Microflown Technologies
Charting sound fields

Datasheet

PU Mini

PM

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PU MINI (PM)

Pressure and particle velocity in one single sensor

PU mini probes are most adequate for array configuration.

PU mini probes are the shortened version of the standard PU regular probe. A ½ inch enclosure houses a sound pressure and particle velocity sensor, integrated package gain and wind protection. The probe head is mounted in a small body, which reduces weight and allows the installation of the PU sensor on high channel- high spatial resolution applications. Scattered arrays for Panel Noise Contribution Analysis, free or fixed grid arrays for the Near Field Acoustic Camera. Hand held array grids are compatible with this sensor.

PU mini probes combined with the new MFPA-2 electronics provide a full solution for high accuracy pressure, particle velocity, intensity and sound power measurements over the whole frequency range (20 Hz – 10 kHz).

I. PM SENSORS

THE VELOCITY SENSOR

The particle velocity sensor is a platinum based MEMS. The Microflown™ consists of two tiny wires which are kept heated at a constant temperature of 200 ^{o}C degrees. Motion of the air surrounding the sensor produces a temperature shift. This temperature difference is proportional to the resistance of the wires, providing a broadband (0.1 Hz to at least 10 KHz) and linear signal proportional to the particle velocity.

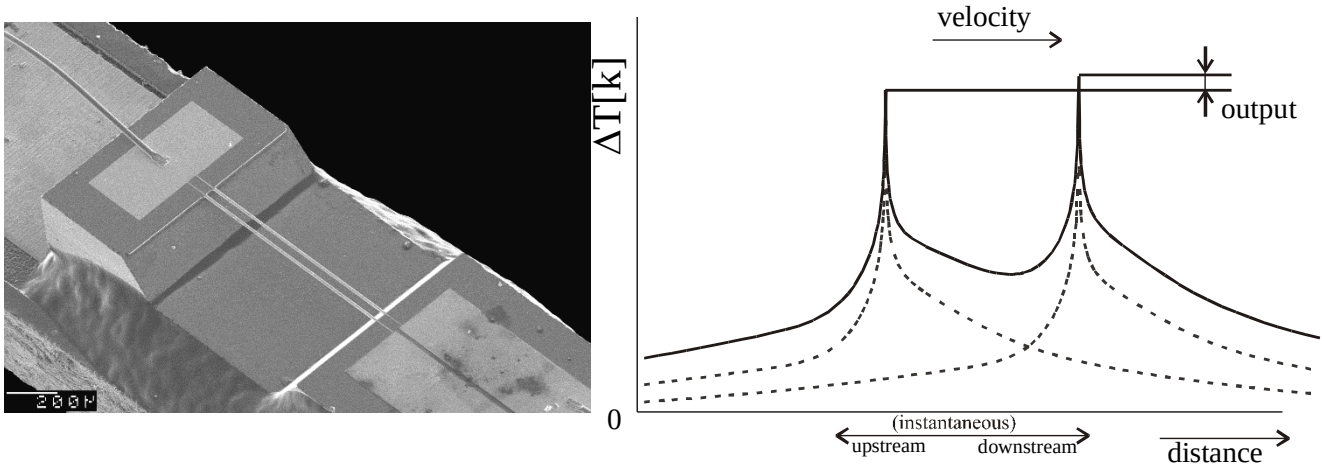

Figure 1. Sensor principle

THE PRESSURE SENSOR

The pressure microphone integrated in the probe is a FG-23329-D65.

The combination of both sensors enables the direct measurement of sound intensity and acoustic impedance.

II. CHARACTERISTICS TABLE

Parameter	Value	Unit/ note
Physical		
Connector	7 pin Lemo	Microflown pinning
Diameter	½	inch
Length	90	mm
Weight	38	g
Probe Environmental Parameters		
Operative temperature range	-20 to 63	°C
Sensitivity variation due to temperature	<0.067	dB/K
Sensitivity variation due to humidity: (30-90%)	0.06	dB/%HR
Sensitivity variation due to pressure: (1-0.82 bar)	0.5	dB
Measurement range Pressure sensor		
Maximum level range	110	dB [SPL ref: 20 e-5 Pa]
Frequency response	20-10.000	Hz
Nominal sensitivity	64.3	mV/Pa @ 1KHz
±1 dB	40- 8.000	Hz
±2 dB	20-10.000	Hz

Measurement range Velocity sensor		
Maximum level range	125	dB [PVL ref: 50 nm/s]
Frequency response	0.1 – 10.000	Hz
Nominal sensitivity	29.3	V/ m/ s @ 250Hz
±1 dB	40 - 8.000	Hz
±2 dB	20 – 10.000	Hz

