection	Specified Condition
MIVT (H15–19) – MIVT (I10–26)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
MIVT (H15–19) or MIVT (I10–26) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(h) Reconnect the inverter connectors.
(i) Reconnect the HV control ECU connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

cardiagn.com

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P3212/275	DRIVE MOTOR ”A” INVERTER TEMPERATURE SENSOR CIRCUIT HIGH/LOW

DTC	P3213/274	DRIVE MOTOR ”A” INVERTER TEMPERATURE SENSOR CIRCUIT HIGH

CIRCUIT DESCRIPTION

The HV control ECU uses a temperature sensor, which is built into the inverter, to detect the temperature of the motor inverter. The same cooling system that is routed to the MG1 and MG2 cools the inverter. This cooling system is independent from the engine cooling system.

The characteristic of the motor inverter temperature sensor is the same as the boost converter temperature sensor (see the description on page 05–736).

The HV control ECU limits the load based on the signals transmitted by the motor inverter temperature sensor, in order to check the effectiveness of the inverter cooling system and prevent the inverter from overheating. Furthermore, the HV control ECU detects a malfunction in the wiring of the motor inverter temperature sensor, as well as in the sensor itself.

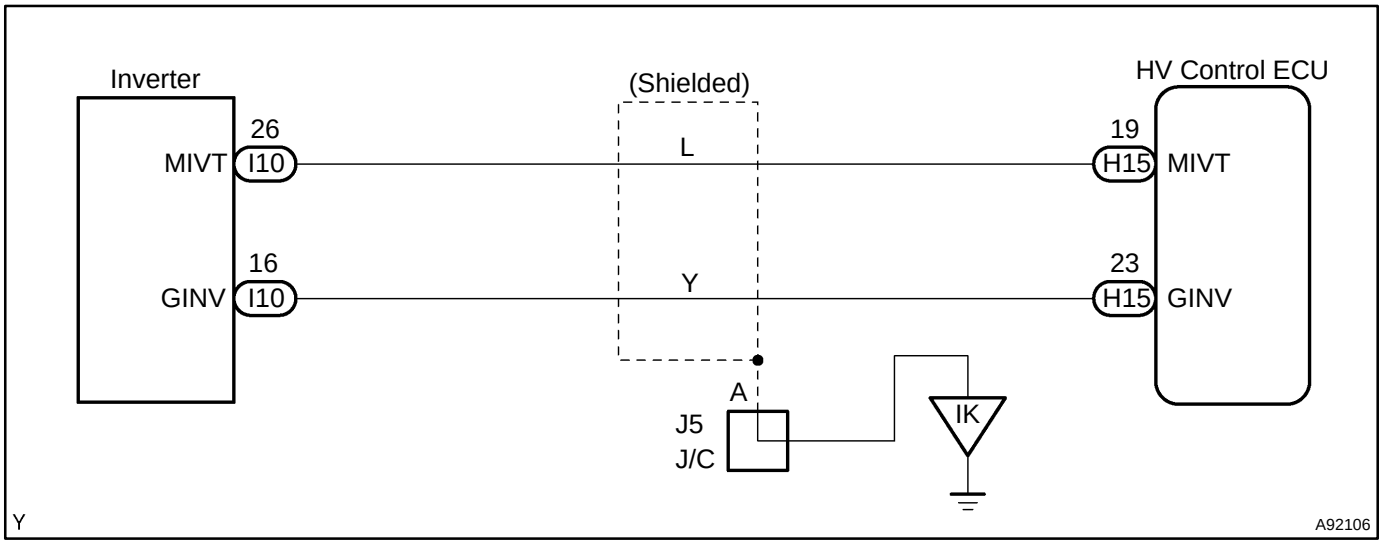
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3212	275	Open or GND short in motor inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU
P3213	274	+B short in motor inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU

HINT:

After confirming DTC P3212 (INF 275) or P3213 (INF 274), confirm MG2 INVERT TEMP in DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST using the hand–held tester.

Temperature Displayed	Malfunction
–50°C (–58°F)	+B short circuit
205°C (401°F)	Open or GND short circuit

WIRING DIAGRAM



cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ VALUE OF HAND–HELD TESTER(MG2 INVERT TEMP)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MG2 INVERT TEMP value on the hand–held tester.

Result:

Temperature Displayed	Proceed to
–50°C (–58°F)	A
205°C (401°F)	B
–49°C to 204°C (–57°F to 400°F)	C

HINT:

- If there is a +B short circuit, the hand–held tester indicates –50°C (–58°F).
- If there is an open or GND short circuit, the hand–held tester indicates 205°C (401°F).

B → **Go to step 4**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)**

A

cardiagn.com

2	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN WIRE HARNESS)

CAUTION:
Wear insulated gloves before performing the following operation.

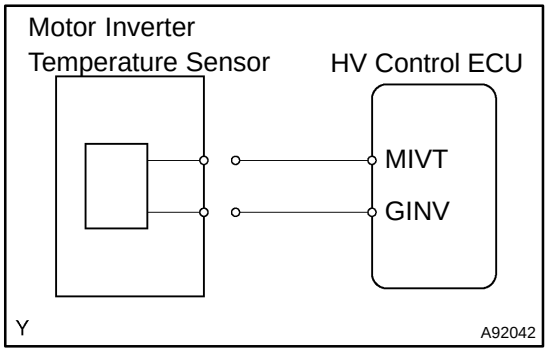
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

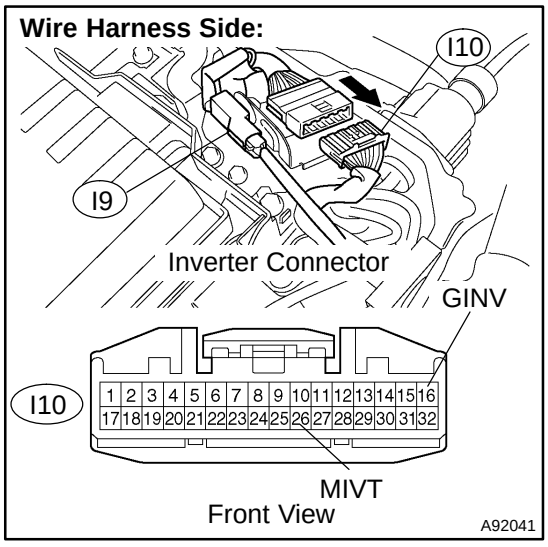
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the I10 inverter connector.
(e) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(g) Read the MG2 INVERT TEMP value on the hand–held tester.
Standard: 205°C (401°F)
(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).





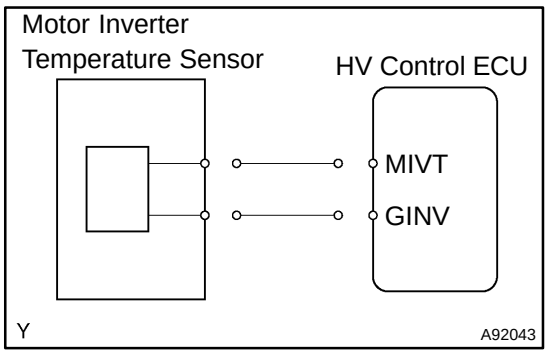
NG → **Go to step 3**

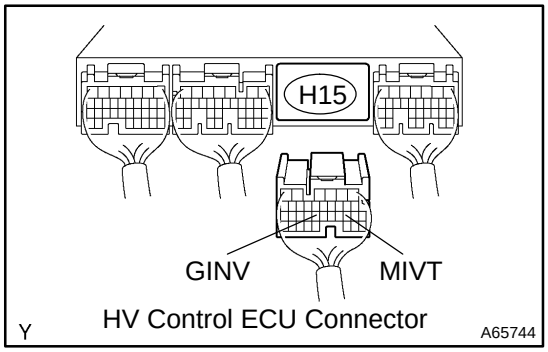
OK →

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

3	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN HYBRID VEHICLE CONTROL ECU)





(a) Disconnect the H15 HV control ECU connector.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the MG2 INVERT TEMP value on the hand–held tester.
Standard: 205°C (401°F)
(e) Reconnect the HV control ECU connector.

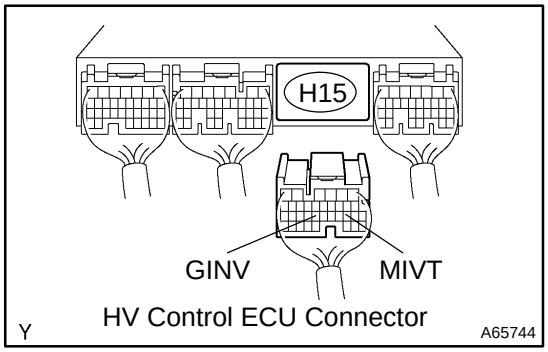
NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

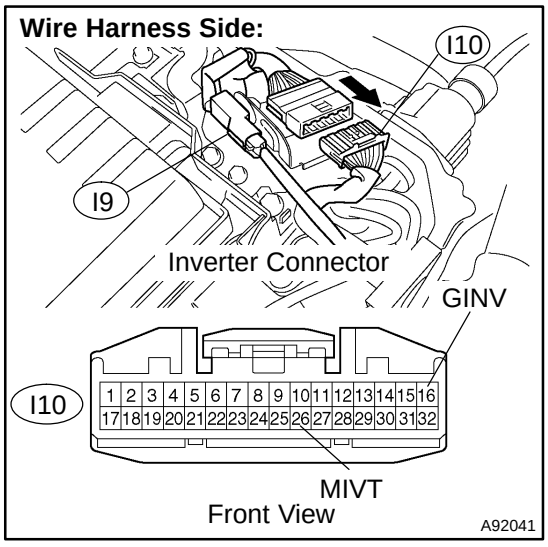
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

cardiagn.com

4	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





OK

CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H15 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
MIVT (H15–19) – MIVT (I10–26)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

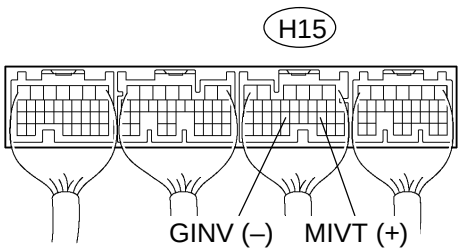
Tester Connection	Specified Condition
MIVT (H15–19) or MIVT (I10–26) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(g) Reconnect the inverter connector.
(h) Reconnect the HV control ECU connector.
(i) Reinstall the inverter cover (see page 21–23).
(j) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

cardiagn.com

5	INSPECT HYBRID VEHICLE CONTROL ECU(MIVT VOLTAGE)



HV Control ECU Connector
A93719

(a) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(b) Measure the voltage between the terminals of the H15 HV control ECU connector.

Standard:

Tester Connection	Specified Condition
MIVT (H15–19) – GINV (H15–23)	2.0 to 4.5 V

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P3221/314	GENERATOR INVERTER TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC	P3221/315	GENERATOR INVERTER TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

Refer to DTC P3222 (INF 313) on page 05–848.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3221	314	Sudden change in generator inverter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly
P3221	315	Generator inverter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly

WIRING DIAGRAM

Refer to DTC P3222 (INF 313) on page 05–848.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	CHECK QUANTITY OF HV COOLANT

(a) Check that there is a sufficient amount of coolant for the inverter.
OK: There is a sufficient amount of coolant for the inverter

NG → **ADD HV COOLANT (See page 22–4)**

OK

2	CHECK COOLANT HOSE

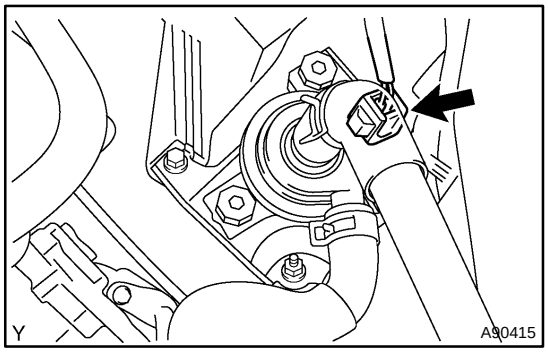
(a) Check that the hoses of the cooling system are not bent or clogged (see the cooling system on page 05–687).
OK: The hoses of the cooling system are not bent or clogged

cardiagn.com

NG → CORRECT TO NORMAL CONDITION

OK

3	CHECK CONNECTION CONDITION OF WATER PUMP CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the water pump connector.
OK: Connector has been connected securely and there is no poor connection.

NG → CONNECT SECURELY

OK

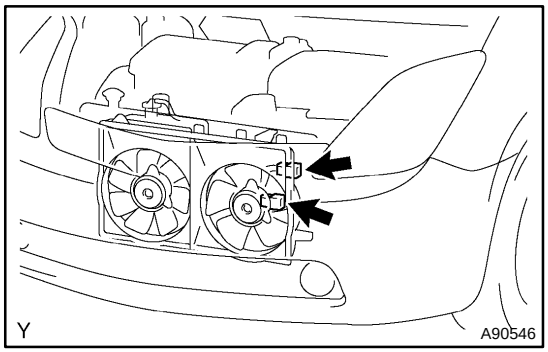
4	CHECK WATER W/MOTOR & BRACKET PUMP ASSY

(a) Turn the power switch ON (IG).
(b) Check the operation of the water pump.
OK: Coolant is sloshing in the reservoir tank

NG → REPLACE WATER W/MOTOR & BRACKET PUMP ASSY

OK

5	CHECK CONNECTION CONDITION OF COOLING FAN MOTOR CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the cooling fan motor connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → CONNECT SECURELY

OK

cardiagn.com

6	INSPECT COOLING FAN MOTOR (See page 16–8)

NG → REPLACE COOLING FAN MOTOR AND ADD ENGINE COOLANT

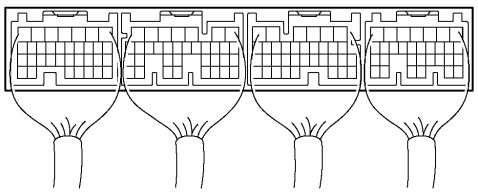
OK

7	INSPECT COOLING FAN MOTOR NO.2 (See page 16–8)

NG → REPLACE COOLING FAN MOTOR NO. 2 AND ADD ENGINE COOLANT

OK

8	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)


HV Control ECU Connector
A18294

(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

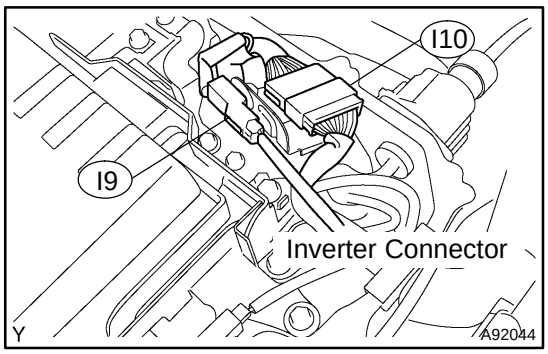
NG → CONNECT SECURELY

OK

9	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).

cardiagn.com

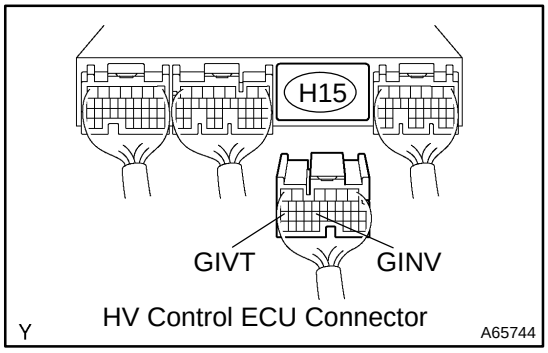


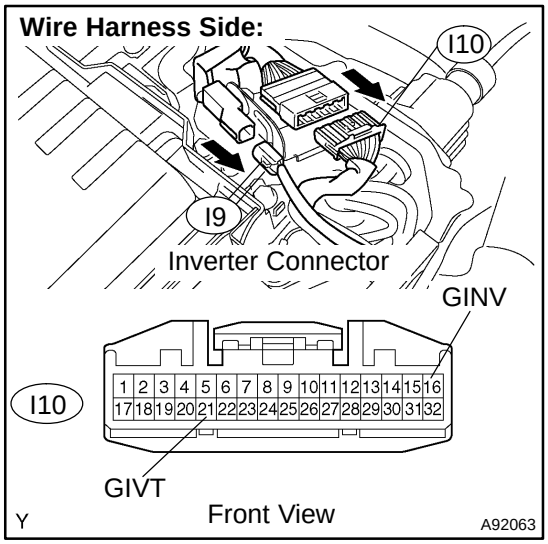
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG	CONNECT SECURELY

OK

10	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the H15 HV control ECU connector.
(c) Disconnect the I9 and I10 inverter connectors.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Measure the voltage between the terminals of the HV control ECU connector and body ground.
Standard:

Tester Connection	Specified Condition
GIVT (H15–27) – Body ground	Below 1 V
GINV (H15–23) – Body ground	Below 1 V

(f) Turn the power switch OFF.
(g) Check the resistance between the wire harness side connectors.
Standard (Check for open):

Tester Connection	Specified Condition
GIVT (H15–27) – GIVT (I10–21)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GIVT (H15–27) or GIVT (I10–21) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

(h) Reconnect the inverter connectors.
(i) Reconnect the HV control ECU connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

cardiagn.com

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

DTC	P3222/313	GENERATOR INVERTER TEMPERATURE SENSOR CIRCUIT HIGH/LOW

DTC	P3223/312	GENERATOR INVERTER TEMPERATURE SENSOR CIRCUIT HIGH

CIRCUIT DESCRIPTION

The HV control ECU uses a temperature sensor, which is built into the inverter, to detect the temperature of the generator inverter. The same cooling system that is routed to the MG1 and MG2 cools the inverter. This cooling system is independent from the engine cooling system.

The characteristic of the generator inverter temperature sensor is the same as the boost converter temperature sensor (see the description on page 05–736).

The HV control ECU limits the load based on the signals transmitted by the generator inverter temperature sensor, in order to check the effectiveness of the inverter cooling system and prevent the inverter from overheating. Furthermore, the HV control ECU detects a malfunction in the wiring of the generator inverter temperature sensor, as well as in the sensor itself.

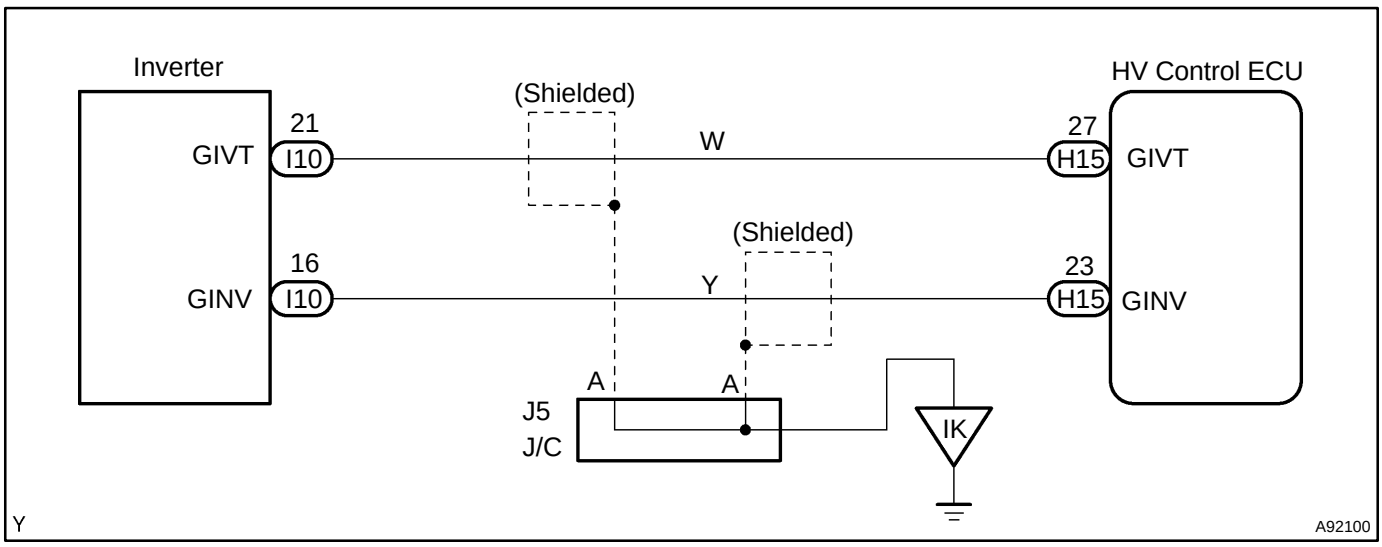
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3222	313	Open or GND short in generator inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU
P3223	312	+B short in generator inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU

HINT:

After confirming DTC P3222 (INF 313) or P3223 (INF 312), confirm MG1 INVERT TEMP in DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST using the hand–held tester.

Temperature Displayed	Malfunction
–50°C (–58°F)	+B short circuit
205°C (401°F)	Open or GND short circuit

WIRING DIAGRAM



cardiagn.com

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	READ VALUE OF HAND–HELD TESTER(MG1 INVERT TEMP)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Read the MG1 INVERT TEMP value on the hand–held tester.

Result:

Temperature Displayed	Proceed to
–50°C (–58°F)	A
205°C (401°F)	B
–49°C to 204°C (–57°F to 400°F)	C

HINT:

- If there is a +B short circuit, the hand–held tester indicates –50°C (–58°F).
- If there is an open or GND short circuit, the hand–held tester indicates 205°C (401°F).

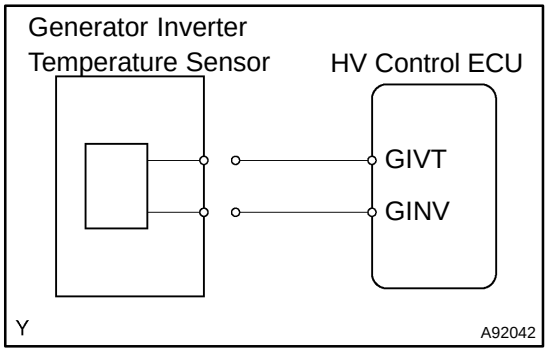
B → **Go to step 4**

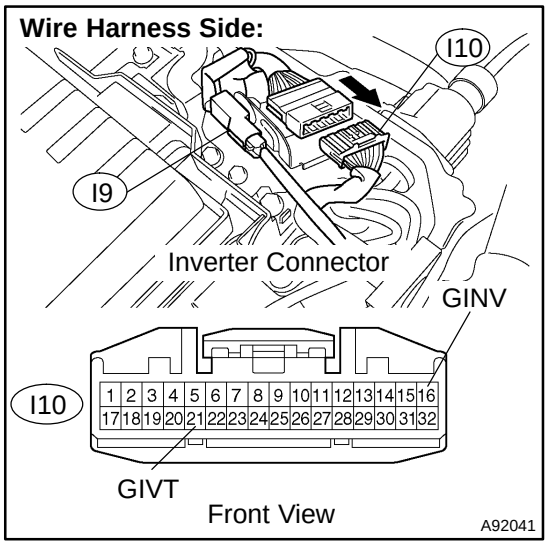
C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–407)**

A

cardiagn.com

2	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN WIRE HARNESS)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the I10 inverter connector.
(e) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(f) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(g) Read the MG1 INVERT TEMP value on the hand–held tester.
Standard: 205°C (401°F)
(h) Turn the power switch OFF.
(i) Reconnect the inverter connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

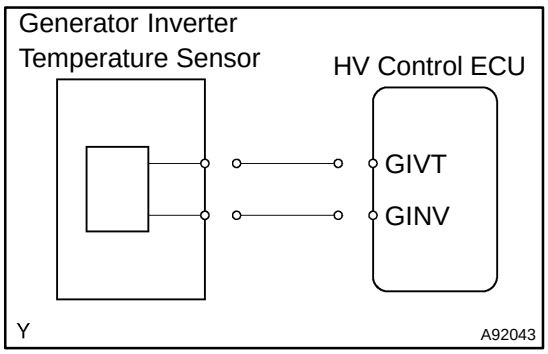
NG → **Go to step 3**

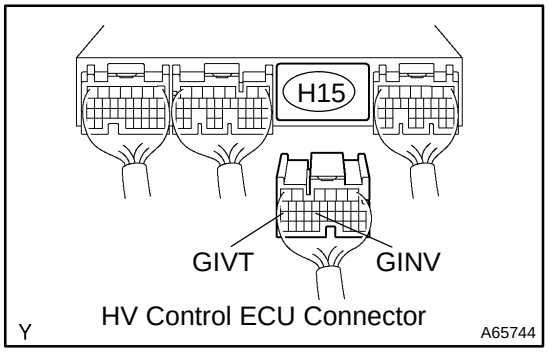
OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

3	READ VALUE OF HAND–HELD TESTER(CHECK FOR +B SHORT IN HYBRID VEHICLE CONTROL ECU)





(a) Disconnect the H15 HV control ECU connector.
(b) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(c) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(d) Read the MG1 INVERT TEMP value on the hand–held tester.

Standard: 205°C (401°F)

(e) Reconnect the HV control ECU connector.

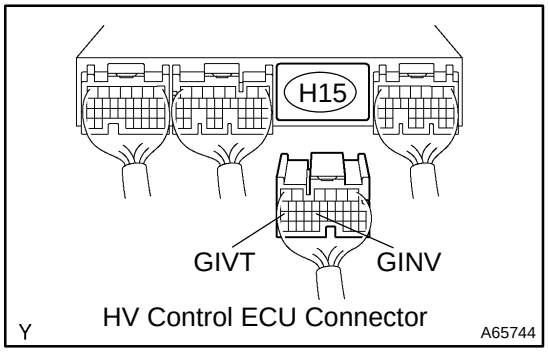
NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)**

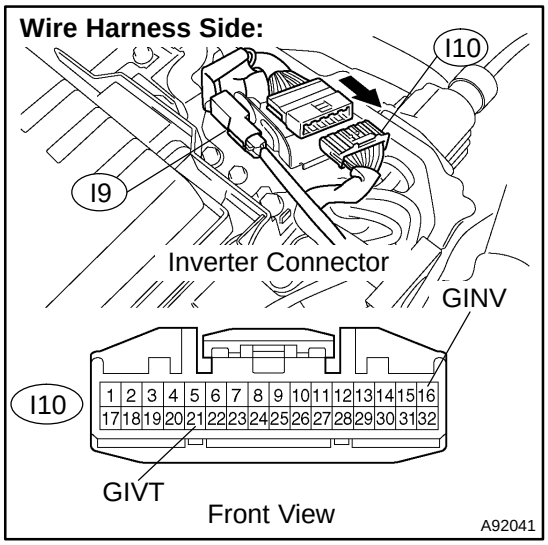
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

cardiagn.com

4	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).

NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.

(c) Remove the inverter cover (see page 21–23).
(d) Disconnect the H15 HV control ECU connector.
(e) Disconnect the I10 inverter connector.
(f) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GIVT (H15–27) – GIVT (I10–21)	Below 1 Ω
GINV (H15–23) – GINV (I10–16)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
GIVT (H15–27) or GIVT (I10–21) – Body ground	10 kΩ or higher
GINV (H15–23) or GINV (I10–16) – Body ground	10 kΩ or higher

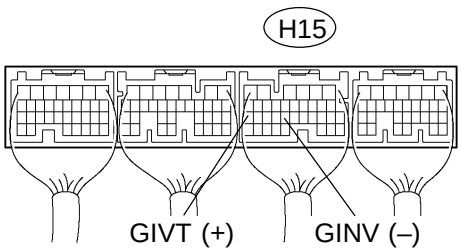
(g) Reconnect the inverter connector.
(h) Reconnect the HV control ECU connector.
(i) Reinstall the inverter cover (see page 21–23).
(j) Reinstall the service plug grip (see page 21–116).

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

cardiagn.com

5	INSPECT HYBRID VEHICLE CONTROL ECU(GIVT VOLTAGE)



HV Control ECU Connector
A93719

(a) Turn the power switch ON (IG).

HINT:

DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(b) Measure the voltage between the terminals of the H15 HV control ECU connector.

Standard:

Tester Connection	Specified Condition
GIVT (H15–27) – GINV (H15–23)	2.0 to 4.5 V

NG → **REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page 21–124)

cardiagn.com

DTC	P3226/562	DC/DC(BOOST) CONVERTER TEMPERATURE SENSOR MALFUNCTION

DTC	P3226/563	DC/DC(BOOST) CONVERTER TEMPERATURE SENSOR MALFUNCTION

CIRCUIT DESCRIPTION

Refer to DTC P0A94 (INF 583) on page 05–736.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3226	562	Sudden change in boost converter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly
P3226	563	Boost converter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly

WIRING DIAGRAM

Refer to DTC P0A94 (INF 583) on page 05–736.

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.**
- **After disconnecting the service plug grip, wait at least for 5 minutes before touching any of the high–voltage connectors or terminals.**

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

1	CHECK QUANTITY OF HV COOLANT

(a) Check that there is a sufficient amount of coolant for the inverter.
OK: There is a sufficient amount of coolant for the inverter

NG → **ADD HV COOLANT (See page 22–4)**

OK

2	CHECK COOLANT HOSE

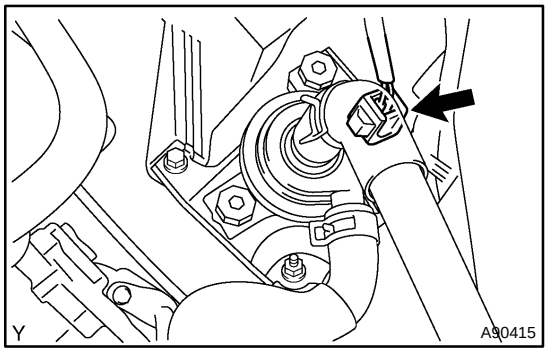
(a) Check that the hoses of the cooling system are not bent or clogged (see the cooling system on page 05–687).
OK: The hoses of the cooling system are not bent or clogged

cardiagn.com

NG → CORRECT TO NORMAL CONDITION

OK

3	CHECK CONNECTION CONDITION OF WATER PUMP CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the water pump connector.
OK: Connector has been connected securely and there is no poor connection.

