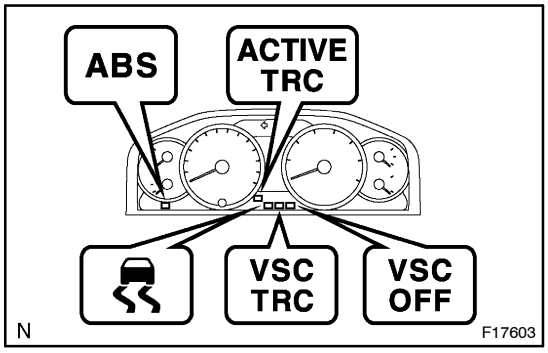
DIARF–01



PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Check the warning lights and buzzer.

(1) Release parking brake lever.

(2) When the ignition switch is turned ON, check that the ABS, VSC TRC and BRAKE warning lights, VSC OFF, SLIP and ACTIVE TRC indicator lights goes on for 3 sec.

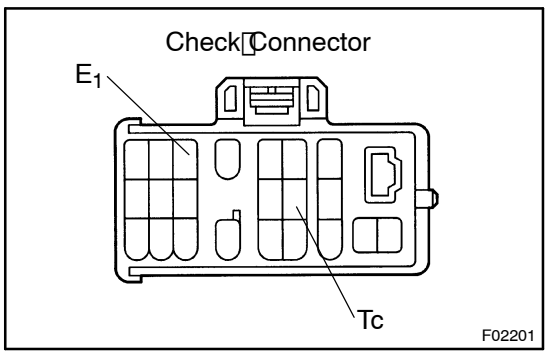
(3) When depressing the brake pedal repeatedly it may turn on the warning lights and buzzer.

HINT:

- If the ECU stores DTC, VSC TRC warning light and VSC OFF indicator light is ON.
- If the indicator check result is not normal, proceed to troubleshooting for the ABS warning light circuit, VSC TRC warning light circuit, BRAKE warning light circuit, VSC OFF indicator light circuit, SLIP indicator light circuit and ACTIVE TRC indicator light circuit.

Trouble Area	See Page
ABS warning light circuit	DI–313
VSC TRC warning light circuit	DI–317
BRAKE warning light circuit	DI–322
VSC OFF indicator light circuit	DI–332
SLIP indicator light circuit	DI–326
ACTIVE TRC indicator light circuit	DI–329

(b) In case of not using hand–held tester:
Check the DTC.



(1) Using SST, connect terminals Tc and E_1 of check connector.
SST 09843–18020

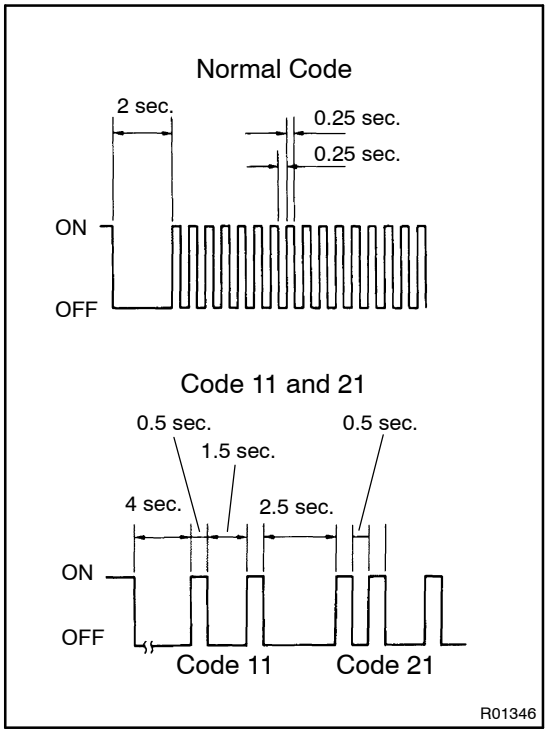
(2) Turn the ignition switch ON.

(3) Read the DTC from the ABS or VSC TRC warning light on the combination meter.

HINT:

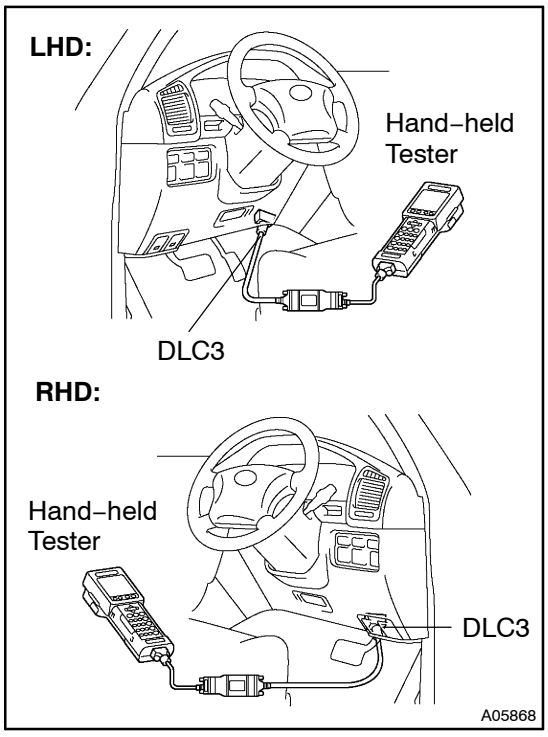
- If no code appears, inspect the Tc circuit, ABS or VSC TRC warning light circuit.

