PLACID INSTRUMENTS

MICROPHONE HANDBOOK

PLACID INSTRUMENTS BV

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NEW CALIBRATED INSTRUMENTS FOR REGISTERING NOISE AND VIBRATION

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NOISE SENSOR

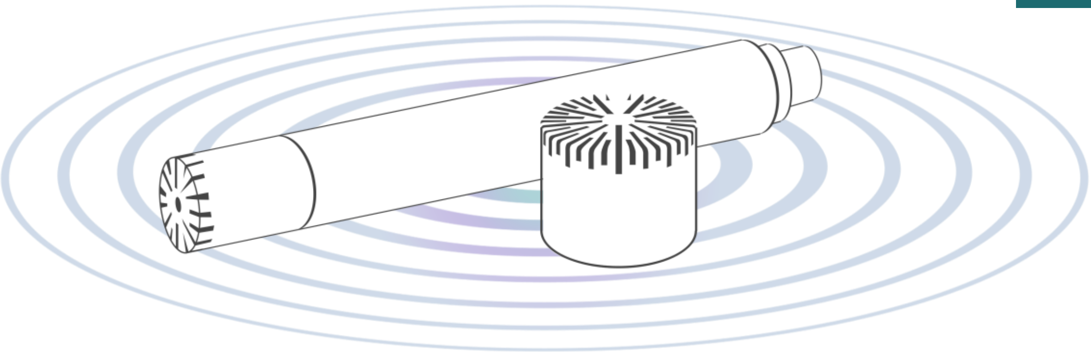
INTRODUCTION TO NOISE SENSORS

A microphone is an energy conversion device that converts sound signals into electrical signals. It is transliterated from the English word "Microphone". Also called microphone, microphone. In the twentieth century, microphones evolved from resistive conversion of acoustic electricity to inductive and capacitive conversion. A large number of new microphone technologies have gradually developed. These include microphones such as aluminum ribbons and moving coils, as well as currently widely used condenser microphones and electrets. Body microphone.

The history of microphones can be traced back to the end of the 19th century, and scientists such as Alexander Graham Bell worked to find a better way to pick up sounds to improve the latest invention of the time-the telephone. During this period, they invented liquid sensors and carbon particle sensors. These sensors did not work well, but they were barely used.

In 1949, Winnipeg Laboratories (the predecessor of Sennheiser) developed the MD4 microphone, which can effectively suppress sound feedback and reduce background noise in noisy environments. This is the world's first noise-cancelling sensor that suppresses feedback.

In 1961, at the Industry Fair in Hanover, Germany, Sennheiser introduced the MK102 and MK103 sensors. These two sensors explain a new sensor manufacturing concept-RF radio frequency capacitive type, which uses a small and thin diaphragm, which has the characteristics of small size and light weight, while ensuring excellent sound quality; In addition, this kind of The sensor is very sensitive to electromagnetic interference. They have a strong anti-interference effect on the climate, which is very suitable for some new fields. For example, it is used by expeditions and operates outdoors day and night. In the face of extreme outdoor conditions with extreme temperature differences, the microphone still performs well. The sensor transmits the vibration of the sound to the diaphragm of the microphone and pushes the magnet inside to change the current, so that the changed current is sent to the sound processing circuit at the back for amplification processing.



ABOUT PLACID MEASUREMENT MICROPHONES

In our everyday life, microphones are utilized in all our electronic devices such as PC's, smart phones, televisions, even in smartwatches. Through this guide, we will explain more about the PLACID microphones that are explicitly designed to be utilized in a complex environment that measures sound: measurement microphones.

MEASUREMENT MICROPHONES

PLACID Instruments BV is a research-oriented high-tech enterprise mainly engaged in the research and development of acoustic measuring equipment, acoustic engineering design, and acoustic vibration technology consulting. The company's core business is the R & D and manufacture of measurement sensors, test systems, professional recording microphones, professional audio equipment, and acoustic vibration test systems.
Nowadays, this method brings values to a various range of measurement microphones for numerous applications from ultra-low to ultra-high sound levels over a very wide array of frequencies.

