

CM 4WD (ITM)



Enhanced Vehicle Dynamics

- Improved dynamics during acceleration and deceleration
- Rapid activation and deactivation
- Fully controllable torque transfer characteristics

Enhanced Vehicle Driving Comfort and Transparency

- No wind-up during tight cornering and parking
- Optimal traction during acceleration

Enhanced Vehicle System Compatibility

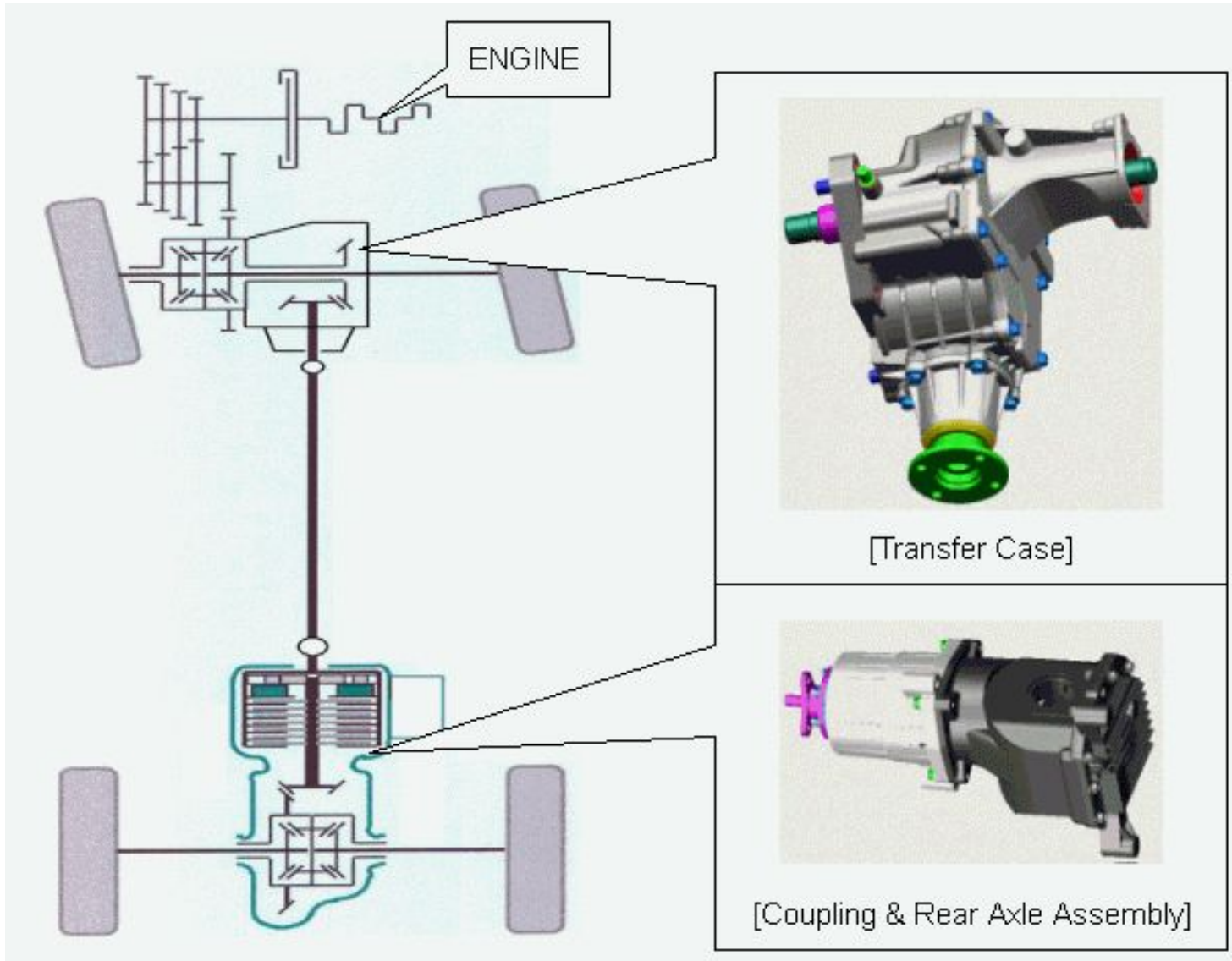
- On-line communication with the CAN system

Better Fuel Consumption

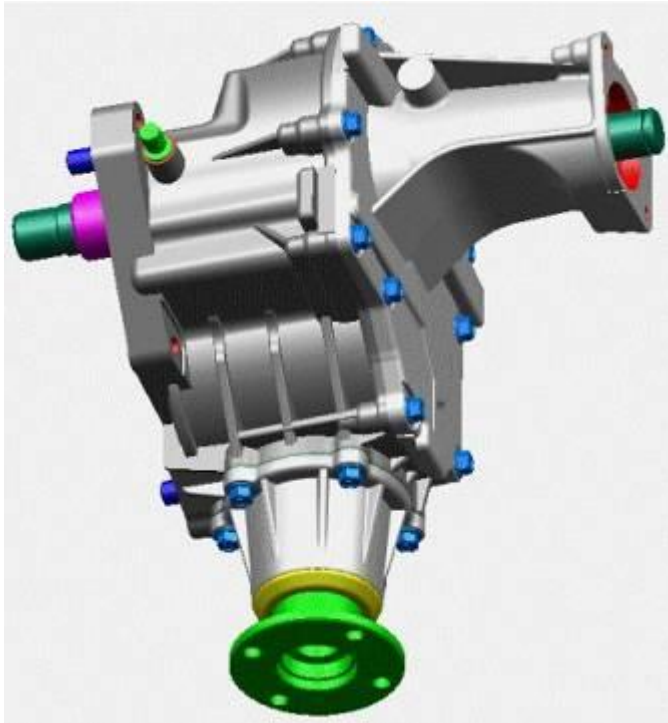
- Compared with 4WD

Variable Torque Control

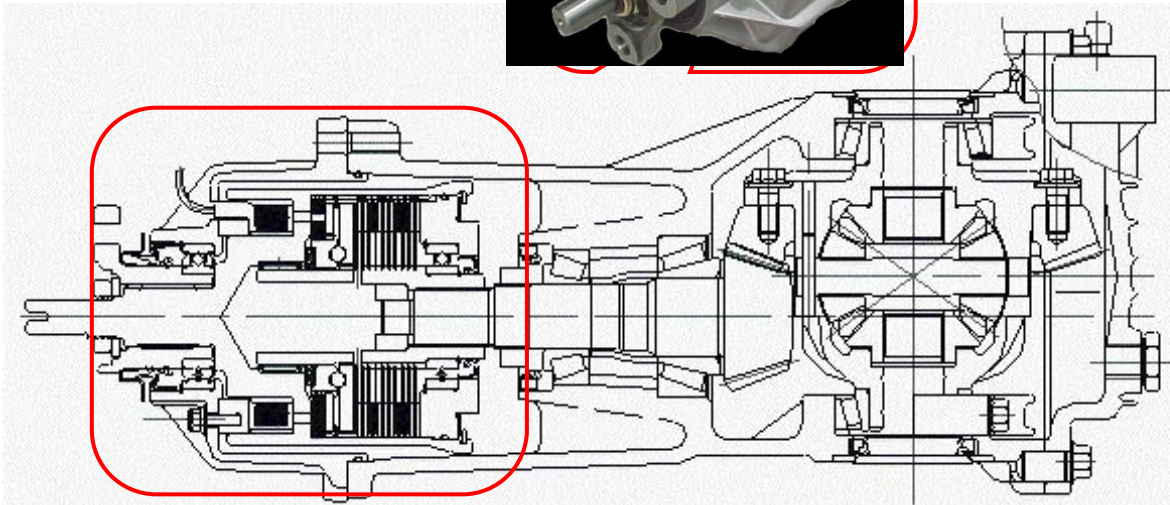
- **At Parking:** Low or zero torque transfer
(for easy and comfortable maneuverability)
- **Acceleration:** High torque transfer for maximum traction
- **High speed driving:** Reduced torque transfer, to minimum
- **Driving on slippery/wet roads:** Swift activation of the coupling
(for maximum traction and safety depending on the slip of the wheels)
- **ABS:** Immediate deactivation on ABS signal
- **ESP/TCS:** Normal torque control on ESP/TCS signal
- **Off-road:** Rapid activation with high torque transfer for maximum traction



