Ultrasonic Sensors for Gas Flow Measurement

Piezoceramics in Ultrasonic Applications

CeramTec
THE CERAMIC EXPERTS

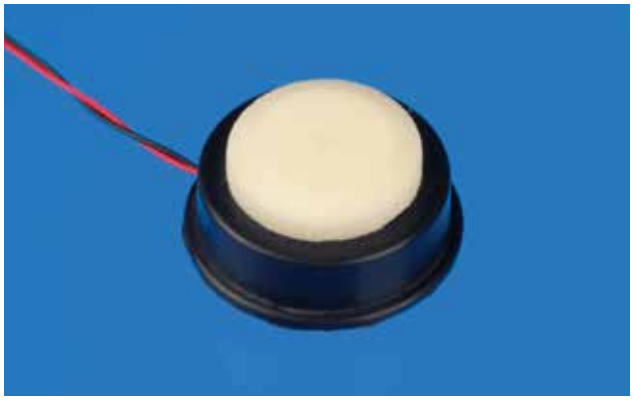
Ultrasonic Sensors for Gas Flow Measurement

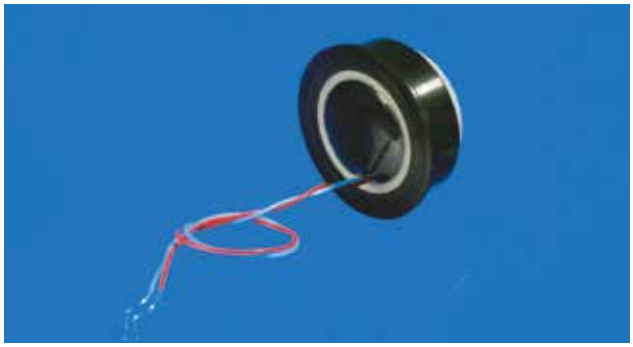
These new Ultrasonic Sensors for Gas Flow Measurement are intended to transmit and receive ultrasonic waves across a gas channel for time of flight measurement of gas flow.

Using 2 of these transducers, in applications such as Smart Metering of natural gas, can provide flow information in 1, 2 or 3 dimensions or air-coupled level sensing of liquids and solids.

For maximum sensitivity and bandwidth there is a choice of frequencies between 200kHz and 400kHz – these can be customised upon request.

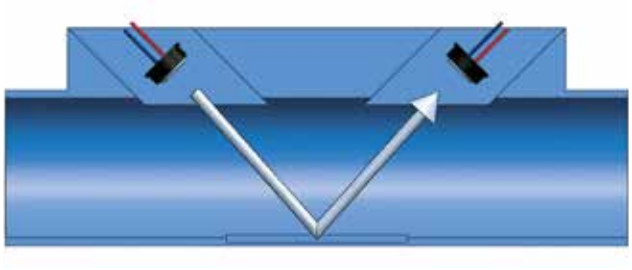
Custom sensors are available with a pressure rating of up to 3,000 PSI and sensitivity better than -40dB, customised air coupled sensors for industrial applications with temperature tolerances exceeding 200°C are available upon request.





	200kHz Sensor	400kHz Sensor
Electrical Specification	All measurement made at 23ºC in air and 50% R.H.	
Nominal drive frequency	200kHz ± 5%	400kHz ± 5%
Maximum instantaneous drive voltage	90Vp-p (single cycle)	
Minimum paired sensitivity	-70dB measured peak-to-peak in air, driven at a 20 cycle burst at 200kHz across a 160mm air channel	-50dB measured peak to peak in air, 20 cycle burst at 400kHz across 160mm channel
Bandwidth	50kHz minimum	50kHz minimum
-3dB Beam width at 200kHz	10º	5º
Capacitance	2500pF +/- 20%	400pF +/- 20%
Tan Delta	0.035 maximum	0.035 maximum
Insulation resistance at 250V	1GΩ MIN	1GΩ MIN
Operating temperature in air	-20ºC to +70ºC	-20ºC to +70ºC
Operating temperature in natural gas	-10ºC to +40ºC	-10ºC to +40ºC
Operational relative humidity	0% to 95% non-condensing	0% to 95% non-condensing
Pressure Rating	8 bar	8 bar

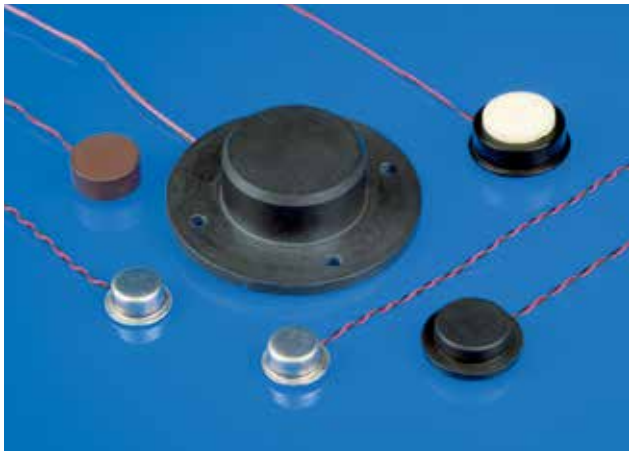
Flow Meter Application Set Up



If the distance between the two transducers (L) is known, then by driving transducer 1 and monitoring the time it takes for transducer 2 to respond (t1), then driving transducer 2 and monitoring the time for transducer 1 to respond (t2), it is possible to calculate the flow rate (v) of the gas within which the transducers are located according to the following equation:

$$v = \frac{L\, t_1 - t_2}{2\, t_1 t_2}$$

Custom Sensor and Transducer Design and Manufacture



Our transducer research and development team is dedicated to working with customers to find solutions for their products. Using top of the range tools such as 3D Finite Element Analysis they can virtual prototype transducers cutting down development time considerably.

Our design engineers can adjust the architecture, manufacture process and material properties of the sensor for a particular application, in low, medium or high volumes. Additionally, we design and manufacture water coupled heat meters for Smart Metering.

Disclaimers

- CeramTec takes no responsibility for applications where a defect might directly injure a third party's or cause damage to life or property. It is the customer's responsibility to ensure the system in which this transducer is used is safe. This product does not provide sealing. Sealing must be achieved external to the transducer.
- Do not expose transducer to ethanol or other solvents.
- Product is not designed for storage or use in corrosive environments.
- Do not immerse in water.
- Transducer may generate a charge when exposed to changing temperature or mechanical impact. The electronic circuitry should be protected accordingly.
- Avoid applying excessive stress to the any part of the transducer.
- CeramTec reserves the right to change the specification from time to time without prior notification.
- Correct at time of issuing.

CeramTec is a global materials engineering company which designs and manufactures a wide range of high specification products with extraordinary properties, across multiple sectors and geographies.
From an extensive range of advanced materials we produce components, assembles and systems that deliver significantly enhanced performance for our customers' products and processes. Our engineered solutions are produced to high tolerances and many are designed for use in extreme environments.
We design and manufacture products for demanding applications in a variety of markets using a comprehensive range of advanced ceramic, glass, precious metal, piezoelectric and dielectric materials. We utilise core competences of applications engineering and superior materials technology, together with state of the art fully integrated manufacturing processes to offer precision ceramic components, ceramic-to-metal assemblies and special coatings for use in a variety of applications.

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