III. SYSTEM CHARACTERISTICS

DYNAMIC RANGE

The dynamic range of the measurement chain formed by the PU match probe (consisting of one particle velocity sensor and one pressure sensor) connected to the MFPA electronics is described by the following graph:

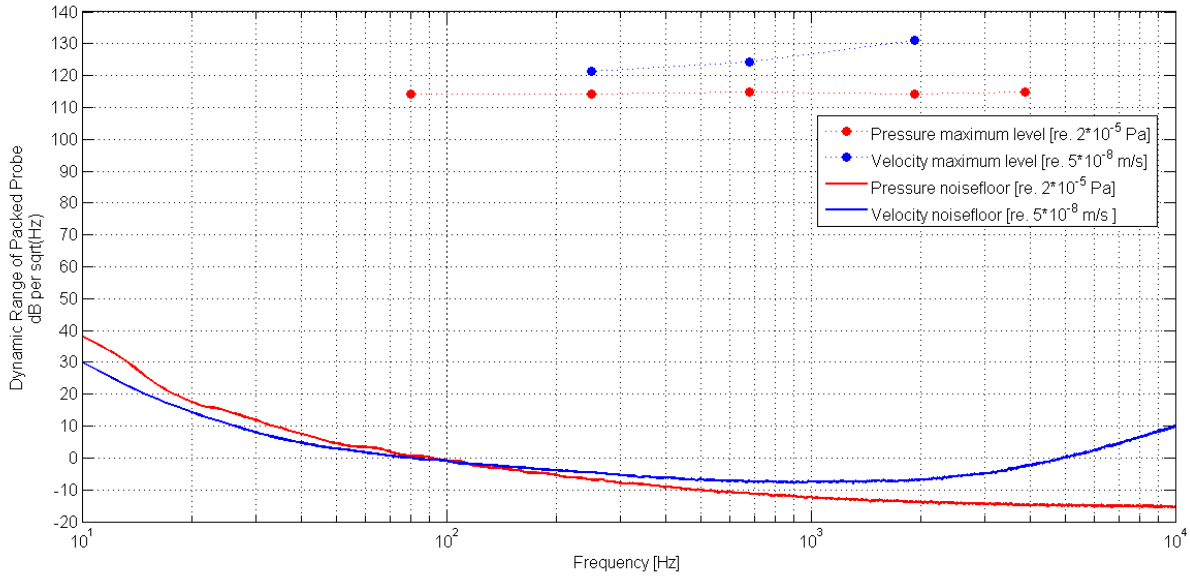

Figure 2. PM probe and MFPA-2 dynamic range

RESPONSE MODEL

The magnitude and phase response for every probe is calibrated, modeled and compiled in the calibration report.

Below is an example of the response of both sound pressure and particle velocity sensors.

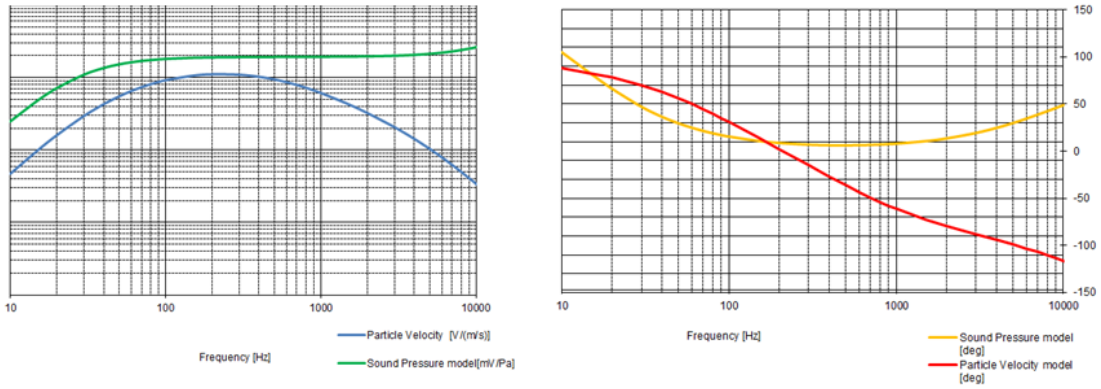

Figure 3. Typical PM model

To correct for the particle velocity sensor behavior, the model of the inverse response needs to be applied in order to obtain a flat response across the whole usable frequency range.

