SeeSV

Propagating Innovation
In Sound and Vibration Measurement

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SM INSTRUMENTS INC.

Now See your Sound and Vibration!

SeeSV-S205 and SeeSV-S200 are real-time sound cameras which implement FPGA-based high-speed beamforming technology. They are developed for highly transient noise source detection, and also perform excellently on stationary noise sources. It is capable of capturing 25 images per second. Highly sensitive microphones detect small annoyance sounds immediately. Its major application is for Buzz, Squeak and Rattle (BSR) noise source detection as well as Noise, Vibration and Harshness (NVH) source visualization. The unique design of SeeSV-S205 makes accurately measuring sound easy. Now you can carry your sound camera anywhere to perform measurements. Sound Cameras have traditionally been heavy and expensive instruments. However, the SeeSV-S205 will open new doors and your ears. It has an ergonomic design, weighs only 1.6 kgs, and has a highly competitive price. Start your sound measurements with our new camera today.

You can enlarge your sound image measurements with SeeSV-M105/M100. They can measure high speed noise sources; such as high speed trains. SeeSV-M105 succeeded in measuring noise with a train traveling at 345 km/h (214 mph). Accurate triggering is provided with photo sensors which are already integrated in the SeeSV-M105/M100 sound camera.

Features

Hardware

- Innovative Unique Design
- High Sensitivity Digital MEMS Microphone
- High Resolution Optical Camera
- FPGA-based Real-Time Analysis
- Light Weight and Highly Portable, 2.0 kg (SeeSV-S205)
- No Control Box. Direct Connection with Ethernet Cable (SeeSV-S205)

Software

- Real-time Sound Imaging
- High Speed Image Update, 25 FPS
- Impulsive Noise Detection
- Optimized for Highly Transient Noise
- Auto Image Ranging Function
- AVI & WAV Export and Replay
- Real-Time Frequency Adjustment
- Real-Time Distance Adjustment
- Linear/Exponential Image Averaging
- Effective Post Processing

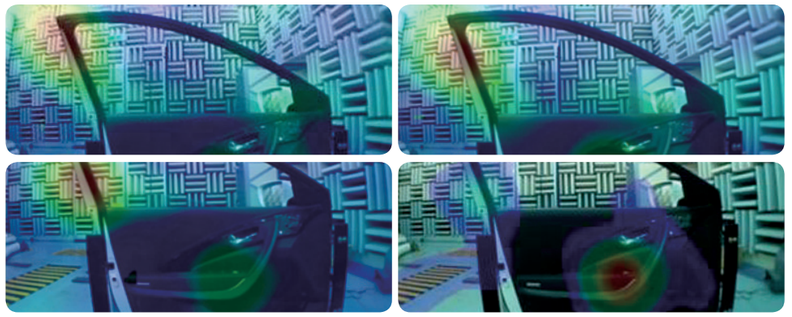
reddot design award
winner 2013

NEW SeeSV-S205

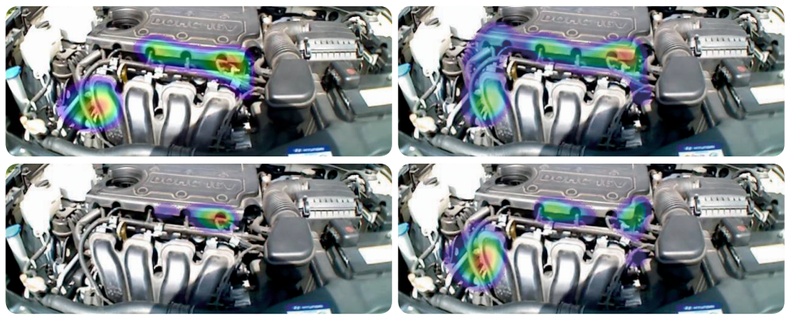
SeeSV-S200

Portable, fast and accurate!

SeeSV-S205 is based on the latest FPGA technology, which makes it possible to integrate signal conditioning, data acquisition, filtering, and beamforming processing into a single chip. Our FPGA is fast; it generates 25 sound images per second with accurate resolution. Our single FPGA does not need high electrical power and is driven by Power of Ethernet (POE). Weighing a mere 1.6 kgs it is easily transportable and usable. MEMS microphone technology is improving every day and is achieving 70 mV/Pa with more than 56 dB signal-to-noise ratio. SeeSV-S205 uses highly accurate digital MEMS microphones for portable, fast, and accurate measurements.



The detection of squeak and rattle noise of vehicle door and its window. [SeeSV-S205]



The detection of high frequency noises from a vehicle engine. [SeeSV-S205]

What is FPGA?

A field-programmable gate array (FPGA) is an integrated circuit designed to be configured by a customer or a designer after manufacturing-hence "field-programmable." The FPGA configuration is generally specified using a hardware description language (HDL), similar to that used for an application-specific integrated circuit (ASIC).
www.wikipedia.org

What is it?