MEASUREMENT PHYSIC SETUP

Measurement microphones are built on a basic corporal principle: the capacitance microphone. Condenser microphones use two charged metal plates (a diaphragm and backplate) that form a capacitor. When soundwaves hit the mic's diaphragm, they vibrate within the diaphragm, and the distance between the back plate and diaphragm impacts the voltage called capacitance.

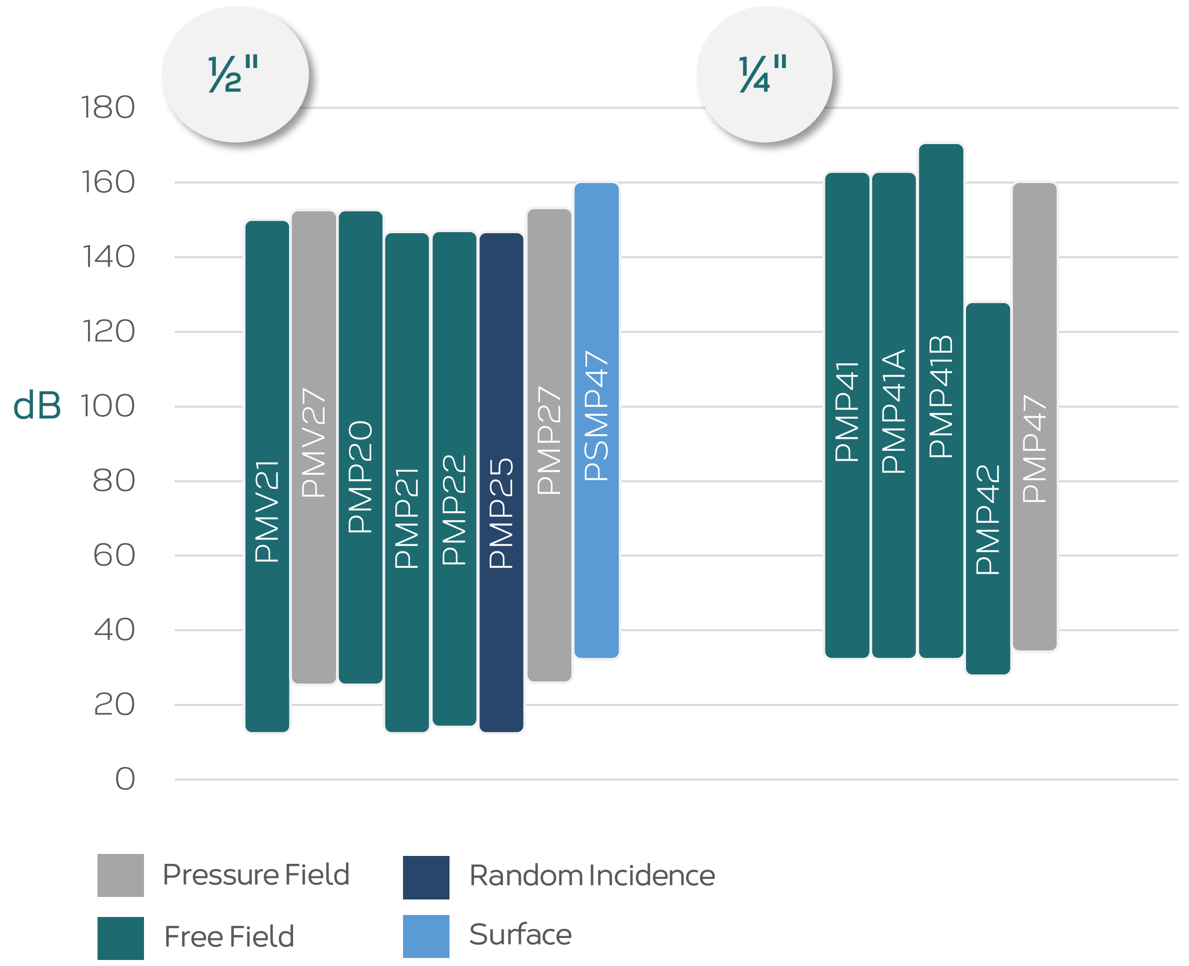
FREQUENCY RANGE OF MICROPHONE

The frequency range of a microphone describes the range of frequencies that it is capable of capturing or reproducing. The range is typically measured in Hertz (Hz) and indicates the lowest and highest frequencies that the microphone can pick up.

