■ELECTRONIC CONTROL SYSTEM

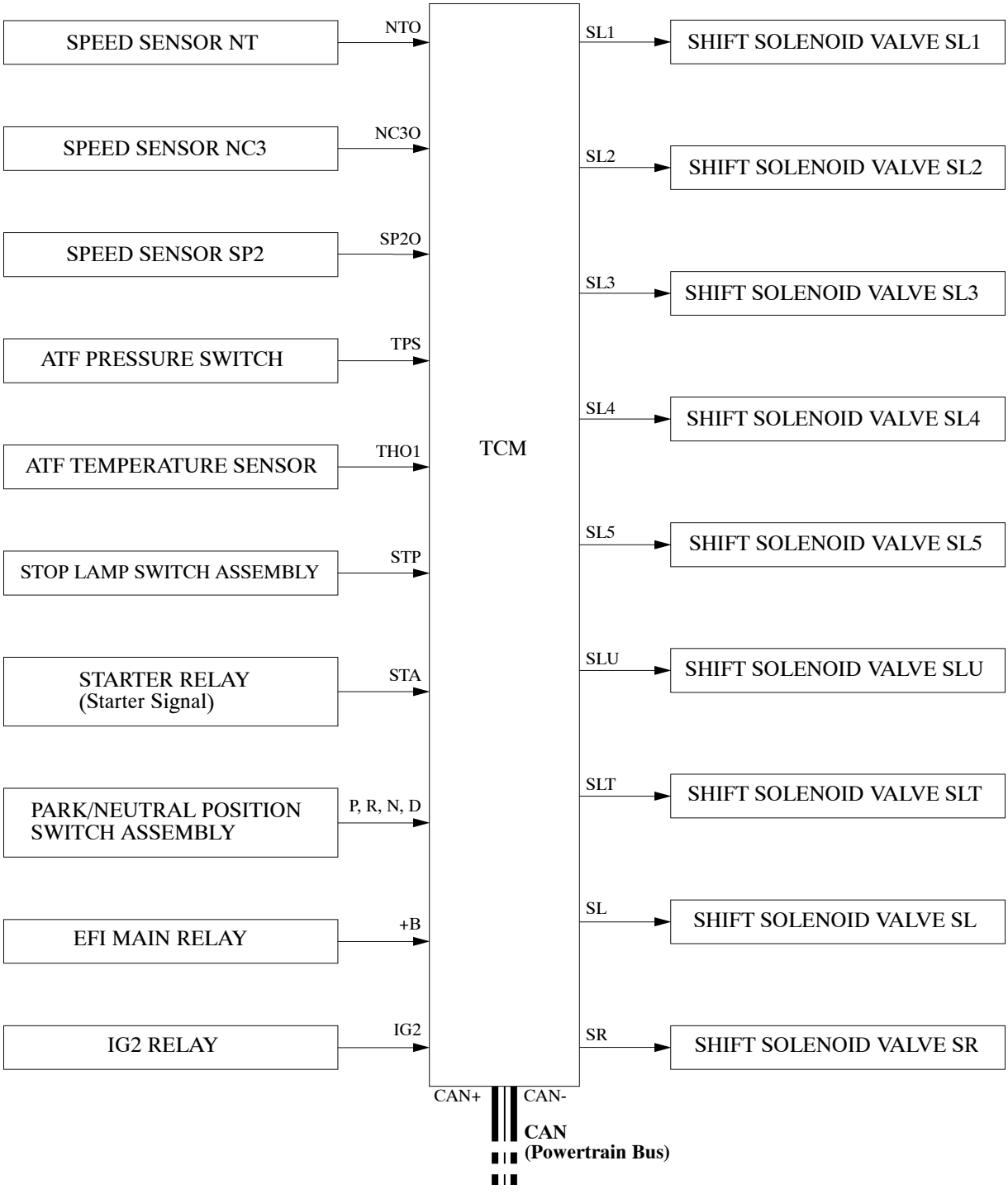
1. General

The electronic control system of the AA80E automatic transmission consists of the control functions listed below.

Controls	Outline
Shift Timing Control	The TCM sends current to shift solenoid valves SL1, SL2, SL3, SL4, SL5, SL and/or SLU based on signals from various sensors, in order to shift the gears.
Clutch Pressure Control (See page CH-37)	• Controls the pressure that is applied directly to the C_1, C_2, C_3, C_4 clutches and B_1 brake by actuating the shift solenoid valves (SL1, SL2, SL3, SL4 and SL5) in accordance with TCM signals. • Shift solenoid valves SLT, SLU, SL1, SL2, SL3, SL4 and SL5 minutely control clutch pressure in accordance with the engine output and driving conditions.
Line Pressure Optimal Control (See page CH-39)	Actuates shift solenoid valve SLT to control the line pressure in accordance with information from the TCM and the operating conditions of the transmission.
Lock-up Timing Control (See page CH-39)	The TCM sends current to shift solenoid valve SLU based on signals from various sensors to engage or disengage the lock-up clutch.
Flex Lock-up Clutch Control (See page CH-40)	Controls shift solenoid valve SLU, provides an intermediate mode for when the lock-up clutch is between on and off, increasing the operating range of the lock-up clutch to improve fuel economy.
Powertrain Integrated Control (See page CH-42)	Controls both the shift control and engine output control in an integrated way, achieving excellent shift characteristics and drivability.
Coast Downshift Control (See page CH-45)	To prevent engine speed from decreasing and thereby maintain fuel cut, the TCM performs downshifts before fuel cut ends.
2nd Gear Start-off and Stop Control (See page CH-46)	When the engine idling speed is high while the engine is warming up and the road surface is slippery, 2nd gear start-off and stop control for low-friction roads is automatically used in order to enhance control of driving force using the accelerator.
AI (Artificial Intelligence) -SHIFT Control (See page CH-47)	Based on the signals from various sensors, the TCM determines the road conditions and the intention of the driver. Thus, an appropriate shift pattern is automatically determined, thus improving drivability.
Multi-mode Transmission (See page CH-49)	• When the shift lever is moved to the M position, 8-speed sport direct shift control is activated, enabling the driver to drive the vehicle in a gear selected using the shift lever or shift paddle switch. • Gear hold control, complete lock-up control, super high response upshift control and blipping downshift control are adopted for 8-speed sport direct shift control to produce a direct feeling in response to accelerator and gear shift operation. • Operating the shift paddle switch "-" (DOWN) with the shift lever in the D position enables D position (fixed range mode). D position (fixed range mode) enables the driver to drive the vehicle in a desired gear range.
Diagnosis (See page CH-58)	When the TCM detects a malfunction, the TCM records the malfunction and memorizes the information that relates to the fault.
Fail-safe (See page CH-59)	If a malfunction is detected in the sensors or solenoids, the TCM performs fail-safe control to prevent the vehicle's drivability from being affected significantly.

2. Construction

The configuration of the electronic control system in the AA80E automatic transmission is as shown in the following chart.



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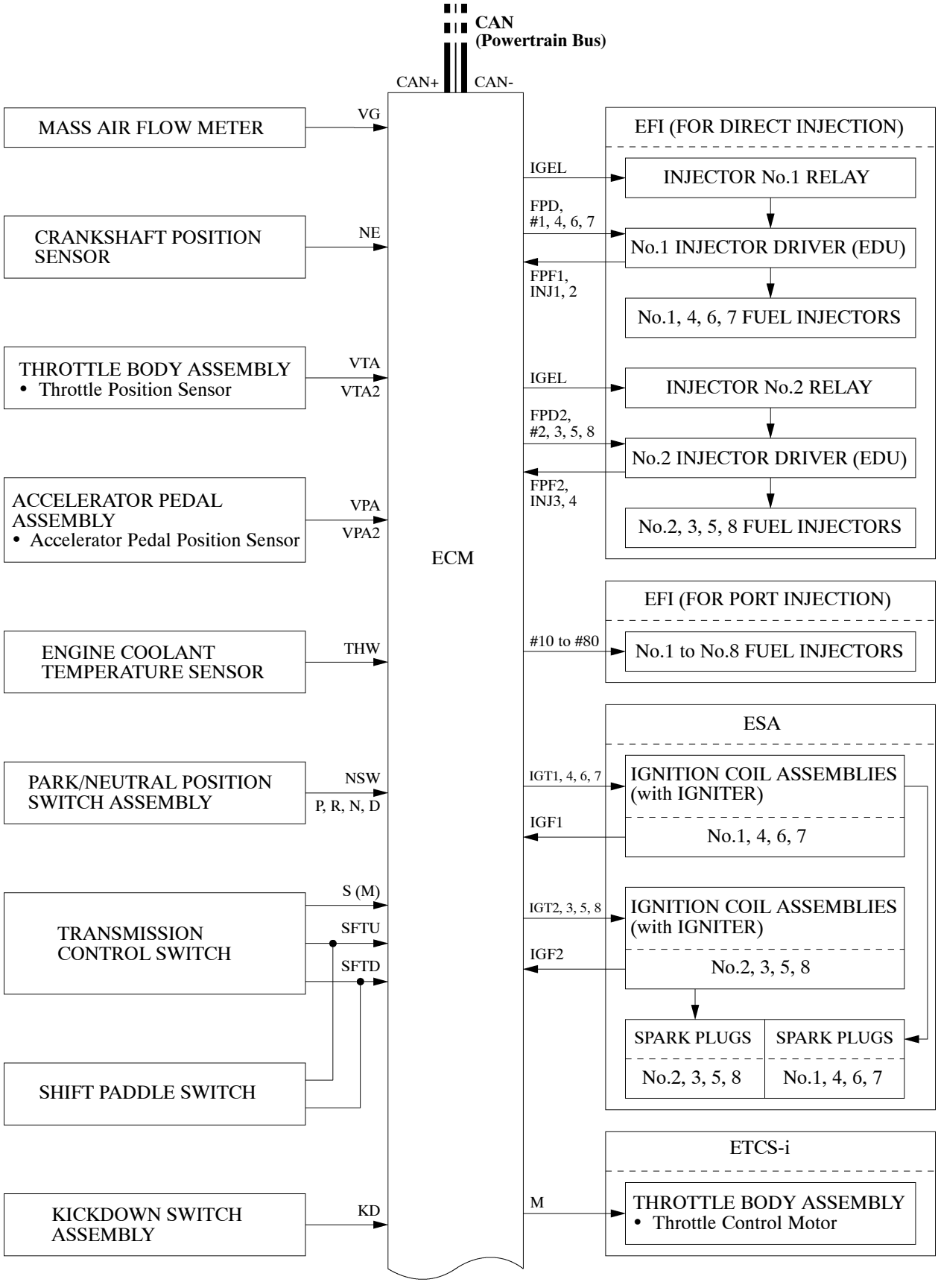

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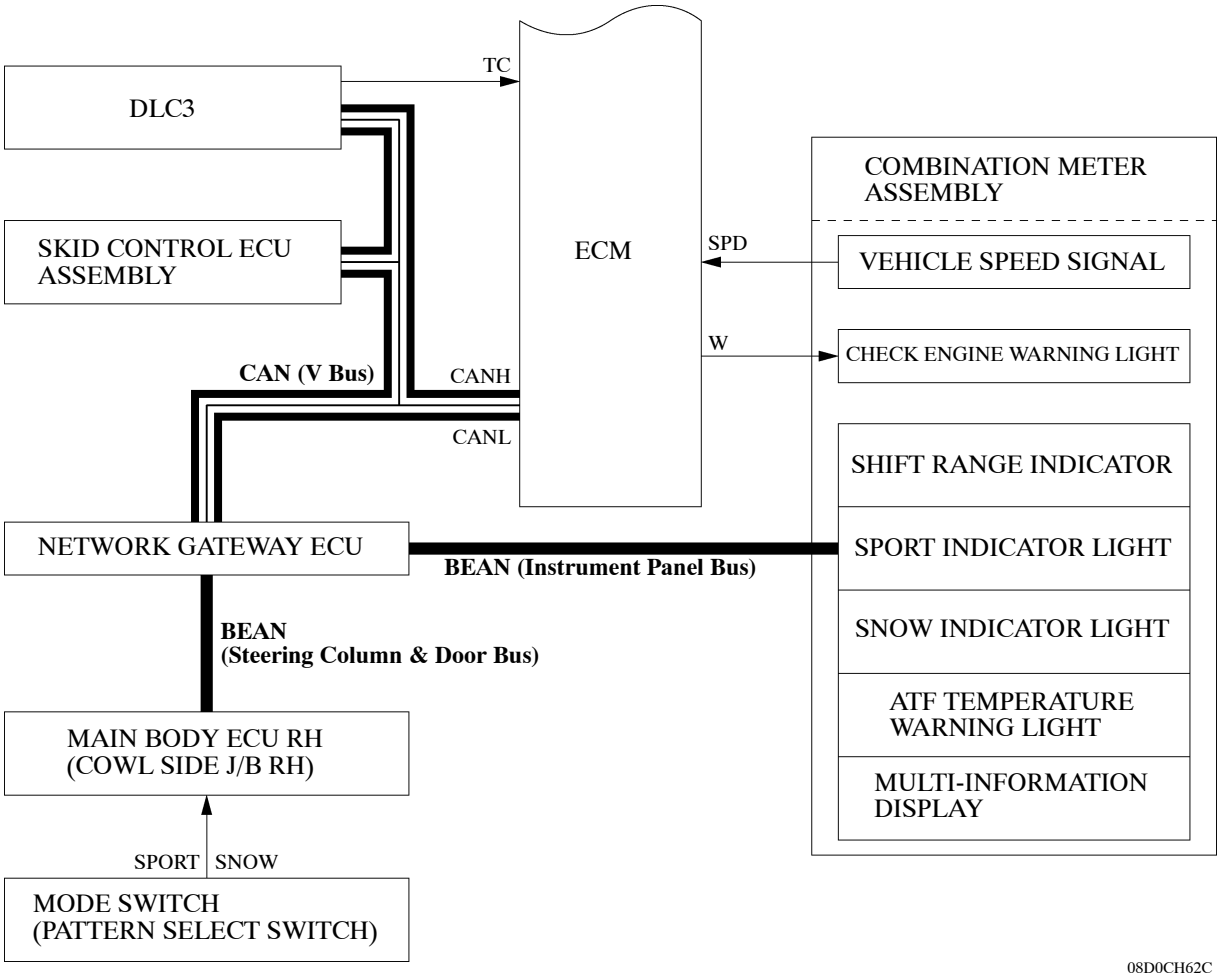
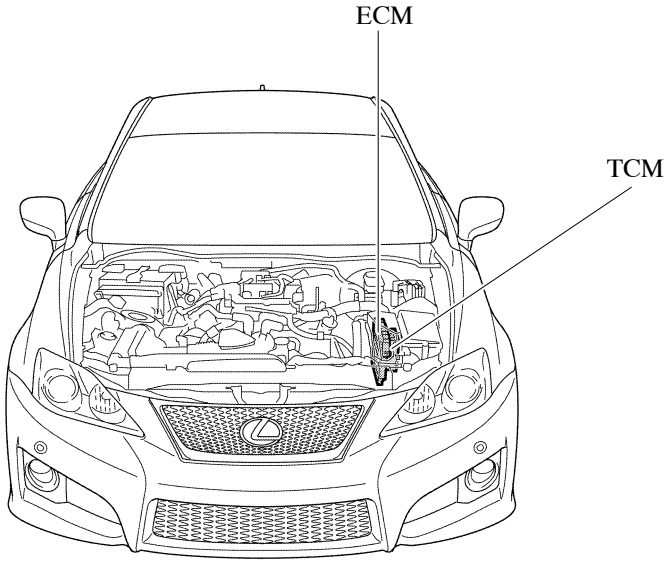

