

GROUP 22B

TWIN CLUTCH-SPORTRONIC SHIFT TRANSMISSION (TC-SST)

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TWIN CLUTCH-SPORTRONIC SHIFT TRANSMISSION (TC-SST)

GENERAL INFORMATION

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The TC-SST (Twin Clutch Sportronic Shift Transmission) assembly is a twin clutch type automatic M/T that offers the easy driving similar to A/T, excellent sport driving, and enhanced fun to drive. The TC-SST assembly offers the following features.

Good fuel efficiency

- Because the basic structure is the same as M/T, it is simple and has a high driving force transmission efficiency.
- Instead of the torque converter, the clutch is used to transfer the driving force from engine, reducing the loss of driving force.
- Through the precise joint control with the engine, the gears can be shifted at the optimum timing. (With NORMAL mode)

Shift feeling

- Corresponding to the optimization of shift change timing by the automatic shifting, the shift shock is reduced, and the shifting is made smooth without torque loss.

Easy drive

- By adopting TC-SST-ECU, solenoid valve, sensor, valve body, and others, the easy driving similar to A/T has been achieved.

Sport drive

- Drive mode switching function is equipped which enables the selection of NORMAL, SPORT, and S-SPORT (super sport).

Fun to Drive

- The manual mode and the paddle shift are adopted that allow the driver to shift gears at any timing.

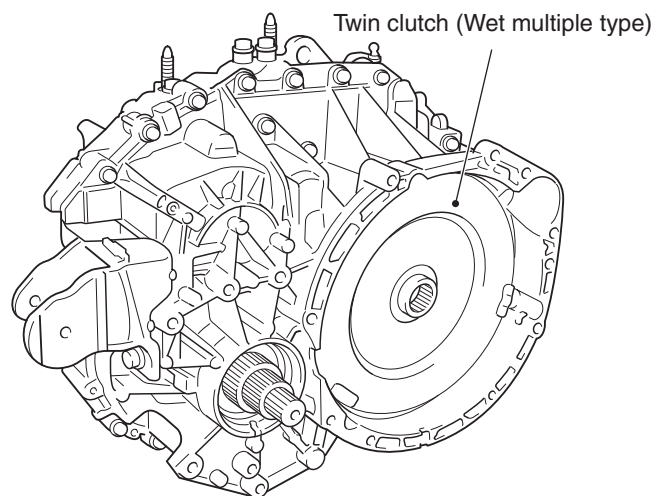
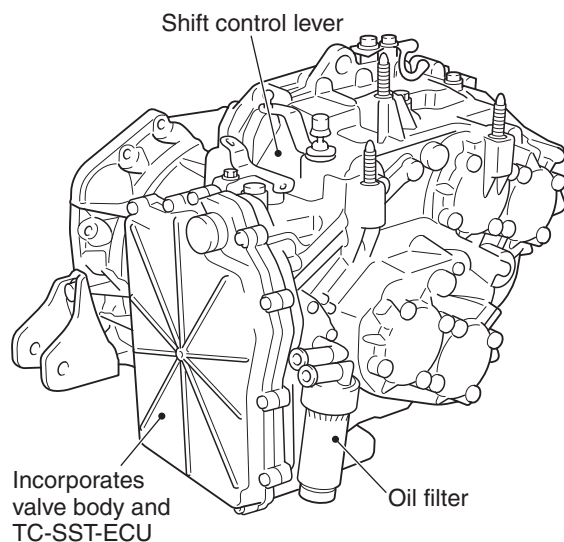
Starting acceleration

- The clutch and gear shift operation are automatically controlled, reducing the power transfer loss and achieving the ideal starting acceleration.

SPECIFICATIONS

Item		Specifications
Transaxle model		W6DGA
Transaxle type		Forward 6-speed, reverse 1-speed, constant mesh
Clutch		Wet multiplate clutch x 2
Transmission ratio	1st	3.655
	2nd	2.368
	3rd	1.754
	4th	1.322
	5th	1.008
	6th	0.775
	Reverse	4.011
Final reduction ratio		4.062
Helical gear LSD (front differential)		Present
Transfer	Reduction ratio	3.307
	Differential gear unit	Hydraulic pressure multiplate clutch (ACD)
Transmission oil	Brand	Mitsubishi genuine Dia-Queen SSTF-I
	Capacity dm ³	7.1 (Including 0.6 in oil cooler)
Transfer oil	Brand	Mitsubishi genuine Dia-Queen LSD Gear Oil
	Capacity dm ³	0.8
AWC control fluid	Brand	Mitsubishi genuine Dia-Queen ATF SPlII
	Capacity dm ³	1.0 (Hydraulic pipe section)

OVERVIEW



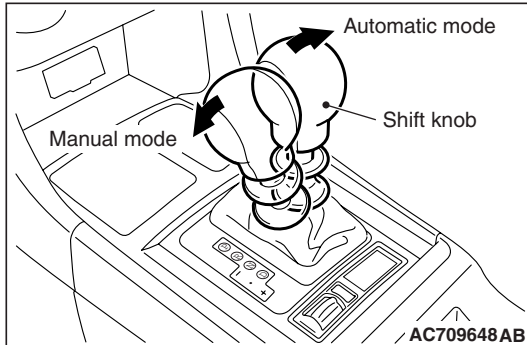
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DESCRIPTION OF FUNCTION

The TC-SST assembly offers the following features, achieving high-performance as well as the easy driving and sport driving.

SHIFTING MODE

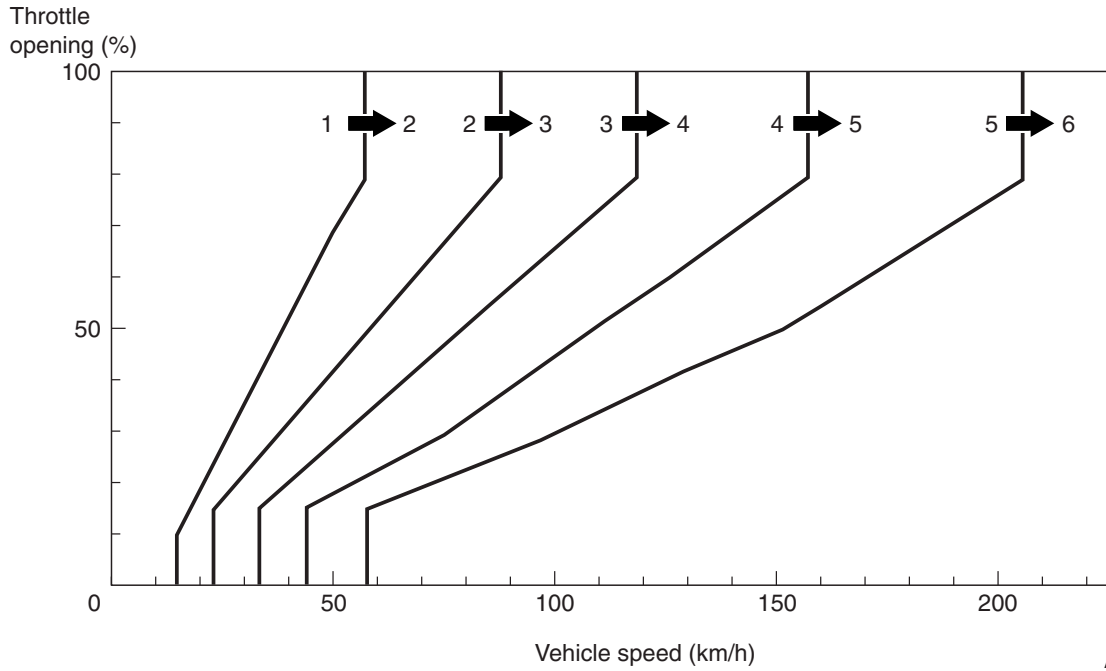
By the operation of shift lever, the automatic mode and manual mode can be selected.



