SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 19AUB204 – AUTOMOTIVE ELECTRICAL AND ELECTRONICS ENGINEERING

II YEAR / IV SEMESTER

Unit 4 – Sensors and Actuators

Topic : Air Mass Flow Sensor

AIR MASS FLOW SENSOR

- An air mass flow sensor, also known as a mass airflow sensor (MAF), is a crucial component in modern fuel-injected engines.
- Its primary function is to measure the amount of air entering the engine's intake system, allowing the engine control unit (ECU) to determine the correct air-fuel mixture for efficient combustion.
- There are a few different types of air mass flow sensors, but the most common is the hot wire or hot film MAF sensor

COMPONENTS

- **Sensor Housing**: This is the outer casing that houses the internal components of the MAF sensor and protects them from environmental factors.
- **Hot Wire or Hot Film Element**: This is the heart of the MAF sensor. It consists of a thin wire or film that is electrically heated to a specific temperature above the ambient temperature. As air flows over this element, it cools down, and the amount of cooling is measured to determine the mass airflow.
- **Electronics**: The MAF sensor contains electronic circuitry responsible for heating the wire or film, measuring the cooling effect caused by the airflow, and converting this information into an electrical signal that the engine control unit (ECU) can use.

COMPONENTS

- **Connector**: The MAF sensor is typically equipped with a connector that allows it to be plugged into the wiring harness of the vehicle, facilitating communication with the ECU.
- **Housing Inlet and Outlet**: These are the entry and exit points for the airflow into and out of the sensor. The shape and design of these openings are engineered to ensure smooth airflow and accurate measurements.

PRINCIPLE USED

- The air mass flow sensor operates on the principle of thermal mass flow measurement. It uses a heated wire or film that is cooled by the airflow passing over it.
- The amount of cooling is directly proportional to the mass of the incoming air, allowing the sensor to determine the air mass flow rate and provide essential data for fuel injection control in the engine management system

WORKING

- The sensor is positioned in the intake air duct of the engine.
- As air flows through the intake, it passes over the sensor's sensing element, which is typically a heated wire or film.
- The sensing element is electrically heated to a specific temperature above the ambient air temperature.
- This heating ensures that the wire or film remains at a constant temperature regardless of changes in the surrounding air temperature.
- As the airflow passes over the heated sensing element, it cools the element down.

WORKING

- The rate of cooling is directly proportional to the mass of the air passing over the sensor.
- More airflow leads to greater cooling effect, indicating a higher mass flow rate.
- The sensor detects the temperature change caused by the airflow cooling effect.
- This change in temperature is converted into an electrical signal, typically a voltage or frequency signal, which corresponds to the mass airflow rate.
- The electrical signal generated by the sensor is sent to the engine control unit (ECU).

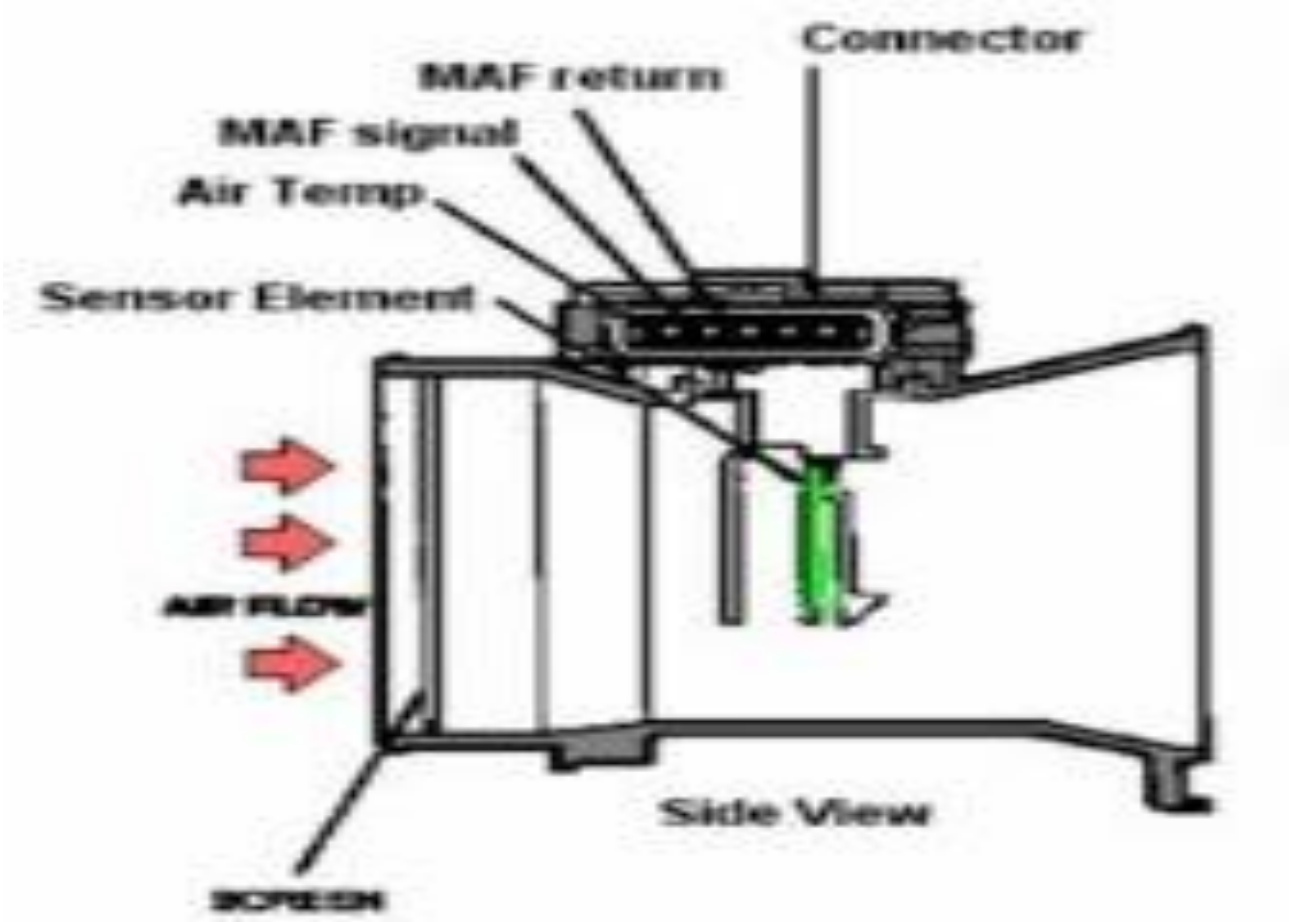
WORKING

- The ECU processes this signal along with other sensor data, such as engine speed and throttle position, to determine the appropriate amount of fuel to inject into the engine.
- Based on the air mass flow rate calculated by the sensor, the ECU adjusts the duration and timing of the fuel injector pulses.
- This ensures that the air-fuel mixture supplied to the engine is optimized for efficient combustion and engine performance.

WORKING

- The ECU continuously monitors the air mass flow sensor's output to maintain the desired air-fuel ratio under various operating conditions.
- This closed-loop control system allows for real-time adjustments to fuel injection, improving fuel efficiency, emissions, and overall engine performance.

WORKING


Connector
MAF return
MAF signal
Air Temp
Sensor Element
AIR FLOW
Side View
SCREEN

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Direct Measurement
- Real time data
- Wide operating range

DISADVANTAGES

- Sensitive to contaminants
- Potential for failure

APPLICATIONS

- Automotive Engines
- HVAC
- Medical Devices
- Aerospace
- Environmental monitoring
- Consumer Electronics

THANK YOU !!!