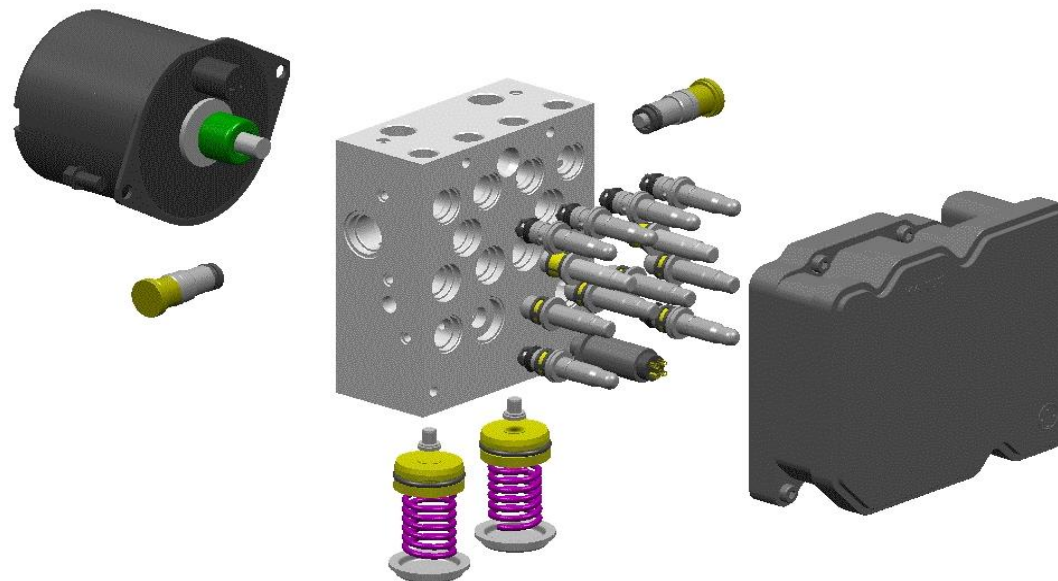




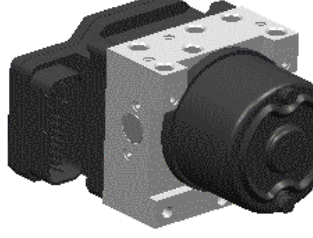
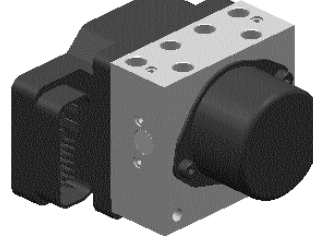
# ESP (MGH-40)




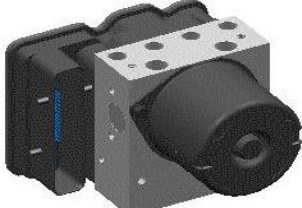







## Application

<b>Area System</b>	<b>General</b>	<b>Middle East</b>	<b>Europe</b>	<b>Aus.</b>
<b>ABS</b>	<b>Option</b>	<b>Option</b>	<b>Option</b>	<b>Option</b>
<b>ESP</b>	<b>-</b>	<b>-</b>	<b>Option</b>	<b>-</b>