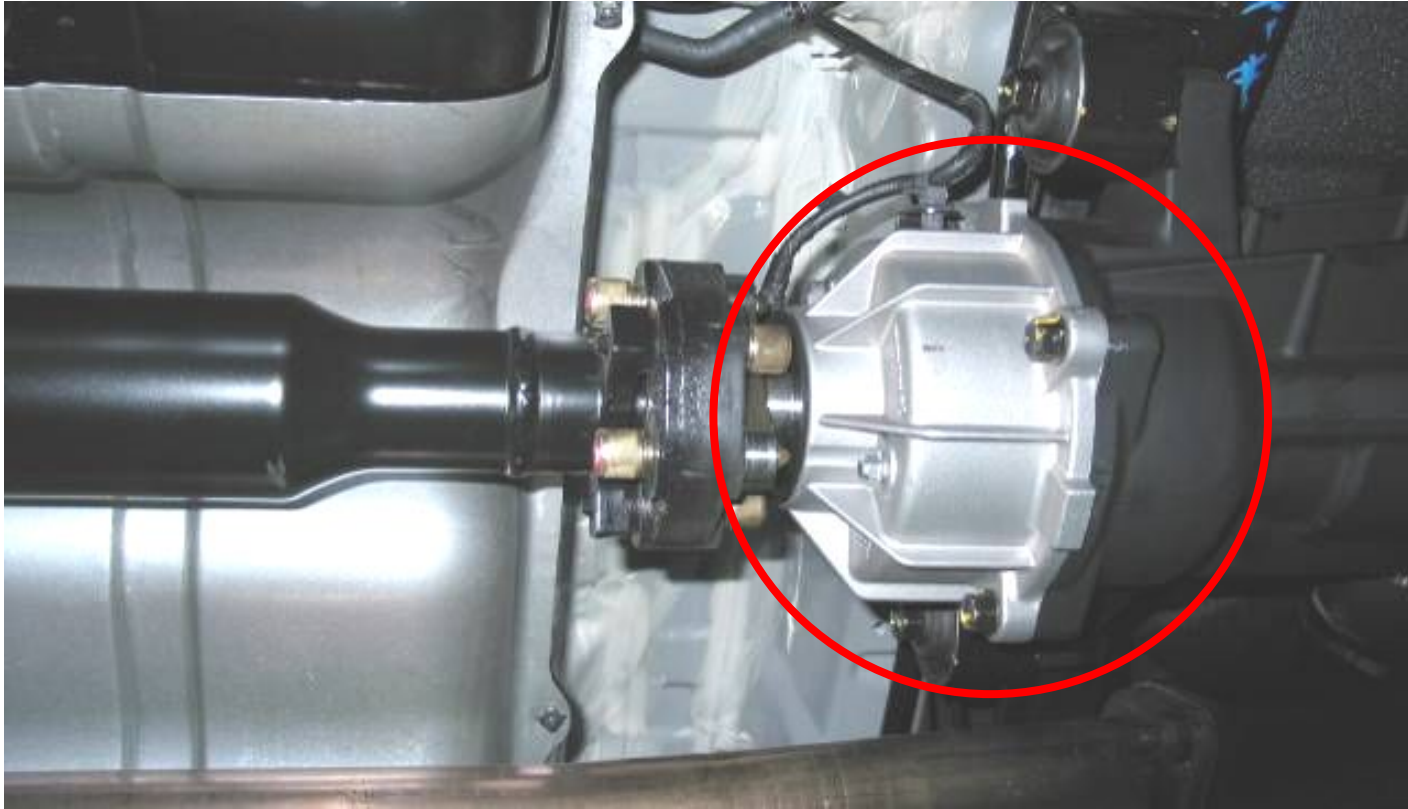
- **4WD Transfer Case:** Santa Fe base modification
- **T/M Case:** Modification of 4WD transfer matching part
- **T/M Differential for 4WD:** Modification of transfer matching part

