Issue:
This bulletin provides diagnosis procedures for various components of the engine management system.

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## Engine Management System Flowcharts – Fault Matrix

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<td>Clutch Pedal Safety Switch</td>
<td>None</td>
<td>No crank.</td>
</tr>
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</table>
Engine Management Relays
Flowchart P-1

Check for discoloring and burning on the blade connections of the relay. This will indicate a bad connection.

Remove the suspect relay,

Carry out the Generic Connector Inspection on the relay base. Pay particular attention to the insertion force check.

Was a fault found?

Replace the suspect pin within the relay base and the relay.

Switch the ignition ‘ON’.

Using a Digital Multi Meter (DMM) check battery and ignition feeds to the relay.

See addition information Generic Connector Inspection.

Yes

END

No

Refer to X-TYPE Electrical Guide.
A

Was battery voltage present at both pins?

NO

Carry out a Generic Harness Check between relay base and the relevant fuses.

If no fault found, Contact the Technical Hotline for further assistance.

YES

Carry out a Generic Harness Check on the remaining pins within the relay base and their associated connectors and pins.

Refer to X-TYPE Electrical Guide.

See Additional information Generic Harness Check.

END

Was a fault found and rectified?

YES

NO

Replace faulty relay.

Contact the Technical Hotline if fault persists.
Camshaft Position Sensor
Flowchart P-2

Camshaft Position Sensor (CMP) faults are indicated via the Malfunction Indicator Lamp (MIL). (only on the second trip).

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTCs).

If any DTCs are stored, carry out the associated guided diagnostic routine.

Related DTCs
- P0340 Camshaft sensor side 1 malfunction.
- P0341 Camshaft sensor side 1 range/performance.
- P1340 Camshaft sensor side 2 malfunction.
- P1341 Camshaft sensor side 2 range/performance.

Was a fault found and rectified?

Disconnect the relevant camshaft electrical connector and carry out a Generic Connector Inspection.

Remove the relevant CMP sensor from vehicle.

Inspect for debris and ensure CMP sensor is clean.

See additional Information Generic Connector Inspection.

A

END

YES

NO
Check CMP sensor and front timing cover for any signs of damage.

Was a fault found and rectified?

Using a Digital Multi Meter (DMM), check the resistance of the sensor between pins 1 and 2. Expected value at 20°C: 467ohms - 595ohms.

Are the readings taken within tolerance.

Replace faulty CMP Sensor.

Using two adapters (JT-034) from the WDS Probe Tip Adapter Kit, attach an adapter to each of the pins on the sensor. Refit the CMP sensor to the vehicle with the adapters attached.

See additional information P-2a

Using WDS, select the oscilloscope and connect the probes to the adapters on the sensor.
Ensure ignition ‘OFF’ and disconnect ECM electrical connector EN016. Carry out connector Inspection.

If the signal is less than 1.5 volts at idle, suspect incorrect air gap between sensor and target. Contact the Technical Hotline for further assistance.

Are the readings as expected?

YES

Start the engine and monitor the readings. Expected readings at idle are between 1.5 and 2.5 volts peak to peak. The voltage will increase with engine speed.

NO

Contact Technical Hotline for further assistance.

Take care when removing the probes not to dislodge the sensor pins.

Carry out a Generic Harness check between the relevant CMP sensor engine harness electrical connector and the ECM electrical connector.

CMP sensor 1 connector
EN043 pin 1 - EN016 pin 094 (orange wire).
EN043 pin 2 - EN016 pin 095 (black wire).

CMP sensor 2 connector
EN033 pin 1 - EN016 pin 068 (green wire).
EN033 pin 2 - EN016 pin 069 (brown wire).

Are the readings as expected?

YES

Contact the Technical Hotline for further assistance.

NO

Was a fault found and rectified?

END

See additional information Generic Connector Inspection.

See additional Information Generic Harness Check.

Take care when removing the probes not to dislodge the sensor pins.

Date of issue 08/02
Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

Was a DTC logged?

Remove any necessary parts to allow access to bank 2 ignition coils. **WARNING: Great care must be taken while engine is running.**

With the engine running, disconnect each ignition coil electrical connector on side 2. Listen to the engine tone; the misfire condition will worsen and the engine speed will drop if the cylinder is 'GOOD'.

Reconnect the connector and move to the next cylinder. When the cylinder with the misfire is disconnected no change will be apparent.

Using the WDS clear all DTCs logged whilst carrying out the ignition coil tests.

Was a suspect cylinder identified?
Remove necessary parts to gain access to bank 1 ignition coils.

See additional information Generic Connector Inspection.

See additional information Generic Harness Check.

Carry out a Generic Connector Inspection and a Generic Harness Check on the engine harness to the ignition coils. (Check all connectors made visible by the removal of the intake manifold)

Using the WDS clear all DTCs logged whilst carrying out the ignition coil tests.

Was a fault found and rectified?

YES

END

NO

Remove all three Ignition coils and spark plugs from bank 2 and swap them with bank 1.
Ignition coil tightening torque 6 Nm
Spark plug tightening torque 15 Nm

With the ignition coils swapped, repeat the process.

With the engine running, disconnect each ignition coil electrical connector on bank 2. Listen to the engine tone; the misfire conditions will worsen and the engine speed will drop if the cylinder is ‘GOOD’.
Reconnect the connector and move to the next cylinder.
When the cylinder with the misfire is disconnected no change will be apparent.

Possible intermittent fault.
Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

Was a suspect cylinder identified?

NO

YES

B
Based on the DTC logged, or the suspected cylinder, disconnect the appropriate ignition coil electrical connector.

Remove the ignition coil and the spark plug. Substitute with known good ignition coil and spark plug and retry.

Replace ignition coil and spark plug. YES

Has the fault been rectified?

END

NO

C

See additional information. Appendix P-3a

See additional information. Generic Connector Inspection.
With the ignition 'ON'
check for battery voltage at fuse 92.
(If no voltage found investigate the ignition relay (R18)
in the Central Junction Fuse Box (CJFB))

Check the condition of 10 Amp fuse 92 in the CJFB.

Was the fuse blown?

YES

NO

Check for battery voltage at pin 1 of the relevant ignition coil engine harness electrical connector.

Carry out a Generic Harness Check between pin 1 of the ignition coil engine harness electrical connector and fuse 92 of the CJFB.

Was a fault found and rectified?

YES

NO

Contact the Technical Hotline for further assistance.

END

NO

Using WDS clear all DTCs logged.

YES

Was a fault found and rectified?

YES

Carry out a Generic Harness Check between pin 3 of the ignition coil engine harness electrical connector and vehicle ground eyelet G08AAL.

NO

D

Note: If the ignition coil fuse has blown, there will be a non-start condition.

