

### Component Location



### General Description

The yaw-rate sensor and later G sensor is installed on the lower floor.

The yaw-rate sensor detects acceleration of the vehicle around its vertical axis, while the G sensor detects lateral acceleration of the vehicle.

When the vehicle is not moving, the G sensor output is approximately 2.5V.

### DTC Description

A lateral acceleration reference signal is calculated from the wheel speeds, the steering angle and the yaw rate signals to observe the lateral acceleration sensor signal.

The difference between the reference signal and the sensor signal is evaluated for failure detection.

A yaw rate reference signal is calculated from the wheel speeds, the steering angle and the lateral acceleration signals to observe the yaw rate sensor signal.

The difference between the reference signal and the sensor signal, and the gradient of the measured sensor signal is evaluated for the failure detection.

If the difference between estimated value and measured value of the sensor is larger than predefined value for predefined time, the failure is recognized. Also impossible signal according to sensor characteristic is detected the failure is recognized.

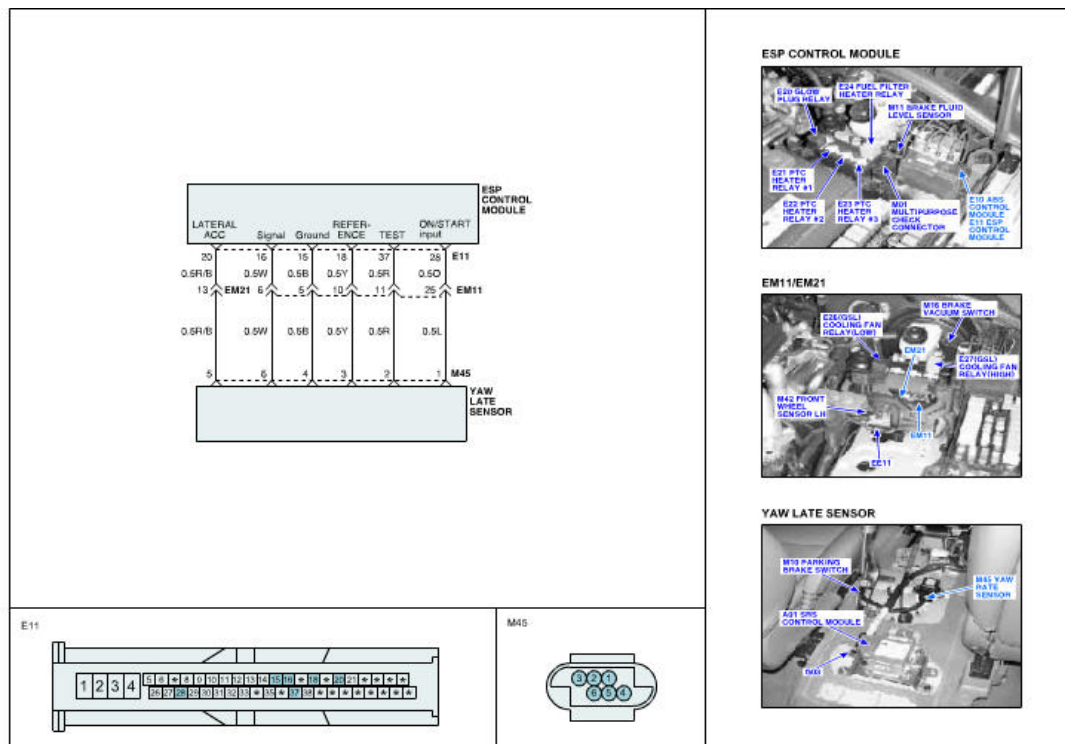
### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		Signal Monitoring	
Case 1	Monitoring Period	Continuous (during stable driving)	
	Enable Conditions	<p>By building a reference lateral G from the yaw-rate sensor, wheel speed sensor and the SAS it is possible to test the lateral G Signal on plausibility. If during stable vehicle behavior an lateral G Failure larger than approximately 2.5 m/s<sup>2</sup> occurs, the ESP controller will disregard the later G sensor information so that a false ESP intervention is prevented. A fault is recognized after 1.6 s during model validity.</p> <p>The measured and offset compensated yaw rate signal is compared to the reference yaw rate signal calculated from yaw rate sensor, lateral G sensor, SAS and wheel speed sensor. If the measured yaw rate deviates more than 2.5 °/s plus a dynamic threshold from the reference yaw rate during model validity, a failure is recognized after 1.6 s. The dynamic threshold is between 2.5 °/s and more than 5°/s. A typical value is 3°/s.</p> <p>- During the possibility to observe the recognition time depends on the amount of failure.</p>	

