

Delphi Probe Air Meters

Delphi Probe Air Meters measure the mass of air ingested by the engine using hot wire anemometry. The concept is simple, the implementation is unique. The heart of the design is a platinum-based, glass-coated, heated sensing element which is a low mass, quick responding device used in a bridge circuit configuration. The element leads have the unique combination of high electrical conductivity and low thermal conductivity to maximize the signal to noise ratio of the air flow. The "brains" of Delphi Probe Air Meters are contained in a custom integrated circuit.

The output signal of Delphi Probe Air Meters is determined by the power required to keep the heated sensing elements at a fixed temperature above ambient. For gasoline engines, the control module utilizes the air meter output signal to precisely determine the scheduling of fuel, enabling an optimal air/fuel ratio and, thus, helping reduce emissions while maintaining drivability. For diesel engines, the controller typically uses the air meter to schedule exhaust gas recirculation.

As more stringent emissions regulations are applied to diesel engines, accurate air flow becomes more and more important. To help manufacturers meet the requirements, Delphi now offers the most accurate air meters in the industry.

Delphi offers a family of interchangeable Probe Air Meters. They can be integrated directly into an air induction system, or into a variety of customer-determined tube diameters:

- **Probe Single** is a low cost air meter that uses one heated element for unidirectional air flow measurement.
- **Probe Dual** uses two heated sensing elements for optimal accuracy and flexibility for unidirectional air flow measurement. This option provides the most robust design for handling variations in air induction systems.
- **Probe Bypass** compensates for pulsation encountered in 4- and 5- cylinder turbocharged engine applications. It offers both the superior durability of Delphi's heated sensor technology and by-pass air flow capability suitable for applications requiring pulse flow compensation air flow measurement.

► Benefits

- Platinum-coated ceramic heated sensing element design is smaller and less fragile than competitive products
- Heated sensing elements are very robust to damage from dust impingement
- Heated sensing elements offer proven durability with more than 125 million in the field over the past 14 years
- Patented temperature compensation algorithm offers robustness to changes in ambient air temperature
- Patented dimple design eliminates the need for a flow straightener in most applications
- Probe design offers low restriction air measurement driving increased horsepower
- Interchangeability is enabled by common mounting footprint



Delphi's family of Probe Air Meters includes the Probe Single (left), the Probe Dual (center), and the Probe Bypass (right).

▶ **Typical Applications**

Delphi air meters, also known as air flow sensors or mass air flow sensors, are designed to function as an integral part of a vehicle's engine management system and can be tailored for use in both gasoline and diesel engine applications.

▶ **Delphi Probe Air Meter Specifications**

Probe Single and Probe Bypass	±3 percent deviation (indicated flow) Upgrade to ±1 percent available
Probe Dual	±1.5 percent deviation (indicated flow) Upgrade to ±1 percent available
Input voltage	12 V or 24 V
Output signal	Frequency or voltage
Mass flow range	Application-dependent
Tube/honeycomb	Optional upgrade
Connectors and gold pins	Available

▶ **Performance Advantages**

Delphi's total systems approach, and unparalleled experience and knowledge of the air/fuel subsystem, provide the advantage for producing effective, reliable air meters. Delphi's air meter-based fueling strategy offers a robust, quick-to-market alternative to speed density-based fueling. Using the air meter strategy, changes to powertrain components will not require re-characterization of volumetric efficiency tables because the air flow is measured directly.

Delphi is the only supplier to offer air meters with dual heated sensing elements which enable any platform, regardless of air induction system variations, to incorporate an air meter into the air/fuel system with minimal engineering effort.

All Delphi Probe Air Meters feature a patented dimpled flow management feature that provides better control of air separation for more consistent air flow across the sensing elements and enabling outstanding performance in application-specific ducting. All three designs are produced on the same manufacturing equipment to minimize investment and, ultimately, the cost to the customer. Delphi Probe Air Meters can be customized with options that include: connector designs, terminal plating, supply voltage, output signal (frequency or voltage), and more.

All Delphi Probe Air Meters can be upgraded to a ±1 percent accuracy specification level to help manufacturers of diesel engines meet the more stringent emissions requirements of the future, such as Euro 5.

▶ **The Delphi Advantage**

Delphi is a leader in air flow measurement technology. Delphi has proven its ability to supply cost effective, reliable products offering unparalleled accuracy. Delphi has delivered more than 50 million air meters for more than 500 different customer applications since 1993.

Delphi air meter product and process engineers offer a unique combination of mechanical, electrical, and vehicle systems knowledge that has enabled the successful evolution of the product line. Delphi remains focused on the continuous improvement of packaging, cost, and performance while minimizing risk and maintaining a commitment to proven elements of design.

Delphi has one of the industry's most complete portfolios of sensors and offers global manufacturing for sensors and an in-depth knowledge of regional market requirements. Delphi is a leader in engine management systems, leveraging many years of experience in integration to provide end-to-end systems. Delphi's engine management systems can help vehicle manufacturers meet emissions and fuel economy standards without compromising performance, dependability, or value.