See additional information Generic Harness Check.
Ensure the ignition is switched ‘OFF’

Disconnect ECM electrical connector EN016 and carry out Connector Inspection.

Carry out a Generic Harness Check between pins 2 and 4 of the relevant ignition coil engine harness electrical connector and the relevant ECM electrical connector pins.

Was a fault found and rectified?

END YES

NO

Contact the Technical Hotline if fault persists.

See additional information Generic Harness Check

See additional information Generic Connector Inspection

Refer to X-TYPE Electrical Guide.
Upstream and Downstream Oxygen Sensors
Flowchart P-4

Upstream and downstream oxygen sensor faults are indicated via the Malfunction Indicator Lamp (MIL). (Federal, Euro/UK and Japan only on the second trip).

See additional information P-1a

Carry out visual check of exhaust system and examine exhaust for cracks between manifold and catalytic converter.

Was a fault found and rectified?

YES

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

NO

See additional information. Generic Connector Inspection.

Check for damage to the electrical connections and harness.

See additional information P-1a

Check for correct orientation of oxygen sensors.

Note: Ensure the sensors are tightened to the correct torque.

Check for air leaks at sensors.

A
Using Worldwide Diagnostic System (WDS), interrogate Engine Control Module (ECM) for Diagnostic Trouble Codes (DTCs).

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

YES

Datalogger Menu options
- Oxygen sensor side 1 downstream.
- Oxygen sensor side 2 downstream.
- Oxygen sensor equivalence ratio side 1 upstream.
- Oxygen sensor equivalence ratio side 2 upstream.
- Oxygen sensor current side 1 upstream.
- Oxygen sensor current side 2 upstream.

The readings taken should be within the minimum and maximum values defined on the WDS help text for each signal.

Note: fluctuating the throttle will cause the values to change within the defined tolerance.

Using the WDS, select the datalogger, engine systems and then select the oxygen sensor signals.

Start the engine and monitor the selected signals when the engine is up to normal operating temperature.

Are the readings as expected?

YES

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

NO

B
With the ignition ‘ON’, check for battery voltage at fuses 38 and 42 of the Power Distribution Fuse Box (PDFB) (if no voltage found investigate battery cable connection to the PDFB).

Check the condition of the relevant oxygen sensor fuse. 30 Amp Fuse No. 38 30 Amp Fuse No. 42

Is the fuse blown?

YES

If the sensor is not already disconnected, disconnect the relevant oxygen sensor. Carry out harness check between pin 2 of the sensor engine harness electrical connector and the relevant fuse.

NO

Using a Digital Multi Meter (DMM), check for battery voltage at pin 2 of the sensor engine harness electrical connector.

Was there battery voltage at pin 2?

NO

Was a fault found and rectified?

YES

Replace 30 Amp fuse if necessary.

NO

Disconnect the relevant oxygen sensor connector. Inspect connector for damage.

See additional information Generic Connector Inspection.

Carry out resistance checks across the electrical connector of the relevant oxygen sensor heater circuit.

Expected readings:
- Upstream pin 1 - pin 2 = 1.0 ohms +0.34/-0.14 ohms.
- Downstream pin 1 - pin 2 = 5.6 ohms +1.2/-0.60 ohms.
- Pin 1 to body of sensor = infinity ohms (open circuit)
- Pin 2 to body of sensor = infinity ohms (open circuit)

YES

Was a fault found and rectified?

NO

Replace 30 Amp fuse if necessary.

END
Ensure ignition is ‘OFF’ and disconnect the ECM electrical connector EN016. Carry out Connector Inspection.

Carry out harness checks on the relevant oxygen sensor engine harness electrical connector pins 1, 3 & 4 to the relevant ECM electrical connector pins.

Were the readings taken within tolerance?

NO

Replace faulty oxygen sensor.

END

YES

See additional information Generic Connector Inspection.

See additional information Generic Harness Check.

END

Was a fault found and rectified?

YES

NO

Contact the Technical Hotline for further assistance.

Refer to the X-TYPE Electrical Guide on JTIS

Date of issue 08/02
Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

Related DTCs
- P0121 Throttle sensor circuit 1 and 2 range/performance.
- P0122 Throttle sensor circuit 1 low input.
- P0123 Throttle sensor circuit 1 high input.
- P0222 Throttle sensor circuit 2 low input.
- P0223 Throttle sensor circuit 2 high input.

DTC P1582 will be logged if a fault has occurred with the Throttle Position Sensor. This is not a throttle fault code, but is used for information only. (See Technical Bulletin XT303-01.)

If any DTCs are stored, carry out the associated guided diagnostic routine.

END

Was a fault found and rectified?

Using WDS, select datalogger, engine systems and then select Throttle position sensor, track 1 (central processor unit 1) Throttle position sensor, track 2 (central processor unit 1)

A
The readings taken should be within the minimum and maximum values defined in the WDS help text for each signal. **Note: Operating the throttle pedal will cause the values to change within the defined tolerances.**

With the ignition ‘ON’ monitor the signals.

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found in the DTC Summaries Disk Issue 2.

Were the readings as expected?

Disconnect the TPS electrical connector EN013 and carry out a Generic Connector Inspection.

Using a Digital Multi Meter (DMM) carry out resistance checks across the sensor

- Throttle position sensor, track 1
  - Between EN013 pin 1 and pin 3,
  - Resistance when throttle closed = 0.5 k-ohms - 0.9 k-ohms.
  - Resistance when throttle fully open = 2.0 k-ohms - 2.4 k-ohms.

- Throttle position sensor, track 2
  - Between EN013 pin 1 and pin 2,
  - Resistance when throttle closed = 1.2 k-ohms - 1.6 k-ohms.
  - Resistance when throttle fully open = 2.1 k-ohms - 2.5 k-ohms.

As the values increase and decrease, pay attention to any display of an Open Circuit (O/C), this will indicate a potential fault on the track.

Replace the throttle body.

Was a fault found?

With TPS DTCs logged the throttle will not operate via the pedal. The throttle motor will operate to the fully open position for a split second when the ignition is switched ‘ON’.

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found in the DTC Summaries Disk Issue 2.

Were the readings as expected?

Disconnect the TPS electrical connector EN013 and carry out a Generic Connector Inspection.

Using a Digital Multi Meter (DMM) carry out resistance checks across the sensor

- Throttle position sensor, track 1
  - Between EN013 pin 1 and pin 3,
  - Resistance when throttle closed = 0.5 k-ohms - 0.9 k-ohms.
  - Resistance when throttle fully open = 2.0 k-ohms - 2.4 k-ohms.