Trouble Area	See page
Tc circuit	DI–339
ABS warning light circuit	DI–313
VSC TRC warning light circuit	DI–317



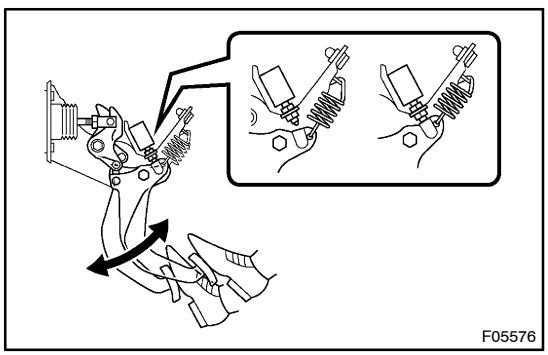
- As an example, the blinking patterns for normal code and codes 11 and 21 are shown on the left.
  (4) Codes are explained in the code table on page DI–198.
  (5) After completing the check, disconnect terminals Tc and E_1 of check connector and turn off the display.

If 2 or more malfunctions are indicated at the same time the lowest numbered DTC will be displayed 1st.



(c) In case of using hand–held tester:
Check the DTC.
(1) Hook up the hand–held tester to the DLC3.
(2) Turn the ignition switch ON.
(3) Read the DTC by following the prompts on the tester screen.

HINT:
Please refer to the hand–held tester operator's manual for further details.



(d) In case of not using hand–held tester:
Clear the DTC.
(1) Using SST, connect terminals Tc and E_1 of check connector.
SST 09843–18020
(2) Turn the ignition switch ON.
(3) Clear the DTC stored in ECU by depressing the brake pedal 8 or more times within 5 sec.

(4) Check that the warning light shows the normal code.
(5) Remove the SST from the terminals of check connector.

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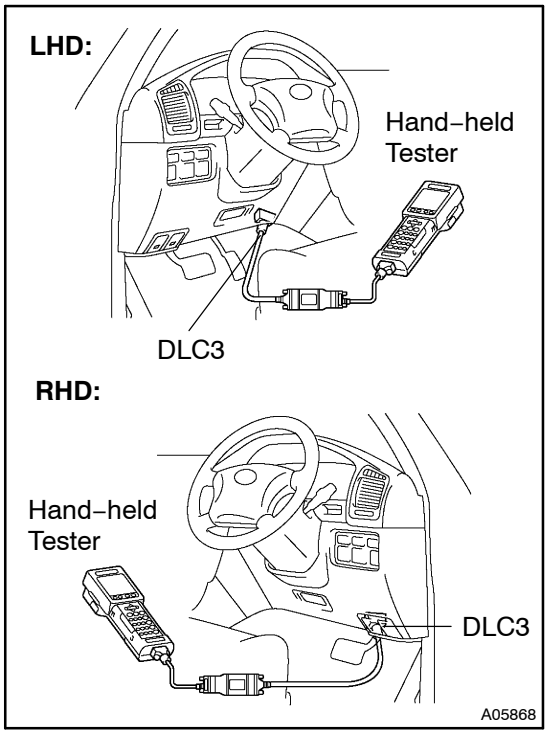


(e) In case of using hand–held tester:
Clear the DTC.
(1) Hook up the hand–held tester to the DLC3.
(2) Turn the ignition switch ON.
(3) Operate the hand–held tester to erase the codes. (See hand–held tester operator's manual.)

2. DATA LIST

HINT:

According to the DATA LIST displayed by the hand–held tester, you can read the value of the switch, sensor, actuator and so on without parts removal. Reading the DATA LIST as a first step of troubleshooting is one of the method to shorten the labor time.

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON.
(c) According to the display on tester, read the "DATA LIST".

Item	Measurement Item/Range (Display)	Normal Condition*	Diagnostic Note
HB MOT RELAY	HB Motor relay status/ ON or OFF	–	–
ABS MOT RELAY	Motor relay status/ ON or OFF	–	–
SOL RELAY	Solenoid relay status/ ON or OFF	–	–
PRESS HIGH	HIGH Hydraulic brake boost pressure/ ON or OFF	–	–
PRESS LOW	LOW Hydraulic brake boost pressure/ ON or OFF	–	–

