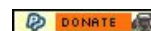


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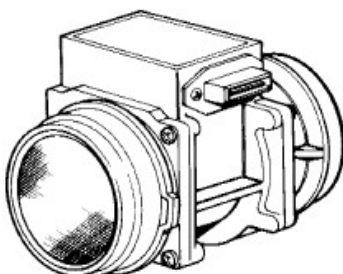
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### - Jag-Lovers' xj40 Ebook -

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XJ40 Air Flow Meter  
(photo courtesy Jaguar Cars Limited)

## 11.9 - Air Flow Meter (by John Pring & Dana Haydel - edited May 4, 2011 by Forrest Eckstein)

### Operation

The mass airflow sensor is a metering device designed to determine the actual "mass" of air entering the engine. It is not a volumetric flow device and it does not require external air density compensation for proper operation. The engine must receive a mass airflow signal to account for changes in air density caused by temperature and altitude. A simple volumetric flow rate signal would be insufficient.

The meter itself, is between the air filter and the inlet manifold (looks like an aluminum tube with a rectangular box on top and a cable harness connecting to it). It is considered a very reliable component typically being trouble-free, and like the engine management computer, should never be condemned without thorough investigation. It performs its primary function of metering the mass of air drawn into the engine using two thermal sensors. These sensors are located within a bypass channel in the MAF sensor. One sensor is termed the "compensating coil" and is unheated while the other sensor is called the "sensing coil" and is electrically heated by the sensor circuitry. The amount of sensing coil current needed to keep the differential temperature between these two sensors constant is directly proportional to engine load (mass air flow).

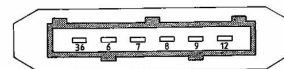
The compensating coil is always at ambient temperature while the sensing coil is always attempting to create a fixed differential temperature as it is cooled by the air stream. In order to clean the sensing coil, the temperature flashes to 1000 degrees C for one second, four seconds after the ignition is switched off. The engine management computer is monitoring a voltage drop within the MAF sensor electronic circuitry, which is directly related to the current flowing through the sensing coil. This design is factory setup and calibrated. It is non-adjustable for the owner.

Early XJ40s incorporate a manual idle trim adjustment which is a 10 turn, 0-1000 ohm potentiometer built in to the air flow meter for minor idle fuel adjustment, but it works independently of the thermal sensors. Later models have adaptive idle fuel metering and no adjustment or input from the owner is necessary. These MAF internal adjustments, whether manual or automatic, are designed for emissions adjustment. The total available trim for either the manual or automatic idle fuel adjustment is only +/-10% of the nominal injector pulse duration at idle. Manual trimming is not recommended unless the

owner has access to an emissions analyzer.

## Functional Checks

Located on the left side of the MAF sensor is the six pin, rectangular electrical connector. This connector can be problematic. It cannot be over-emphasized that the engine management system utilizes low voltage control signals. These signals are subject to faults and high resistance joints caused by corrosion. To overcome this known problem, later models of XJ40s were equipped with gold plated connections. The connector is held in with wire clip. If you push up on the wire clip from underneath, the connector can be removed from the sensor.



Electrical conductivity problems may be resolved by simple cleaning of the connector pins using a quality electronic component cleaner. It may be necessary to bend each male connector pins (in the MAF sensor housing) slightly to insure good connectivity. Pin layout is according to the figure below. Pin 36 is towards the front of the car. Pin identifiers may change from model to model, but the basic function remains the same.

### Preliminary checks for MAF Sensor:

The following table lists typical pin-outs for power and grounds. Check and correct each before going any further with the tests.

Pin 36 & Pin 6	Grounds
Pin 7	ECU Ground
Pin 8	Empty Connector
Pin 9	12 VDC Supply
Pin 12	ECU Supply 5.0 VDC

### On car tests for MAF sensor:

The following table lists the voltages expected to be measured at the MAF connector for 3 different tests: two with the engine NOT running and one with the engine running at idle.

Ignition ON MAF disconnected (no start)	Ignition ON MAF connected (no start)	Engine Running @ idle (~750RPMs) MAF connected
Pin 7 < 1V (leakage)	Pin 7 > 1V (leakage)	Pin 7 ≈ 1.2V to 1.4V
Pin 9 = Battery voltage	Pin 9 = Battery voltage or slightly less	Pin 9 > Battery voltage due to alternator operating
Pin 12 ≈ 5V	Pin 12 ≈ 1.85V	Pin 12 ≈ 1.8 to 2.5V

### Diagnostics:

Battery voltages on Pin 9 that deviates significantly from the chart need to be investigated further and repairs made.

Note: Should the battery be disconnected the engine management will need to re-learn the base idle. This "re-learning" is automatically achieved by operating the engine at normal coolant temperature and driving for a distance > 50 yards. The engine may stall at idle once or twice until the adjustment values are accepted and stored within the ECU RAM.

Pin 7 readings of < 1.2V can produce poor running conditions and if lower possibly **no start**. A voltage of < 0.2V or > 4.5V is will generate a diagnostic test code (DTC 12). Refer to Fault Code List for other diagnostic help with this fault.

The Pin 12 reading will typically increase towards 5V as engine revolutions are increased. This reference voltage is from the ECU.

### Bench Test (Circuit Checks) for MAF Sensor:

- 1) Remove the electrical connector from the MAF sensor.

2) Connect a 12VDC power source (battery) to Pin 9 (+) which is normal 12 VDC supply to the MAF sensor and Pin 36 (-) which is normal ground for the MAF sensor. Ensure the power supply positive is connected to Pin 9 and the negative is connected to Pin 36. Do not reverse power supply polarity.

3) Connect a quality digital multi-meter setup to monitor voltage to Pin 7 (+) and Pin 6 (-). Ensure multi-meter positive test lead is to Pin 7 and negative test lead is to Pin 6. If multi-meter polarity is reversed, voltages will indicate negative but the absolute values will be correct.

Two tests are to be performed. The airflow meter is stationary in both cases but in one case compressed air is "blown" in the direction the air would normally enter the engine.

Test 1 : Air meter stationary with no flow		Test 2 : Air meter stationary with directed blast of air	
Voltage readings	Diagnostics	Voltage readings	Diagnostics
0.2 to 0.4V	OK	Rise to 1.5V then returns to Test 1 voltage	OK
0V	Output open circuit	0V	Output Open circuit
> 0.7V	Output Drifted Module inoperative. Sensors(s) detached	Same voltage as in Test 1	Module inoperative
		> 5V	Sensor(s) wire detached Calibration drifted

This section currently maintained by Pascal Gademer; questions, comments, submissions and suggestions, email [pascal@jag-lovers.org](mailto:pascal@jag-lovers.org)

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