Mode	Control content
Automatic mode (Shift lever position: D)	<ul style="list-style-type: none"> Shifting is performed automatically according to the shift map. By the operation of paddle shift, the mode can be changed to the manual mode. (When the "+" side lever of paddle shift is pulled for 1 second, the mode returns to the automatic mode. When the vehicle is stopped, the mode automatically returns to the automatic mode.) In combination with the drive mode, it provides support for the economy driving to circuit driving.
Manual mode (Shift lever position: +/- side)	<ul style="list-style-type: none"> By the operation of shift lever or paddle shift, the driver can change gears at any timing. No automatic shifting is performed during driving, but the selection of 1st gear and clutch engagement at starting are performed automatically. Also, the gear is downshifted automatically during deceleration before a stop, and the clutch is released during stop to achieve the neutral status. <p>NOTE:</p> <ul style="list-style-type: none"> Depending on the driving and operation conditions, the shifting may be restricted, including the prohibition of upshifting to ensure the driving performance and prohibition of downshifting to prevent the engine over revolution. When the fluid temperature is high, the shifting may be delayed from the operation in order to protect the TC-SST assembly.

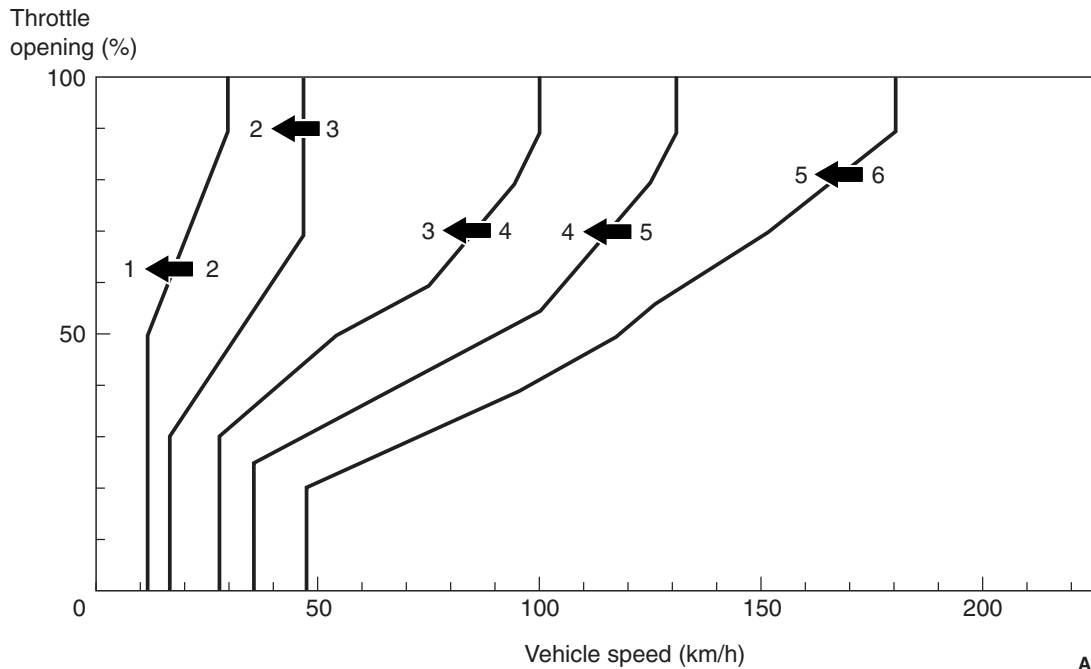
SHIFT MAP

<NORMAL - UPSHIFT>



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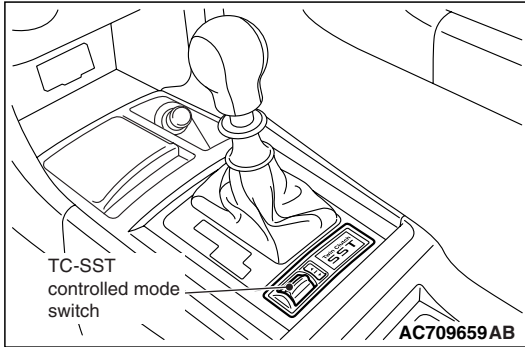
<NORMAL - DOWNSHIFT>



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DRIVE MODE

By the switching of twin clutch SST control mode switch, three types of control modes, which are NORMAL, SPORT, and S-SPORT (super sport), can be selected.



Mode	Control content
NORMAL	<ul style="list-style-type: none"> This mode is best suited for the normal driving on normal roads, expressways, and snowy roads. A consideration is given to comfort and fuel efficiency, and the control is performed to shift gears smoothly at low engine speed.
SPORT	<ul style="list-style-type: none"> This mode is best suited for sport driving. Compared to NORMAL, the control is performed to shift gears swiftly at high engine speed. This mode enables driving that is characteristic of EVOLUTION, offered by the shifting timing focused on acceleration, the deceleration by downshifting at braking, and others.
S-SPORT	<ul style="list-style-type: none"> This mode takes full advantage of the engine performance. Compared to SPORT, the control is performed to shift gears more swiftly at even higher engine speed. <p>NOTE:</p> <ul style="list-style-type: none"> <i>S-SPORT can be selected only when the mode switch is pressed and held for 3 seconds or more when the vehicle is stopped or when the vehicle speed is low (approximately 10 km/h or less).</i> <i>The gears are shifted swiftly with the engine running at high speed, a shock may be accompanied by the shifting.</i>

CREEP FUNCTION

With TC-SST, by intentionally making the clutch to slip (half clutch), the creep driving can be performed which is similar to A/T. Because this function allows the forward and backward driving in low speed, the driving becomes easier on congested road and when parking the vehicle.