- Frequency response: Signal [Volts] / Su or Sp
- Phase response: Signal [Volts] - ϕu or ϕp

- VELOCITY SENSOR MODEL:

$$Su\left[\frac{V}{m/s}\right] = \frac{S_u@250\,Hz\left[\frac{V}{m/s}\right]}{\sqrt{1+\frac{f_{c1u}^2}{f^2}}\sqrt{1+\frac{f^2}{f_{c2u}^2}}\sqrt{1+\frac{f^2}{f_{c3u}^2}}\sqrt{1+\frac{f_{c4u}^2}{f^2}}}$$

$$\varphi_u[deg] = arctan\frac{C_{1u}}{f} - arctan\frac{f}{C_{2u}} - arctan\frac{f}{C_{3uf}} + \arctan\frac{C_{4u}}{f}$$

- PRESSURE SENSOR MODEL:

$$Sp\left[\frac{mV}{Pa}\right] = Sp@1KHz\frac{\sqrt{1+\frac{f^2}{f_{c3p}^2}}}{\sqrt{1+\frac{f_{c1p}^2}{f^2}}\sqrt{1+\frac{f_{c2p}^2}{f^2}}}$$

$$\varphi_p[deg] = \arctan\frac{C_{1fp}}{f} + arctan\frac{C_{2fp}}{f} + arctan\frac{f}{C_{3fp}}$$

DIRECTIVITY

- VELOCITY SENSOR:

The polar pattern of the Particle Velocity sensor has a figure of eight response (green in figure 4).

- PRESSURE SENSOR:

The polar pattern of the Sound Pressure sensor has an omnidirectional response as shown by the red line in figure 4.

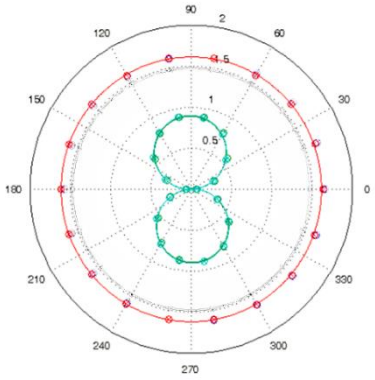

Figure 4: PM polar pattern

DC-FLOW

The maximum level of DC-flow that the U sensor in the PU regular probe can withstand is consistent with 1.5 m/s wind speed.

RECALIBRATION

The PU sensors require a qualified calibration every 2 years.

IV. USAGE AND PRECAUTIONS

- Do not submerge the electronics in water as this will lead to permanent damage.
- Only use the 7 pin to 7 pin Lemo cable supplied with the kit. Any modifications to this cable or the use of cables of a different brand or type may result in permanent damage to the probe or the signal conditioner.
- The PU regular probe must be powered via a Microflown™ signal conditioner, the new MFPA series or the prior MFSC/ Router. Do not power the sensor with any other device; this might cause permanent damage to the system.
- Access exposure to dust/dirt particles could damage the Microflown™ sensor.

V. TECHNICAL SUPPORT

For any problem or doubt with your equipment, please contact Microflown™ Technologies Customer service:

- Mail: cs@microflown.com
- Skype: cs.microflown
- Telephone: +31(0) 88 001 08 11 Monday to Friday, from 9:00 to 17:00 (UTC+1).

VI. WARRANTY POLICY, REPAIRS AND REPLACEMENTS

WARRANTY AND REPLACEMENT OR SUBSTITUTION

During the first two years (24 months) the seller offers a warranty on all its products, except for trading items and third party manufactured items. The seller warrants that all products will be free from defects in materials and workmanship for this period of two years. During this two year period, the seller will repair or replace defect products free of charge. Products damaged by accident, abuse, misuse, natural disaster or by any unauthorized disassembly, repair or modification are not covered by this warranty. The incurred transportation costs of returning the products to seller will be borne by the buyer. The logistical cost for returning the products back to the buyer will be borne by the seller. Several products come with a "VOID if seal is broken" sticker, the warranty is void at all times when this sticker is broken.

GRACE PERIOD (YEAR 3 AND 4)

During the third and fourth year the seller offers a grace period. In the grace period the products purchased at an earlier date can be replaced by completely new state of the art products of the same scope of the original purchase. This applies only for the products known as standard probes and signal conditioners. In the first year of the grace period, (year 3) customers have an option to replace their products for 25 % of the actual ex works end-user price. The full freight and packaging charges apply.

In the second year of the grace period, (year4) customers have an option to replace their products for 50 % of the actual ex works end-user price. The full freight and packaging charges apply.

The new products are accompanied by a new warranty. Both the two years warranty and grace period become applicable again from the date of invoice.

REPAIRS OUTSIDE WARRANTY POLICY

Replaced/repaired parts come with a six month warranty under the same conditions as the two year warranty.