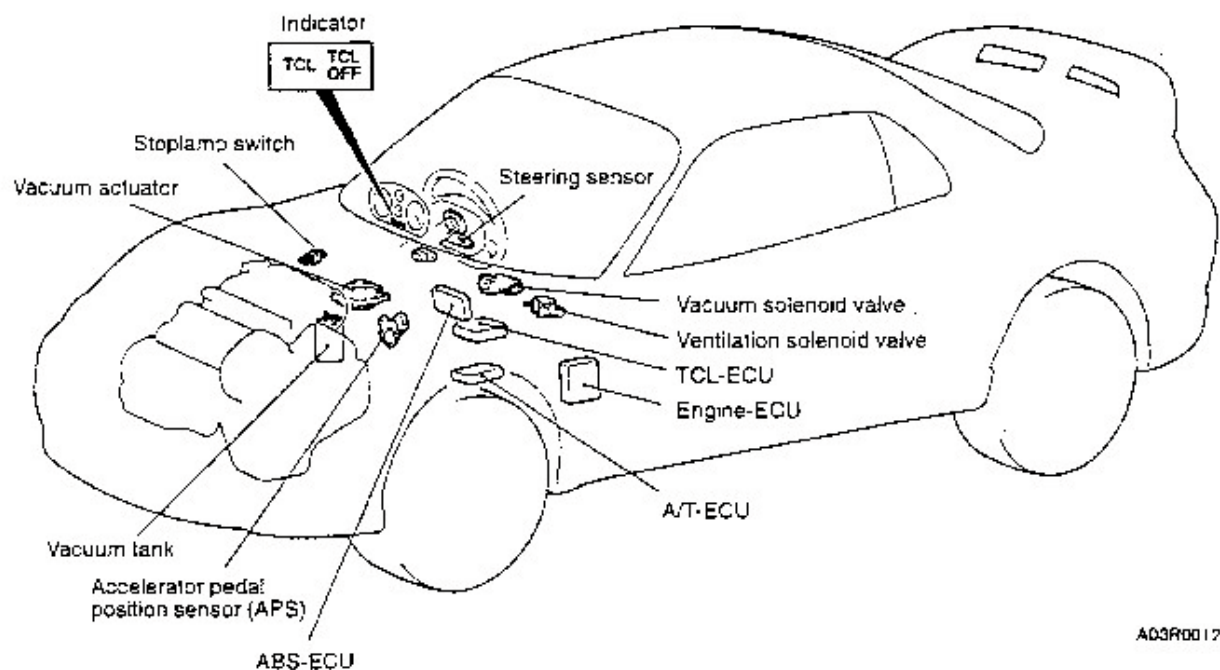


## TCL (TRACTION CONTROL SYSTEM)

The TCL system (slip control and trace control) is incorporated to increase starting and acceleration on slippery surfaces such as snow covered roads,