KICK-DOWN FUNCTION

For the overtakes on expressway and the acceleration on upslope, when the accelerator pedal is depressed suddenly, the gear is intentionally downshifted for one gear.

Depending on the driving conditions, the downshifting may be performed with 2 or 3 gears skipped, or the downshifting may be rejected.

DESCRIPTION OF CONSTRUCTION AND OPERATION

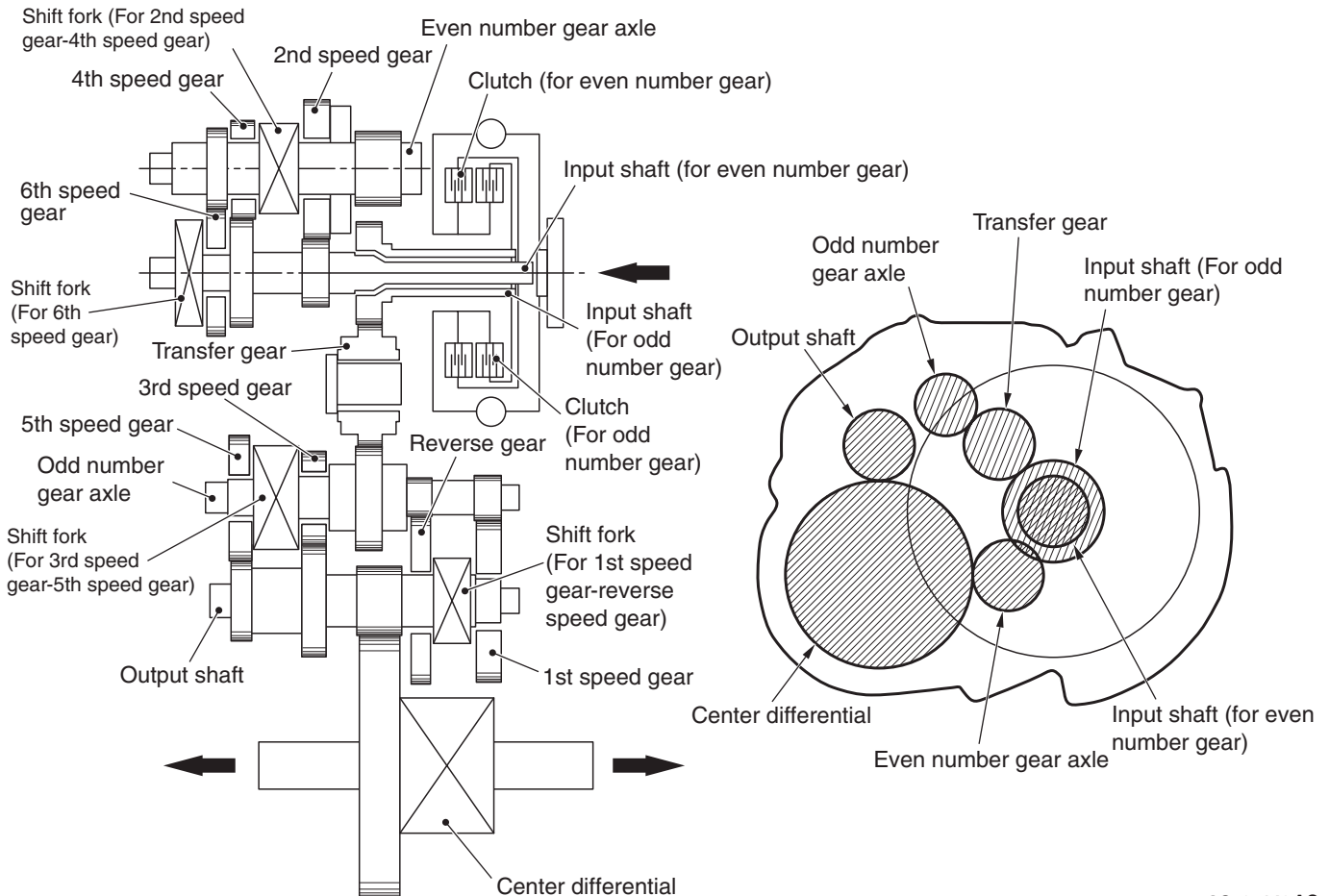
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The TC-SST assembly consists mainly of the clutch, shifting section, valve body, and TC-SST-ECU. The valve body is controlled by TC-SST-ECU, and the clutch and shifting operations are performed by the hydraulic pressure from the valve body.

Name	Structure and action	
Shift mechanism	Clutch	Two wet multiplate clutches are divided for the odd number gears and even number gears, and each clutch is engaged and released alternately.
	Shifting section (Reverse, 1st, 3rd, 5th)	The odd number gear axle consists of the reverse, 1st, 3rd, and 5th gears, synchronizer, and two shift forks, and it is connected to the clutch (for odd number gears).
	Shifting section (2nd, 4th, 6th)	The even number gear axle consists of the 2nd, 4th, and 6th gears, synchronizer, and two shift forks, and it is connected to the clutch (for even number gears).
Hydraulic mechanism	Valve body	The hydraulic circuit for feeding oil to each part of TC-SST assembly is mounted, and the solenoid valve for changing the circulating path and controlling the hydraulic pressure is equipped.
Control mechanism	TC-SST-ECU	Incorporated into the TC-SST assembly. Controls the solenoid valve based on various signals.