- Throttle position sensor, track 2
  - Between EN013 pin 1 and pin 2,
  - Resistance when throttle closed = 1.2 k-ohms - 1.6 k-ohms.
  - Resistance when throttle fully open = 2.1 k-ohms - 2.5 k-ohms.

As the values increase and decrease, pay attention to any display of an Open Circuit (O/C), this will indicate a potential fault on the track.

Replace the throttle body.
With the ignition 'ON' and using a DMM, check for 5 volt supply at pin 4 of TPS electrical connector EN013.

Was the reading as expected?

Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.

Carry out a Generic Connector Inspection on ECM electrical connector EN016.

Carry out Generic Harness Check between TPS electrical connector EN013 and the ECM electrical connector EN016 EN013 pin 4 - EN016 pin 12 (Orange and Yellow wire).

Was a fault found and rectified?

Contact Technical Hotline for further assistance.
Carry out generic harness check between TPS electrical connector EN013 and the ECM electrical connector EN016.

EN013 pin 3 - EN016 pin75 (Purple wire)
EN013 pin 2 - EN016 pin76 (Yellow wire)
EN013 pin 1 - EN016 pin19 (Black and green wire)

Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.

See additional information Generic Connector Inspection.

See additional information Generic Harness Check.

Carry out generic connector inspection on ECM electrical connector EN016.

Was a fault found and rectified?

YES
END

NO
Contact Technical Hotline for further assistance.
Throttle motor faults are indicated via the Malfunction Indicator Lamp (MIL).
(Federal, Euro/UK and Japan only on second trip).

Related DTCs
P1229 Throttle motor control circuit malfunction.
P1224 Throttle control position error.
P1251 Throttle motor relay 'OFF' failure.
P1658 Relay 'ON' failure.
P1631 Relay Driver 'OFF' failure.
P1631 Relay Driver 'ON' failure.

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

YES → END

NO → A
A periodic clicking noise will be heard from the throttle motor when the ignition is switched 'ON' and 'OFF'.

Remove the air cleaner outlet pipe from the throttle body and air cleaner.

Switch the ignition 'ON'
Operate the throttle pedal to see the throttle plate open and close.

Was the motor operating? NO

DTC P1250 or P1254 may be logged if a fault has occurred with the operation of the Throttle return spring.

Ensure that throttle plate is clear of debris and excessive black deposits are removed.

Check that the throttle valve returns to its original position but does not completely close and that the plate is moving smoothly.

Replace throttle body. YES

Was a fault found?

NO

Possible intermittent fault.
Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.
Ensure the ignition is switched ‘OFF’.

Disconnect the throttle motor electrical connector EN010 and carry out a Generic Connector Inspection.

Disconnect ECM electrical connector EN016 and carry out a Generic Connector inspection.

Refer to X-TYPE electrical guide.

Check the Throttle Motor Relay (R11) Follow the Engine Management Relays flowchart P- 1.

Contact Technical Hotline if fault persists.
Accelerator Pedal Position Sensor
Flowchart P-7

Accelerator Pedal Position (APP) Sensor faults are indicated via the Malfunction Indicator Lamp (MIL) on the second trip.

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

END

YES

Related DTCs
P1122  APP sensor circuit 1 low input.
P1123  APP sensor circuit 1 high input.
P1215  APP sensor circuit 2 low input.
P1216  APP sensor circuit 2 high input.
P1344  APP sensor circuits 1 and 2 range/performance.

NO

Using WDS, select Datalogger, Engine Systems and then select pedal demand position sensor 1 (central processor unit 1 and 2) and pedal demand position sensor 2 (central processor unit 1 and 2).

Monitor the signals,
APP1 values
Max = 4.04 volts ± 0.3 volt
Min = 0.84 volts ± 0.3 volt
APP 2 values
Min = 0.94 volts ± 0.3 volt
Max = 3.35 volts ± 0.3 volt

Moving the throttle pedal will cause the values to change within the defined tolerances for each signal.

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

YES

Were the readings as expected?

NO

A
Using a Digital Multi Meter (DMM) carry out resistance checks across the sensor

APP track 1
PA001 pin 3 and pin 4 = 1500 ohms ± 450 ohms (at approximately 20 °C)
Gently depress the pedal and the resistance will increase.
Release the pedal and the resistance will decrease to the original value.

APP track 2
PA001 pin 1 and pin 6 = 840 ohms ± 252 ohms (at approximately 20 °C)
Gently depress the pedal and the resistance will decrease.
Release the pedal and the resistance will increase to the original value.

As the values increase and decrease pay attention to any display of an open circuit (O/C), this will indicate a bad connection on the track.

Were the readings as expected? NO

Replace faulty accelerator pedal assembly.

YES

See additional information Generic Connector Inspection.

Disconnect the Pedal Position sensor electrical connector PA001 and inspect for damage.

Remove the pedal from the vehicle for accessibility if necessary.

Were the readings as expected? NO

Remove the pedal from the vehicle for accessibility if necessary.

Replace faulty accelerator pedal assembly.

YES
With the ignition 'ON' and using a DMM, check for 5 volt supply at pin 2 and pin 5 of APP electrical connector PA001.

Was the reading as expected?

Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.

Was a fault found and rectified?

Contact Technical Hotline for further assistance.
Ensure ignition 'OFF' and disconnect ECM electrical connector EN016.

Carry out a Generic Connector Inspection on ECM electrical connector EN016.

See additional information Generic Harness Check.

See additional information Generic Connector Inspection.

Carry out a Generic Harness Check between the APP Sensor electrical connector and the ECM electrical connector.

APP circuit 1.
PA001 pin 4 - EN016 pin 102. (Red wire)
PA001 pin 3 - EN016 pin 20. (Black and Green wire)

APP circuit 2.
PA001 pin 1 - EN016 pin 103. (Yellow wire)
PA001 pin 6 - EN016 pin 19. (Black and Green wire)

Was a fault found and rectified?

END

YES

NO

Contact the Technical Hotline for further assistance.
Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

Yes

Related DTCs
P0010 VVT side 1 circuit malfunction.
P1384 VVT side 1 malfunction.
P0020 VVT side 2 circuit malfunction.
P1396 VVT side 2 malfunction.

Note: When using datalogger the VVT is shown as Variable Camshaft Timing

Note: Fluctuating the engine speed and load will cause a change in the duty cycle applied to the VVT (0-100%)

Using WDS, select datalogger, engine systems and then select Variable Camshaft Timing duty cycle for both VVT solenoids.

Monitor the signals.

Monitor both signals and compare the readings.
If the VVT in question has no duty applied (0%) there is an electrical fault on the circuit from the ECM and either P0010 or P0020 will be logged.

No

END
If DTC P1396 or P1384 is logged, suspect mechanical failure of the VVT.

Contact the Technical Hotline for further assistance.

Disconnect the relevant VVT electrical connector and inspect for damage.