VSC/TRC OFF SW	VSC OFF switch/ ON or OFF	–	–
IDLE SW	Main idle switch/ ON or OFF	ON: Accelerator pedal released OFF: Accelerator pedal depressed	–
STOP LIGHT SW	Stop light switch/ ON or OFF	ON: Brake pedal released OFF: Brake pedal depressed	–
PKB SW	PKB sw/ ON or OFF	ON: Parking brake applied OFF: Parking brake released	–
ABS OPERT FR	Front Right wheel operation/ BEFORE or OPERATE	BEFORE: No ABS operation (FR) OPERATE: During ABS operation (FR)	–
ABS OPERT FL	Front Left wheel operation/ BEFORE or OPERATE	BEFORE: No ABS operation (FL) OPERATE: During ABS operation (FL)	–
ABS OPERT RR	Rear Right wheel operation/ BEFORE or OPERATE	BEFORE: No ABS operation (RR) OPERATE: During ABS operation (RR)	–
ABS OPRET RL	Rear Left wheel operation/ BEFORE or OPERATE	BEFORE: No ABS operation (RL) OPERATE: During ABS operation (RL)	–
WHEEL SPD FR	Front Right wheel speed / Min.: 0km/h, Max.: 326.4 km/h	Actual wheel speed	Speed indicated on speedometer
WHEEL SPD FL	Front Left wheel speed/ Min.: 0km/h, Max.: 326.4 km/h	Actual wheel speed	Speed indicated on speedometer
WHEEL SPD RR	Rear Right wheel speed/ Min.: 0km/h, Max.: 326.4 km/h	Actual wheel speed	Speed indicated on speedometer
WHEEL SPD RL	Rear Left wheel speed/ Min.: 0km/h, Max.: 326.4 km/h	Actual wheel speed	Speed indicated on speedometer
DECELERAT SENS	G sensor (GL1 filter)/ Min.: −1.869 G, Max.: 1.869	Approximately 0 ± 0.13 G at still condition	Reading changes when vehicle is bounced
DECELERAT SENS2	G sensor (GL2 filter)/ Min.: −1.869 G, Max.: 1.869	Approximately 0 ± 0.13 G at still condition	Reading changes when vehicle is bounced
IG VOLTAGE	ECU IG power voltage/ UNDER or NORMAL or OVER	–	–
SFRR	SFRR/ ON or OFF	–	–
SFRH	SFRH/ ON or OFF	–	–
SFLR	SFLR/ ON or OFF	–	–
SFLH	SFLH/ ON or OFF	–	–
SRRR (SRR)	SRRR (SRR)/ ON or OFF	–	–
SRRH (SRH)	SRRH (SRH)/ ON or OFF	–	–
SRLR	SRLR/ ON or OFF	–	–
SRLH	SRLH/ ON or OFF	–	–
SRCF (SA1)	SRCF (SA1)/ ON or OFF	–	–
SRCR (SA2)	SRCR (SA2)/ ON or OFF	–	–
SRMF (SMCF, SA3)	SRMF (SMCF, SA3)/ ON or OFF	–	–
SRMR (SMCR, STR)	SRMR (SMCR, STR)/ ON or OFF	–	–
THROTTLE	Throttle position sensor/ Min.: 0 deg, Max.: 125 deg	–	–
ENGINE SPD	Engine Speed/ Min.: 0 rpm, Max.: 6000 rpm	Actual engine speed	–

YAW RATE	Yaw rate sensor/ Min.: –128 deg/s, Max.: 128 deg/s	–	–
YAW ZERO VALUE	Memorized zero value/ Min.: –128 deg/s, Max.: 128 deg/s	–	–
STEERING ANG	Steering sensor/ Min.: –1682 deg, Max.: 1877 deg	–1682 to 1877 deg	Turn the steering wheel changes the value
MAS CYL PRS 1	Master cylinder pressure 1/ Min.: 0 V, Max.: 5 V	When brake pedal is released: 0.3 – 0.9 V	Reading increases when brake pedal is depressed
AIR BLD SUPPORT	Air bleed availability/ NOT SUP or SUPPORT	w/ BA: Supported w/ VSC: Not supported	–
TEST MODE	Test mode operation/ NORMAL or TEST	NORMAL: Normal mode TEST: During test mode	–
#CODES	Number of Trouble Code/ Min.: 0, Max.: 255	MIn.: 0, Max.: 48	–

3. ACTIVE TEST

HINT:

Performing the ACTIVE TEST using the hand–held tester allows the relay, VSV, actuator and so on to operate without parts removal. Performing the ACTIVE TEST as a first step of troubleshooting is one of the method to shorten the labor time.

It is possible to display the DATA LIST during the ACTIVE TEST.

(a) Connect the hand–held tester to the DLC3.

(b) Turn the ignition switch ON.

(c) According to the display on tester, perform the ”ACTIVE TEST”.

HINT:

IG must be turned ON to proceed Active Test using a hand–held tester.

*1: For VSC equipped vehicles only

Item	Test Details	Diagnostic Note
SFRR	Turns ABS solenoid (SFRR) ON / OFF	Operation of solenoid (clicking sound) can be heard
SFRH	Turns ABS solenoid (SFRH) ON / OFF	Operation of solenoid (clicking sound) can be heard
SFLR	Turns ABS solenoid (SFLR) ON / OFF	Operation of solenoid (clicking sound) can be heard
SFLH	Turns ABS solenoid (SFLH) ON / OFF	Operation of solenoid (clicking sound) can be heard
SRRR	Turns ABS solenoid (SRRR) ON / OFF	Operation of solenoid (clicking sound) can be heard
SRRH	Turns ABS solenoid (SRRH) ON / OFF	Operation of solenoid (clicking sound) can be heard
SRLR	Turns ABS solenoid (SRLR) ON / OFF	Operation of solenoid (clicking sound) can be heard
SRLH	Turns ABS solenoid (SRLH) ON / OFF	Operation of solenoid (clicking sound) can be heard
SRCF (SA1)	Turns ABS solenoid (SRCF (SA1)) ON / OFF	Operation of solenoid (clicking sound) can be heard
SRCR (SA2)	Turns ABS solenoid (SRCR (SA2)) ON / OFF	Operation of solenoid (clicking sound) can be heard
SRMF (SMCF, SA3)	Turns ABS solenoid (SMCF, SA3)) ON / OFF	Operation of solenoid (clicking sound) can be heard