SeeSV-S205 is the handheld sound camera. A sound camera visualizes sound in color contours, similar to the way a thermal camera visualizes temperature. When developing/repairing home appliances, vehicles or vessels, engineers can quickly spot the source of noise such as buzz, squeak and rattle, which is difficult to detect otherwise.

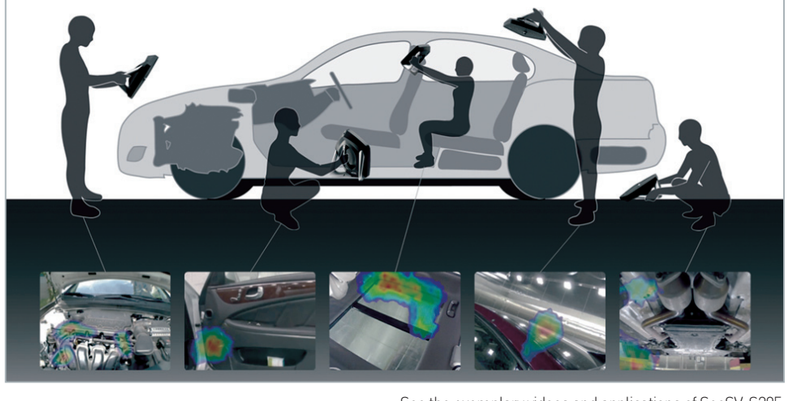
Five spiral arrays of high-sensitivity digital microphones and a high-resolution optical camera superpose sound images onto visual images in real-time (at 25 frames per second), enabling intuitive visualization and recording (in AVI and WAV format) of the sound data.

This innovatively small and light-weighted sound camera weighs only 1.78kg and measures 39cm wide and 38cm high, with its ergonomically designed grips providing exceptional usability.

A sound camera **visualizes sound in color contours,** similar to the way a thermal camera visualizes temperature. When developing/repairing home appliances, vehicles or vessels, engineers can quickly **spot the source of noise** such as buzz, squeak and rattle, which is difficult to detect otherwise.

Unlike any other existing products, SeeSV-S205 allows users to freely move and interactively explore various noise sources even in upper surfaces, lower surfaces, or narrow spaces.

See the exemplary videos and applications of SeeSV-S205 at http://www.youtube.com/sminstruments.



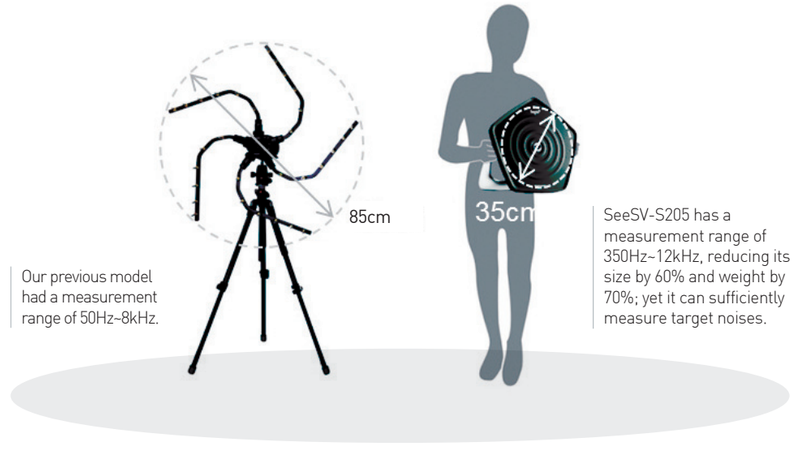
See the exemplary videos and applications of SeeSV-S205 at http://www.youtube.com/sminstruments.

What is the challenge?

Noise from industrial products may imply design faults, abrasion of components, or other problems. However, it is not easy to spot the noise source with bare eyes and ears. A sound camera can be useful in this situation. But existing models were large and heavy, thus could only be used on a tripod. Installation was complicated, and exploration of upper/lower surfaces or narrow spaces was difficult. We developed a new sound camera that a user can freely move and interactively explore the target with. The design requirements were:

- Size and weight should be appropriate for mobile use, without compromising the performance level.
- Usability should be ensured, considering both usage scenarios and ergonomics.
- A user should be able to use the device without prior knowledge about acoustics.
- Microphones should be safely protected during mobile uses and storage.
- Design should be aesthetically pleasing and intuitively exhibit its identity and usage.

In order to measure low frequency noises (50Hz~) with long wavelengths, our previous model had large spaces between microphones. Based on the idea that noises from industrial products such as BRS have relatively higher frequencies, we moved the measurement range (350Hz~), drastically reducing the size enough for mobile use.



Our previous model had a measurement range of 50Hz~8kHz.