SHIFT MECHANISM

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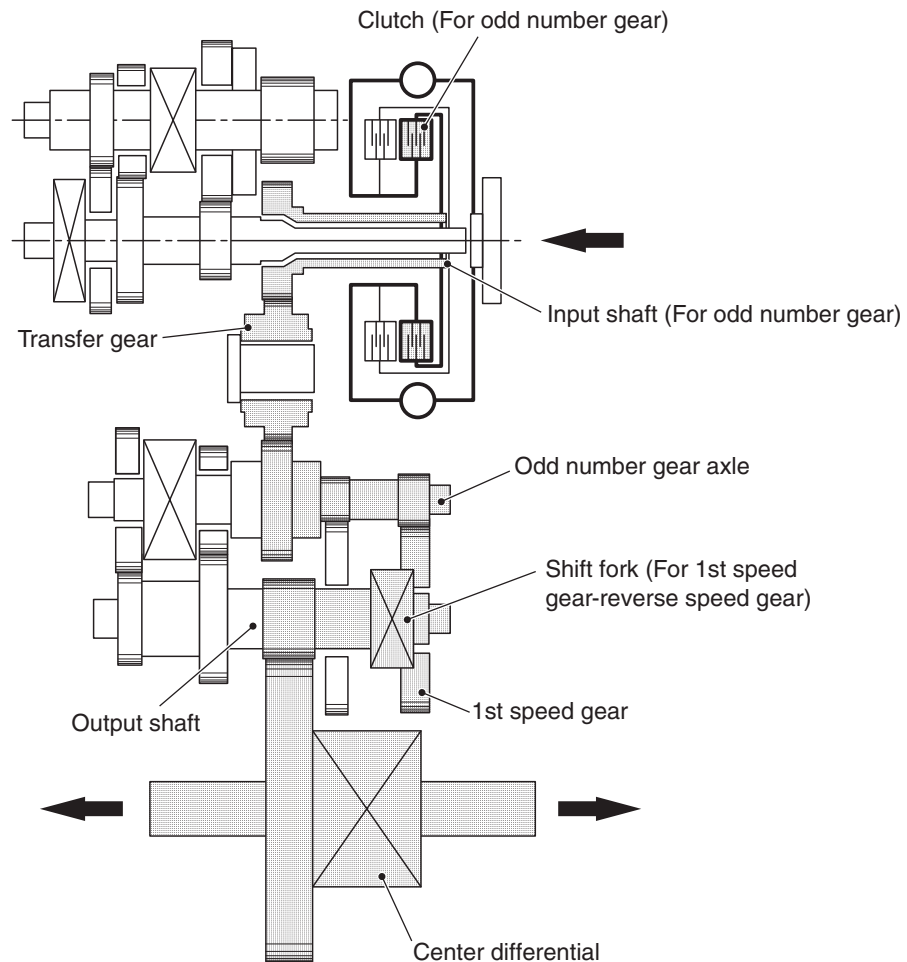
The shifting mechanism of TC-SST assembly is divided into two systems as the odd number gear axle (reverse, 1st, 3rd, 5th) and even number gear axle (2nd, 4th, 6th). Each mechanism is joined with an independent clutch, establishing a structure with which two 3-speed M/T mechanisms are combined.

WHEN IN P AND N RANGE

In the P range and N range, the 2nd gear and the reverse gear are engaged beforehand with the two clutches kept released.

AT STARTING

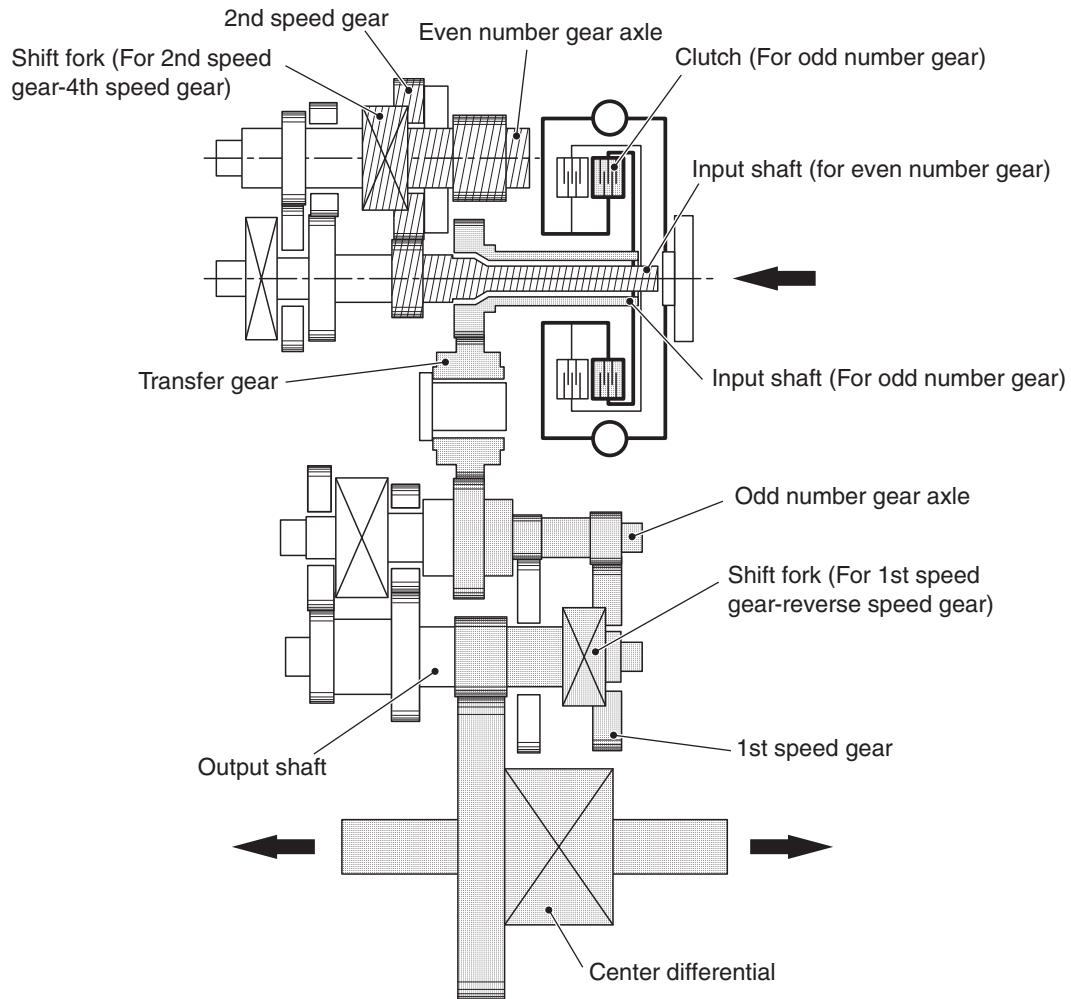
(P → D RANGE, N → D RANGE)



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Corresponding to the operations from P to D and from N to D, the shift fork (for 1st – reverse) is shifted from the reverse gear to the 1st gear to engage the 1st gear. Then, the clutch for the odd number gears is engaged to perform the 1st gear starting.