NG → CONNECT SECURELY

OK

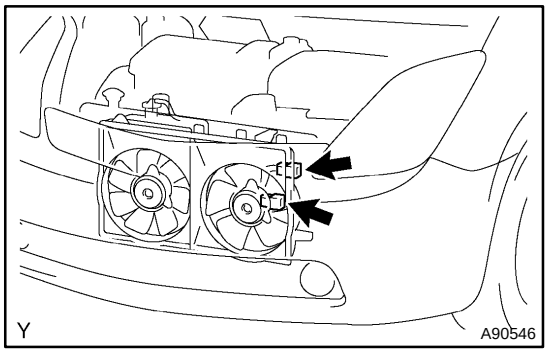
4	CHECK WATER W/MOTOR & BRACKET PUMP ASSY

(a) Turn the power switch ON (IG).
(b) Check the operation of the water pump.
OK: Coolant is sloshing in the reservoir tank

NG → REPLACE WATER W/MOTOR & BRACKET PUMP ASSY

OK

5	CHECK CONNECTION CONDITION OF COOLING FAN MOTOR CONNECTOR(LOOSENESS AND POOR CONTACT)



(a) Check the connection condition of the cooling fan motor connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → CONNECT SECURELY

OK

cardiagn.com

6	INSPECT COOLING FAN MOTOR (See page 16–8)

NG → REPLACE COOLING FAN MOTOR AND ADD ENGINE COOLANT

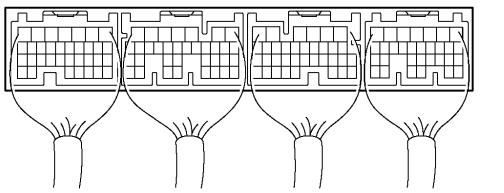
OK

7	INSPECT COOLING FAN MOTOR NO.2 (See page 16–8)

NG → REPLACE COOLING FAN MOTOR NO. 2 AND ADD ENGINE COOLANT

OK

8	CHECK CONNECTION CONDITION OF HYBRID VEHICLE CONTROL ECU CONNECTOR(LOOSENESS AND POOR CONTACT)


HV Control ECU Connector
A18294

(a) Check the connection condition of all the connectors at the HV control ECU.
OK: Connectors have been connected securely and there is no poor connection.

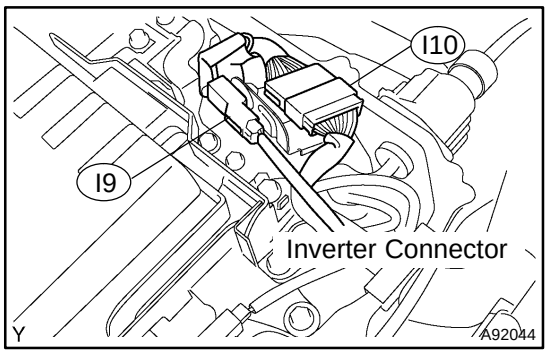
NG → CONNECT SECURELY

OK

9	CHECK CONNECTION CONDITION OF INVERTER CONNECTOR(LOOSENESS AND POOR CONTACT)

CAUTION:
Wear insulated gloves before performing the following operation.
(a) Turn the power switch OFF.
(b) Remove the service plug grip (see page 21–116).
NOTICE:
Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, never turn the power switch ON (READY) in this state.
(c) Remove the inverter cover (see page 21–23).

cardiagn.com

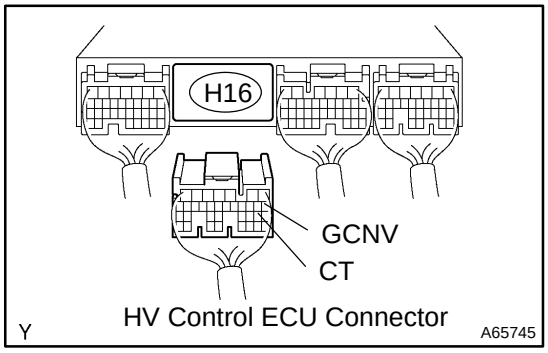


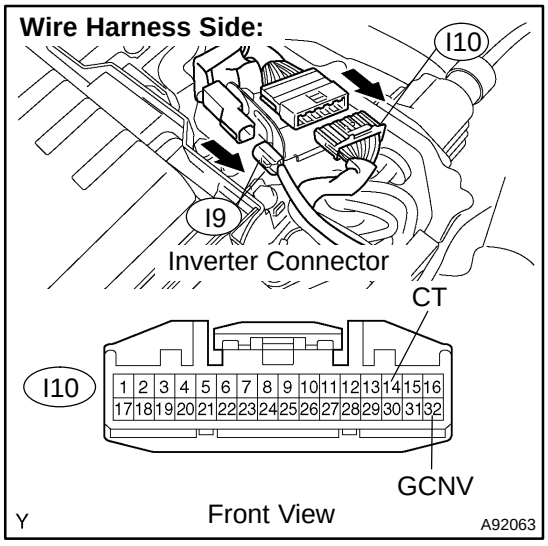
(d) Check the connection condition of the I9 and I10 inverter connectors.
OK: Connectors have been connected securely and there is no poor connection.

NG → **CONNECT SECURELY**

OK

10	CHECK HARNESS AND CONNECTOR(HYBRID VEHICLE CONTROL ECU – INVERTER)





CAUTION:
Wear insulated gloves before performing the following operation.

(a) Check that the service plug grip and inverter cover have been removed.
(b) Disconnect the H16 HV control ECU connector.
(c) Disconnect the I9 and I10 inverter connectors.
(d) Turn the power switch ON (IG).

HINT:
DTCs for the interlock switch system are output when turning the power switch ON (IG) with both service plug grip and inverter cover removed.

(e) Measure the voltage between the terminals of the HV control ECU connector and body ground.
Standard:

Tester Connection	Specified Condition
CT (H16–21) – Body ground	Below 1 V
GCNV (H16–8) – Body ground	Below 1 V

(f) Turn the power switch OFF.
(g) Check the resistance between the wire harness side connectors.
Standard (Check for open):

Tester Connection	Specified Condition
CT (H16–21) – CT (I10–14)	Below 1 Ω
GCNV (H16–8) – GCNV (I10–32)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
CT (H16–21) or CT (I10–14) – Body ground	10 kΩ or higher
GCNV (H16–8) or GCNV (I10–32) – Body ground	10 kΩ or higher

(h) Reconnect the inverter connectors.
(i) Reconnect the HV control ECU connector.
(j) Reinstall the inverter cover (see page 21–23).
(k) Reinstall the service plug grip (see page 21–116).

cardiagn.com

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE W/CONVERTER INVERTER ASSY (See page 21–23)

cardiagn.com

05J82–01

CHECK FOR INTERMITTENT PROBLEMS

1. CHECK FOR INTERMITTENT PROBLEMS

(a) Perform a simulation test (see page 01–37).
  (1) In the simulation test, reproduce the driving condition at the trouble occurrence according to the customer's comments and freeze frame data recorded with DTCs, such as an opening angle of the accelerator pedal, SOC, engine coolant temperature, engine rpm, and MG1/MG2 rpm and torque.

(b) Check the connector(s) and terminal(s) (see page 01–47).

(c) Wiggle the harness and connector(s) (see page 01–47).

cardiagn.com

05J7V–01

DEFINITION OF TERMS

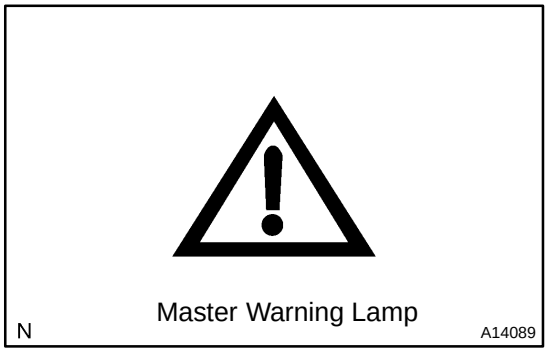
1. Definition of terms

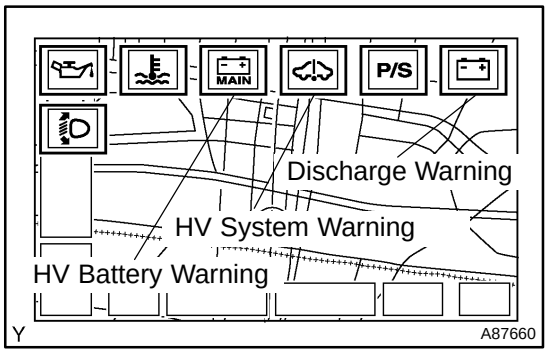
Each monitor description follows a standardized format using these terms:

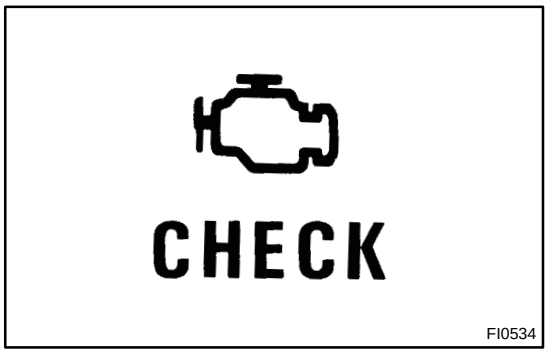
Term	Definition
Duration	The minimum time that the HV control ECU must sense a continuous deviation in the monitored value(s) before setting a DTC. This timing begins after the ”typical enabling conditions” are met
Frequency of operation	The number of times that the HV control ECU checks for malfunction per driving cycle ”Once per driving cycle” means that the HV control ECU detects malfunction only one time during a single driving cycle ”Continuous” means that the HV control ECU detects malfunction every time when enabling condition is met
MIL operation	MIL illumination timing after a defect is detected ”Immediately” means that the HV control ECU illuminates the MIL the instant the HV control ECU determines that there is malfunction ”2 driving cycles” means that the HV control ECU illuminates the MIL if the same malfunction is detected again in the 2nd driving cycle
Monitor description	Description of what the HV control ECU monitors and how it detects malfunction (monitoring purpose and its details)
Related DTCs	A group of DTCs that is classified by a system and a troubleshooting procedure
Required sensor/components	The sensors and components that are used by the HV control ECU to detect malfunction
Sequence of operation	The priority order that is applied to monitoring, if multiple sensors and components are used to detect the malfunction While another sensor is being monitored, the next sensor or component will not be monitored until the previous monitoring has concluded
Typical enabling condition	Preconditions that allow the HV control ECU to detect malfunction With all preconditions satisfied, the HV control ECU sets the DTC when the monitored value(s) exceeds the malfunction threshold(s)
Typical malfunction thresholds	Beyond this value, the HV control ECU will conclude that there is malfunction and set a DTC

cardiagn.com

DIAGNOSIS SYSTEM







1. DESCRIPTION

(a) The HV control ECU has a self–diagnosis system. If the computer, the hybrid vehicle control system or the components operate improperly, the ECU diagnoses improper operation to detect malfunction, and illuminates the master warning lamp in the combination meter together with any of indicators on the multi–information display, the HV system warning, the HV battery warning or the discharge warning.

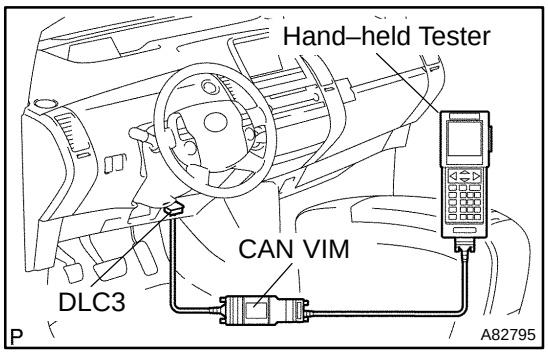
HINT:

The master warning lamp illuminates when THS II fails and it blinks when in inspection mode.

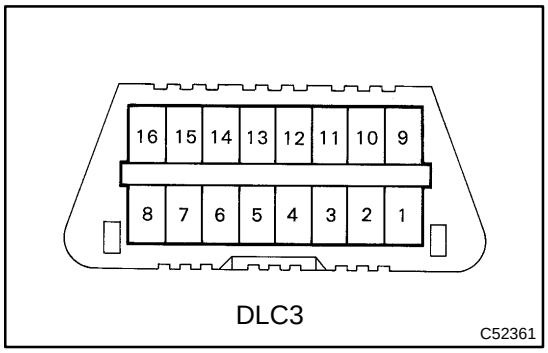
- When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is that you need to connect the OBD II scan tool complying with SAE J1978 or the hand–held tester to the vehicle, and read various data output from the vehicle's ECUs.
- OBD II regulations require that the vehicle's on–board computer illuminates the Malfunction Indicator Lamp (MIL) in the instrument panel when the computer detects malfunction in: 1) the emission control systems/components, or 2) the powertrain control components (which affect vehicle emissions), or 3) the computers. In addition, the applicable Diagnostic Trouble Codes (DTCs) prescribed by SAE J2012 are recorded in the HV control ECU memory (see page 05–440).

If the malfunction does not recur in 3 consecutive trips, the MIL will go off automatically. However the DTCs remain recorded in the HV control ECU memory.

cardiagn.com



- To check the DTCs, connect the hand–held tester to the Data Link Connector 3 (DLC3) with the CAN vehicle interface module (CAN VIM). Or, connect the OBD II scan tool to the DLC3. The hand–held tester or OBD II scan tool also enables you to erase the DTCs and check the freeze frame data and various forms of THS II data (for operating instructions, refer to their respective instruction manuals). The DTCs include SAE controlled codes and manufacturer controlled codes. SAE controlled codes must be set as prescribed by the SAE, while manufacturer controlled codes can be set by a manufacturer within the prescribed limits (see the DTC chart on page 05–440).
- Freeze frame data:
  The freeze frame data records the driving condition when malfunction is detected. When troubleshooting, it can help determine if the vehicle was running, braked, stopped, or reversed.



2. CHECK DLC3

The HV control ECU uses the ISO 9141–2 for communication protocol. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 9141–2 format.

Symbol	Terminal No.	Name	Reference Terminal	Result	Condition
SIL	7	Bus "+" line	5 – Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	11 to 14 V	Always
CANH	6	HIGH–level CAN bus line	14 – LOW–level CAN bus line	54 to 69 Ω	Power switch OFF
CANH	6	HIGH–level CAN bus line	16 – Battery positive	1 MΩ or higher	Power switch OFF
CANH	6	HIGH–level CAN bus line	4 – Chassis ground	1 kΩ or higher	Power switch OFF
CANL	14	LOW–level CAN bus line	16 – Battery positive	1 MΩ or higher	Power switch OFF
CANL	14	LOW–level CAN bus line	4 – Chassis ground	1 kΩ or higher	Power switch OFF

HINT:

If the display shows UNABLE TO CONNECT TO VEHICLE when you have connected the cable of the hand–held tester or the OBD II scan tool to the DLC3, turned the power switch ON and operated the tester, there is a problem on the vehicle side or tester side.

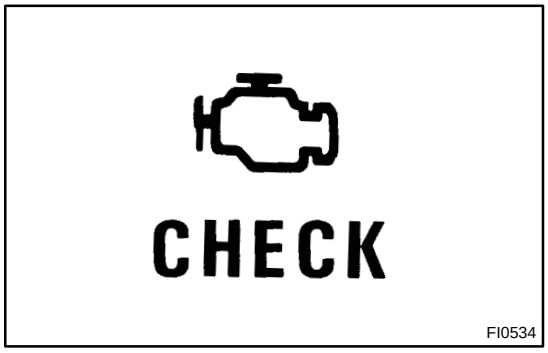
cardiagn.com

- If the communication is normal when the tester or scan tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If the communication is still impossible when the tester or scan tool is connected to another vehicle, the problem is probably in the tester or scan tool itself, so consult the Service Department listed in its instruction manual.

3. INSPECT AUXILIARY BATTERY

(a) Measure the voltage of the auxiliary battery.
Voltage: 11 to 14 V

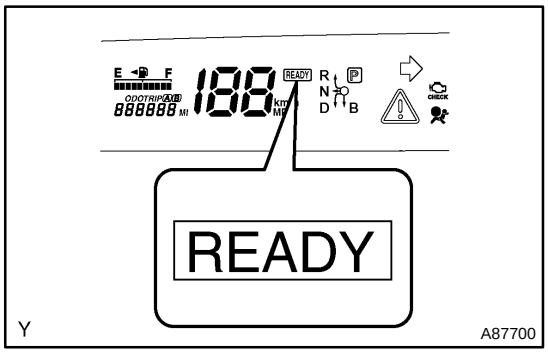
(b) Inspect the auxiliary battery, fuses, fusible links, wiring harness, connectors and ground.



4. CHECK MIL

(a) The MIL illuminates when the power switch is turned ON and the ”READY” lamp is OFF.

If the MIL is not illuminated, troubleshoot the MIL circuit (see page 05–381).



(b) When the ”READY” turns on, the MIL should turn off.

If the MIL remains on, the diagnosis system has detected malfunction or abnormality in the system.

cardiagn.com

05J8B–01

DATA LIST/ACTIVE TEST

1. DATA LIST

NOTICE:

- **The values of DATA LIST could vary significantly with slight differences in measurement, differences in the environment in which the measurements are obtained, or the aging of the vehicle. Thus, definite standards or judgment values are unavailable. Therefore, there may be a malfunction even if a measured value is within the reference range.**
- **In case of intricate symptoms, collect sample data from another vehicle of the same model operating under identical conditions, in order to reach an overall judgment by comparing all the items of DATA LIST.**

HINT:

Using DATA LIST displayed by the hand–held tester, you can read the value of the switches, sensors, actuators and so on without parts removal. Reading DATA LIST as a first step of troubleshooting is one method to shorten diagnostic time.

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) According to the display on the tester, read DATA LIST.

Hand–held Tester Display	Measurement Item/Range (Display)	Reference Range	Diagnostic Note
COOLANT TEMP	Engine coolant temperature/ Min.: –40°C, Max.: 140°C	After warming up: 80 to 100°C (176 to 212°F)	• If the value is –40°C (–40°F): Open in sensor circuit • If the value is 140°C (284°F): Short in sensor circuit
VEHICLE SPD	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Vehicle stopped: 0 km/h (0 mph)	—
ENG RUN TIME	Elapsed time after starting engine Min.: 0 s, Max.: 65,535 s	—	—
+B	Auxiliary battery voltage/ Min.: 0 V, Max.: 65.535 V	Constant: Auxiliary battery voltage ±3 V	—
ACCEL POS #1	Accelerator pedal position sensor No. 1/ Min.: 0 %, Max.: 100 %	Accelerator pedal depressed: Changes with accelerator pedal pressure	—
ACCEL POS #2	Accelerator pedal position sensor No. 2/ Min.: 0 %, Max.: 100 %	Accelerator pedal depressed: Changes with accelerator pedal pressure	—
AMBIENT TEMP	Ambient air temperature/ Min.: –40°C, Max.: 215°C	Power switch ON (IG): Same as ambient air temperature	—
INTAKE AIR TEMP	Intake air temperature/ Min.: –40°C, Max.: 140°C	Constant: Same as ambient air temperature	—
DTC CLEAR WARM	The number of times engine is warmed up after clearing DTCs/ Min.: 0, Max.: 255	MIL OFF, engine coolant temperature increases from below 22°C (71.6°F) before starting the engine to above 70°C (158°F) after starting the engine: Increases once	—
DTC CLEAR RUN	Drive distance after clearing DTCs/ Min.: 0 km, Max.: 65,535 km	—	—
DTC CLEAR MIN	Elapsed time after clearing DTCs/ Min.: 0 min, Max.: 65,535 min	—	—

cardiagn.com

Hand–held Tester Display	Measurement Item/Range (Display)	Reference Range	Diagnostic Note
MIL ON RUN DIST	Drive distance after malfunction occurrence/ Min.: 0 km, Max.: 65,535 km	—	—
MIL ON ENG TIME	Elapsed time after starting engine with MIL ON/ Min.: 0 min, Max.: 65,535 min	—	—
MIL Status	MIL status/ ON or OFF	MIL ON: ON	Constant ON: Repair in accordance with detected DTCs
MG2 REV	MG2 revolution/ Min.: –16,383 rpm, Max.: 16,383 rpm	—	—
MG2 TORQ	MG2 torque/ Min.: –500 Nm, Max.: 500 Nm	—	—
MG2 TRQ EXC VAL	MG2 torque execution value/ Min.: –512 Nm, Max.: 508 Nm	After full–load acceleration with READY lamp ON and engine stopped: Less than ±20 % of MG2 TORQ	—
MG1 REV	MG1 revolution/ Min.: –16,383 rpm, Max.: 16,383 rpm	—	—
MG1 TORQ	MG1 torque/ Min.: –500 Nm, Max.: 500 Nm	—	—
MG1 TRQ EXC VAL	MG1 torque execution value/ Min.: –512 Nm, Max.: 508 Nm	1 second has elapsed after the engine was started automatically with READY lamp ON, engine stopped, A/C fan Hi, head lamp ON and the P position: Less than ±20 % of MG1 TORQ	—
REGEN EXEC TORQ	Regenerative brake execution torque/ Min.: 0 Nm, Max.: 186 Nm	—	—
REGEN RQST TORQ	Regenerative brake request torque/ Min.: 0 Nm, Max.: 186 Nm	Vehicle speed 30 km/h (19 mph) and master cylinder hydraulic pressure –200 Nm: Changes with brake pedal pressure	—
MG1 INVERT TEMP	MG1 inverter temperature/ Min.: –50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is –50°C (–58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MG2 INVERT TEMP	MG2 inverter temperature/ Min.: –50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is –50°C (–58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MOTOR2 TEMP	Transaxle fluid temperature/ Min.: –50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is –50°C (–58°F): Open or +B short in sensor circuit • If the value is 205°C (401°F): GND short in sensor circuit
MOTOR1 TEMP	MG2 motor temperature/ Min.: –50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is –50°C (–58°F): Open or +B short in sensor circuit • If the value is 205°C (401°F): GND short in sensor circuit

cardiagn.com

Hand–held Tester Display	Measurement Item/Range (Display)	Reference Range	Diagnostic Note
CONVERTER TEMP	Boost converter temperature/ Min.: –50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 60°C (77 to 140°F)	• If the value is –50°C (–58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
ACCEL DEG	Accelerator pedal depressed angle/ Min.: 0 %, Max.: 100 %	Accelerator pedal depressed: Changes with accelerator pedal pressure	—
POWER RQST	Engine power output request value/ Min.: 0 W, Max.: 320,000 W	—	—
TARGET ENG SPD	Target engine speed/ Min.: 0 rpm, Max.: 8,000 rpm	—	—
ENGINE SPD	Engine speed/ Min.: 0 rpm, Max.: 8,000 rpm	Idling*: 950 to 1,050 rpm	—
VEHICLE SPD	Resolver vehicle speed/ Min.: –256 km/h, Max.: 254 km/h	Driving at 40 km/h (25 mph): 40 km/h (25 mph)	—
MCYL CTRL POWER	Braking torque that is equivalent to the master cylinder hydraulic pressure/ Min.: –512 Nm, Max.: 508 Nm	Brake pedal depressed: Changes with brake pedal pressure	—
SOC	Battery state of charge/ Min.: 0 %, Max.: 100 %	Constant: 0 to 100 %	—
WOUT CTRL POWER	Discharge control power value/ Min.: 0 W, Max.: 81,600 W	21,000 W or less	—
WIN CTRL POWER	Charge control power value/ Min.: –40,800 W, Max.: 0 W	–25,000 W or more	—
DCHG RQST SOC	Discharge request to adjust SOC/ Min.: –20,480 W, Max.: 20,320 W	• Uniform on–board charging: –4,400 W • Usually: 0 W	—
PWR RESOURCE VB	HV battery voltage/ Min.: 0 V, Max.: 510 V	READY lamp ON and P position: 150 to 300 V	—
PWR RESOURCE IB	HV battery current/ Min.: –256 A, Max.: 254 A	—	—
VL	High voltage before it is boosted/ Min.: 0 V, Max.: 510 V	Power switch ON (READY): Practically the same as the HV battery voltage	• If the value is 0 V: Open or GND short in sensor circuit • If the value is 510 V: +B short in sensor circuit
VH	High voltage after it is boosted/ Min.: 0 V, Max.: 765 V	Engine revved up in P position: HV battery voltage to 500 V	• If the value is 0 V: Open or GND short in sensor circuit • If the value is 765 V: +B short in sensor circuit
RAIS PRES RATIO	Boost ratio/ Min.: 0 %, Max.: 100 %	The pre–boost voltage and the post–boost voltage are equal: 0 to 10 %	—
DRIVE CONDITION	Drive condition ID/ Min.: 0, Max.: 6	• Engine stopped: 0 • Engine about to be stopped: 1 • Engine about to be started: 2 • Engine operated or operating: 3 • Generating or loading movement: 4 • Revving up with P position: 6	—

cardiagn.com

Hand–held Tester Display	Measurement Item/Range (Display)	Reference Range	Diagnostic Note
M SHIFT SENSOR	Output voltage of the shift position sensor (main)/ Min.: 0 V, Max.: 5 V	• Selector lever in home position: 2.0 to 3.0 V • Shifting into R position: 4.0 to 4.8 V • Shifting into B or D position: 0.2 to 1.0 V	—
S SHIFT SENSOR	Output voltage of the shift position sensor (sub)/ Min.: 0 V, Max.: 5 V	• Selector lever in home position: 2.0 to 3.0 V • Shifting into R position: 4.0 to 4.8 V • Shifting into B or D position: 0.2 to 1.0 V	—
SM SHIFT SENSOR	Output voltage of the select position sensor (main)/ Min.: 0 V, Max.: 5 V	• Selector lever in home position: 0.5 to 2.0 V • Shifting into R, N or D position: 3.0 to 4.85 V	—
SS SHIFT SENSOR	Output voltage of the select position sensor (sub)/ Min.: 0 V, Max.: 5 V	• Selector lever in home position: 0.5 to 2.0 V • Shifting into R, N or D position: 3.0 to 4.85 V	—
SHIFT POSITION	Shift position	P, R, N, D or B	—
A/C CONSMPT PWR	A/C consumption power/ Min.: 0 kW, Max.: 5 kW	—	—
DRIVE CONDITION	Driving condition	• MG1 load: MG1 • MG2 load: MG2	—
SHORT WAVE HIGH	Waveform voltage in leak detection circuit in battery ECU/ Min.: 0 V, Max.: 5 V	READY lamp is left ON for 2 minutes, and the pre–boost voltage and the post–boost voltage are equal: 4 V or more	—
ECU TYPE	Type of ECU	HV ECU	—
CURRENT DTC	The number of current DTCs/ Min.: 0, Max.: 255	—	—
HISTORY DTC	The number of history DTCs/ Min.: 0, Max.: 255	—	—
CHECK MODE	Check mode/ ON or OFF	—	—
ENG STOP RQST	Engine stop request/ NO or RQST	Requesting engine stop: RQST	—
IDLING REQUEST	Engine idling request/ NO or RQST	Requesting idle: RQST	—
HV BATT CH RQST	HV battery charging request/ NO or RQST	Requesting HV battery charging: RQST	—
ENG STP INHIBIT	Engine stop inhibit request/ NO or RQST	Requesting engine intermittent prohibition: RQST	—
AIRCON REQUEST	Engine starting request from A/C amplifier/ NO or RQST	Requesting engine start from A/C amplifier: RQST	—
ENG WARM UP RQT	Engine warm–up request/ NO or RQST	Requesting engine warm–up: RQST	—
SMR CONT1	Operating condition of system main relay No. 1/ ON or OFF	Power switch ON (READY): OFF	—
SMR CONT2	Operating condition of system main relay No. 2/ ON or OFF	Power switch ON (READY): ON	—
SMR CONT3	Operating condition of system main relay No. 3/ ON or OFF	Power switch ON (READY): ON	—

cardiagn.com

Hand–held Tester Display	Measurement Item/Range (Display)	Reference Range	Diagnostic Note
MG1 GATE	MG1 gate status/ ON or OFF	ON	—
MG2 GATE	MG2 gate status/ ON or OFF	Shutting down motor inverter: ON	—
CNV GATE	Boost converter gate status/ ON or OFF	Shutting down boost converter: ON	—
A/C GATE	A/C gate status/ ON or OFF	Shutting down A/C inverter: ON	—
SMARTKEY	Electronic key ID code check status/ ON or OFF	When electronic key ID code corresponds to ID code registered in ECU: ON	—

*: If no conditions are specifically stated for ”Idling”, it means the engine for inspection mode, the shift position is in P, the A/C switch is OFF, and accelerator pedal is not depressed.

cardiagn.com

2. ACTIVE TEST

NOTICE:

Beware that if the connector to the hand–held tester becomes disconnected or a communication error occurs during ACTIVE TEST, the vehicle could become inoperative (READY lamp OFF).

