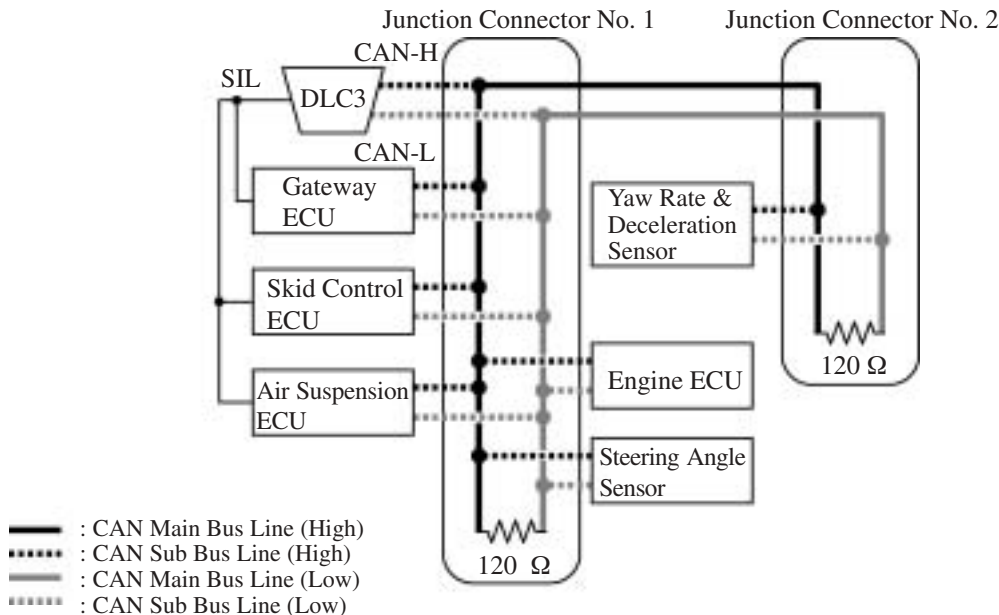## 4. CAN (Controller Area Network)

General

- The CAN comprises three junction connectors forming the two main bus line, and the sub bus lines connecting each ECU and sensors. The main bus line has a resister at the end to provide stability for the circuit.
- CAN uses a twisted-pair wire as the communication line, so the bus line has a + (high) line and a – (low) line.
- A DTC for a CAN communication error is output to the hand-held tester from DLC3 via the serial communication line for diagnosis of skid control ECU and air suspenstion ECU.
  DLC3 is equipped with CAN-H and CAN-L terminals for CAN diagnosis. It is possible to determine if there is an open or short on the main bus line by measuring the resistance value between these terminals. For details on CAN diagnosis, .
- Although the communication speed of BEAN and AVC-LAN is almost same, the CAN communication speed is much faster than BEAN and AVC-LAN. When the driving control system uses BEAN and AVC-LAN with a slower communication speed than CAN, the slower communication speed means that system control could possibly be delayed. As the result, the driving control system uses CAN, which has a fast communication speed and can send and receive in a short time.