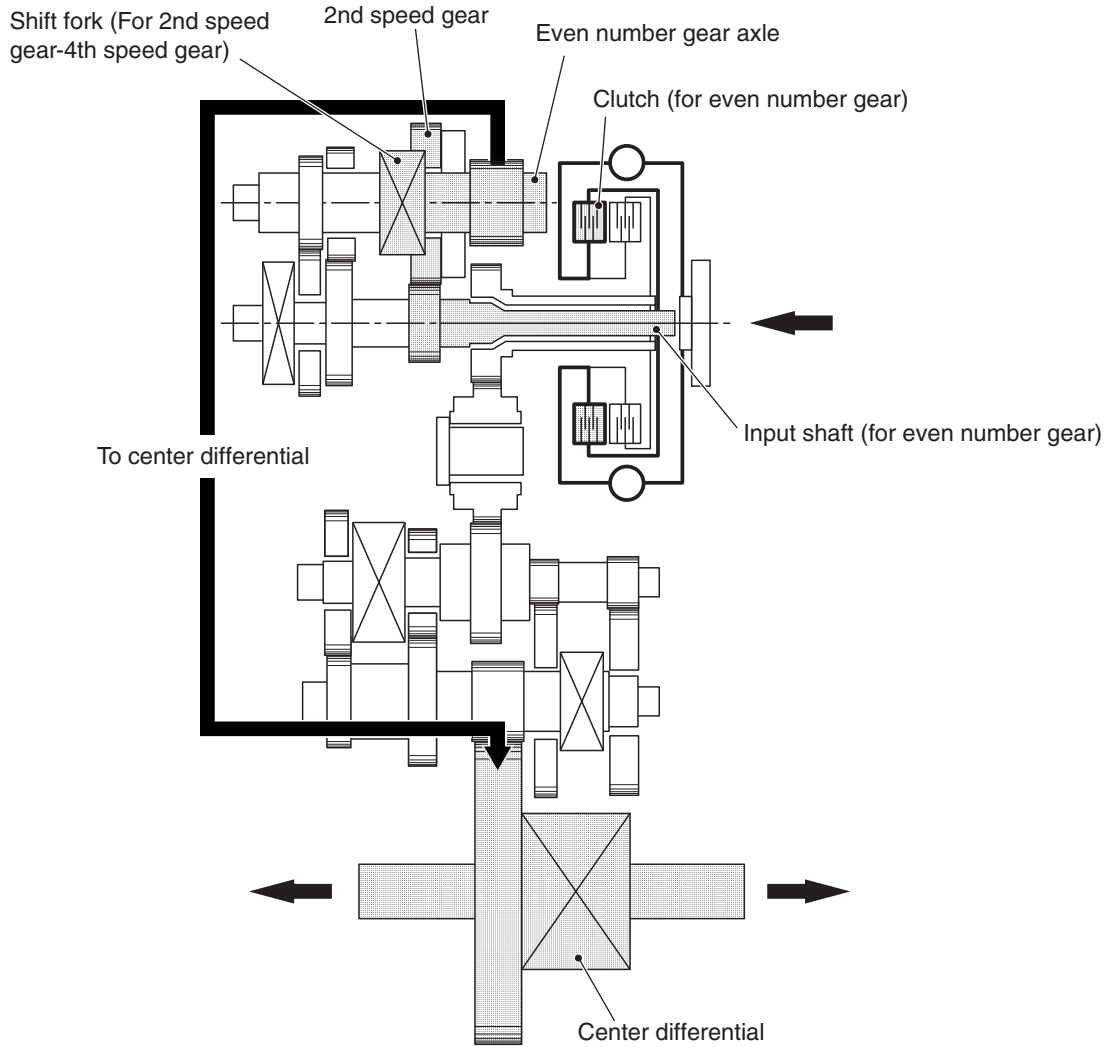
WHEN DRIVING IN 1ST GEAR



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During driving with the 1st gear, the even number gear clutch is kept released, and the 2nd gear is engaged in advance. (During driving with even number gears, the odd number gears are engaged in advance.)

WHEN DRIVING IN 2ND GEAR



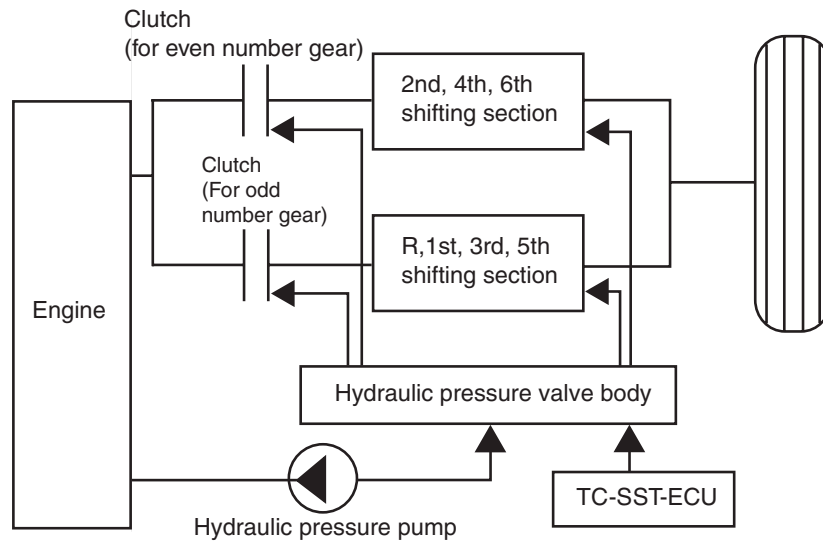
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The clutch (for odd number gears) is released at the shifting timing in accordance with the shift map, and the clutch (for even number gears) is engaged to perform driving with the 2nd gear.

Because the shifting is performed only by the alternation of two clutches, the shifting time is short, and the clutch does not become completely released during driving.

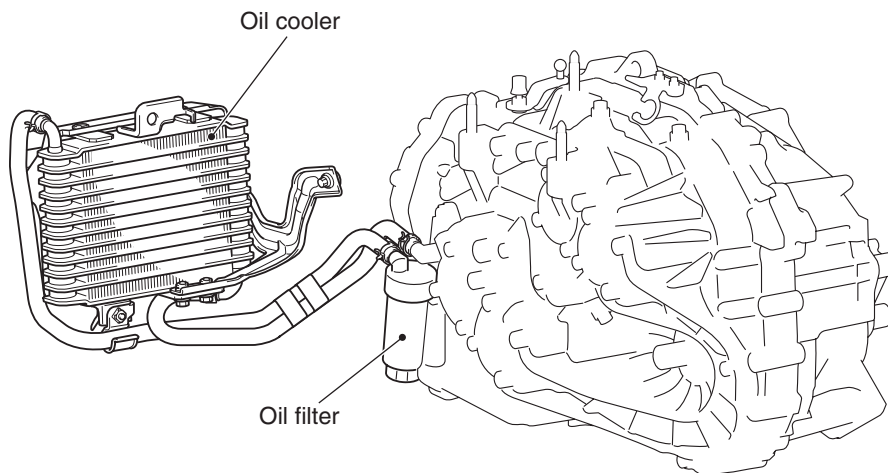
HYDRAULIC MECHANISM

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By the operation of solenoid valve, the valve body feeds the hydraulic pressure needed for the operation of clutch and each shifting section. The solenoid valve is controlled by TC-SST-ECU, and the hydraulic pump generates the hydraulic pressure by using the engine power.