DLC3
TC
ECM
COMBINATION METER ASSEMBLY
SKID CONTROL ECU ASSEMBLY
SPD
VEHICLE SPEED SIGNAL
W
CHECK ENGINE WARNING LIGHT
CAN (V Bus)
CANH
CANL
SHIFT RANGE INDICATOR
NETWORK GATEWAY ECU
BEAN (Instrument Panel Bus)
SPORT INDICATOR LIGHT
SNOW INDICATOR LIGHT
BEAN
(Steering Column & Door Bus)
ATF TEMPERATURE WARNING LIGHT
MAIN BODY ECU RH
(COWL SIDE J/B RH)
MULTI-INFORMATION DISPLAY
SPORT
SNOW
MODE SWITCH
(PATTERN SELECT SWITCH)
08D0CH62C

3. Layout of Main Components



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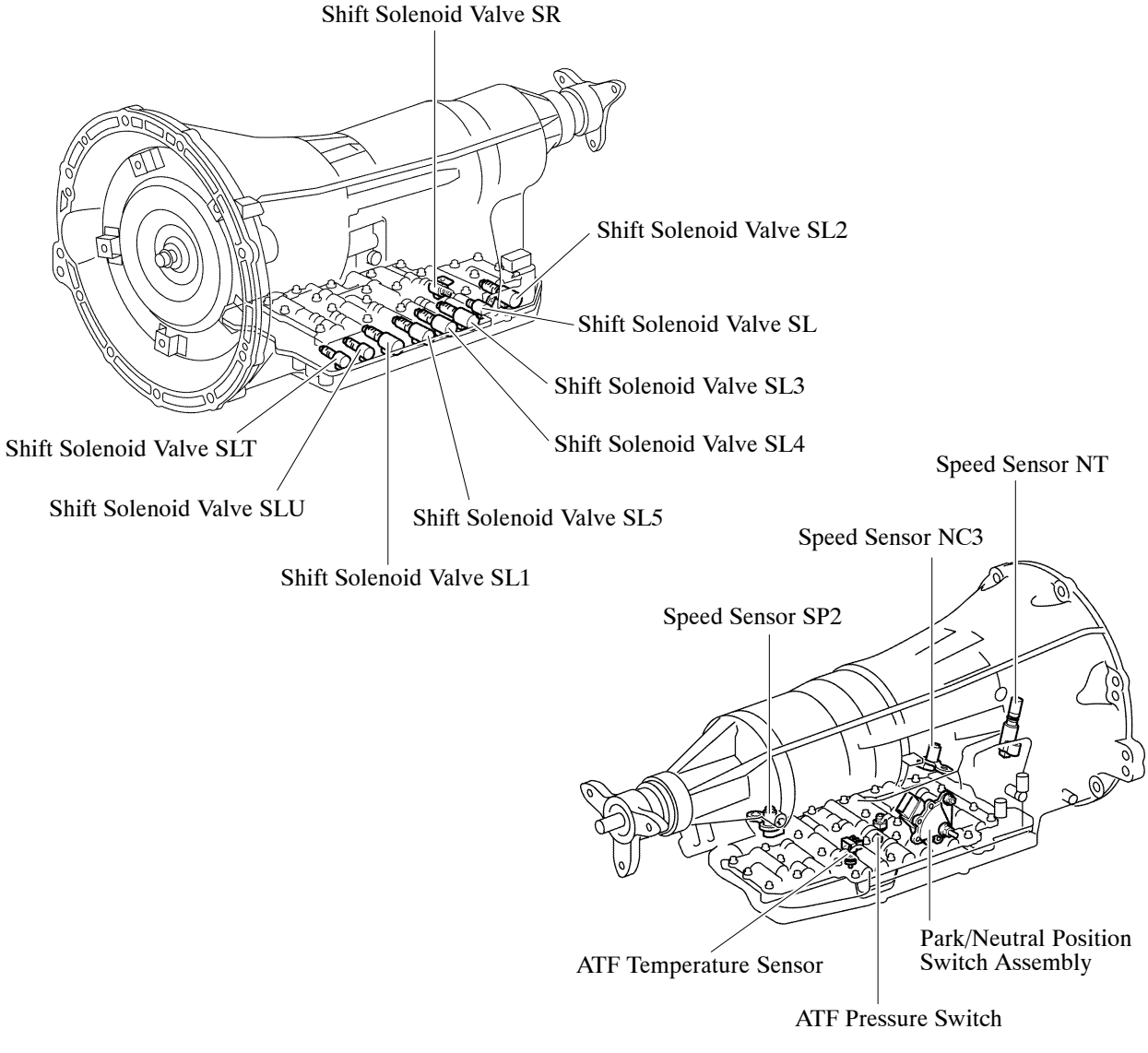

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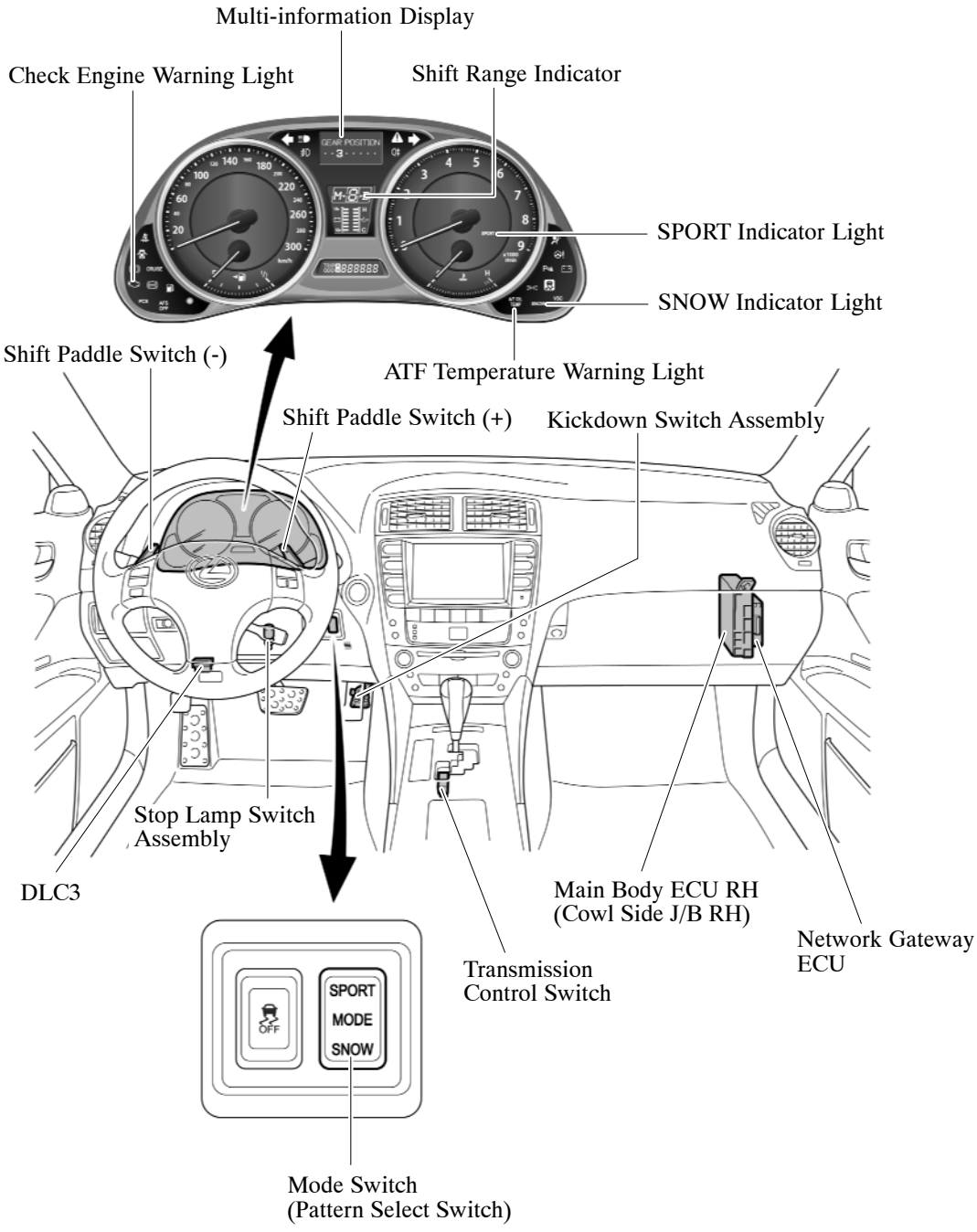
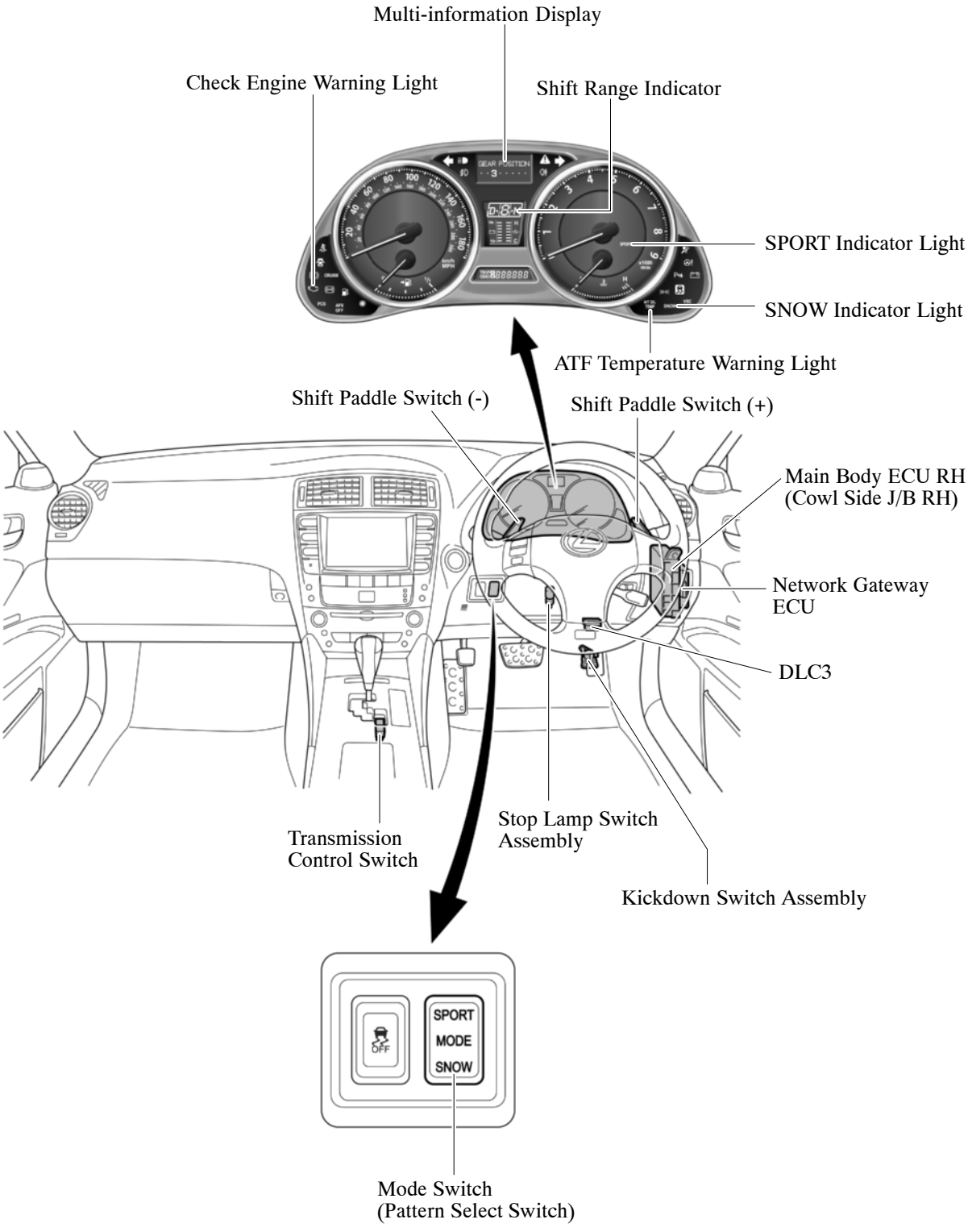


08E0CH05Z

LHD Models



RHD Models

08E0CH09Z

CH

4. Construction and Operation of Main Components

TCM

- The TCM has been isolated from the ECM. All the solenoid valves and sensors used for automatic transmission control are directly connected to the TCM through the connector located in side of the automatic transmission.
- The TCM maintains communication with the ECM through the CAN (Controller Area Network). Thus, engine control is effected in coordination with ECT control.

Mode Switch (Pattern Select Switch)

- The mode switch changes control for the engine, automatic transmission, VDIM and electric power steering in an integrated manner. The mode switch makes it possible to select SPORT, Normal or SNOW modes.
- When SPORT mode is selected, the SPORT indicator illuminates, VDIM enters SPORT mode, and the electric power steering, automatic transmission control and engine control all change to SPORT mode.
- When the mode switch is set to SPORT, D position gear shifts, AI-SHIFT selective gear shifts and throttle opening in response to the amount that the accelerator is depressed are changed to produce more sporty characteristics.

▶ Modes and Their Effect on Controls ◀

Mode / Control		SPORT	NORMAL	SNOW
Engine-transmission Control	D Position (Normal)	SPORT*1	NORMAL	SNOW
	D Position (Fixed Range Mode)	SPORT*1 (Fixed Range Mode*2)	NORMAL (Fixed Range Mode*2)	SNOW (Fixed Range Mode*2)
	M Position	Gear Hold Control	Gear Hold Control	Gear Hold Control
VDIM Control		SPORT	NORMAL	NORMAL
Power Steering Control		SPORT	NORMAL	NORMAL
Indicator Light		SPORT (Green)	-	SNOW (Yellow)

*1: Equivalent to conventional ECT POWER control.
*2: If the speed of the vehicle drops below a designated point, a downshift will be automatically performed from the current gear.

ATF Temperature Warning Light

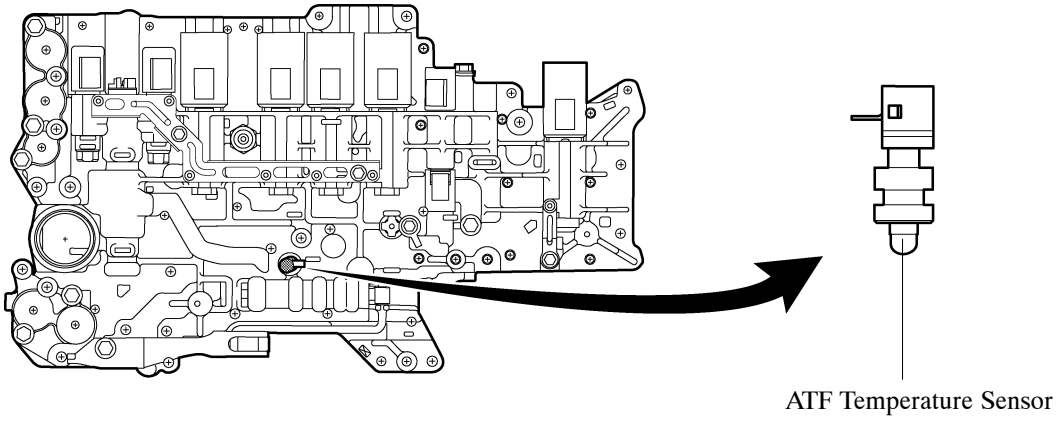
An ATF temperature warning light is adopted to inform the driver in the event that the ATF temperature becomes high. The warning light will go out when the temperature returns to normal.

