

FAULT DIAGNOSIS

The Brake warning and ABS warning lamps extinguish in the opposite order to that currently accomplished on the XJS: the ABS warning light is now the first to extinguish followed by the brake warning light. This is because on the XJ6 the ABS warning light extinguishes at 95 +/- 5 bar and the brake warning extinction remains at the XJS installation setting of 105 +/- 4 bar. The warning lamp blink fault codes are the same as for the XJS ABS. The electrical system tests differ, however, since the XJS and XJ6 ECU connectors are different (55 way on XJ6). The XJ6 system tests are listed below.

SYSTEM TEST

TEST 1

Battery voltage at ABS module
Voltmeter connected to terminals
1 and 53 at ABS module
Ignition 'ON' should be over 10 Volts

-If incorrect check battery condition.
-Check wiring from terminal 53 to
ignition switch
-Check wiring from terminal 1 to earth

TEST 2

Main relay continuity test
between Terminals 1 and 33
ABS module
Ignition 'OFF'
Should have continuity

-If incorrect remove relay and check
wiring from terminal 33 to pin 30
at relay
-Check wiring from pin 87a of relay to
earth. If OK replace relay.

TEST 3

Main relay resistance test.
Terminals 34 and 53 ABS module

Should be 50 to 100 Ohms

-If incorrect remove main relay and
check wiring from terminal 34 to pin
85 at relay
-Check wiring from pin 86 at relay to
battery positive.

TEST 4

Main relay operation
Bridge ABS terminals 1 and 34
Voltmeter to ABS terminals 1 & 33

Ignition 'ON'
Should be over 10 Volts

-If incorrect remove main relay
-Check fuse
-Check wiring from pin 87 of relay to
fuse
-Remove bridge wire

TEST 5

Left-hand side rear wheel sensor
resistance check

Connect Ohmmeter between terminals
28 and 46
Ignition 'OFF'

Resistance to be 0.8 - 1.4 kOhms

-If incorrect check wheel sensor connector.
Disconnect wheel sensor and check
sensor resistance, if incorrect
replace sensor.
-If resistance of sensor correct check
wiring from sensor to ABS block
connector terminals 28 and 46

TEST 6

Right-hand side front wheel sensor

Resistance check

Connect Ohmmeter between terminals
29 and 47

Ignition 'OFF'

Resistance to be 0.8 - 1.4 kOhms

- If incorrect check wheel sensor connector
- Disconnect wheel sensor and check sensor resistance, if incorrect replace sensor.
- If resistance of sensor correct check wiring from sensor to ABS block connector terminals 29 and 47

TEST 7

Right-hand side rear wheel sensor

Resistance check

Connect Ohmmeter between terminals
27 and 45

Ignition 'OFF'

Resistance to be 0.8 - 1.4 kOhms

- If incorrect check wheel sensor connector
- Disconnect wheel sensor and check sensor resistance, if incorrect replace sensor.
- If resistance of sensor correct check wiring from sensor to ABS block connector terminals 27 and 45

TEST 8

Left-hand side front wheel sensor

Resistance check

Connect Ohmmeter between terminals
30 and 48

Ignition 'OFF'

Resistance to be 0.8 - 1.4 kOhms

- If incorrect check wheel sensor connector
- Disconnect wheel sensor and check sensor resistance, if incorrect replace sensor.
- If resistance of sensor correct check wiring from sensor to ABS block connector terminals 30 and 48

TEST 9

Left-hand side rear sensor voltage

Raise car on wheel free ramp

Spin wheel at 1 rev per second

AC Voltmeter connected to
terminals 28 and 46 ABS module

Ignition 'OFF'

Should be 0.04-0.1 Volts

- If incorrect:
- Check sensor mounting
- Check toothed wheel
- Check hub carrier

TEST 10

Right-hand side front sensor voltage.

Raise car on wheel free ramp

Spin wheel at 1 rev per second

AC Voltmeter connected to
terminals

29 and 47 ABS module

Ignition 'OFF'

Should be 0.15-0.7 Volts

- If incorrect:
- Check sensor mounting
- Check toothed wheel
- Check vertical link

TEST 11

Right-hand side rear sensor voltage

Raise car on wheel free ramp

Spin wheel at 1 rev per second

AC Voltmeter connected to
terminals 27 and 45 ABS module

Ignition 'OFF'

Should be 0.04-0.1 Volts

- If incorrect:
- Check sensor mounting
- Check toothed wheel
- Check hub carrier