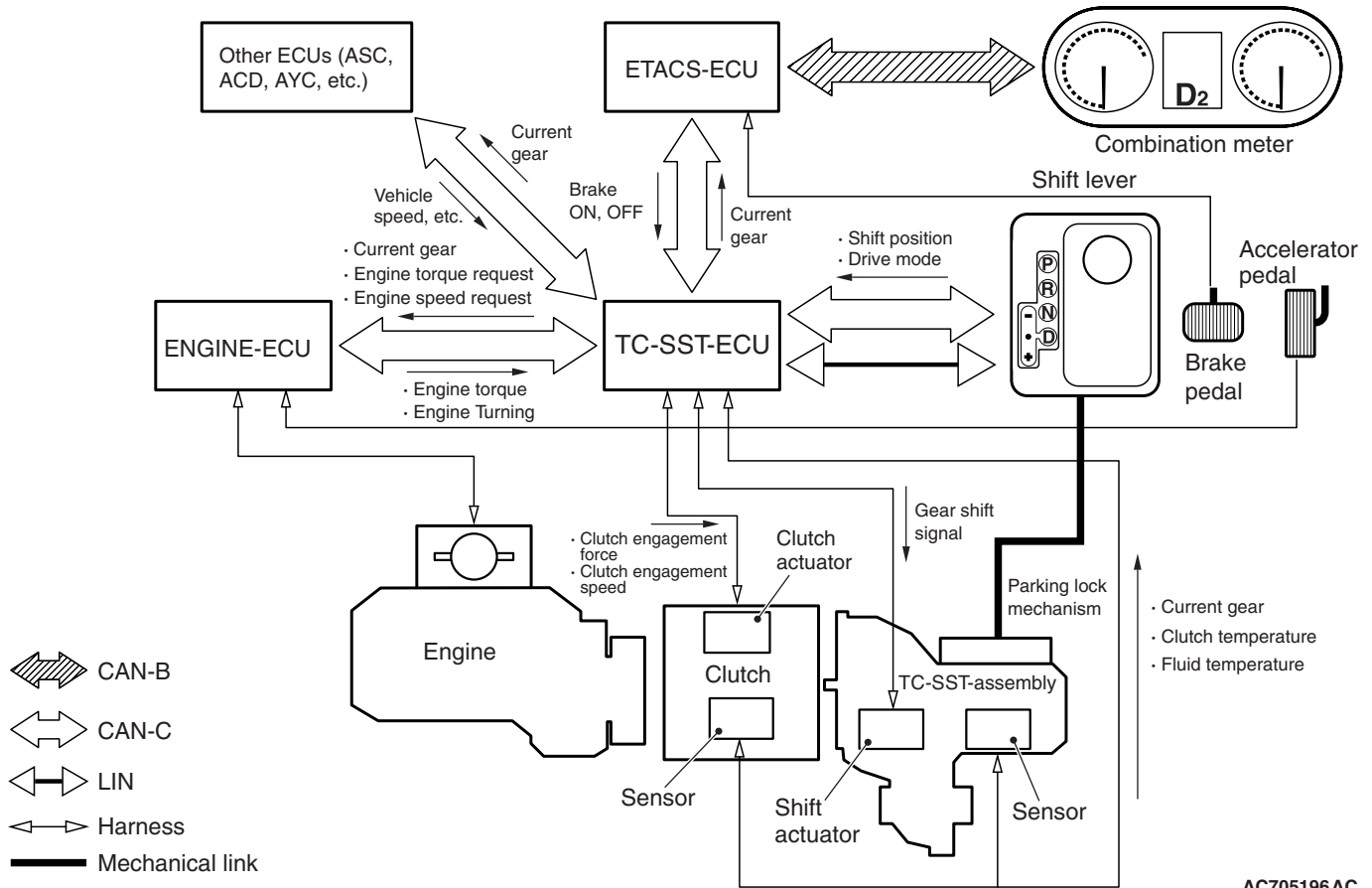


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Also, to prevent the oil performance drop, the oil cooler and oil filter are equipped.

CONTROL MECHANISM

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TC-SST-ECU communicates with various systems (engine control module, shift lever, twin clutch SST control mode switch, and others) to recognize the driver operation, driving condition, malfunction of systems, and others, and performs the corresponding control of TC-SST assembly.

Name	Function content
TC-SST-ECU	<ul style="list-style-type: none"> Incorporated into the TC-SST assembly. Controls the solenoid valve of valve body based on the driver operations and signals from sensors and ECUs, and performs the engagement and releasing of clutch as well as the gear shifting. By sending and receiving the information on engine torque, engine speed, shifted gear, and others with the engine control module, performs the integrated control of engine and TC-SST assembly.
Engine control module	By sending and receiving the information on engine torque, engine speed, shifted gear, and others with TC-SST-ECU, performs the integrated control of engine and TC-SST assembly.

Name	Function content
ETACS-ECU	<ul style="list-style-type: none"> • Transmits the information to TC-SST-ECU of the brake operation and others needed for the vehicle starting and shifting timing. • Receives the information from TC-SST-ECU of the current gear, TC-SST assembly malfunction, and others, and sends the information to the combination meter to display the information.
Other ECUs (ASC-ECU, S-AWC-ECU, and others)	By the communication with ECUs which are relevant to the driving performance, controls the TC-SST assembly to support the normal driving to the circuit driving.
Shift lever	By sending the information to TC-SST-ECU of the driver operations, and shifting mode and drive mode switching/selection, controls the TC-SST assembly corresponding to the operation conditions.

DIAGNOSTIC FUNCTION

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DIAGNOSTIC TROUBLE CODE

If a trouble is present to the TC-SST assembly, a corresponding trouble spot is stored in the TC-SST-ECU as the diagnostic trouble code below, and the code can be read by using the scan tool (M.U.T.-III).

DIAGNOSTIC TROUBLE CODE TABLE

Code No.	Diagnostic item	Main trouble cause
P0630	Chassis number	VIN not written
P0701	EEPROM	EEPROM malfunction
P0702	Internal control module, monitoring processor	Malfunction of internal control module, monitoring processor
P0711	TC-SST-ECU temperature sensor	Gradient error of TC-SST-ECU temperature sensor
P0712		Output low range out of TC-SST-ECU temperature sensor
P0713		Output high range out of TC-SST-ECU temperature sensor
P0715	Input shaft 1 (odd number gear axle) speed sensor	Malfunction of input shaft 1 (odd number gear axle) speed sensor
P0716		Poor performance of input shaft 1 (odd number gear axle) speed sensor
P0746	Line pressure solenoid	Drive current range out of line pressure solenoid
P0753	Shift select solenoid 1	Open circuit in shift select solenoid 1
P0758	Shift select solenoid 2	Open circuit in shift select solenoid 2
P0776	Clutch cooling flow solenoid	Drive current range out of clutch cooling flow solenoid
P0777	Clutch cooling flow solenoid	Clutch cooling flow solenoid sticking
P0841	Clutch 1 pressure sensor	Poor performance of clutch 1 pressure sensor
P0842		Output low range out of clutch 1 pressure sensor
P0843		Output high range out of clutch 1 pressure sensor
P0846	Clutch 2 pressure sensor	Poor performance of clutch 2 pressure sensor
P0847		Output low range out of clutch 2 pressure sensor
P0848		Output high range out of clutch 2 pressure sensor

