



ABB Instrumentation

Torbar Averaging Pitot Tubes Economical Flow Metering Solutions for Gases, Liquids and Steam

What is a TORBAR?

The TORBAR is a multiport self-averaging flow meter with a design based on the classical pitot tube concept of fluid flow measurement.

Since the introduction of the TORBAR in 1985, thousands have been installed into a large variety of industries world wide.

How TORBAR Works

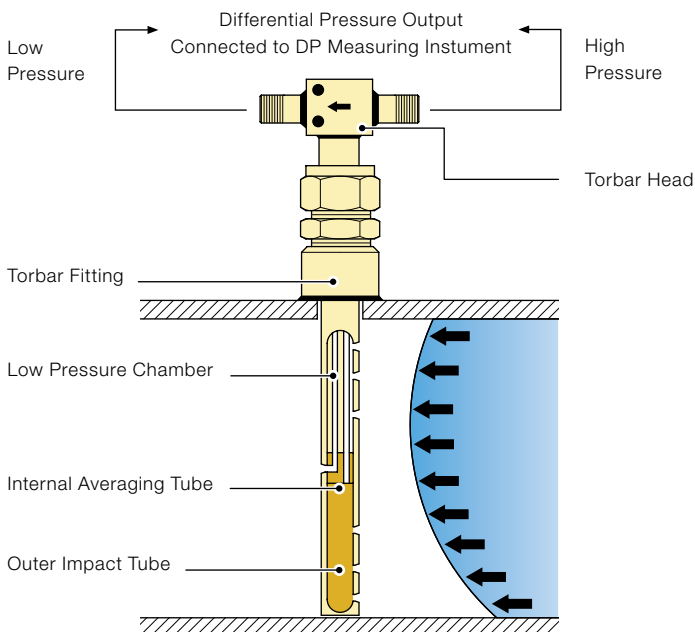
TORBAR produces an averaged differential pressure (DP) signal proportional to the square of the flow rate.

The DP output is normally piped to a Differential Pressure transmitter in order to generate an electrical signal proportional to the flow rate. For certain applications, the DP transmitter can be directly mounted on to the TORBAR via an integral 3-valve manifold.

The Mass TRIBAR also incorporates pressure and temperature compensation. See page 5 for more details.

Each TORBAR is designed to span the process pipe diameter and comprises four basic components:

- Outer impact tube - ONE PIECE CONSTRUCTION
- Internal averaging tube
- Low pressure chamber
- Head

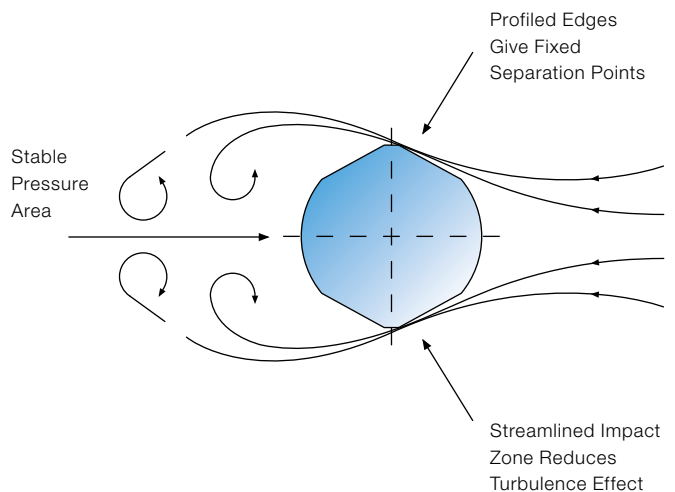


The outer impact tube has a number of pressure sensing holes facing upstream which are positioned at equal annular points in accordance with a log-linear distribution. The “total pressures” developed at each upstream hole by the impact of the flowing medium are firstly averaged within the outer impact tube and then to a second order (and more accurately) averaged within the internal averaging tube. This pressure is represented at the head as the high pressure component of the DP output. The low pressure component is generated from a single sensing hole located on the downstream side of the outer impact tube. For bi-directional flow measurement, the TORBAR can be supplied with the same number of downstream ports as upstream.

Profile Shape

The TORBAR is an improvement on the round sensor design due to the unique profiled flats which are positioned around the downstream hole in order to define the separation point at which the flow lines “break-off” as the fluid passes around the outer impact tube. This feature creates a stable pressure area at the downstream pressure sensing hole thereby maintaining a more constant flow co-efficient at high velocities enabling a very wide range of flow measurement (turndown).