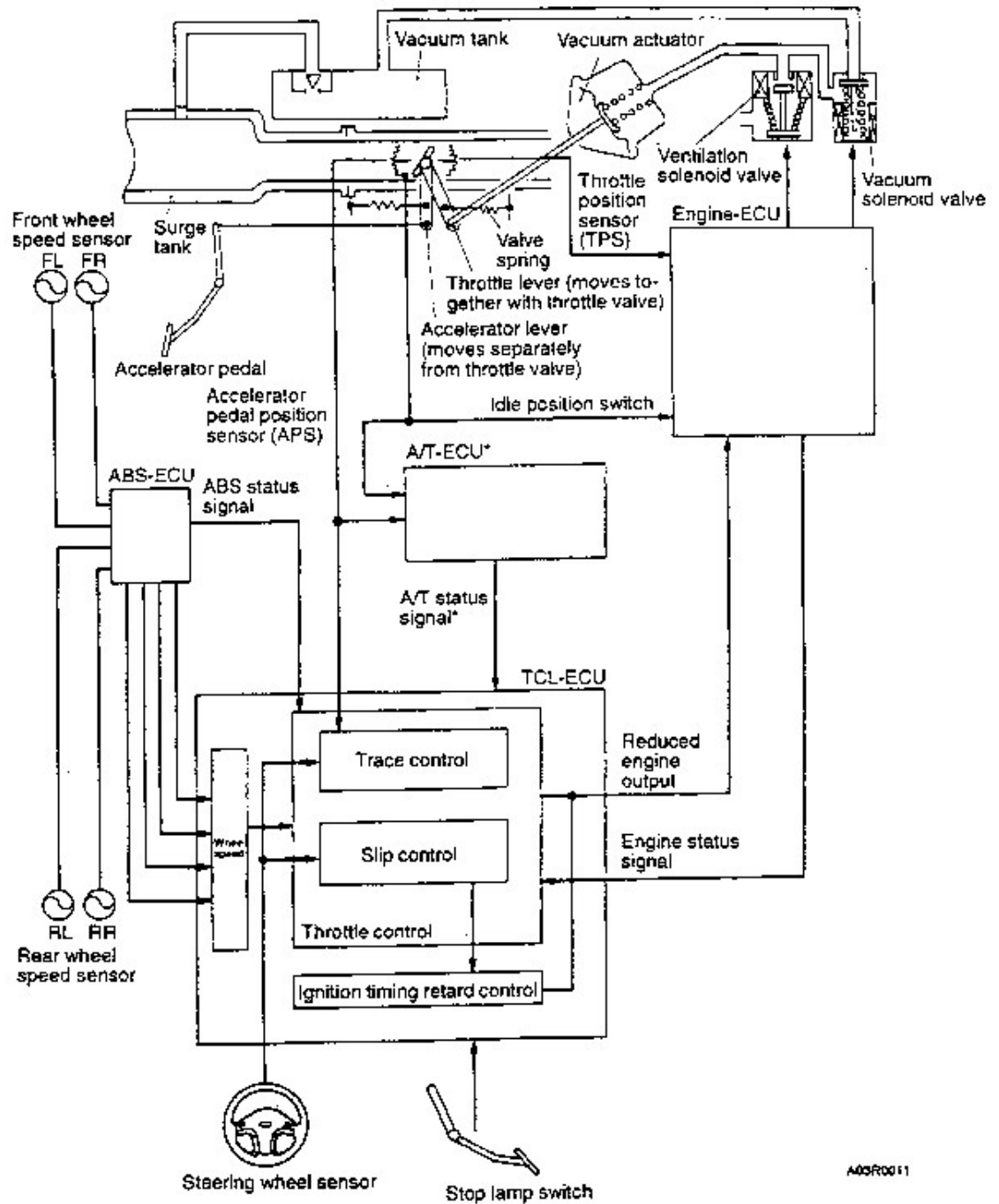
and to increase steering stability and steering acceleration operability on general roads. This allows easy driving to be realized.

