



ANTI-LOCK BRAKING SYSTEM

ON-BOARD DIAGNOSIS

Warning Lamp Blink Display

A detected system failure can sometimes come from several different failure sources; for example, a failure indicating 'discontinuity of a sensor signal' can be caused by missing wheel sensor teeth, a loose sensor, intermittent sensor connection or trigger failure.

To assist in on-board intermittent fault diagnosis, a warning lamp blink display system has been developed, using numerical codes cross-referenced to code identification charts to identify failures.

Carry out on-board fault diagnosis procedure as follows:

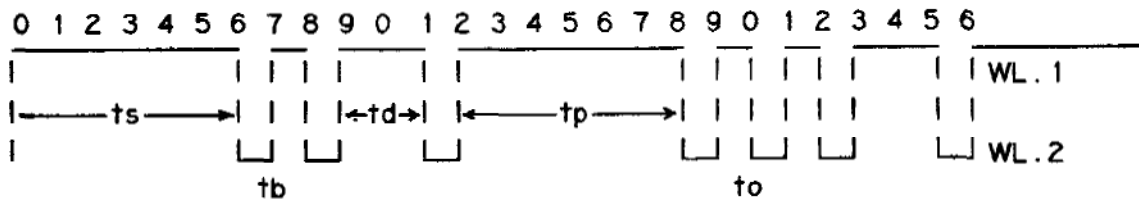
1. Ensure that the ignition is off.
2. Locate the 3-way Econoseal diagnostic connector in the rear wheel arch, close to the ABS ECM.
3. Insert a 'short' (JDS Reference lead) across the black lead (ground) and the Brown / Pink lead (trigger line to pin 26 of the ECM).
4. Turn on the ignition (position 2) and observe the warning lamp.
5. After six seconds the blink sequence of the first code begins.
6. Count the blink pulses and write down the resulting two digit number. After a 6.5 seconds pause the next code begins, and so on, until all the failure codes are read out and the warning light remains off.
7. Remove the 'short' lead and switch the ignition OFF.

Fig. 1 shows a typical code output. The first digit (tens) is represented by two flashes (blinks), the second digit (units) by one flash (blink) giving 21.

After a 6.5 second pause, the next output is given: the first digit (tens) is represented by three blinks, the second digit (units) by one blink giving 31.

Note: The ECM is only capable of dealing with one type of fault at a time, eg code 21 will display but code 22 will not – instead the blink sequence will move to the next fault type, code 31 or higher. Therefore, on completion of the required maintenance work, carry out the ECM memory erase procedure, then repeat the blink display diagnosis procedure. This will indicate any remaining or new faults in the system.

Note: On completion of all ABS or associated maintenance work, carry out the ECM memory erase procedure (to erase the memory, drive the car at a speed greater than 30 Km/h (19 Mile/h) see page 70-23). Repeat the on-board intermittent fault diagnosis procedure (see above). This will indicate any new / persistent faults still in the system.



J70-181

WL1 Warning light off
 WL2 Warning light on
 ts Start time after ignition switched on

tb Time of one blink
 td Time between tens and units
 tp Pause between codes
 to Time off between blinks