▶ Warning Light Illumination ◀

ATF Temperature Warning Light	ATF Temperature
ON	140°C or more
OFF	135°C or less

ATF Temperature Sensor

- The ATF temperature sensor is installed in the transmission valve body assembly for direct detection of the fluid temperature.
- The ATF temperature sensor is used for hydraulic pressure control. This sensor is used for fine-tuning the pressure that is used to apply clutches and brakes in the transmission. This helps to ensure smooth shift quality.
- The ATF temperature sensor also is used for the ATF temperature warning light.

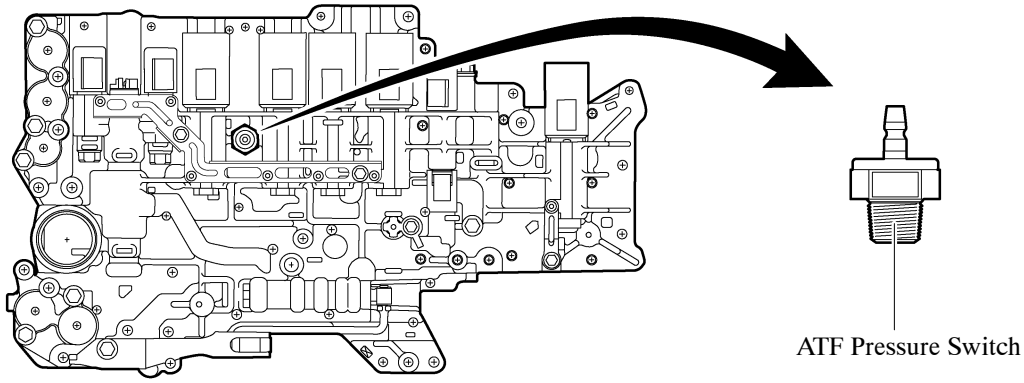


Transmission Valve Body Assembly (Lower Valve Body)

08D0CH117C

ATF Pressure Switch

- The ATF pressure switch is located in the output fluid passage of shift solenoid valve SL1, it turns on and off in accordance with the shift solenoid valve SL1 output fluid pressure.
- If shift solenoid valve SL1 malfunctions, the TCM determines the appropriate fail-safe operation to be performed in accordance with the signal from the ATF pressure switch.

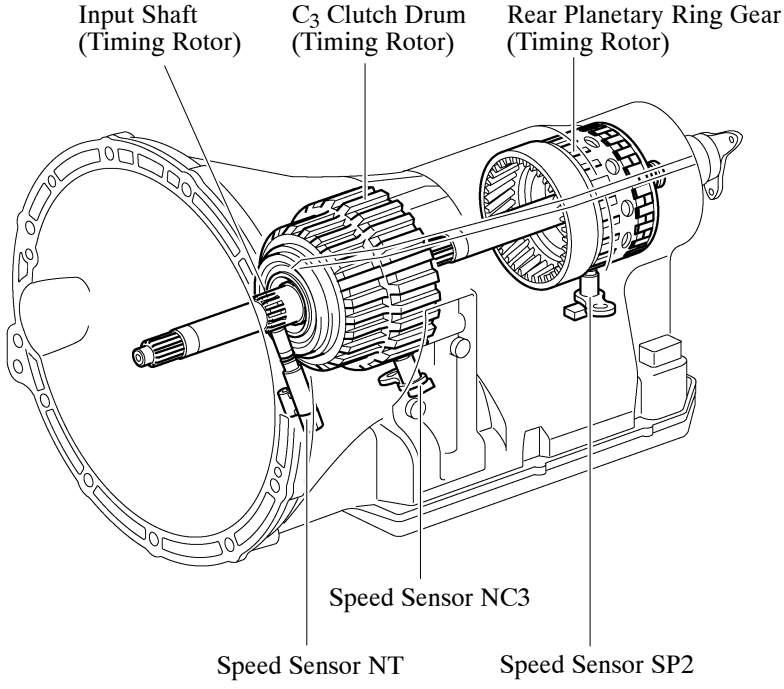


Transmission Valve Body Assembly (Lower Valve Body)

036CH35TE

Speed Sensors

- The AA80E automatic transmission uses speed sensor NT, speed sensor NC3 and speed sensor SP2. Thus, the TCM can detect the timing of the shifting of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions. These speed sensors are the Hall type.
- The speed sensor NT detects the input speed of the transmission. The input shaft is used as the timing rotor for this sensor.
- The speed sensor NC3 detects the speed of intermediate shaft. The C_3 clutch drum is used as the timing rotor for this sensor.
- The speed sensor SP2 detects the speed of the output shaft. The rear planetary ring gear is used as the timing rotor for this sensor.
- Hall type speed sensors consists of a magnet and a Hall IC. The Hall IC converts the changes in the magnetic flux density that occur through the rotation of the timing rotor into an electric signal, and outputs the signal to the TCM.



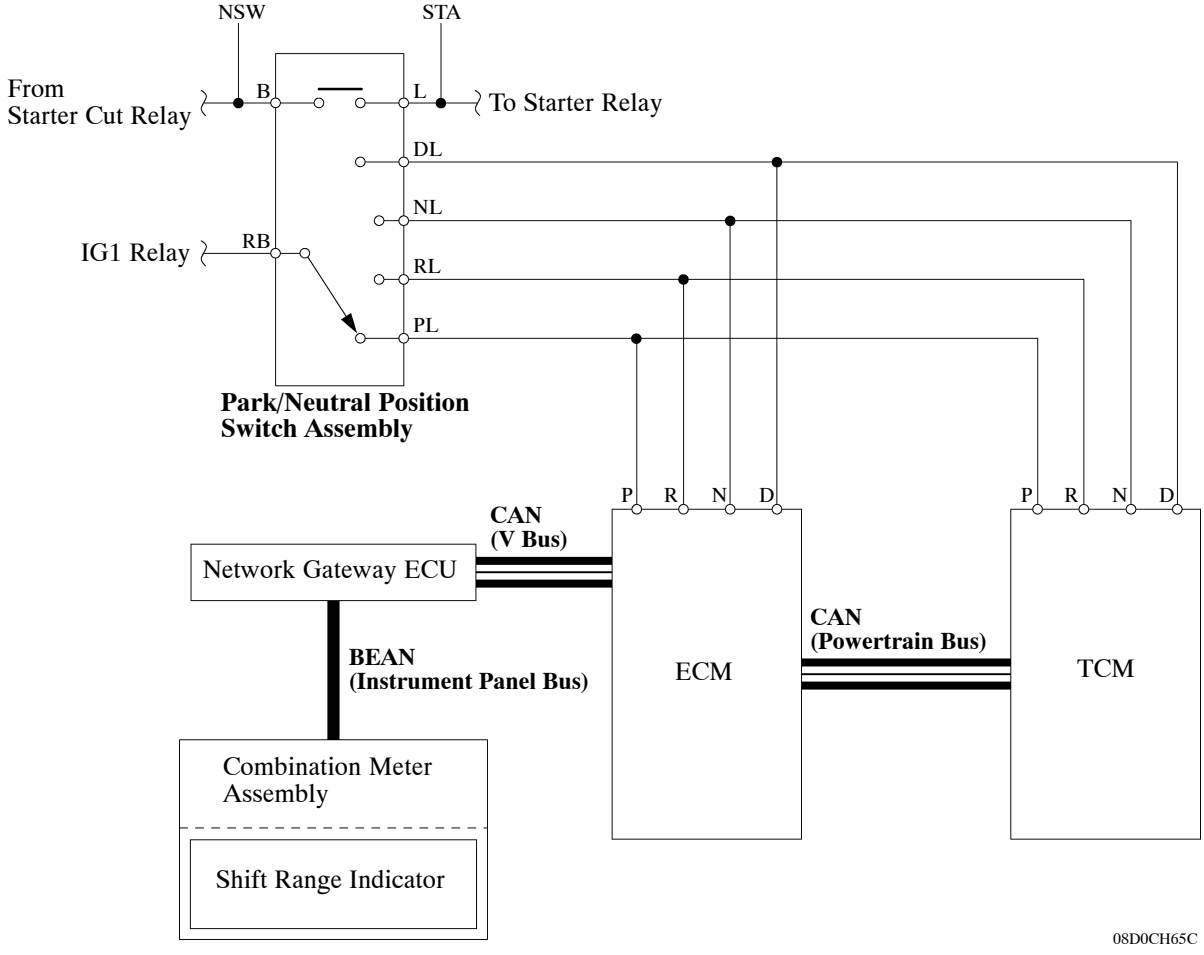
036CH36Z

Park/Neutral Position Switch Assembly

The TCM and ECM use these switches to detect the shift lever position.

- The park/neutral position switch assembly detects the shift lever position (P, R, N or D) and transmits the signal to both the ECM and TCM. The ECM then transmits signals to the combination meter for the shift range indicator (P, R, N and D) in response to the signal it received from the switch.

▶ Wiring Diagram ◀



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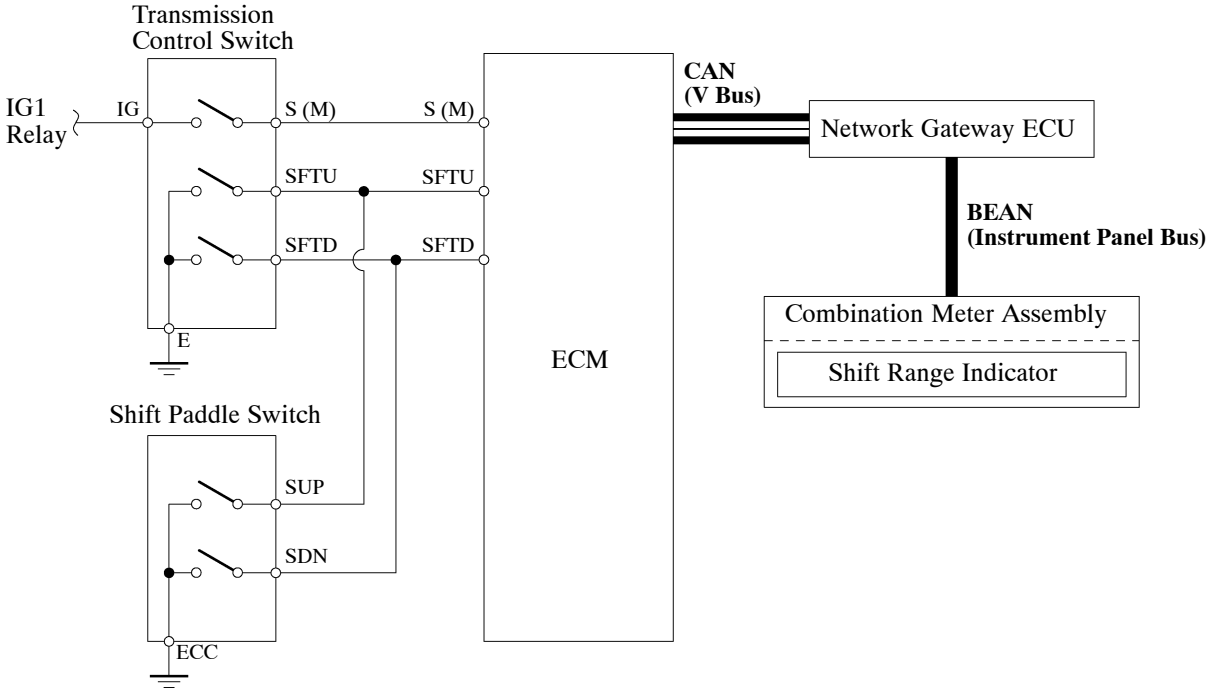
Transmission Control Switch and Shift Paddle Switch

- The transmission control switch is installed inside the shift lever assembly to inform the ECM of the shift lever position. The ECM turns on the shift range indicator.
- The transmission control switch detects whether the shift lever is in the D position or in the M position. If the shift lever is in the M position, the switch detects the operating conditions of the shift lever (front ["+" position] or rear ["-" position]), and sends signals to the ECM. At this time, the ECM turns on the shift range indicator for the selected range.
- The shift paddle switches are installed in the steering wheel assembly. The ECM detects the operation of the shift paddle switches (right ["+"position] or left ["-"position]) when the shift lever is in the D position or M position. At this time, the ECM turns on the shift range indicator for the selected range or gear.

▶ Wiring Diagram◀



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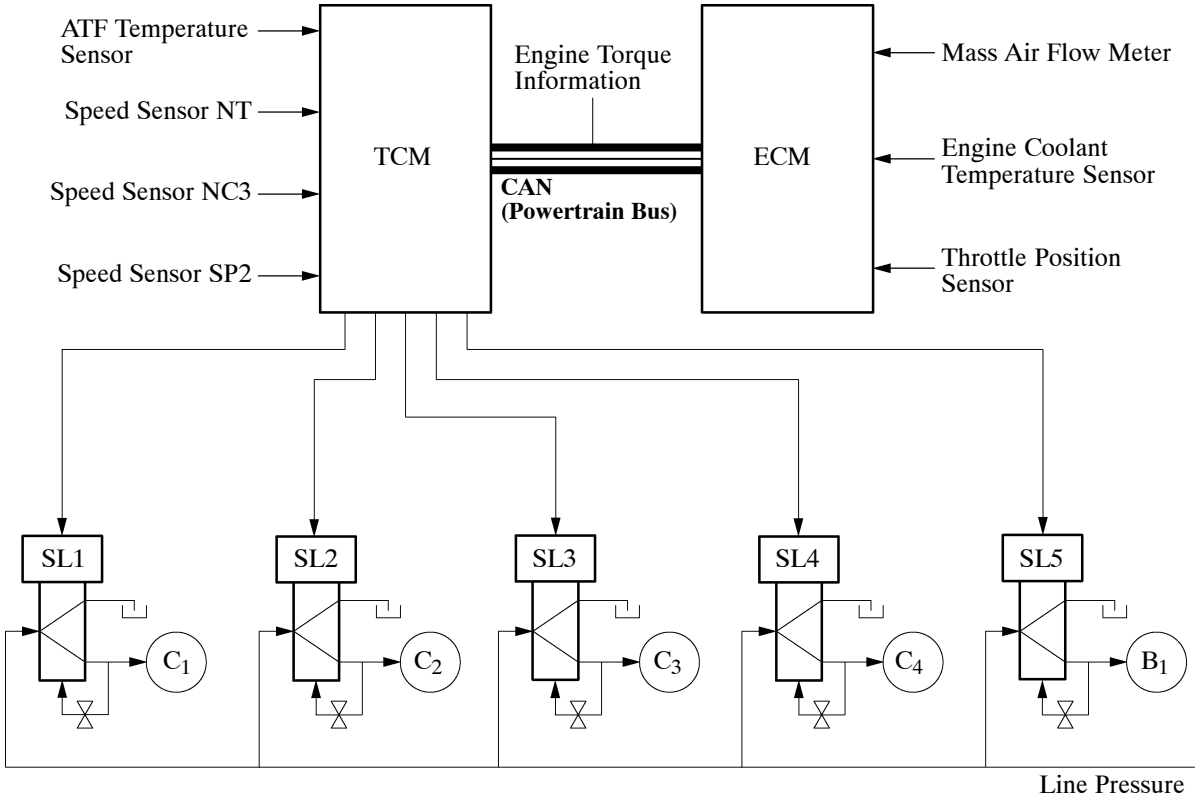
5. Clutch Pressure Control

Clutch to Clutch Pressure Control

- Clutch to clutch pressure control is used for shift control. As a result, shift control in 2nd gear or above is possible without using a one-way clutch, making the automatic transmission lightweight and compact.
- Based on ECM instructions, the TCM controls each clutch and brake accordingly with the optimum fluid pressure and timing in accordance with the information transmitted by the sensors, in order to shift the gears. The TCM does this using fluid pressure circuits which enable the clutches and brakes (C_1, C_2, C_3, C_4 and B_1) to be controlled independently, and high flow SL1, SL2, SL3, SL4 and SL5 shift solenoid valves, which directly control the line pressure. As a result, highly responsive and excellent shift characteristics have been realized.