SRMR (SMCR, STR)	Turns ABS solenoid (SRMR (SMCR, STR)) ON / OFF	Operation of solenoid (clicking sound) can be heard
SFRR & SFRH	Turns ABS solenoid SFRR & SFRH ON / OFF	Operation of solenoid (clicking sound) can be heard
SFLR & SFLH	Turns ABS solenoid SFLR & SFLH ON / OFF	Operation of solenoid (clicking sound) can be heard
SRH & SRR	Turns ABS solenoid SRRR & SRRH ON / OFF	Operation of solenoid (clicking sound) can be heard
SRLR & SRLH	Turns ABS solenoid SRLR & SRLH ON / OFF	Operation of solenoid (clicking sound) can be heard
SFRH & SFLH	Turns ABS solenoid SFRH & SFLH ON / OFF	Operation of solenoid (clicking sound) can be heard
SRCF & SRCR	Turns ABS solenoid SRCF & SRCR ON / OFF	Operation of solenoid (clicking sound) can be heard
SRMF & SRMR	Turns ABS solenoid SRMF & SRMR ON / OFF	Operation of solenoid (clicking sound) can be heard
SOL RELAY	Turns ABS solenoid relay ON/OFF	Operation of solenoid (clicking sound) can be heard
ABS MOT RELAY	Turns ABS motor relay ON/OFF	Operation of motor (clicking sound) can be heard
TRAC MOT RELAY	Turns TRC motor relay ON/OFF	Operation of motor (clicking sound) can be heard
ABS WARN LIGHT	Turns ABS warning light ON / OFF	Observe combination meter
VSC WARN LIGHT	Turns VSC warning light ON / OFF	Observe combination meter
VSC/ TRC OFF IND	Turns VSC / TRC OFF indicator ON / OFF	Observe combination meter
SLIP INDI LIGHT	Turns SLIP indicator light ON / OFF	Observe combination meter
BRAKE WRN LIGHT	Turns BRAKE warning light ON / OFF	Observe combination meter
VSC/BR WARN BUZ	Turns VSC / BRAKE warning buzzer ON / OFF	Buzzer can be heard

4. FREEZE FRAME DATA

(a) The vehicle (sensor) status memorized during ABS and/or VSC operation or at the time of error code detection can be displayed by the hand–held tester.

(b) Only one record of freeze frame data is stored and the freeze frame data generated during ABS and/or VSC operation are constantly updated. Also, the number of the ignition switch's "ON" after the freeze frame data is stored can be memorized up to 31 and it can be displayed.

HINT:

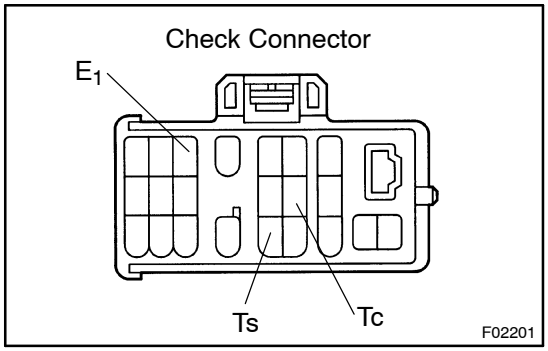
If the ignition switch "ON" operation exceeds 31 times, "31" appears on the display.

(c) If the diagnosis code abnormality occurs, the freeze frame data at the occurrence of the abnormality is stored but the ABS actuation data is deleted.

Hand–held tester display	Measurement Item	Reference Value*
VEHICLE SPD	Wheel speed sensor reading	Speed indicated on speedometer
STOP LIGHT SW	Stop light switch signal	Stop light switch ON: ON, OFF: OFF
# IG ON	Number of operations of ignition switch ON after memorizing freeze frame data	0 – 31
MAS CYL PRESS	Master cylinder pressure sensor reading	Brake pedal release : 0.3 – 0.9 V Brake pedal depress: 0.8 – 4.5 V
MASS PRESS GRADE	Master cylinder pressure sensor change	–30 – 200 MPa/s

Hand–held tester display	Measurement Item	Reference Value*
SYSTEM	System status	ABS activated: ABS VSC/TRC activated: VSC/TRC BA activated: BA Fail safe mode activated: FAIL SF No system activated: NO SYS
YAW RATE	Yaw rate angle sensor reading	–100 – 100
STEERING ANG	Steering sensor reading	Left turn: Increase Right turn: Drop
THROTTLE	Throttle position sensor reading	Release accelerator pedal: Approx. 0 deg. Depress accelerator pedal: Approx. 90 deg.
G (RIGHT & LEFT)	Right and left G	–1.869 – 1.869
G (BACK & FORTH)	Back and forth G	–1.869 – 1.869
VSC (TRC) OFF SW	VSC OFF switch signal	TRAC OFF SW ON: ON OFF: OFF
SHIFT POSITION	Shift lever position	FAIL P,N R D 4 3 2 L
THROTTLE	Throttle sensor reading	0 – 125 deg.