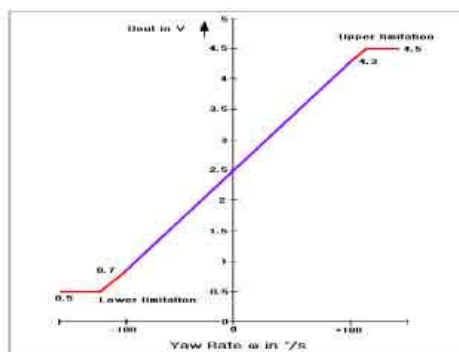
Case 2	Monitoring Period	Continuous (during driving)	<p>Faulty Yaw Rate &amp; Lateral G sensor</p> <p>Open or short of Yaw Rate &amp; Lateral G sensor</p>
	Enable Conditions	During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered later G value is equivalent to the offset. If the offset value exceeds a threshold of approximately 2.25 m/s <sup>2</sup> an later G fault is determined. Failure detection time depends on the driving distance, vehicle speed and on the amount of failed later G signal. Within 30 km of symmetrical driving the calculated offset corresponds to the sensor offset.	
Case 3	Monitoring Period	Continuous (If no under voltage is detected)	
	Enable Conditions	A fault is detected If the lateral G is higher than 15 m/s <sup>2</sup> for more than 800ms.	
Case 4	Monitoring Period	Continuous (during standstill)	
	Enable Conditions	If the filtered value of  lateral G  is larger than 7 m/s <sup>2</sup> for more than 400 m/s a fault is set.	
Case 5	Monitoring Period	Continuous (dependent on driving situation)	
	Enable Conditions	<p>Standstill compensation :</p> <ul style="list-style-type: none"> <li>- The offset corresponds to the measured and filtered input value. Failure threshold 5.25 °/s.</li> </ul> <p>Fast compensation (during driving if no standstill compensation could be completed):</p> <ul style="list-style-type: none"> <li>- The offset corresponds to the slightly filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, later G sensor and wheel speed sensor. Failure threshold is 7.5 °/s.</li> </ul> <p>Long-term ("normal") compensation (during driving after succeeded standstill or fast offset compensation):</p> <ul style="list-style-type: none"> <li>- The offset corresponds to the strong filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, later G sensor and wheel speed sensor. Failure threshold is 7.5 °/s.</li> </ul>	
Case 6	Monitoring Period	After every standstill.	
	Enable Conditions	The measured yaw rate and the model yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals doesn't fit and forward driving is recognized, a fault is determined.	
	Monitoring Period	Continuous (after initialization of the YRS and if no under voltage is detected)	
		The yaw rate sensor BITE logic evaluates	

Case7	Enable Conditions	the BITE-signal by extraction of the measured yaw rate of the vehicle. The allowed range for the BITE-signal is $25^{\circ}/s \pm 7^{\circ}/s$ . If the BITE-signal is not in the allowed range, a suspected failure bit is set after 200ms. A failure is set within 400 ms.	
Case 8	Monitoring Period	After YRS(yaw rate sensor)-initialization, no under voltage	
	Enable Conditions	Depending on the driving conditions a signal gradient higher than $10 \sim 23^{\circ}/s$ / 40 ms sets a suspected failure bit after 280ms, unless a single signal peak is recognized by a peakfilter. A failure is set, if the good check is not settled successfully after 10s.	
Case 9	Monitoring Period	Continuous (except spinning, use of handbrake, unsteady driving conditions or a detected under voltage)	
	Enable Conditions	<p>During standstill</p> <ul style="list-style-type: none"> <li>- The allowed range of the yaw rate sensor signal is <math>\pm 30^{\circ}/s</math>. Leaving this range for 5s sets a fault. In case of driving off after the failure was present for longer than 500ms during standstill, the fault is detected immediately.</li> </ul> <p>While driving</p> <ul style="list-style-type: none"> <li>- The allowed range of the yaw rate sensor signal is <math>\pm 94.75^{\circ}/s</math> and a suspected failure bit is set, if the signal is out of this range for 500ms. A fault is set after 1s.</li> </ul>	
Case10	Monitoring Period	Once after power up and no low voltage.	
	Enable Conditions	A line fault is detected if $0.2V < VLG < 0.8V$ isn't continued for a time $t \geq 60ms$ during POS (POS : power on selftest)	
Fail Safe		<p>Reduced controller function.</p> <p>Inhibit the ESP control and allow the ABS/EBD control.</p> <p>The ESP warning lamps are activated.</p>	

## Schematic Diagram

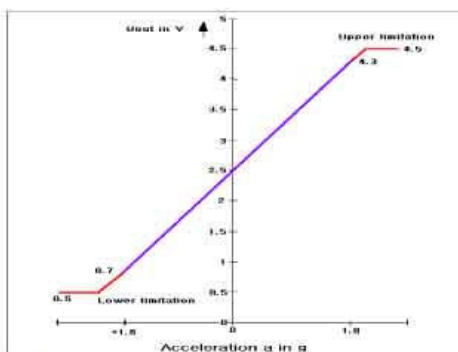


## Signal Waveform



**Fig.1**

Fig 1) Yaw Rate value of Yaw Rate sensor as a function of voltage.



**Fig.2**

Fig 2) Acceleration value of G sensor as a function of voltage.