HINT:

Performing ACTIVE TEST using the hand–held tester allows the relay, VSV, actuator and so on to operate without parts removal. Performing ACTIVE TEST as a first step of troubleshooting is one method to shorten diagnostic time.

It is possible to display items in DATA LIST during ACTIVE TEST.

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / ACTIVE TEST.
(e) According to the display on the tester, perform ACTIVE TEST.

Hand–held Tester Display	Purpose	Test Details	Test Condition
INSPECTION MOD1 *	• To check its operation while the engine is running • To disable traction control while performing a speedometer test or the like	• Runs the engine continuously with the P position • Cancels the traction control that is effected when the rotational difference between the front and rear wheels is excessive other than the P position	Power switch ON (IG), HV system normal, not in inspection mode, and other active tests not being executed
INSPECTION MOD2 *	To disable traction control while performing a speedometer test or the like	Cancels the traction control that is effected when the rotational difference between the front and rear wheels is excessive other than the P position	Power switch ON (IG), HV system normal, not in inspection mode, and other active tests not being executed
INVERTER STOP *	To determine if there is an internal leak in the inverter or the HV control ECU	Keeps the inverter power transistor actuation signal ON	Power switch ON (IG), P position, HV system normal, inverter actuation not being disabled, shutting down inverter, and other active tests not being executed
CRANKING RQST *	To crank the engine continuously in order to measure the compression	Allows the engine to continue cranking by activating the generator continuously	Power switch ON (IG), HV system normal, not in cranking mode, and other active tests not being executed

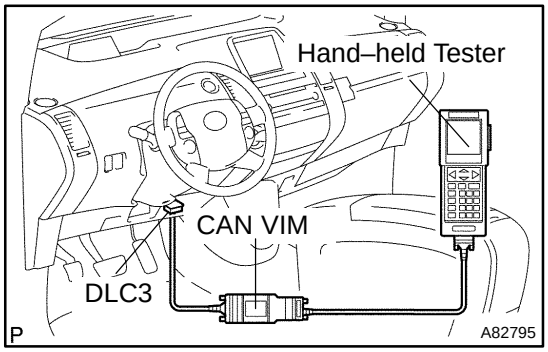
NOTICE:

***: The hand–held tester results in a communication error and the vehicle's READY lamp turns OFF upon the completion of ACTIVE TEST. Therefore, in order to use the tester again, turn the power switch OFF, and restart by turn it ON.**

cardiagn.com

05J85–01

DTC CHECK/CLEAR



1. CHECK DTC (HV ECU)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.

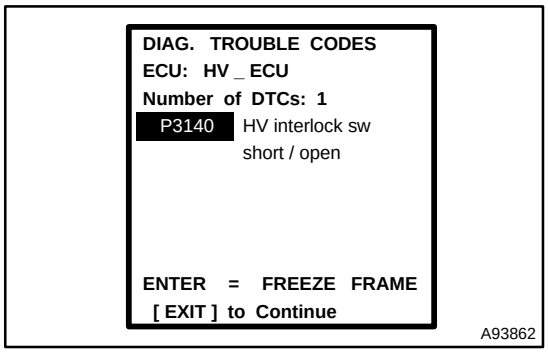
(b) Turn the power switch ON (IG) and turn the hand–held tester or the OBD II scan tool ON.

(c) Using the hand–held tester or the OBD II scan tool, check the DTCs and freeze frame data and then write them down.

For the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.

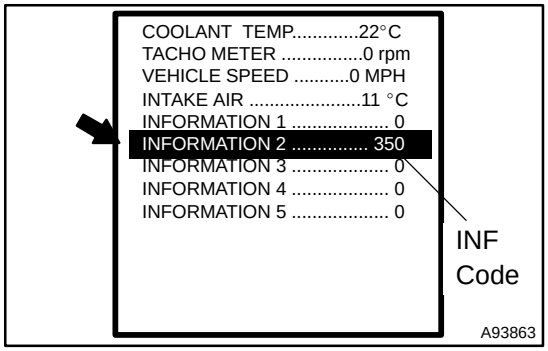
For the OBD II scan tool, see its instruction manual.

(d) See page 05–440 to confirm the details of the DTCs.



2. CHECK FREEZE FRAME DATA AND INFORMATION

(a) If a DTC is present, select that DTC in order to display its freeze frame data.



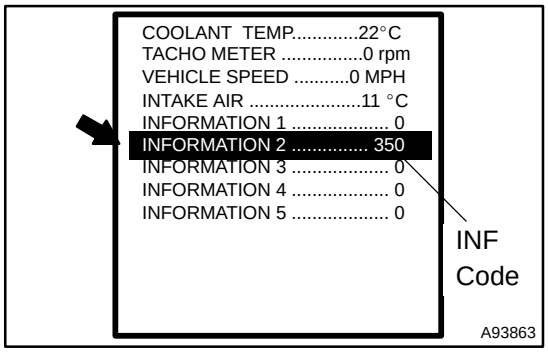
(b) Read recorded freeze frame data at the time of detection of a DTC.

NOTICE:

Information code (INF code) is displayed in one of the columns, INFORMATION 1 to 5, on the freeze frame data screen. Check the details by following the procedures in the following steps.

HINT:

In the case shown in the illustration, refer to troubleshooting for DTC P3140 and INF code 350.

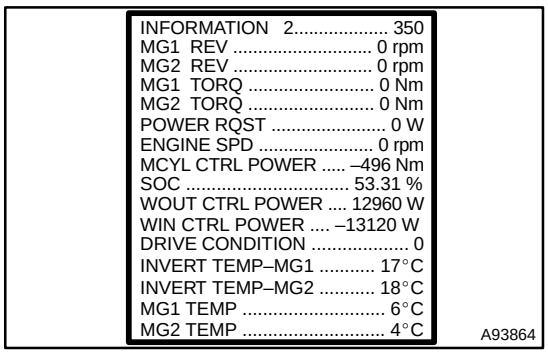


(c) Read information.

(1) Select the item that has an INF code from among INFORMATION 1 to 5 on the freeze frame data screen.

(2) Press ENTER.

cardiagn.com



(3) Information is displayed as shown in the illustration.

3. CHECK DTC (SYSTEMS OTHER THAN HV ECU)

HINT:

The HV control ECU maintains mutual communication with the computers, including the ECM, battery ECU, skid control ECU, power steering ECU and other. Therefore, if the HV control ECU outputs a warning, it is necessary to check and record the DTCs of all the systems.

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.

(b) Turn the power switch ON (IG) and turn the hand–held tester or the OBD II scan tool ON.

(c) For the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / CODES (All).
For the OBD II scan tool, see its instruction manual.

(d) If DTCs are present, check the relevant systems.

HINT:

If DTCs for the CAN communication system are present in addition to other DTCs, first troubleshoot and repair malfunction in the CAN communication (see page 05–2602).

4. CLEAR DTC

NOTICE:

Clearing the DTCs will also clear the freeze frame data, information (see page 05–422) and operation history data (see page 05–426).

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.

(b) Turn the power switch ON (IG) and turn the hand–held tester or the OBD II scan tool ON.

(c) Check that the shift position is in the P position.

(d) Clear DTCs and freeze frame data with the hand–held tester or the OBD II scan tool.
For the hand–held tester:
(1) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / CLEAR CODES.
(2) Press YES.
For the OBD II scan tool, see its instruction manual.

cardiagn.com

05J88–01

FAIL–SAFE CHART

1. FAIL–SAFE CHART

DTC No.	Detection Item	INF Code	Driving Condition
B2799	Immobilizer malfunction	539	Impossible to drive
B2799	Immobilizer malfunction	540	Impossible to drive
B2799	Immobilizer malfunction	541	Impossible to drive
B2799	Immobilizer malfunction	542	Impossible to drive
B2799	Immobilizer malfunction	543	Impossible to drive
B2799	Immobilizer malfunction	544	Impossible to drive
P0336	Crankshaft Position Sensor ”A” Circuit Range/Performance	137	Normal driving
P0338	Crankshaft Position Sensor ”A” Circuit High Input	600	Normal driving
P0340	Camshaft Position Sensor ”A” Circuit	532	Normal driving
P0343	Camshaft Position Sensor ”A” Circuit High Input	601	Normal driving
P0500	Vehicle Speed Sensor ”A”	352	Cruise control driving impossible
P0560	System Voltage	117	Normal driving
P0571	Brake Switch ”A” Circuit	115	Cruise control driving impossible
P0607	Control Module Performance	116	Cruise control driving impossible
P0705	Transmission Range Sensor Circuit	571	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	572	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	573	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	574	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	575	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	576	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	577	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	578	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	595	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0705	Transmission Range Sensor Circuit	596	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0851	Park/Neutral Switch Input Circuit Low	579	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0852	Park/Neutral Switch Input Circuit High	580	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P0A08	DC/DC Converter Status Circuit	264	Normal driving
P0A09	DC/DC Converter Status Circuit Low Input	265	Normal driving
P0A09	DC/DC Converter Status Circuit Low Input	591	Normal driving
P0A0F	Engine Failed to Start	204	Limited driving
P0A0F	Engine Failed to Start	205	Limited driving
P0A0F	Engine Failed to Start	238	Limited driving
P0A0F	Engine Failed to Start	533	Limited driving
P0A0F	Engine Failed to Start	534	Limited driving
P0A10	DC/DC Converter Status Circuit High Input	263	Normal driving
P0A10	DC/DC Converter Status Circuit High Input	592	Normal driving
P0A1D	Hybrid Powertrain Control Module	134	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	135	Impossible to drive

cardiagn.com

DTC No.	Detection Item	INF Code	Driving Condition
P0A1D	Hybrid Powertrain Control Module	139	Normal driving
P0A1D	Hybrid Powertrain Control Module	140	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	141	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	142	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	143	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	144	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	145	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	148	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	149	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	150	Limited driving
P0A1D	Hybrid Powertrain Control Module	151	Limited driving
P0A1D	Hybrid Powertrain Control Module	152	Limited driving
P0A1D	Hybrid Powertrain Control Module	155	Limited driving
P0A1D	Hybrid Powertrain Control Module	156	Limited driving
P0A1D	Hybrid Powertrain Control Module	158	Limited driving
P0A1D	Hybrid Powertrain Control Module	159	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	160	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	163	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	164	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	165	Limited driving
P0A1D	Hybrid Powertrain Control Module	166	Normal driving
P0A1D	Hybrid Powertrain Control Module	167	Limited driving
P0A1D	Hybrid Powertrain Control Module	168	Limited driving
P0A1D	Hybrid Powertrain Control Module	177	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	178	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	180	Limited driving
P0A1D	Hybrid Powertrain Control Module	181	Limited driving
P0A1D	Hybrid Powertrain Control Module	182	Limited driving
P0A1D	Hybrid Powertrain Control Module	183	Limited driving
P0A1D	Hybrid Powertrain Control Module	184	Limited driving
P0A1D	Hybrid Powertrain Control Module	185	Limited driving
P0A1D	Hybrid Powertrain Control Module	186	Limited driving
P0A1D	Hybrid Powertrain Control Module	187	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	188	Limited driving
P0A1D	Hybrid Powertrain Control Module	189	Limited driving
P0A1D	Hybrid Powertrain Control Module	192	Limited driving
P0A1D	Hybrid Powertrain Control Module	193	Limited driving
P0A1D	Hybrid Powertrain Control Module	195	Limited driving
P0A1D	Hybrid Powertrain Control Module	196	Limited driving
P0A1D	Hybrid Powertrain Control Module	197	Limited driving
P0A1D	Hybrid Powertrain Control Module	198	Normal driving
P0A1D	Hybrid Powertrain Control Module	199	Limited driving
P0A1D	Hybrid Powertrain Control Module	200	Limited driving
P0A1D	Hybrid Powertrain Control Module	390	Limited driving
P0A1D	Hybrid Powertrain Control Module	392	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	393	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	511	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	512	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	564	Limited driving
P0A1D	Hybrid Powertrain Control Module	565	Limited driving
P0A1D	Hybrid Powertrain Control Module	567	Impossible to drive

cardiagn.com

DTC No.	Detection Item	INF Code	Driving Condition
P0A1D	Hybrid Powertrain Control Module	568	Limited driving
P0A1D	Hybrid Powertrain Control Module	569	Limited driving
P0A1D	Hybrid Powertrain Control Module	570	Impossible to drive
P0A1D	Hybrid Powertrain Control Module	615	Limited driving
P0A1F	Battery Energy Control Module	123	Limited driving
P0A1F	Battery Energy Control Module	129	Limited driving
P0A1F	Battery Energy Control Module	593	Normal driving
P0A2B	Drive Motor ”A” Temperature Sensor Circuit Range/Performance	248	Normal driving
P0A2B	Drive Motor ”A” Temperature Sensor Circuit Range/Performance	250	Normal driving
P0A2C	Drive Motor ”A” Temperature Sensor Circuit Low	247	Normal driving
P0A2D	Drive Motor ”A” Temperature Sensor Circuit High	249	Normal driving
P0A37	Generator Temperature Sensor Circuit Range/Performance	258	Normal driving
P0A37	Generator Temperature Sensor Circuit Range/Performance	260	Normal driving
P0A38	Generator Temperature Sensor Circuit Low	257	Normal driving
P0A39	Generator Temperature Sensor Circuit High	259	Normal driving
P0A3F	Drive Motor ”A” Position Sensor Circuit	243	Limited driving
P0A40	Drive Motor ”A” Position Sensor Circuit Range/Performance	500	Limited driving
P0A41	Drive Motor ”A” Position Sensor Circuit Low	245	Limited driving
P0A4B	Generator Position Sensor Circuit	253	Limited driving
P0A4C	Generator Position Sensor Circuit Range/Performance	513	Limited driving
P0A4D	Generator Position Sensor Circuit Low	255	Limited driving
P0A51	Drive Motor ”A” Current Sensor Circuit	174	Limited driving
P0A60	Drive Motor ”A” Phase V Current	288	Limited driving
P0A60	Drive Motor ”A” Phase V Current	289	Limited driving
P0A60	Drive Motor ”A” Phase V Current	290	Limited driving
P0A60	Drive Motor ”A” Phase V Current	292	Limited driving
P0A60	Drive Motor ”A” Phase V Current	294	Limited driving
P0A60	Drive Motor ”A” Phase V Current	501	Limited driving
P0A63	Drive Motor ”A” Phase W Current	296	Limited driving
P0A63	Drive Motor ”A” Phase W Current	297	Limited driving
P0A63	Drive Motor ”A” Phase W Current	298	Limited driving
P0A63	Drive Motor ”A” Phase W Current	300	Limited driving
P0A63	Drive Motor ”A” Phase W Current	302	Limited driving
P0A63	Drive Motor ”A” Phase W Current	502	Limited driving
P0A72	Generator Phase V Current	326	Limited driving
P0A72	Generator Phase V Current	327	Limited driving
P0A72	Generator Phase V Current	328	Limited driving
P0A72	Generator Phase V Current	330	Limited driving
P0A72	Generator Phase V Current	333	Limited driving
P0A72	Generator Phase V Current	515	Limited driving
P0A75	Generator Phase W Current	334	Limited driving
P0A75	Generator Phase W Current	335	Limited driving
P0A75	Generator Phase W Current	336	Limited driving
P0A75	Generator Phase W Current	338	Limited driving
P0A75	Generator Phase W Current	341	Limited driving
P0A75	Generator Phase W Current	516	Limited driving

cardiagn.com

DTC No.	Detection Item	INF Code	Driving Condition
P0A78	Drive Motor "A" Inverter Performance	266	Limited driving
P0A78	Drive Motor "A" Inverter Performance	267	Limited driving
P0A78	Drive Motor "A" Inverter Performance	272	Normal driving
P0A78	Drive Motor "A" Inverter Performance	278	Normal driving
P0A78	Drive Motor "A" Inverter Performance	279	Limited driving
P0A78	Drive Motor "A" Inverter Performance	280	Normal driving
P0A78	Drive Motor "A" Inverter Performance	282	Limited driving
P0A78	Drive Motor "A" Inverter Performance	283	Normal driving
P0A78	Drive Motor "A" Inverter Performance	284	Limited driving
P0A78	Drive Motor "A" Inverter Performance	285	Normal driving
P0A78	Drive Motor "A" Inverter Performance	286	Limited driving
P0A78	Drive Motor "A" Inverter Performance	287	Limited driving
P0A78	Drive Motor "A" Inverter Performance	304	Normal driving
P0A78	Drive Motor "A" Inverter Performance	305	Normal driving
P0A78	Drive Motor "A" Inverter Performance	306	Limited driving
P0A78	Drive Motor "A" Inverter Performance	308	Impossible to drive
P0A78	Drive Motor "A" Inverter Performance	503	Limited driving
P0A78	Drive Motor "A" Inverter Performance	504	Limited driving
P0A78	Drive Motor "A" Inverter Performance	505	Limited driving
P0A78	Drive Motor "A" Inverter Performance	506	Limited driving
P0A78	Drive Motor "A" Inverter Performance	507	Normal driving
P0A78	Drive Motor "A" Inverter Performance	508	Normal driving
P0A78	Drive Motor "A" Inverter Performance	510	Normal driving
P0A78	Drive Motor "A" Inverter Performance	523	Limited driving
P0A78	Drive Motor "A" Inverter Performance	586	Limited driving
P0A7A	Generator Inverter Performance	309	Limited driving
P0A7A	Generator Inverter Performance	321	Normal driving
P0A7A	Generator Inverter Performance	322	Limited driving
P0A7A	Generator Inverter Performance	323	Normal driving
P0A7A	Generator Inverter Performance	324	Limited driving
P0A7A	Generator Inverter Performance	325	Limited driving
P0A7A	Generator Inverter Performance	342	Limited driving
P0A7A	Generator Inverter Performance	343	Limited driving
P0A7A	Generator Inverter Performance	344	Limited driving
P0A7A	Generator Inverter Performance	517	Limited driving
P0A7A	Generator Inverter Performance	518	Limited driving
P0A7A	Generator Inverter Performance	519	Limited driving
P0A7A	Generator Inverter Performance	520	Limited driving
P0A7A	Generator Inverter Performance	522	Normal driving
P0A90	Drive Motor "A" Performance	239	Limited driving
P0A90	Drive Motor "A" Performance	240	Limited driving
P0A90	Drive Motor "A" Performance	241	Limited driving
P0A90	Drive Motor "A" Performance	242	Limited driving
P0A90	Drive Motor "A" Performance	251	Limited driving
P0A90	Drive Motor "A" Performance	509	Limited driving
P0A90	Drive Motor "A" Performance	602	Limited driving
P0A90	Drive Motor "A" Performance	604	Limited driving
P0A90	Drive Motor "A" Performance	605	Limited driving
P0A92	Hybrid Generator Performance	261	Limited driving
P0A92	Hybrid Generator Performance	521	Limited driving
P0A92	Hybrid Generator Performance	606	Limited driving

cardiagn.com

DTC No.	Detection Item	INF Code	Driving Condition
P0A92	Hybrid Generator Performance	607	Limited driving
P0A93	Inverter Cooling System Performance	346	Normal driving
P0A93	Inverter Cooling System Performance	347	Normal driving
P0A94	DC/DC Converter Performance	442	Limited driving
P0A94	DC/DC Converter Performance	545	Limited driving
P0A94	DC/DC Converter Performance	546	Limited driving
P0A94	DC/DC Converter Performance	547	Limited driving
P0A94	DC/DC Converter Performance	548	Limited driving
P0A94	DC/DC Converter Performance	549	Limited driving
P0A94	DC/DC Converter Performance	550	Limited driving
P0A94	DC/DC Converter Performance	551	Limited driving
P0A94	DC/DC Converter Performance	552	Limited driving
P0A94	DC/DC Converter Performance	553	Limited driving
P0A94	DC/DC Converter Performance	554	Limited driving
P0A94	DC/DC Converter Performance	555	Limited driving
P0A94	DC/DC Converter Performance	556	Limited driving
P0A94	DC/DC Converter Performance	557	Limited driving
P0A94	DC/DC Converter Performance	558	Normal driving
P0A94	DC/DC Converter Performance	559	Limited driving
P0A94	DC/DC Converter Performance	560	Normal driving
P0A94	DC/DC Converter Performance	561	Limited driving
P0A94	DC/DC Converter Performance	583	Normal driving
P0A94	DC/DC Converter Performance	584	Normal driving
P0A94	DC/DC Converter Performance	585	Normal driving
P0A94	DC/DC Converter Performance	587	Limited driving
P0A94	DC/DC Converter Performance	588	Limited driving
P0A94	DC/DC Converter Performance	589	Normal driving
P0A94	DC/DC Converter Performance	590	Normal driving
P0AA1	Hybrid Battery Positive Contactor Circuit Stuck Closed	224	Normal driving
P0AA1	Hybrid Battery Positive Contactor Circuit Stuck Closed	226	Impossible to drive
P0AA1	Hybrid Battery Positive Contactor Circuit Stuck Closed	231	Impossible to drive
P0AA1	Hybrid Battery Positive Contactor Circuit Stuck Closed	233	Impossible to drive
P0AA2	Hybrid Battery Positive Contactor Circuit Stuck Open	225	Normal driving
P0AA2	Hybrid Battery Positive Contactor Circuit Stuck Open	227	Impossible to drive
P0AA4	Hybrid Battery Negative Contactor Circuit Stuck Closed	228	Impossible to drive
P0AA4	Hybrid Battery Negative Contactor Circuit Stuck Closed	232	Limited driving
P0AA5	Hybrid Battery Negative Contactor Circuit Stuck Open	229	Impossible to drive
P2120	Throttle/Pedal Position Sensor/Switch ”D” Circuit	111	Limited driving
P2121	Throttle/Pedal Position Sensor/Switch ”D” Circuit Range/Performance	106	Limited driving
P2121	Throttle/Pedal Position Sensor/Switch ”D” Circuit Range/Performance	114	Limited driving
P2122	Throttle/Pedal Position Sensor/Switch ”D” Circuit Low Input	104	Limited driving

cardiagn.com

DTC No.	Detection Item	INF Code	Driving Condition
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	105	Limited driving
P2125	Throttle/Pedal Position Sensor/Switch "E" Circuit	112	Limited driving
P2126	Throttle/Pedal Position Sensor/Switch "E" Circuit Range/Performance	109	Limited driving
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	107	Limited driving
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	108	Limited driving
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	110	Limited driving
P3000	Battery Control System Malfunction	123	Limited driving
P3000	Battery Control System Malfunction	125	Limited driving
P3000	Battery Control System Malfunction	388	Limited driving
P3000	Battery Control System Malfunction	389	Limited driving
P3000	Battery Control System Malfunction	603	Limited driving
P3004	High Voltage Power Resource Malfunction	131	Impossible to drive
P3004	High Voltage Power Resource Malfunction	132	Normal driving
P3004	High Voltage Power Resource Malfunction	133	Limited driving
P3009	High Voltage Power Short Circuit	526	Normal driving
P3009	High Voltage Power Short Circuit	611	Normal driving
P3009	High Voltage Power Short Circuit	612	Normal driving
P3009	High Voltage Power Short Circuit	613	Normal driving
P3009	High Voltage Power Short Circuit	614	Normal driving
P3102	Transmission Control ECU Malfunction	524	Impossible to drive
P3102	Transmission Control ECU Malfunction	525	Impossible to drive
P3102	Transmission Control ECU Malfunction	581	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P3102	Transmission Control ECU Malfunction	582	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P3102	Transmission Control ECU Malfunction	597	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P3102	Transmission Control ECU Malfunction	598	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P3102	Transmission Control ECU Malfunction	599	If shift position cannot be fixed: Impossible to drive If shift position is being fixed: Normal driving
P3107	Lost Communication with Airbag System Control Module	213	Normal driving
P3107	Lost Communication with Airbag System Control Module	214	Normal driving
P3107	Lost Communication with Airbag System Control Module	215	Normal driving
P3108	Lost Communication with A/C System Control Module	535	Normal driving
P3108	Lost Communication with A/C System Control Module	536	Normal driving
P3108	Lost Communication with A/C System Control Module	537	Normal driving
P3108	Lost Communication with A/C System Control Module	538	Normal driving
P3108	Lost Communication with A/C System Control Module	594	Normal driving
P3110	HV Main Relay Malfunction	223	Normal driving
P3110	HV Main Relay Malfunction	527	Impossible to drive

cardiagn.com

DTC No.	Detection Item	INF Code	Driving Condition
P3137	Collision Sensor Low Input	348	Normal driving
P3138	Collision Sensor High Input	349	Normal driving
P3140	HV Interlock Switch Operation	350	Normal driving
P3143	HV Interlock Switch Open/Short	351	Normal driving
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit Range/Performance	276	Normal driving
P3211	Drive Motor ”A” Inverter Temperature Sensor Circuit Range/Performance	277	Normal driving
P3212	Drive motor ”A” Inverter Temperature Sensor Circuit Range/Performance	275	Normal driving
P3213	Drive Motor ”A” Inverter Temperature Sensor Circuit High	274	Normal driving
P3221	Generator Inverter Temperature Sensor Circuit Range/Performance	314	Normal driving
P3221	Generator Inverter Temperature Sensor Circuit Range/Performance	315	Normal driving
P3222	Generator Inverter Temperature Sensor Circuit High/Low	313	Normal driving
P3223	Generator Inverter Temperature Sensor Circuit High	312	Normal driving
P3226	DC/DC (Boost) Converter Temperature Sensor Malfunction	562	Normal driving
P3226	DC/DC (Boost) Converter Temperature Sensor Malfunction	563	Normal driving
U0100	Lost Communication with ECM/PCM ”A”	211	Limited driving
U0100	Lost Communication with ECM/PCM ”A”	212	Limited driving
U0100	Lost Communication with ECM/PCM ”A”	530	Limited driving
U0111	Lost Communication with Battery Energy Control Module ”A”	208	Limited driving
U0111	Lost Communication with Battery Energy Control Module ”A”	531	Limited driving
U0129	Lost Communication with Brake System Control Module	220	Regenerative brake ineffective
U0129	Lost Communication with Brake System Control Module	222	Regenerative brake ineffective
U0129	Lost Communication with Brake System Control Module	528	Regenerative brake ineffective
U0129	Lost Communication with Brake System Control Module	529	Regenerative brake ineffective
U0131	Lost Communication with Power Steering Control Module	433	Normal driving
U0131	Lost Communication with Power Steering Control Module	434	Normal driving
U0146	Lost Communication with Gateway ”A”	435	Normal driving

cardiagn.com

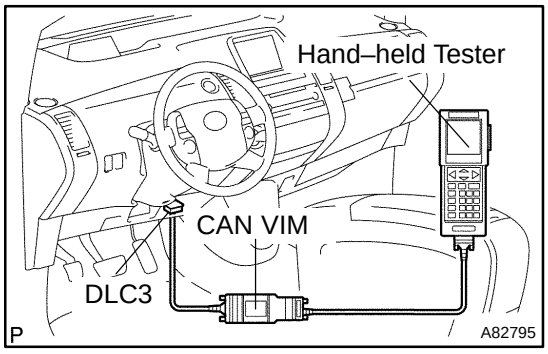
05J87–01

OPERATION HISTORY DATA

1. OPERATION HISTORY DATA

HINT:

The operation history data records the special operations performed by the driver and the number of abnormal conditions that have been input into the HV control ECU.



(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DATA LIST.
(e) Select the menu to view the number of special operations or controls that have been effected.

HINT:

- LATEST OPER: Among the past occurrences, the number of special operations or controls that have been effected during the most recent 1 trip detection.
- LATEST TRIP: The number of trips after the occurrence of LATEST OPER.
- BEF LATST OPER: The number of occurrences 1 previously from the LATEST OPER.
- BEF LATST TRIP: The number of trips after the occurrence of BEF LATST OPER.

Operation history data:

Hand–held Tester Display	Count Condition
SHIFT BEF READY	Selector lever moved with READY lamp blinking
N RANGE CTRL 2	N position control effected due to frequent shifting operation
STEP ACCEL IN N	Accelerator pedal depressed in N position
AUX. BATT LOW	Auxiliary battery voltage below 9.5 V
HV INTERMITTENT	Instantaneous open at IGSW terminal of HV control ECU
MG2 (NO1) TEMP HIGH	Motor temperature climbed above 174°C (345°F)
MG2 (NO2) TEMP HIGH	Transaxle fluid temperature climbed above 162°C (324°F)
MG2 INV TEMP HI	Motor inverter temperature climbed above 111°C (232°F)
MG1 INV TEMP HI	Generator inverter temperature climbed above 111°C (232°F)
MAIN BATT LOW	Battery state of charge dropped below 30 %
RESIST OVR HEAT	Limit resistor forecast temperature climbed above 120°C (248°F)
COOLANT HEAT	Inverter coolant forecast temperature climbed above 65°C (149°F)
CONVERTER HEAT	Boost converter temperature climbed above 111°C (232°F)
SHIFT P IN RUN	Shifted to P while driving
BKWRD DIR SHIFT	Shifted to R while moving forward or to D or B while moving in reverse
PREVENT STAYING	Engine speed stays in resonance frequency band

cardiagn.com

05J86–01

INFORMATION/FREEZE FRAME DATA

1. FREEZE FRAME DATA

HINT:

The freeze frame data records the driving condition at the time of detection of a DTC. It is used for estimating or simulating the condition of the vehicle when malfunction occurred. To check the details of the hybrid vehicle control system, check the detailed information for the DTC (Information).

(a) Connect the hand–held tester to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / HV ECU / DTC INFO / TROUBLE CODES.
(e) Select a DTC in order to display its freeze frame data.
(f) Check the freeze frame data of the DTC that has been detected.
(g) Check information of the DTC (see next page).