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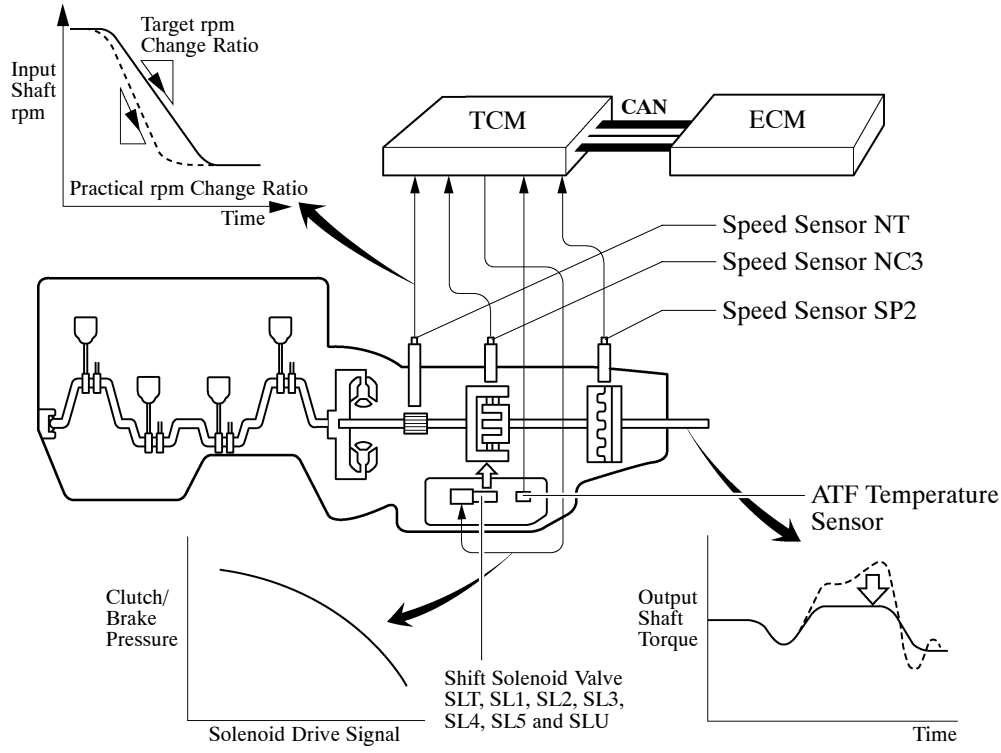
Clutch Pressure Optimal Control

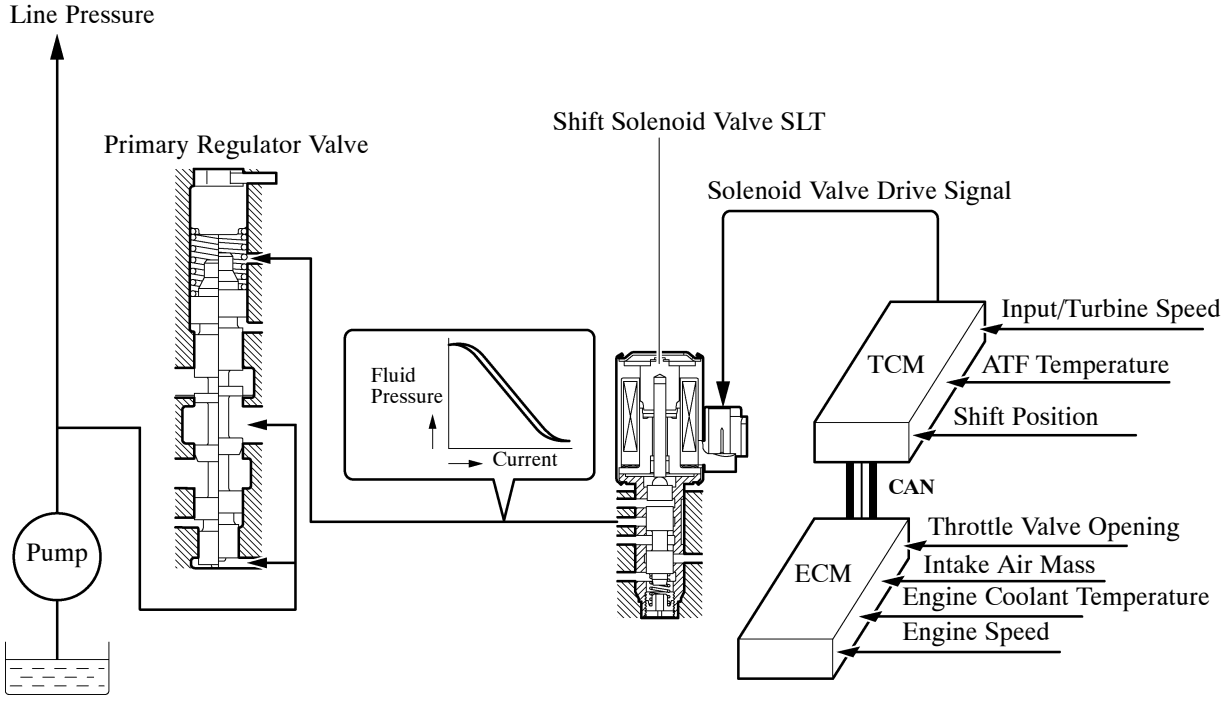
The TCM monitors the signals from various types of sensors, such as the speed sensor NT and speed sensor NC3, allowing shift solenoid valves SLT, SL1, SL2, SL3, SL4, SL5 and SLU to minutely control the clutch pressure in accordance with engine output and driving conditions. As a result, smooth shift characteristics have been realized.



08D0CH68C

6. Line Pressure Optimal Control

Through the use of the shift solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transmission.
Accordingly, the line pressure can be controlled minutely in accordance with the engine output, traveling condition, and the ATF temperature, thus realizing smooth shift characteristics and optimizing the workload of the oil pump (reducing unnecessary parasitic losses).



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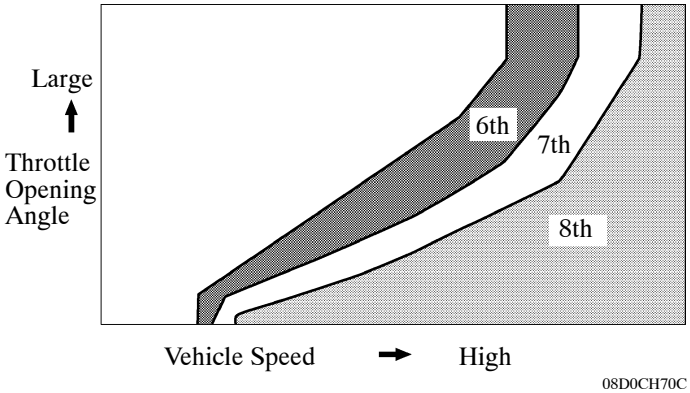
7. Lock-up Timing Control

The TCM uses lock-up timing control in order to improve the fuel consumption performance in 6th gear or higher when the shift lever is in D, or when D8, D7 or D6 range has been selected.

▶ Lock-up Operating Range ◀



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▶ Lock-up Operation Gears in Each Range ◀

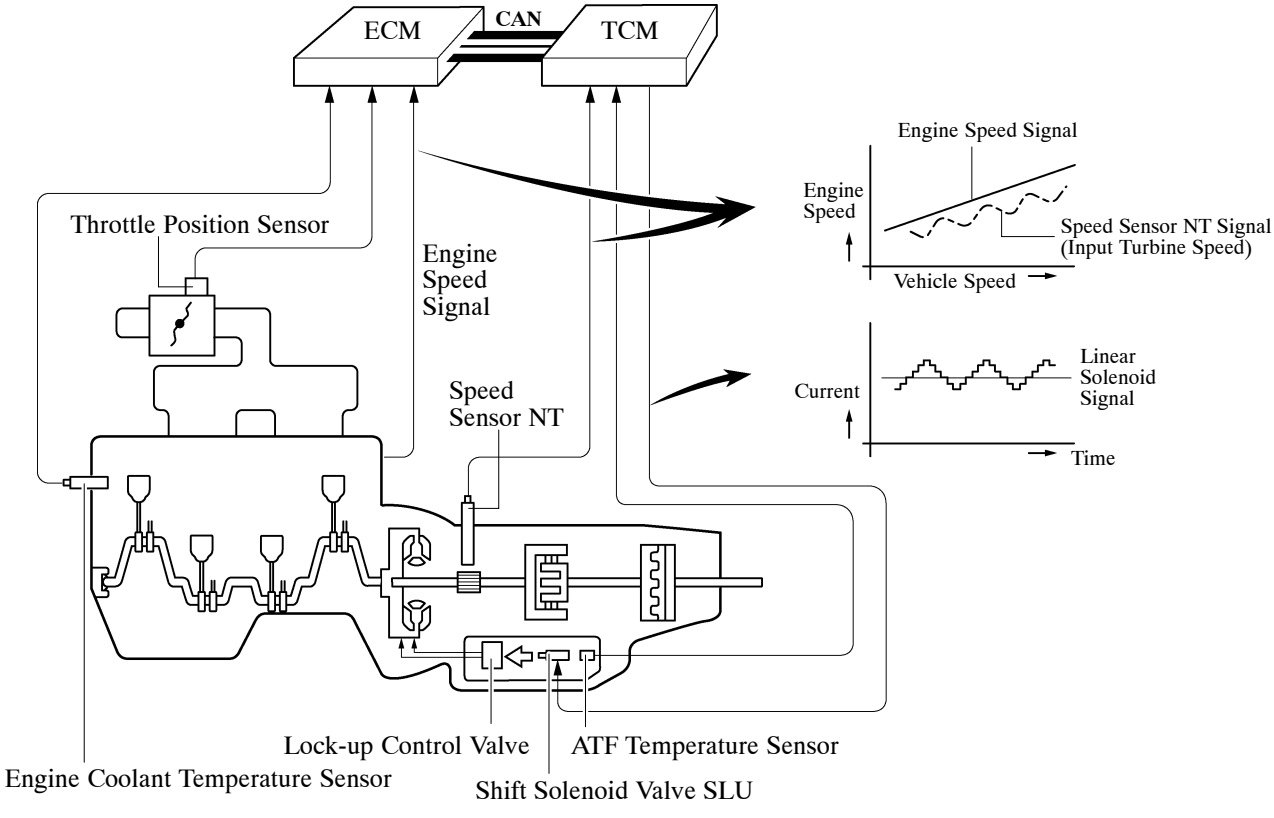
Position or Range / Gear	D, D8	D7	D6
1st	×	×	×
2nd	×	×	×
3rd	×	×	×
4th	×	×	×
5th	×	×	×
6th	○	○	○
7th	○	○	—
8th	○	—	—

○: Available ×: Not available —: Not applicable

8. Flex Lock-up Clutch Control

In addition to the conventional lock-up timing control, flex lock-up clutch control is used.
In the low-to-mid-speed range, this flex lock-up clutch control regulates the shift solenoid valve SLU to provide an intermediate mode between the ON/OFF operation of the lock-up clutch in order to improve the energy transmitting efficiency in this range.
As a result, the operating range of the lock-up clutch has been increased and fuel economy has been improved.

- During acceleration, flex lock-up clutch control operates in 4th gear or higher when the shift lever is in D, or when D8, D7, D6, D5 or D4 range has been selected.
- During deceleration, flex lock-up clutch control operates in 5th gear or higher when the shift lever is in D, or when D8, D7, D6, or D5 range has been selected.
- Even when the vehicle is decelerating (the accelerator pedal is released), flex lock-up clutch control operates. Therefore, the fuel-cut area of the engine has been expanded and fuel-economy has been improved.



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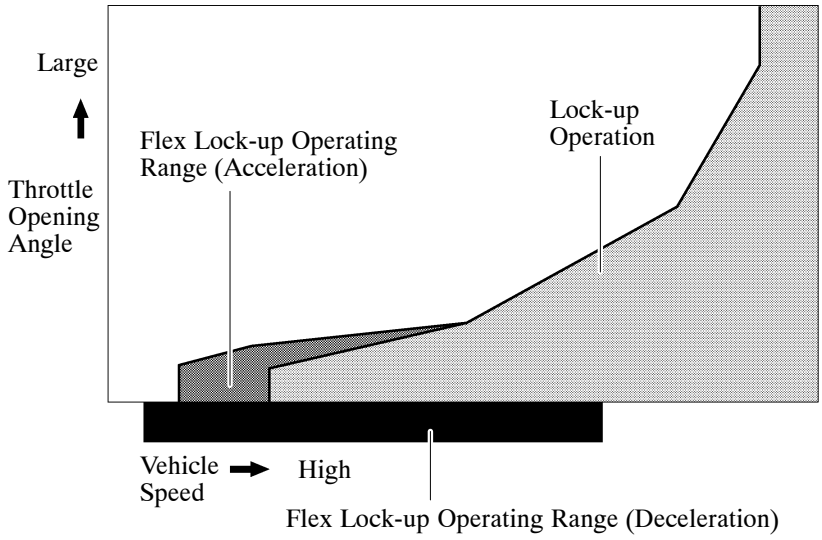
▶ Flex Lock-up Operating Range ◀



08D0CH72C

▶ Flex Lock-up Operation ◀

Position or Range / Gear	D, D8	D7	D6	D5	D4
1st	×	×	×	×	×
2nd	×	×	×	×	×
3rd	×	×	×	×	×
4th	○	○	○	○	○
5th	○*	○*	○*	○*	—
6th	○*	○*	○*	—	—
7th	○*	○*	—	—	—
8th	○*	—	—	—	—

○: Operates ×: Does not operate —: Not applicable
*: Flex lock-up clutch control also operates during deceleration