▶ **System Diagram of LHD Model** ◀
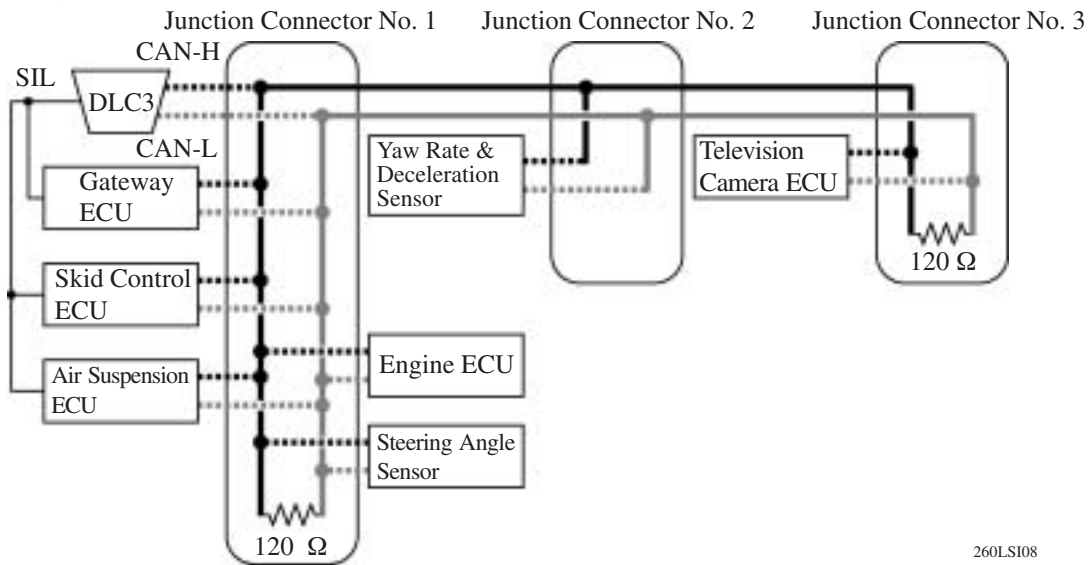
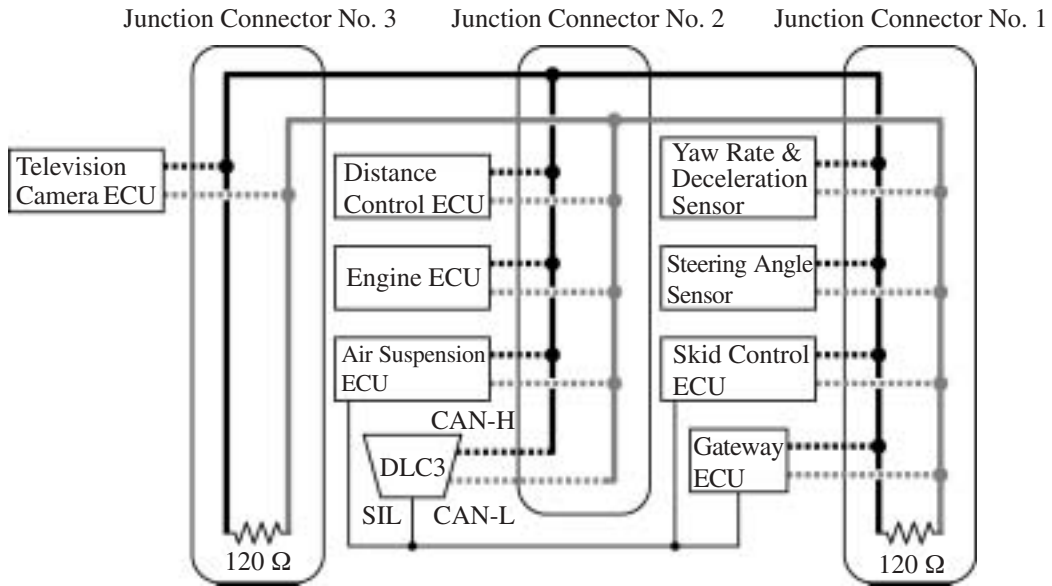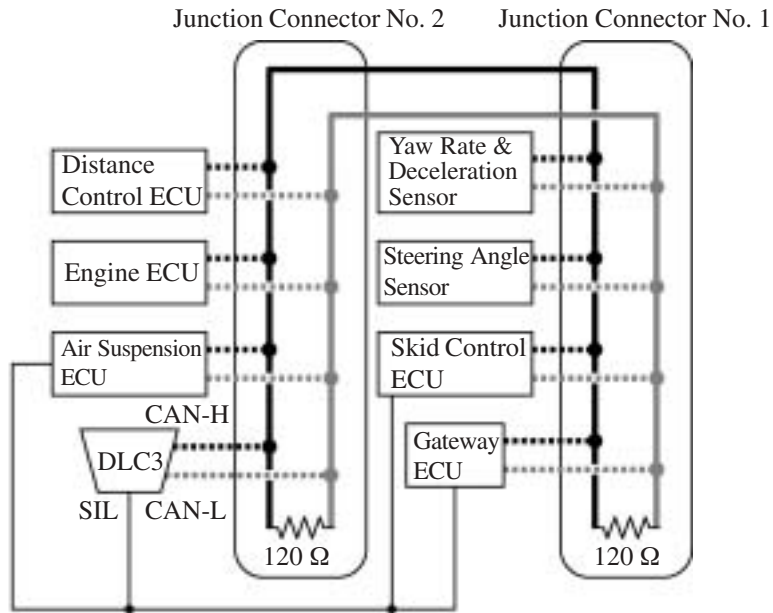**with Rear View Monitor/Back Guide Monitor Function**