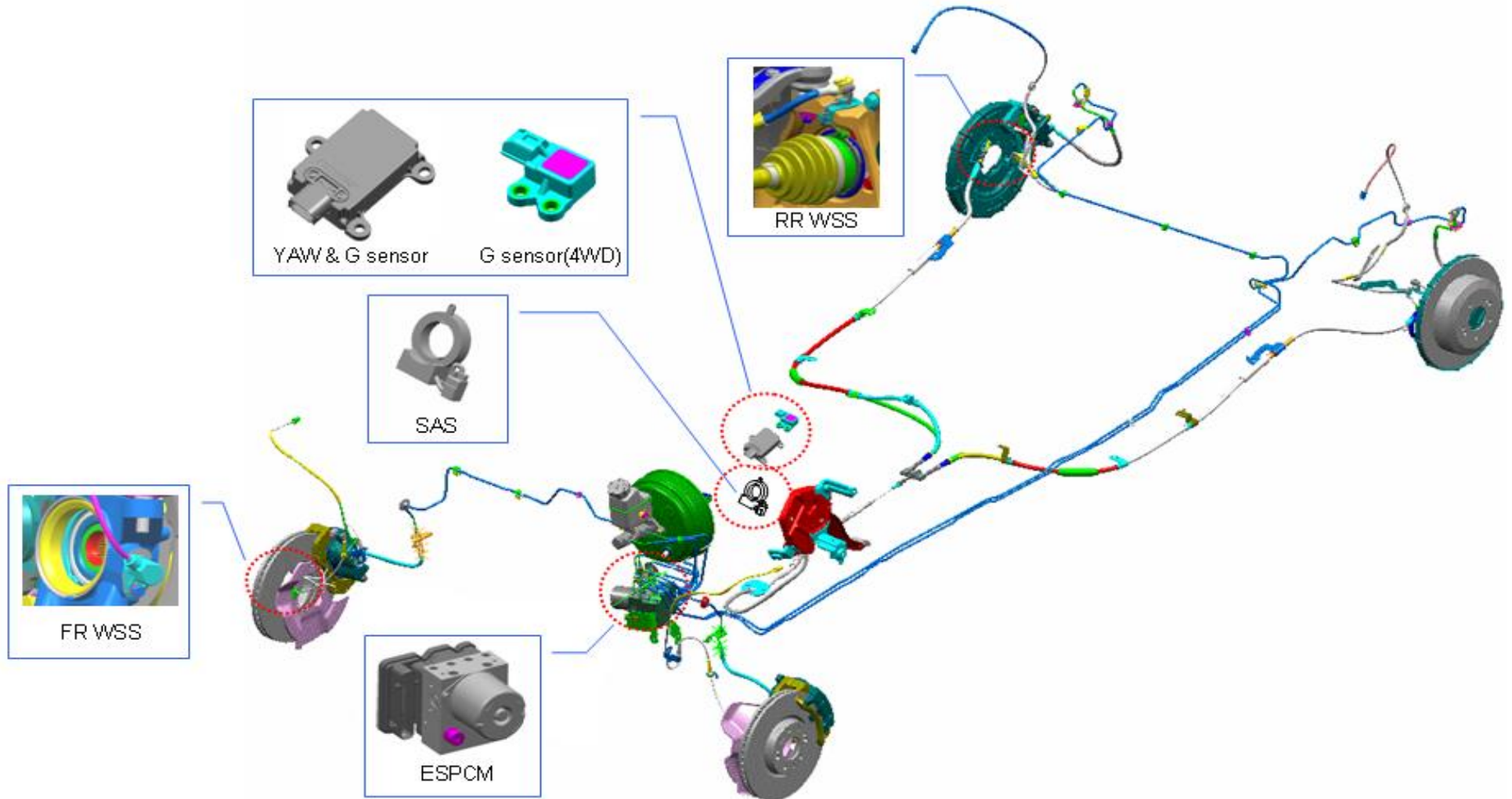
## Comparison

Item	MGH 10	MGH 20	MGH 25	MGH 40
Model				
Application	LC, XD, SM	GK, FC	JM	EN, TQ
MP year	1999 (ABS) 2000 (TCS)	2001 (TCS)	2003 (ABS) 2004 (ESP)	Aug. 2006 (ESP)
Key Points	On-Off valve control		LFC + MSC + PBA + MIRC LFC: Linear flow control MSC: Motor speed control PBA: Panic brake assist MIRC: Modified independent rear control	LFC + MSC + PBA + MIRC + ROP ROP: Roll over prevention

## Comparison

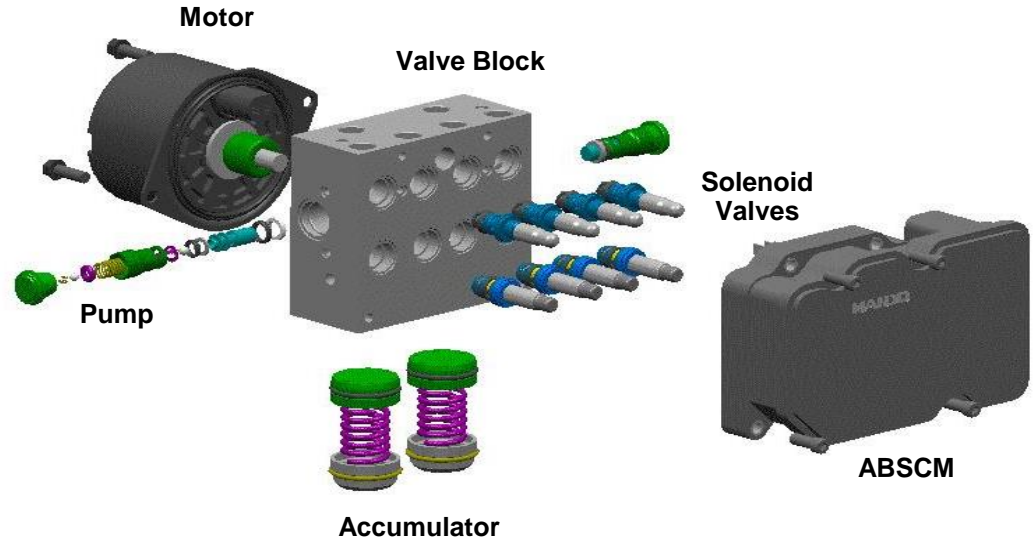
Items	ABS	ESP
HECU Assembly		
Wheel speed sensor		
Yaw & lateral G-sensor	-	
Pressure sensor	-	 <i>Built in type</i>
Steering angle sensor	-	
Longitudinal G-sensor		