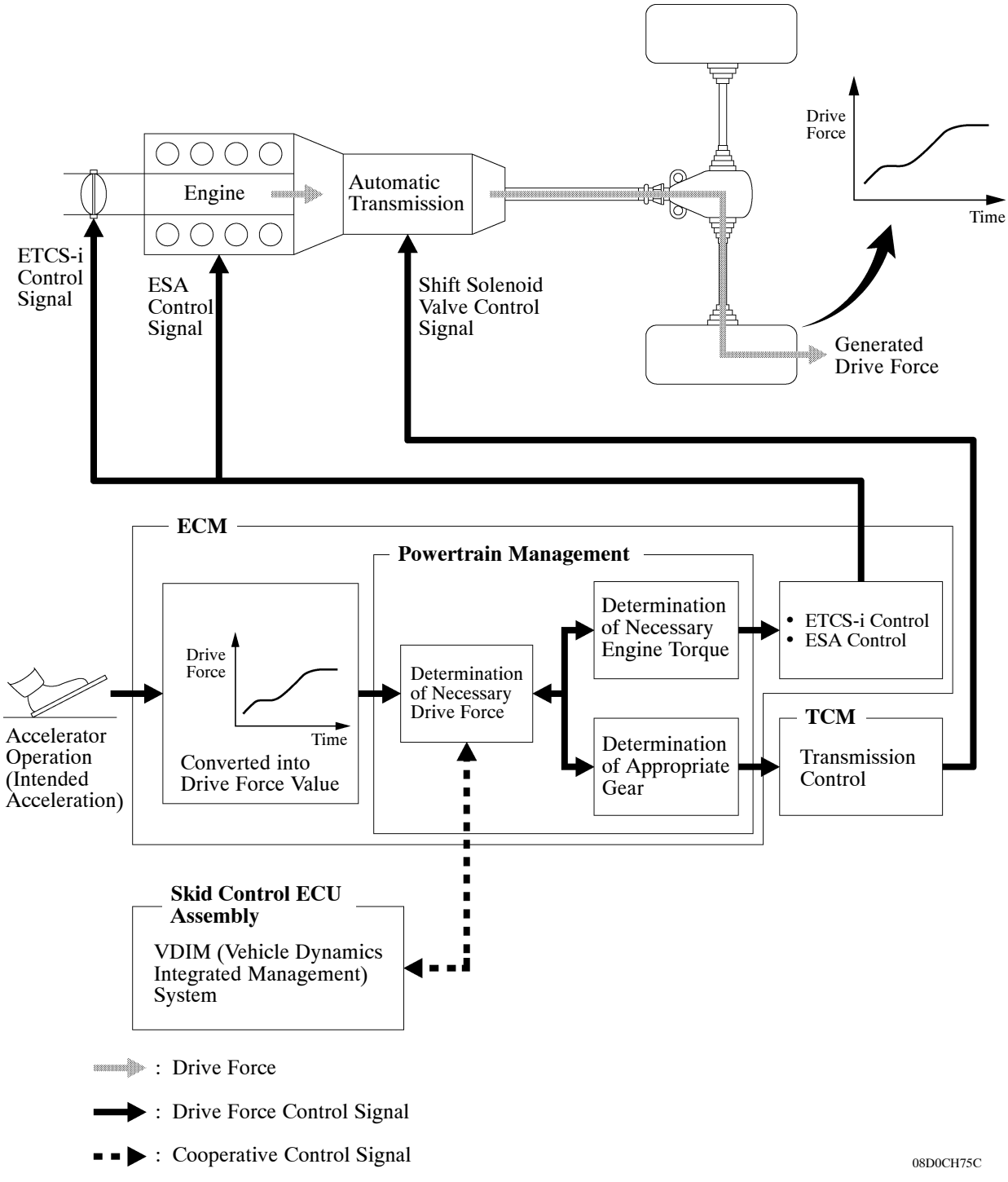
CH

9. Powertrain Integrated Control

General

DRAMS (Driving Response and Acceleration Management System) is adopted for this vehicle. This system integrally controls the engine, transmission and other driving related controls. By integrally controlling the engine and automatic transmission using this system, quick response and a high quality driving feel in accordance with the driver's intentions is achieved, such as when accelerating or decelerating or during gear shifts.

▶ DRAMS System Diagram ◀



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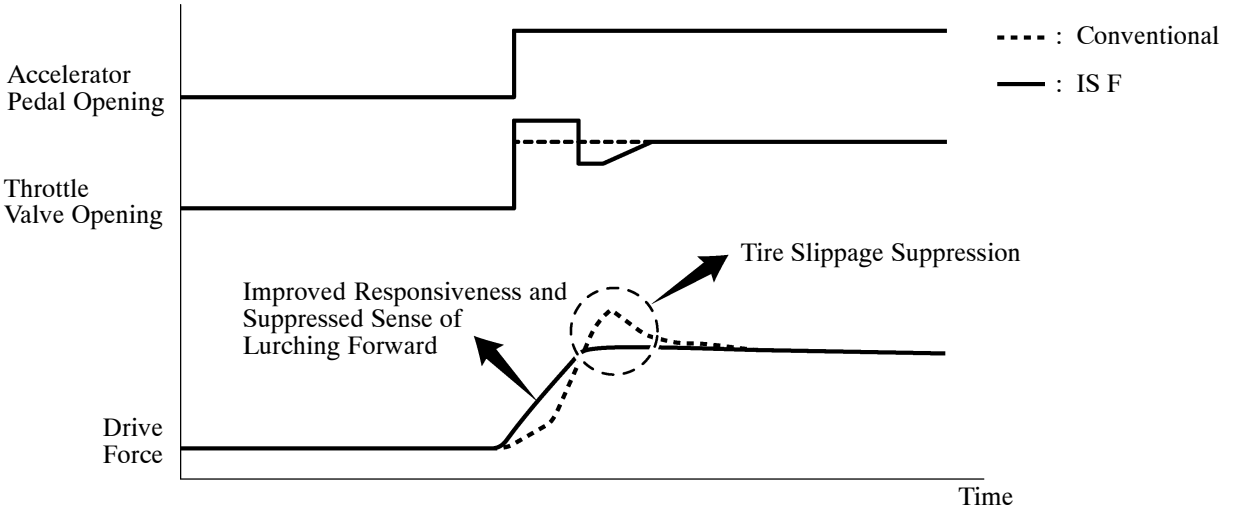
Throttle Control at Launch

The engine output is optimally controlled with ETCS-i (Electronic Throttle Control System-intelligent) in real-time according to the transient force from the torque converter when the vehicle is launched. This achieves a “suppressed sense of lurching forward”, “tire slippage suppression” and “improved responsiveness”, ensuring excellent launch performance.



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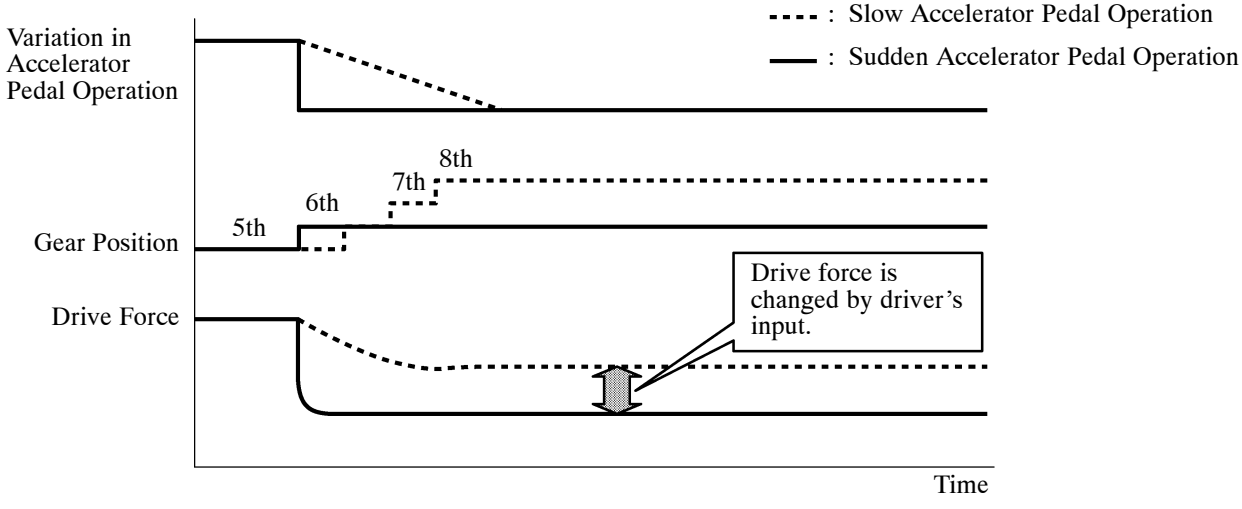
Deceleration Force Control

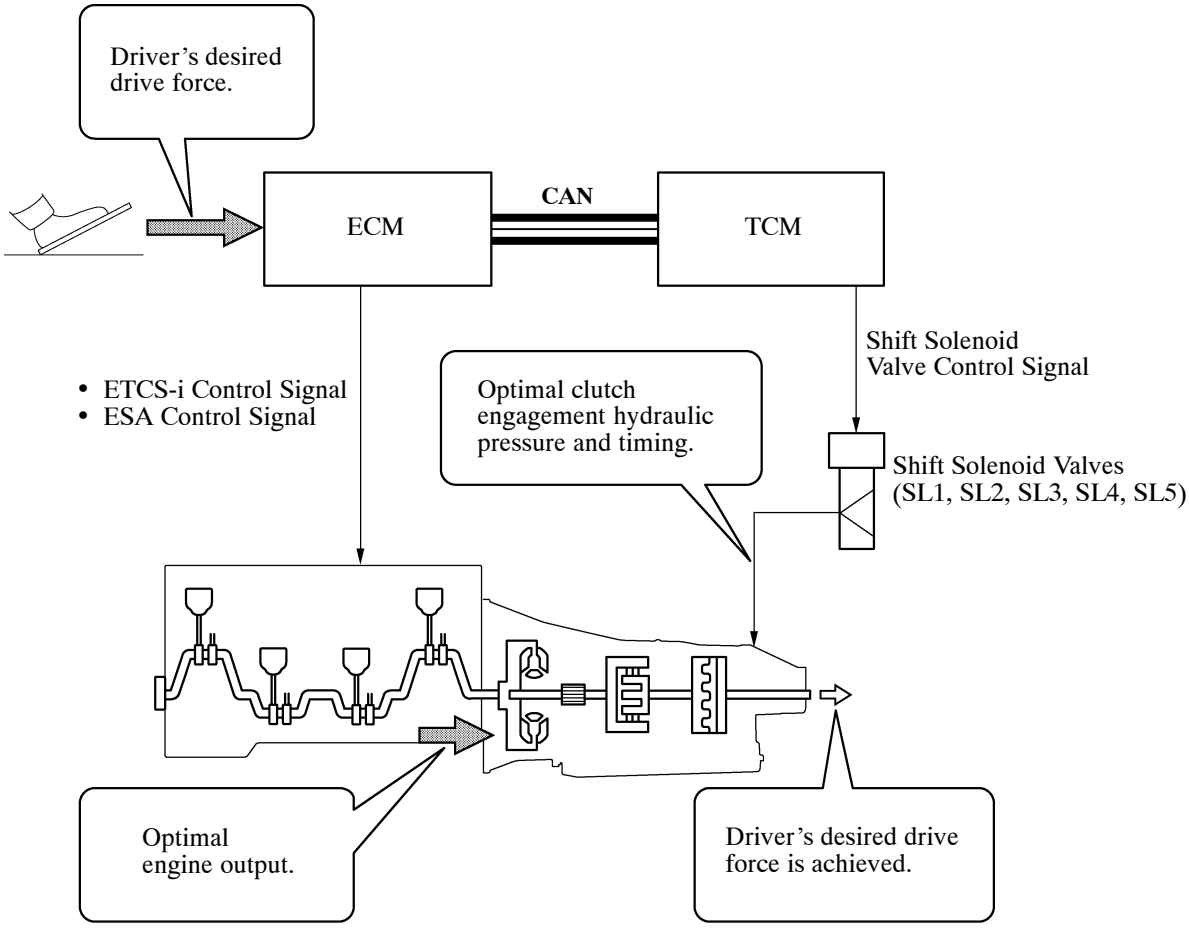
The ECM determines the gear position when the accelerator pedal is OFF (released completely) in accordance with the way the accelerator pedal is released (suddenly or slowly) during deceleration. In this way, unnecessary upshifts and downshifts are prevented when the accelerator pedal is OFF and subsequent smooth acceleration is ensured, matching the driver’s intentions.



08D0CH77C

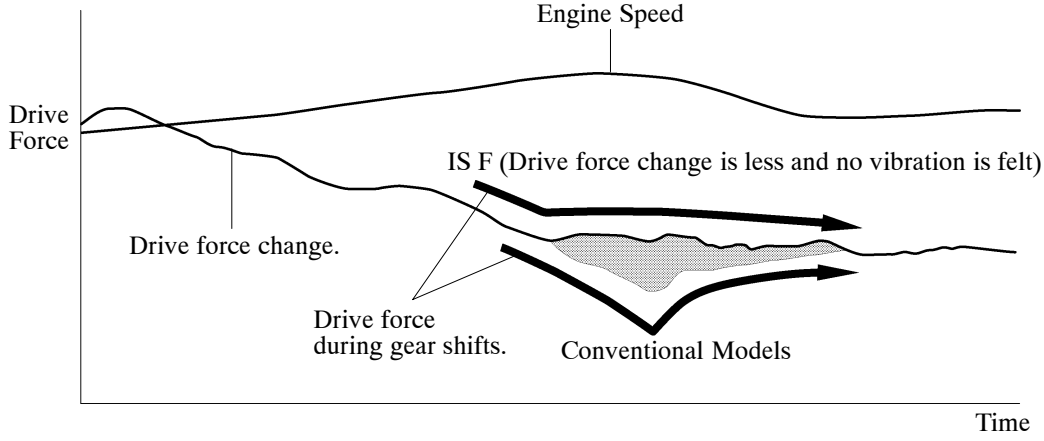
Transient Shifting Control

Through integrated control with ETCS-i (Electronic Throttle Control System-intelligent) and ESA (Electronic Spark Advance), and electronic control of the engagement and release speed of clutch and brake hydraulic pressures, excellent response and shift shock reduction have been achieved.



08D0CH78C

- Engine torque control used during gear shifts has been newly added to the cooperative control of the engine torque control and clutch hydraulic pressure control performed during gear shifts. This enhances gear engagement characteristics during gear shifts and achieves smooth gear changes.

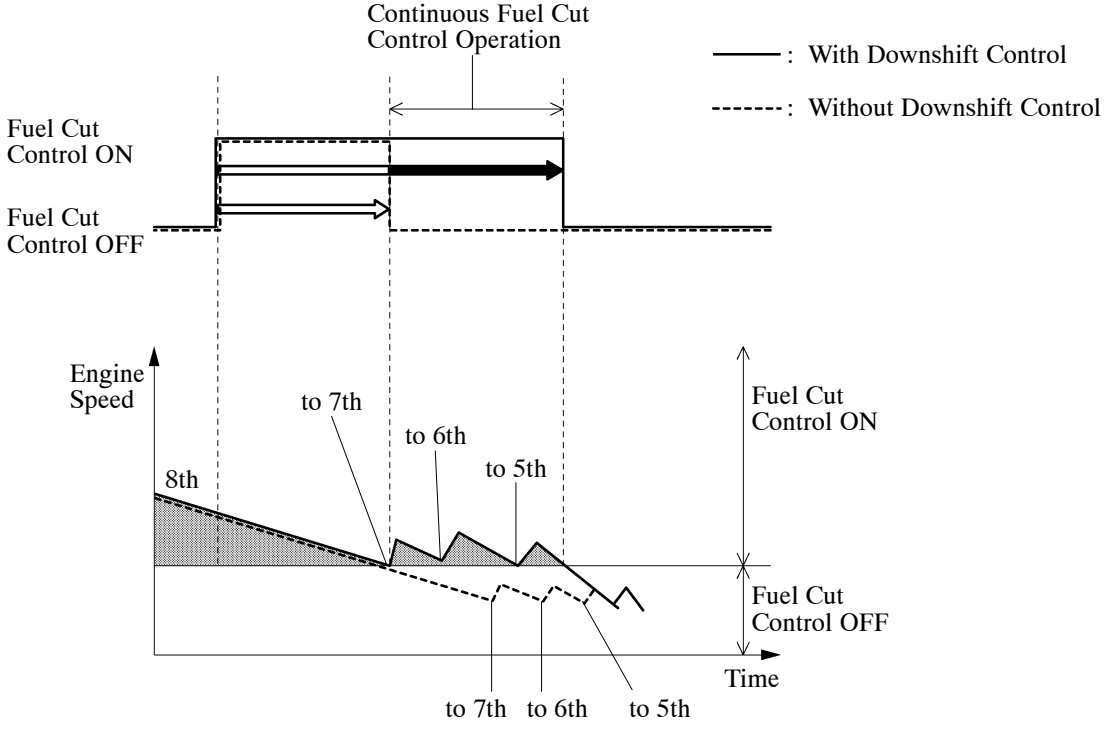


08D0CH79C

10. Coast Downshift Control

As a result of coast downshift control, downshifts are performed to maintain sufficient engine speed to avoid ending fuel cut control. Thus, fuel cut time is extended and fuel economy is achieved.