### CONSTRUCTION DIAGRAM



A03R0017

## SYSTEM CONFIGURATION DIAGRAM



NOTE

\*: Except M/T

A03R0011

## MAJOR COMPONENT LISTING

Part name	Function
Traction control unit (TCL-ECU)	In response to signals from the individual sensors, the TCL-ECU sends information on the target torque, ignition timing retard amount, etc. to the engine-ECU.
	Controls self-diagnosis and fail-safe functions.
	Controls diagnosis functions (when MUT-II is connected).
Engine control unit (Engine-ECU)	Sends the signals required for TCL's engine control to the TCL-ECU. <ul style="list-style-type: none"> <li>Transmission data <ol style="list-style-type: none"> <li>Throttle valve opening data</li> <li>Engine speed</li> <li>CHECK ENGINE lamp: ON/OFF</li> <li>Idle position switch: ON/OFF</li> <li>Ignition switch (IG1): ON/OFF</li> <li>Variable valve timing operation: ON/OFF</li> <li>Engine specifications*: Differences in type, destination and control system, existence of communication errors</li> <li>Engine throttle control: failed/normal</li> </ol> </li> </ul> (*) Transmit as the engine output differs according to the engine specifications.)
	In response to an engine torque control request and ignition timing retard request from the TCL-ECU, the engine-ECU makes a correction suitable for the engine condition (cold or hot state) and controls the vacuum type throttle actuator drive solenoid valve and ignition timing.
ECU-5A/T control unit (A/T-ECU)	Sends the signals required for TCL's engine control to the TCL-ECU. <ul style="list-style-type: none"> <li>Transmission data <ol style="list-style-type: none"> <li>Shift lever position: P, R, N, D</li> <li>Variable speed related information</li> </ol> </li> </ul>
ABS control unit (ABS-ECU)	Converts the wheel speed signal into square waves (pulses) and sends it to the TCL-ECU.
	Sends the operating status (normal or failed) of the ABS to the TCL-ECU.
Engine control relay	When the engine control relay turns ON, power is supplied to TCL-ECU. The control relay is controlled by the engine-ECU.
Steering wheel sensor	Sends a steering wheel angle to the TCL-ECU.
Accelerator pedal position sensor (APS)	Detects an accelerator pedal movement and sends a signal to the TCL-ECU.
TCL switch	Sends a signal to for switching the TCL control modes (TCL-ON, TCL-OFF) to the TCL-ECU.
TCL-OFF indicator	Lights when the TCL slip control function and trace control function are stopped (when TCL switch is pressed to OFF side). Lights or flickers when TCL function is stopped (fail-safe) by TCL-ECU self-diagnosis function.
TCL indicator	Illuminates when the TCL's slip control and trace control functions are active.
Stop lamp switch	Detects a brake pedal movement and sends a signal to the TCL-ECU.
Vacuum solenoid valve	Opens or closes the passage between the vacuum tank and vacuum actuator in response to a command from the engine-ECU when the TCL control is active.
Ventilation solenoid valve	Opens or closes the passage between the vacuum tank and atmosphere in response to a command from the engine-ECU when the TCL control is active.
Vacuum tank	Accumulates vacuum to drive the vacuum actuator.
Vacuum actuator	Opens or closes the throttle valve by means of the vacuum which is controlled by the engine-ECU.

## NOTE

For those components that are shared by other electronic controlled systems, only their functions which are associated with TCL control are described.

## CONSTRUCTION AND OPERATION

### 1. TCL Control Modes

The control mode can be selected by operating the TCL switch.

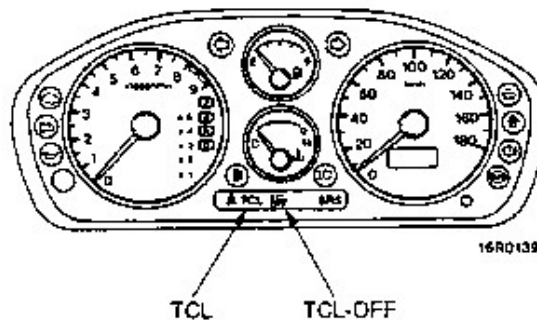
(1) TCL-ON (press switch to ON side)

(2) TCL-OFF (press switch to OFF side)

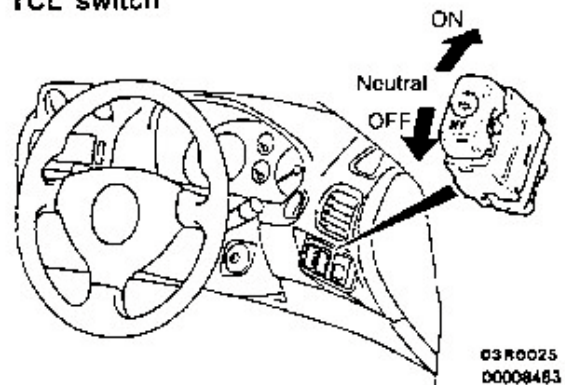
If the system detects an error, the fail-safe mode will be entered automatically.