TEST 12

Left-hand side front sensor voltage
Raise car on wheel free ramp
Spin wheel at 1 rev per second
AC Voltmeter connected to
terminals
30 and 85 ABS module
Ignition 'OFF'
Should be 0.15-0.7 Volts

-If incorrect:
-Check sensor mounting
-Check toothed wheel

-Check vertical link

TEST 13

Sensor cable screen continuity
test
Left-hand rear
Continuity tester between
terminals 6 and 1
Ignition 'OFF'
Should be no continuity

-If incorrect check that sensor is not
earthed
-Check sensor cable from sensor to
module is not earthed

TEST 14

Sensor cable screen continuity
test
Right-hand front
Continuity tester between
terminals 28 and 1
Ignition 'OFF'
Should be no continuity

-If incorrect check that sensor is not
earthed
-Check sensor cable from sensor to
module is not earthed

TEST 15

Sensor cable screen continuity
test
Right-hand rear
Continuity tester between
terminals 27 and 1
Ignition 'OFF'
Should be no continuity

-If incorrect check that sensor is not
earthed
-Check sensor cable from sensor to
module is not earthed

TEST 16

Sensor cable screen continuity
test
Left-hand front
Continuity tester between
terminals 30 and 1
Ignition 'OFF'
Should be no continuity

-If incorrect check that sensor is not
earthed
-Check sensor cable from sensor to
module is not earthed

TEST 17

Check valve block connection
Connect Voltmeter to terminals
1 and 3.
Ignition 'ON'
Should be over 10 Volts

-If no continuity disconnect the valve
block
-Check wiring from pin 30 at relay to
terminal 3
-Check wiring from terminal 3 of module
to pin 7 of valve block

TEST 18

Main valve resistance
Ohm-meter connected to terminals 3
and 39 of ABS module
Ignition 'OFF'

Correct reading 2 - 5 Ohms

-If incorrect disconnect the main valve
-Measure main valve resistance
-Check continuity of wiring from pin 2
of valve to terminal 39 of module
connector
-Check pin 1 terminal of valve to
module connector terminal 3

<p>TEST 19 Check resistance of RH front inlet valve Ohm-meter connected to ABS module connector terminals 3 and 38 Ignition 'OFF' Should be 3 - 5 Ohms</p>	<p>-If incorrect disconnect valve block and measure resistance between valve pins 1 and 7 -Check wiring from ABS module terminal 38 to pin 6 (LHD) or pin 1 (RHD) of valve block</p>
<p>TEST 20 Check resistance of rear inlet valve Ohm-meter connected to ABS module connector terminals 3 and 54 Ignition 'OFF' Should be 3 - 5 Ohms</p>	<p>-If incorrect disconnect valve block and measure resistance between valve pins 1 and 7 -Check wiring from ABS module terminal 2 to pin 3 of valve block</p>
<p>TEST 21 Check resistance of RH front inlet valve Ohm-meter connected to ABS module connector terminals 3 and 20 Ignition 'OFF' Should be 3 - 5 Ohms</p>	<p>-If incorrect disconnect valve block and measure resistance between valve pins 5 and 7 -Check wiring from ABS module terminal 35 to pin 1 (LHD) and pin 6 (LHD) of valve block</p>
<p>TEST 22 Check resistance of rear outlet valve Ohm-meter connected to ABS module connector terminals 3 and 36 Ignition 'OFF' Should be 5 - 7 Ohms</p>	<p>-If incorrect disconnect valve block and measure resistance between valve pins 4 and 7 -Check wiring from ABS module terminal 33 to pin 4 of valve block</p>
<p>TEST 23 Check resistance of RH front outlet valve Ohm-meter connected to ABS module connector terminals 3 and 21 Ignition 'OFF' Should be 5 - 7 Ohms</p>	<p>-If incorrect disconnect valve block and measure resistance between valve pins 5 and 7 -Check wiring from ABS module terminal 16 to pin 2 (LHD) and pin 5 (RHD) of valve block</p>
<p>TEST 24 Check resistance of LH front outlet valve Ohm-meter connected to ABS module connector terminals 3 and 2 Ignition 'OFF' Should be 5 - 7 Ohms</p>	<p>-If incorrect disconnect valve block and measure resistance between valve pins 5 and 7 -Check wiring from ABS module terminal 34 to pin 5 (LHD) and pin 2 (RHD) of valve block</p>
<p>TEST 25 Inlet and outlet valve function Bridge ABS module terminals 1, 2 and 20 Ignition 'OFF' - Apply foot brake LH front wheel should be locked Switch ignition 'ON' - Road wheel must now rotate - Brake pedal must not go to the floor</p>	<p>-If an incorrect result is obtained renew valve block -Check electric/hydraulic interconnection</p>