## ESP Components

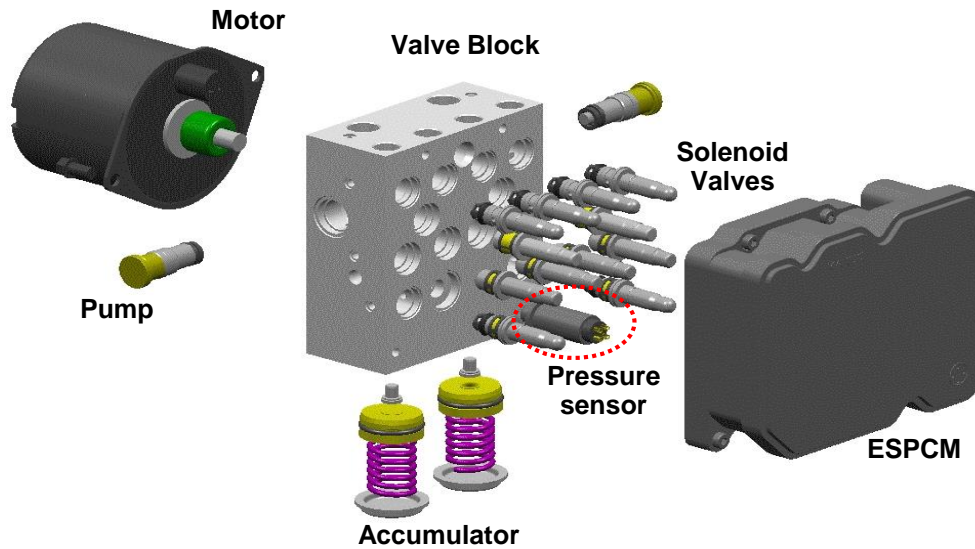


## Components of HECU

### MGH-40 ABS

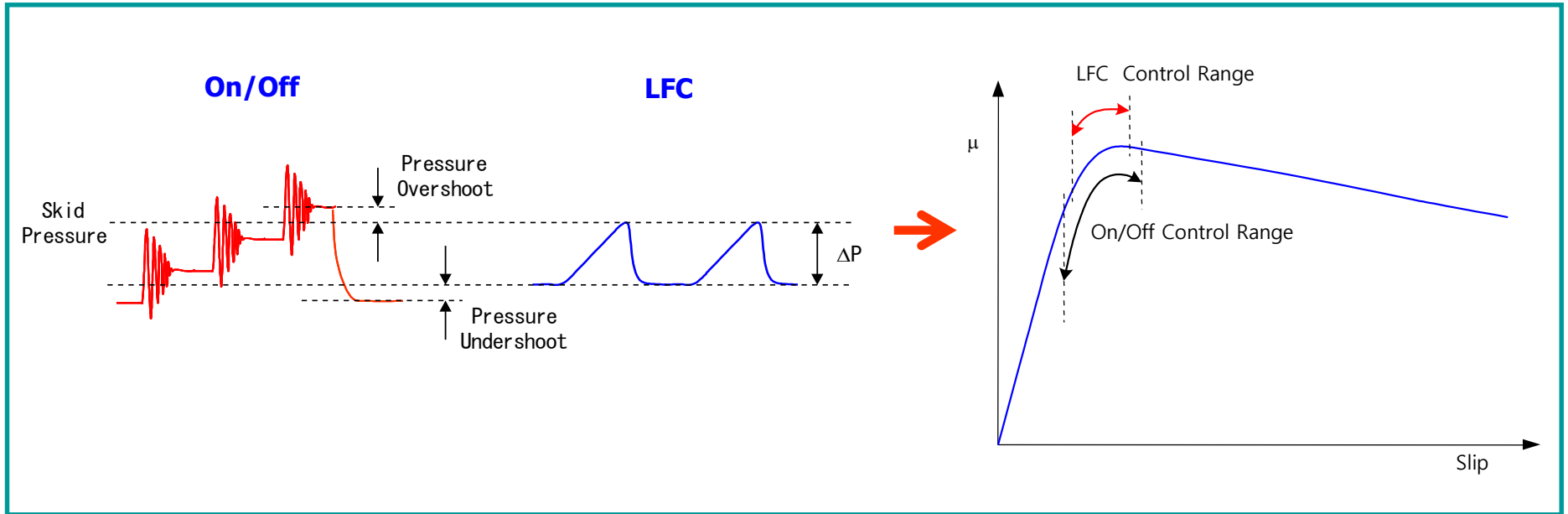


### MGH-40 ESP



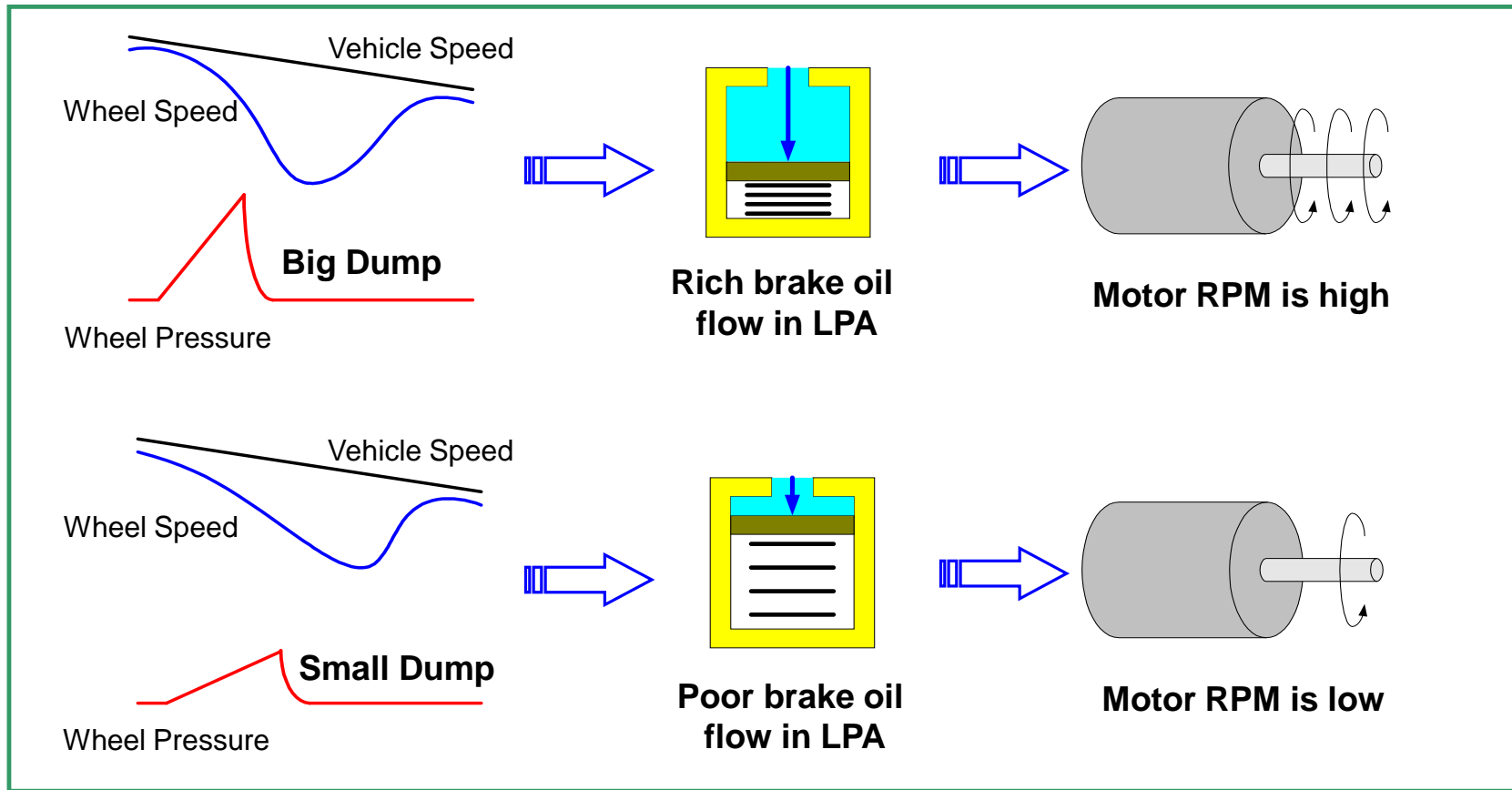
## Features

### LFC (Linear Flow Control)



## Features

### MSC (Motor Speed Control)

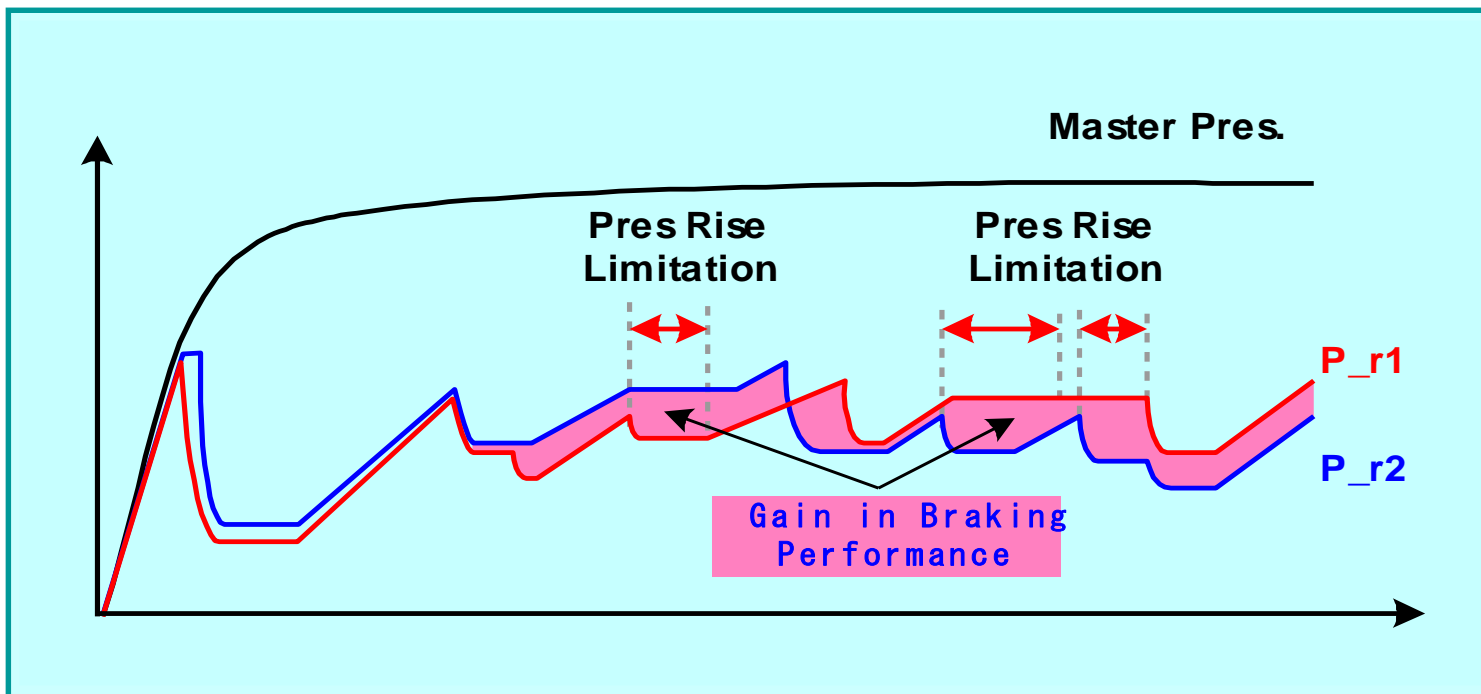