Freeze frame data:

Hand–held Tester Display	Measurement Item/Range (Display)	Suspected Vehicle Status When Malfunction Occurs
FREEZE DTC	DTC corresponding to displayed freeze frame data	—
COOLANT TEMP	Engine coolant temperature/ Min.: –40°C, Max.: 140°C	Cold or warm engine
VEHICLE SPD	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Stopped, or driving (low, medium, and high speeds)
ENG RUN TIME	Elapsed time after starting engine Min.: 0 s, Max.: 65,535 s	Elapsed time from engine start
+B	Auxiliary battery voltage/ Min.: 0 V, Max.: 65.535 V	Condition of auxiliary battery
ACCEL POS #1	Accelerator pedal position sensor No. 1/ Min.: 0 %, Max.: 100 %	Idling, accelerating, or decelerating
ACCEL POS #2	Accelerator pedal position sensor No. 2/ Min.: 0 %, Max.: 100 %	Idling, accelerating or decelerating (For comparison with above to detect failure of accelerator pedal position sensor No .1)
AMBIENT TEMP	Ambient air temperature/ Min.: –40°C, Max.: 215°C	Ambient air temperature
INTAKE AIR TEMP	Intake air temperature/ Min.: –40°C, Max.: 140°C	Ambient air temperature
DTC CLEAR WARM	The number of times engine is warmed up after clearing DTCs/ Min.: 0, Max.: 255	Frequency of the malfunction recurrence after clearing DTCs
DTC CLEAR RUN	Drive distance after clearing DTCs/ Min.: 0 km, Max.: 65,535 km	Frequency of the malfunction recurrence after clearing DTCs
DTC CLEAR MIN	Elapsed time after clearing DTCs/ Min.: 0 min, Max.: 65,535 min	Frequency of the malfunction recurrence after clearing DTCs
ECU TYPE	Type of ECU	—
INFORMATION 1 to 5	Information code	—

cardiagn.com

2. INFORMATION

HINT:

Similar to freeze frame data, information records operating condition of the HV system and components at the time of detection of a DTC.

(a) Select one which has an INF code from among INFORMATION 1 to 5.

(b) Check the information of the DTC.

Information:

Hand–held Tester Display	Measurement Item/Range (Display)	Suspected Vehicle Status When Malfunction Occurs
INFORMATION N	Information code	Indication of system with malfunction
MG1 REV	MG1 revolution/ Min.: –16,384 rpm, Max.: 16,256 rpm	MG1 speed • Forward rotation appears as ”+” • Backward rotation appears as ”–”
MG2 REV	MG2 revolution/ Min.: –16,384 rpm, Max.: 16,256 rpm	MG2 speed (proportionate to vehicle speed) • Forward rotation appears as ”+” • Backward rotation appears as ”–” Moving direction of vehicle • Forward direction appears as ”+” • Backward direction appears as ”–”
MG1 TORQ	MG1 torque/ Min.: –512 Nm, Max.: 508 Nm	When MG1 rotation in + direction: • Torque appears as ”+” while MG1 discharges • Torque appears as ”–” while MG1 charges When MG1 rotation in – direction: • Torque appears as ”–” while MG1 discharges • Torque appears as ”+” while MG1 charges
MG2 TORQ	MG2 torque/ Min.: –512 Nm, Max.: 508 Nm	When MG2 rotation in + direction: • Torque appears as ”+” while MG2 discharges • Torque appears as ”–” while MG2 charges When MG2 rotation in – direction: • Torque appears as ”–” while MG2 discharges • Torque appears as ”+” while MG2 charges
INVERT TEMP–MG1	MG1 inverter temperature/ Min.: –50°C, Max.: 205°C	MG1 inverter temperature
INVERT TEMP–MG2	MG2 inverter temperature/ Min.: –50°C, Max.: 205°C	MG2 inverter temperature
MG2 TEMP (No2)	Transaxle fluid temperature/ Min.: –50°C, Max.: 205°C	Transaxle fluid temperature
MG2 TEMP (No1)	MG2 temperature/ Min.: –50°C, Max.: 205°C	MG2 temperature
POWER RQST	Request engine power/ Min.: 0 W, Max.: 255 kW	Engine power output requested to ECM
ENGINE SPD	Engine speed/ Min.: 0 rpm, Max.: 16,320 rpm	Engine speed
MCYL CTRL POWER	Master cylinder control torque/ Min.: –512 Nm, Max.: 508 Nm	Brake force requested by driver
SOC	Battery state of charge/ Min.: 0 %, Max.: 100 %	State of charge of HV battery
WOUT CTRL POWER	Power value discharge control/ Min.: 0 W, Max.: 81,600 W	Discharge amount of HV battery
WIN CTRL POWER	Power value charge control/ Min.: –40,800 W, Max.: 0 W	Charge amount of HV battery
DRIVE CONDITION	Drive condition ID • Engine stopped: 0 • Engine about to be stopped: 1 • Engine about to be started: 2 • Engine operated or operating: 3 • Generating or loading movement: 4 • Revving up with P position: 6	Engine operating condition

cardiagn.com

Hand–held Tester Display	Measurement Item/Range (Display)	Suspected Vehicle Status When Malfunction Occurs
PWR RESOURCE VB	HV battery voltage/ Min.: 0 V, Max.: 510 V	HV battery voltage
PWR RESOURCE IB	HV battery current/ Min.: –256 A, Max.: 254 A	Charging/discharging state of HV battery • Discharging amperage indicated by a positive value • Charging amperage indicated by a negative value
SHIFT POSITION	Shift position (P, R, N, D or B position)	Shift position
ACCEL SENSOR MAIN	Accelerator pedal position sensor main/ Min.: 0 %, Max.: 100 %	Idling, accelerating, or decelerating
AUX. BATT V	Auxiliary battery voltage/ Min.: 0 V, Max.: 20 V	State of auxiliary battery
CONVERTER TEMP	Boost converter temperature/ Min.: –50°C, Max.: 205°C	Boost converter temperature
VL	High voltage before it is boosted/ Min.: 0 V, Max.: 510 V	High voltage level before it is boosted
VH	High voltage after it is boosted/ Min.: 0 V, Max.: 765 V	High voltage level after it is boosted
IG ON TIME	The time after power switch ON (IG)/ Min.: 0 min, Max.: 255 min	Time elapsed with power switch ON (IG)
VEHICLE SPD–MAX	Maximum vehicle speed/ Min.: –256 km/h, Max.: 254 km/h	Maximum vehicle speed
A/C CONSMPT PWR	A/C consumption power/ Min.: 0 kW, Max.: 5 kW	A/C load
ENG STOP RQST	Engine stop request/ NO or YES	Presence of engine stop request
IDLING REQUEST	Engine idling request/ NO or YES	Presence of idle stop request
ENGINE FUEL CUT	Engine fuel cut request/ NO or YES	Presence of fuel cut request
HV BATT CH RQST	HV battery charging request/ NO or YES	Presence of HV battery charging request
ENG WARM UP RQT	Engine warming up request/ NO or YES	Presence of engine warm–up request
STOP SW COND	Stop lamp switch ON condition/ NO or YES	Brake pedal depressed or released
CRUISE CONTROL	Cruise control active condition/ NO or YES	Operation under cruise control ON or OFF
EXCLUSIVE INFO 1 to 7	Exclusive information (in form of numerical data)	Exclusive Information linked to Information
OCCURENCE ORDER	Occurrence sequence of information	Occurrence sequence of information
INVT TMP–MG1 IG	MG1 inverter temperature after power switch ON (IG)/ Min.: –50°C, Max.: 205°C	MG1 inverter temperature soon after power switch ON (IG)
INVT TMP–MG2 IG	MG2 inverter temperature after power switch ON (IG)/ Min.: –50°C, Max.: 205°C	MG2 inverter temperature soon after power switch ON (IG)
MG2 TEMP IG	MG2 temperature after power switch ON (IG)/ Min.: –50°C, Max.: 205°C	MG2 temperature soon after power switch ON (IG)
CONVRTR TEMP IG	Boost converter temperature after power switch ON (IG)/ Min.: –50°C, Max.: 205°C	Boost converter temperature soon after power switch ON (IG)
SOC IG	Battery state of charge after power switch ON (IG)/ Min.: 0 %, Max.: 100 %	Battery state of charge soon after power switch ON (IG)
INVT TMP–MG1MAX	MG1 inverter maximum temperature/ Min.: –50°C, Max.: 205°C	Overheating state of MG1 inverter
INVT TMP–MG2MAX	MG2 inverter maximum temperature/ Min.: –50°C, Max.: 205°C	Overheating state of MG2 inverter
MG2 TEMP MAX	MG2 maximum temperature/ Min.: –50°C, Max.: 205°C	Overheating state of MG2
CONVRTR TMP MAX	Boost converter maximum temperature/ Min.: –50°C, Max.: 205°C	Overheating state of boost converter

cardiagn.com

Hand–held Tester Display	Measurement Item/Range (Display)	Suspected Vehicle Status When Malfunction Occurs
SOC MAX	Maximum status of charge/ Min.: 0 %, Max.: 100 %	Over–charging of HV battery
SOC MIN	Minimum status of charge/ Min.: 0 %, Max.: 100 %	Over–discharging of HV battery

cardiagn.com

05J7Z–01

SYSTEM DESCRIPTION

1. GENERAL

The THS–II control system consists of the following control.

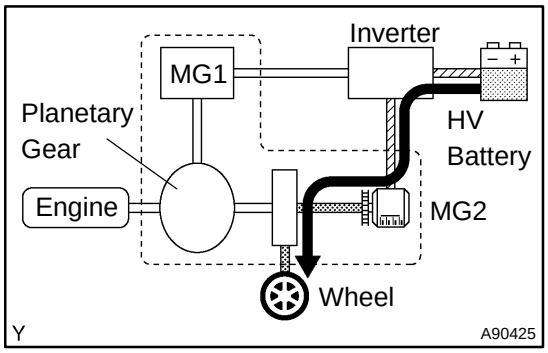
Item	Outline
HV control ECU Control	• The HV control ECU controls the MG1, MG2, engine, regenerative brake control and HV battery SOC. These factors are determined by the shift position, accelerator pedal position and vehicle speed. • The HV control ECU monitors the SOC and temperature of the HV battery, MG1 and MG2, in order to optimally control these items. • When the shift position is in N, the HV control ECU effects shutdown control to electrically stop the MG1 and MG2. • If the drive wheels rotate without traction, the HV control ECU performs the motor traction control that provides a restraint on a rotation of MG2, in order to protect the planetary gear unit and prevent MG1 from generating excessive electricity. • For the purpose of protecting the circuit from high voltage and ensuring the reliability of the circuit shutdown, the HV control ECU effects SMR control through the use of 3 relays to connect and shut down the high–voltage circuit.
ECM Control	The ECM receives the demand power and the target rpm, which were sent from the HV control ECU, and controls the ETCS–i system, fuel injection volume, ignition timing and VVT–i system.
Inverter Control	• In accordance with the signals provided by the HV control ECU, the inverter converts a direct current (HV battery) into an alternating current (MG1 and MG2), or vice versa. In addition, the inverter supplies the AC (MG1) power to the AC (MG2). However, when electricity is supplied from MG1 to MG2 , the electricity is converted into DC inside the inverter. • The HV control ECU sends the signal to the power transistor in the inverter for switching the U, V and W phase of the MG1 and MG2 in order to drive the MG1 and MG2. • The HV control ECU shuts down if it receives an overheating, over–current, or fault voltage signal from the inverter.
Boost Converter Control	• In accordance with the signals provided by the HV control ECU, the boost converter boosts the nominal voltage of DC 201.6 V (for HV battery) up to the maximum voltage of DC 500 V. • The maximum voltage of AC 500 V generated by the MG1 or MG2 is converted into a direct current by the inverter, the boost converter drops the direct current to DC 201.6 V (for HV battery) based on the signals from the HV control ECU.
Converter Control	• The DC/DC converter drops the nominal voltage of DC 201.6 V into DC 12 V in order to supply electricity to body electrical components, as well as to recharge the auxiliary battery (DC 12 V). • This converter controls the terminals of the auxiliary battery to a constant voltage.
A/C Inverter Control	A/C inverter converts the nominal voltage of the HV battery from DC 201.6 to AC 201.6 V and supplies power to operate the electric compressor of the A/C system.
MG1 and MG2 Main Control	• MG1, which is rotated by the engine, generates high voltage (maximum voltage of AC 500 V) in order to operate the MG2 and charge the HV battery. Also, it functions as a starter to start the engine. • MG2 primarily provides additional power to the engine in order to increase the overall drive force. During braking, or when the accelerator pedal is not depressed, it generates electricity to recharge the HV battery (regenerative brake system). • Speed sensors detect the speed and position of the MG1 and MG2 and output them to the HV control ECU. • A temperature sensor mounted on the MG2 detects a MG2 temperature and transmits it to the HV control ECU.
Skid Control ECU Control	During braking, the skid control ECU calculates the total braking force and transmits regenerative brake force request to the HV control ECU. Upon receiving this signal, the HV control ECU calculates the regeneration brake demand power value and transmits it to the skid control ECU. Based on this, the skid control ECU calculates and executes the required hydraulic pressure brake force.
Battery ECU Control	The battery ECU effects monitor control to monitor the conditions of the HV battery and cooling fan control to keep the HV battery at a predetermined temperature. Thus, it optimally controls these components.
Shift Control	• The HV control ECU detects the shift position (P, R, N, D, or B) in accordance with the signal provided by the shift position sensor, and controls the MG1, MG2, and engine, in order to create the driving conditions that suit the selected shift position. • The transmission control ECU detects that the driver has pressed the P position switch through a signal provided by the HV control ECU. Then, transmission control ECU operates the shift control actuator in order to mechanically lock the transaxle.

cardiagn.com

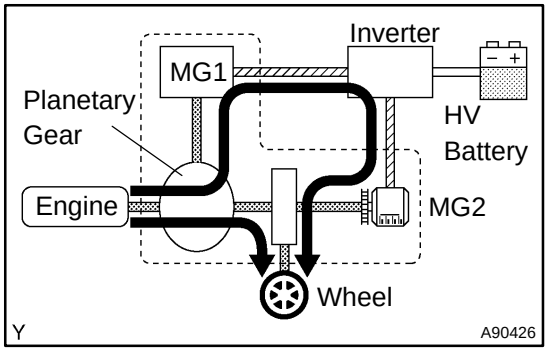
Item	Outline
During Collision Control	At the time of a collision, if the HV control ECU receives an airbag deployment signal from the airbag ECU or an actuation signal from the circuit breaker sensor located in the inverter, it turns OFF the SMR and power switch in order to shut off the entire power supply.
Cruise Control System Operation Control	When the cruise control ECU built in the HV control ECU receives a cruise control switch signal, it calculates the cruise control request value, and calculates the motive forces of the engine, MG1, and MG2 to achieve an optimal combination.
Indicator and Warning Lamp Illumination Control	Illuminates or blinks the lamps to inform the driver of the vehicle condition or system malfunction.
Diagnosis	When the HV control ECU detects malfunction, the HV control ECU diagnoses and memorizes values corresponding to the failure.
Fail–Safe	When the HV control ECU detects malfunction, the HV control ECU stops or controls the actuator and ECUs according to the data already stored in its memory.

2. BASIC OPERATION

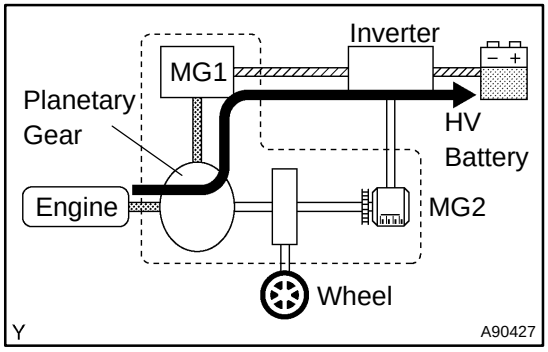
(a) This system controls the following modes in order to achieve the most efficient operations to match the driving conditions:



(1) Supply of electrical power from the HV battery to MG2 provides force to drive the wheels.

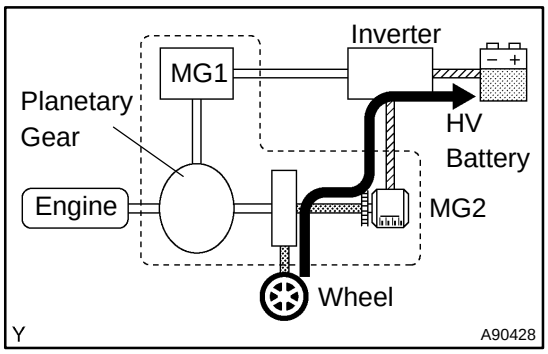


(2) While the wheels are being driven by the engine via the planetary gear, MG1 is rotated by the engine via the planetary gears, in order to supply the generated electricity to MG2.



(3) MG1 is rotated by the engine via the planetary gear, in order to charge the HV battery.

cardiagn.com

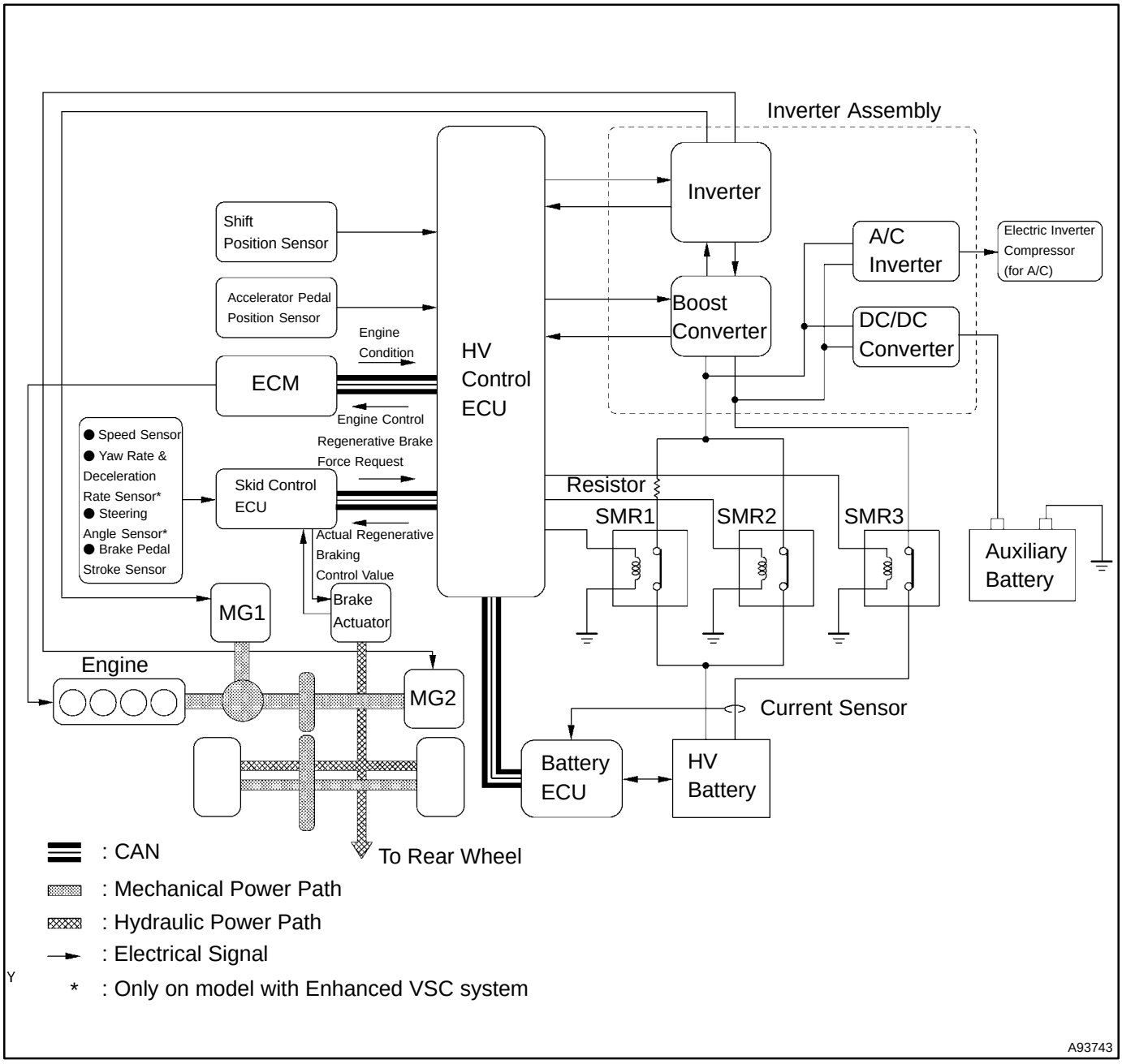


(4) When the vehicle is decelerating, kinetic energy from the wheels is recovered and converted into electrical energy and used to recharge the HV battery by means of MG2.

(b) The HV control ECU switches between these modes ((1), (2), (3), (1) + (2) + (3), or (4)) according to the driving condition. However, when the SOC (State of Charge) of the HV battery is low, the HV battery is charged by the engine by turning MG1.
As a result, it achieves far greater fuel economy compared to conventional gasoline engine vehicles, at a reduced level of exhaust gas emissions. Furthermore, this revolutionary power–train has eliminated the constraints that are associated with electric vehicles (such as their short cruising range or their reliance on external recharging units).

cardiagn.com

3. SYSTEM DIAGRAM



cardiagn.com

4. FUNCTION OF MAIN COMPONENTS

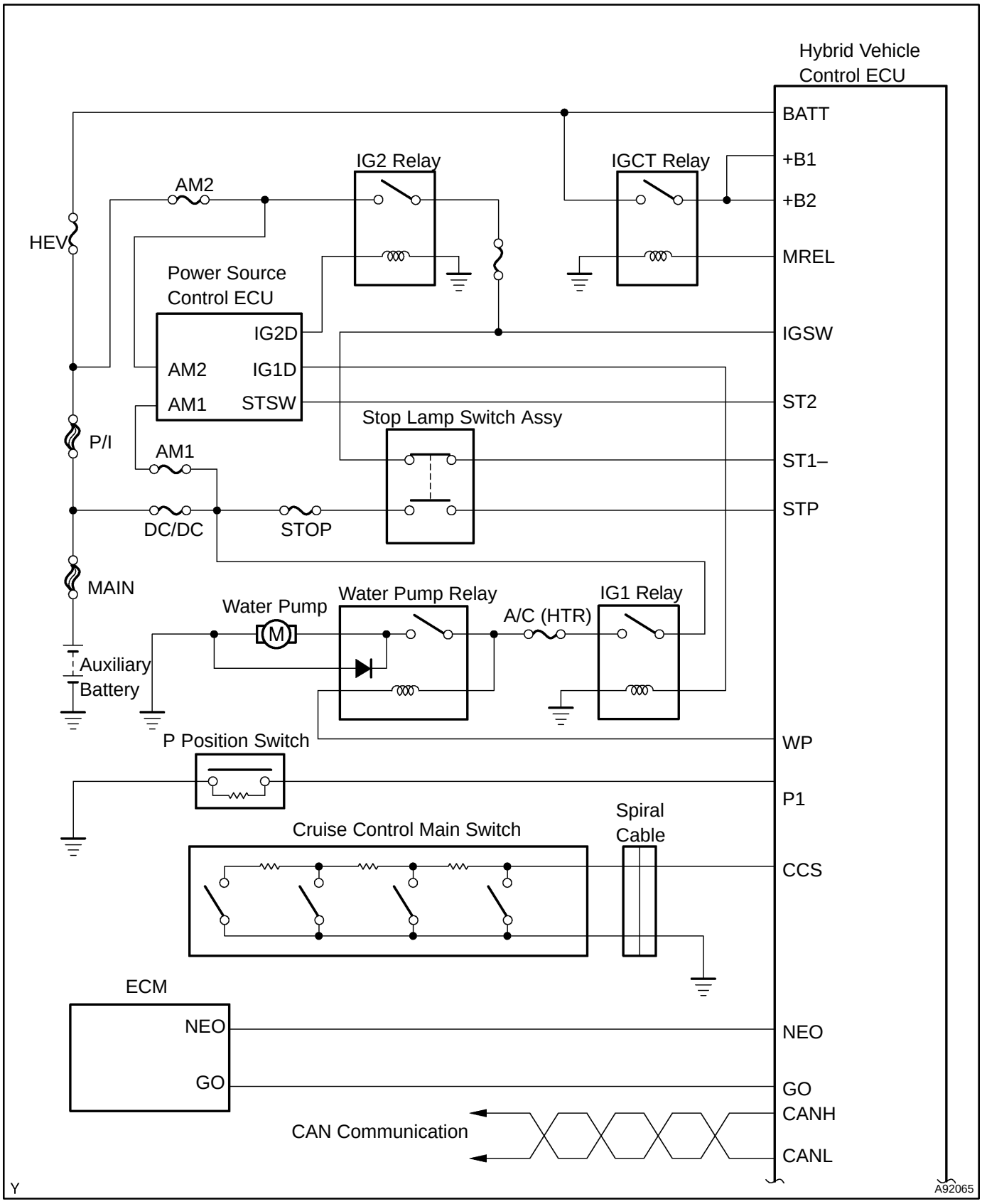
Item	Outline
MG1	MG1, which is rotated by the engine, generates high–voltage electricity in order to operate the MG2 or charge the HV battery. Also, it functions as a starter to start the engine.
MG2	• Driven by electrical power from the MG1 or HV battery, and generates motive force for the vehicle. • During braking, or when the accelerator pedal is not depressed, it generates electricity to re-charge the HV battery (regenerative brake control).
Planetary Gear Unit	Distributes the engine's drive force as appropriate to directly drive the vehicle as well as the generator.
HV Battery	Supplies electric power to the MG2 during start–off, acceleration, and uphill driving. Recharged during braking or when the accelerator pedal is not depressed.
Inverter	Converts the high–voltage DC (HV battery) into AC (MG1 and MG2) and vice versa (converts AC into DC).
Boost Converter	Boosts the nominal voltage of the HV battery from DC 201.6 to DC 500 V and vice versa (drops DC 500 V to DC 201.6 V).
DC/DC Converter	Drops the nominal voltage of DC 201.6 V into DC 12 V in order to supply electricity to body electrical components, as well as to recharge the auxiliary battery (DC 12 V).
A/C Inverter	Converts the nominal voltage of DC 201.6 V of the HV battery to AC 201.6 V and supplies power to operate the electric inverter compressor of the A/C system.
HV Control ECU	Information from each sensor as well as from the ECUs (ECM, Battery ECU, skid control ECU, and EPS ECU) is received, and based on this the required torque and output power is calculated. Sends the calculated result to the ECM, inverter assembly, battery ECU and skid control ECU.
ECM	Activates the ETCS–i (Electronic Throttle Control System–intelligent) in accordance with the target engine speed and required engine motive force received from the HV control ECU.
Battery ECU	Monitors the charging condition of the HV battery.
Skid Control ECU	Controls the regenerative brake that is effected by the MG2 and the hydraulic brake so that the total braking force equals that of a conventional vehicle that is equipped only with hydraulic brakes. Also, performs the brake system control (ABS with EBD, Brake Assist, and Enhanced VSC *) conventionally.
Accelerator Pedal Position Sensor	Converts the accelerator pedal position angle into an electrical signal and outputs it to the HV control ECU.
Shift Position Sensor	Converts the shift position into an electrical signal and outputs it to the HV control ECU.
SMR (System Main Relay)	Connects and disconnects the high–voltage power circuit between battery and inverter assembly, through the use of a signal from the HV control ECU.
Interlock Switch (for Inverter Cover and Service Plug Grip)	Verifies that the cover of both the inverter and the service plug grip have been installed.
Circuit Breaker Sensor	The high–voltage circuit is intercepted if a vehicle collision has been detected.
Service Plug Grip	Shuts off the high–voltage circuit of the HV battery when this plug is removed for vehicle inspection or maintenance.

