

# WELES WA101

1/2" PU Sound Intensity Probe



## KEY FEATURES:

- Direct measurement of sound pressure and particle velocity
- Omnidirectional Pressure Sensor
- Bidirectional Velocity Sensor

Weles Acoustics WA101 is a general purpose sound intensity probe which relies on direct measurement of sound pressure and particle velocity. Full acoustic bandwidth can be analyzed from just one measurement - no spacers required.



WELES ACOUSTICS SP. Z O.O.  
PRZEMYSŁOWA 13, 44-200, RYBNIK, POLAND

## KEY APPLICATIONS:

- Sound source localization and ranking under constant and variable noise output – highest performance and accuracy is achieved with particle velocity measurement
- Particle velocity mapping
- Sound intensity mapping
- Sound power measurement
- Sound pressure measurement
- Quick troubleshooting – listen to particle velocity

## TECHNOLOGY:

Sound intensity is defined as the product of sound pressure and particle velocity. The WA101 sound intensity probe consists of two acoustic transducers: sound pressure microphone and Weles particle velocity sensor. Both quantities are measured directly, thus allowing to establish the sound intensity in the entire frequency range covered by WA101 probe. No spacers are required. The entire acoustic bandwidth can be analyzed with just one measurement. No standards yet exist for measuring sound intensity with PU probes.

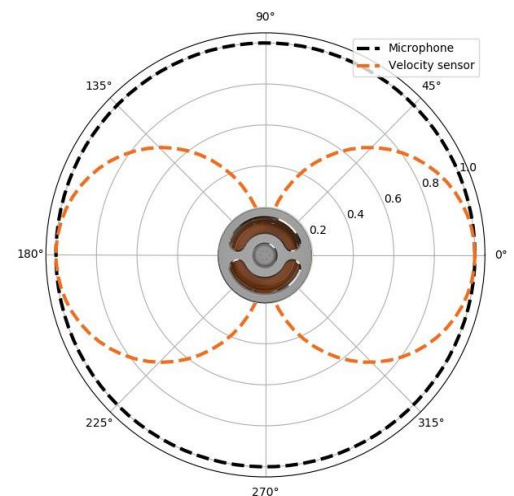
Weles Acoustics designs and manufactures particle velocity transducers. Particle velocity is a physical quantity that together with sound pressure fully characterizes any sound field. Intrinsic characteristics of particle velocity physics coupled with distinctive features of the Weles sensor make it a unique tool for sound source localization. Working principle of the particle velocity sensor is similar to a hot wire anemometer. The sensor consists of several thin platinum strings. These strings are heated to a near incandescent temperature. Passing sound waves alter the temperature, and in turn the electrical resistance of the heated strings. The resulting voltage difference is proportional to the acoustic particle velocity.

The Weles particle velocity sensor is directional. Its polar pattern resembles a figure-of-eight. It is a bi-directional transducer. Thanks to this trait and the nature of particle velocity, the transducer is a powerful diagnostics tool for any noise or vibration issues – even in the presence of high levels of background noise.

## DESIGN:

The casing of WA101 sound intensity probe is built out of high quality stainless steel. The head of the probe was engineered to provide maximum acoustic transparency while maintaining protection for both sensing elements from particles of dust, sand or oil. The robust and durable housing encloses a 3D printed mechanical sound amplifier that is built around the Weles particle velocity sensor.

The mechanical amplifier is designed to increase the signal-to-noise ratio of the velocity transducer, as well as provide a mounting point for the electret sound pressure microphone. Thanks to this unique architecture, sound intensity is measured almost exactly at the same point. The distance separating both sensing elements is smaller than 8mm making the WA101 a very compact and capable solution.





WA101 probe is built, assembled and tested by Weles Acoustics. Each probe is calibrated and mechanically tested to withstand minor shocks and excessive vibration – This PU sound intensity probe is built to endure. See specification for details.

Each WA101 probe is delivered with a Weles BOX. Connection between the probe and the BOX is established with a 7-pin LEMO cable. The BOX is designed to provide power to all sensing elements built into the probe. Furthermore, the Weles BOX acts as an interface between any data acquisition system that is meant to process analog signals provided by the probe. For WA101 two signals are provided over two BNC connectors: sound pressure and particle velocity.