SeeSV-S205 has a measurement range of 350Hz~12kHz, reducing its size by 60% and weight by 70%; yet it can sufficiently measure target noises.

What makes this an excellent design solution?

The ergonomically designed handles provide excellent usability. Its central handle at the back enables stable one-hand grip, allowing the user to control the noise source or computer with the other hand. Two side handles enable the user to comfortably hold the camera in many different ways, also providing steady stand at the same time. Its symmetric form does not discriminate handedness; the two-hand grip enables women and older users to handle the device with less physical strength.

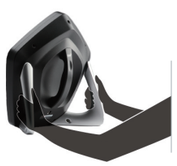
Simplified preparation process makes SeeSV-S205 easy to use. The previous model required users to assemble microphone modules and connect it to a controller and computer with multiple cables. SeeSV-S205 mounted all the sensors inside the main body and unified the cables, also making storage/transportation easier. Its intuitive software interface lets anyone measure noises only with simple instructions.

Designed as a single solid body without moving parts, SeeSV-S205 is durable. Also, microphones are located in between embossing wave patterns, protecting them from scratches/damages.

SeeSV-S205's overall appearance informs even first-time users to grab the handles, aim to the front, and stand the device on the side handles. The embossed pattern of concentric circles at the front visualizes sound wave propagation, signifying its identity as a sound measuring instrument. Pentagonal form of the main body harmonizes with the five spiral microphone arrays, with the side handles completing the unique design of SeeSV-S205.

Even the frist-time users intuitively understand how to hold, use and stand the device. Pentagonal form of the main body harmonizes with the five spiral microphone arrays, with the side handles completing the unique design of SeeSV-S205.

Its central handle at the back enables stable one-hand grip, allowing the user to control the noise source or computer with the other hand.



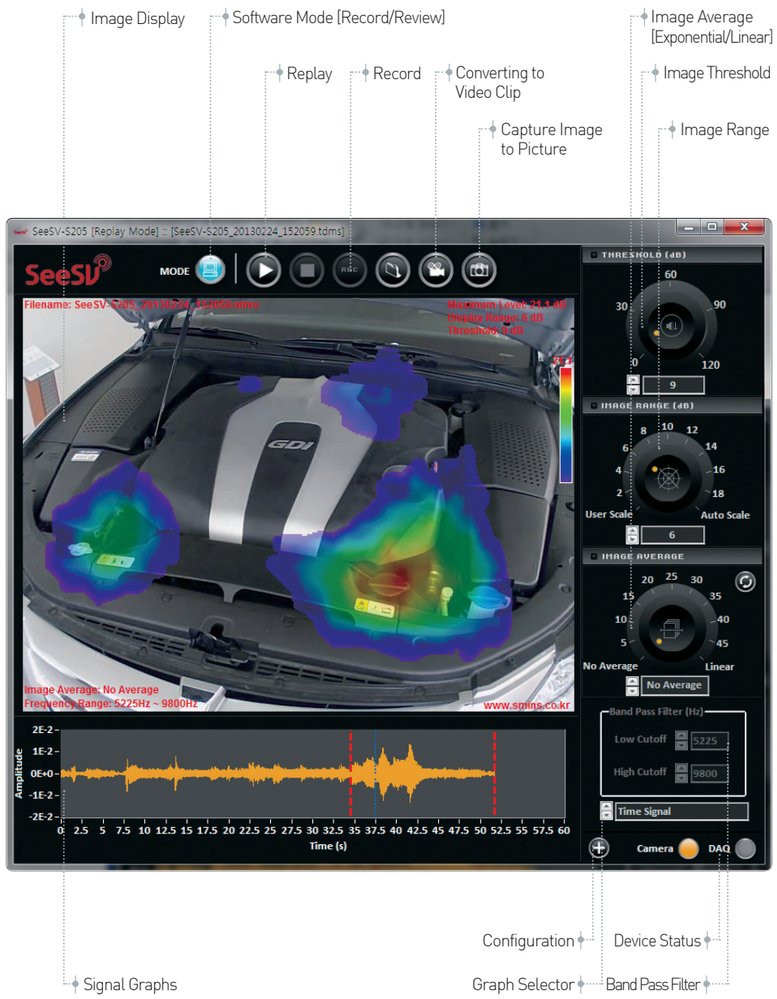
Two side handles enable the user to comfortably hold the camera in many different ways.

Two side handles also provide steady stand.

The three handles at the back provide excellent usability, considering both usage scenario and ergonomics.

It's a camera! Easy operation!

SeeSV-S205 and SeeSV-S200 include simple, easy, and high performance software. They automatically start their operation as soon as the user runs the software. You can record sound videos with our intuitive graphical user interface. 'Record' and 'Stop' buttons control video recordings and our 'Replay' button replays the recorded video at various speeds of your choosing. It is almost as simple as using an mp3 player. There are three knobs on right side: 'Threshold,' 'Image Range,' and 'Image Average.' These make controlling the quality of your image simple.