——— : CAN Main Bus Line (High)
▪▪▪▪▪▪▪ : CAN Sub Bus Line (High)
——— : CAN Main Bus Line (Low)
▪▪▪▪▪▪▪ : CAN Sub Bus Line (Low)

without Rear View Monitor/Back Guide Monitor Function

▶ **System Diagram of RHD Model** ◀

Junction Connector No. 3   Junction Connector No. 2   Junction Connector No. 1

2

Television Camera ECU

Distance Control ECU

Engine ECU

Air Suspension ECU

Yaw Rate & Deceleration Sensor

Steering Angle Sensor

Skid Control ECU

Gateway ECU

CAN-H

DLC3

SIL   CAN-L

120 Ω   120 Ω

with Rear View Monitor/Back Guide Monitor Function   260LSI03

Junction Connector No. 2   Junction Connector No. 1

Distance Control ECU

Engine ECU

Air Suspension ECU

Yaw Rate & Deceleration Sensor

Steering Angle Sensor

Skid Control ECU

Gateway ECU

CAN-H

DLC3

SIL   CAN-L

120 Ω   120 Ω

without Rear View Monitor/Back Guide Monitor Function

━━━ : CAN Main Bus Line (High)   260LSI32
┅┅┅ : CAN Sub Bus Line (High)
━━━ : CAN Main Bus Line (Low)
┅┅┅ : CAN Sub Bus Line (Low)

Diagnosis of CAN

A DTC is output if a malfunction occurs in the ECUs or sensors that are connected to CAN. By outputting multiple DTCs, the diagnosis function of CAN is able to identify the area of the malfunction more accurately. To diagnose the skid control ECU, DTCs are output to a hand-held tester from DLC3 via the serial communication line.

▶ **Multiple DTCs** ◀

| DTC No.	Detection Item
U0100, U0123 U0124, U0126	Skid control ECU communication interruption
U0126, B2414*1 P1576*2, 5C-42*3	Steering angle sensor communication interruption
U0123, U0124	Yaw rate & deceleration sensor communication interruption

*1: This DTC is output for AFS ECU
*2: This DTC is output for engine ECU
*3: This DTC is output for multi display

▶ **DTC Chart Output from Skid Control ECU** ◀

DTC No.	Detection Item
U0073	CAN communication function fault
U0100	Communication interruption between skid control ECU and engine ECU
U0123	Communication interruption between skid control ECU and yaw rate & deceleration sensor (no yaw rate sensor signal)
U0124	Communication interruption between skid control ECU and yaw rate & deceleration sensor (no deceleration sensor signal)
U0126	Communication interruption between skid control ECU and steering angle sensor

• DLC3 is equipped with CAN-H and CAN-L terminals for CAN diagnosis. It is possible to determine if there is an open or short on the main bus line by measuring the resistance value between these terminals. It is also possible to determine if there is a short between the bus line – power supply/ground by measuring the resistance value between terminal CAN-H or CAN-L, and the BAT or CG terminal.

CG   CAN-H   SIL

CAN-L   BAT

DLC3   241BE110
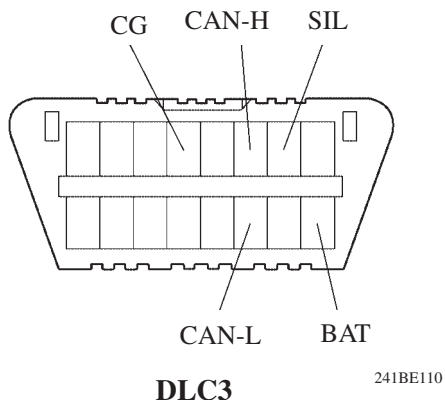
Resistance Value	Bus Line Condition
54 Ω – 67 Ω	Normal
	Sub bus line open (DTC is output)
	Short between bus line – power supply/ground (DTC is output)
more than 67 Ω	Sub bus line open
	Main bus line open
less than 54 Ω	Short between bus line – power supply/ground (DTC is output)
	Short between bus line