Using a Digital Multi Meter (DMM), check the resistance of the relevant solenoid between pins 1 and 2.
Expected value at 20 °C = 6 ohms - 10 ohms.
Check for a resistance to ground.
Expected value:
Pin 1 to ground = infinity ohms (open circuit)
Pin 2 to ground = infinity ohms (open circuit)

Replace the relevant VVT solenoid.

Were the readings taken within tolerance?

Yes

B

No

END

Was the duty cycle greater than 0%?

Yes

See additional information
Generic Connector Inspection.

No

A
Carry out Generic Harness Check between the relevant VVT solenoid engine harness electrical connector and the ECM electrical connector.

- VVT solenoid side 1
  - EN061 pin 1 - EN016 pin 109. (Red and white wire)
  - EN061 pin 2 (Black and green wire) - ground eyelet G8AR (Black wire).
- VVT solenoid side 2
  - EN042 pin 1 - EN016 pin 110. (Red and white wire)
  - EN042 pin 2 (Black and green wire) - ground eyelet G8AR (Black wire).

Ensure the ignition is switched ‘OFF’ and disconnect ECM electrical connector EN016.

Carry out a Generic Connector Inspection on ECM electrical connector EN016.

See additional information Generic Connector Inspection.

See additional information Generic Harness Check.

Refer to X-TYPE electrical guide.

Was a fault found and rectified?

END

Contact the Technical Hotline for further assistance.

YES

NO
Intake Air Temperature Sensor
Flowchart P-9

Intake Air Temperature Sensor (IAT) faults are indicated via the Malfunction Indicator Lamp (MIL). (only on second trip).

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

The IAT sensor is an integrated part of the Mass Air Flow sensor.

Related DTCs
P0096 Intake air temperature range performance.
P0097 Intake air temperature sensor low input.
P0098 Intake air temperature sensor high input.

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

END

YES

NO

A
Were the readings as expected?

YES

NO

Check the Resistance of the sensor in comparison to the air temperature. Expected readings will be approximately:
-20°C = 16.0 k-ohms ± 2.4 k-ohms
10°C = 4.0 k-ohms ± 1.00 k-ohms
20°C = 2.45 k-ohms ± 0.24 k-ohms
30°C = 1.55 k-ohms ± 0.25 k-ohms
60°C = 0.58 k-ohms ± 0.087 k-ohms

Replace faulty MAF sensor.

NO

Were the readings as expected?

YES

B

Using WDS, select datalogger, engine systems and then select Intake Air Temperature.

The readings taken should be within the minimum and maximum values defined on the WDS help text.

A slight change in temperature should be apparent if the engine speed is increased.

Monitor the readings with the engine running.

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

Were the readings as expected?

YES

NO

Disconnect IAT sensor electrical connector EN006, and carry out Generic Connector Inspection.

See additional information Generic Connector Inspection.

Use a thermometer to measure the air temperature.

Removing the sensor from the engine and lightly blowing on the sensor will alter the reading.
Using a Digital Multi Meter (DMM)
check for battery voltage at pin 1 of electrical connector EN006.

Switch the ignition 'ON'

If the supply has been lost or the fuse is blown, suspect additional engine component fault codes to be logged.

Was battery voltage present?

NO → D

YES → C
Carry out Generic Harness Check between MAF electrical connector EN006 and the ECM electrical connector EN016.

- EN006 Pin 4 - EN016 pin 71 (orange wire)
- EN006 Pin 5 - EN016 pins 19 (black and green wire)

Ensure the ignition is switched ‘OFF’ and disconnect ECM electrical connector EN016.

See additional information Generic Connector Inspection.

Carry out a Generic Connector Inspection on ECM electrical connector EN016.

See additional information Generic Harness Check.

Was a fault found and rectified?

- YES: END
- NO: Contact the Technical Hotline for further assistance.
With the ignition 'ON' check for battery voltage at both sides of fuse 36 of the Power Distribution Fuse Box (PDFB) (If no voltage found investigate Engine Management System Control relay R7 in the PDFB).

Check 10 amp fuse No. 36 at the PDFB.

Was the fuse blown?

YES

Carry out a Generic Harness check between pin 1 of electrical connector EN006 and fuse 36. Suspect short circuit low.

END

YES

Was a fault found and rectified?

NO

Contact the Technical Hotline for further assistance.

Refer to the EMS relays flowchart P-1.

Refer to X-TYPE electrical guide on JTIS.

Date of issue 08/02
Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for DTCs.

Related DTCs
P0101 Sensor circuit range/performance
P0102 Sensor circuit low voltage.
P0103 Sensor circuit high voltage.
P1104 Sensor ground malfunction

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

END
A

Using WDS, select datalogger, engine systems and then select Mass Air Flow Meter.

Run engine to normal operating temperature.

Note: An increase in engine speed will increase the reading.

Monitor the selected signal.
Expected reading at idle
3.0 grams per second - 6.0 grams per second.

Possible intermittent fault.
Clear DTCs and road test to the monitoring conditions on the DTC Summaries Disk Issue 2.

Were the readings as expected?

YES

NO

B
Using a Digital Multi Meter (DMM) check for battery voltage at pin 1 of electrical connector EN006.

Switch the ignition 'ON'

If the supply has been lost or the fuse is blown, suspect additional engine component fault codes to be logged.

Was battery voltage present?

NO → D

YES

Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.

Inspect ECM electrical connector and pins for damage.

See additional information Generic Connector Inspection.

Disconnect the MAF electrical connector EN006 and carry out a Generic Connector Inspection.

See additional information Generic Connector Inspection.
Carry out Generic Harness Check between MAF electrical connector EN006 and the ECM electrical connector EN016.
EN006 Pin 3 - EN016 pin 44 (Green and white wire)
EN006 Pin 2 - EN016 pins 45 (Black and white wire)
EN006 Pin 2 - EN016 pins 46 (Black and white wire)

Was a fault found and rectified?

Contact the Technical Hotline for further assistance.
With the ignition 'ON' check for battery voltage at both sides of fuse 36 of the Power Distribution Fuse Box (PDFB) (If no voltage found investigate Engine Management System Control relay R7 in PDFB).

Check 10 Amp fuse No. 36 at the PDFB.

Was the fuse blown?

YES

Carry out a Generic Harness check between pin 1 of electrical connector EN006 and fuse 36. Suspect short circuit low.

NO

Carry out a Generic Harness check between pin 1 of electrical connector EN006 and fuse 36. Suspect open circuit.

Was a fault found and rectified?

YES

Contact the Technical Hotline for further assistance.

NO

Refer to X-TYPE electrical guide.

Refer to the EMS relays flowchart P-1.

END

Refer to the EMS relays flowchart P-1.