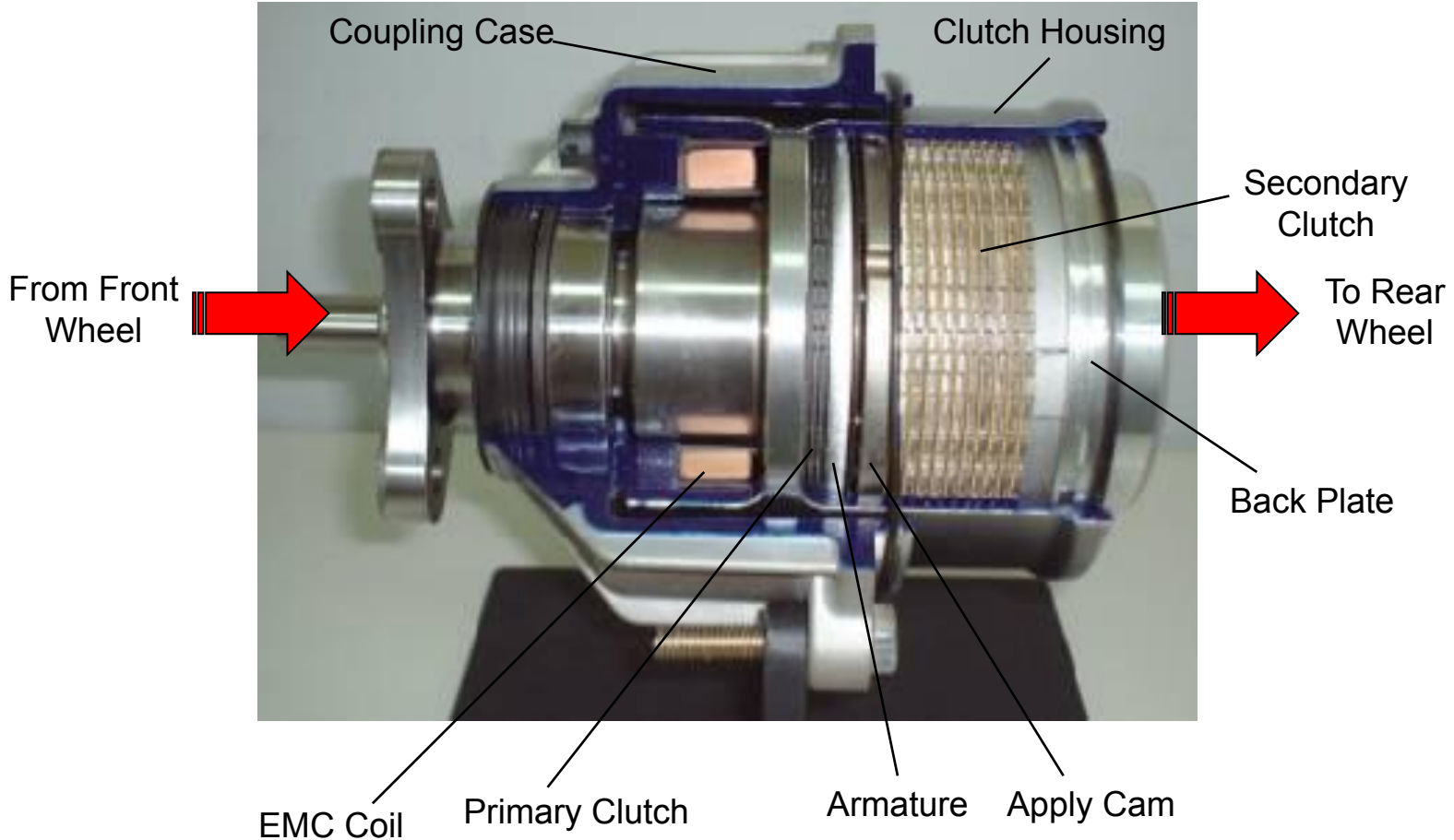


- **Coupling:** Same as Santa Fe
- **Rear Axle:** Santa Fe base modification
- **Control Unit:** Santa Fe base modification



ITM	Feature	Self-contained, compact, light-weight, torque transfer device for on-demand 4WD
	Torque	1200 Nm
	Weight	8 kg
	Size	150mm Long, 140mm OD, 120mm ID
	Housing	Aluminum
	Operating Voltage	12 volts
	Operating Temperature	-40 °C ~ 150 °C
	4WD Coupling Oil	Mobil Fluid – LT (0.15L)
	Primary Clutch	Disc (3 EA), Plate (3 EA)
	Secondary Clutch	Disc (10 EA), Plate (10 EA)







[Housing]



Primary Clutch



[Primary Clutch]



Base Cam



[Armature]



[Apply Cam]