## Features

### MIRC (Modified Independent Rear Control)

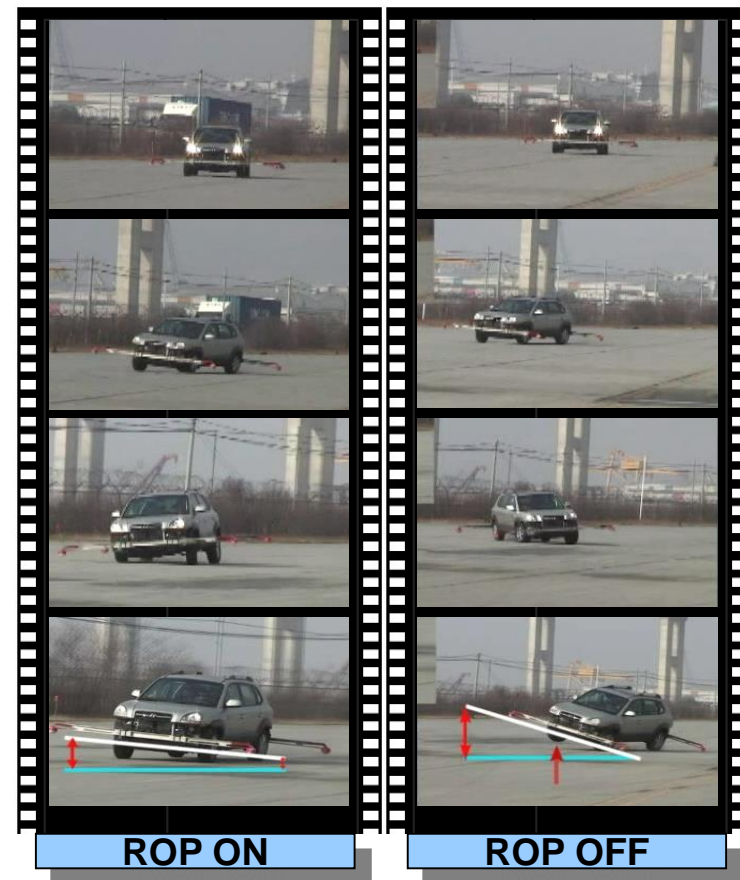
- Enhancement of braking performance
- Independent pressure control according to rear wheel movement  
(for the vehicle safety, the control is limited : pressure difference RR vs. RL is less than 20 bar)