Refer to X-TYPE electrical guide.

Date of issue 08/02
Engine Fuel Temperature Sensor  
Flowchart P-11

Engine Fuel Temperature (EFT) Sensor faults are indicated via the Malfunction Indicator Lamp (MIL). (Federal, Euro/UK and Japan only on second trip).

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

Related DTCs
- P0181 Engine fuel temperature sensor range performance.
- P0182 Engine fuel temperature sensor low input.
- P0183 Engine fuel temperature sensor high input.

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

END

NO

Was a fault found and rectified?

NO

A
Were the readings as expected?

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

Using WDS, select datalogger, engine systems and then select Fuel Rail Temperature Sensor

A change in temperature should be apparent as the engine temperature increases.

Monitor the readings with the engine running. The WDS will display the values as a voltage.

Using a Digital Multi Meter (DMM) check the resistance of the EFT sensor.

Note: When using datalogger the EFT sensor is shown as the Fuel Rail Temperature Sensor.

See additional information Generic Connector Inspection.

If replacement is required:

Replace faulty EFT sensor.

Were the readings as expected?
Carry out Generic Harness Check between EFT electrical connector IL008 and the ECM electrical connector EN016.

Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.

See additional information Generic Connector Inspection.

Carry out a Generic Connector Inspection on ECM electrical connector EN016.

Refer to X-TYPE electrical guide.

See additional information Generic Harness Check.

Carry out Generic Harness Check between EFT electrical connector IL008 and the ECM electrical connector EN016.

IL008 Pin 1 (Brown and blue wire) - EN016 pin 19 (Black and green wire).
IL008 Pin 2 (White and blue wire) - EN016 pin 50 (Blue wire).

Was a fault found and rectified?

END

YES

Contact the Technical Hotline for further assistance.

NO
Crankshaft Position Sensor
Flowchart P-12

Crankshaft Position (CKP) sensor faults are indicated via the Malfunction Indicator Lamp (MIL).
(only on second trip).

Related DTCs
P0335 Sensor malfunction.
P0336 Sensor circuit range/performance.

Note: The vehicle will run if a fault lies within the crankshaft sensor or the associated circuit, but the customer will be experiencing long crank times.

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

YES

END

NO

Ensure the ignition is switched 'OFF'.

See Additional Information Generic Connector Inspection.

Disconnect the CKP sensor electrical connector and carry out a Generic Connector Inspection.

A
Remove the CKP sensor from the vehicle and check for any signs of damage.

Inspect for debris and ensure CKP sensor is clean.

Remove the CKP sensor from the vehicle and check for any signs of damage.

Check CKP sensor mounting in the engine block is clean of any debris and is not damaged.

Was a fault found and rectified?

YES

END

NO

Using a Digital Multi Meter (DMM), check the resistance of the CKP sensor. Expected value at 20 °C 305 ohms - 395 ohms.

Replace faulty CKP sensor.

Were the readings as expected?

NO

YES

B
Start the engine and monitor the readings.
Expected reading at idle, between 1.5 - 4 volts peak to peak.
The voltage will increase with engine speed.

Were the readings as expected?

YES → Refit the CKP sensor.

NO → Contact the Technical Hotline for further assistance.

Using the adapters (number JT-034) from the WDS Probe Tip Adapter Kit, attach an adapter to each of the pins on the CKP sensor electrical connector.

WARNING: Keep probes / hands/equipment clear of rotating pulleys and drive belts.

Using the WDS, select the oscilloscope and connect the red and black probes to the adapters on the sensor.

If the signal is less than 1.5 volts at idle, suspect incorrect air gap between sensor and target. Check to ensure sensor is fitting flush.

See Additional Information P-12a.

CKP sensor retaining bolt tightening torque 10 Nm.

See Additional Information P-12a.
Ensure ignition is switched ‘OFF’ and disconnect ECM electrical connector EN016.

Inspect ECM connector and pins for damage.

See Additional Information Generic Connector Inspection.

Refer to X-TYPE electrical guide.

See Additional Information Generic Harness Check.

Carry out a Generic Harness Check between CKP sensor electrical connector and the ECM electrical connector.
EN012 pin 001 - EN016 pin 037 (Yellow wire)
EN012 pin 002 - EN016 pin 036 (Purple wire).

Was a fault found and rectified?

END

Contact Technical Hotline for further assistance.
Air Leakage
Flowchart P-13

Visually check that all vacuum and breather pipes are correctly fitted to the inlet manifold and air cleaner outlet pipe.

If the air leak is severe and the engine cannot compensate for the leak a DTC will be logged.

Related DTCs
P0171 Fuel system too lean bank 1.
P0174 Fuel system too lean bank 2.

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

Using the WDS, select the datalogger tab.

If an air leak is present expect the equivalence ratio to be between 1.05% to 1.25% at idle.

The STFT values should fluctuate around 0% ± 7%.

From the menu select the Short Term Fuel Trim (STFT) for banks 1 and 2, also select Oxygen Sensor Upstream Equivalence Ratio for banks 1 and 2.

It is possible that an air leak will be heard with the engine running at idle, dependent on the severity of the leak.

Run engine to normal operating temperature and monitor the selected signals.

A
Using the Jaguar spray AC90, spray around the joints of the components and pipes listed below and monitor the selected signals.

- Air cleaner outlet pipe.
- Breather pipe to cylinder bank 1.
- Breather pipe to cylinder bank 2.
- Vacuum pipe to brake servo.
- Vacuum pipe to evaporative (EVAP) Purge valve.
- Intake Manifold Tuning Valves.
- Manifold Absolute Pressure Sensor.
- Inlet manifold gaskets (upper and Lower).

Listen to the engine tone, there may be a change in idle speed, dependent on the severity of the leak.

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

The Oxygen sensor upstream equivalence ratio will decrease, possibly as low as 0.75% if the AC90 spray is drawn into the manifold.

Were the readings as expected?

NO

Listen to the engine tone, there may be a change in idle speed, dependent on the severity of the leak.

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

The Oxygen sensor upstream equivalence ratio will decrease, possibly as low as 0.75% if the AC90 spray is drawn into the manifold.

Were the readings as expected?

YES

Contact the Technical Hotline

NO

Was a fault found and rectified?

YES

END
The Park / Neutral switch is part of the Transmission Rotary (TR) switch.

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) and the Transmission Control Module (TCM) for Diagnostic Trouble Codes (DTC).

Related DTCs
ECM
P1517 Park, Neutral switch driving malfunction.
P1516 Park, Neutral switch starting malfunction.

TCM
P0706 Transmission Range sensor

If any DTCs are stored, carry out the associated guided diagnostic routine or select Transmission systems from the Content Model menu, Sensors and then Transmission range switch. Run the guided diagnostic test.