*: Only on model with Enhanced VSC System

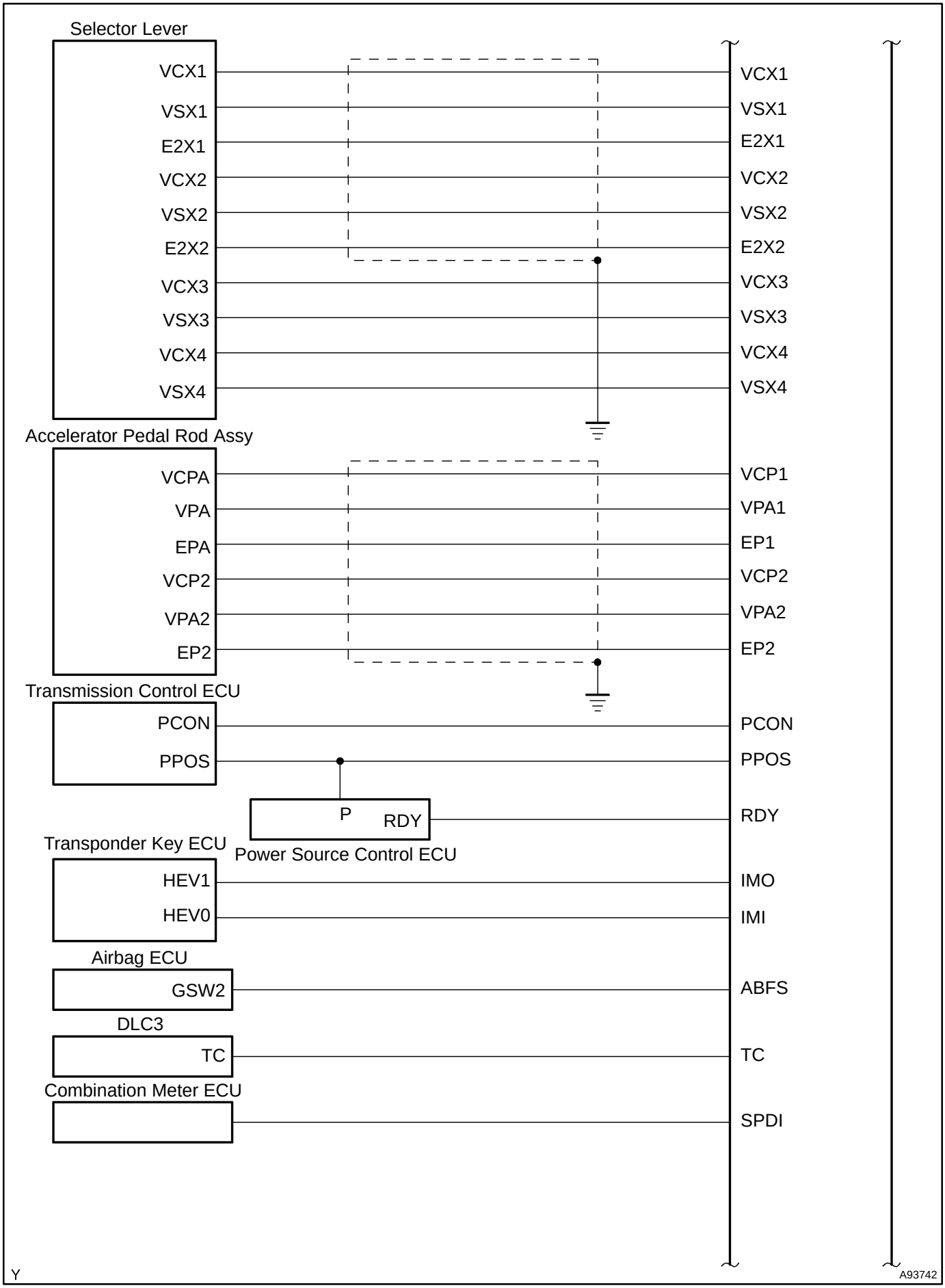
cardiagn.com

05J7Y–01

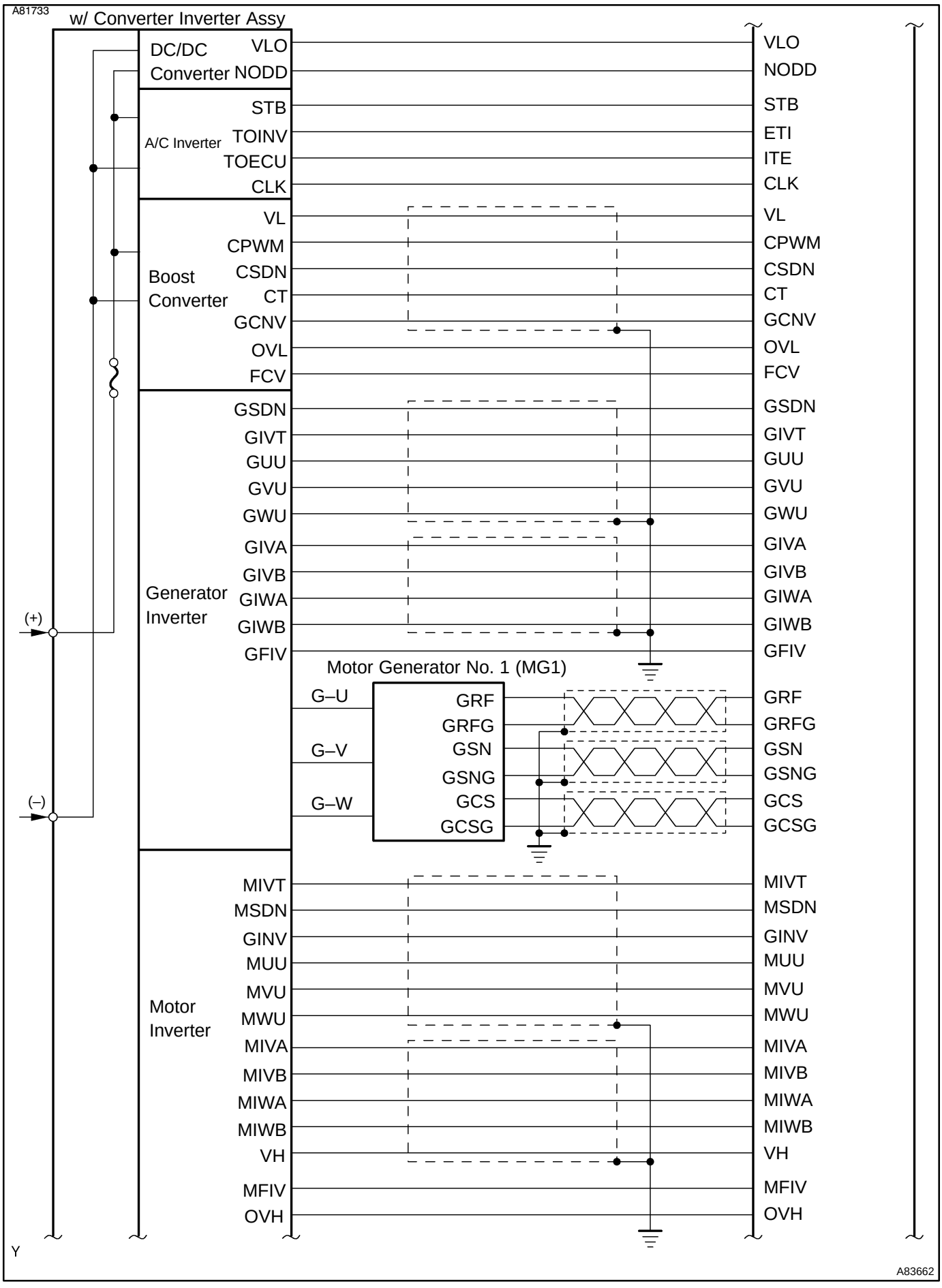
SYSTEM DIAGRAM



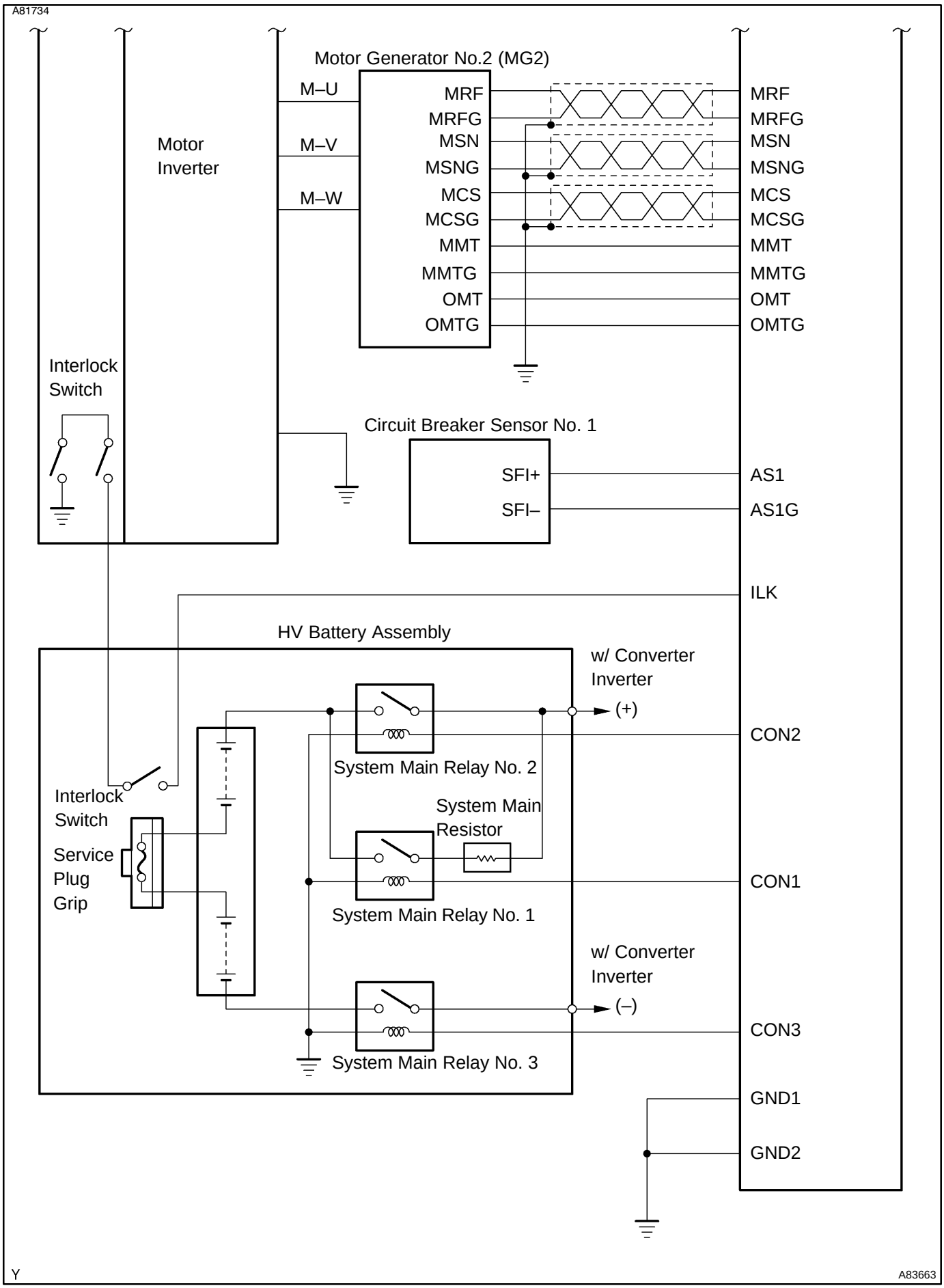
cardiagn.com



cardiagn.com

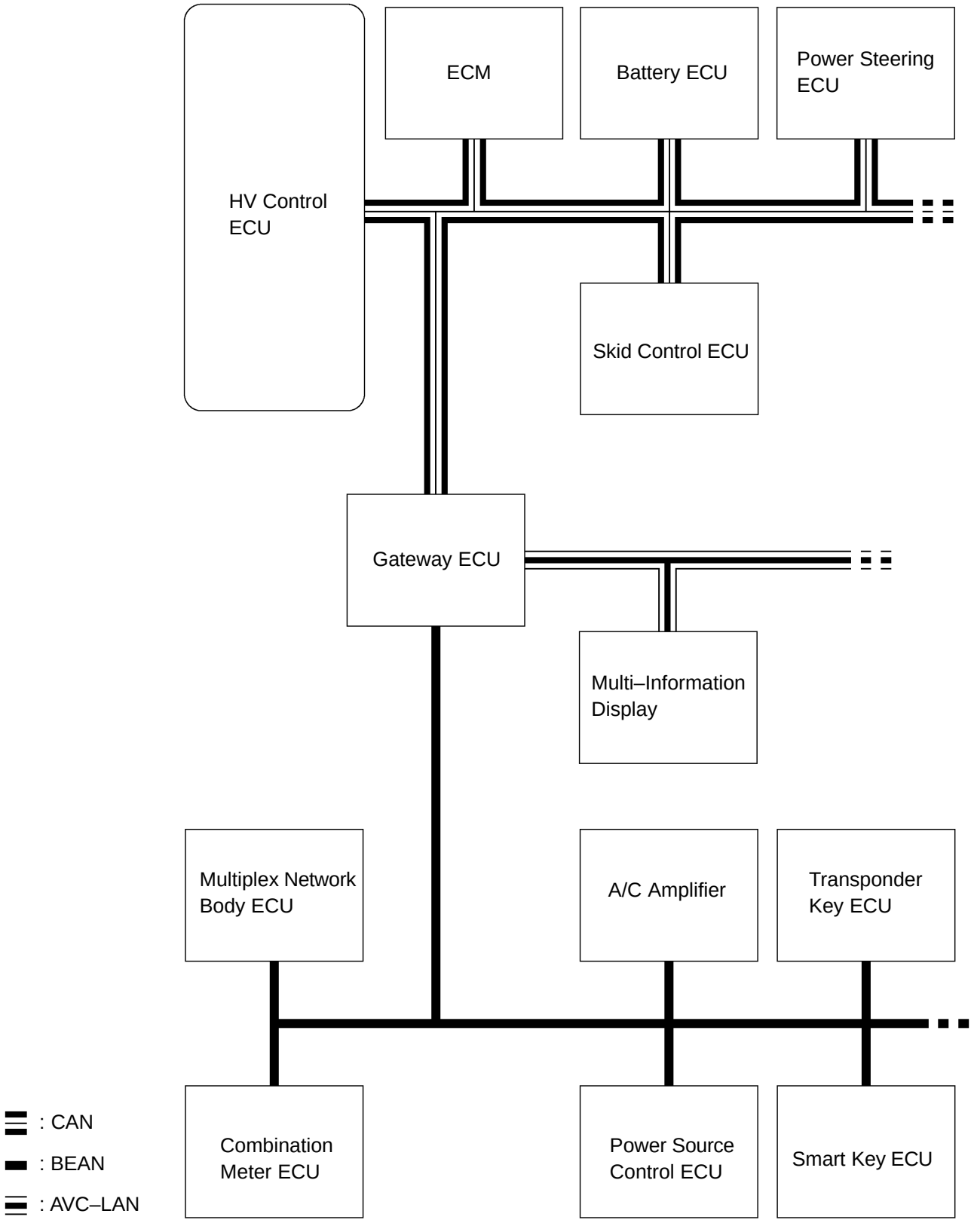


cardiagn.com



cardiagn.com

Communication Diagram:



Y

A93744

cardiagn.com

05J7W–01

PART AND SYSTEM NAME LIST

1. PART AND SYSTEM NAME LIST

This reference list indicates the part names used in this manual along with their definitions.

TOYOTA name	Definition
Toyota HCAC system	HC adsorptive three–way catalytic converter
Hydrocarbon absorptive catalyst (HCAC) system	HC adsorptive three–way catalytic converter
HC adsorptive three–way catalyst	HC adsorptive three–way catalytic converter
Variable valve timing sensor, VVT sensor	Camshaft position sensor
Variable valve timing system, VVT system	Camshaft timing control system
Oil control valve for variable valve timing, OCV for VVT, VVT OCV	Camshaft timing oil control valve
Variable timing and lift, VVTL	Camshaft timing and lift control
Engine speed sensor	Crankshaft position sensor
Knock control module	Engine knock control module
Knock sensor	Engine knock sensor
Vacuum sensor	Manifold air pressure sensor
Internal control module, Control module, Engine control ECU, PCM	Power train control module
FC idle	Deceleration fuel cut
Idle air control	Idle speed control
CCV, Canister closed valve	Evaporative emissions canister vent valve
VSV for EVAP	Evaporative emissions canister purge valve
VSV for bypass valve, VSV for vapor pressure sensor	Evaporative emission pressure switching valve
Vapor pressure sensor	Fuel tank pressure sensor
Charcoal canister, Canister	Evaporative emissions canister
ORVR system	On–board refueling vapor recovery system
Intake manifold runner control	Intake manifold tuning system
Intake manifold runner valve, IMRV, IACV (runner valve)	Intake manifold tuning valve
Intake control VSV	Intake manifold tuning solenoid valve
O2 sensor	Heater oxygen sensor
Oxygen sensor pumping current circuit	Oxygen sensor output signal
Oxygen sensor reference ground circuit	Oxygen sensor signal ground
Accel position sensor	Accelerator pedal position sensor
Throttle actuator control motor, Actuator control motor, Electronic throttle motor, Throttle control motor	Electronic throttle actuator
Electronic throttle control system, Throttle actuator control system	Electronic throttle control system
Throttle/pedal position sensor, Throttle/pedal position switch, Throttle position sensor/switch	Throttle position sensor
Turbo press sensor	Turbocharger pressure sensor
Turbo VSV	Turbocharger pressure control solenoid valve
P/S pressure switch	Power–steering pressure switch
Speed sensor, Vehicle speed sensor ”A”, Speed sensor for skid control ECU	Vehicle speed sensor
ATF temperature sensor, Trans. fluid temp. sensor, ATF temperature sensor ”A”	Transmission fluid temperature sensor
Electronic controlled automatic transmission, ECT	Electronically controlled automatic transmission
Intermediate shaft speed sensor ”A”	Counter gear speed sensor
Output speed sensor	Output shaft speed sensor
Input speed sensor, Input turbine speed sensor ”A”, Speed sensor (NT), Turbine speed sensor	Input turbine speed sensor
PNP switch, NSW	Park/neutral position switch
Pressure control solenoid	Transmission pressure control solenoid

cardiagn.com

TOYOTA name	Definition
Shift solenoid	Transmission shift solenoid valve
Transmission control switch, Shift lock control unit	Shift lock control module
Engine immobilizer system, Immobilizer system	Vehicle anti–theft system

2. ABBREVIATIONS LIST IN THIS MANUAL

Abbreviations	Meaning
AC	Alternating Current
A/C	Air Conditioning
A/D	Analog/Digital Converter
ACM	Active Control Engine Mount
AFS	Air Fuel Ratio Sensor
AP	Accelerator Pedal
A/T	Automatic Transmission (Transaxle)
ATF	Automatic Transmission Fluid
Ave.	Average
B+	Battery Positive Voltage
BARO	Barometric Pressure
CAN	Controller Area Network
CL	Closed Loop
Calif.	California
CCV	Charcoal Canister Vent
CPU	Central Processing Unit
DC	Direct Current
DLC1 DLC2 DLC3	Data Link Connector 1 Data Link Connector 2 Data Link Connector 3
DTC	Diagnostic Trouble Code
DTM	Diagnostic Test Mode
ECM	Engine Control Module
ECT	Engine Coolant Temperature
ECU	Electronic Control Unit
EEPROM	Electrically Erasable Programmable Read Only Memory
EPS	Electric Power Steering
ETCS	Electronic Throttle Control System
EVAP	Evaporative Emissions
F/B	Feedback
FC	Fan Control
Fed.	Federal
FEEPROM	Flash Electrically Erasable Programmable Read Only Memory
FEPROM	Flash Erasable Programmable Read Only Memory
Fr	Front
FTP	Fuel Tank Pressure
GND	Ground
GSA	Gear Shift Actuator
HC	Hydrocarbons
HPU	Hydraulic Power Unit
HV	Hybrid Vehicle
IAC	Idle Air Control
IAT	Intake Air Temperature
INF	Information
ISC	Idle Speed Control
J/B	Junction Block

cardiagn.com

Abbreviations	Meaning
J/C	Junction Connector
LH	Left–Hand
MG1	Motor Generator No. 1
MG2	Motor Generator No. 2
MIL	Malfunction Indicator Lamp
Min.	Minute(s)
MY	Model Year
No.	Number
NVRAM	Non–Volatile Random Access Memory
OBD	On–Board Diagnostic
OCV	Oil Control Valve
O/D	Overdrive
OP	Open Loop
PCM	Powertrain Control Module
PNP	Park/Neutral Position
PROM	Programmable Read Only Memory
PS, P/S	Power Steering
PSP	Power Steering Pressure
PWM	Pulse Width Modulation
RAM	Random Access Memory
R/B	Relay Block
Rev.	Revolutions
RH	Right–Hand
RM	Relay Module
ROM	Read Only Memory
RPM	Revolution Per Minutes (RPM)
Rr	Rear
SAE	Society of Automotive Engineers Inc.
Sec.	Second(s)
SMR	System Main Relay
SMT	Sequential Manual Transmission
SOC	State Of Charge
SRI	Service Reminder Indicator
SRT	System Readiness Test
ST	Scan Tool
STD	Standard
SW	Switch
TCM	Transmission Control Module
THA	Intake Air Temperature
THS	TOYOTA Hybrid System
TR	Transmission Range
TWC	Three–Way Catalytic Converter
VIN	Vehicle Identification Number
VM	Voltage Monitor
VR	Voltage Regulator
VSS	Vehicle Speed Sensor
VSV	Vacuum Switching Valve
VVT	Variable Valve Timing (System)
VVTL	Variable Valve Timing and Lift (System)
w/	With
w/o	Without

cardiagn.com

05J81–01

CUSTOMER PROBLEM ANALYSIS CHECK

Prius Problem Check Sheet

Please fill in the blanks within bold frame

Name of Dealer	Person in Charge at Headquarters	Person in Charge at Dealer
Office		

Vehicle Specifications

Model Code	NHW 20 –AHE	Problem Occurrence Date	. .	Odometer Reading	miles km
Licence No.		Service Entry Date	. .	Production date	. .
VIN		Option	☐ Navigation (☐equipped by manufacturer ☐dealer) ☐ Cold climate specifications ☐ others ( )		

Interview Results

Contents of complaint (Status when and before/after occurring in the order of events as correct as possible)

Characteristics of Customer	
Vehicle used before	
Main use area	☐ city area ☐ suburbs ☐ mountain area ☐ other ( )
Frequency in use	☐ every day ☐ ____times/week or month

Driving Condition

Vehicle Speed
_____mph
_____km/h
☐ when starting
☐ when accelerating
☐ when normal driving
☐ when decelerating
☐ when braking
☐ when stopping
☐ when parking
☐ when turning
☐ when ABS actuating
☐ cruise control driving
☐ others ( )

Road Condition

☐ level road
☐ up hill or down hill
☐ dry paved road
☐ wet paved road
☐ rough paved road
☐ unpaved road
☐ snowy or frozen road
☐ bump or curb
☐ others ( )

Vehicle Condition

☐ Power switch ON (not getting ready)
☐ when starting
☐ right after starting
☐ until____minute after starting
☐ until____minute after starting of driving
☐ when stopping system

Status of engine
☐ while stopping engine
☐ when revolving engine

HV battery indication
☐____/8 segments
☐ unidentified

A/C status
☐ ON
☐ OFF
☐ unidentified

Power switch indicator
☐ illumination (orange or green)
☐ blink
☐ no illumination

Shift position (indication)
☐ P ☐ R ☐ N
☐ D ☐ B
☐ when operating
_____ → _____
☐ no indication
☐ blink
☐ unidentified

P position switch status
☐ illumination
☐ blink
☐ no illumination
☐ unidentified

Warning lamp
☐ ⚠
☐ engine
☐ charge
☐ PS
☐ HV battery
☐ HV
☐ brake (yellow or red)
☐ ABS
☐ VSC
☐ slip
☐ coolant
☐ other warning ( )
☐ no warning lamp

Brake operation
☐ brake slowly
☐ brake suddenly
☐ operation with a left foot
☐ not operating

Accelerator pedal operation
☐ when depressing
☐ when releasing
☐ when getting a foot off from the pedal

Frequency in occurrence
☐ always
☐_____ times/week or month
☐ only once

Weather: _____ ☐ unidentified
Temperature: _____F _____C ☐ unidentified
Fuel level ____/10 segments ☐ unidentified

LLC maintenance record ( )
Frequency in use
☐ every day
☐____times/week or month

Vehicle Verification Results

Diagnostic trouble code

HV ★				Brake ★	
INF				INF	
SFI ★		Power Source control		Gate way	
Battery ★		A/C		Smart	
Transmission Control ★		SRS		Immobilizer	
EPS ★		Body		Theft Deterrent	
				Navigation	

★: Indicates that the system has a function to store the freeze frame data. If DTCs have been set, please attach the freeze frame data.

Vehicle Inspection Results (Verification items, reason to identify/presume the cause parts, etc.)	Duplication Status
	☐ always ☐ sometimes conditions when the malfunction occurred ( ) ☐ no reproduction
Replacement Parts	**Confirmation Results After Repair**
Problem parts: No/Yes (Sending date: . .)	☐ normal ☐ reproduction ☐ other ( )

cardiagn.com

05J8M–01

DIAGNOSTIC TROUBLE CODE CHART

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
B2799 (05–2367) *4 (05–2414) *5	Immobilizer Malfunction	539	Immobilizer malfunction	• Immobilizer system	X	X	–
B2799 (05–2367) *4 (05–2414) *5	Immobilizer Malfunction	540	Immobilizer malfunction	• Immobilizer system	X	X	–
B2799 (05–2367) *4 (05–2414) *5	Immobilizer Malfunction	541	Immobilizer malfunction	• Immobilizer system	X	X	–
B2799 (05–2367) *4 (05–2414) *5	Immobilizer Malfunction	542	Immobilizer malfunction	• Immobilizer system	X	X	–
B2799 (05–2367) *4 (05–2414) *5	Immobilizer Malfunction	543	Immobilizer malfunction	• Immobilizer system	X	X	–
B2799 (05–2367) *4 (05–2414) *5	Immobilizer Malfunction	544	Immobilizer malfunction	• Immobilizer system	X	X	–
P0336 (05–459)	Crankshaft Position Sensor ”A” Circuit Range/Performance	137	Engine speed sensor deviation malfunction (CAN communication)	• Wire harness or connector • Crankshaft position sensor • Camshaft position sensor • HV control ECU	X	○	• HV system
P0338 (05–462)	Crankshaft Position Sensor ”A” Circuit High Input	600	NEO signal circuit malfunction	• Wire harness or connector • HV control ECU	X	○	• HV system
P0340 (05–459)	Camshaft Position Sensor ”A” Circuit	532	Engine speed sensor deviation malfunction (pulse signal)	• Wire harness or connector • Crankshaft position sensor • Camshaft position sensor • HV control ECU	X	○	• HV system
P0343 (05–462)	Camshaft Position Sensor ”A” Circuit High Input	601	GO signal circuit malfunction	• Wire harness or connector • HV control ECU	X	○	• HV system
P0500 (05–2698)	Vehicle Speed Sensor ”A”	352	No input of vehicle speed signal during cruise control driving	• Cruise control system	X	X	–
P0560 (05–464)	System Voltage	117	HV control ECU back–up power source circuit malfunction	• Wire harness or connector • HEV fuse	○	○	• HV system
P0571 (05–2702)	Brake Switch ”A” Circuit	115	Open or short in stop lamp switch circuit	• Cruise control system	X	X	–
P0607 (05–2707)	Control Module Performance	116	When STP signal of HV control ECU is inconsistent with that of skid control ECU, with cruise control indicator ON	• Cruise control system	X	X	–
P0705 (05–468)	Transmission Range Sensor Circuit	571	Open or GND short in shift main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	572	+B short in shift main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	573	Open or GND short in shift sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0705 (05–468)	Transmission Range Sensor Circuit	574	+B short in shift sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	575	Open or GND short in select main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	576	+B short in select main sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	577	Open or GND short in select sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	578	+B short in select sub sensor circuit	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	595	Difference between shift main sensor value and shift sub sensor value is large	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0705 (05–468)	Transmission Range Sensor Circuit	596	Difference between select main sensor value and select sub sensor value is large	• Wire harness or connector • Selector lever • HV control ECU	X	○	• HV system
P0851 (05–479)	Park/Neutral Switch Input Circuit Low	579	GND short in P position switch circuit	• Wire harness or connector • P position switch • HV control ECU	X	○	• HV system
P0852 (05–479)	Park/Neutral Switch Input Circuit High	580	Open or +B short in P position switch circuit	• Wire harness or connector • P position switch • HV control ECU	X	○	• HV system
P0A08 (05–482)	DC/DC Converter Status Circuit	264	DC/DC converter malfunction	• w/ converter inverter assembly	X	○	• HV system • Discharge
P0A09 (05–483)	DC/DC Converter Status Circuit Low Input	265	Open or GND short in NODD signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly	X	○	• HV system • Discharge
P0A09 (05–485)	DC/DC Converter Status Circuit Low Input	591	Open or GND short in VLO signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly	X	○	• HV system • Discharge
P0A0F (05–487)	Engine Failed to Start	204	Abnormal signal input from ECM (abnormal engine output)	• ECM • SFI system	X	○	• HV system
P0A0F (05–487)	Engine Failed to Start	205	Abnormal signal input from ECM (engine is unable to start)	• ECM • SFI system	X	○	• HV system
P0A0F (05–488)	Engine Failed to Start	238	Engine does not start even though cranking it (transaxle input malfunction [engine system])	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU	X	○	• HV system
P0A0F (05–487)	Engine Failed to Start	533	Abnormal signal input from ECM (abnormal engine output by running out of fuel)	• ECM • SFI system	X	○	• HV system
P0A0F (05–487)	Engine Failed to Start	534	Abnormal signal input from ECM (engine is unable to start by running out of fuel)	• ECM • SFI system	X	○	• HV system
P0A10 (05–483)	DC/DC Converter Status Circuit High Input	263	+B short in NODD signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly	X	○	• HV system • Discharge