*: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.

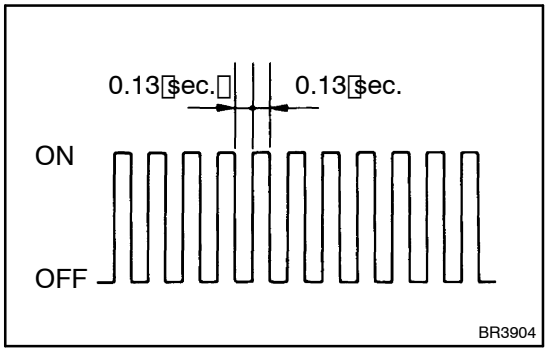


5. SPEED SENSOR SIGNAL CHECK (TEST MODE)

HINT:

- When replacing the yaw rate sensor or ECU, make sure to perform yaw rate sensor zero point calibration.
- If the ignition switch is turned from ON to ACC or LOCK during test mode, DTC will be erased.

(a) In case of not using hand–held tester:
Check the speed sensor signal.
(1) Turn the ignition switch OFF.
(2) Using SST, connect terminals Ts and E_1 of check connector.
SST 09843–18020
(3) Start the engine.



(4) Check that the ABS warning light blinks.

HINT:
If the ABS warning light does not blink, inspect the ABS warning light circuit and Ts circuit (See page DI–313 and DI–341).

(5) Keep the vehicle in the stationary condition on the flat place for 6 sec. or more.

(6) Shift the transfer lever in L4 position and turn the center diff. lock switch ON.

(7) Leaving the vehicle in the stationary condition and the brake pedal in free condition for 1 sec. or more, continue to depress the brake pedal with 98 N (10 kgf, 22 lbf) of force or more for 1 sec. or more.

(8) Leaving the vehicle in the stationary condition, depress the brake pedal with 98 N (10 kgf, 22 lbf) of force or more for 1 sec. or more.

HINT:
At this time, the ABS warning light comes on for 3 sec.

(9) Drive vehicle straight forward.
When driving the vehicle with the speed faster than 45 km/h (28 mph) for several seconds, check that the ABS warning light comes off.

HINT:
There is a case that the sensor check is not completed if the vehicle has its rear wheels spun or its steering wheel steered during this check.

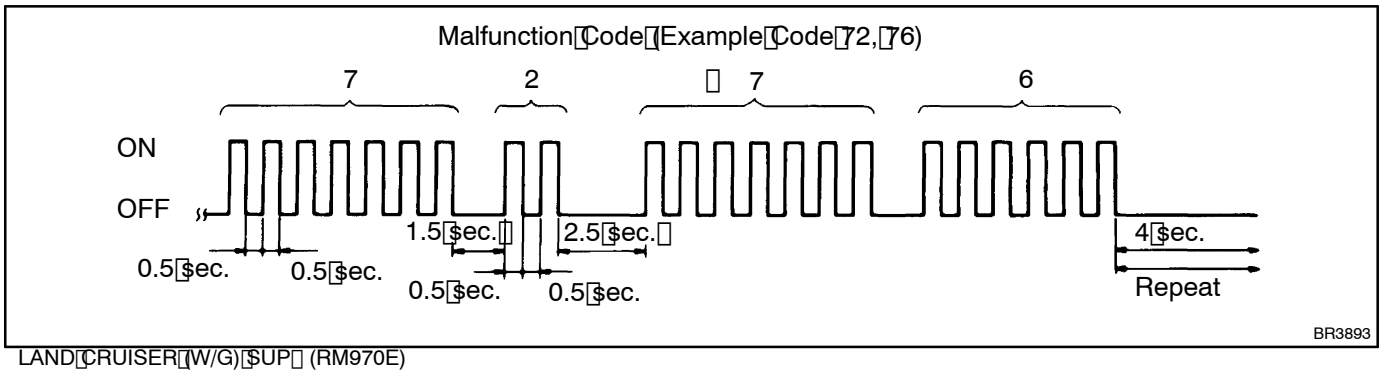
(10) Stop the vehicle.

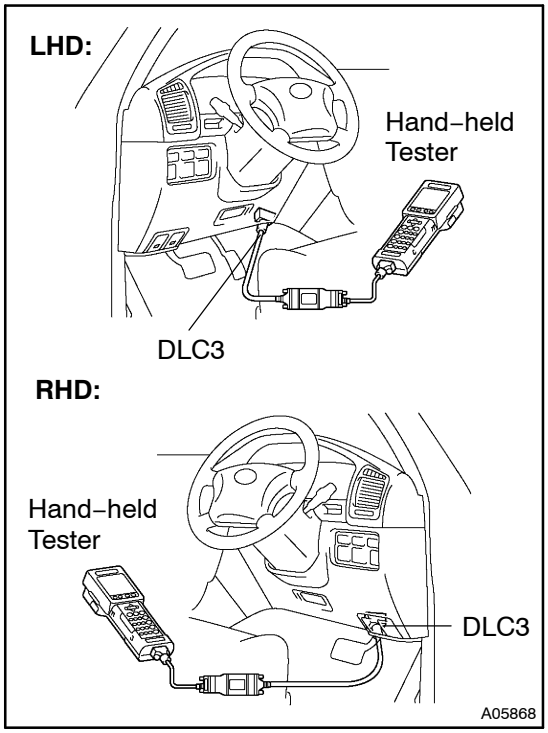
(11) Using SST, connect terminals Tc and E_1 of check connector.
SST 09843–18020

(12) Read the number of blinks of the ABS warning light.