- In this control, when slowing with the transmission in 8th gear, the transmission downshifts from 8th to 7th, 7th to 6th and then 6th to 5th before fuel cut control ends, so that fuel cut control can continue operating. In addition, the TCM performs downshifts when the vehicle is decelerated from both 6th and 7th gears.



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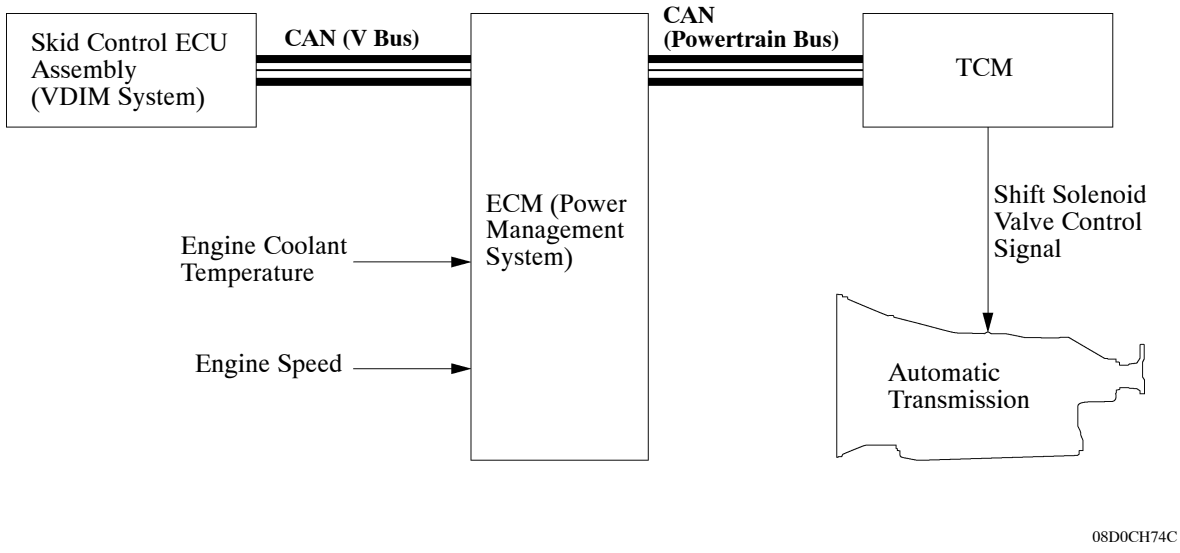
11. 2nd Gear Start-off and Stop Control

When the engine idle speed is high while the engine is warming up and when the road surface is slippery, 2nd gear start-off and stop control for low-friction roads is automatically used in order to enhance control of drive force using the accelerator.

- When the VDIM (Vehicle Dynamics Integrated Management) system determines that the road surface is slippery from information such as an indication of a slipping tire, the power management system selects 2nd gear for starting off and stopping.
- If the VDIM system determines that the vehicle is not on a low-friction road surface, or the engine has finished warming up, 1st gear will once again be used for starting off and stopping as normal.
- When the shift lever is in the M position, 1st gear (M1) would usually be selected for starting off and stopping. However, when this control is performed, 2nd gear (M2) will automatically be selected.

▶ System Diagram ◀



▶ Examples of Control (Only when engine is warming up) ◀

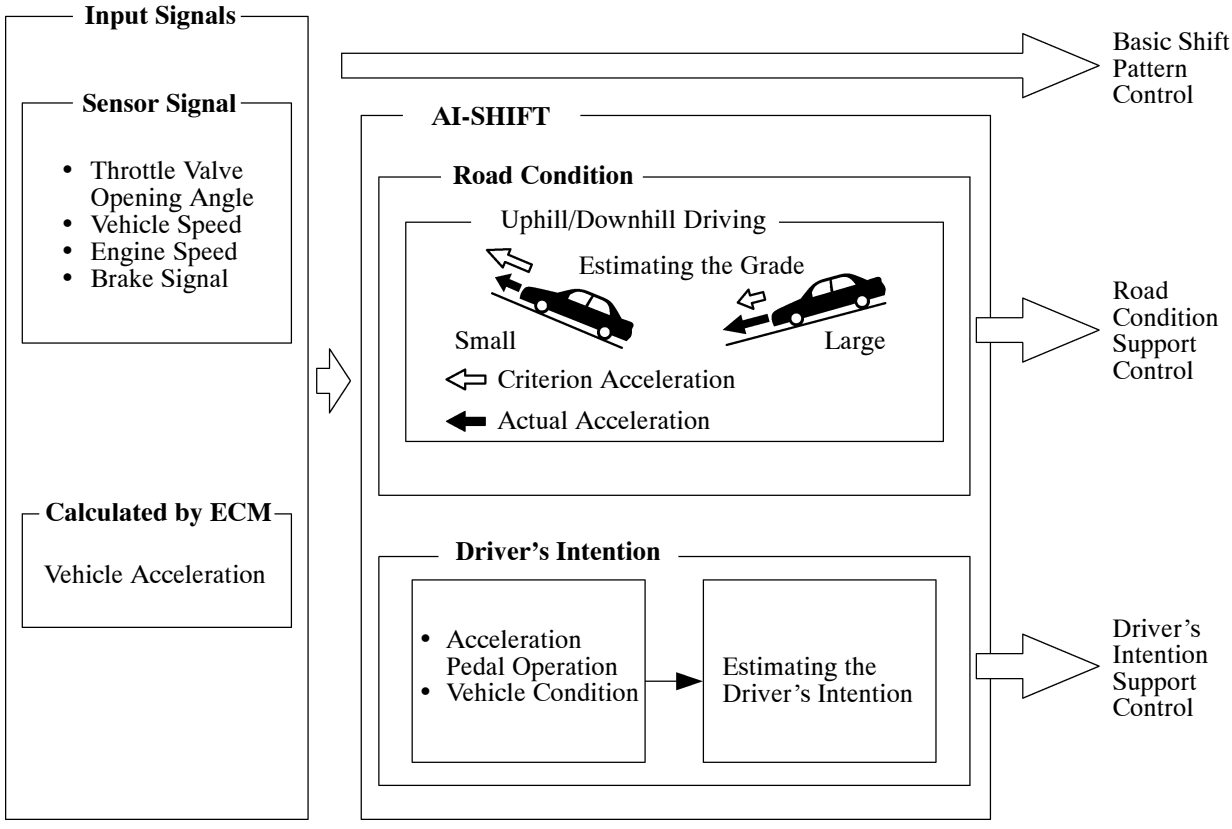
TRC operates when the vehicle starts off.	If TRC operates when the vehicle starts off in 1st gear, the gear will be changed to 2nd immediately to reduce driving force transmitted to the tires.
ABS operates before the vehicle stops.	If ABS operates before the vehicle stops, the transmission only shifts down to 2nd gear. Even after the vehicle stops, 2nd gear is maintained. In this case, 2nd gear will be used when the vehicle starts off.

12. AI-SHIFT Control

General

AI (Artificial Intelligence)-SHIFT control is adopted to automatically change the shift pattern based on road conditions and the driver's intentions. AI-SHIFT control, in addition to SPORT, Normal and SNOW mode selection carried out by the driver, enables comfortable driving to be achieved.

- The AI-SHIFT control includes a road condition support control and a driver's intention support control.
- The AI-SHIFT control determines optimal transmission control based on input signals and automatically changes the shift pattern.
- AI-SHIFT control is effect only with the shift lever in the D position, based on the accelerator and brake operation data. AI-SHIFT control will be canceled when the driver selects the M position.



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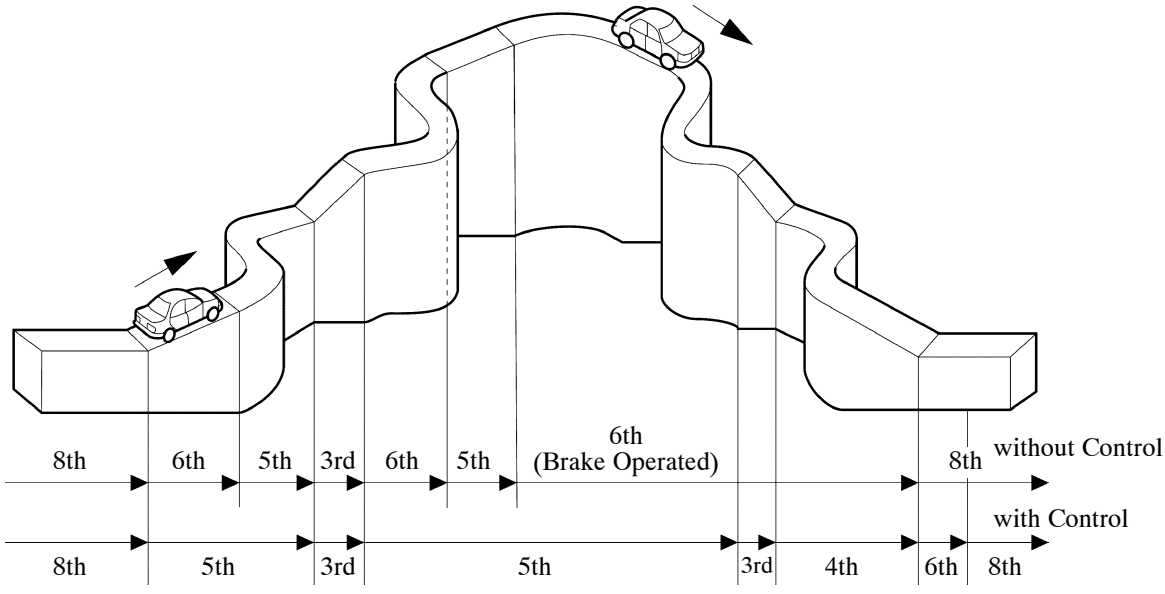
Road Condition Support Control

Under road condition support control, the ECM identifies the throttle valve opening angle and the vehicle speed to determine whether the vehicle is traveling uphill or downhill, and indicates the optimal gear to the TCM.

- To achieve the optimal drive force while driving uphill, this control prevents the transmission from upshifting to 6th or 7th or 8th gear.
- To achieve the optimal engine brake effect while driving downhill, this control automatically downshifts the transmission to 5th or 4th or 3rd gear.



040SC13C

Driver's Intention Support Control

This control estimates the driver's intention based on the accelerator operation and vehicle condition and selects a shift pattern that is well-suited to each driver.

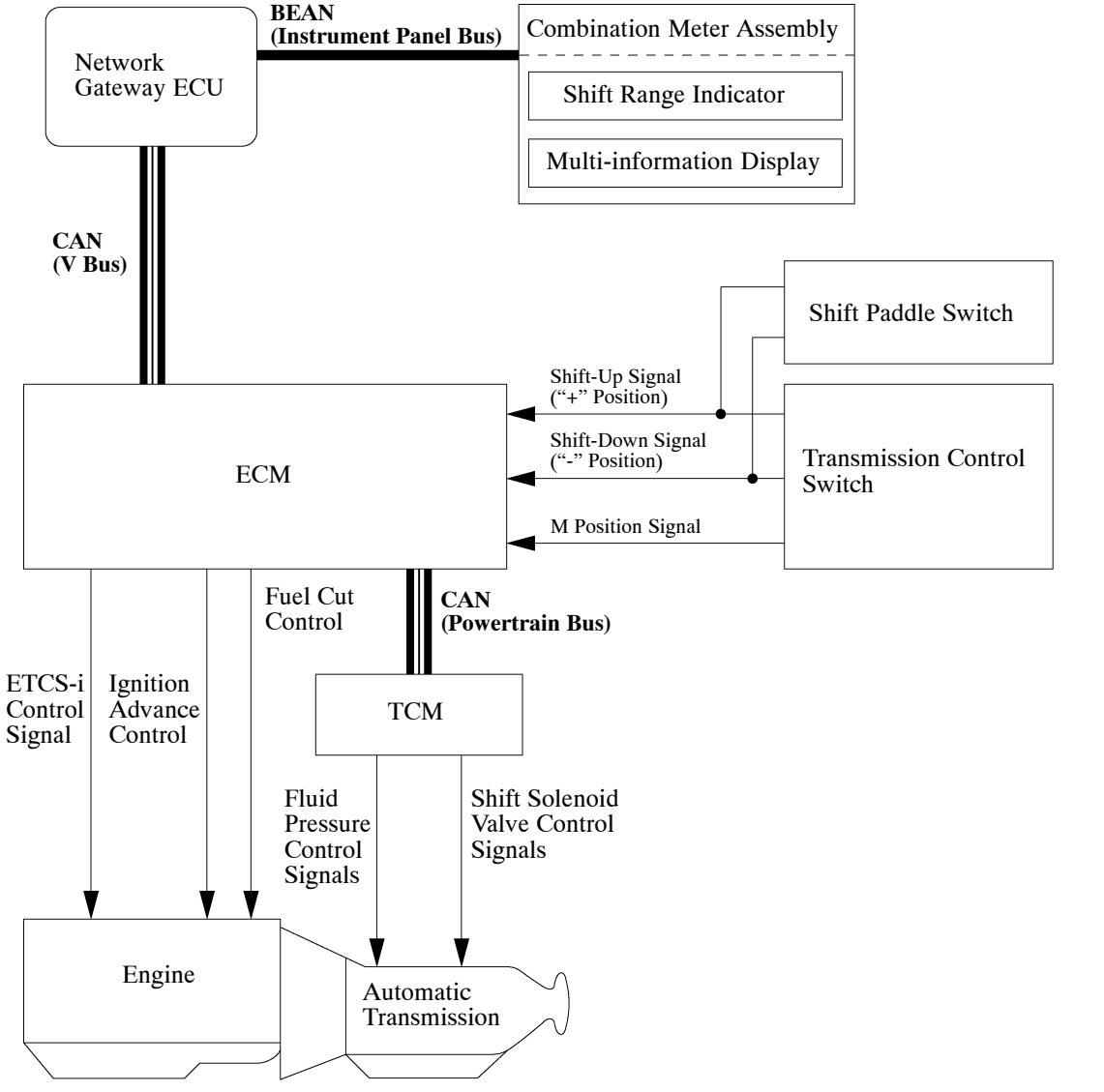
13. Multi-mode Transmission

General

By moving the shift lever to the front ("+"position) or to the rear ("-"position), the driver can select the desired gear (only M position). Also, shift paddle switches are adopted, which enable changing the shift ranges or gears while the driver is holding the steering wheel. Thus, the driver is able to shift gears with a manual-like feel.

- When the shift lever is moved to the M position, automatic shift mode changes to 8-speed sport direct shift control, enabling the driver to drive the vehicle in a gear selected using the shift lever or shift paddle switches "+" (UP) or "-" (DOWN).
  When the shift lever is in the D position, operating the shift paddle switch "-" (DOWN) enables D position (fixed range mode), allowing the driver to drive the vehicle in a desired gear range using the "+" (UP) or "-" (DOWN) shift paddle switches.