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A10 (05–485)	DC/DC Converter Status Circuit High Input	592	+B short in VLO signal circuit of DC/DC converter	• Wire harness or connector • w/ converter inverter assembly	X	○	• HV system • Discharge
P0A1D (05–493)	Hybrid Powertrain Control Module	134	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–493)	Hybrid Powertrain Control Module	135	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–494)	Hybrid Powertrain Control Module	139	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–495)	Hybrid Powertrain Control Module	140	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–496)	Hybrid Powertrain Control Module	141	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–497)	Hybrid Powertrain Control Module	142	ST signal of HV control ECU is ON with power switch OFF	• Wire harness or connector • Power source control ECU	○	○	• HV system
P0A1D (05–500)	Hybrid Powertrain Control Module	143	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–501)	Hybrid Powertrain Control Module	144	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–501)	Hybrid Powertrain Control Module	145	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–502)	Hybrid Powertrain Control Module	148	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–502)	Hybrid Powertrain Control Module	149	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–503)	Hybrid Powertrain Control Module	150	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–503)	Hybrid Powertrain Control Module	151	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–503)	Hybrid Powertrain Control Module	152	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–503)	Hybrid Powertrain Control Module	155	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–503)	Hybrid Powertrain Control Module	156	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–503)	Hybrid Powertrain Control Module	158	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–505)	Hybrid Powertrain Control Module	159	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–505)	Hybrid Powertrain Control Module	160	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–506)	Hybrid Powertrain Control Module	163	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–506)	Hybrid Powertrain Control Module	164	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–507)	Hybrid Powertrain Control Module	165	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–508)	Hybrid Powertrain Control Module	166	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–508)	Hybrid Powertrain Control Module	167	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–507)	Hybrid Powertrain Control Module	168	HV control ECU internal error	• HV control ECU	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A1D (05–509)	Hybrid Powertrain Control Module	177	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–509)	Hybrid Powertrain Control Module	178	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–510)	Hybrid Powertrain Control Module	180	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–510)	Hybrid Powertrain Control Module	181	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–510)	Hybrid Powertrain Control Module	182	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–510)	Hybrid Powertrain Control Module	183	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–510)	Hybrid Powertrain Control Module	184	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–510)	Hybrid Powertrain Control Module	185	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–510)	Hybrid Powertrain Control Module	186	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–512)	Hybrid Powertrain Control Module	187	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–513)	Hybrid Powertrain Control Module	188	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–513)	Hybrid Powertrain Control Module	189	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–513)	Hybrid Powertrain Control Module	192	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–513)	Hybrid Powertrain Control Module	193	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–513)	Hybrid Powertrain Control Module	195	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–513)	Hybrid Powertrain Control Module	196	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–508)	Hybrid Powertrain Control Module	197	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–507)	Hybrid Powertrain Control Module	198	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–507)	Hybrid Powertrain Control Module	199	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–508)	Hybrid Powertrain Control Module	200	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–515)	Hybrid Powertrain Control Module	390	Charge control malfunction	• HV control ECU	○	○	• HV system
P0A1D (05–509)	Hybrid Powertrain Control Module	392	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–516)	Hybrid Powertrain Control Module	393	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–506)	Hybrid Powertrain Control Module	511	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–506)	Hybrid Powertrain Control Module	512	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–503)	Hybrid Powertrain Control Module	564	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–513)	Hybrid Powertrain Control Module	565	HV control ECU internal error	• HV control ECU	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A1D (05–509)	Hybrid Powertrain Control Module	567	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–517)	Hybrid Powertrain Control Module	568	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–517)	Hybrid Powertrain Control Module	569	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–493)	Hybrid Powertrain Control Module	570	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1D (05–519)	Hybrid Powertrain Control Module	615	HV control ECU internal error	• HV control ECU	○	○	• HV system
P0A1F (05–520)	Battery Energy Control Module	123	Abnormal signal input from battery ECU (ROMRAM malfunction)	• HV battery system • Battery ECU	○	○	• HV system
P0A1F (05–521)	Battery Energy Control Module	129	HV battery voltage circuit malfunction	• HV battery voltage circuit • Service plug grip • High voltage fuse • Battery plug • Battery ECU	○	○	• HV system
P0A1F (05–525)	Battery Energy Control Module	593	IG2 signal circuit of battery ECU malfunction	• Wire harness or connector • Battery ECU	○	○	• HV system
P0A2B (05–528)	Drive Motor "A" Temperature Sensor Circuit Range/Performance	248	Motor temperature sensor No. 1 malfunction	• Hybrid vehicle motor	X	○	• HV system
P0A2B (05–528)	Drive Motor "A" Temperature Sensor Circuit Range/Performance	250	Motor temperature sensor No. 1 performance problem	• Hybrid vehicle motor	X	○	• HV system
P0A2C (05–529)	Drive Motor "A" Temperature Sensor Circuit Low	247	GND short in motor temperature sensor No. 1 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU	X	○	• HV system
P0A2D (05–529)	Drive Motor "A" Temperature Sensor Circuit High	249	Open or +B short in motor temperature sensor No. 1 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU	X	○	• HV system
P0A37 (05–535)	Generator Temperature Sensor Circuit Range/Performance	258	Motor temperature sensor No. 2 malfunction	• Hybrid vehicle motor	X	○	• HV system
P0A37 (05–536)	Generator Temperature Sensor Circuit Range/Performance	260	Motor temperature sensor No. 2 performance problem	• Hybrid vehicle motor • Transaxle fluid leakage • HV transaxle assembly	X	○	• HV system
P0A38 (05–537)	Generator Temperature Sensor Circuit Low	257	GND short in motor temperature sensor No. 2 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU	X	○	• HV system
P0A39 (05–537)	Generator Temperature Sensor Circuit High	259	Open or +B short in motor temperature sensor No. 2 circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU	X	○	• HV system
P0A3F (05–542)	Drive Motor "A" Position Sensor Circuit	243	Interphase short in motor resolver circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU	○	○	• HV system
P0A40 (05–542)	Drive Motor "A" Position Sensor Circuit Range/Performance	500	Motor resolver output is out of normal range	• Wire harness or connector • Hybrid vehicle motor • HV control ECU	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A41 (05–542)	Drive Motor "A" Position Sensor Circuit Low	245	Open or short in motor resolver circuit	• Wire harness or connector • Hybrid vehicle motor • HV control ECU	○	○	• HV system
P0A4B (05–547)	Generator Position Sensor Circuit	253	Interphase short in generator resolver circuit	• Wire harness or connector • Hybrid vehicle generator • HV control ECU	○	○	• HV system
P0A4C (05–547)	Generator Position Sensor Circuit Range/Performance	513	Generator resolver output is out of normal range	• Wire harness or connector • Hybrid vehicle generator • HV control ECU	○	○	• HV system
P0A4D (05–547)	Generator Position Sensor Circuit Low	255	Open or short in generator resolver circuit	• Wire harness or connector • Hybrid vehicle generator • HV control ECU	○	○	• HV system
P0A51 (05–551)	Drive Motor "A" Current Sensor Circuit	174	HV control ECU internal error	• HV control ECU	X	○	• HV system
P0A60 (05–552)	Drive Motor "A" Phase V Current	288	Phase V current sub sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A60 (05–552)	Drive Motor "A" Phase V Current	289	Open in phase V current sub sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A60 (05–552)	Drive Motor "A" Phase V Current	290	Phase V current main sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A60 (05–552)	Drive Motor "A" Phase V Current	292	Open in phase V current main sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A60 (05–552)	Drive Motor "A" Phase V Current	294	Phase V current main and sub sensors of motor inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A60 (05–552)	Drive Motor "A" Phase V Current	501	Phase V current main and sub sensors of motor inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A63 (05–552)	Drive Motor "A" Phase W Current	296	Phase W current sub sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A63 (05–552)	Drive Motor "A" Phase W Current	297	Open in phase W current sub sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A63 (05–552)	Drive Motor "A" Phase W Current	298	Phase W current main sensor of motor inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A63 (05–552)	Drive Motor "A" Phase W Current	300	Open in phase W current main sensor circuit of motor inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A63 (05–552)	Drive Motor "A" Phase W Current	302	Phase W current main and sub sensors of motor inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A63 (05–552)	Drive Motor "A" Phase W Current	502	Phase W current main and sub sensors of motor inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A72 (05–557)	Generator Phase V Current	326	Phase V current sub sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A72 (05–557)	Generator Phase V Current	327	Open in phase V current sub sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A72 (05–557)	Generator Phase V Current	328	Phase V current main sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A72 (05–557)	Generator Phase V Current	330	Open in phase V current main sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A72 (05–557)	Generator Phase V Current	333	Phase V current main and sub sensors of generator inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A72 (05–557)	Generator Phase V Current	515	Phase V current main and sub sensors of generator inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A75 (05–557)	Generator Phase W Current	334	Phase W current sub sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A75 (05–557)	Generator Phase W Current	335	Open in phase W current sub sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A75 (05–557)	Generator Phase W Current	336	Phase W current main sensor of generator inverter current sensor malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A75 (05–557)	Generator Phase W Current	338	Open in phase W current main sensor circuit of generator inverter current sensor	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A75 (05–557)	Generator Phase W Current	341	Phase W current main and sub sensors of generator inverter current sensor performance problem	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A75 (05–557)	Generator Phase W Current	516	Phase W current main and sub sensors of generator inverter current sensor offset malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–562)	Drive Motor "A" Inverter Performance	266	Open or GND short in inverter voltage (VH) signal circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	○	○	• HV system
P0A78 (05–562)	Drive Motor "A" Inverter Performance	267	+B short in inverter voltage (VH) signal circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	○	○	• HV system
P0A78 (05–571)	Drive Motor "A" Inverter Performance	272	Abnormality in motor PWM circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–574)	Drive Motor "A" Inverter Performance	278	+B short in motor inverter over–voltage (OVH) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A78 (05–577)	Drive Motor "A" Inverter Performance	279	Motor inverter over–voltage (OVH) signal detection (over–voltage by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–574)	Drive Motor "A" Inverter Performance	280	Open or GND short in motor inverter over–voltage (OVH) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–586)	Drive Motor "A" Inverter Performance	282	Motor inverter over voltage (OVH) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–590)	Drive Motor "A" Inverter Performance	283	+B short in motor inverter fail (MFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–593)	Drive Motor "A" Inverter Performance	284	Motor inverter fail (MFIV) signal detection (inverter overheating)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–590)	Drive Motor "A" Inverter Performance	285	Open or GND short in motor inverter fail (MFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–601)	Drive Motor "A" Inverter Performance	286	Motor inverter fail (MFIV) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–604)	Drive Motor "A" Inverter Performance	287	Motor inverter fail (MFIV) signal detection (over current by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–611)	Drive Motor "A" Inverter Performance	304	Open or +B short in motor gate shutdown (MSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–611)	Drive Motor "A" Inverter Performance	305	GND short in motor gate shutdown (MSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–614)	Drive Motor "A" Inverter Performance	306	Failure in monitoring MG2 torque performance	• Hybrid vehicle motor • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–617)	Drive Motor "A" Inverter Performance	308	Collision signal input from airbag ECU or circuit breaker sensor No. 1	• Supplemental restraint system • Circuit breaker sensor No. 1	○	○	• HV system
P0A78 (05–577)	Drive Motor "A" Inverter Performance	503	Motor inverter over–voltage (OVH) signal detection (over–voltage by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A78 (05–577)	Drive Motor "A" Inverter Performance	504	Motor inverter over–voltage (OVH) signal detection (over–voltage by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–604)	Drive Motor "A" Inverter Performance	505	Motor inverter fail (MFIV) signal detection (over current by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–604)	Drive Motor "A" Inverter Performance	506	Motor inverter fail (MFIV) signal detection (over current by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–611)	Drive Motor "A" Inverter Performance	507	Open in motor gate shutdown (MSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–618)	Drive Motor "A" Inverter Performance	508	Motor gate shutdown (MSDN) signal malfunction	• Wire harness or connector • HV control ECU	○	○	• HV system
P0A78 (05–621)	Drive Motor "A" Inverter Performance	510	Motor inverter gate malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–623)	Drive Motor "A" Inverter Performance	523	Inverter voltage (VH) sensor offset malfunction	• System main relay • w/ converter inverter assembly	○	○	• HV system
P0A78 (05–625)	Drive Motor "A" Inverter Performance	586	Inverter voltage (VH) sensor performance problem	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–628)	Generator Inverter Performance	309	Abnormality in generator PWM circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–631)	Generator Inverter Performance	321	+B short in generator inverter fail (GFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–634)	Generator Inverter Performance	322	Generator inverter fail (GFIV) signal detection (inverter overheating)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–631)	Generator Inverter Performance	323	Open or GND short in generator inverter fail (GFIV) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–642)	Generator Inverter Performance	324	Generator inverter fail (GFIV) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–645)	Generator Inverter Performance	325	Generator inverter fail (GFIV) signal detection (over current by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A7A (05–652)	Generator Inverter Performance	342	Open or +B short in generator gate shutdown (GSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–652)	Generator Inverter Performance	343	GND short in generator gate shutdown (GSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–655)	Generator Inverter Performance	344	Failure in monitoring MG1 torque performance	• Hybrid vehicle generator • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–645)	Generator Inverter Performance	517	Generator inverter fail (GFIV) signal detection (over current by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–645)	Generator Inverter Performance	518	Generator inverter fail (GFIV) signal detection (over current by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–652)	Generator Inverter Performance	519	Open in generator gate shutdown (GSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A7A (05–658)	Generator Inverter Performance	520	Generator gate shutdown (GSDN) signal malfunction	• Wire harness or connector • HV control ECU	○	○	• HV system
P0A7A (05–661)	Generator Inverter Performance	522	Generator inverter gate malfunction	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A90 (05–663)	Drive Motor "A" Performance	239	HV transaxle input malfunction (shaft damaged)	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU	○	○	• HV system
P0A90 (05–669)	Drive Motor "A" Performance	240	Generator locked	• Hybrid vehicle generator	○	○	• HV system
P0A90 (05–663)	Drive Motor "A" Performance	241	HV transaxle input malfunction (torque limiter slipping)	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU	○	○	• HV system
P0A90 (05–670)	Drive Motor "A" Performance	242	Planetary gear locked	• HV transaxle assembly	○	○	• HV system
P0A90 (05–671)	Drive Motor "A" Performance	251	MG2 magnetic force deterioration or same phase short circuit	• Hybrid vehicle motor	○	○	• HV system
P0A90 (05–673)	Drive Motor "A" Performance	509	MG2 system malfunction	• Hybrid vehicle motor • w/ converter inverter assembly	○	○	• HV system
P0A90 (05–663)	Drive Motor "A" Performance	602	HV transaxle output malfunction	• Engine assembly • HV transaxle assembly (shaft or gear) • Transmission input damper • Wire harness or connector • HV control ECU	○	○	• HV system
P0A90 (05–676)	Drive Motor "A" Performance	604	MG2 power balance malfunction (small power balance)	• Battery current sensor • Hybrid vehicle motor	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A90 (05–676)	Drive Motor "A" Performance	605	MG2 power balance malfunction (large power balance)	• Battery current sensor • Hybrid vehicle motor	○	○	• HV system
P0A92 (05–679)	Hybrid Generator Performance	261	MG1 magnetic force deterioration or same phase short circuit	• Hybrid vehicle generator	○	○	• HV system
P0A92 (05–681)	Hybrid Generator Performance	521	MG1 system malfunction	• Hybrid vehicle generator • w/ converter inverter assembly	○	○	• HV system
P0A92 (05–684)	Hybrid Generator Performance	606	MG1 power balance malfunction (small power balance)	• Battery current sensor • Hybrid vehicle generator	○	○	• HV system
P0A92 (05–684)	Hybrid Generator Performance	607	MG1 power balance malfunction (large power balance)	• Battery current sensor • Hybrid vehicle generator	○	○	• HV system
P0A93 (05–687)	Inverter Cooling System Performance	346	Inverter cooling system malfunction (water pump system malfunction)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	○	○	• HV system
P0A93 (05–687)	Inverter Cooling System Performance	347	Inverter cooling system malfunction (electric cooling fan system malfunction)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–691)	DC/DC Converter Performance	442	Abnormal voltage execution value	• w/ converter inverter assembly	○	○	• HV system
P0A94 (05–693)	DC/DC Converter Performance	545	Open or GND short in boost converter over–voltage (OVL) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–693)	DC/DC Converter Performance	546	+B short in boost converter over–voltage (OVL) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–696)	DC/DC Converter Performance	547	Boost converter over voltage (OVL) signal detection (over voltage by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–696)	DC/DC Converter Performance	548	Boost converter over voltage (OVL) signal detection (over voltage by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–696)	DC/DC Converter Performance	549	Boost converter over voltage (OVL) signal detection (over voltage by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–704)	DC/DC Converter Performance	550	Boost converter over–voltage (OVL) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A94 (05–707)	DC/DC Converter Performance	551	Open or GND short in boost converter fail (FCV) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–707)	DC/DC Converter Performance	552	+B short in boost converter fail (FCV) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–710)	DC/DC Converter Performance	553	Boost converter fail (FCV) signal detection (boost converter overheating)	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–719)	DC/DC Converter Performance	554	Boost converter fail (FCV) signal detection (over current by HV control ECU malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–719)	DC/DC Converter Performance	555	Boost converter fail (FCV) signal detection (over current by inverter assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–719)	DC/DC Converter Performance	556	Boost converter fail (FCV) signal detection (over current by HV transaxle assembly malfunction)	• Wire harness or connector • HV transaxle assembly • Hybrid vehicle motor • Hybrid vehicle generator • HV control ECU • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–727)	DC/DC Converter Performance	557	Boost converter fail (FCV) signal detection (circuit malfunction)	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–730)	DC/DC Converter Performance	558	GND short in boost converter gate shutdown (CSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–730)	DC/DC Converter Performance	559	Open or +B short in boost converter gate shutdown (CSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–730)	DC/DC Converter Performance	560	Open in boost converter gate shutdown (CSDN) signal circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–733)	DC/DC Converter Performance	561	Abnormal boost converter gate shutdown (CSDN) signal	• Wire harness or connector • HV control ECU	○	○	• HV system
P0A94 (05–736)	DC/DC Converter Performance	583	Open or GND short in boost converter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	○	○	• HV system
P0A94 (05–736)	DC/DC Converter Performance	584	+B short in boost converter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	○	○	• HV system
P0A94 (05–743)	DC/DC Converter Performance	585	Boost converter voltage (VL) sensor performance problem	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P0A94 (05–746)	DC/DC Converter Performance	587	Difference between voltages from HV battery voltage (VB) sensor and boost converter voltage (VL) sensor is large	• Wire harness or connector • w/ converter inverter assembly • Service plug grip • High voltage fuse • Battery ECU	○	○	• HV system
P0A94 (05–751)	DC/DC Converter Performance	588	Abnormality in boost converter PWM circuit	• Wire harness or connector • w/ converter inverter assembly	○	○	• HV system
P0A94 (05–754)	DC/DC Converter Performance	589	Open or GND short in boost converter voltage (VL) signal circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	○	○	• HV system
P0A94 (05–754)	DC/DC Converter Performance	590	+B short in boost converter voltage (VL) signal circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	○	○	• HV system
P0AA1 (05–760)	Hybrid Battery Positive Contactor Circuit Stuck Closed	224	Open or +B short in system main relay No. 1 circuit	• Wire harness or connector • System main relay No. 1 • HV control ECU	X	○	• HV system
P0AA1 (05–763)	Hybrid Battery Positive Contactor Circuit Stuck Closed	226	Open or +B short in system main relay No. 2 circuit	• Wire harness or connector • System main relay No. 2 • HV control ECU	X	○	• HV system
P0AA1 (05–765)	Hybrid Battery Positive Contactor Circuit Stuck Closed	231	System main relay terminal of HV battery positive side stuck closed	• System main relay No. 1 • System main relay No. 2	X	○	• HV system
P0AA1 (05–766)	Hybrid Battery Positive Contactor Circuit Stuck Closed	233	System main relay terminals of HV battery positive and negative sides stuck closed	• System main relay No. 1 • System main relay No. 2 • System main relay No. 3	X	○	• HV system
P0AA2 (05–760)	Hybrid Battery Positive Contactor Circuit Stuck Open	225	GND short in system main relay No. 1 circuit	• Wire harness or connector • System main relay No. 1 • HV control ECU	X	○	• HV system
P0AA2 (05–763)	Hybrid Battery Positive Contactor Circuit Stuck Open	227	GND short in system main relay No. 2 circuit	• Wire harness or connector • System main relay No. 2 • HV control ECU	X	○	• HV system
P0AA4 (05–767)	Hybrid Battery Negative Contactor Circuit Stuck Closed	228	Open or +B short in system main relay No. 3 circuit	• Wire harness or connector • System main relay No. 3 • HV control ECU	○	○	• HV system
P0AA4 (05–770)	Hybrid Battery Negative Contactor Circuit Stuck Closed	232	System main relay terminal of HV battery negative side stuck closed	• System main relay No. 3	○	○	• HV system
P0AA5 (05–767)	Hybrid Battery Negative Contactor Circuit Stuck Open	229	GND short in system main relay No. 3 circuit	• Wire harness or connector • System main relay No. 3 • HV control ECU	X	○	• HV system
P2120 (05–771)	Throttle/Pedal Position Sensor/ Switch "D" Circuit	111	Accelerator pedal position main sensor value does not change while its sub sensor value changes	• Accelerator pedal rod assembly	X	○	• HV system
P2121 (05–771)	Throttle/Pedal Position Sensor/ Switch "D" Circuit Range/Performance	106	Internal error of accelerator pedal position main sensor	• Accelerator pedal rod assembly	X	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P2121 (05–771)	Throttle/Pedal Position Sensor/ Switch "D" Circuit Range/Performance	114	Accelerator pedal not smoothly returning to its original position	• Accelerator pedal rod assembly	X	○	• HV system
P2122 (05–772)	Throttle/Pedal Position Sensor/ Switch "D" Circuit Low Input	104	Open or GND short in accelerator pedal position main sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU	X	○	• HV system
P2123 (05–772)	Throttle/Pedal Position Sensor/ Switch "D" Circuit High Input	105	+B short in accelerator pedal position main sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU	X	○	• HV system
P2125 (05–771)	Throttle/Pedal Position Sensor/ Switch "E" Circuit	112	Accelerator pedal position sub sensor value does not change while its main sensor value changes	• Accelerator pedal rod assembly	X	○	• HV system
P2126 (05–771)	Throttle/Pedal Position Sensor/ Switch "E" Circuit Range/Performance	109	Internal error of accelerator pedal position sub sensor	• Accelerator pedal rod assembly	X	○	• HV system
P2127 (05–772)	Throttle/Pedal Position Sensor/ Switch "E" Circuit Low Input	107	Open or GND short in accelerator pedal position sub sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU	X	○	• HV system
P2128 (05–772)	Throttle/Pedal Position Sensor/ Switch "E" Circuit High Input	108	+B short in accelerator pedal position sub sensor circuit	• Wire harness or connector • Accelerator pedal rod assembly • HV control ECU	X	○	• HV system
P2138 (05–771)	Throttle/Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	110	Difference between main sensor value and sub sensor value is large	• Accelerator pedal rod assembly	X	○	• HV system
P3000 (05–777)	Battery Control System Malfunction	123	Abnormal signal input from battery ECU (HV battery system malfunction)	• HV battery system • Battery ECU	○	○	• HV system
P3000 (05–777)	Battery Control System Malfunction	125	Abnormal signal input from battery ECU (High voltage fuse blown out)	• HV battery system • Battery ECU	○	○	• HV system
P3000 (05–778)	Battery Control System Malfunction	388	Abnormal signal input from battery ECU (discharge inhibition control malfunction)	• HV control system • Fuel shortage • HV battery assembly	X	○	• HV battery
P3000 (05–780)	Battery Control System Malfunction	389	Abnormal signal input from battery ECU (drop of high voltage)	• HV control system • HV battery assembly	X	○	• HV battery
P3000 (05–777)	Battery Control System Malfunction	603	Abnormal signal input from battery ECU (HV battery cooling system malfunction)	• HV battery system • Battery ECU	○	○	• HV system
P3004 (05–781)	High Voltage Power Resource Malfunction	131	High voltage fuse has blown out, service plug grip is disconnected or limiter resistance is cut off	• HV battery system • System main resistor • System main relay No. 1 • System main relay No. 3 • Main battery cable • Main battery cable No. 2 • Frame wire • w/ converter inverter assembly • HV control ECU	X	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P3004 (05–788)	High Voltage Power Resource Malfunction	132	Inverter voltage sensor malfunction, or limiter resistance increases	• HV control system • System main resistor • System main relay No. 1 • System main relay No. 3 • Main battery cable • Main battery cable No. 2 • Frame wire • w/ converter inverter assembly • HV control ECU	X	○	• HV system
P3004 (05–794)	High Voltage Power Resource Malfunction	133	Abnormal signal input from battery ECU	• HV battery system • Battery ECU	X	X	–
P3009 (05–795)	High Voltage Power Short Circuit	526	Insulation resistance of high voltage circuit and body is low	• Frame wire • System main relay • System main resistor • HV battery assembly • w/ motor compressor assembly • Battery ECU • HV transaxle assembly • w/ converter inverter assembly • Main battery cable • Main battery cable No. 2 • Battery plug • Frame wire No. 2 • Junction block assembly	X	○	• HV system
P3009 (05–795)	High Voltage Power Short Circuit	611	Insulation resistance of A/C compressor motor or A/C inverter is low	• w/ motor compressor assembly • w/ converter inverter assembly	X	○	• HV system
P3009 (05–795)	High Voltage Power Short Circuit	612	Insulation resistance of HV battery, battery ECU, system main relay, or system main resistor is low	• HV battery assembly • Battery ECU • System main relay • System main resistor • Main battery cable • Main battery cable No. 2 • Battery plug • Frame wire No. 2 • Junction block assembly	X	○	• HV system
P3009 (05–795)	High Voltage Power Short Circuit	613	Insulation resistance of HV transaxle or motor and generator inverters is low	• HV transaxle assembly • w/ converter inverter assembly	X	○	• HV system
P3009 (05–795)	High Voltage Power Short Circuit	614	Insulation resistance of motor and generator inverters, A/C inverter, system main relay, system main resistor, or frame wire is low	• Frame wire • System main relay • System main resistor • HV battery assembly • w/ converter inverter assembly • Main battery cable • Main battery cable No. 2 • Battery plug • Frame wire No. 2 • Junction block assembly	X	○	• HV system
P3102 (05–815)	Transmission Control ECU Malfunction	524	BEAN communication problem of transmission control ECU	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU	X	○	• HV system
P3102 (05–815)	Transmission Control ECU Malfunction	525	Transmission control ECU IG OFF command malfunction	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU	X	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P3102 (05–815)	Transmission Control ECU Malfunction	581	Transmission control ECU malfunction	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU	X	○	• HV system
P3102 (05–815)	Transmission Control ECU Malfunction	582	P position (PPOS) signal is logically inconsistent	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU	X	○	• HV system
P3102 (05–815)	Transmission Control ECU Malfunction	597	GND short in P position (PPOS) signal circuit	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU	X	○	• HV system
P3102 (05–815)	Transmission Control ECU Malfunction	598	+B short in P position (PPOS) signal circuit	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU	X	○	• HV system
P3102 (05–815)	Transmission Control ECU Malfunction	599	P position (PPOS) signal malfunction (output pulse is abnormal)	• Wire harness or connector • Transmission control ECU • HV control ECU • Power source control ECU	X	○	• HV system
P3107 (05–818)	Lost Communication with Airbag System Control Module	213	GND short in communication circuit between airbag ECU and HV control ECU	• Wire harness or connector • Airbag ECU	X	○	• HV system
P3107 (05–818)	Lost Communication with Airbag System Control Module	214	Open or +B short in communication circuit between airbag ECU and HV control ECU	• Wire harness or connector • Airbag ECU	X	○	• HV system
P3107 (05–818)	Lost Communication with Airbag System Control Module	215	Abnormal communication signals between airbag ECU and HV control ECU	• Wire harness or connector • Airbag ECU	X	○	• HV system
P3108 (05–820)	Lost Communication with A/C System Control Module	535	Serial communication malfunction	• Wire harness or connector • w/ converter inverter assembly	X	X	–
P3108 (05–820)	Lost Communication with A/C System Control Module	536	A/C inverter malfunction	• Wire harness or connector • w/ converter inverter assembly	X	X	–
P3108 (05–822)	Lost Communication with A/C System Control Module	537	A/C amplifier malfunction	• A/C amplifier	X	X	–
P3108 (05–820)	Lost Communication with A/C System Control Module	538	Open in STB signal circuit	• Wire harness or connector • w/ converter inverter assembly	X	X	–
P3108 (05–823)	Lost Communication with A/C System Control Module	594	CAN communication malfunction	• CAN communication system	X	X	–
P3110 (05–824)	HV Main Relay Malfunction	223	IGCT relay is always closed	• Wire harness or connector • Integration relay (IGCT relay)	X	○	• HV system
P3110 (05–824)	HV Main Relay Malfunction	527	IG2 logical inconsistency	• Wire harness or connector • Integration relay (IG2 relay)	X	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P3137 (05–826)	Collision Sensor Low Input	348	GND short in circuit breaker sensor No. 1 circuit	• Wire harness or connector • Circuit breaker sensor No. 1	X	○	• HV system
P3138 (05–826)	Collision Sensor High Input	349	Open or +B short in circuit breaker sensor No. 1 circuit	• Wire harness or connector • Circuit breaker sensor No. 1	X	○	• HV system
P3140 (05–828)	HV Interlock Switch Operation	350	Operating safety devices with vehicle stopped (ILK signal is ON)	• Service plug grip installation • Inverter cover installation	X	○	• HV system
P3143 (05–829)	HV Interlock Switch Open/Short	351	Open in interlock signal circuit while vehicle is running	• Wire harness or connector • Battery plug (interlock switch No. 2) • w/ converter inverter assembly (interlock switch No. 1)	X	○	• HV system
P3211 (05–832)	Drive Motor "A" Inverter Temperature Sensor Circuit Range/Performance	276	Sudden change in motor inverter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	X	○	• HV system
P3211 (05–832)	Drive Motor "A" Inverter Temperature Sensor Circuit Range/Performance	277	Motor inverter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	X	○	• HV system
P3212 (05–837)	Drive Motor "A" Inverter Temperature Sensor Circuit High/Low	275	Open or GND short in motor inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	X	○	• HV system
P3213 (05–837)	Drive Motor "A" Inverter Temperature Sensor Circuit High	274	+B short in motor inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	X	○	• HV system
P3221 (05–843)	Generator Inverter Temperature Sensor Circuit Range/Performance	314	Sudden change in generator inverter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	X	○	• HV system
P3221 (05–843)	Generator Inverter Temperature Sensor Circuit Range/Performance	315	Generator inverter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	X	○	• HV system
P3222 (05–848)	Generator Inverter Temperature Sensor Circuit High/Low	313	Open or GND short in generator inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	X	○	• HV system
P3223 (05–848)	Generator Inverter Temperature Sensor Circuit High	312	+B short in generator inverter temperature sensor circuit	• Wire harness or connector • w/ converter inverter assembly • HV control ECU	X	○	• HV system

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
P3226 (05–854)	DC/DC (Boost) Converter Temperature Sensor Malfunction	562	Sudden change in boost converter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	X	○	• HV system
P3226 (05–854)	DC/DC (Boost) Converter Temperature Sensor Malfunction	563	Boost converter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water w/ motor & bracket pump assembly • Cooling fan motor • Cooling fan motor No. 2 • w/ converter inverter assembly	X	○	• HV system
U0100 (05–859)	Lost Communication with ECM/ PCM ”A”	211	CAN communication problem between ECM and HV control ECU (no signal input)	• CAN communication system	○	○	• HV system
U0100 (05–859)	Lost Communication with ECM/ PCM ”A”	212	CAN communication problem between ECM and HV control ECU (transmission error)	• CAN communication system	○	○	• HV system
U0100 (05–859)	Lost Communication with ECM/ PCM ”A”	530	CAN communication problem between ECM and HV control ECU (CAN communication system malfunction)	• CAN communication system	○	○	• HV system
U0111 (05–859)	Lost Communication with Battery Energy Control Module ”A”	208	CAN communication problem between battery ECU and HV control ECU (no signal input)	• CAN communication system	○	○	• HV system
U0111 (05–859)	Lost Communication with Battery Energy Control Module ”A”	531	CAN communication problem between battery ECU and HV control ECU (CAN communication system malfunction)	• CAN communication system	○	○	• HV system
U0129 (05–859)	Lost Communication with Brake System Control Module	220	CAN communication problem between skid control ECU and HV control ECU (no signal input)	• CAN communication system	X	○	• HV system
U0129 (05–859)	Lost Communication with Brake System Control Module	222	CAN communication problem between skid control ECU and HV control ECU (CAN communication system malfunction)	• CAN communication system	X	○	• HV system
U0129 (05–859)	Lost Communication with Brake System Control Module	528	CAN communication problem between skid control ECU and HV control ECU (transmission error)	• CAN communication system	X	○	• HV system
U0129 (05–859)	Lost Communication with Brake System Control Module	529	CAN communication problem between skid control ECU and HV control ECU (regenerative torque malfunction)	• CAN communication system	X	○	• HV system
U0131 (05–859)	Lost Communication with Power Steering Control Module	433	CAN communication problem between power steering ECU and HV control ECU (no signal input)	• CAN communication system	X	X	–

cardiagn.com

DTC No. (See Page)	Detection Item	INF Code	Detection Condition	Trouble Area	MIL *1	Master Warning Lamp *2	Warning *3
U0131 (05–859)	Lost Communication with Power Steering Control Module	434	CAN communication problem between power steering ECU and HV control ECU (CAN communication system malfunction)	• CAN communication system	X	X	–
U0146 (05–859)	Lost Communication with Gateway "A"	435	CAN communication problem between gateway ECU and HV control ECU (no signal input)	• CAN communication system	X	○	• HV system

*1: "○" ... MIL is illuminated, "X" ... MIL is not illuminated.
*2: "○" ... Master warning lamp is illuminated, "X" ... Master warning lamp is not illuminated.
*3: Warning on the multi–information display
*4: w/ smart entry system
*5: w/o smart entry system

cardiagn.com

05J80–01

HOW TO PROCEED WITH TROUBLESHOOTING

The hand–held tester can be used at step 3, 4, 5, 8.