Most microphones can pick up frequencies within the range of 20 Hz to 20,000 Hz, which is also known as the audible range of human hearing. However, some microphones may have a narrower or wider frequency range depending on their intended use.

For example, a microphone designed for recording bass-heavy music may have a lower frequency range than a microphone designed for capturing high-pitched sounds like bird songs. On the other hand, a microphone designed for speech may have a narrower frequency range, typically between 100 Hz and 10,000 Hz.

The frequency ranges of various PLACID microphones are shown in different colors to distinguish between pressure as shown the chart below.



UPPER LIMITING SENSOR SENSITIVITY

The upper limit of the sensor's sensitivity depends on its size, more precisely, its size and the wavelength tested. We all know that sound travels in the air at a constant speed. The shorter the wavelength, the higher the frequency. This requires a small sensor size for high frequency testing. But the smaller the size, the more its dynamic range will be affected.

LOWER LIMITING SENSOR SENSITIVITY

The lower limit of the sensor's sensitivity depends on its static balance system, that is, at very low frequencies, the sensor measures the difference between its internal pressure and static pressure. If the inside of the sensor is absolutely closed, changes in atmospheric pressure and altitude will cause static reflection on the diaphragm, and the frequency response and sensitivity will change accordingly.

NOISE SENSOR SELECTION GUIDE

There are various types of noise sensors. Different test scenarios need to select sensors with different parameters. The selection steps and keywords for each step are explained in detail below.

STEP 1
Judge whether it is an external polarization sensor or a pre-polarization sensor

STEP 2
Judge whether the application scenario is free field test, pressure field test or random field test

STEP 3
Determine the dynamic range (sensitivity) of the test sound

STEP 4
Determine the frequency range of the test sound

To choose a suitable sensor, consider the frequency range, dynamic range, and test application of the sound source. Several reference factors are listed below:

1 SHOULD YOU CHOOSE AN EXTERNAL POLARIZATION SENSOR OR A PRE-POLARIZED SENSOR?

There are two kinds of power supply methods for capacitive sensors: one is the external voltage supply, and the other is the microphone itself. This kind of PTFE layer has been injected with a permanent charge in advance.

Distinguish between externally polarized voltage-powered sensors and pre-polarized sensors.
For externally polarized voltage-powered sensors: This sensor needs to be used with a standard preamplifier, like PLACID's NV21, with a 7-pin lemo connector. The preamplifier needs an external polarized voltage of 200V, and the voltage value is added to the sensor. The external polarization sensor is the most accurate and stable sensor. It is best to choose this type when the test requirements are high.

About pre-polarized sensors: This type of sensor needs to be connected with a CCP (Constant Current Power DC power supply) preamp, and then connected to a power source that can supply DC power.

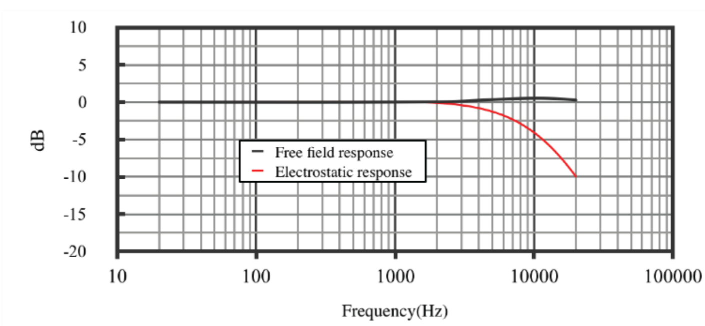
SENSOR SELECTION GUIDE

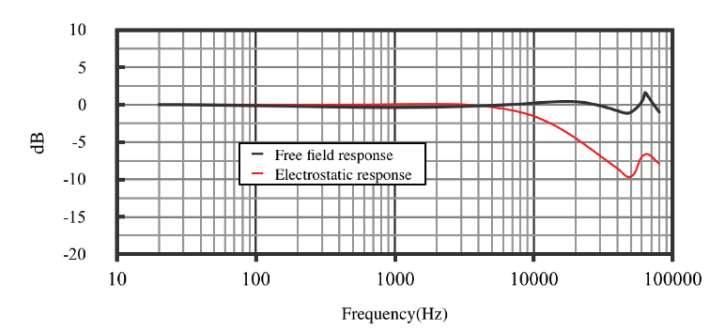
2 IS THE APPLICATION SCENARIO A FREE FIELD TEST, A PRESSURE FIELD TEST, OR A RANDOM FIELD TEST?