▶ System Diagram ◀



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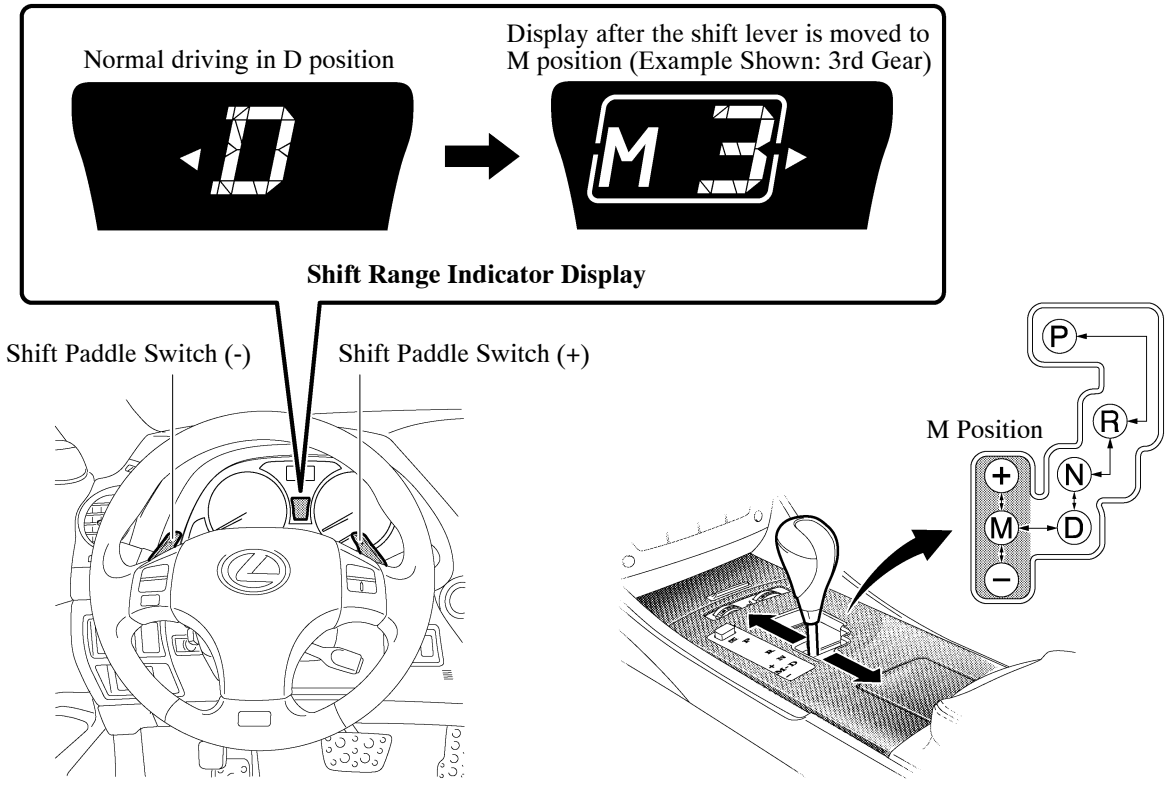
Selection of 8-speed Sport Direct Shift Control

When the shift lever is moved from the D position to the M position, 8-speed sport direct shift control is activated and gear hold type sequential shift mode is entered. At this time, the shift range indicator "M" illuminates to inform the driver that 8-speed sport direct shift control has been activated.

- When the shift lever or a shift paddle switch is operated "+" (UP), or "-" (DOWN), an upshift or downshift will be performed from the currently selected gear.
- The default gear when the shift lever is moved from the D position to the M position is the same gear as the gear that was in use while driving in the D position. (No gear shift occurs when the shift lever is moved from the D position to the M position.)
- If the shift lever is moved from the D position to the M position during the system check that occurs after the engine switch is turned on (IG) (while the "F" mark is displayed on the multi-information display), this will cause both D position control and the D indication on the shift range indicator to continue. If the shift lever is moved from the D position to the M position after the system check completes, 8-speed sport direct shift control will be performed.



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- To prevent engine overrevving, selection of lower gears using 8-speed sports direct shift control will not be permitted until the appropriate speed specified in the following table has been reached.

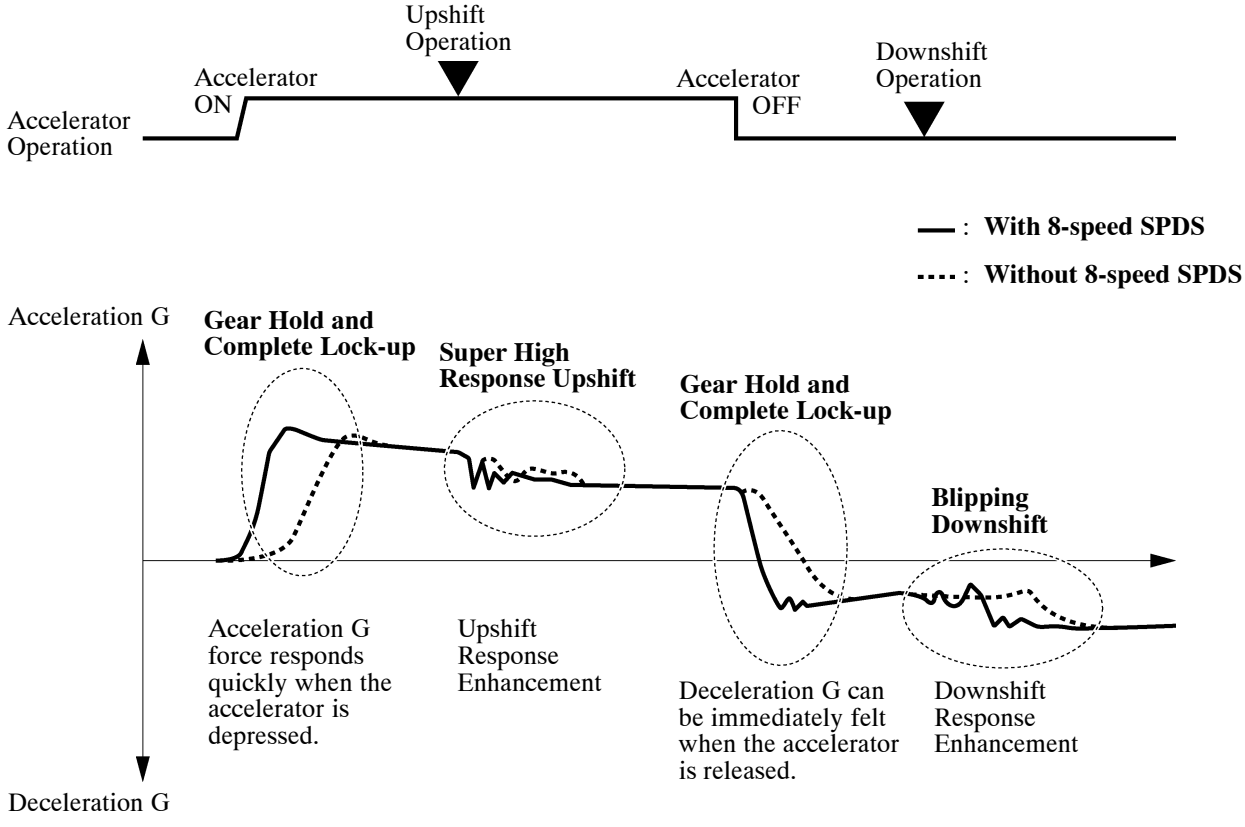
Downshift Permission Speed: km/h					
M2→M1	M3→M2	M4→M3	M5→M4	M6→M5	M7→M6
38 to 57	102 to 130	147 to 165	185 to 194	220 to 230	255 to 265

- When downshifting is attempted while driving at a vehicle speed at which downshifting is impossible, the buzzer sounds twice as a warning and the downshift is prohibited.

8-speed Sport Direct Shift Control

1) General

- When the shift lever is moved to the M position, 8-speed SPDS (Sports Direct Shift) control is enabled, placing an emphasis on shift response and feel, as well as maintaining a direct feel when the accelerator is operated.
- To produce a direct feeling in response to accelerator and gear shift operation, gear hold control, complete lock-up control, super high response upshift control, and blipping downshift control are adopted.



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2) Gear Hold Control

In M position, it is possible to make use of the highest engine speeds by holding the vehicle in a gear. Gear hold control means that gear shifts will not be performed as long as the paddle switches or shift lever are not operated in either the"+" (UP), or "-" (DOWN) direction.

- If the vehicle speed drops below any of the designated points shown in the following table, a downshift will be performed from the current gear. When the temperature of the ATF or engine coolant is low, shifts will be performed based on the shift points for low fluid temperature.

▶ Vehicle speed for each automatic downshift in the M position ◀

Vehicle Speed for Each Automatic Downshift: km/h						
M2→M1	M3→M2	M4→M3	M5→M4	M6→M5	M7→M5	M8→M7
10 to 15	15 to 20	35 to 41	42 to 48	53 to 59	56 to 62	67 to 74

- When the vehicle comes to a stop, 1st gear (M1) will be automatically selected.

3) Complete Lock-up Control

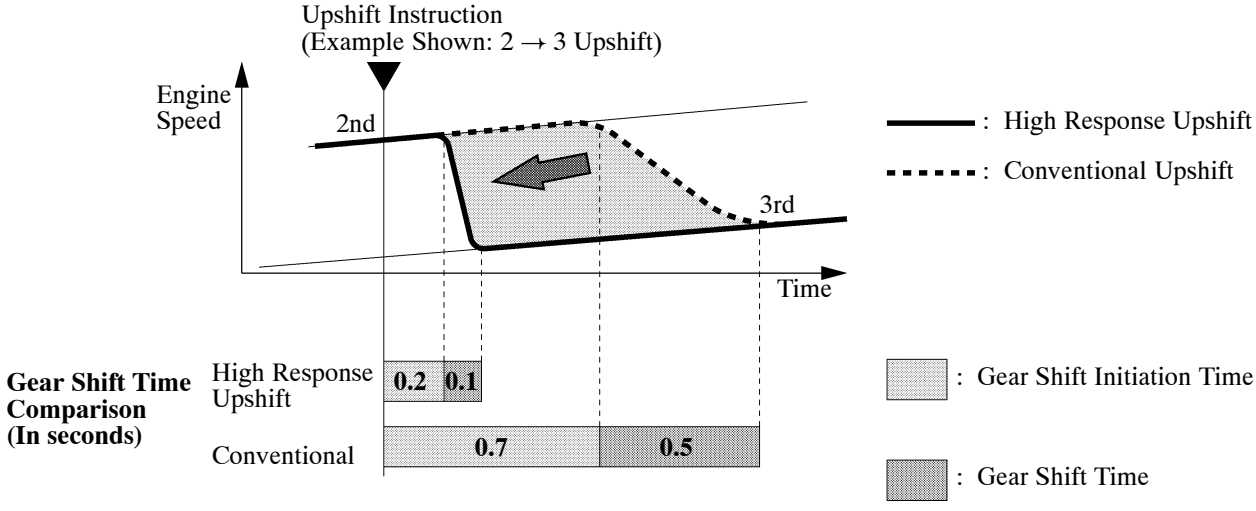
Complete lock-up control is used during both acceleration and deceleration when in 2nd gear and higher, without using the torque converter function. This enables changes in engine output to be transmitted directly to the transmission just as would occur with a manual transmission. However, even for 2nd gear and higher, if engine speed is too low to allow lock-up, the torque converter function will be used.

- For 1st gear, to make use of the torque increasing action of the torque converter, lock-up is not operated.

4) Super High Response Upshift Control

For 8-speed sports direct shift, the based on ECM instruction, the TCM uses clutch to clutch pressure control to directly control transmission clutch pressures and achieve high response gearshifts. In addition, the ECM manages the powertrain (engine and transmission) in an integrated manner.

- When an upshift instruction is received, the TCM uses clutch to clutch pressure control to perform quick and precise control over engagement and disengagement of clutches. At the same time, the ECM sends instructions to manage the powertrain, finely controlling the engine torque and engine speed during a gear change. Through these rapidly performed cooperative controls, a quick gearshift speed is achieved, with a 0.2-second period for shift initiation and a 0.1-second gear shift.
- Engine torque moderation for gear changes is finely controlled by the ECM so that the ETCS-i (Electronic Throttle Control System-intelligent), fuel cut and ESA (Electronic Spark Advance) controls are optimized according to the driving conditions.



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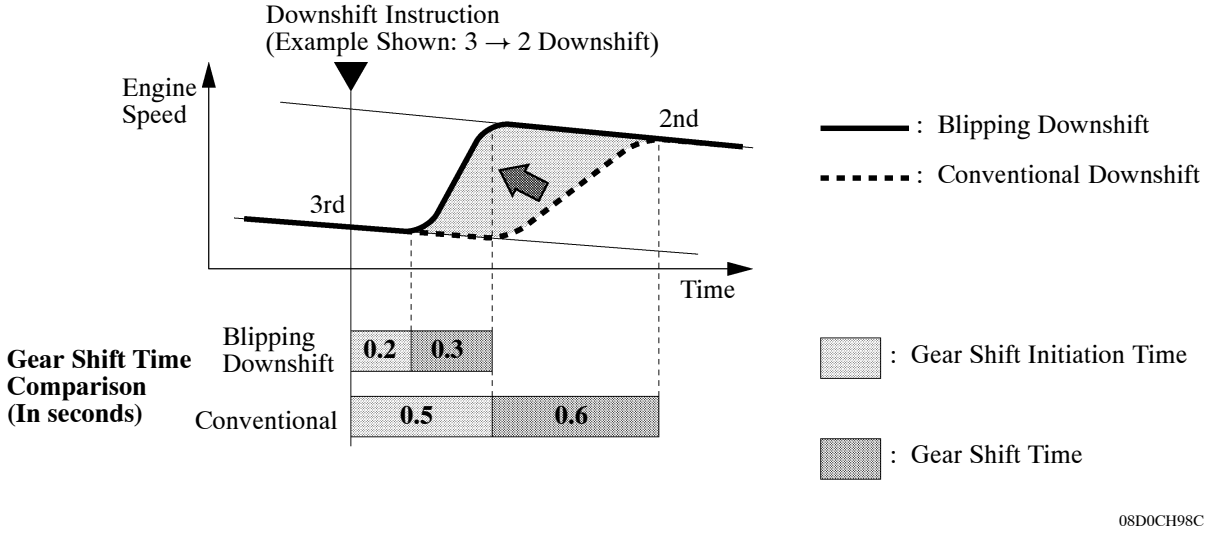
5) Blipping Downshift Control

Using powertrain management which resides in the ECM, similar to the controls for the super high response upshifts, the TCM and ECM perform downshifts and quick blipping of the throttle.

- When a downshift instruction is received, based on ECM instructions, the TCM uses clutch to clutch pressure control to quickly disengage the currently engaged clutch to produce neutral. Next, the ECM uses ETCS-i to quickly open the electronic throttle and instantaneously increases engine speed (blipping) to achieve the engine speed needed to match speeds for the gear change. At the same time, the TCM uses clutch to clutch pressure control to complete the gear change by smoothly and quickly engaging the clutch to be engaged.