Control mode	System status	TCL indicator	TCL-OFF indicator	Control function (slip control)	Control function (trace control)
TCL-ON	TCL on	ON	OFF	○	○
	TCL off	OFF	OFF		
TCL-OFF	—	OFF	ON	x	x
Fail-safe	Fail-safe on	OFF	Flashing or ON	x	x

Indicator



TCL switch



### 2. Control System

The slip control details are described as follows:

- (1) Actual drive wheel speed operation  
The actual drive wheel speed is operated from the average drive wheel (front wheel) speed.
- (2) Target engine torque extraction  
The M/T vehicle's engine torque is extracted based on the variable speed information obtained by the reference drive wheel torque obtained in the same manner as the A/T vehicle and the ratio of the drive wheel (front wheel) speed and engine speed.

(3) Others

The threshold value of each control is changed according to the difference in the engine output and drive method, etc., and is set to match the vehicle.

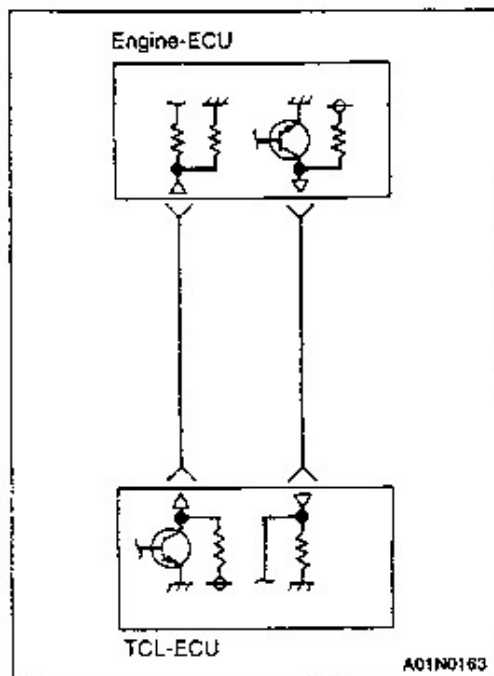


### 3. TCL Control Unit (TCL-ECU)

#### SERIAL COMMUNICATION BETWEEN ENGINE-ECU

The TCL-ECU carries out bidirectional serial (multiplex) communication to obtain the information required for the TCL control from the engine-ECU,

and to convey the output reduction request to the engine-ECU.



#### Major Communication Data Items

##### 1. Engine-ECU → TCL-ECU

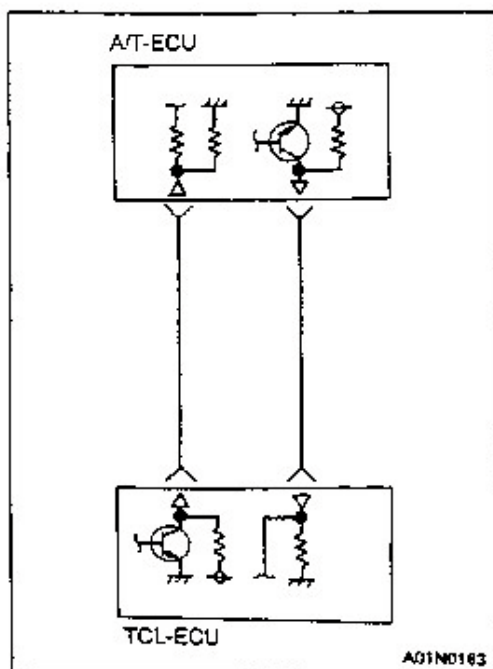
No.	Contents
1.	Throttle valve opening data
2.	Engine speed
3.	CHECK ENGINE lamp: ON/OFF
4.	Idle switch: ON/OFF
5.	IG1 switch: ON/OFF
6.	Variable valve timing operation: ON/OFF
7.	Engine specifications: Differences in type, destination and control system, existence of communication errors
8.	Detection of a malfunction in the vacuum or ventilation solenoid valve drive circuit: failed/normal

##### 2. TCL-ECU → Engine-ECU

No.	Contents
1.	Target engine torque for reduction of engine output
2.	Ignition timing retard request level
3.	TCL control: ON/OFF
4.	Detection of data contradiction between APS and TPS: failed/normal

#### SERIAL COMMUNICATION BETWEEN A/T-ECU

The TCL-ECU carries out bidirectional serial (multiplex) communication to obtain the information required for engine control from the A/T-ECU.