Apply Cam

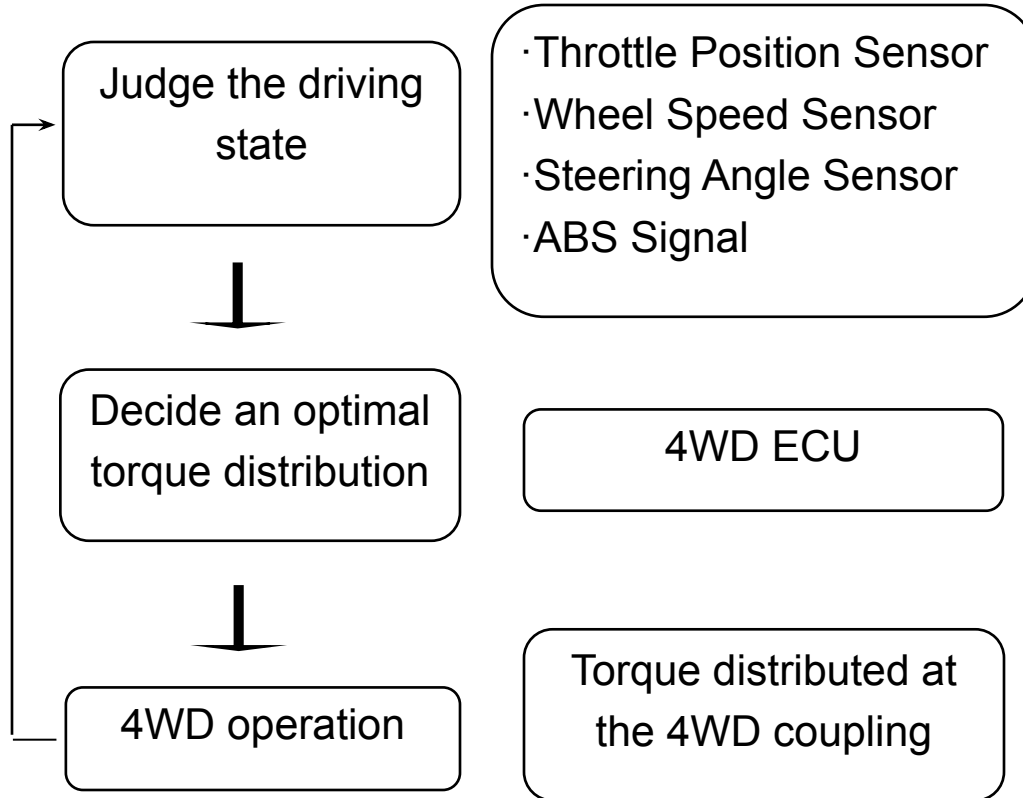


Back Plate

To rear differential

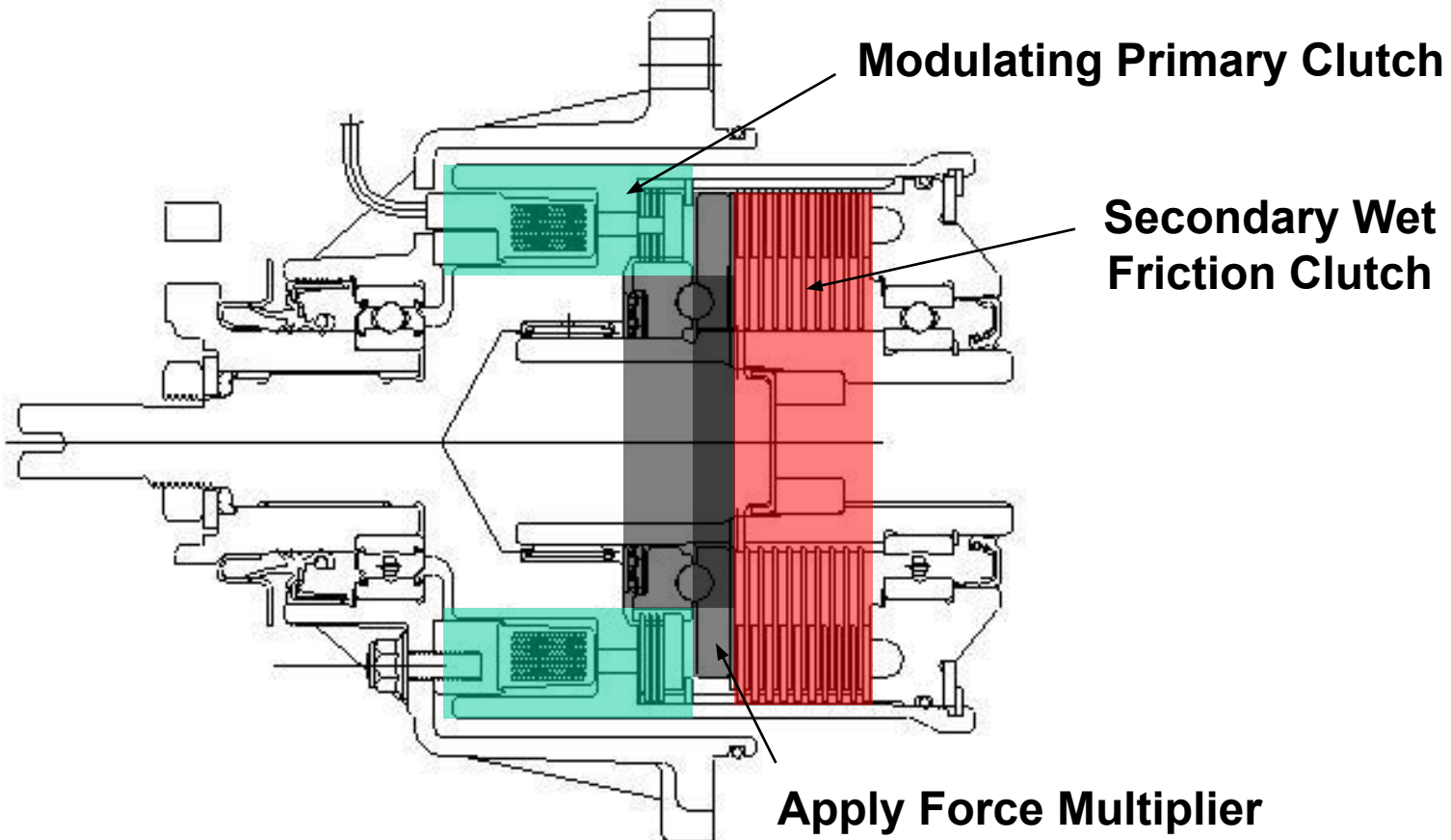


EMC connector

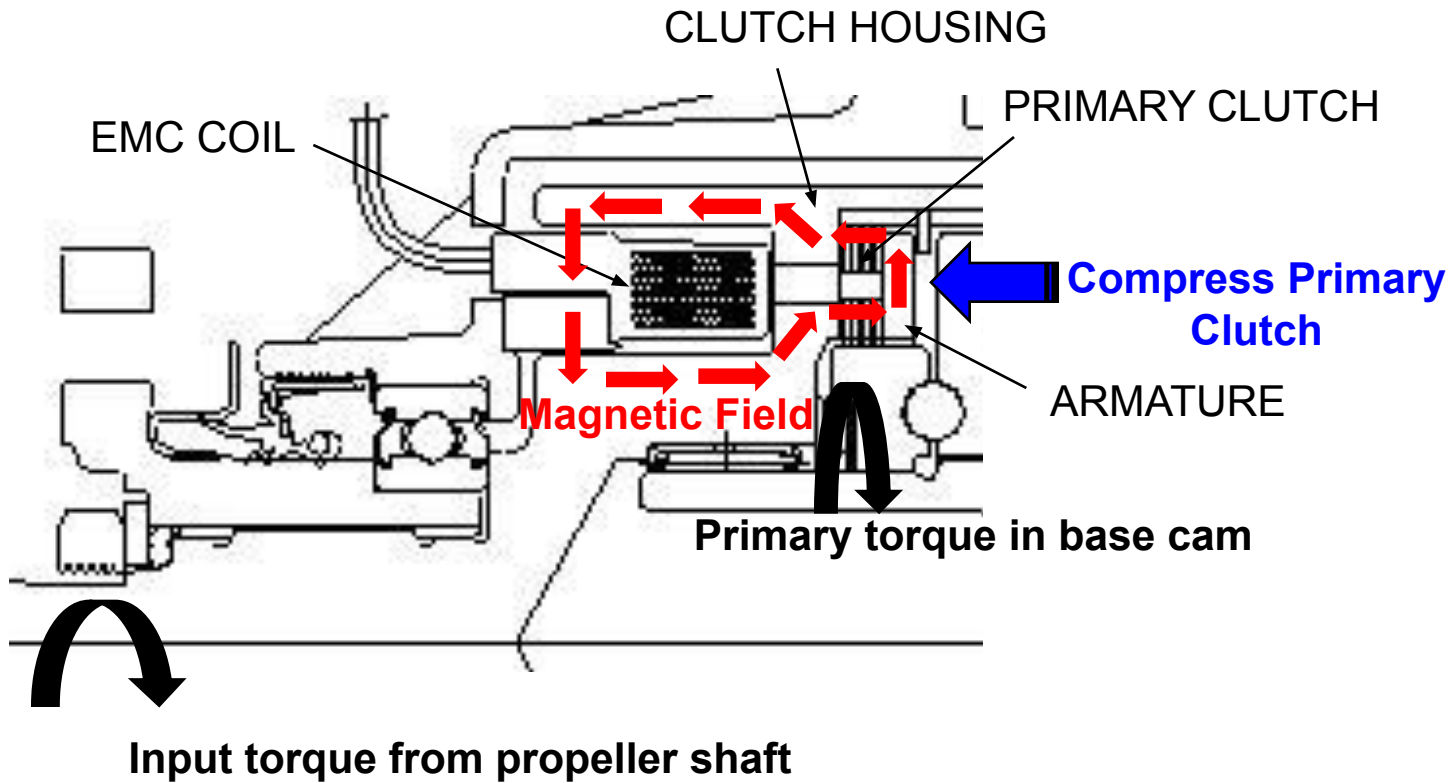


[Operating Chart]