- Application : ABS, ESP



## Features

### ROP (Roll Over Prevention)

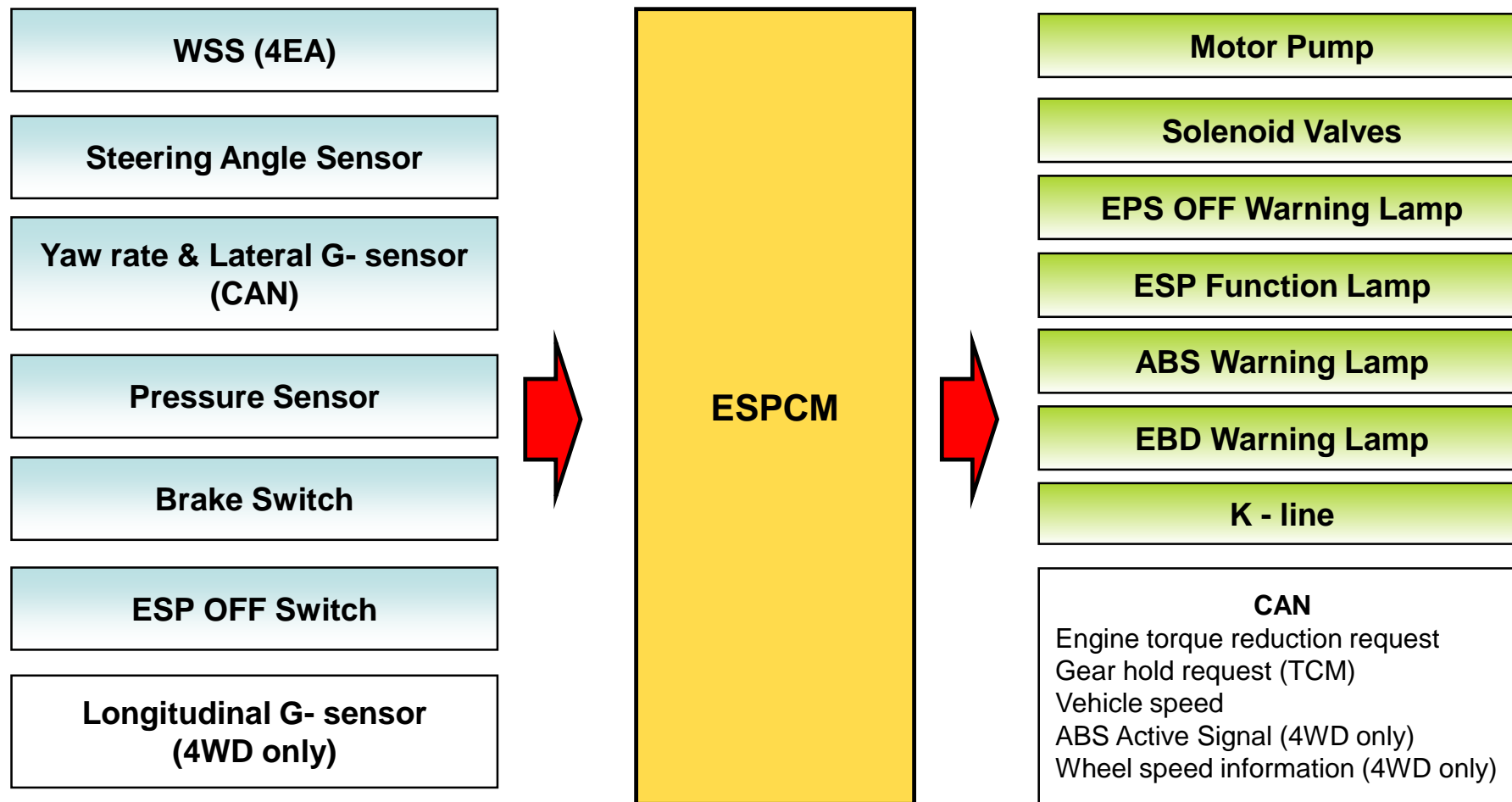
- Prevention of vehicle roll-over
- Extended logic of ESP
- Function inhibited when ESP OFF switch ON
- Input : yaw rate, lateral G
- Output : brake control, engine torque control
- Application : ESP