1	VEHICLE BROUGHT TO WORKSHOP

2	CUSTOMER PROBLEM ANALYSIS (See page 05–406)

3	CONNECT HAND–HELD TESTER OR OBD II SCAN TOOL TO DLC3

HINT:
If the display indicates a communication fault in the tester, inspect the DLC3.

4	CHECK AND RECORD DTC AND FREEZE FRAME DATA (See page 05–420)

HINT:
If a DTC related to the CAN communication system malfunction is output, first troubleshoot and repair the CAN communication (see page 05–2602).

5	CLEAR DTC (See page 05–420)

6	PROBLEM SYMPTOM CONFIRMATION

(a) When the malfunction does not occur, go to A.
(b) When the malfunction occurs, go to B.

B	Go to step 8

A

7	SYMPTOM SIMULATION

8	CHECK DTC (See page 05–420)

9	DTC CHART (See page 05–440)

cardiagn.com

10	**CIRCUIT INSPECTION**

11	**IDENTIFICATION OF PROBLEM**

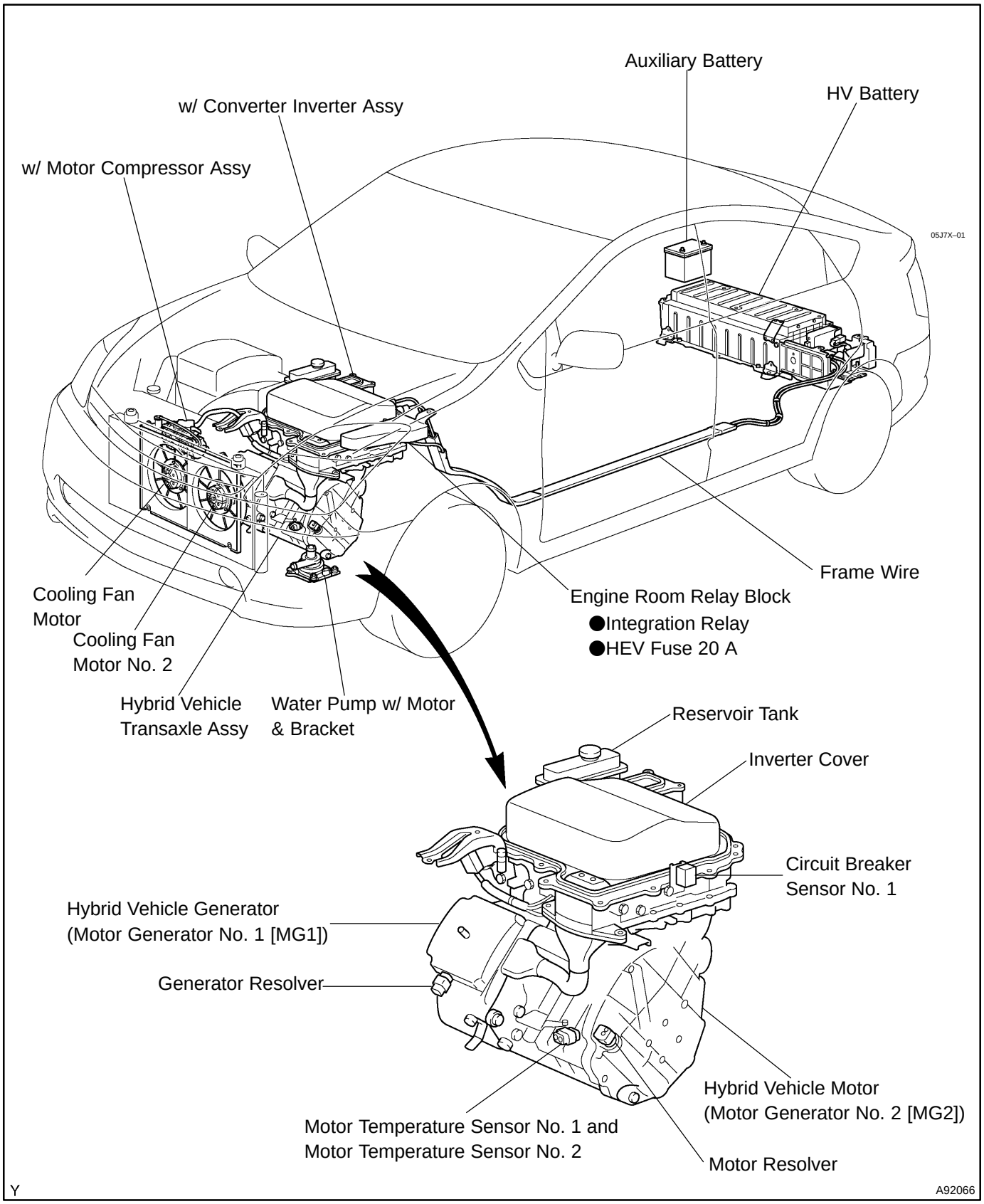
12	**ADJUSTMENT AND/OR REPAIR**

13	**CONFIRMATION TEST**

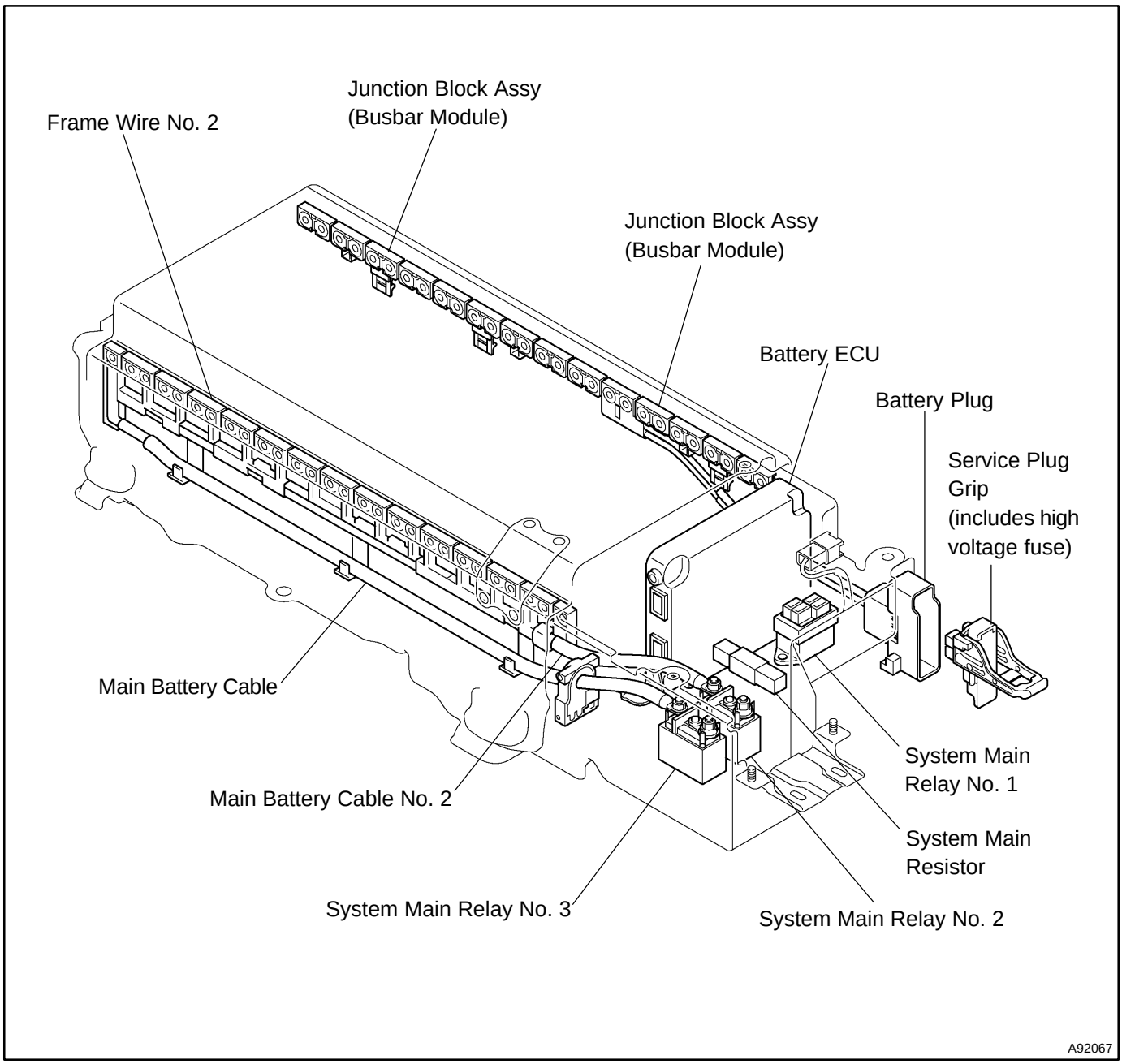
END

cardiagn.com

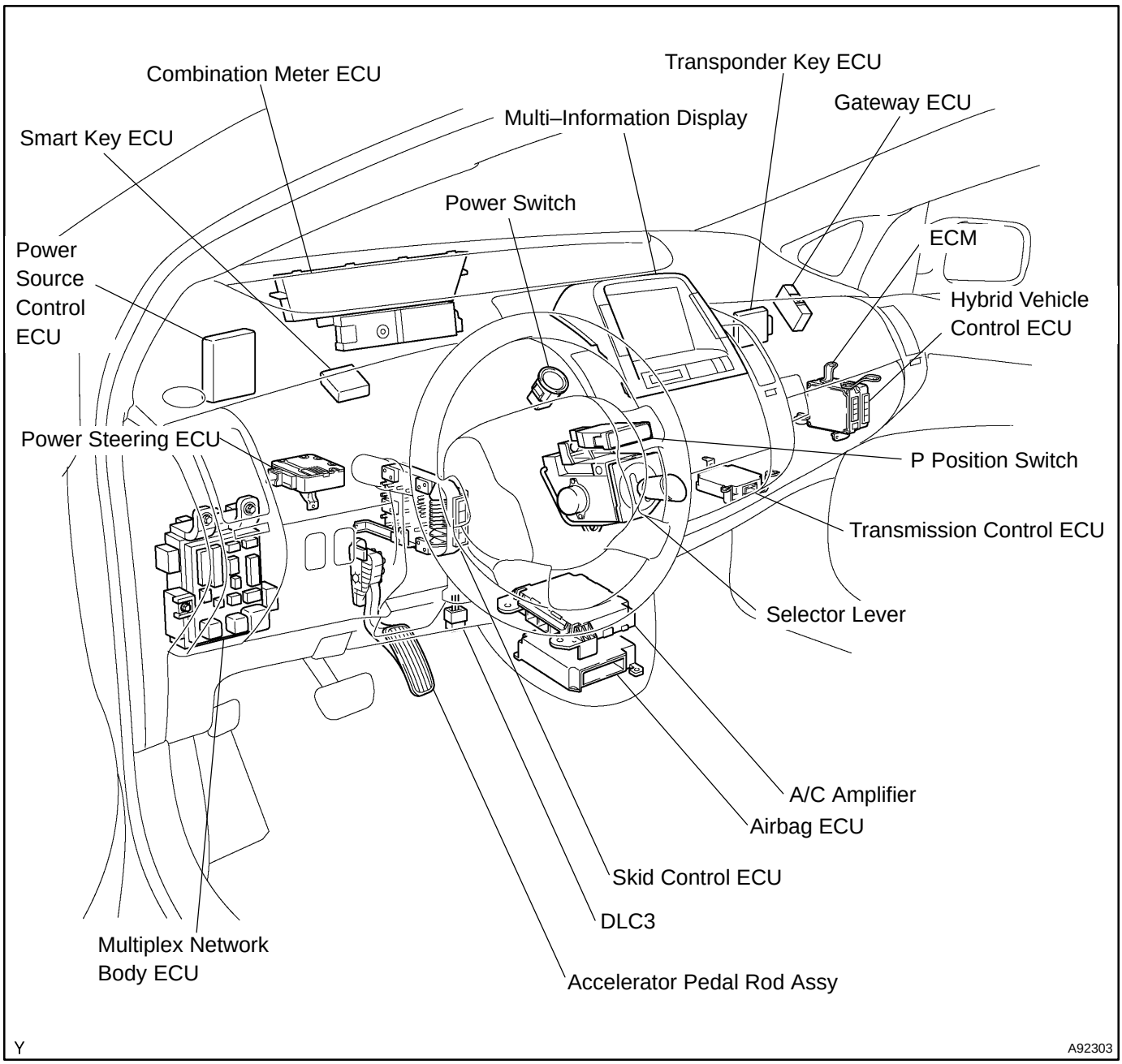
LOCATION



cardiagn.com



cardiagn.com

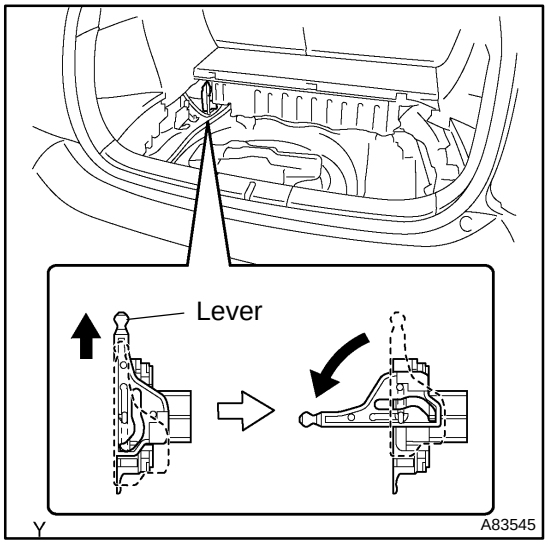


cardiagn.com

HYBRID CONTROL SYSTEM

PRECAUTION

05J7U–01



1. Precautions for inspecting the hybrid control system

(a) Before inspecting the high–voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and removing the service plug grip (see page 01–5). After removing the service plug grip, put it in your pocket to prevent other technicians from reconnecting it while you are servicing the high–voltage system.

NOTICE:

Turning the power switch ON (READY) with the service plug grip removed could cause malfunction. Therefore, do not turn the power switch ON (READY) unless instructed by the repair manual.

(b) After disconnecting the service plug grip, wait at least for 5 minutes before touching any of high–voltage connectors or terminals.

HINT:

At least 5 minutes is required to discharge the high–voltage condenser inside the inverter.

(c) Since liquid leakage may occur, wear protective goggles when checking inside the HV battery.

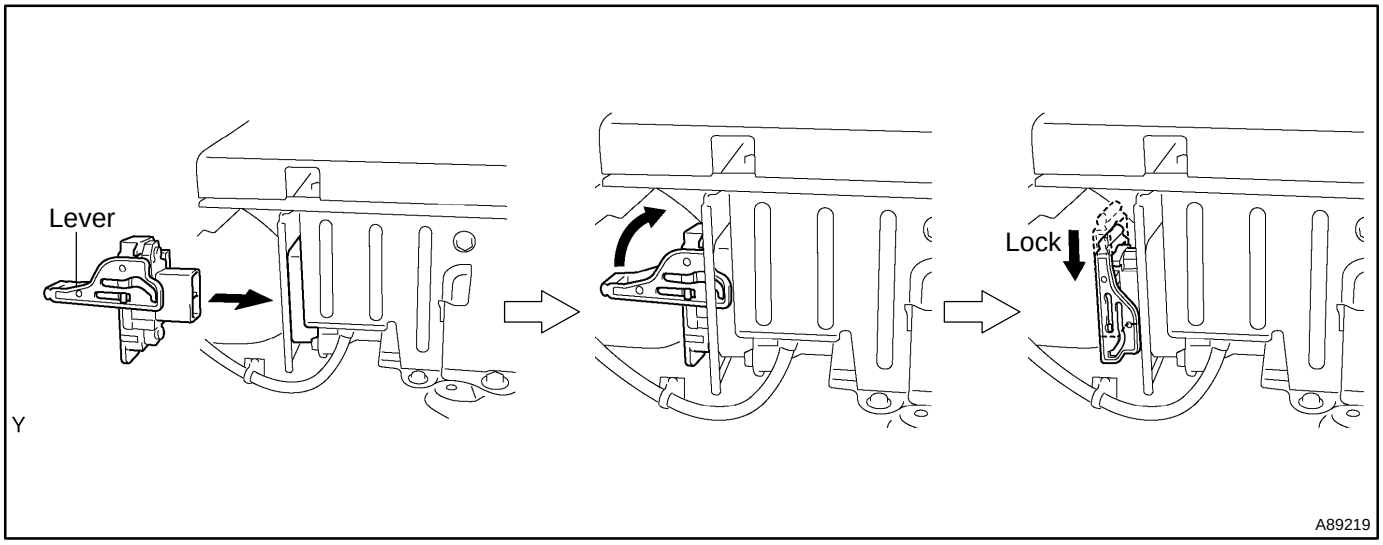
(d) Wear insulated gloves, turn the power switch OFF, and disconnect the negative terminal of the auxiliary battery before touching any of the orange–colored wires of the high–voltage system.

(e) Turn the power switch OFF before performing a resistance check.

(f) Turn the power switch OFF before disconnecting or reconnecting any connector.

cardiagn.com

(g) To install this service plug grip, the lever must be flipped and locked downward. Once it is locked in place, it turns the interlock switch ON. Make sure to lock it securely because if you leave it unlocked, the system will output a DTC pertaining to the interlock switch system.



2. NOTICE FOR INITIALIZATION

When disconnecting the negative (–) battery terminal, initialize the following systems after the terminal is reconnected.

System Name	See Page
Power Window Control System	05–2028

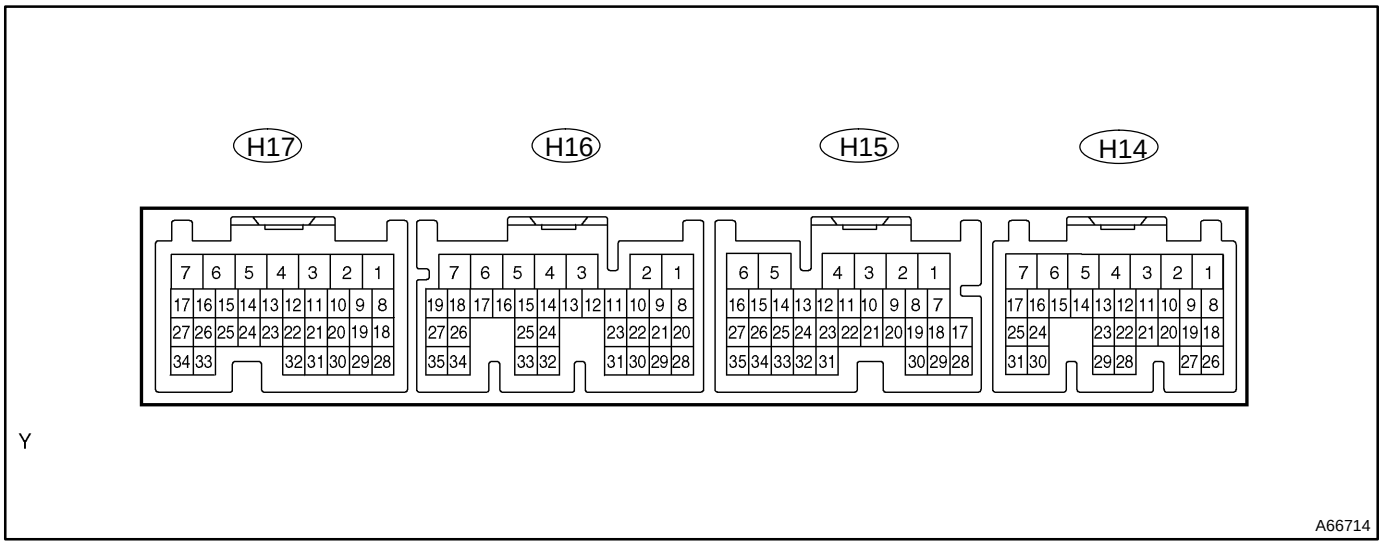
3. NOTICE FOR HYBRID SYSTEM ACTIVATION

- **When the warning lamp is illuminated or the battery has been disconnected and reconnected, pressing the power switch may not start the system on the first try. If so, press the power switch again.**
- **With the power switch's power mode changed to ON (IG), disconnect the battery. If the key is not in the key slot during reconnection, DTC B2799 may be output.**

cardiagn.com

05J83–01

TERMINALS OF ECU



Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
ST2 (H14–5) – GND1 (H14–1)	Y – W–B	Starter signal	Power switch ON (READY)	9 to 14
IGSW (H14–7) – GND1 (H14–1)	O – W–B	IG signal	Power switch ON (IG)	9 to 14
BATT (H15–6) – GND1 (H14–1)	Y – W–B	Auxiliary battery (for measuring the battery voltage and for the HV control ECU memory)	Always	9 to 14
+B1 (H16–7) – GND1 (H14–1)	L – W–B	Power source of HV control ECU	Power switch ON (IG)	9 to 14
+B2 (H16–6) – GND1 (H14–1)	L – W–B	Power source of HV control ECU	Power switch ON (IG)	9 to 14
MREL (H16–4) – GND1 (H14–1)	O – W–B	Main relay	Power switch ON (IG)	9 to 14
CANH (H14–8) – GND1 (H14–1)	B – W–B	HIGH–level CAN bus line	Power switch ON (IG)	Pulse generation (see waveform 1)
CANL (H14–9) – GND1 (H14–1)	W – W–B	LOW–level CAN bus line	Power switch ON (IG)	Pulse generation (see waveform 2)
NEO (H16–12) – GND1 (H14–1)	LG – W–B	Engine speed signal	Engine running	Pulse generation (see waveform 3)
GO (H16–13) – GND1 (H14–1)	Y – W–B	G signal	Engine running	Pulse generation (see waveform 4)
SPDI (H14–19) – GND1 (H14–1)	V – W–B	Vehicle speed signal	Driving at approximately 12 mph (20 km/h)	Pulse generation (see waveform 5)
VPA1 (H16–26) – EP1 (H16–27)	L – B	Accelerator pedal position sensor (for the HV system)	Power switch ON (IG), accelerator pedal released	0.5 to 1.1
VPA1 (H16–26) – EP1 (H16–27)	L – B	Accelerator pedal position sensor (for the HV system)	Power switch ON (IG), engine stopped in P position, accelerator pedal fully depressed	2.6 to 4.5
VPA2 (H16–34) – EP2 (H16–35)	W – R	Accelerator pedal position sensor (for the sensor malfunction detection)	Power switch ON (IG),accelerator pedal fully depressed	1.2 to 2.0
VPA2 (H16–34) – EP2 (H16–35)	W – R	Accelerator pedal position sensor (for the sensor malfunction detection)	Power switch ON (IG), engine stopped in P position, accelerator pedal released	3.4 to 5.3
VCP1 (H16–25) – EP1 (H16–27)	Y – B	Power source of accelerator pedal position sensor (for VPA1)	Power switch ON (IG)	4.5 to 5.5

cardiagn.com

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
VCP2 (H16–33) – EP2 (H16–35)	G – R	Power source of accelerator pedal position sensor (for VPA2)	Power switch ON (IG)	4.5 to 5.5
VSX1 (H14–25) – E2X1 (H14–15)	B – R	Shift position sensor (main)	Power switch ON (IG), selector lever home position	2.0 to 3.0
VSX1 (H14–25) – E2X1 (H14–15)	B – R	Shift position sensor (main)	Power switch ON (IG), selector lever moved to R position	4.0 to 4.8
VSX1 (H14–25) – E2X1 (H14–15)	B – R	Shift position sensor (main)	Power switch ON (IG), selector lever moved to B or D position	0.2 to 1.0
VSX2 (H14–24) – E2X2 (H14–14)	L – Y	Shift position sensor (sub)	Power switch ON (IG), selector lever home position	2.0 to 3.0
VSX2 (H14–24) – E2X2 (H14–14)	L – Y	Shift position sensor (sub)	Power switch ON (IG), selector lever moved to R position	4.0 to 4.8
VSX2 (H14–24) – E2X2 (H14–14)	L – Y	Shift position sensor (sub)	Power switch ON (IG), selector lever moved to B or D position	0.2 to 1.0
VCX1 (H14–17) – E2X1 (H14–15)	W – R	Power source of shift position sensor (for VSX1)	Power switch ON (IG)	4.5 to 5.5
VCX2 (H14–16) – E2X2 (H14–14)	G – Y	Power source of shift position sensor (for VSX2)	Power switch ON (IG)	4.5 to 5.5
VSX3 (H14–23) – GND1 (H14–1)	BR – W–B	Select position sensor (main)	Power switch ON (IG), selector lever home position	0.5 to 2.0
VSX3 (H14–23) – GND1 (H14–1)	BR – W–B	Select position sensor (main)	Power switch ON (IG), selector lever moved to R, N or D position	3.0 to 4.85
VSX4 (H14–30) – GND1 (H14–1)	SB – W–B	Select position sensor (sub)	Power switch ON (IG), selector lever home position	0.5 to 2.0
VSX4 (H14–30) – GND1 (H14–1)	SB– W–B	Select position sensor (sub)	Power switch ON (IG), selector lever moved to R, N or D position	3.0 to 4.85
VCX3 (H14–21) – GND1 (H14–1)	W – W–B	Power source of select position sensor (for VSX3)	Power switch ON (IG)	9 to 14
VCX4 (H14–31) – GND1 (H14–1)	P – W–B	Power source of select position sensor (for VSX4)	Power switch ON (IG)	9 to 14
NODD (H16–24) – GND1 (H14–1)	V – W–B	DC/DC movement monitor or stop request signal	When converter is in normal operation	5 to 7
NODD (H16–24) – GND1 (H14–1)	V – W–B	DC/DC movement monitor or stop request signal	When converter is improper	2 to 4
NODD (H16–24) – GND1 (H14–1)	V – W–B	DC/DC movement monitor or stop request signal	When converter is required to stop	0.1 to 0.5
VLO (H16–31) – GND1 (H14–1)	L – W–B	Two–stage selector signal	Converter switching to 14 V output	13 to 14
VLO (H16–31) – GND1 (H14–1)	L – W–B	Two–stage selector signal	Converter switching to 13.5 V output	Below 0.5
TC (H14–6) – GND1 (H14–1)	P – W–B	Terminal TC of DLC3	Power switch ON (IG)	9 to 14
STP (H15–3) – GND1 (H14–1)	L – W–B	Stop lamp switch	Brake pedal depressed	9 to 14
STP (H15–3) – GND1 (H14–1)	L – W–B	Stop lamp switch	Brake pedal released	2 to 3
ABFS (H14–20) – GND1 (H14–1)	L – W–B	Airbag deployment signal	Power switch ON (READY) (2 seconds after ACC ON)	Pulse generation (see waveform 6 to 8)
AS1 (H16–15) – AS1G (H16–16)	Y – W	Circuit breaker sensor No. 1	Satellite signal system normal	2.5 to 2.9
ILK (H15–1) – GND1 (H14–1)	V – W–B	Interlock switch	Power switch ON (IG), inverter cover and service plug grip installed normally	Below 1