TEST 26

Inlet and outlet valve function
Bridge ABS module terminals 1, 21 and 38
Ignition 'OFF' - Apply foot brake
RH front wheel should be locked
Switch ignition 'ON' - Road wheel must now rotate - Brake pedal must not go to the floor

-If an incorrect result is obtained
renew valve block
-Check electric/hydraulic interconnection

TEST 27

Inlet and outlet valve function
Bridge ABS module terminals 1, 36 and 54
Ignition 'OFF' - Apply foot brake
Both rear wheels should be locked
Switch ignition 'ON' - Road wheels must now rotate - Brake pedal must not go to the floor

-If an incorrect result is obtained renew valve block
-Check electric/hydraulic interconnection

TEST 28

Fluid level warning indicator and pressure warning switch continuity
Connect continuity tester to ABS terminals 8 and 51 - Switch ignition

-If incorrect disconnect reservoir plug, check for continuity between reservoir pins 1 and 2
-Disconnect pres. warning switch, check 'ON' and wait for pump to stop running plug for continuity between pressure warning switch pins 3 and 5
-Check fluid level
-Check wiring between terminals 8 and 51

Switch ignition 'OFF'
Should have continuity

TEST 29

Pressure warning switch operation
With the ignition switched 'OFF' pump the brake pedal 20 times until the pedal becomes hard
Connect continuity test to ABS terminals 8 and 51 - should be no continuity at pins 1 and 2 of fluid level reservoir switch

-If incorrect check for no continuity at pins 3 and 5 of pressure warning switch; if continuity exists renew pressure switch

TEST 30

Ground short to pres. warning switch, fluid level switch circuit.
Ohm-meter connected to ABS module connector terminals 8 and 1; then 51 and 1.
Should be no continuity

-If incorrect check pressure warning and fluid level switches, wiring between switches and ABS connectors 8 and 51, and switches themselves for ground short.

SINGLE FAILURE WARNINGS

FAILURE	EFFECT	RESULT	INDICATOR
Brake fluid low	Requires topping up	Brake fluid low at level 1	Brake warning light on
Broken sensor		No ABS	ABS warning light on
Partial intermittent failure on front axle		No ABS on rears only	ABS warning light on
Partial intermittent failure on front axle above 40kph		No ABS	ABS warning light on
Partial intermittent failure on rear axle above 20kph		No ABS	ABS warning light on
Partial intermittent failure on rear axle below 20kph		No ABS	ABS warning light on
Pressure Switch connection broken	Accumulator will not charge	Loss of power assistance. Unboosted front brakes only No ABS	ABS warning light on Brake warning light on VCM display 'FAIL'
30 A main fuse blown (pump motor)	Accumulator will not charge	Loss of power assistance. Unboosted front brakes only No ABS	ABS, brake warning and circuit failure lights on. VCM displays 'FAIL' and 'FUSE 5'
30 A ABS fuse blown		NO ABS	ABS and circuit failure warning light on. VCM displays 'FUSE 6'
Pump connection broken	Accumulator will not charge	Loss of power assistance Unboosted front brakes only No ABS	ABS and brake warning lights on when pressure drops
Brake fluid low at level 2		Boosted brakes ABS on rear only	ABS and brake warning lights on
Failed front hydraulic circuit	Loss of fluid to level 2	Boosted rears with ABS only	ABS and brake warning lights on
Failed rear hydraulic circuit	Loss of fluid	Unboosted front brakes only	ABS and brake warning lights on

ANTI-LOCK BRAKING SYSTEM

ON-BOARD INTERMITTENT DIAGNOSIS

70.00.00

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.

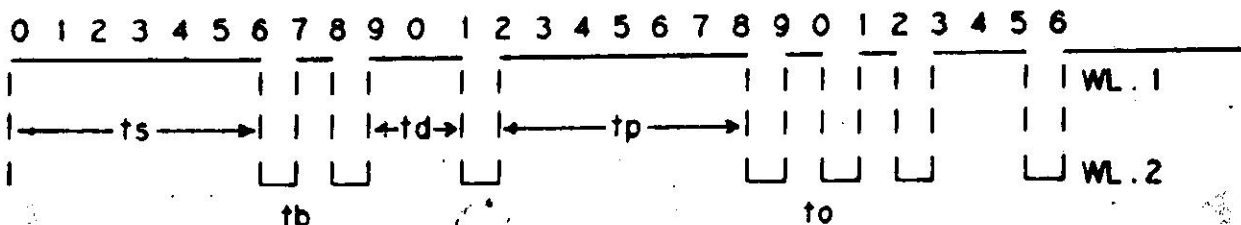
Carry out on-board fault diagnosis procedure as follows:

- 1 Ensure that the ignition is OFF.
- 2 Locate the PM4 diagnostic connector in the rear wheel arch, close to the ABS ECU.
- 3 Insert a 'short' (JDS reference lead) across the black lead (ground) and the brown/pink lead (trigger line to pin 23 of the ECU).
- 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 warning light remains off.
- 7 Remove the 'short lead' and switch the ignition 'OFF'.