Fig. 1



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High Priority Failures

FAIL CODE	1ST DIGIT	FAILURE MODE	FAILURE CAUSES	REPAIR INSTRUCTIONS (See Note 1)	2ND DIGIT	FAILURE LOCATION
11	1	Redundancy failure	Disturbed / defective redundancy channel	Check if disturbance affects ABS system. Check prop cable harness installation	1	-
12	1	Internal ECM failure	Defective ECM	Renew ECM	2	-
21	2	Valve failure	Defective valve / cable harness / power transistor in ECM	Check indicated solenoid valve / terminals for short or interruption (21 - 27)	1	Main valve
22	2				2	Inlet valve front left
23	2				3	Outlet valve front left
24	2				4	Inlet valve front right
25	2				5	Outlet valve front right
26	2				6	Inlet valve rear
27	2				7	Outlet valve rear
31	3	Sensor failure recognised by 'Trigger Monitoring'	Interrupted / shorted sensor coil / sensor cable, open connector defective trigger circuit	Check indicated sensor / wire terminals for short circuit or interruption (31-34)	1	Sensor front left
32					2	Sensor front right
33	3				3	Sensor rear right
34	3				4	Sensor rear left
35	3	Sensor failure recognised by 'Monitoring of Wheel Speed Continuity' at vehicle speed ABOVE 40 Km/h (25 Mile/h)	Intermittently interrupted / shorted sensor coil / cable. Damaged teeth on wheel too sensor large bearing clearance / wrong air gap.	Check indicated sensor / wire terminals for short circuit or interruption (35-38). Check tooth wheel regularity sensor air gap and bearing clearance See Note 4	5	Sensor front left
36	3				6	Sensor front right
37	3				7	Sensor rear right
38	3				8	Sensor rear left



High Priority Failures

FAIL CODE	1ST DIGIT	FAILURE MODE	FAILURE CAUSES	REPAIR INSTRUCTIONS (See Note 1)	2ND DIGIT	FAILURE LOCATION
41	4	Sensor failure recognised by 'Wheel Speed Comparison'	Missing sensor signal (sensor not inserted), too large air gap, tooth wheel not installed	Check air gap / tooth wheel	1	Sensor front left
42	4				2	Sensor front right
43	4				3	Sensor rear right
44	4				4	Sensor rear left
51	5	'Pressure reduction and Wheel Response monitoring' at vehicle speed ABOVE 40 Km/h (25 Mile/h)	Hydraulically non-operational outlet valve	Check indicated outlet valve hydraulically See Note 3	1	Outlet valve front left
52	5				2	Outlet valve front right
53	5				3	Outlet valve rear (Same as 54)
54	5				4	Outlet valve rear (Same as 53)
55	5	'Long Term Monitoring of Control Duration'	Long term detection of missing sensor signal (sensor loose), too large air gap	Check indicated sensor, air gap and tooth wheel (55 - 58)	5	Sensor front left
56	5				6	Sensor front right
57	5				7	Sensor rear right
58	5				8	Sensor rear left
61	6	Warning switch input cannot be processed	Short circuit / leakage current from battery to warning switch path	Check reservoir, pressure warning switches and related wires for short circuit and leakage current	1	-

- Note:**
1. If indicated repair instructions do not help, renew the ECM.
 2. If the warning lamp stays on continuously without any failure code being displayed, the failure is probably in the ECM. Check the electric power supply FIRST, then renew the ECM.
 3. If repair instructions for display codes 51 - 54 do not help, proceed with repair instruction 71 - 74 and vice versa.
 4. If repair instructions for display codes 35 - 38 do not help, proceed with repair instruction 75 - 78 and vice versa.



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Low Priority Failures (See Note 5)

FAIL CODE	1ST DIGIT	FAILURE MODE	FAILURE CAUSES	REPAIR INSTRUCTIONS (See Note 1)	2ND DIGIT	FAILURE LOCATION
71	7	'Pressure Reduction and Wheel Response Monitoring' at vehicle speed BELOW 40 Km/h (25 Mile/h)	Long term detection of RFI	Check indicated ground lead and ECM EMC for proper grounding (71 - 74) See Note 3	1	Sensor front left
72	7				2	Sensor front right
73	7				3	Sensor rear right
74	7				4	Sensor rear left
75	7	Sensor failure recognised by 'Monitoring of Wheel Speed Continuity' at vehicle speed BELOW 40 Km/h (25 Mile/h)	Disturbances caused by RFI or ignition, excessive axle vibration, too large bearing clearance / too small air gap	Check indicated sensor ground lead / ECM for proper grounding. Check for axle vibration, loose sensor mounting, correct bearing clearance / air gap (75 - 78) See Note 4	5	Sensor front left
76	7				6	Sensor front right
77	7				7	Sensor rear right
78	7				8	Sensor rear left