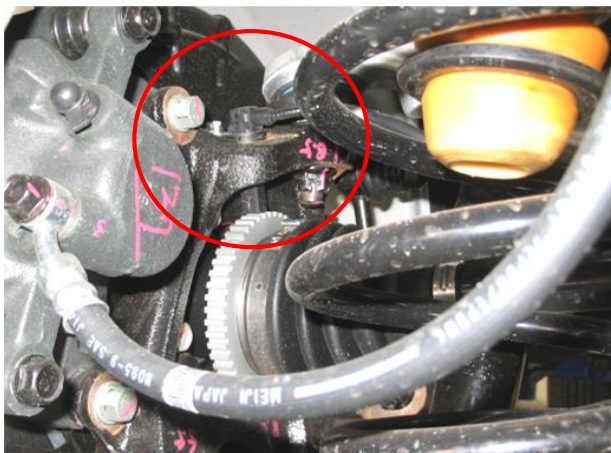
- Test vehicle: TUCSON
- Test condition
  - on the dry asphalt
  - vehicle speed : 120~180km/h

## Inputs & Outputs

### MGH-40 ESP



## Active Wheel Speed Sensor



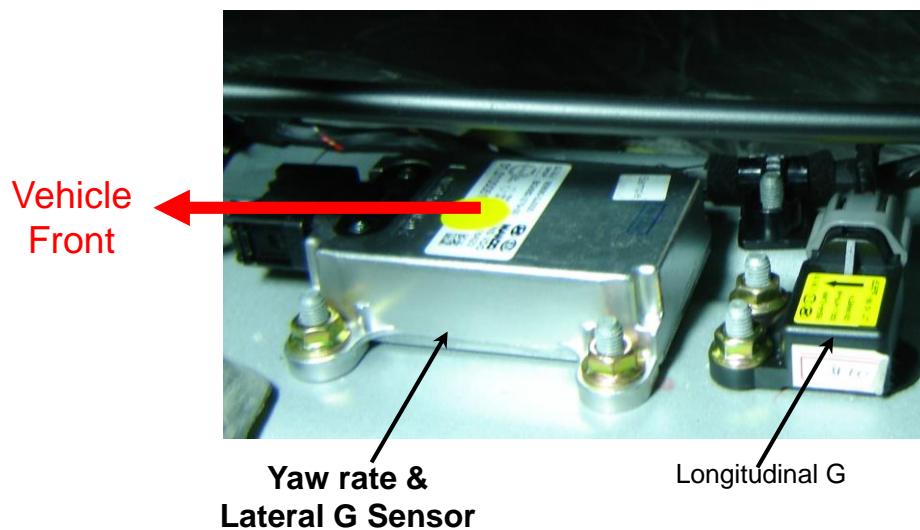
- Type: Active type (Hall effect)
- Power supply: 12V
- Air gap: 0.2~2.0mm
- Frequency: 1~2,500Hz
- Possible to detect 0km/h
- Not sensitive to the noise and air gap.