Fig 1 shows a typical error 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 ECU 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 on to the next fault type, code 31 or higher. Therefore, on completion of the required maintenance work, carry out the ECU 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 ECU MEMORY ERASE PROCEDURE (TO ERASE THE MEMORY, DRIVE THE CAR AT A SPEED GREATER THAN 19mph (30km/h) SEE PAGE 70-27), THEN REPEAT THE ON-BOARD INTERMITTENT FAULT DIAGNOSIS PROCEDURE (SEE ABOVE). THIS WILL INDICATE ANY NEW/PERSISTENT FAULTS STILL IN THE SYSTEM.



J70-181

Fig 1

HIGH PRIORITY FAILURES

→ (plug at LR- Black To Bylow - pink - jumped - Turn key on) To evade drive vehicle 20mph.

FAILURE CODE	FIRST DIGIT	FAILURE MODE	FAILURE CAUSES	REPAIR INSTRUCTIONS (See Note 1)	SECOND DIGIT	FAILURE LOCATION
11	1	Redundancy failure	Disturbed/ defective redundancy channel harness installation	Check if disturbance affects ABS system. Check prop cable	1	-
12	1	Internal ECU failure	Defective ECU	Replace ECU	2	-
21	2	Valve failure	Defective valve/ cable harness/ power transistor in ECU	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

NOTES:

- 1 If indicated repair instructions do not help, replace the ECU.
- 2 If the warning lamp stays on continuously without any failure code being displayed, the failure is probably in the ECU. Check the electric power supply FIRST, then replace the ECU.

HIGH PRIORITY FAILURES

FAILURE CODE	FIRST DIGIT	FAILURE MODE	FAILURE CAUSES	REPAIR INSTRUCTIONS (See Note 1)	SECOND DIGIT	FAILURE LOCATION
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	3				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 40km/hr	Intermittently interrupted/sorted sensor coil/cable. Damaged teeth on sensor wheel/ too 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 3	5	Sensor front left
36	3				6	Sensor front right
37	3				7	Sensor rear right
38	3				8	Sensor rear left
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

NOTES:

- 1 If indicated repair instructions do not help, replace the ECU.
- 2 If the warning lamp stays on continuously without any failure code being displayed, the failure is probably in the ECU. Check the electric power supply FIRST, then replace the ECU.
- 3 If repair instructions for display codes 35-38 do not help, proceed with repair instruction 75-78, and vice versa.

HIGH PRIORITY FAILURES

FAILURE CODE	FIRST DIGIT	FAILURE MODE	FAILURE CAUSES	REPAIR INSTRUCTIONS (See Note 1)	SECOND DIGIT	FAILURE LOCATION
51	5	'Pressure reduction & Wheel Response Monitoring' at vehicle speed ABOVE 40km/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 not processable	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	-

NOTES:

- 1 If indicated repair instructions do not help, replace the ECU.
- 2 If the warning lamp stays on continuously without any failure code being displayed, the failure is probably in the ECU.
Check the electric power supply FIRST, then replace the ECU.
- 3 If repair instructions for display codes 51 - 54 do not help, proceed with repair instruction 71 - 74, and vice versa.

LOW PRIORITY FAILURES (See note 5)

FAILURE CODE	FIRST DIGIT	FAILURE MODE	FAILURE CAUSES	REPAIR INSTRUCTIONS (See Note 1)	SECOND DIGIT	FAILURE LOCATION
71	7	Pressure Reduction and Wheel Reponse Monitoring at vehicle speed BELOW 40km/h	Long term detection of RF1	Check indicated sensor ground lead and ECU 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 40km/h	Disturbances caused by RFI or ignition, excessive axle vibration, too large bearing clearance, too small air gap	Check indicated sensor ground lead. ECU 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

NOTES:

- 1 If indicated repair instructions do not help, replace the ECU.
- 2 If the warning lamp stays on continuously without any failure code being displayed, the failure is probably in the ECU.
Check the electric power supply FIRST, then replace the ECU.
- 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.