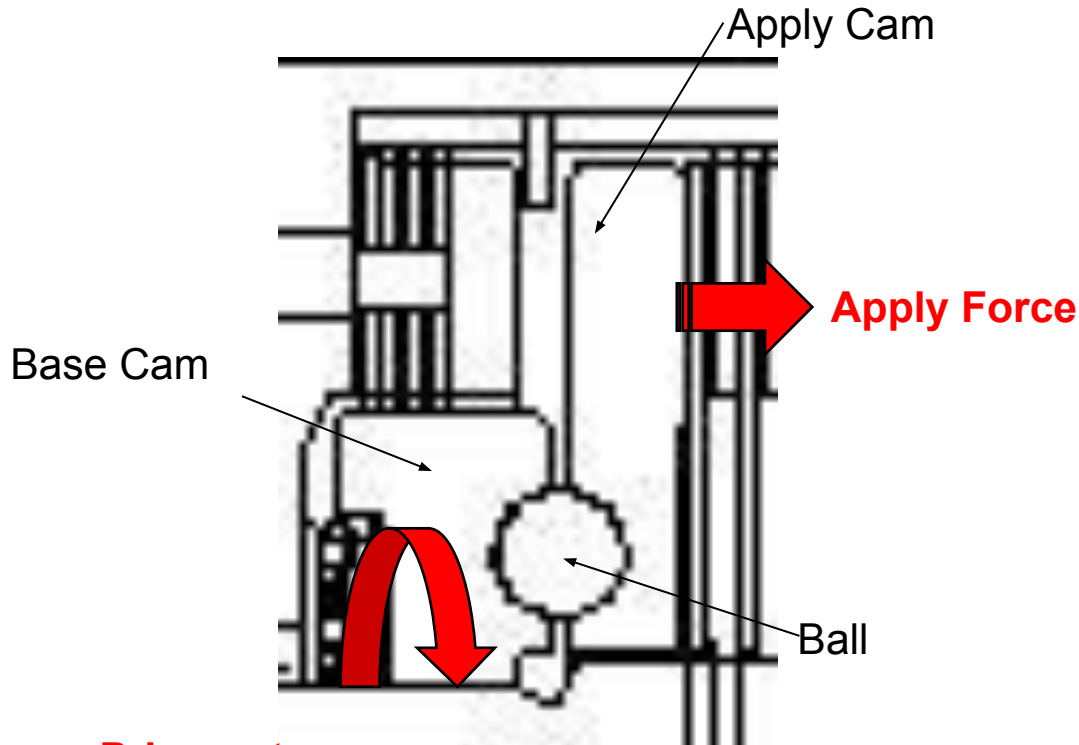
SECTION VIEW



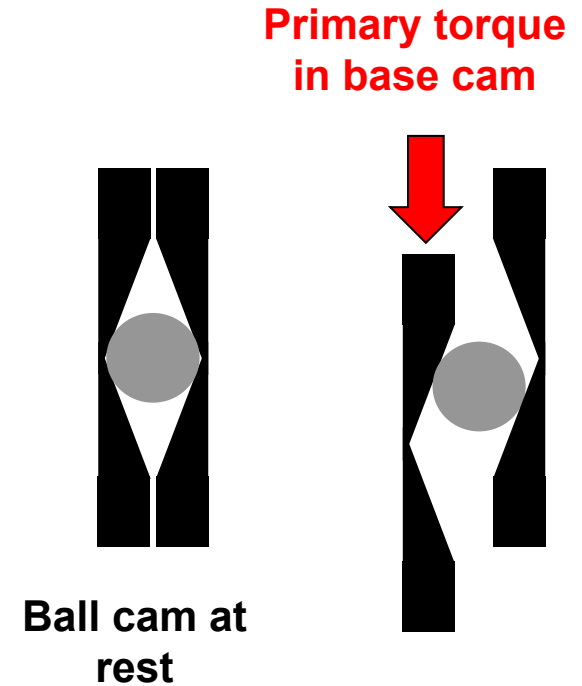
MODULATING PRIMARY CLUTCH



APPLY FORCE AMPLIFIER



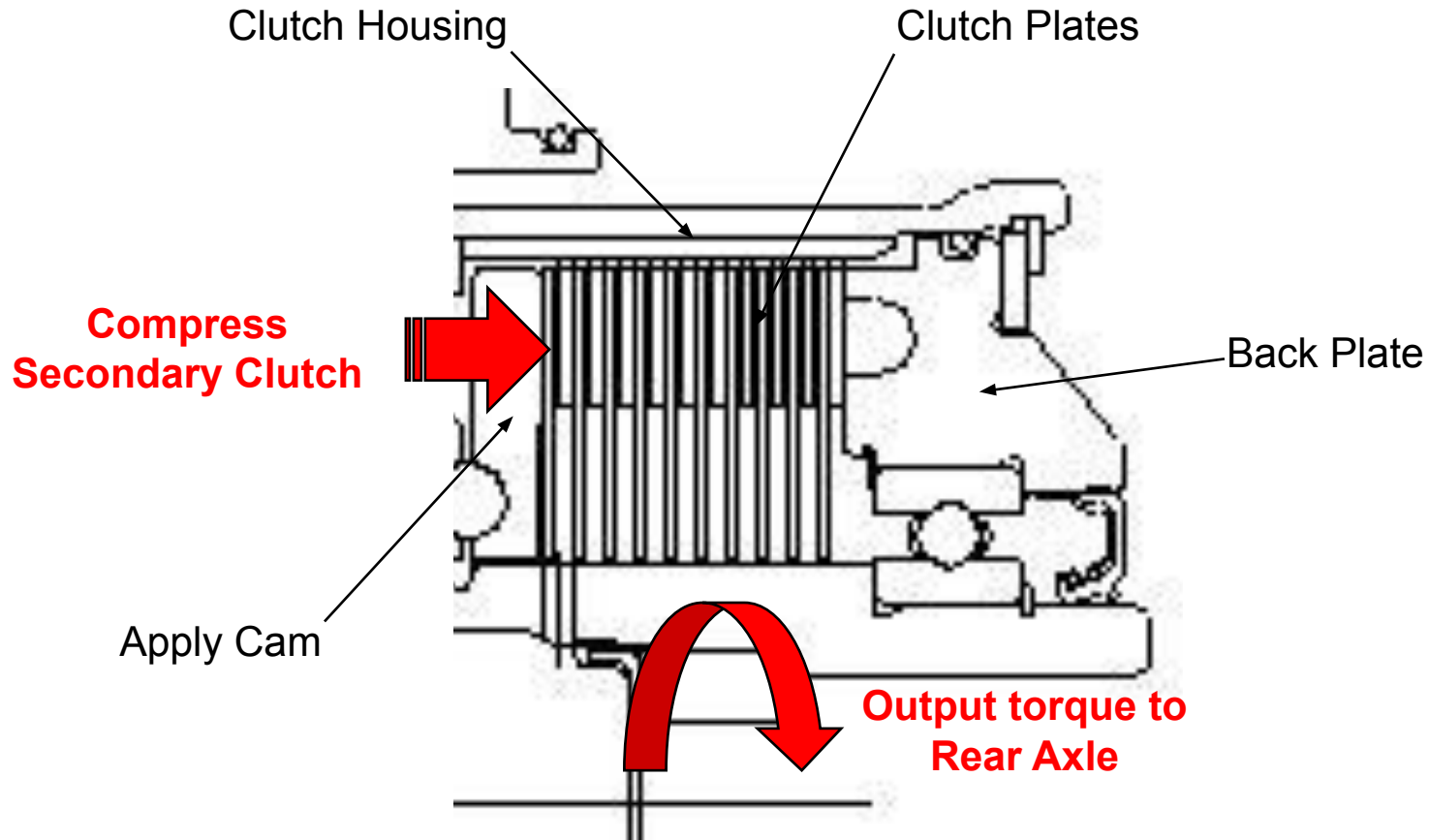
**Primary torque
in base cam**



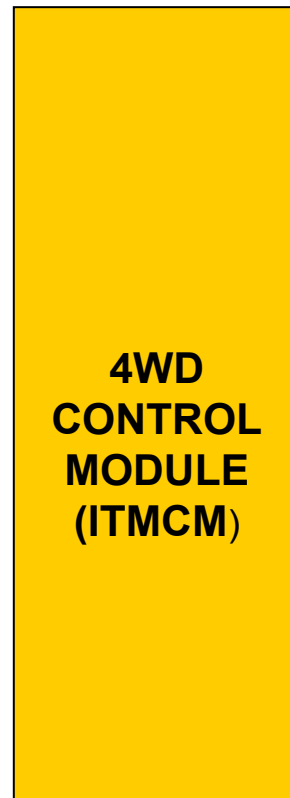
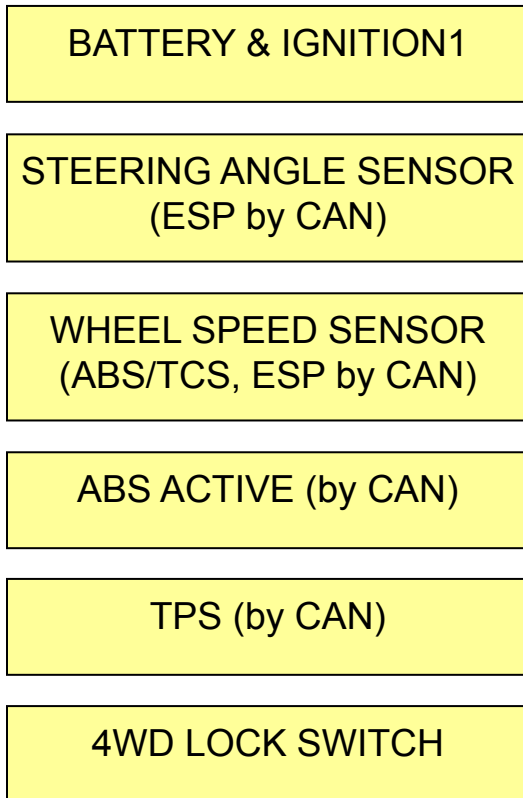
**Ball cam at
rest**