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%		

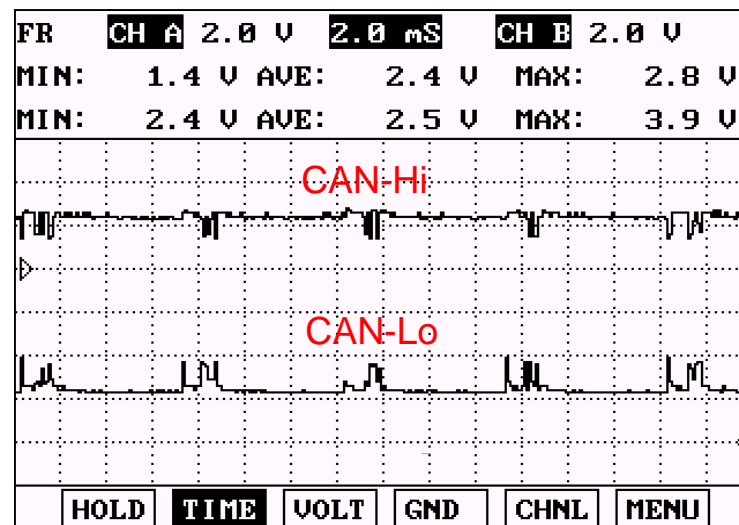
## Yaw rate & Lateral G-Sensor



- Power supply: 6.5~18V
- **Signal output: CAN interface**
- G sensor : -1.5~1.5g
- Yaw sensor: -75~75°/sec



[Location]

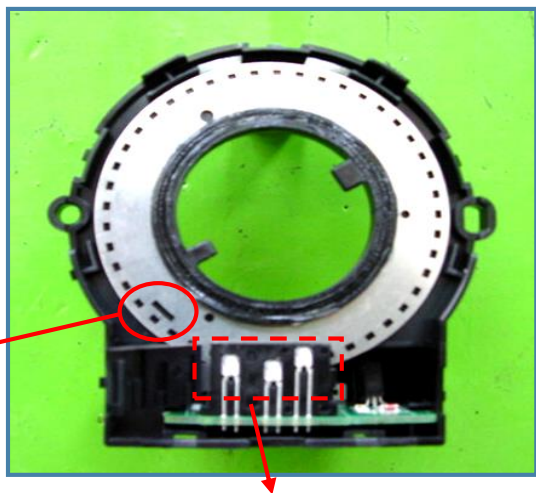


[Output Signal]

## Steering Angle Sensor



- 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



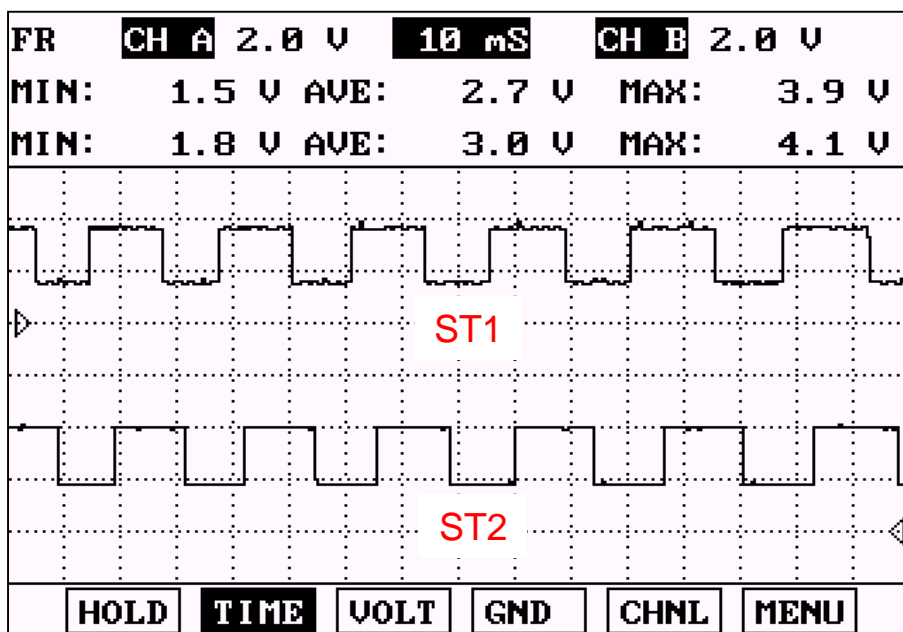
STN

Photo diode (ST1, ST2, STN)

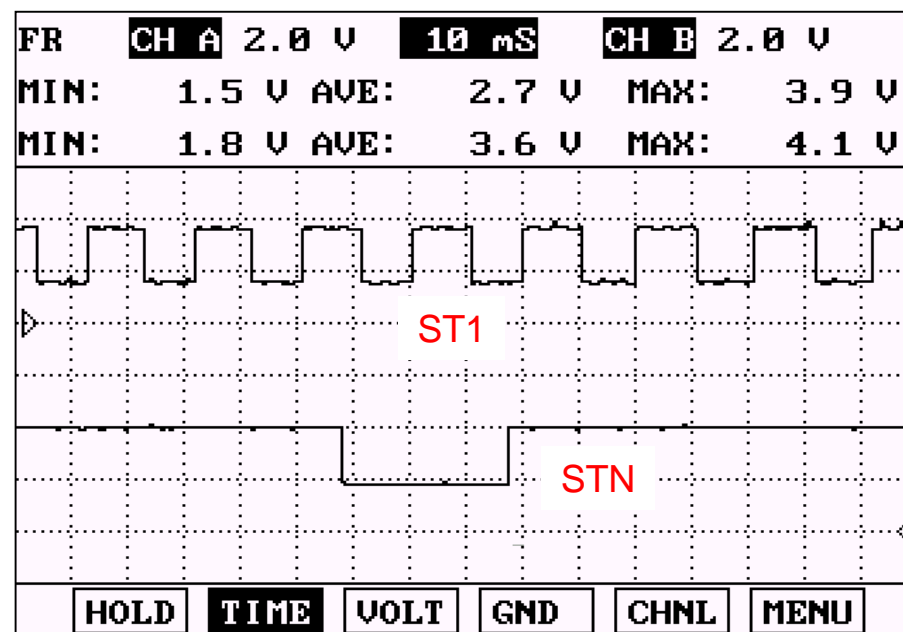
- Sensor type : Photo interrupt type
- Sensor output type : Open Collector Type
- Output pulse quantity : 45 pulse  
(Pulse cycle 8°)
- Supply voltage : !IGN1 (8~16V)
- Output voltage :  $1.3 \leq V_{OL} \leq 2.0V$ ,  
 $3.0 \leq V_{OH} \leq 4.1V$