HINT:
- See the list of DTC shown on the next page.
- If every sensor is normal, a normal code is output (A cycle of 0.25 sec. ON and 0.25 sec. OFF is repeated).
- If 2 or more malfunctions are indicated at the same time, the lowest numbered code will be displayed 1st.

(13) After doing the check, disconnect the SST from terminals Ts and E_1, Tc and E_1 of check connector and turn ignition switch OFF.
SST 09843–18020





(b) In case of using hand–held tester:
Check the sensor signal.
(1) Hook up the hand–held tester to the DLC3.
(2) Do step (3) and (4) to (10) on the previous page.
(3) Read the DTC by following the prompts on the tester screen.

HINT:
Please refer to the hand–held tester operator's manual for further details.

DTC of speed sensor check function:

Code No.	Diagnosis	Trouble Area
C1271 / 71	Low output voltage of right front speed sensor	• Right front speed sensor • Sensor installation • Sensor rotor
C1272 / 72	Low output voltage of left front speed sensor	• Left front speed sensor • Sensor installation • Sensor rotor
C1273 / 73	Low output voltage of right rear speed sensor	• Right rear speed sensor • Sensor installation • Sensor rotor
C1274 / 74	Low output voltage of left rear speed sensor	• Left rear speed sensor • Sensor installation • Sensor rotor
C1275 / 75	Abnormal change in output voltage of right front speed sensor	Right front speed sensor rotor
C1276 / 76	Abnormal change in output voltage of left front speed sensor	Left front speed sensor rotor
C1277 / 77	Abnormal change in output voltage of right rear speed sensor	Right rear speed sensor rotor
C1278 / 78	Abnormal change in output voltage of left rear speed sensor	Left rear speed sensor rotor
C1279 / 79	Deceleration sensor is faulty	• Deceleration sensor • Sensor installation
C1281 / 81	Master cylinder pressure sensor output signal is faulty	Master cylinder pressure sensor
C1282 / 82	Transfer indicator (center diff. lock) switch malfunction	Transfer indicator (center diff. lock) switch
C1283 / 83	Transfer L4 position switch malfunction	Transfer L4 position switch

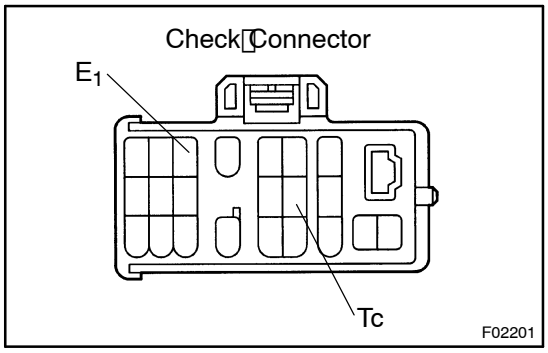
6. In case of not using hand-held tester: VSC SENSOR CHECK (TEST MODE)

NOTICE:

When having replaced the yaw rate sensor, deceleration sensor and/or ECU, perform zero point calibration of the yaw rate and deceleration sensors (See step 7.).

HINT:

If the ignition switch is turned from ON to ACC or LOCK during test mode, DTC will be erased.



(a) Procedures for test mode:

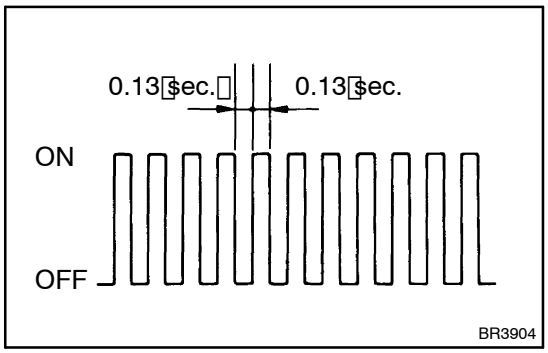
(1) Turn the ignition switch OFF.

(2) Check that the shift lever position is at P range, turn the steering wheel to the neutral range.

(3) Using SST, connect terminals Ts and E_1 of check connector.

SST 09843–18020

(4) Start the engine.



(5) Check that the VSC TRC warning light blinks.

HINT:

If the VSC TRC warning light does not blink, inspect the VSC TRC warning light circuit and Ts terminal circuit (See page DI–317 and DI–341).