**Primary torque
in base cam**

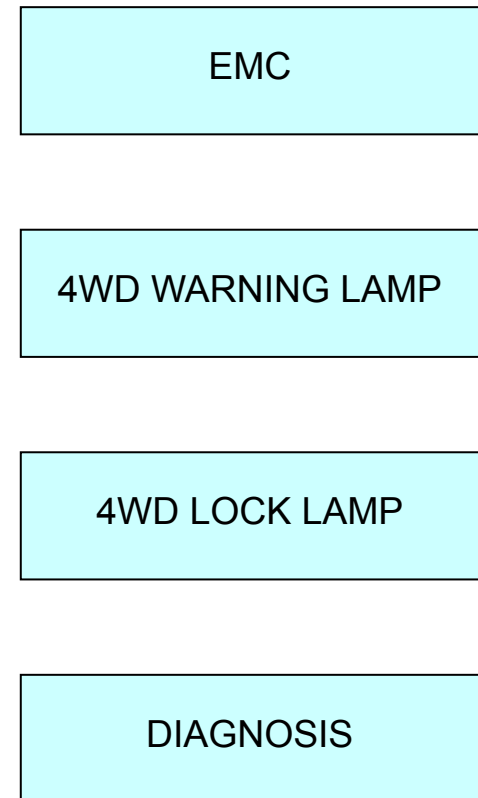
DARY WET FRICTION CLUTCH



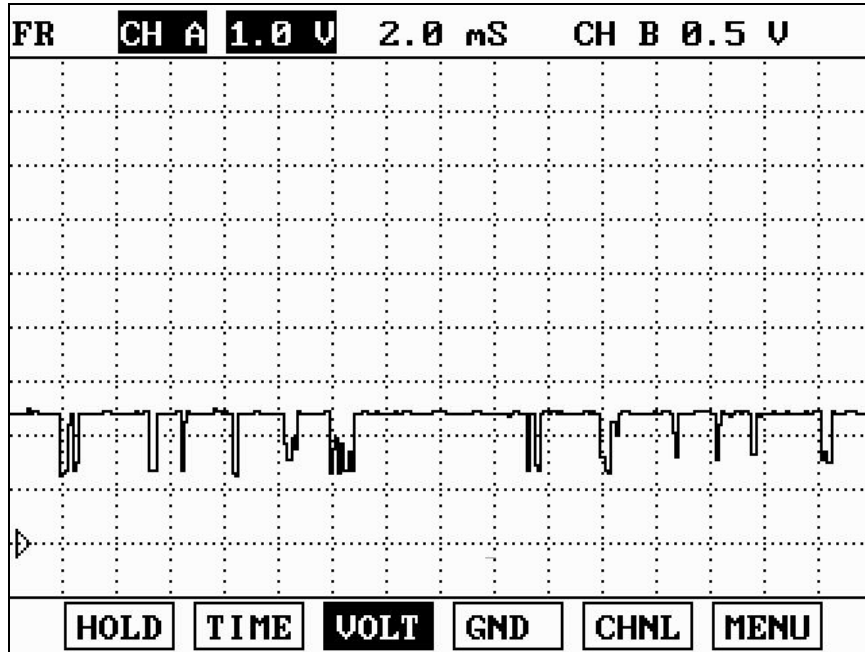
INPUTS



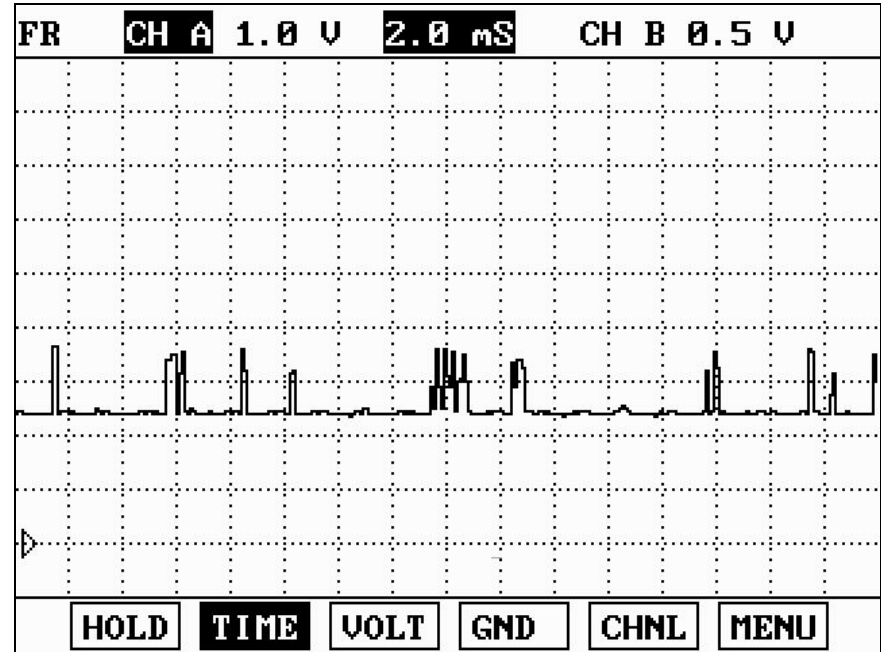
OUTPUTS



OUTPUT SIGNAL



[CAN-LOW]

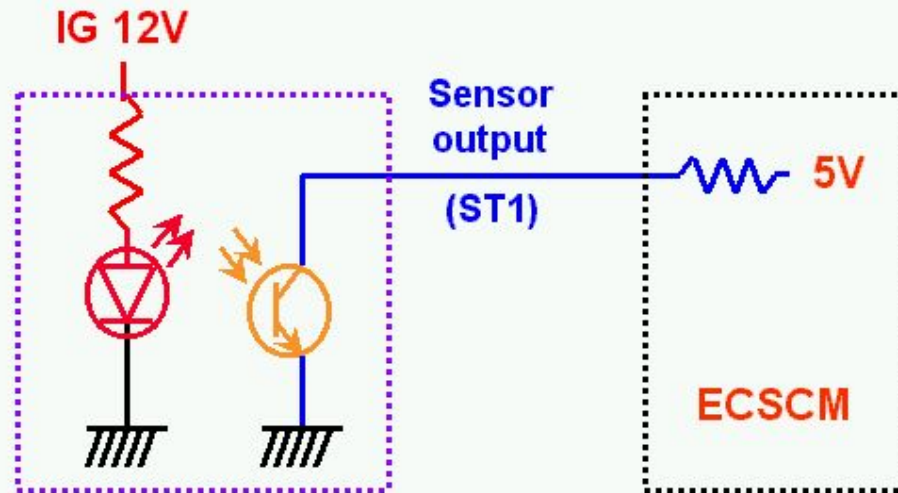
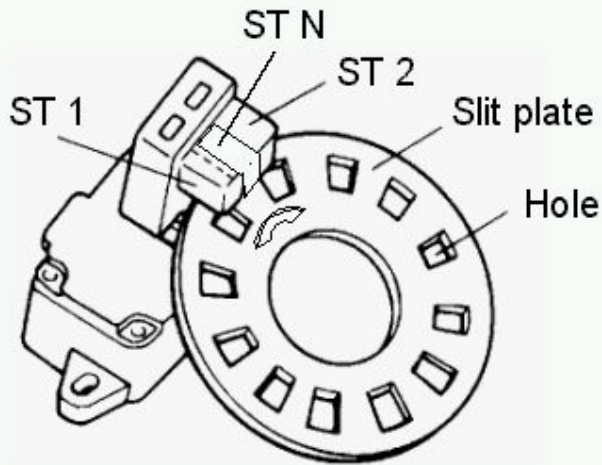