According to different application scenarios, measurement sensors can be divided into three groups: free field, pressure field and random field. The fundamental difference between these three groups of sensors is that at high frequencies, the test wavelength is similar to the sensor size, and the presence of the sensor will affect the sound field.

A. FREE FIELD SENSOR

The free field sensor actually measures the sound pressure value when the sensor is not in the sound field. At high frequencies, the sensor itself can affect the sound pressure test. This type of sensor has been designed with compensation for its effect on the sound field.
For most sound pressure tests, we choose free-field microphones, which are used in sound level meters, sound power, and radiation studies.



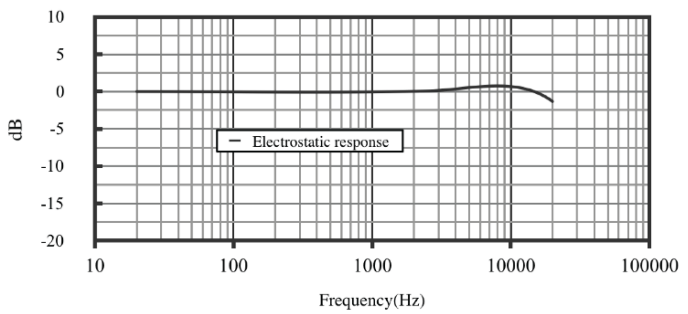


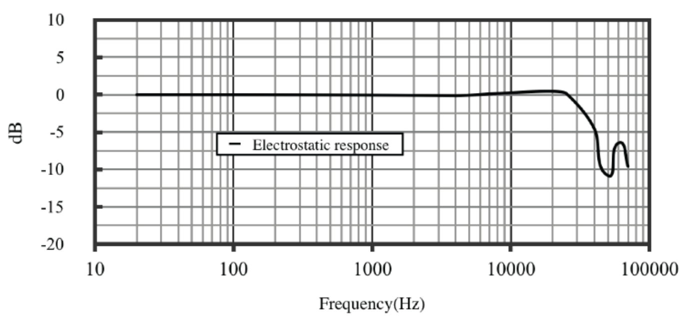
Type	Diameter	Frequency (Hz ~ kHz)	Sensi tivity (mV/Pa)	Dynamic Range (dBA)	IEC 61094 designation
PMV21	½"	20 ~ 20	40	16 – 150	WS2F Class I
PMP20	½ "	20 ~ 40	12	25 – 155	WS2F Class I
PMP21	½ "	20 ~ 20	50	16 – 146	WS2F Class I
PMP22	½ "	20 ~ 16	40	17 – 148	WS2F Class II
PMP40	7 mm	20 ~ 20	50	30 – 126	Type II
PMP41	¼ "	20 ~ 16	4	34 – 164	WS3F Class I
PMP42	7 mm	20 ~ 16	8	36 – 142	WS3F Class II