Was a fault found and rectified?
YES → END
NO → A
A

Using WDS, select datalogger, Transmission Systems and then select Gear Selector Position.

Switch the Ignition 'ON'.

Monitor the signal. Engage each gear in turn.

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions on the DTC Summaries Disk Issue 2.

Did the readings correspond with the selected gear?

YES

Suspect P0760 to be logged if the cable adjustment is incorrect.

NO

Refer to the setting procedure outlined in JTIS. Selector lever cable adjustment.

Check Selector lever cable adjustment.

END

YES

Was a fault found and rectified?

NO

Contact Technical Hotline for further assistance.
Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

Related DTCs
- P0191 Injection Pressure sensor circuit range/ performance.
- P0192 Injection Pressure sensor circuit low voltage.
- P0193 Injection Pressure sensor circuit high voltage.

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

Using WDS, from the content model menu select Engine Systems. Select datalogger tab, then select Fuel Rail Pressure sensor, Manifold Absolute Pressure (MAP) sensor, and Modulated Fuel Pump Control - Duty Cycle.

Note: When using datalogger the IP sensor is shown as the Fuel Rail Pressure Sensor.
Connect a suitable calibrated fuel wet gauge to the Schrader valve.

Start the engine and allow the gauge to prime.

Monitor the WDS readings. Confirm correct operation of the IP sensor by using this calculation.

100 Kpa - MAP reading (kPa) + wet gauge reading (kPa) should be equal to the IP sensor reading ± 10 kPa.

Were the readings within ± 10 kPa?

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found in the DTC Summaries Disk Issue 2.

If an electrical fault is present on the Injector pressure sensor circuit, expect the reading to default to 483 kPa.

Disconnect the IP sensor electrical connector IL007 and carry out a Generic Connector Inspection.

See Additional Information Generic Connector Inspection.

YES

NO
With the ignition 'ON' and using a Digital Multi Meter (DMM), check for 5 volt supply at pin 1 of IP sensor electrical connector IL007.

Was the reading as expected?

If the 5 volt supply has been lost from the ECM, suspect additional sensor fault codes will be logged.

Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.

See Additional Information Generic Connector Inspection.

Carry out a Generic Connector Inspection on ECM electrical connector EN016.

Refer to X-TYPE electrical guide.

See additional information Generic Harness Check.

Carry out Generic Harness Check between the IP sensor electrical connector IL007 and the ECM electrical connector EN016. IL007 pin 001 - EN016 pin 012.

Was a fault found and rectified?

Contact Technical Hotline for further assistance.

END
Carry out Generic Harness Check between the IP sensor and the ECM electrical connector EN016.

IL007 pin 003 (White and green wire) - EN016 pin 073 (Blue wire)
IL007 pin 002 (White and green wire) - EN016 pin 019 (Black and green wire)

Ensure the ignition is switched ‘OFF’ and disconnect ECM electrical connector EN016.

See Additional Information Generic Connector Inspection.

Carry out a Generic Connector Inspection on ECM electrical connector EN016.

Refer to X-TYPE electrical guide.

See Additional Information Generic Harness Check.

END

Was a fault found and rectified?

NO

Replace faulty IP Sensor.

YES

Replace faulty IP Sensor.
Knock Sensor
Flowchart P-16

Knock Sensor (KS) faults are indicated via the Malfunction Indicator Lamp (MIL). (only on second trip).

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

Note:
The vehicle timing will be retarded and the maximum engine speed reduced to 3000rpm if a fault lies with the KS or the circuit.

Related DTCs
P0332 Knock Sensor circuit out of range low voltage.
P0333 Knock Sensor circuit out of range high voltage.
P1648 ECM Knock Sensor self test failure.

If any DTCs are stored, carry out the associated guided diagnostic routine.

Was a fault found and rectified?

END

YES

NO

A
A

See Additional Information Generic Connector Inspection.

Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016 and carry out a Generic Connector Inspection.

See Additional Information Generic Harness Check.

Using a Digital Multi Meter (DMM) check the resistance of the KS and the harness via the ECM electrical connector. EN016 pin 100 - EN016 pin 098. The expected reading 200k-ohms ± 80k-ohms

Were the readings as expected?  

NO

B

See Additional Information Generic Harness Check.

YES

Carry out a Generic Harness Check on electrical connector EN016 pin 100 and EN016 pin 098 to ensure no short circuits are apparent.

See Additional Information Generic Harness Check.

Was a fault found and rectified?

YES

END

NO

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found in the DTC Summaries Disk Issue 2.
Disconnect KS electrical connector EN023 and carry out a Generic Connector Inspection.

Carry out Generic Harness Check between KS electrical connector EN023 and the ECM electrical connector EN016.
- EN023 Pin 001 - EN016 pin 098 (Brown wire)
- EN023 Pin 002 (White wire) - EN016 pin 100 (Black and green wire)

Was a fault found and rectified?

YES: Replace faulty Knock Sensor.

NO: See Additional Information Generic Harness Check.
Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC).

If related DTCs are stored, carry out the associated guided diagnostic routine.

Related DTCs
P0834 Clutch pedal switch low voltage.
P0835 Clutch pedal switch high voltage.

Was a fault found and rectified?

END

YES

NO

A
A

Ensure the ignition is switched "OFF" and disconnect ECM electrical connector EN016.

Inspect the ECM electrical connector for damage.

Use WDS probe adapter kit to avoid damage to ECM pins.

Using a Digital Multi Meter (DMM), connect the probes to ECM electrical connector EN016 pin 007 and EN016 pin 031.

Fully depress the clutch pedal and check for continuity.

Were the readings as expected?

NO → B

YES

Contact Technical Hotline for further assistance.

See Additional Information Generic Connector Inspection.
Disconnect the clutch pedal safety switch electrical connector PA005.

The clutch pedal safety switch is located at the bottom of the pedal box and is black in color.

Note: When removing the clutch pedal safety switch electrical connector, if the switch is removed from the pedal box you must install a new clutch pedal safety switch.

Carry out a Generic Harness Check between the clutch switch electrical connector PA005 and the ECM electrical connector EN016.

- PA005 pin 001 - EN016 pin 007
- PA005 pin 002 - EN016 pin 031

Was a fault found and rectified?

NO → Replace faulty clutch pedal safety switch.

YES → END
Engine Coolant Temperature Sensor
Flowchart P-18

Engine Coolant Temperature (ECT) Sensor faults are indicated via the Malfunction Indicator Lamp (MIL).
(only on second trip)

Ensure the coolant level is correct, and no leaks are apparent before carrying out any diagnostics

Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for Diagnostic Trouble Codes (DTC)

Related DTCs
P0116 Sensor circuit range/performance.
P0117 Sensor circuit high voltage.
P0118 Sensor circuit low voltage.
P0125 Poor sensor response.