Code No.	Diagnostic item	Main trouble cause
P0960	Line pressure solenoid	Open circuit in line pressure solenoid
P0961		Overvoltage of line pressure solenoid
P0962		Short to ground in line pressure solenoid
P0963		Short to power supply in line pressure solenoid
P0964	Clutch cooling flow solenoid	Open circuit in clutch cooling flow solenoid
P0965		Overvoltage of clutch cooling flow solenoid
P0966		Short to ground in clutch cooling flow solenoid
P0967		Short to power supply in clutch cooling flow solenoid
P0968	Shift/cooling switching solenoid	Open circuit in shift/cooling switching solenoid
P0970		Short to ground in shift/cooling switching solenoid
P0971		Short to power supply in shift/cooling switching solenoid
P0973	Shift select solenoid 1	Short to ground in shift select solenoid 1
P0974		Short to power supply in shift select solenoid 1
P0976	Shift select solenoid 2	Short to ground in shift select solenoid 2
P0977		Short to power supply in shift select solenoid 2
P1637	EEPROM	DTC storing malfunction of EEPROM
P1676	Variant coding	Variant coding not complete
P1802	Shift lever	Malfunction of shift lever LIN communication
P1803		CAN or LIN time-out error of shift lever
P1804	Shift fork position sensor 1 and 2	Shift fork position sensor 1 and 2 system (Power supply voltage low range out)
P1805		Shift fork position sensor 1 and 2 system (Power supply voltage high range out)
P1806	Shift fork position sensor 3 and 4	Shift fork position sensor 3 and 4 system (Power supply voltage low range out)
P1807		Shift fork position sensor 3 and 4 system (Power supply voltage high range out)
P1808	TC-SST-ECU temperature, fluid temperature sensor	Correlation error of TC-SST-ECU temperature, fluid temperature sensor
P180C	Clutch pressure cut	Clutch pressure cut spool sticking
P181B	Clutch 1	Pressure low range out of clutch 1
P181C		Pressure high range out of clutch 1
P181E	Clutch 2	Pressure low range out of clutch 2
P181F		Pressure high range out of clutch 2
P1820	Shift fork position sensor 1	Voltage low range out of shift fork position sensor 1
P1821		Voltage high range out of shift fork position sensor 1
P1822		Output range out of shift fork position sensor 1
P1823		Gradient error of shift fork position sensor 1
P1824		Poor performance of shift fork position sensor 1

Code No.	Diagnostic item	Main trouble cause
P1825	Shift fork position sensor 2	Voltage low range out of shift fork position sensor 2
P1826		Voltage high range out of shift fork position sensor 2
P1827		Output range out of shift fork position sensor 2
P1828		Gradient error of shift fork position sensor 2
P1829		Poor performance of shift fork position sensor 2
P182A	Shift fork position sensor 3	Voltage low range out of shift fork position sensor 3
P182B		Voltage high range out of shift fork position sensor 3
P182C		Output range out of shift fork position sensor 3
P182D		Gradient error of shift fork position sensor 3
P182E		Poor performance of shift fork position sensor 3
P1831	Shift fork position sensor 4	Voltage low range out of shift fork position sensor 4
P1832		Voltage high range out of shift fork position sensor 4
P1833		Output range out of shift fork position sensor 4
P1834		Gradient error of shift fork position sensor 4
P1835		Poor performance of shift fork position sensor 4
P1836	Shift fork 1	Malfunction of shift fork 1
P183D	Shift fork 2	Malfunction of shift fork 2
P1844	Shift fork 3	Malfunction of shift fork 3
P184B	Shift fork 4	Malfunction of shift fork 4
P1852	Shift fork 1 or 2	Opposite direction movement of shift fork 1 or 2
P1855	Shift fork 3 or 4	Opposite direction movement of shift fork 3 or 4
P1857	Odd number gear axle	Odd number gear axle interlock
P1858	Even number gear axle	Even number gear axle interlock
P1859	Clutch 1	Disengagement too late with clutch 1
P185A		Engagement too late with clutch 1
P185B	Clutch 2	Disengagement too late with clutch 2
P185C		Engagement too late with clutch 2
P185D	Clutch	Clutch open not possible
P1862	High side 1	Open circuit in high side 1
P1863		Short to power supply in high side 1
P1864		Overcurrent of high side 1
P1866	High side 2	Open circuit in high side 2
P1867		Short to power supply in high side 2
P1868		Overcurrent of high side 2
P186A	High side 3	Open circuit in high side 3
P186B		Short to power supply in high side 3
P186C		Overcurrent of high side 3
P186D	High side 1 to 3	Voltage low range out
P1871	APS	APS signal abnormality

Code No.	Diagnostic item	Main trouble cause
P1872	Between shift lever and TC-SST	Q-A function abnormality between shift lever and TC-SST
P1873	Clutch 1	Pressure abnormality of clutch 1
P1874	Clutch 2	Pressure abnormality of clutch 2
P1875	Damper speed sensor	Poor performance of damper speed sensor
P1876	Gear	Gear block
P2718	Clutch/shift pressure solenoid 1	Open circuit in clutch/shift pressure solenoid 1
P2719		Overcurrent of clutch/shift pressure solenoid 1
P2720		Short to ground in clutch/shift pressure solenoid 1
P2721		Short to power supply in clutch/shift pressure solenoid 1
P2727	Clutch/shift pressure solenoid 2	Open circuit in clutch/shift pressure solenoid 2
P2728		Overcurrent of clutch/shift pressure solenoid 2
P2729		Short to ground in clutch/shift pressure solenoid 2
P2730		Short to power supply in clutch/shift pressure solenoid 2
P2733	Clutch/shift switching solenoid 1	Spool sticking of clutch/shift switching solenoid 1
P2736		Open circuit in clutch/shift switching solenoid 1
P2738		Short to ground in clutch/shift switching solenoid 1
P2739		Short to power supply in clutch/shift switching solenoid 1
P2741	Fluid temperature sensor	Gradient error of fluid temperature sensor
P2742		Output low range out of fluid temperature sensor
P2743	Fluid temperature sensor system (Output high range out)	Fluid temperature sensor system (Output high range out)
P2766	Input shaft 2 (even number gear axle) speed sensor	Poor performance of input shaft 2 (even number gear axle) speed sensor
P2809	Clutch/shift switching solenoid 2	Spool sticking of clutch/shift switching solenoid 2
P2812		Open circuit in clutch/shift switching solenoid 2
P2814		Short to ground in clutch/shift switching solenoid 2
P2815		Short to power supply in clutch/shift switching solenoid 2
U0001	Bus off	Bus off
U0100	Engine time-out error	Engine time-out error
U0103	Shift lever time-out error	Shift lever time-out error
U0121	ASC time-out error	ASC time-out error
U0136	S-AWC time-out error	S-AWC time-out error
U0141	ETACS time-out error	ETACS time-out error