- Note:**
1. If indicated repair instructions do not help, renew the ECM.
 2. If the warning lamp stays on continuously without any failure code being displayed, the failure is probably in the ECM. Check the electric power supply FIRST, then renew the ECM.
 3. If repair instructions for display codes 71 - 74 do not help, proceed with repair instruction 51 - 54 and vice versa.
 4. If repair instructions for display codes 75 - 78 do not help, proceed with repair instruction 35 - 38 and vice versa.
 5. Failures with display codes 71 - 78 are 'Low priority failures' which cause only temporary and partial control inhibit. These failures will be stored in the memory, even though they may not be noticed by the vehicle driver.



WARNING LAMP INDICATIONS WITHOUT ERROR CODE OUTPUT

The on-board diagnosis can only monitor errors that generate electrical signals. The error code information is triggered by the diagnosis trigger input and displayed by the warning lamp.

TEST CYCLE FOR WARNING SWITCH PATH:

After the ignition is switched 'ON' (providing the brake pressure warning light is 'OFF'), the warning lamp (WL) remains 'ON' for approximately 1.7 seconds. Then it flickers for approximately one second to test the reservoir and pressure switch path. If the warning lamp flickers continuously, this path is open or short circuited to ground potential.

IMPROPER INSTALLATION:

If the main connector is not installed in the ECM (or if the connector is loose) and the ignition is switched 'ON' (position 2), the main relay remains 'resting' and the warning lamp is switched 'ON' by the 'resting' contact of the main relay.

FAILURES OF THE ECM

FAILURES DETECTED BY INTERNAL TIME-OUT:

Certain hardware faults cause the ECM to be switched off by internal time-out. Any hardware fault will cause the warning lamp to light continuously and, since main power is cut off, the ECM is no longer capable of storing / outputting failure codes.

SHORT CIRCUIT AT THE DIAGNOSIS TRIGGER INPUT:

If the diagnosis trigger input is shorted to ground potential, the ECM goes into the diagnosis output mode when the ignition is switched on and if a failure is stored in the continuous memory. As the car accelerates and reaches 8 km/hr (5 mph), the short to ground on the diagnosis trigger unit still exists, the ECM is switched off and the warning lamp lights continuously.

WARNING LAMP PATH FAULTS:

Short circuiting the warning lamp wire to ground potential will activate the warning lamp but will not affect the anti-lock braking facility. The ECM cannot recognise this short circuit.

DEFECTIVE WARNING LAMP DRIVER:

If there is a defect in the warning lamp driver inside the ECM, either the warning lamp will remain continuously 'OFF', or will stay continuously 'ON', depending on the internal failure cause.

MISCELLANEOUS WARNING LAMP DISPLAYS/CONDITIONS:

In the case of intermittent / defective contacts or leads in the warning lamp driving path, the warning lamp may flicker 'ON / OFF' for undefined periods.

If the warning lamp is 'blown-out' or otherwise damaged / destroyed, no information about the status of the ECM is possible.

Note: The driver will realise that the ABS warning lamp circuitry is faulty, because the lamp will not illuminate on the ignition cycle.

MEMORY ERASE PROCEDURE

Complete the on-board fault diagnosis procedure and repair all indicated failures.

Note: Ensure that all failures have been indicated and identified, i.e. that the warning lamp off at the end of the display cycle (see NOTE 5 at the end of the diagnosis procedure, page 70 - 22). If the display cycle has not been completed, the failure memory will not erase.

To erase the memory, drive the car at a speed greater than 30 Km/h (19 Mile/h).
The failure memory is now clear.

BRAKE WARNING LIGHT SWITCH

During warning light switch renewal and adjustment - 86.65.56, the operator must ensure that the brake pedal is fully returned against its stop PRIOR TO SETTING THE SWITCH. Failure to do this may result in a no-warning lights condition.