SENSOR SELECTION GUIDE

B. PRESSURE FIELD SENSOR

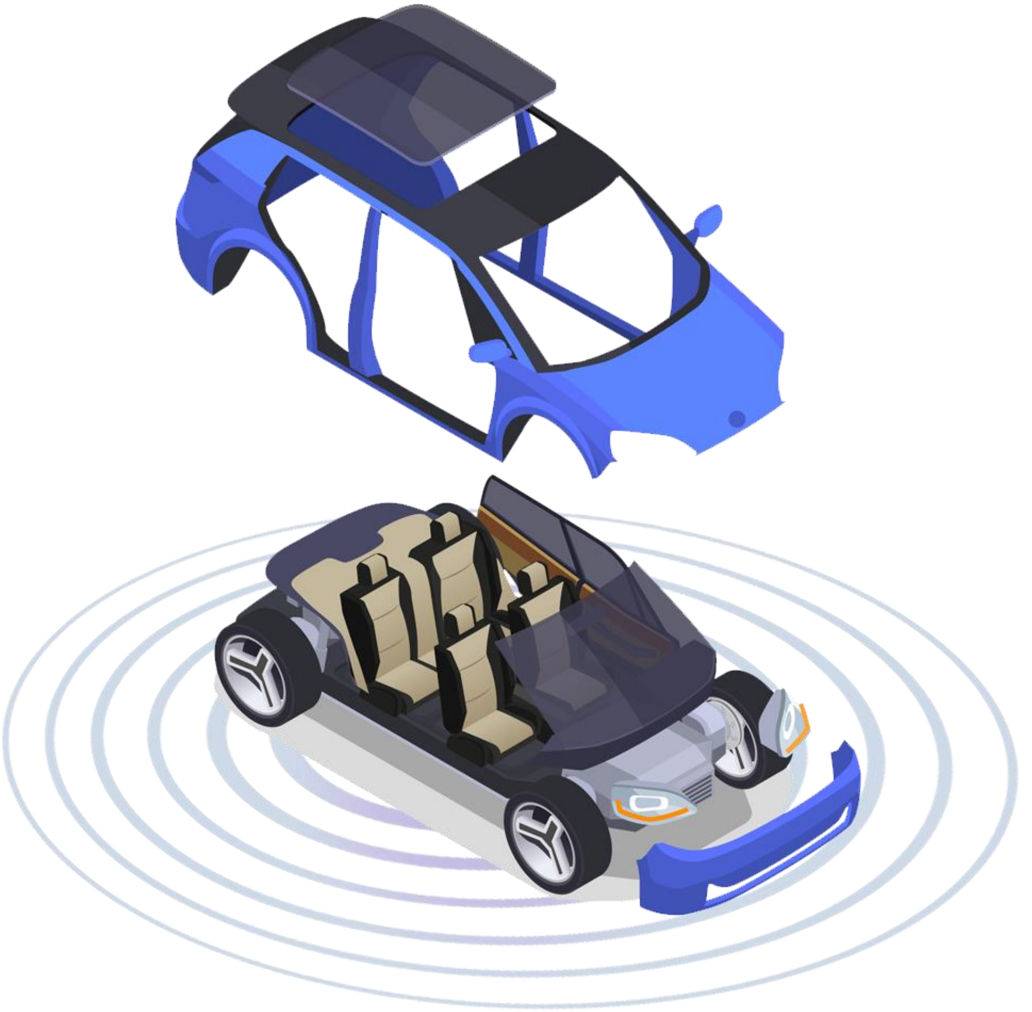
The pressure field microphone measures the sound pressure on the sensor diaphragm. Practical applications are in closed coupling cavities, or in walls and solid boundaries. In this case, the sensor forms part of the wall and the measured sound pressure is also the value of the sound pressure on the wall.





Type	Diameter	Frequency (Hz ~ kHz)	Sensitivity (mV/Pa)	Dynamic Range (dBA)	IEC 61094 designation
PMV27	½ “	20 ~ 20	12	25 – 155	WS2P Class I
PMP27	½ “	20 ~ 20	12	25 – 155	WS2P Class I
PMP47	¼ “	20 – 20	4	35 – 162	WS3P Class I

SENSOR SELECTION GUIDE



C. RANDOM FIELD SENSOR

Random field sensors are used to test sound fields with sound from different sources, like reverberation chambers or other highly reflective fields. The effect of sound from different directions on the sensor depends on how these sound waves are distributed. For a test sensor, its distribution standard has been defined statistically. According to ANSI standards, random field sensors are often used in sound pressure level testing.

Type	Diameter	Diaphragm Resonance Frequency	Sensitivity (mV/Pa)	Equivalent Noise Leve	IEC 61094 designation
PMP25	½ “	14 kHz	50	< 16 dB(A)	WS2D

3 TEST THE DYNAMIC RANGE AND SENSITIVITY OF THE SOUND.

The dynamic range of a sensor refers to the entire range from the lowest sound pressure to the highest sound pressure that the sensor can measure. This is not only a unique characteristic of the sensor, the preamplifier used with the sensor also has its own dynamic range. The dynamic range of a sensor depends largely on its sensitivity.