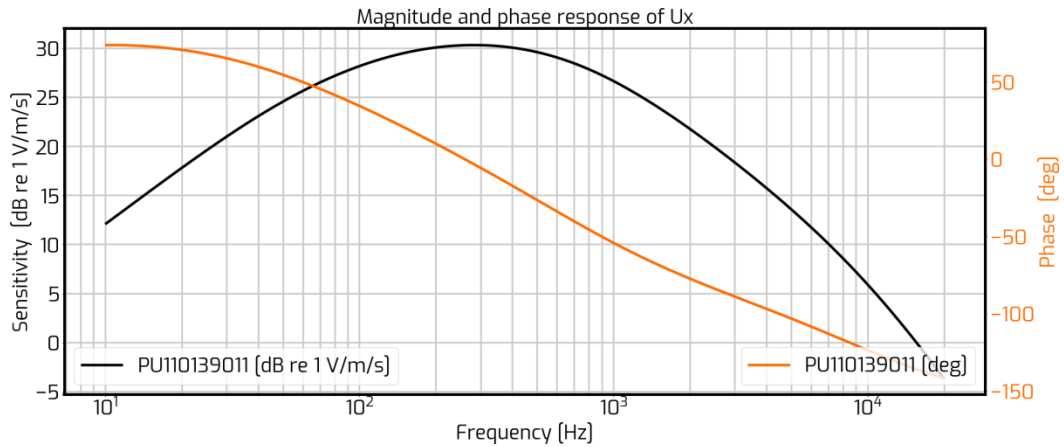
For test campaigns requiring multiple probes the Weles BOX X can be supplied. The Weles BOX X supports up to 10 individual WA101 Probe units. More details in the "additional product configuration options", Furthermore, the standard dual channel Weles BOX can also be equipped with a live playback function, which allows for real time listening to the signals acquired the WA101 prob.

## SPECIFICATIONS:

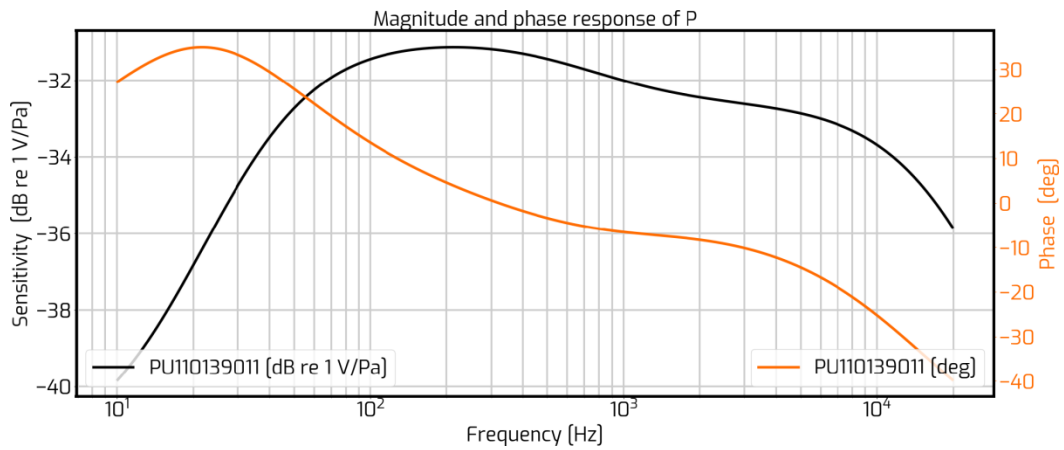
Parameter	Particle Velocity	Sound Pressure	Sound Intensity
Frequency range ( $\pm 2$ dB)	20 Hz to 20 kHz	20 Hz to 20 kHz	20 Hz to 10 kHz
Total self-noise (20 Hz – 10 kHz)	46 dB (A)	30 dB (A)	46 dB (A)
Dynamic range upper limit (<3% THD)	136 dB SVL	136 dB SPL	136 dB SIL
Directivity	Bi-directional	Omnidirectional	Bi-directional
Output Voltage Swing	10 Vp	10 Vp	-
Temperature range, operation	-20 to 85 °C	-20 to 85 °C	-20 to 85 °C
Temperature range, storage	-40 to 85 °C	-40 to 85 °C	-40 to 85 °C
Temperature coef. @250 Hz	-0.0517 dB/°C	-0.0235 dB/°C	-0.0517 dB/°C
Static pressure coef. @250 Hz	<0.5 dB/kPa	<0.5 dB/kPa	<0.5 dB/kPa
Humidity coef. @250 Hz	0.06 dB/%RH	0.05 dB/%RH	0.06 dB/%RH
Maximum DC airflow	1 m/s		
Connector type	Lemo 7p EGG-1B-307		
Weight	38g (WA101 Probe)/365g (Weles BOX WA101)		
Dimensions	89,5/12.7 Length/Diameter		
CE/RoHS compliant	Yes/Yes		

Weles Acoustics reserves the right to change specifications without notice.