[CAN-HIGH]



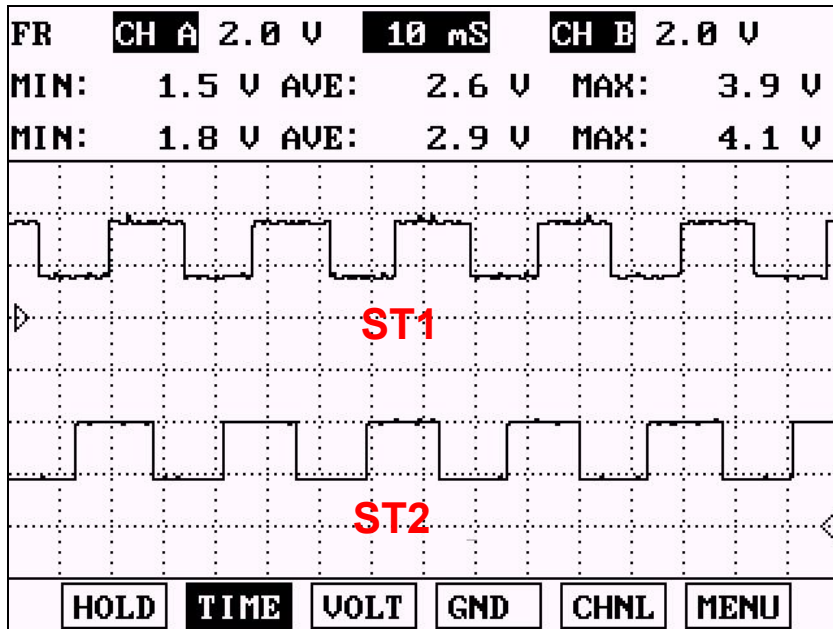
Application

- Location: Inside steering wheel
- Calculate the steering amount and direction
- 3 Input Signals (ST 1, ST 2, ST N)
- ST N detects the neutral position of steering wheel
- Output voltage : $1.3 \leq V_{OL} \leq 2.0V$, $3.0 \leq V_{OH} \leq 4.1V$

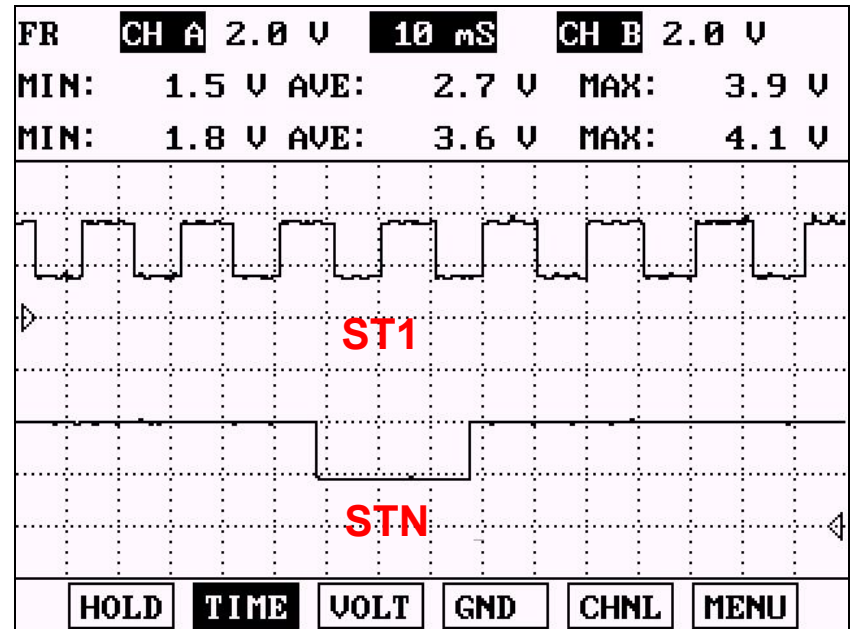


If ESP is adopted, SAS data is shared from ESP through Can communication.

OUTPUT SIGNAL



[Steering sensor output, ST1/ST2]



[Steering sensor output, ST1/STN]



- Type: Hall Effect
- Components: HALL IC, Capacitor, Magnet
- Output signal: Digital (Open Collector Type circuit integrated)
- Good characteristics against temperature variation and noise
- Low RPM Detection: 0 RPM can be detected
- Air gap sensitivity: stable output pulse width against air-gap change
- Supplying power: DC 12V

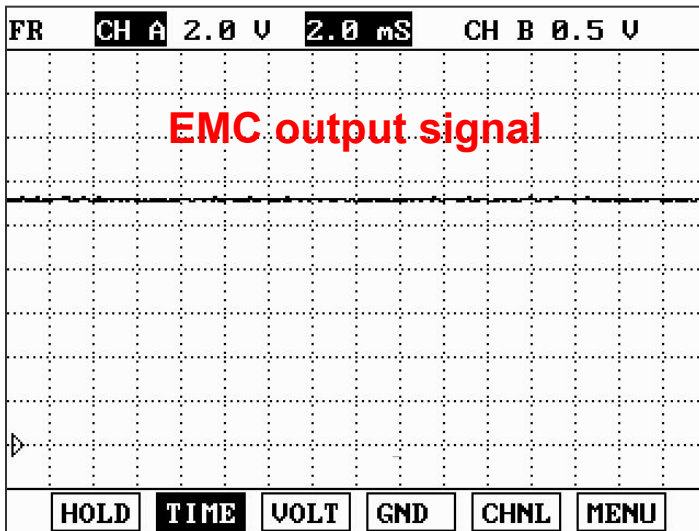
OUTPUT SIGNAL		MAX	TYPICAL	MIN
LOWER SIGNAL	I_{LOW} (mA)	5.9	7	8.4
UPPER SIGNAL	I_{HIGH} (mA)	11.8	14	16.8
SIGNAL RATIO	I_{HIGH} / I_{LOW}	1.85 or more		
OPERATING FREQUENCY		1 ~ 2500 Hz		
OPERATING DUTY		30~70%		



[4WD LOCK Switch]



[4WD LOCK Lamp]



[When '4WD LOCK' is selected]

This switch is selected 4WD LOCK lamp comes on. The ITMCM applies maximum current to the EMC resulting in 50 to 50 torque distribution.

Is there any speed limitation with '4WD LOCK' mode?

Yes, there is.

The maximum current flows until 35 km/h.