TRANSAXLE CONTROL

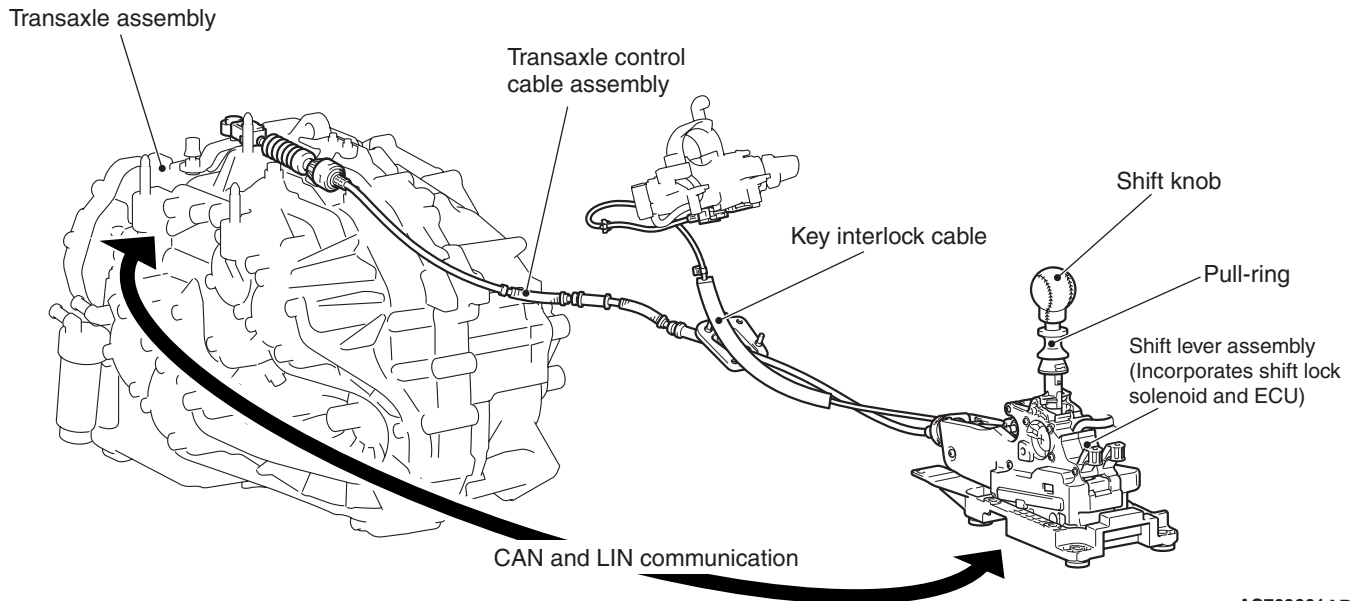
GENERAL INFORMATION

In order to differentiate the TC-SST assembly shift lever from A/T and CVT, a new exclusive shift lever has been developed whose appearance is made similar to that for M/T. It offers the following features.

- Sporty, straight type shift lever operation has been adopted, and the operating power at each shift position have been properly tuned, ensuring the firm and smooth operation feel.
- The manual mode (6-speed) has been installed to allow manual shifting according to the driver's operation.
- ECU that is incorporated in the shift lever transmits the lever position information and others to TC-SST-ECU via CAN (main circuit) and LIN (auxiliary circuit).

- For the parking lock mechanism, the transaxle control cable is adopted.
- The electrical control-type shift lock (shift lever cannot be shifted to the position other than P position unless the brake pedal is depressed) mechanism with the solenoid has been adopted to facilitate the tuning work in assembly. The cable type having an established past record is adopted for the key interlock mechanism.
- Spherical shift knob is used to achieve the same quality as that for M/T.
- As a mis-operation preventative mechanism between P and R range, the pull ring has been adopted.
- The main components have been made of resin to reduce weight and number of components.

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ERRONEOUS OPERATION PREVENTION MECHANISMS

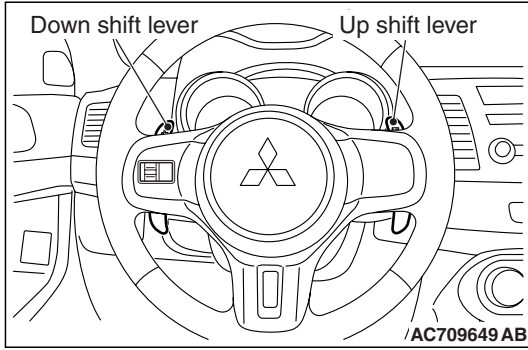
SHIFT LOCK MECHANISM

This is basically the same as with the electric shift lock mechanism which is used for OUTLANDER.

KEY INTERLOCK MECHANISM

This is basically the same as with the cable-type key interlock mechanism which is used for A/T vehicles.

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PADDLE SHIFT

M2222005000024

This mechanism is basically the same as that used for OUT-LANDER.

NOTE: With the automatic shifting (shift lever position: D), when the mode is changed to the sport mode by the paddle shift operation, the mode is cancelled by the conditions below.

- Upshift lever is pulled for 1 second or more.
- Vehicle is stopped.
- No operation is performed for 4 minutes and 25 seconds.

DIAGNOSTIC FUNCTION

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DIAGNOSTIC TROUBLE CODE

If a trouble is present to the shift lever, a corresponding trouble spot is stored in the shift lever-ECU as the diagnostic trouble code below, and the code can be read by using the scan tool (M.U.T.-III).

DIAGNOSTIC TROUBLE CODE TABLE

Code No.	Diagnostic item	Main trouble cause
P0563	Abnormality in power supply	Overvoltage from battery
P198D	Defective EEPROM	EEPROM writing data abnormality
P198E	Malfunction of the lever position sensor	No signal is present.
P198F		Signal is present multiple in numbers.
U0001	Bus off	Bus off
U0100	Engine time-out error	Engine time-out error
U0101	TC-SST time-out error	TC-SST time-out error
U0121	ASC time-out error	ASC time-out error
U0141	ETACS time-out error	ETACS time-out error

SUPER ALL WHEEL CONTROL (S-AWC)

GENERAL INFORMATION

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For more information on S-AWC, refer to GROUP 22A.