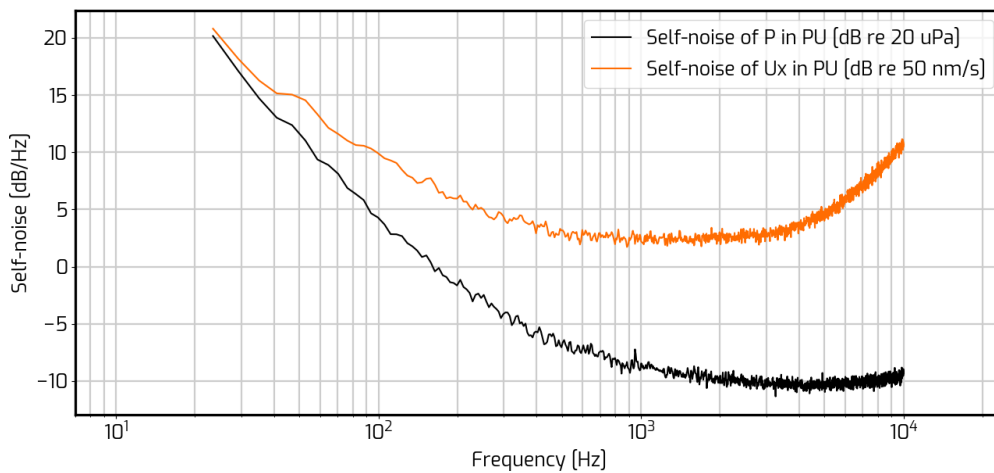
**TYPICAL FREQUENCY RESPONSE – PARTICLE VELOCITY SENSOR:**



**TYPICAL FREQUENCY RESPONSE – SOUND PRESSURE MICROPHONE:**



**TYPICAL SELF-NOISE – SOUND PRESSURE MICROPHONE/PARTICLE VELOCITY SENSOR:**



## **CALIBRATION:**

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Calibration is carried out in a stainless steel standing wave tube. The WA101 PU intensity probe is positioned in the middle of the tube while a reference microphone is fixed at the rigid end of the tube. The ratio between particle velocity ( $u$ ) and reference sound pressure ( $p_{ref}$ ) is determined. Direct comparison of measured  $u/p_{ref}$  ratio with the known theoretical value of the same ratio, allows obtaining the amplitude calibration curve for any given frequency. The same technique is employed to establish the amplitude calibration curve of the sound pressure ( $p$ ) transducer. Phase mismatch between  $p$  and  $u$  sensors is determined, by measuring the transfer function between  $u$  and  $p$ . The reference sound pressure is not used in this case.

Calibration techniques employed and perfected at Weles Acoustics ensure a precise and reliable measurement of particle velocity, sound pressure and sound intensity. All particle velocity sensors and microphones are calibrated in a controlled laboratory environment. Each probe manufactured at Weles Acoustics is delivered with an individual traceable calibration certificate. State of the art equipment is used to complete the calibration process and ensure a high quality product. We recommend to recalibrate the probe every year at Weles Acoustics headquarters.

## **WARRANTY AND QUALITY ASSURANCE:**

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Sound intensity probes manufactured at Weles Acoustics are built from high quality materials carefully picked during the probes' design stage. The WA101 is covered by a 2 year warranty period. The warranty period covers any and all equipment failures not caused by negligent use, or purposeful mishandling. The warranty does not cover damages caused by using a third party power supply or third party cable that connects the WA101 probe with Weles BOX.

All probes manufactured by Weles Acoustics can be covered by Weles Quality Assurance Program. As a member of this program, any service needs of your probe will be handled by skilled and dedicated Weles Acoustics staff. We will take care of recalibrating your probe at annual intervals and make any necessary repairs should they be required. This service will be rendered as long as you wish to remain a member of the program. For more information please contact us at [info@weles-acoustics.com](mailto:info@weles-acoustics.com).

## **SERVICE:**

WA101 Sound Intensity probe is fully serviceable. Nearly any component of the system can be replaced, repaired or recalibrated. All maintenance and repair tasks are carried out at Weles Acoustics headquarters in Poland. Cost estimates for repairs are provided on a case by case basis. For members of the Weles Quality Assurance Program all service needs are covered at a fixed annual cost.