If any DTCs are stored, carry out the associated guided diagnostic routine

Run engine up to normal operating temperature and ensure cooling fans operate at 95°C

Was a fault found and rectified?

The engine coolant temperature is maintained between 85 - 95 °C

Using WDS select the datalogger tab. Select Engine Systems and then select the Engine Coolant Temperature (ECT) Sensor. Monitor the readings to verify the operation of the ECT sensor

Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

Were the readings as expected?

YES

NO

A
Run engine up to normal operating temperature and ensure cooling fans operate at 95°C.

Disconnect the ECT electrical connector. Carry out a Generic Connector Inspection.

Check the resistance of the sensor in comparison to the engine temperature. Expected readings:
-10°C = 9.16 k-ohms
20°C = 2.45 ± 0.14 k-ohms
40°C = 1.15 k-ohms
60°C = 0.584 k-ohms
80°C = 0.31 ± 0.008 k-ohms

Was a fault found?

Replace faulty ECT sensor

Run engine up to normal operating temperature and ensure cooling fans operate at 95°C.

Remove the sensor and ensure that the sensor is free from contamination and is not damaged, (i.e. cracked or corroded).

Was a fault found?

Replace faulty ECT sensor

Run engine up to normal operating temperature and ensure cooling fans operate at 95°C.

Refit the sensor (tightening torque 19.6 Nm)

END
Carry out a Generic Harness Check between ECT electrical connector and the ECM electrical connector.

**EN018 pin 002 - EN016 pin 070** (Blue and yellow wire)

**EN018 pin 001 - EN016 pin 019** (Black and green wire)

Ensure the ignition is switched ‘OFF’ and disconnect ECM electrical connector EN016

Inspect ECM electrical connector and pins for damage

See Additional Information
Generic Connector Inspection

Refer to X-TYPE Electrical Guide

See Additional Information
Generic Harness Check

Carry out a Generic Harness Check between ECT electrical connector and the ECM electrical connector.

END  YES  Was a fault found and rectified?

NO  Contact Technical Hotline for further assistance
Oscilloscope set up.

1. Configuration sub tab. 
   Channel 1
   Select: Red probe and black probe-Differential.

2. Channel calculation sub tab.
   Select: Maximum voltage.

3. Main oscilloscope display sub tab.
   Y-axis select: Scale set to 1 volt/div.
   X-axis select: Scale set to 10 ms/div.


Illustration 1 Trace of the cam sensor at idle
Illustration 2 Trace of cam sensor at 2000 rpm
### Additional Information P-3a

<table>
<thead>
<tr>
<th>Related Diagnostic Trouble Codes.</th>
<th>Criteria.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1367 Ignition amplifier group 1 malfunction</td>
<td>All side 1 coils malfunction</td>
</tr>
<tr>
<td>P1368 Ignition amplifier group 2 malfunction</td>
<td>All side 2 coils malfunction</td>
</tr>
<tr>
<td>P0351 to P0356 Ignition amplifier malfunction at the associated cylinder number 1 to 6</td>
<td>Ignition coil open/short circuit/damaged harness on the associated cylinder</td>
</tr>
<tr>
<td>P0300 Misfire random/multiple cylinders</td>
<td>Random misfire detected or misfires on 1 or more cylinders</td>
</tr>
<tr>
<td>P0301 to P0306 Misfire at the associated cylinder number 1 to 6</td>
<td>Misfire detected on the associated cylinder</td>
</tr>
</tbody>
</table>

For further information refer to DTC Summaries Disk Issue 2

Side 1 of engine as indicated at 7, Illustration 3  
Side 2 of engine as indicated at 8, Illustration 3  
Front of engine as indicated at 9, Illustration 3

Always refer to the Technical Hotline if problems are encountered.
Subject: Upstream and Downstream Oxygen Sensors.

**Checks**

- The upstream sensor is also identified as the UHEGO and has a grey connector.
- The downstream sensor is also identified as the HEGO and has a black connector.
- To ensure that the sensors are fitted correctly, the upstream sensor is situated directly above the catalytic converter (Pre-catalytic), and the downstream sensor is at the center of the catalytic converter.
- If the sensor positions are reversed this will cause catalytic converter monitor diagnostic trouble codes P0420 and P0430 to be logged.
- If the catalyst monitor DTCs are logged (P0420/P0430) and the orientation of the sensors is correct then suspect catalytic converter failure. Removing the catalytic converter and visually checking the honeycomb layout can check this.
- Air leaks are possible at the connection of the sensor to the exhaust. Ensure the sensors are tightened to the correct torque.
- Problems may occur due to air leaks within the exhaust system.
- Carry out visual checks for cracks and leaks from the manifold down to the catalytic converter.
- Listen for the exhaust gas escaping when cold, as it may not be noticeable as the exhaust warms and expands.

**Cautions**

Removal. (Always refer to JTIS)

Ensure the connector on the flylead is disconnected before removal.
Failure to do this may cause the wires to twist and damage or pull out of the sensor.

Installing. (Always refer to JTIS)

Over tightening may cause damage to the element within the sensor.
Ensure the correct tightening torque is used when installing the sensor.
(Torque setting for both sensors 40 Nm +/- 7.2 Nm.)
Ensure the flylead is routed correctly and is not taut, as this may cause damage with engine movement.
### Additional information P-4a cont.

<table>
<thead>
<tr>
<th>DTC</th>
<th>Description</th>
<th>DTC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0031</td>
<td>Heater control circuit low A</td>
<td>P0037</td>
<td>Heater control circuit low A</td>
</tr>
<tr>
<td>P0032</td>
<td>Heater control circuit high A</td>
<td>P0057</td>
<td>Heater control circuit low B</td>
</tr>
<tr>
<td>P0051</td>
<td>Heater control circuit low B</td>
<td>P0038</td>
<td>Heater control circuit high A</td>
</tr>
<tr>
<td>P0052</td>
<td>Heater control circuit high B</td>
<td>P0058</td>
<td>Heater control circuit high B</td>
</tr>
<tr>
<td>P0131</td>
<td>Circuit low voltage A</td>
<td>P0137</td>
<td>Circuit low voltage A</td>
</tr>
<tr>
<td>P0132</td>
<td>Circuit high voltage A</td>
<td>P0157</td>
<td>Circuit low voltage B</td>
</tr>
<tr>
<td>P0133</td>
<td>Circuit slow response 1A</td>
<td>P0138</td>
<td>Circuit high voltage A</td>
</tr>
<tr>
<td>P0151</td>
<td>Circuit low voltage B</td>
<td>P0158</td>
<td>Circuit high voltage B</td>
</tr>
<tr>
<td>P0152</td>
<td>Circuit high voltage B</td>
<td>P0140</td>
<td>Circuit no activity A</td>
</tr>
<tr>
<td>P0153</td>
<td>Circuit slow response 1B</td>
<td>P0160</td>
<td>Circuit no activity B</td>
</tr>
<tr>
<td>P1646</td>
<td>Control module open/shorted A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1647</td>
<td>Control module open/shorted B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For further information, refer to DTC Summaries Disk Issue 2
### Additional Information P-11a