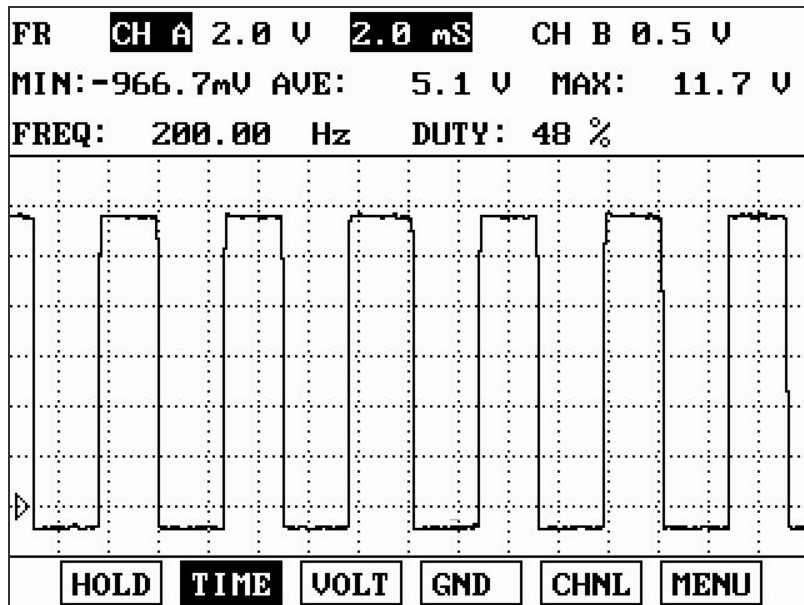
When the vehicle speed is over 35 km/h, ITMCM controls the EMC current on the duty basis. Even so, '4WD LOCK' lamp still remains on at the moment. When the vehicle speed comes down under 35km/h, the EMC current comes back to the battery voltage.

Is the ESP operation available at the '4WD LOCK' mode?

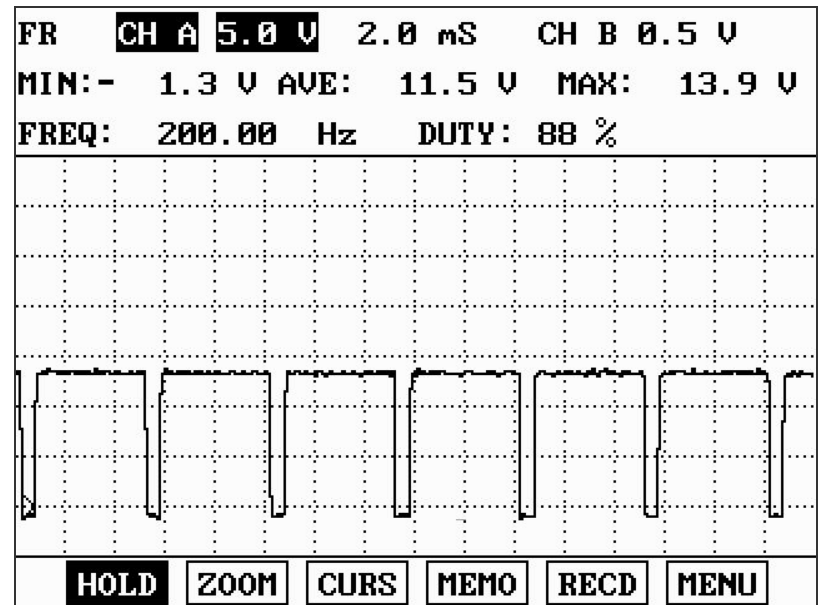
Yes, ESP function operates as normal.

The ITMCM varies the applied current to the EMC to make a torque distribution to the rear wheels.

The EMC current increases then the magnetic force increases. Stronger magnetic force results in higher pressing force to secondary clutch.



[IG ON, with WOT]



[Maximum duty ratio]

4WD warning lamp blinks (2Hz) when a system failure is detected.



FAILSAFE

Input	Error Description	Diagnostic	Diagnostic Lamp	Clearing Strategy
TPS	Loss of signal Out of range	P1726	Blinking	Active P-code cleared error is removed after 1 second
Error Strategy	A fault code from the CAN Bus, Signal lost for 1 sec. Fault code stored in memory			
ECU Action	TPS=0, The ITMCM will not send current to the clutch coil.			

FAILSAFE

Input	Error Description	Diagnostic	Diagnostic Lamp	Clearing Strategy
Steer_1	Loss of signal Out of range	P1717	Blinking	Active P-code cleared if error is removed after 1 second
Steer_2	Loss of signal Out of range	P1718	Blinking	
Steer-C	Loss of signal Out of range	P1719	Blinking	
Error Strategy	Out of Range Signal : Voltage \geq 4.5 vdc for greater than 1 second			
ECU Action	Steering Wheel Sensor input=0. The ITMCM will not send current to the clutch coil.			

FAILSAFE

Input	Error Description	Diagnostic	Diagnostic Lamp	Clearing Strategy
FLSS	Loss of signal	P1750	Blinking	Fault cleared at ignition cycle reset. P-code stored, and erased by K-Line tool
FRSS		P1751		
RLSS		P1752		
RRSS		P1753		
Error Strategy	Measure individual wheel, if speed difference is 30kph for 30 seconds fault code will be set. Ignition cycle reset			
ECU Action	Speed sensor error will turn ITM off. ITM will not have output			

FAILSAFE

Input	Error Description	Diagnostic	Diagnostic Lamp	Clearing Strategy
C.A.N	ECM-ITMCM Communication Line, or ECM side malfunction	P1764	Blinking	Active P-code cleared if error is removed
Error Strategy	Loss of the following signals TPS, Transmission type.			
ECU Action	The ITMCM will not send current to the clutch coil.			
C.A.N	TCSCM-ITMCM CAN Line, or ECM side malfunction	P1765	Blinking	Active P-code cleared if error is removed
Error Strategy	Loss of the following signals Wheel Speed No signal for greater than 1 second, and a fault will be set.			
ECU Action	Speed sensor error will turn ITM off. ITM will not have output			

FAILSAFE

Input	Error Description	Diagnostic	Diagnostic Lamp	Clearing Strategy
EMC	Short/Open to Battery	P1728	Blinking	Same as Speed sensor fault
	Short to Grid	P1729		
Error Strategy	25 occurrences in a row mature			
ECU action	EMC Error will turn ITM off. The ITMCM will not send current to the clutch coil			

PIN ASSIGNMENT

Pin No.	44-50-000-093-a (95447-39980, CBS)	44-50-000-094-a (95447-39982, ABS/TCS)	44-50-000-095-a (99447-39984, ESP)
1	EMC GND	EMC GND	EMC GND
2	STEERING REF GND	STEERING REF GND	
3	STEERING REF C	STEERING REF C	
4	4WD LOCK SWITCH INPUT	4WD LOCK SWITCH INPUT	4WD LOCK SWITCH INPUT
5	RRSS GND RTN		
6	RLSS GND RTN		
7	FRSS GND RTN		
8	FLSS GND RTN		
9	CAN H	CAN H	CAN H
10	CAN L	CAN L	CAN L
11	ITMCM GROUND	ITMCM GROUND	ITMCM GROUND
12			

PIN ASSIGNMENT

Pin No.	44-50-000-093-a (95447-39980, CBS)	44-50-000-094-a (95447-39982, ABS/TCS)	44-50-000-095-a (99447-39984, ESP)
13	BATTERY INPUT	BATTERY INPUT	BATTERY INPUT
14	EMC OUTPUT	EMC OUTPUT	EMC OUTPUT
15	STEERING REF 5V	STEERING REF 5V	
16	STEERING 2 INPUT	STEERING 2 INPUT	
17	STEERING 1 INPUT	STEERING 1 INPUT	
18			
19	4WD WARNING LAMP	4WD WARNING LAMP	4WD WARNING LAMP
20	RR SPEED SENSOR		
21	RL SPEED SENSOR		
22	FR SPEED SENSOR		
23	FL SPEED SENSOR		
24	4WD LOCK LAMP	4WD LOCK LAMP	4WD LOCK LAMP
25	IGNITION INPUT	IGNITION INPUT	IGNITION INPUT
26	K LINE	K LINE	K LINE