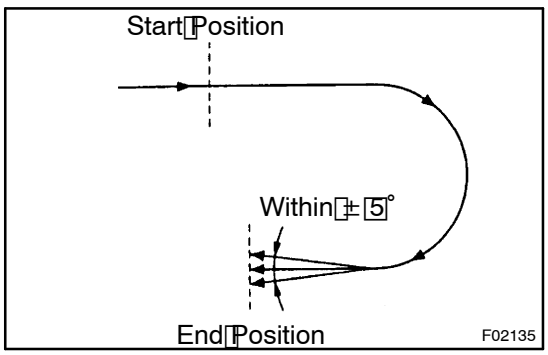
Turn the steering wheel either to left or right for 450° or more from the vehicle stationary condition, and turn back the steering wheel to the straight ahead position.

(b) Keep the vehicle in a stationary on a level place for 1 sec. or more.

(c) Check the yaw rate sensor.

Shift the shift lever to the D range and drive the vehicle at the vehicle speed of approx. 5 km/h (3 mph), turn the steering wheel either to left or right for 90° or more, and maintain 180° circular drive for the vehicle.

Stop the vehicle and shift the shift lever to the P range, check that the VSC buzzer sounds for 3 sec.



If the VSC buzzer sounded, the sensor check is in normal completion.

If the VSC buzzer does not sound, do the sensor check again.

If the VSC buzzer still won't sound, check the VSC buzzer circuit, then do the sensor check again.

Trouble Area	See page
VSC buzzer circuit	DI–337

HINT:

- Drive the vehicle circularly by 180°. At the end of the turn, the direction of the vehicle should be within 180° ± 5° of its start position.
- Do not spin the rear wheels.

- Do not shift the shift lever to P range during the turn.
- Do not stop the vehicle during the turn.

(d) Read the DTC.

(1) Using SST, connect terminals Tc and E_1 of check connector.

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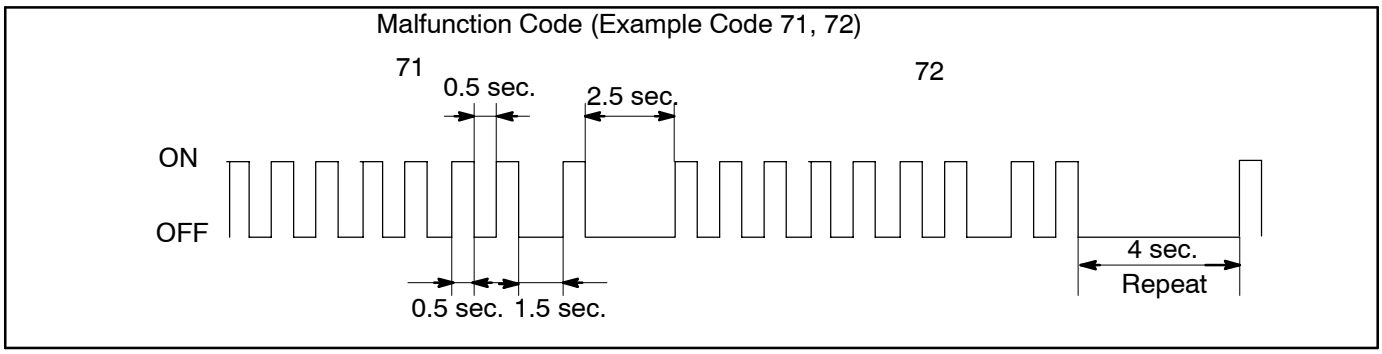
(2) Read the number of blinks of the VSC TRC warning light.

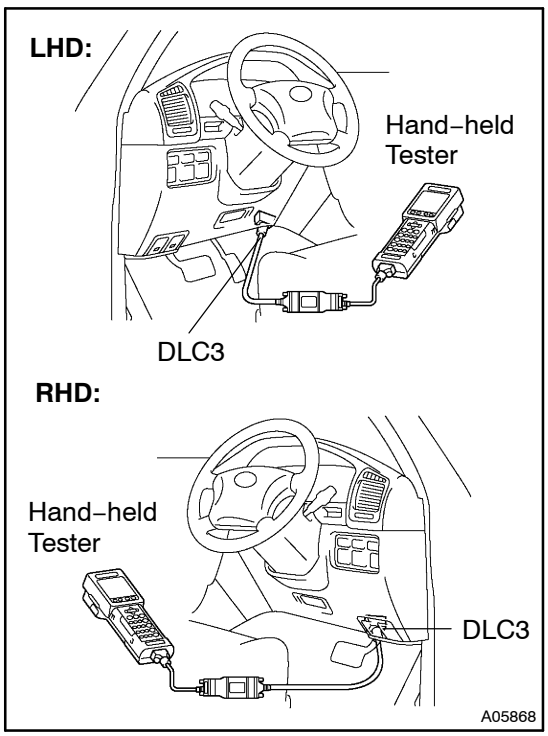
HINT:

- See the list of DTC shown on the next page.
- If every sensor is normal, a normal code is output. (A cycle of 0.25 sec. ON and 0.25 sec. OFF is repeated.)
- If 2 or more malfunctions are indicated at the same time, the lowest numbered code will be displayed 1st.



(3) After doing the check, disconnect the SST from terminals Ts and E_1, Tc and E_1 of check connector and turn ignition switch OFF.

SST 09843–18020



7. In case of using hand–held tester:
CHECK VSC SENSOR SIGNAL

(a) Hook up the hand–held tester to the DLC3.