#### Engine Fuel Temperature Sensor Characteristics.

<table>
<thead>
<tr>
<th>Temperature.</th>
<th>Nominal resistance Using DMM.</th>
<th>WDS Datalogger voltage display.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10°C (14°F)</td>
<td>160.3 k-ohms ± 8.3 k-ohms</td>
<td>4.15 volts ± 0.04 v</td>
</tr>
<tr>
<td>10°C (50°F)</td>
<td>58.9 k-ohms ± 2.9 k-ohms</td>
<td>3.52 volts ± 0.06 v</td>
</tr>
<tr>
<td>20°C (68°F)</td>
<td>37.3 k-ohms ± 2.1 k-ohms</td>
<td>3.09 volts ± 0.07 v</td>
</tr>
<tr>
<td>30°C (86°F)</td>
<td>24.2 k-ohms ± 1.4 k-ohms</td>
<td>2.62 volts ± 0.07 v</td>
</tr>
<tr>
<td>40°C (104°F)</td>
<td>16.1 k-ohms ± 0.9 k-ohms</td>
<td>2.15 volts ± 0.08 v</td>
</tr>
</tbody>
</table>

**Abbreviations:**
- WDS - Worldwide Diagnostic System.
- DMM - Digital Multi Meter.

**Note:**
When testing the Engine Fuel Temperature sensor, if the vehicle is cold (approximately workshop temperature 20°C) it is possible to invoke a temperature change by rubbing the rail where the sensor is situated, this will increase the temperature and decrease the resistance.

**WARNING:** PARTS MAY BE HOT.
Additional Information P-12a

Oscilloscope set up.
1 Configuration sub tab.
   Channel 1
   Select: Red probe and black probe - Differential.
2 Channel calculation sub tab.
   Select: Maximum voltage.
3 Main oscilloscope display sub tab.
   Y-axis select: Scale set to 1 V/div.
   X-axis select: Scale set to 10 ms/div.
4 Select: Full screen.

![Oscilloscope Image]

Fig. 4 Trace of the crankshaft sensor at idle
Generic Connector Inspection

Electrical failures can be caused by problems with the connectors and their pins. Below are a number of points that may aid in investigation.

**Backed-out Pins**

Inspection of the connector; look for signs that the pin has backed-out. If a seal is fitted to the pin it may be protruding further out the back of the connector. If a pin has backed-out of the cavity in the connector, there is a possibility that it has been forced out when the connector was mated. Make sure that the pins are in line when the two halves of the connector are mated.

**Bent Pins**

Disconnect the two halves of the connector and visually inspect the pins. If a pin is bent over there is a possibility of a short from pin to pin. Pins can easily be bent over when the connector is mated. Check to ensure the pins within the connector are not knocked out of alignment before the two halves of the connector are mated.

**Water ingress/fluid ingress**

Disconnect the connector and inspect for signs of water ingress, corrosion may have occurred. If water or any other fluid is visible this may cause a bad connection or even short circuit to the other pins within the connector. Examine the connector seals for any damage and to ensure that the seals are fitted correctly. Ensure that the two halves of the connector latch together securely.

**Probing**

Ensure when probing a pin that the correct probe is used and excessive force is not used as this may weaken the locating clip and allow the pin to work loose. Care must be taken when probing female pins as the pin can easily be splayed if probed with the incorrect adaptor or the wrong tool. This would then have the potential to cause a bad connection between the two mating halves. Always use the Worldwide Diagnostic System probe kit when probing pins within a connector. (Jaguar probe adaptor kit part number. 3548-1358-00.)

**Insertion force**

Insertion force is imperative to ensure a good connection is made between the two mating pins. If the female pin is splayed, the connection will be poor. To check the insertion force of the female connector, identify the correct male pin within WDS probe adaptor kit. Gently insert the adaptor into the female pin and then repeat with the other pins within the connector. If the pin in question feels loose in comparison replace both male and female pins.

**Chafing**

Inspect the harness when in close contact to other objects (i.e. sharp steel brackets). Engine vibration will cause the outer protection to quickly chafe through if the harness is not routed correctly. When performing a repair, ensure that heat resistant tape is used where relevant. Before repairing or replacing any harness, always refer to the electrical wiring harness repair guide, reference publication number JTP 586. When repairing a harness ensure the Jaguar harness repair kit is used. (Part number. 418-S065 and 418-S411.)

Always refer to Technical Hotline if problems are encountered.
Generic Harness Check

- When carrying out any of the tests in the generic harness check, it is imperative that any other sources that share the harness are taken into consideration when a measurement is taken.
- The X-TYPE electrical guide (publication part number – JJM 10 38 20/20) will show all other sources sharing that harness i.e. splices and sensors. This electrical guide is in JTIS.
- Always ensure the digital voltmeter is operating correctly before proceeding.
- Always use the WDS probe kit when probing pins within a connector.

Note: Do not insert the Digital Multi Meter (DMM) leads into the connector pins. (Probe adaptor kit part number: 3548-1358-00.)

Continuity test

Using a DMM, connect the DMM to the pins at both ends of the circuit that you are testing. Ensure you connect to the correct pin when a large number of pins are used in a connector. (Use WDS Probe adapter kit).

Set the DMM to the resistance test or the continuity beeper. The resistance should be between 0 – 10 ohms. If a high resistance or open circuit is found investigate harness for damage.

Short circuit high fault

The DMM can be connected to any ground source on the vehicle, but it is preferable to use the battery negative pole.

Set the DMM to Volts DC; connect the DMM red probe to the suspect pin of the circuit and the DMM black probe to the battery negative pole. No voltage should be seen, if 4 – 13 volts is seen suspect short circuit high and investigate harness for damage.

Always test the circuit with the ignition 'ON' and 'OFF' when trying to identify this fault condition.

Short circuit low fault (to ground)

The DMM can be connected to any ground source on the vehicle, but it is preferable to use the battery negative pole.

Set the DMM to the resistance test; connect the DMM to the suspect pin of the circuit and the battery negative pole, an infinity reading/open circuit (O/C) should be seen.

If a resistance is seen, suspect short circuit low and investigate harness for damage.

Always refer to the Technical Hotline if problems are encountered.