Profile Shape



Features and Benefits

- Unique profile shape enables high flow turndown
- Dual averaging for better accuracy
- One-piece outer tube for optimum strength
- Suitable for pipe sizes from 10mm to 8000mm
- Suitable for square or rectangular section ducts
- Available as hot-tap for insertion into pressurized pipes
- Optional direct mounting transmitter arrangement
- Zero co-efficient drift ensures long term stability
- Low permanent pressure loss means low energy consumption – and significant cost benefits
- Low installation costs
- Long term accuracy
- Low maintenance costs



General Specifications

- TORBAR is suitable for liquid, gas, and steam flow measurement
- Accuracy $\pm 1\%$ of actual flow rate verified by independent flow laboratories
- Repeatability of measurement $\pm 0.1\%$
- Reynolds number. Minimum Re: 1.2×10^4
- Flow rate turndown typically 10:1 (100:1 of DP).
The restriction being the resolution of the transmitting device under a square root relationship
- Maximum working pressure up to 500 bar
- Maximum working temperature up to 600°C
- Maximum viscosity 200 cp (mPas)
- Short upstream and downstream straight pipe lengths
- Long term accuracy unaffected by wear

Construction

- TORBARs are engineered and manufactured to stringent routines including BS, ANSI, ASME, ISO and DIN standards
- Welding is carried out by Lloyds qualified welders to ASME IX and European standards
- Quality control system is approved to BS EN ISO 9001:2008 Independent Flow Tests
- CE marking - in conformance with 97/23/EC PED
- Russian and Chinese Type Approvals available
- TORBARs are leak tested before dispatch
- Standard material of construction is 316L stainless steel but many other materials are available on request.
- All TORBARs have full material traceability
- NDE and Hydrostatic Pressure Test Certificates available
- Stainless steel data plate as standard

Independent Flow Tests –
The TORBAR accuracy and repeatability of measurement has been verified by independent testing laboratories in the United Kingdom.

Applications

Thousands of TORBARs have been successfully used on a large variety of flow applications throughout the world by many different industries, such as:

- Oil production (onshore, offshore)
- Oil refining
- Chemical
- Pharmaceutical
- Power generation
- Building services
- HVAC
- Nuclear
- Food
- Water distribution
- Water treatment
- Effluent treatment
- Gas processing
- Gas transmission

Applications where TORBARs have been used successfully include the flow measurement of:

- Natural gas
- Flue gas
- Nitrogen gas
- Hydrocarbon gas
- Methane gas
- Combustion gas
- Sour gas
- Exhaust gas
- Coke oven gas
- Carbon dioxide gas
- Petrol vapour
- Ventilation air
- Compressed air
- Hot air
- Solvent laden air
- Saturated air
- Saturated steam
- Superheated steam
- Sea water
- Cooling water
- River water
- Waste water
- Potable water
- Liquid oxygen
- Crude oil
- Nitric acid
- Red wine
- Liquid petroleum

The TORBAR is NOT suitable for the measurement of 2 phase fluids or when the fluid does not completely fill the cross section of the pipe.



Withdrawable (hot tap)
TORBAR with geared retraction

Mass TRIBAR

Compensated mass flow meter

The MASS TRIBAR is an insertion flowmeter comprising an integral 3 or 5 valve manifold, a PT100 temperature element and a Smart Multivariable Transmitter attached to a TORBAR averaging flow element.

The MASS TRIBAR measures pressure, temperature and differential pressure directly from the TORBAR and computes the compensated mass flow within the MV transmitter by automatically compensating for fluctuations in temperature and pressure. Inferential flow calculations assume pressure and temperature remain constant, which is often extremely misleading and gives rise to large inaccuracies.

The MASS TRIBAR is ideally suited for the flow measurement of liquids and gases and the totally integrated concept provides several direct advantages.

- Averaged flow profile measurement
- Simple one or two hole installation
- Compact integral construction
- RTD easily removable for maintenance
- Zero transmission lags
- Low pressure loss/low operating costs
- Single product sourcing

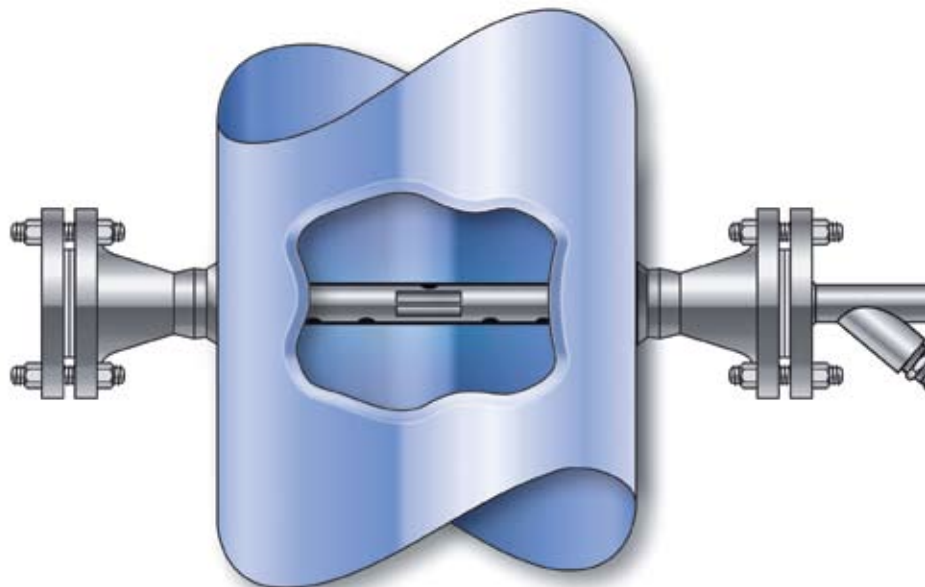
Cost Savings

With the MASS TRIBAR configuration, you can expect substantially lower wiring costs, as well as much less capital spending on piping, manifolds, mounting, safety barriers and the like. With four measurements from one instrument you will be driving down the installed cost of flow compensation by as much as 60%. Also the MASS TRIBAR may totally eliminate the need for a mass flow computer and can free your control system from performing complex flow calculations. The compensated flow calculation is done right in the instrument before it sends data to your control room freeing up your automation system for other process control tasks.