Sensitivity refers to the ratio of the change in the output amount △ y to the change in the input amount △ x under the steady-state operation of the sensor. It is the slope of the output-input characteristic curve. If there is a linear relationship between the sensor's output and input, then the sensitivity S is a constant. Otherwise, it will change with the amount of input. The dimension of sensitivity is the ratio of the dimensions of output and input. For example, if a sound pressure sensor changes its output voltage by 50mV when the displacement changes by 1Pa, its sensitivity should be expressed as 50 mV / Pa. When the dimensions of the sensor's output and input are the same, the sensitivity can be understood as the magnification.

Under normal circumstances, the dynamic range of a sensor with high sensitivity is closer to the lower limit--more biased toward measuring sound source signals with low sound pressure levels; correspondingly, the dynamic range of a sensor with low sensitivity is closer to the upper limit--more favorable to measure high Low-level sound source signal.

This is because the sensitivity of the sensor is mainly determined by the size of the sensor and the strength of its diaphragm. We most commonly use 1/2 ", 1/4", 1/8 ". The larger the sensor size, the more signals with longer wavelengths can be picked up. , According to the formula: speed = wavelength * frequency). Generally speaking, the larger the sensor size, the looser the diaphragm, the larger the elastic coefficient, the higher the sensitivity. In contrast, the smaller the sensor, the tighter the diaphragm, the smaller the elastic coefficient, and the lower the sensitivity.

UPPER LIMIT OF DYNAMIC RANGE:

With the increase of the sound pressure, the vibration intensity of the diaphragm becomes larger and larger. Until a certain point is reached, the diaphragm is about to hit the bottom plate. This signal is the maximum sound pressure value that the sensor can measure. This sound pressure is the upper limit of the dynamic response of the sensor.

LOWER LIMIT OF DYNAMIC RANGE:

In the absence of a sound source signal, the thermal motion of air molecules is enough to excite the sensor to output a very small signal. The noise signal generated by the "molecular thermal motion" is about 5uV, which means that no matter what acoustic test, this 5uV will be added to the test result. Therefore, the sensor cannot measure the noise signal generated by the thermal movement of the metal below it.

UPPER LIMIT OF SENSOR SENSITIVITY:

The upper limit of the sensor's sensitivity depends on its size, more precisely, its size and the wavelength tested. We all know that sound travels in the air at a constant speed. The shorter the wavelength, the higher the frequency. This requires a small sensor size for high frequency testing. But the smaller the size, the more its dynamic range will be affected.

SENSOR SENSITIVITY LOWER LIMIT:

The lower limit of the sensor's sensitivity depends on its static balance system, that is, at very low frequencies, the sensor actually measures the difference between its internal pressure and static pressure. If the inside of the sensor is absolutely closed, changes in atmospheric pressure and altitude will cause static reflection on the diaphragm, and the frequency response and sensitivity will change accordingly.

In order to avoid this static reflection effect, each sensor must open a small opening to balance out this static pressure. But this small opening must be small enough so as not to affect the test dynamic signal. It is not difficult to understand that in our daily life, when we breathe normally, there will be no loud noises and breath balance between breaths and breaths. But if you open your mouth too much, you will make a sound. The small mouth on the sensor is its "small mouth". Without this small mouth, it cannot complete the "breathing balance" and it cannot collect signals.

4 WHAT IS THE TEST FREQUENCY RANGE FROM HZ TO HZ?.

Definition of frequency range: the range between the upper and lower limits of the sensor frequency. The lowest frequency of PLACID sensor is about 5Hz, and the highest can reach 100KHz.

EXPAND SHARING:

The frequency of sound that human ears can hear is between 20Hz and 20KHz. This means that children, people's hearing becomes narrower with age, and adults' hearing treble is only 12KHz. There are also individual differences related to hearing training..

The frequency of music also belongs to this range, and music producers can also exceed it, but it is basically not done (what's the use of the inaudible?) Formats such as mp3, wav, ape, etc. are not related to the frequency range.
A low-frequency test requires a sensor that can better balance the static pressure. This sensor has a very small hole. When the sound pressure is applied to the diaphragm, the small hole will more smoothly balance the vibration airflow. Infrasound waves are the source of sound below 20Hz, so you can use them to detect infrasound waves.
Conversely, high-frequency testing is mainly related to the strength, elasticity, mass, and degree of scattering of the sensor diaphragm

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