(b) Do steps (a) – (2), (a) – (4) and (b) to (e) on the previous pages.

(c) Read the DTC by following the prompts on the tester screen.

HINT:

Please refer to the hand–held tester operator's manual for further details.

DTC of the VSC sensor check function:

Code No.	Diagnosis	Trouble Area
C0371 / 71	Yaw rate sensor output signal malfunction	• Yaw rate sensor • Yaw rate sensor circuit

8. IF NECESSARY, PERFORM ZERO POINT CALIBRATION OF YAW RATE AND DECELERATION SENSORS

HINT:

- When having replaced the yaw rate sensor, deceleration sensor or/and the ECU, make sure to perform yaw rate and deceleration sensors zero point calibration.
- This operation is also required when the deceleration sensor or yaw rate sensor has been replaced since the calibrated zero point of both sensors will be erased.

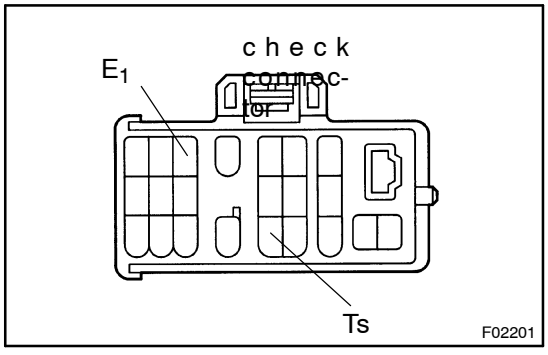
NOTICE:

- **While obtaining the zero point, do not give any vibration to the vehicle by tilting, moving or shaking it and keep it in a stationary condition. (Do not start the engine.)**
- **Be sure to do this on a level surface (within an inclination of 1 %).**

(a) Clear the zero point of the yaw rate and deceleration sensors.

(1) Shift the shift lever to P range.

(2) Turn the ignition switch ON in a stationary condition.



(3) With the ignition switch ON, using SST, repeat a cycle of short and open between terminals Ts and E_1 of check connector 4 times or more within 8 sec. Check that the VSC warning light is lit indicating the recorded zero point is erased.

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(4) Turn the ignition switch OFF.

(b) Obtain zero point of the yaw rate sensor.

(1) Make the terminals Ts and E_1 of check connector disconnected.

(2) Turn the ignition switch ON.

HINT:

The vehicle should be in a stationary condition with the shift lever in P range.

(3) Check that the lighted VSC warning light goes off about 15 sec. after the ignition switch is turned ON.

HINT:

Even if the ignition is not turned OFF in step (a)–(4) and remains ON, the yaw rate sensor zero point calibration can be completed. In this case, the VSC warning light is lit about 15 sec. and starts blinking. (Normal code)

(4) After ensuring that the VSC warning light remains OFF for 2 sec., turn the ignition switch OFF.

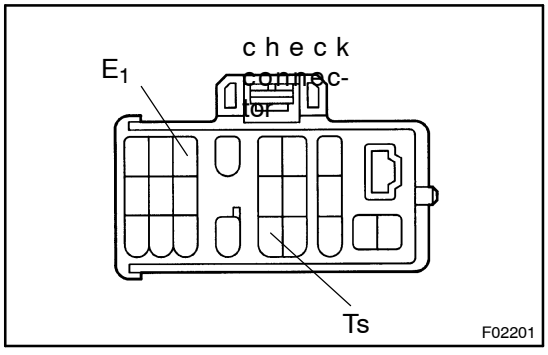
HINT:

If the ignition switch is not turned OFF in step (a)–(4), ensure the blinking light for 2 sec. and turn the ignition switch OFF.

(c) Perform deceleration sensor zero point calibration.

NOTICE:

After step (b) (the yaw rate sensor zero point calibration), the VSC warning light goes off. At this time, if the vehicle is driven without performing step (c) (deceleration sensor zero point calibration), deceleration sensor zero point calibration malfunction will be detected and the VSC warning light will light up. Therefore, perform step (c) right after step (b).



(1) Using SST, connect the terminals Ts and E_1 of check connector.

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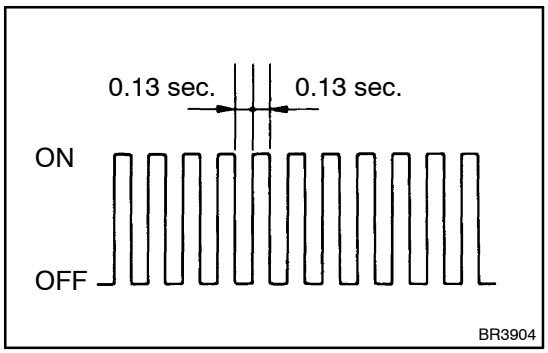
(2) Turn the ignition switch ON.

HINT:

Make the vehicle in a stationary condition with the shift lever in P range.



(3) After turning the ignition switch ON, check that the VSC warning light is lit for about 4 sec. and then starts quick blinking at 0.13 sec. intervals.

(4) After ensuring the blinking of the VSC warning light for 2 sec., turn the ignition switch OFF.

(5) Remove the SST and make the terminals Ts and E1 of check connector disconnected.

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