▶ **Inspection for short between bus line – power supply/ground** ◀

| Inspection Item	Resistance Value	Bus line condition
CAN-H – BAT	more than 1kΩ	No bus line malfunction if no DTC output
	less than 1kΩ	Short between bus line – power supply/ground
CAN-L – BAT	more than 1kΩ	No bus line malfunction if no DTC output
	less than 1kΩ	Short between bus line – power supply/ground
CAN-H – CG	more than 1kΩ	No bus line malfunction if no DTC output
	less than 1kΩ	Short between bus line – power supply/ground
CAN-L – CG	more than 1kΩ	No bus line malfunction if no DTC output
	less than 1kΩ	Short between bus line – power supply/ground

Service Tip

Because the engine ECU of the new LS430 effects diagnosis communication through CAN protocol, an Intelligent Tester II is required in order to obtain diagnostic information. For details, see the LEXUS LS430 Repair Manual Supplement (Pub. No. RM1049E).

Fail-Safe of CAN

If one of the buses is shorted, CAN communication transfers to the fail-safe mode in order to prevent unintended operation. At this time, the devices that are connected to CAN will inform the relevant ECUs of the occurrence of a malfunction. In the fail-safe mode, the controls will effect the processes that are specified for each system.

▶ **Example: Brake Control system** ◀
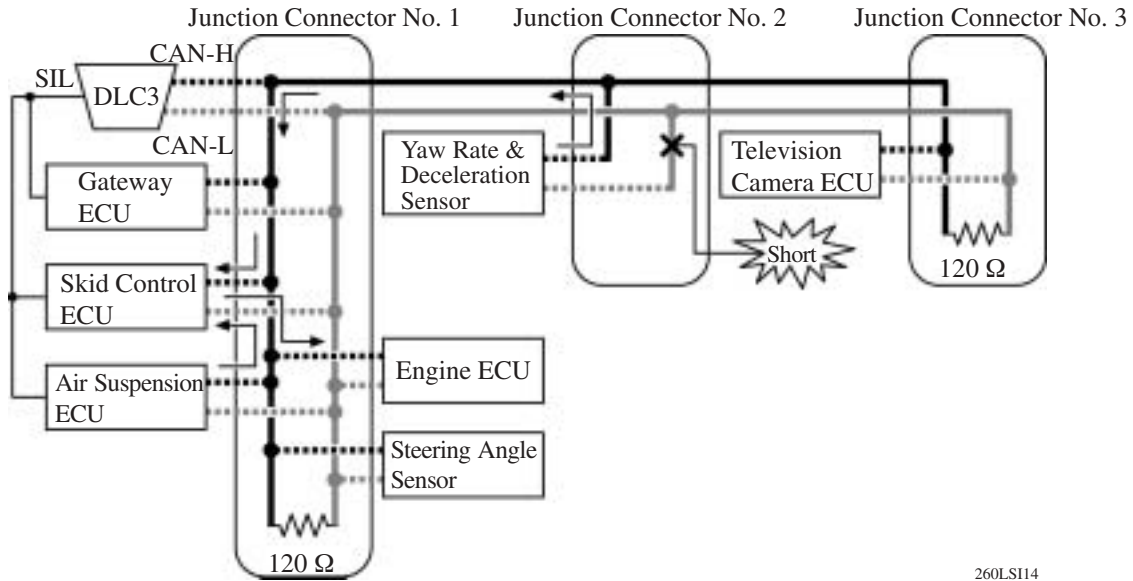
260LSI14

▶ **Influences on Each System During a Communication Error** ◀

System \ Item	Brake Control (ABS with EBD, TRAC, VSC)		Dynamic Laser Cruise	Combination Meter	Rear View Monitor/ Back Guide Monitor	Air Suspension
Engine ECU	—	Receive	Transmit	Transmit	—	Transmit
Skid Control ECU	Receive	Transmit	Receive	Transmit	—	Transmit
Steering Angle Sensor	Transmit	—	—	—	Transmit	—
Yaw Rate & Deceleration Sensor	Transmit	—	—	—	—	—
Distance Control ECU	—	—	—	—	—	—
Television Camera ECU	—	—	—	—	Receive	—
Air Suspension ECU	—	—	—	—	—	Receive
Gateway ECU	—	—	—	Receive	—	—
Control during disabled communication	System stops			Warning light does not illuminate or illuminates constantly	Serial Parking Assist Mode stops	System stops
Diagnosis (driver's recognition of error)	Warning light illuminates			Warning light illumination abnormal enables the recognition of errors	System stoppage enables the recognition of errors	