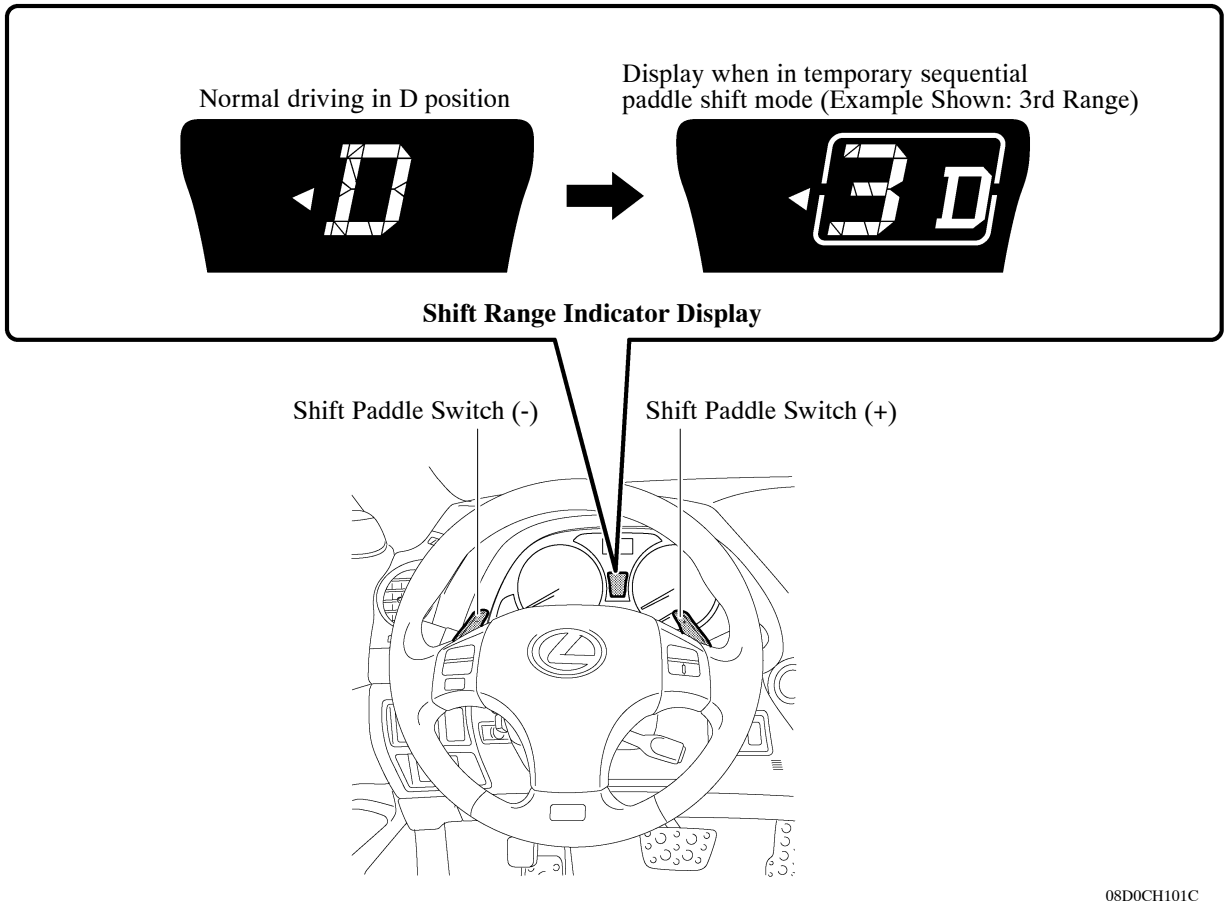


D Position (Fixed Range Mode)

1) General

When the shift lever is in the D position, operating the "-" side shift paddle switch will enter fixed range mode which restricts the highest gear. By operating the shift paddle switches "+" (UP) or "-" (DOWN), the shift range can be changed. At this time, the shift range indicator in the combination meter changes to inform the driver that the D position (fixed range mode) has been entered.

- If the vehicle is stopped, driving at a constant speed, or accelerating for more than a specified period of time, the vehicle will change back to normal D position operation. Alternately, if the "+" side paddle switch is operated for one second or more, normal D position operation will resume.



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2) Initial Selection of a Shift Range

The driver selects D position (fixed range mode) by operating the "-" side shift paddle switch. When this mode is entered, the vehicle selects a gear range. The default gear range selected is based on vehicle speed and the gear that was in use prior to selecting this mode. In the following two tables, based on the gear in use and vehicle speed, there may be two different possible default gear ranges. The range that will be selected is the lower of the two.

▶ Table 1 ◀

Vehicle Speed: km/h	Default Gear Range
Below 58 to 65	D4
58 to 65 or more ~ Below 83 to 90	D5
83 to 90 or more ~ Below 194 to 202	D6
194 to 202 or more	D7

▶ Table 2 ◀

Operation	Operating the "-" side shift paddle switch while driving in D position							
Gear in use when Driving in D position	1st	2nd	3rd	4th	5th	6th	7th	8th
Default Gear Range	D1	D1	D2	D3	D4	D5	D6	D7

3) Usable Gears

Under this control, the TCM performs optimal shift control within the usable gear range that the driver has selected. As with an ordinary automatic transmission, it shifts to the 1st gear when the vehicle is stopped.

Shift Range	Shift Range Indicator Indication	Usable Gear
D8	8 D	8th ↔ 7th ↔ 6th ↔ 5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st
D7	7 D	7th ↔ 6th ↔ 5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st
D6	6 D	6th ↔ 5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st
D5	5 D	5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st
D4	4 D	4th ↔ 3rd ↔ 2nd ↔ 1st
D3	3 D	3rd ↔ 2nd ↔ 1st
D2	2 D	2nd ↔ 1st
D1	1 D	1st

4) Selection of a Lower Shift Range

When the vehicle is operating in a shift range using this control, and the "-" shift paddle switch is operated, the TCM determines the shift range to be selected in accordance with the shift range and gear positions in use before the shift paddle switch is operated.

Gear position before shift paddle switch operation	Range in use before shift paddle switch operation							
	D8 Range	D7 Range	D6 Range	D5 Range	D4 Range	D3 Range	D2 Range	D1 Range
8th	D7 Range*1	—	—	—	—	—	—	—
7th	D6 Range*1	D6 Range*1	—	—	—	—	—	—
6th	D5 Range*1	D5 Range*1	D5 Range*1	—	—	—	—	—
5th	D4 Range*1	D4 Range*1	D4 Range*1	D4 Range*1	—	—	—	—
4th	D4 Range*2	D4 Range*2	D4 Range*2	D4 Range*2	D3 Range*3	—	—	—
3rd						D2 Range*3	—	—
2nd							D1 Range*3	—
1st								D1 Range

*1: The gear and shift range are downshifted by one step from the gear and shift range in use before the shift paddle switch is operated.
*2: D4 range is selected (no downshift will occur).
*3: The range selected is one lower than the range in use before the shift paddle switch is operated.

5) Speeds for Selection of a Lower Shift Range

- To prevent engine overrevving, selection of lower speed ranges using D position (fixed range mode) will not be permitted until the appropriate speed specified in the following table has been reached.

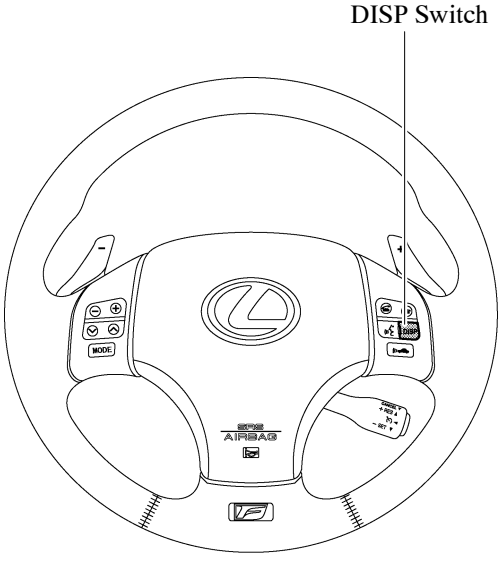
▶ Lowest Shift Range Permitted when "-" Paddle Operated ◀

Shift Range	D1	D2	D3	D4	D5	D6
Vehicle Speed: km/h	38 to 44	71 to 78	133 to 140	171 to 180	205 to 214	255 to 265

- When downshifting is attempted while driving at a vehicle speed at which downshifting is impossible, the buzzer sounds twice as a warning and the downshift is prohibited.

Gear Position Indicator

- The gear position indicator is added to the menus of the multi-information display.
- The gear position indicator can be displayed by operating the DISP switch on the steering wheel.
- The gear position indicator indicates the usable gears in the current shift range by using "·", and the current gear position with the numerical number. Accordingly, both the shift range and the current gear position are clearly indicated to contribute to a sporty driving in the D position (fixed range mode). During 8-speed sport direct shift control (M position), the "F" mark is displayed on the multi-information display.



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Third gear is in use and the shift lever is in D or the D8 range is selected.

First gear is in use and the D2 range is selected.

Display during 8-speed sport direct shift control (M position).

The shift lever is in a position other than D or M.

Gear position indicator display examples

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14. Diagnosis

- When the TCM detects a malfunction, the TCM records the malfunction and memorizes the information related to the fault. Furthermore, the TCM illuminates or blinks the check engine warning light in the combination meter assembly to inform the driver.
- The ECM will also store the DTC (Diagnostic Trouble Code) of the malfunctions. The DTC stored in the TCM are output to the intelligent tester connected to the DLC3 via the ECM.
- For details, see the LEXUS IS F Repair Manual (Pub. No. RM08E0E).

Service Tip

- The TCM uses the CAN protocol for diagnostic communication. Therefore, the intelligent tester is required for accessing diagnostic data. For details, see the LEXUS IS F Repair Manual (Pub. No. RM08E0E).
- To clear a DTC that is stored in the TCM, use the intelligent tester, disconnect the battery terminal or remove the EFI fuse for 1 minute or longer.

15. Fail-safe

The fail-safe functions minimize the loss of operability when an abnormality occurs in the following parts.

▶ Fail-safe Control List ◀

Malfunction Part	Function
Speed Sensor NT	• Shifting to 2nd and 8th is prohibited. • Lock-up clutch control is prohibited. • AI-SHIFT control is prohibited.
Speed Sensor NC3	• Lock-up clutch control is prohibited. • AI-SHIFT control is prohibited.
Speed Sensor SP2	• Shifting to 2nd and 8th is prohibited. • Lock-up clutch control is prohibited. • AI-SHIFT control is prohibited.
ATF Temperature Sensor	• Shifting between 1st to 5th gears is allowed. • Lock-up clutch control is prohibited. • AI-SHIFT control is prohibited.
ATF Pressure Switch	Performs the same control as when there is a shift solenoid valve SL1 ON malfunction.
TCM Power Supply (voltage is low)	• If the vehicle is being driven in 1st to 7th gears, the transmission is fixed in 7th gear. • If the vehicle is being driven in the 8th gear, the transmission is fixed in 8th gear.
CAN Communication	• Shifting to only either 1st or 3rd gears is allowed. • Lock-up clutch control is prohibited.
Knock Control Sensor	• If the vehicle is being driven in 1st to 5th gears, upshifting to 6th or higher is prohibited. • If the vehicle is driven in 6th gear or higher, upshifting to any gear higher than that being used when a malfunction is detected is prohibited. • Lock-up clutch control is prohibited.
Shift Solenoid Valve SL1, SL2, SL3, SL4, SL5 and SR	• When a shift solenoid valve listed at left fails, the current to the failed solenoid valve is cut off. • Shift control is changed to a fail-safe mode to shift gears using the normal solenoid valves to allow continued driving. • Shift controls in fail-safe mode are described in the table on the next page. For details, see the LEXUS IS F Repair Manual (Pub. No. RM08E0E).

▶ Shift Solenoid Valve Normal Operation Chart ◀

Gear Position	1st	2nd	3rd	4th	5th	6th	7th	8th
Shift Solenoid Valve SL1	ON	ON	ON	ON	ON	OFF	OFF	OFF
Shift Solenoid Valve SL2	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Shift Solenoid Valve SL3	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
Shift Solenoid Valve SL4	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
Shift Solenoid Valve SL5	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON

▶ Fail-safe Control Chart ◀

Gear Position in Normal Operation		1st	2nd	3rd	4th	5th	6th	7th	8th
SL1	ON Malfunction (Without Fail-safe Control)	1st	2nd	3rd	4th	5th	6th	7th	8th
	Fail-safe Control during ON Malfunction	1st	2nd	3rd	4th	5th	5th	5th	5th
	OFF Malfunction (Without Fail-safe Control)	N	N	N	N	N	6th	7th	8th
	Fail-safe Control during OFF Malfunction	6th	6th	6th	6th	6th	6th	7th	8th
	Fail-safe Control during OFF Malfunction (From third trip onward)	Fixed in 3rd							
SL2	ON Malfunction (Without Fail-safe Control)	5th	8th	7th	6th	5th	6th	7th	8th
	Fail-safe Control during ON Malfunction	5th	5th	5th	5th	5th	6th	7th	8th
	OFF Malfunction (Without Fail-safe Control)	1st	2nd	3rd	4th	1st	N	N	N
	Fail-safe Control during OFF Malfunction (Until vehicle stops)	Fixed in 7th							
	Fail-safe Control during OFF Malfunction*	1st	2nd	3rd	4th	4th	4th	4th	4th
SL3	ON Malfunction (Without Fail-safe Control)	3rd	3rd	3rd	3rd	7th	7th	7th	7th
	Fail-safe Control during ON Malfunction (This malfunction is detected while driving in 4th or below.)	Fixed in 3rd							
	Fail-safe Control during ON Malfunction (This malfunction is detected while driving in 5th or above.)	Fixed in 7th (If vehicle stops once, then it is fixed in 3rd.)							
	OFF Malfunction (Without Fail-safe Control)	1st	2nd	1st	4th	5th	6th	N	8th
	Fail-safe Control during OFF Malfunction (This malfunction is detected while driving in 7th. However, shifting higher than 7th is prohibited once downshifted to 6th or below.)	1st	2nd	4th	4th	5th	6th	8th	8th
	Fail-safe Control during OFF Malfunction (This malfunction is detected while driving in 6th or below.)	1st	2nd	4th	4th	5th	6th	6th	6th

*: When vehicle is driven after fail-safe detection.

(Continued)

Gear Position in Normal Operation		**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**
SL4	ON Malfunction (Without Fail-safe Control)	4th	4th	3rd	4th	6th	6th	7th	6th
	Fail-safe Control during ON Malfunction (This malfunction is detected while driving in 4th or below.)	Fixed in 3rd							
	Fail-safe Control during ON Malfunction (This malfunction is detected while driving in 5th or above.)	Fixed in 7th (If vehicle stops once, then it is fixed in 3rd.)							
	OFF Malfunction (Without Fail-safe Control)	1st	2nd	3rd	1st	5th	N	7th	8th
	Fail-safe Control during OFF Malfunction (This malfunction is detected while driving in 6th. However, shifting to 4th, 6th, 7th, or 8th is prohibited once downshifted to 5th or below.)	1st	2nd	3rd	5th	5th	7th	7th	7th
	Fail-safe Control during OFF Malfunction (This malfunction is detected while driving in 4th.)	1st	2nd	3rd	5th	5th	5th	5th	5th
SL5	ON Malfunction (Without Fail-safe Control)	2nd	2nd	3rd	4th	8th	6th	7th	8th
	Fail-safe Control during ON Malfunction (This malfunction is detected while driving in 4th or below.)	Fixed in 3rd							
	Fail-safe Control during ON Malfunction (This malfunction is detected while driving in 5th or above.)	Fixed in 7th (If vehicle stops once, then it is fixed in 3rd.)							
	OFF Malfunction (Without Fail-safe Control)	1st	1st	3rd	4th	5th	6th	7th	N
	Fail-safe Control during OFF Malfunction	1st	3rd	3rd	4th	5th	6th	7th	7th
SR	OFF Malfunction (Malfunctions occur while driving in 5th or below.)	1st	2nd	3rd	4th	1st	7th	7th	7th
	OFF Malfunction (Malfunctions occur while driving in 6th or above, or after shifting to 7th.)	7th	7th	7th	7th	7th	7th	7th	7th
	Fail-safe Control during OFF Malfunction (This malfunction is detected while driving in 5th or above.)	Fixed in 7th							
	OFF Malfunction (Trip is commenced despite malfunctions having occurred in SR.)	3rd	3rd	3rd	3rd	7th	7th	7th	7th
	Fail-safe Control during OFF Malfunction (This malfunction is detected while driving in 4th or below.)	Fixed in 3rd							
	Fail-safe Control during OFF Malfunction* (This malfunction is detected while driving in 5th or above.)	Fixed in 7th (If vehicle stops once, then it is fixed in 3rd.)							

*: After trip is commenced despite malfunctions having occurred in SR.

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