SG 2000 Stack Gas Flow Metering System

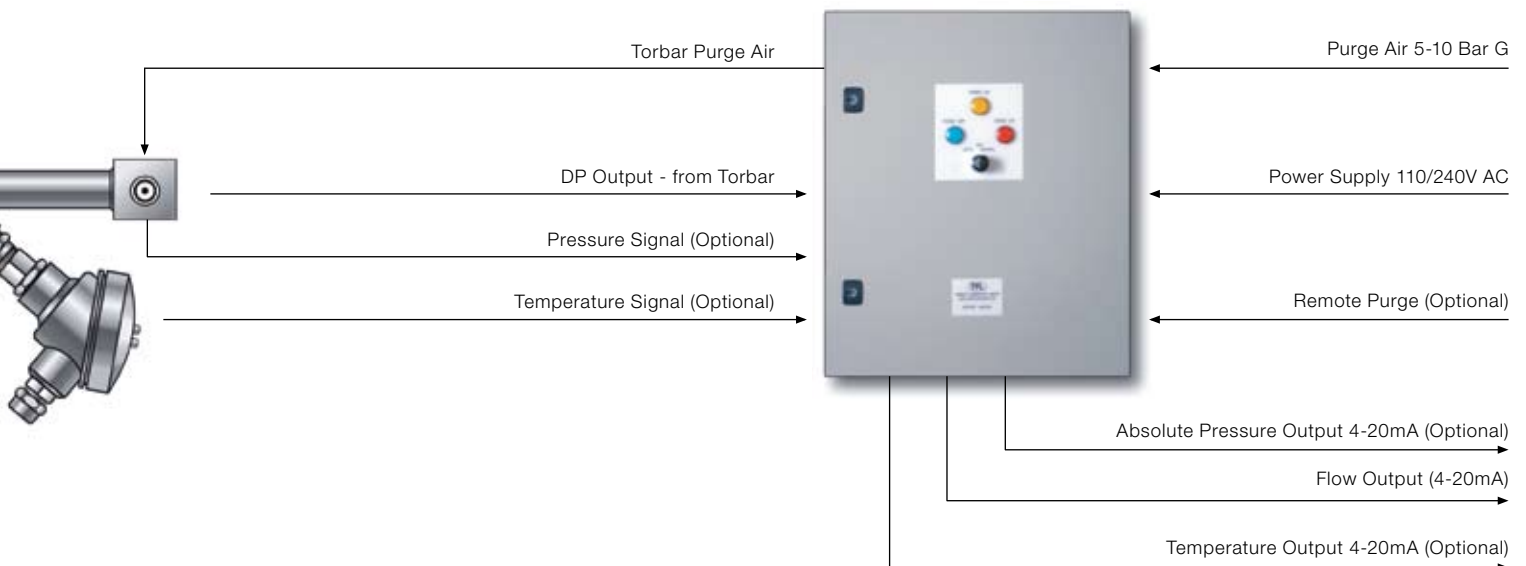
The SG2000 series is a flow measurement system with integral purge to be used with a TORBAR flow sensor for the measurement of gas flow rates in chimneys and stacks where the dust concentration is higher than $20\text{mg}/\text{m}^3$ or where any moisture content may be a problem. The purge duration and frequency is programmable to keep the TORBAR sensing holes clean of contaminants.



The SG2000 is available with or without a DP transmitter and can be supplied with temperature compensation of the flow reading and separate stack pressure and temperature outputs when required. Other options and accessories are available.

Features and benefits

- Simple installation in stacks up to 8 metres diameter
- Weatherproof (IP66) metal enclosure contains all necessary components for reliable flow measurement of contaminated flow stacks (CEMS)
- Available in special materials for high temperatures (up to 1200°C)
- 4-20 mA signal output from flow transmitter for volumetric or mass flow
- Automatic high pressure blast to clear sensing holes of particulate build up and/or moisture
- Programmed purge sequence by PLC
- Auto mode – Purge sequence activation from control room
- “Sample hold” – during purge, SG2000 holds last measured flow value and reconnects to output when purge complete
- SG2000 enclosure houses flow transmitter with auto zero feature
- Flow scale range field adjustable over 5:1 of full scale range with output scaling options such as variable pulse rates, signal averaging and auto zero checking
- Optional temperature compensation available to compute mass flow
- Optional pressure compensation available



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