#### Major Communication Data Items

##### 1. A/T-ECU → TCL-ECU

No.	Contents
1.	Shift lever position: P, R, N, D
2.	Variable speed related information

##### 2. TCL-ECU → A/T-ECU

No.	Contents
1.	Speed variation prohibit signal

**FAIL-SAFE FUNCTION**

The TCL-ECU always monitors the input and output signals. When it detects a failure in the system, it commands the following actions.

**During No Control**

- The engine control is cancelled.

**During Control**

- Engine output command is gradually made to conform to the normal accelerator pedal operation.
- Ignition timing retard amount is gradually reduced and the retard command is finally cancelled.

**DIAGNOSIS FUNCTIONS**

The TCL-ECU has the following functions to facilitate inspection of the TCL system.

- Outputting diagnosis code
- Outputting service data

**NOTE**

An actuator test function, executed on the engine-ECU side, is also provided. (Refer to P.1-9.)

**DIAGNOSIS CODES**

There are 24 diagnosis items, including during correct operation. The memory with backup power supply is used, so even if the engine is stopped,

the data is held is held until the battery terminal is disconnected.

**Diagnosis Results Display Items When Using MUT-II**

Code No.	Major contents of diagnosis
11	APS output abnormal
12	APS or TPS defective
13	APS or TPS output abnormal
23*	Stop lamp switch
24	TCL switch short-circuited
26*	Ignition switch (IG2) line open-circuited
27*	ECU power voltage too low
31	Right front wheel speed sensor open-circuited
32	Left front wheel speed sensor open-circuited
33	Right rear wheel speed sensor open-circuited
34	Left rear wheel speed sensor open-circuited
35*	Either of the rear wheel speed sensors defective
36	Both of the rear wheel speed sensors defective
41	Steering wheel sensor (ST-1) open-circuited
42	Steering wheel sensor (ST-2) open-circuited
43	Steering wheel sensor (ST-N) open-circuited
44	Steering wheel sensor (ST-1 or ST-2) short-circuited
45	Steering wheel sensor (ST-N) short-circuited
71	Error in communication with engine-ECU
72	CHECK ENGINE lamp ON
73	Failure in throttle control of engine-ECU
74	Error in communication with A/T-ECU
76*	ABS failure

**NOTE**

The code Nos. marked \* are output only while the failure persists. If control determines that the failure condition has disappeared, it clears the associated code No. stored in memory.

**SERVICE DATA**

Of the data input to the TCL-ECU, the following items can be read using the MUT-II.

No.	Service data item	Indication unit
11	APS opening	mV
13	TPS opening	mV
15*1	State of input from inhibitor switch	R, N, D, P
16*1	Shift position	4, 3, 2, 1
21	State of input from idle position switch	ON/OFF
22	State of input from ignition switch	ON/OFF
23	State of input from stop lamp switch	ON/OFF
24	State of input from TCL-ON switch	ON/OFF
25	State of input from TCL-OFF switch	ON/OFF
27	ECU power voltage	V
31	Right front wheel speed	km/h
32	Left front wheel speed	km/h
33	Rear right wheel speed	km/h
34	Rear left wheel speed	km/h
40	Engine speed	r/min
44	Steering angle	° (deg)
45	Steering neutral point learning	ON/OFF
51	Slip control condition	ON/OFF
52	Trace control condition	ON/OFF
74	Steering wheel sensor (ST-N) signal	HIGH/LOW
75	Steering wheel sensor (ST-1) signal	HIGH-LOW
76	Steering wheel sensor (ST-2) signal	HIGH-LOW
81	Engine model	6A12
82	Engine valve type	DOHC
83	Engine air induction type	N/A
84	Engine classification	MIVEC

**NOTE**

(1) \*1: A/T

(2) Item No. 44 indicates the right side as R and the left side as L using the neutral position (at ignition key "ON" before neutral position teaching) as 0°.

(3) Item No. 45 indicates "ON" when the steering neutral position has been taught.