## Steering Angle Sensor

Output signal



[ST1, ST2]



[ST1, STN]

## Diagnosis & Troubleshooting

### Checking procedure before diagnosis

Before diagnosis with a scan tool, confirm the operation of warning lamps is normal.

Turn the IG key OFF → ON,

1. If ABS/EBD/ESP OFF lamps turn on for 3 seconds and turn off  
: warning lamps and ABS/ESP systems are okay]
2. If ABS/EBD/ESP OFF lamps stay off
  - ① Remove the ABS/ESP Connector.
  - ② IG key ON
  - ③ ABS/EBD stays off → warning lamp circuit error → check the cluster & wiring
  - ④ ABS/EBD stays on → warning lamp circuit normal, ABS error → diagnosis with HI-SCAN

### Caution during vehicle service

1. Remove the ABS/ESP connector before ECM or TCM work.  
(if not, CAN related DTCs will be memorized on the ESPCM)
2. Before Remove the connectors, turn the ignition off.



## Diagnosis & Troubleshooting

### Motor/Valve/Fuse check

Error Code	Fault Type	Cause	Checking Procedure
C2402	Motor Short to BAT/GND	Power supply	1. Check the motor power (BATT2) and fuse/wiring (10~16V) 2. Check the Chassis GND & ESPCM GND : less than 10mΩ 3. Drives over 20kph → Warning lamp ON → check 1 → Okay → <b>Replace the HECU</b>
	Motor Open	Motor fuse	
	Motor Fuse Open	Defected motor	
	Motor Lock		
C2112	Valve Relay Open/Short	Power supply	1. Check the valve relay power (BATT1) and fuse/wiring (10~16V) 2. Check the Chassis GND & ESPCM GND : less than 10mΩ
	Fuse Open	Valve Relay Fuse	
C2380	Open/Short Leakage Current	Solenoid Valve	

## Diagnosis & Troubleshooting

### CAN check

Error Code	Fault Type	Cause	Checking Procedure
C1616	CAN Bus OFF	CAN BUS	<ol style="list-style-type: none"> <li>1. Check the resistance between the CAN High and the CAN Low (Normal : 60 Ω)</li> <li>2. If the resistance is abnormal check the wiring condition</li> </ol>
C1611 C1612	Message Timeout	No ECM message No TCM Message	<ol style="list-style-type: none"> <li>1. Check the ECM and TCM connectors and wiring condition</li> <li>2. Check if there are CAN related DTCs from ECM &amp; TCM</li> <li>3. Read the CAN data from TCM current data with HI-SCAN</li> </ol>
C1605	CAN H/W Fail	CAN H/W Error	<ol style="list-style-type: none"> <li>1. Replace the HECU.</li> </ol>

## Diagnosis & Troubleshooting

### Pressure sensor check

Error Code	Fault Type	Cause	Checking Procedure
C1235	Sensor Open/Short	Sensor circuit	1. Replace the HECU.
C1237	Sensor Signal Error	Sensor	1. Check if the brake light switch & brake switch & wiring is normal 2. If okay, replace the HECU.

## Diagnosis & Troubleshooting

### Yaw rate & Lateral G sensor

Error Code	Fault Type	Case	Checking Procedure
C1644	Sensor CAN BUS OFF	CAN BUS	<ol style="list-style-type: none"> <li>1. Check the resistance between the CAN High and the CAN Low (Normal : 60 Ω)</li> <li>2. If the resistance is abnormal check the wiring condition</li> </ol>
C1643	Sensor CAN Message Timeout	Sensor CAN Message	<ol style="list-style-type: none"> <li>1. Check Sensor connector &amp; wiring</li> <li>2. Check the CAN signal</li> <li>3. If the CAN signal is okay but problems occurs <b>replace the sensor</b></li> </ol>
C1283	Abnormal Signal	Offset, Noise Stick	<ol style="list-style-type: none"> <li>1. Check Sensor connector &amp; wiring</li> <li>2. Check if sensor installation is okay.</li> <li>3. Remove the sensor mounting bolts and IG on. Move the sensor and read the current data of HI-SCAN.</li> <li>4. If problem occurs, <b>replace the sensor</b></li> </ol>
C1647	Sensor CAN H/W Fail	Sensor CAN H/W	<b>Replace the sensor</b>
C1282	CBIT Fail	Sensor Self Test Error	<b>Replace the sensor</b>