cardiagn.com

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
ILK (H15–1) – GND1 (H14–1)	V – W–B	Interlock switch	Power switch ON (IG), inverter cover or service plug grip detached	9 to 14
CON1 (H16–1) – GND1 (H14–1)	R – W–B	System main relay No. 1	Power switch OFF to ON (READY)	Pulse generation (see waveform 9)
CON2 (H16–2) – GND1 (H14–1)	G – W–B	System main relay No. 2	Power switch OFF to ON (READY)	Pulse generation (see waveform 9)
CON3 (H16–3) – GND1 (H14–1)	Y – W–B	System main relay No. 3	Power switch OFF to ON (READY)	Pulse generation (see waveform 9)
VH (H15–26) – GINV (H15–23)	Y – W–B	Inverter condenser voltage monitor	Power switch ON (READY)	1.6 to 3.8
GUU (H15–15) – GINV (H15–23)	B – Y	Generator switch U signal	Power switch ON (IG)	Pulse generation (see waveform 10)
GVU (H15–14) – GINV (H15–23)	G – Y	Generator switch V signal	Power switch ON (IG)	Pulse generation (see waveform 10)
GWU (H15–13) – GINV (H15–23)	Y – Y	Generator switch W signal	Power switch ON (IG)	Pulse generation (see waveform 10)
GIVA (H15–34) – GINV (H15–23)	W – Y	Generator V phase current	Power switch ON (IG)	Approximately 0
GIVB (H15–33) – GINV (H15–23)	B – Y	Generator V phase current	Power switch ON (IG)	Approximately 0
GIWA (H15–32) – GINV (H15–23)	R – Y	Generator W phase current	Power switch ON (IG)	Approximately 0
GIWB (H15–31) – GINV (H15–23)	G – Y	Generator W phase current	Power switch ON (IG)	Approximately 0
GIVT (H15–27) – GINV (H15–23)	W – Y	Generator inverter temperature sensor	Power switch ON (IG)	2 to 4.5
GSDN (H15–16) – GINV (H15–23)	R – W–B	Generator shutdown signal	Power switch ON (READY), N position	0.2 to 0.7
GSDN (H15–16) – GINV (H15–23)	R – W–B	Generator shutdown signal	Power switch ON (READY), P position	5.1 to 13.6
GFIV (H15–35) – GINV (H15–23)	GR – W–B	Generator inverter fail signal	Power switch ON (IG), inverter normal	5.4 to 7.4
GFIV (H15–35) – GINV (H15–23)	GR – W–B	Generator inverter fail signal	Power switch ON (IG), inverter abnormal	2 to 3
GRF (H17–27) – GRFG (H17–26)	B – W	Generator resolver signal	Generator resolver stopped or rotating	Pulse generation (see waveform 11, 12)
GSN (H17–22) – GSNG (H17–21)	R – G	Generator resolver signal	Generator resolver stopped or rotating	Pulse generation (see waveform 11, 12)
GCS (H17–23) – GCSG (H17–24)	Y – BR	Generator resolver signal	Generator resolver stopped or rotating	Pulse generation (see waveform 11, 12)
OMT (H17–30) – OMTG (H17–29)	B – G	Motor temperature sensor No. 2	Refer to DATA LIST on page 05–434	–
MUU (H15–9) – GINV (H15–23)	B – Y	Motor switch U signal	Power switch ON (IG)	Pulse generation (see waveform 13)
MVU (H15–10) – GINV (H15–23)	W – Y	Motor switch V signal	Power switch ON (IG)	Pulse generation (see waveform 13)
MWU (H15–11) – GINV (H15–23)	R – Y	Motor switch W signal	Power switch ON (IG)	Pulse generation (see waveform 13)
MIVA (H15–30) – GINV (H15–23)	G – Y	Motor V phase current	Power switch ON (IG)	Approximately 0
MIVB (H15–21) – GINV (H15–23)	W – Y	Motor V phase current	Power switch ON (IG)	Approximately 0
MIWA (H15–29) – GINV (H15–23)	R – Y	Motor W phase current	Power switch ON (IG)	Approximately 0

cardiagn.com

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
MIWB (H15–20) – GINV (H15–23)	B – Y	Motor W phase current	Power switch ON (IG)	Approximately 0
MIVT (H15–19) – GINV (H15–23)	L – Y	Motor inverter temperature sensor	Power switch ON (IG)	2 to 4.5
MSDN (H15–8) – GINV (H15–23)	G – W–B	Motor shutdown signal	Power switch ON (READY), N position	0.2 to 0.7
MSDN (H15–8) – GINV (H15–23)	G – W–B	Motor shutdown signal	Power switch ON (READY), P position	5.1 to 13.6
OVH (H15–22) – GINV (H15–23)	BR – W–B	Motor inverter over voltage signal	Power switch ON (IG), inverter normal	5.3 to 7.3
OVH (H15–22) – GINV (H15–23)	BR – W–B	Motor inverter over voltage signal	Power switch ON (IG), inverter abnormal	1.9 to 2.9
MFIV (H15–18) – GINV (H15–23)	G – W–B	Motor inverter fail signal	Power switch ON (IG), inverter normal	5.4 to 7.4
MFIV (H15–18) – GINV (H15–23)	G – W–B	Motor inverter fail signal	Power switch ON (IG), inverter abnormal	2 to 3
MRF (H17–34) – MRFG (H17–33)	L – P	Motor resolver signal	Motor resolver stopped or rotating	Pulse generation (see waveform 11, 12)
MSN (H17–20) – MSNG (H17–19)	G – R	Motor resolver signal	Motor resolver stopped or rotating	Pulse generation (see waveform 11, 12)
MCS (H17–32) – MCSG (H17–31)	Y – BR	Motor resolver signal	Motor resolver stopped or rotating	Pulse generation (see waveform 11, 12)
MMT (H17–18) – MMTG (H17–28)	B – R	Motor temperature sensor No. 1	Refer to DATA LIST on page 05–434	–
VL (H16–30) – GCNV (H16–8)	Y – G	Boost converter input voltage	Power switch ON (READY)	1.9 to 3.4
OVL (H16–22) – GCNV (H16–8)	B – G	Boost converter over voltage signal	Power switch ON (IG), boost converter normal	5.3 to 7.7
OVL (H16–22) – GCNV (H16–8)	B – G	Boost converter over voltage signal	Power switch ON (IG), boost converter abnormal	1.9 to 3.0
FCV (H16–20) – GCNV (H16–8)	W – G	Boost converter fail signal	Power switch ON (IG), boost converter normal	5.3 to 7.7
FCV (H16–20) – GCNV (H16–8)	W – G	Boost converter fail signal	Power switch ON (IG), boost converter abnormal	1.9 to 3.0
CT (H16–21) – GCNV (H16–8)	R – G	Boost converter temperature sensor	Power switch ON (IG)	2.0 to 4.5
CPWM (H16–10) – GCNV (H16–8)	B – G	Boost converter PWM switch signal	Power switch ON (READY), parking brake ON, D position, brake pedal and accelerator pedal depressed	Pulse generation (see waveform 14)
CSDN (H16–9) – GCNV (H16–8)	W – G	Boost converter shutdown signal	Power switch ON (IG)	5.6 or higher
CSDN (H16–9) – GCNV (H16–8)	W – G	Boost converter shutdown signal	Power switch ON (READY)	Below 0.7
ST1– (H15–2) – GND1 (H14–1)	G – W–B	Stop lamp switch (opposite to STP)	Power switch ON (IG) and brake pedal depressed	Below 0.5
ST1– (H15–2) – GND1 (H14–1)	G – W–B	Stop lamp switch (opposite to STP)	Power switch ON (IG) and brake pedal released	9 to 14
CCS (H14–13) – GND1 (H14–1)	V – W–B	Cruise control switch	Cruise control system – Terminal of ECU – CCS terminal (see page 05–2690)	–
IMI (H14–18) – GND1 (H14–1)	W – W–B	Immobilizer communication	Immobilizer communicating	Pulse generation (see waveform 15)
IMO (H14–26) – GND1 (H14–1)	R – W–B	Immobilizer communication	Immobilizer communicating	Pulse generation (see waveform 15)
P1 (H15–17) – GND1 (H14–1)	Y – W–B	P position switch	Power switch ON (IG), P position switch ON	3 to 5

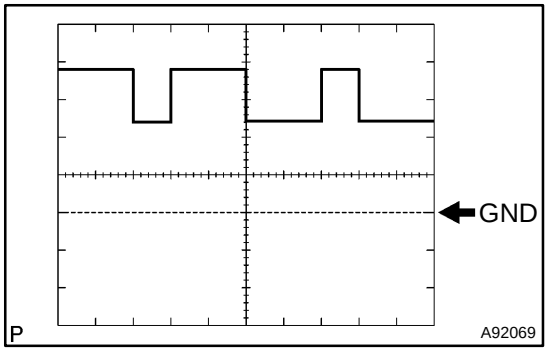
cardiagn.com

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
P1 (H15–17) – GND1 (H14–1)	Y – W–B	P position switch	Power switch ON (IG), P position switch OFF	7 to 12
PCON (H17–9) – GND1 (H14–1)	LG – W–B	P position control signal	Power switch ON (IG)	Pulse generation (see waveform 16)
PPOS (H17–10) – GND1 (H14–1)	W – W–B	P position signal	Power switch ON (IG)	Pulse generation (see waveform 16)
RDY (H14–28) – GND1 (H14–1)	R – W–B	READY control signal	Power switch ON (IG)	Pulse generation (see waveform 17)
RDY (H14–28) – GND1 (H14–1)	R – W–B	READY control signal	Power switch ON (READY)	Pulse generation (see waveform 18)
CLK (H16–17) – GND1 (H14–1)	G – W–B	A/C communication	Power switch ON (IG), A/C operating	Pulse generation (see waveform 19)
ITE (H16–14) – GND1 (H14–1)	Y – W–B	A/C communication	Power switch ON (IG), A/C operating	Pulse generation (see waveform 19)
ETI (H15–24) – GND1 (H14–1)	R – W–B	A/C communication	Power switch ON (IG), A/C operating	Pulse generation (see waveform 19)
STB (H15–25) – GND1 (H14–1)	W – W–B	A/C communication	Power switch ON (IG), A/C operating	Pulse generation (see waveform 19)
WP (H16–5) – GND1 (H14–1)	O – W–B	Water pump relay control	Power switch ON (IG), A/C operating	Below 2
GND1 (H14–1) – Body ground	W–B – Body ground	Ground	Always (resistance check)	Below 5 Ω
GND2 (H14–4) – Body ground	W–B – Body ground	Ground	Always (resistance check)	Below 5 Ω

1. Oscilloscope waveforms

HINT:

In the oscilloscope waveform samples, which are provided here for informational purposes. Noise and fluttering waveforms have been omitted.

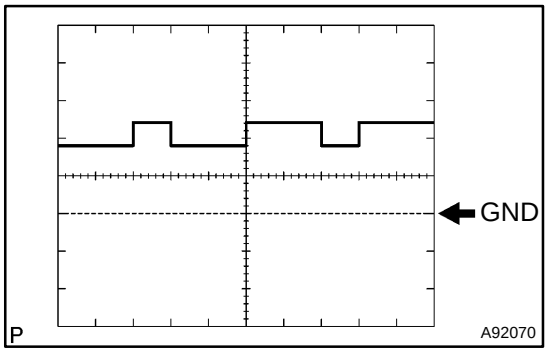


(a) Waveform 1 (HIGH–level CAN bus line)

Item	Contents
Terminal	CANH – GND1
Equipment Setting	1 V/Division, 2 µs/Division
Condition	Power switch ON (IG)

HINT:

The waveform varies depending on the contents of communication.



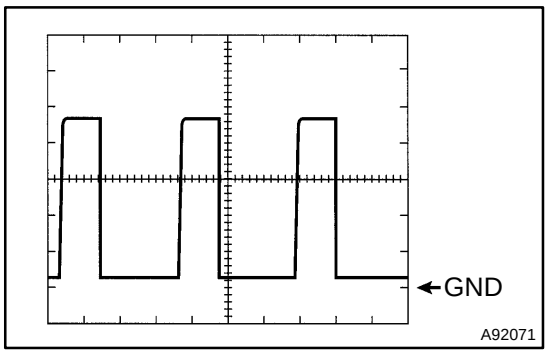
(b) Waveform 2 (LOW–level CAN bus line)

Item	Contents
Terminal	CANL – GND1
Equipment Setting	1 V/Division, 2 µs/Division
Condition	Power switch ON (IG)

HINT:

The waveform varies depending on the contents of communication.

cardiagn.com

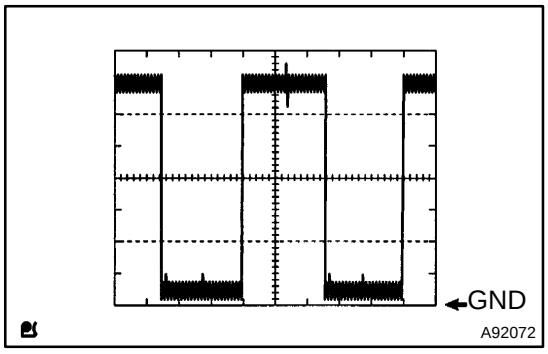


(c) Waveform 3 (engine speed signal)

Item	Contents
Terminal	NEO – GND1
Equipment Setting	1 V/Division, 2 ms/Division
Condition	Engine idling

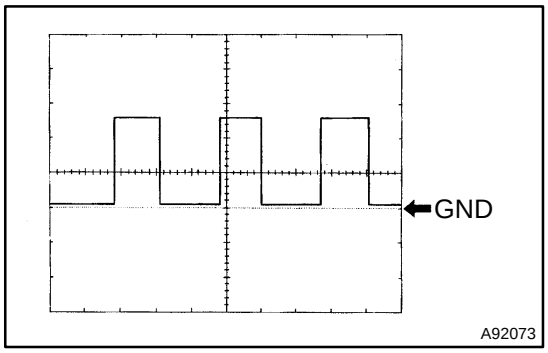
HINT:

The pulse cycle becomes shorter as the engine speed increases.



(d) Waveform 4 (G signal)

Item	Contents
Terminal	GO – GND1
Equipment Setting	2 V/Division, 20 ms/Division
Condition	Engine idling

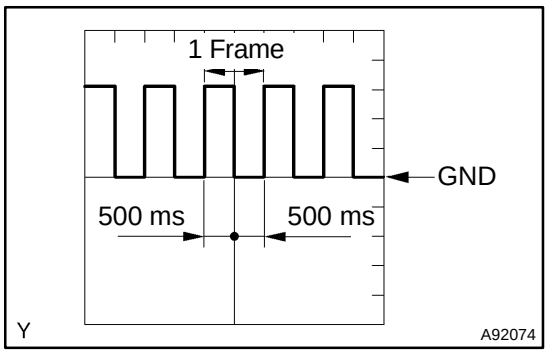


(e) Waveform 5 (vehicle speed signal)

Item	Contents
Terminal	SPDI – GND1
Equipment Setting	2 V/Division, 20 ms/Division
Condition	Driving at approximately 20 km/h (12 mph)

HINT:

The higher the vehicle speed, the shorter the cycle and higher the voltage.

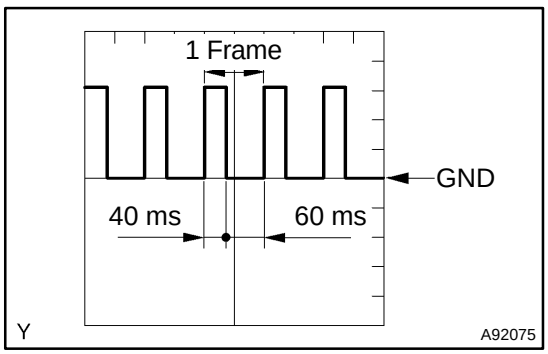


(f) Waveform 6 (airbag deployment signal)

Item	Contents
Terminal	ABFS – GND1
Equipment Setting	1 V/Division, 500 ms/Division
Condition	Power switch ON (READY) (2 seconds after ACC ON) Airbag system normal

HINT:

The waveform on the left is repeated when the airbag system is normal.



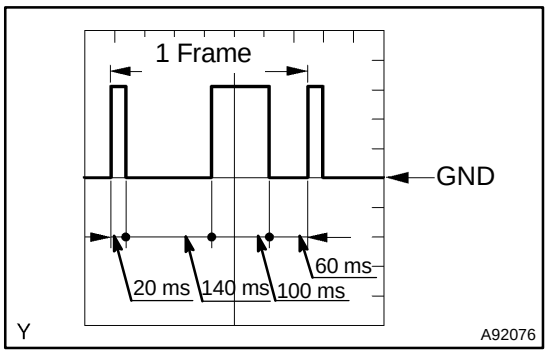
(g) Waveform 7 (airbag deployment signal)

Item	Contents
Terminal	ABFS – GND1
Equipment Setting	1 V/Division, 50 ms/Division
Condition	Power switch ON (READY) (2 seconds after ACC ON) Airbag system abnormal

HINT:

The waveform on the left is repeated when the airbag system is abnormal.

cardiagn.com

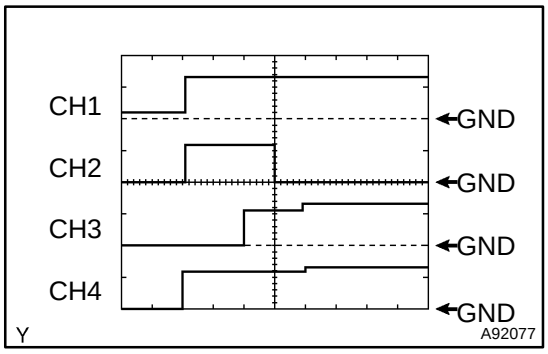


(h) Waveform 8 (airbag deployment signal)

Item	Contents
Terminal	ABFS – GND1
Equipment Setting	1 V/Division, 50 ms/Division
Condition	Power switch ON (READY) (2 seconds after ACC ON) Airbag system deployed (during collision)

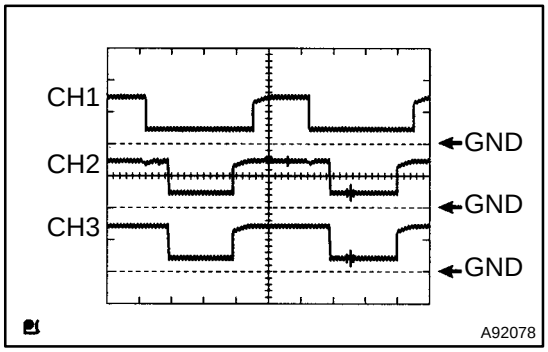
HINT:

When the airbag system is deployed, after 1 frame of transmission indicating a normal condition is completed, the waveform on the left is repeated for 50 frames. After that, normal transmission returns.



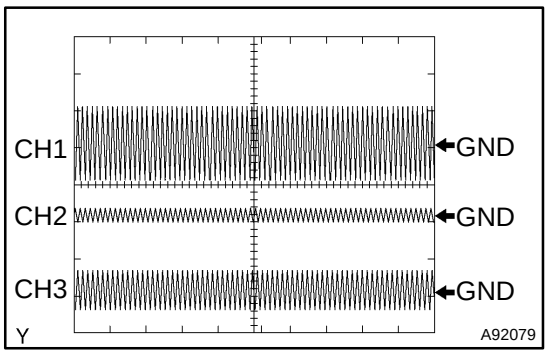
(i) Waveform 9 (system main relay signal)

Item	Contents
Terminal	CH1: IGSW – GND1 CH2: CON1 – GND1 CH3: CON2 – GND1 CH4: CON3 – GND1
Equipment Setting	10 V/Division, 100 ms/Division
Condition	Power switch OFF to ON (READY)



(j) Waveform 10 (generator switch U, V, and W signal)

Item	Contents
Terminal	CH1: GUU – GINV CH2: GVU – GINV CH3: GWU – GINV
Equipment Setting	10 V/Division, 20 μs/Division
Condition	Power switch ON (IG)



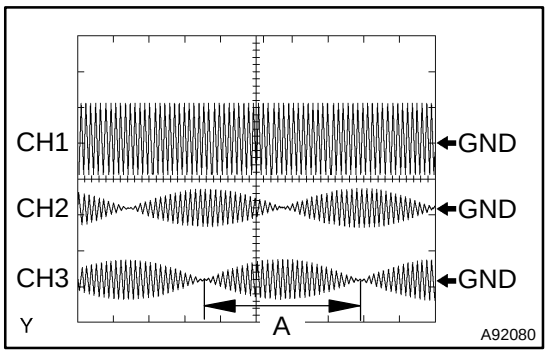
(k) Waveform 11 (generator or motor resolver)

Item	Contents
Terminal (Generator Resolver)	CH1: GRF – GRFG CH2: GSN – GSNG CH3: GCS – GCSG
Terminal (Motor Resolver)	CH1: MRF – MRFG CH2: MSN – MSNG CH3: MCS – MCSG
Equipment Setting	CH1: 10 V/Division, 1 ms/Division CH2, 3: 5 V/Division, 1 ms/Division
Condition	Generator or motor stopped

HINT:

The phases and the waveform height of the GSN and GCS, or the MSN and MCS change depending on the stopped position of rotor.

cardiagn.com

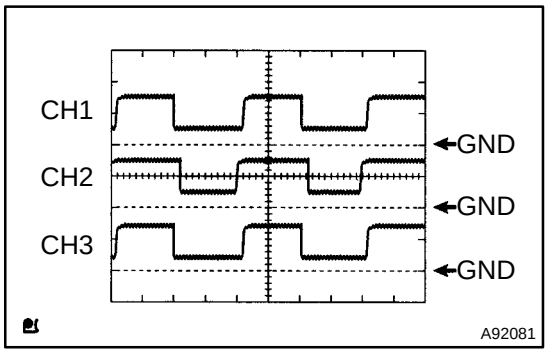


(l) Waveform 12 (generator or motor resolver)

Item	Contents
Terminal (Generator Resolver)	CH1: GRF – GRFG CH2: GSN – GSNG CH3: GCS – GCSG
Terminal (Motor Resolver)	CH1: MRF – MRFG CH2: MSN – MSNG CH3: MCS – MCSG
Equipment Setting	CH1: 10 V/Division, 1 ms/Division CH2, 3: 5 V/Division, 1 ms/Division
Condition	Generator or motor stopped

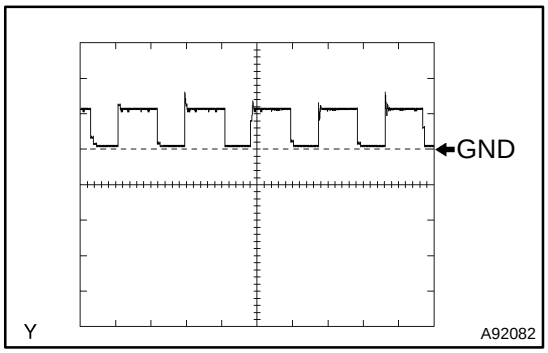
HINT:

Distance ”A” in the diagram becomes shorter as the rotor speed increases.



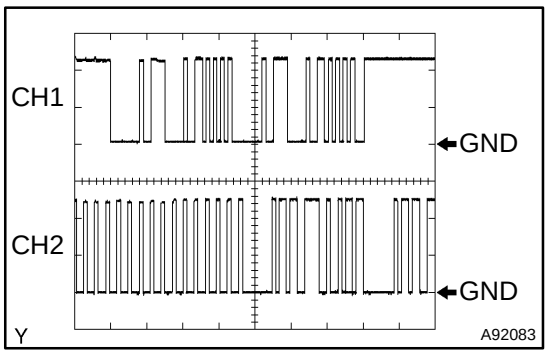
(m) Waveform 13 (motor switch U, V, and W signal)

Item	Contents
Terminal	CH1: MUU – GINV CH2: MVU – GINV CH3: MWU – GINV
Equipment Setting	10 V/Division, 50 µs/Division
Condition	Power switch ON (IG)



(n) Waveform 14 (boost converter PWM switch signal)

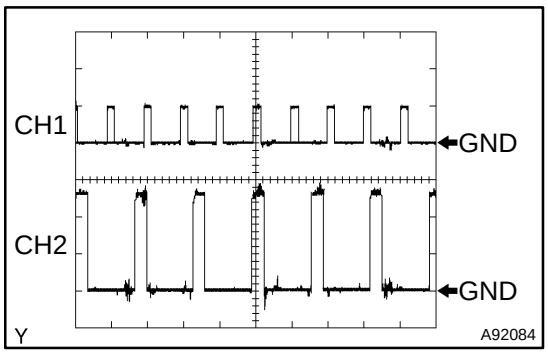
Item	Contents
Terminal	CPWM – GCNV
Equipment Setting	10 V/Division, 50 µs/Division
Condition	Power switch ON (READY), parking brake ON, D position, brake pedal and accelerator pedal depressed



(o) Waveform 15 (immobilizer communication)

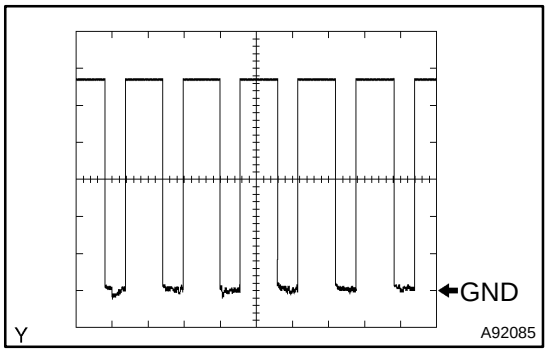
Item	Contents
Terminal	CH1: IMO – GND1 CH2: IMI – GND1
Equipment Setting	5 V/Division, 200 ms/Division
Condition	Immobilizer communicating

cardiagn.com



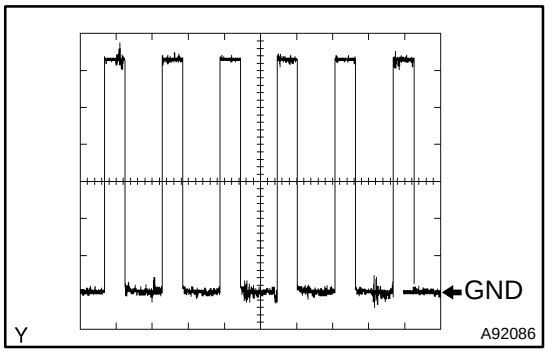
(p) Waveform 16 (P position control signal, P position signal)

Item	Contents
Terminal	CH1: PCON – GND1 CH2: PPOS – GND1
Equipment Setting	5 V/Division, 20 ms/Division
Condition	Power switch ON (IG)



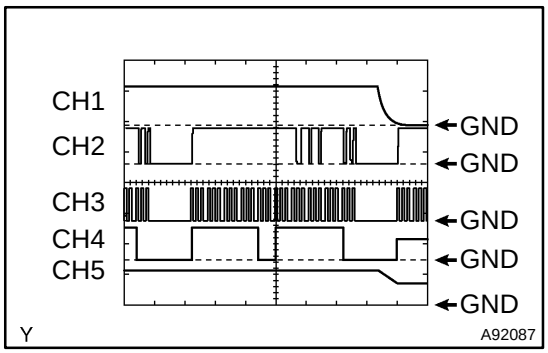
(q) Waveform 17 (READY control signal)

Item	Contents
Terminal	RDY – GND1
Equipment Setting	2 V/Division, 20 ms/Division
Condition	Power switch ON (IG)



(r) Waveform 18 (READY control signal)

Item	Contents
Terminal	RDY – GND1
Equipment Setting	2V/Division, 20ms/Division
Condition	Power switch ON (READY)



(s) Waveform 19 (A/C communication)

Item	Contents
Terminal	CH1: IGSW – GND1 CH2: ITE – GND1 CH3: CLK – GND1 CH4: ETI – GND1 CH5: STB– GND1
Equipment Setting	10 V/Division, 50 ms/Division
Condition	Power switch ON (IG) and A/C operating

cardiagn.com