## **SYSTEM COMPONENTS:**

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The WA101 1/2" Sound Intensity probe comprises the following items:

- WA101 Sound Intensity probe
- Weles BOX WA101 /Weles BOX WA101H (live playback function included)/Weles BOX X (supports up to 10 WA101 probes)
- 7 pin male LEMO to 7 pin male LEMO cable
- 5V Power supply
- Protective case
- Calibration certificate

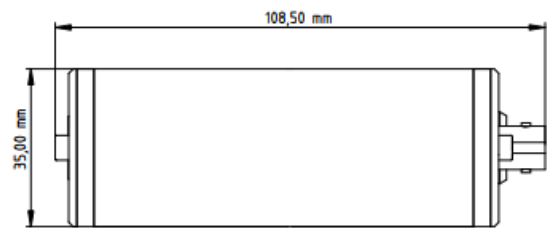
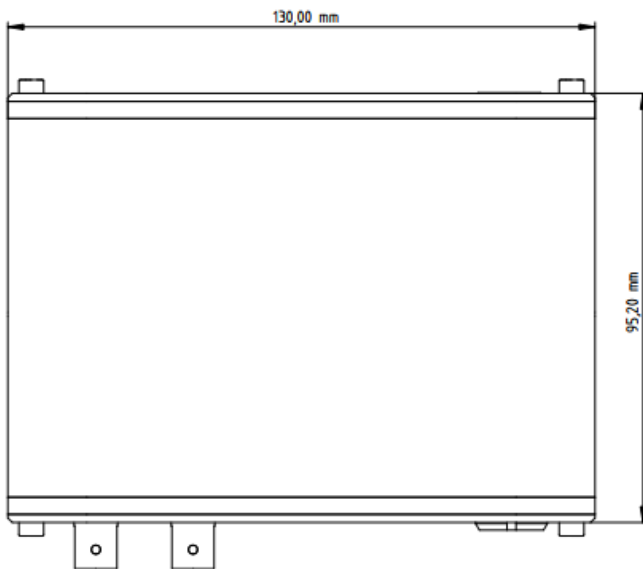
**DIMENSIONS:**

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WA101 1/2" Sound Intensity probe:



Weles BOX WA101:



## ADDITIONAL PRODUCT CONFIGURATIONS:

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### WA101H - LIVE PLAYBACK OPTION FOR WA101 SOUND PROBE:



The WA101H allows for real-time playback of signals measured by two transducers embedded into the WA101 PU probe. The ability to listen in real-time to either the particle velocity or sound pressure presents a very powerful tool for quick sound source localization or quality control, especially in measurement environments with high levels of background noise. Simply put on the headphones, scan your sound source and listen to particle velocity - locating sources of squeaks, buzzes clicks and rattling noises has never been easier.

Weles Acoustics WA101H is a variant of the standard WA101 1/2" PU Sound Probe product package. The WA101H consists of WA101 probe and the Weles BOX WA101H. Both systems rely on the same probe and deliver the same performance. However, unlike the standard version of WA101 Sound probe, the WA101H is equipped with an embedded high fidelity headphone amplifier. The headphone amplifier is installed in the Weles BOX. The WA101H is a fully portable system that can be powered from a USB 3.0 port.

### WA101H - SYSTEM COMPONENTS

The WA101H 1/2" Sound Intensity probe comprises the following items:

- WA101 Sound Intensity probe
- Weles BOX WA101H
- 7 pin male LEMO to 7 pin male LEMO cable
- 5V Power supply
- Protective case
- Calibration certificate
- Sony WH1000XM3 noise canceling headset

**WELES BOX X - AN INTEGRATED MODULAR SOLUTION FOR WA101 PU PROBE ARRAYS:**



Weles Acoustics' Weles BOX X is a modular device designed to support up to 10 standard WA101 1/2" PU Sound Probes. Each probe can be operated separately through a dedicated Weles BOX card equipped with its own individual power switch, probe input port and 2 analog BNC output channels - First channel for sound pressure, second for particle velocity.

Most challenging NVH (Noise Vibration Harshness) test campaigns require simultaneous acquisition of sound data from sensors positioned at multiple locations around the tested device. In the standard configuration of the WA101 PU probe, the probe is equipped with a dedicated power unit, which is called the Weles BOX. However, working with a stack of several Weles BOXes can be unwieldy. For all such applications the Weles BOX X is a great solution.

The Weles BOX X was designed for all measurements which require multiple PU probes. Such measurements include the so-called panel noise contribution analysis, operational transfer path analysis or simply sound intensity measurements at fixed probe locations under a variable noise output regime - for example, run-up of an electric/internal combustion engine, or order analysis of any type of rotating machinery. The Weles BOX X will also be useful for a custom PU probe array configuration.

**WELES BOX X - SYSTEM COMPONENTS**

Weles BOX X is an optional power delivery unit for the WA101 PU probe. The Weles BOX X comprises the following items:

- Up to 10 Weles BOX power cards (one card required for one WA101 PU Probe)
- Integrated power supply (Input 100-240 AC, 50/60Hz)
- Country specific power cord
- Protective case