Sound Camera
SeeSV-S205
Handheld Real-Time Sound Camera

SeeSV-S205 is a real-time handheld sound camera which implements FPGA-based high speed beamforming technology. SeeSV-S205 is developed for Buzz, Squeak and Rattle (BSR) noise source detection as well as Noise, Vibration and Harshness (NVH) source visualization. It displays transient noise effectively due to its high image per second update rate. The unique design of SeeSV-S205 makes measuring sound easy.

Features

Hardware

- Unique, Innovative Design
- High Sensitivity Digital MEMS Microphone
- High Resolution Optical Camera
- FPGA-based Real-Time Analysis
- Light Weight at 2.5 kg

Software

- Real-time Sound Imaging
- High Speed Image Update, 25 FPS
- Impulsive Noise Detection
- Optimized for BSR detection
- Auto Image Ranging Function
- AVI & WAV Export and Replay
- Real-Time Frequency Adjustment
- Linear/Exponential Image Averaging
- Effective Post Processing
- FFT and Octave Analysis

Applications

- BSR Noise Detection
- NVH Noise, Power Train Noise Detection
- Noise Leakage Detection

Specifications

Microphone Array	
Mic. Type	Digital MEMS Microphone
Number of Mic.	30
Mic. Sensitivity	70 mV/Pa
Array Diameter	35 cm
Frequency Range	Min. 350 Hz Max. 12 kHz Recommended 2 kHz ~ 10 kHz (60 deg ½ Bandwidth)
Meas. Distance	0.2 m ~ 5 m (Recommended)
Weight	2.5 kg

Data Acquisition and Processing	
Sampling Rate	25.6 kS/s
Imaging Algorithm	Beamforming
Image Ranging	Automatic/Manual

Environmental Condition	
Operating Temp.	-20 °C ~ 50 °C
Humidity	10~ 85 %

Sound Camera
SeeSV-S200
High Resolution Real-Time Sound Camera

SeeSV-S200 is a real-time sound camera which implements FPGA-based high speed beamforming technology. SeeSV-S205 is developed for Buzz, Squeak and Rattle (BSR) noise source detection as well as Noise, Vibration, and Harshness (NVH) source visualization. It displays transient noise effectively due to its high image per second update rate.

Features

Hardware

- Easy to Carry and Install
- ¼" Condenser Microphone
- 85 cm Diameter Array
- High Resolution Optical Camera
- FPGA-based Real-Time Analysis

Software

- Real-time Sound Imaging
- High Speed Image Update, 25 FPS
- Impulsive Noise Detection
- Optimized for BSR detection
- Auto Image Ranging Function
- AVI & WAV Export and Replay
- Real-Time Frequency Adjustment
- Linear/Exponential Image Averaging
- Effective Post Processing
- FFT and Octave Analysis

Applications

- BSR Noise Detection
- NVH Noise, Power Train Noise Detection
- Noise Leakage Detection

Specifications

Microphone Array	
Mic. Type	¼" Condenser Mic.
Number of Mic.	30
Mic. Sensitivity	50 mV/Pa
Array Diameter	85 cm
Frequency Range	Min. 50 Hz Max. 8kHz Recommended 0.8 kHz ~ 5 kHz (60 deg ½ Bandwidth)
Meas. Distance	0.5 m ~ 10 m (Recommended)
Weight	6.0 kg

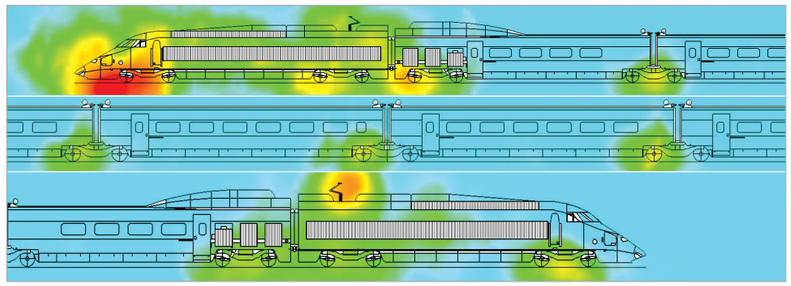
Data Acquisition and Processing	
Sampling Rate	25.6 kS/s
Imaging Algorithm	Beamforming
Image Ranging	Automatic/Manual

Environmental Condition	
Operating Temp.	-20 °C ~ 50 °C
Humidity	10~ 85 %

Sound Camera
SeeSV-M105/M100

Moving Noise Source
Sound Camera

SeeSV-M105/M100 generates a noise map of moving noise sources such as high speed trains which can travel over 400 km/h. SeeSV-M Series employs a large diameter of microphone arrays and a large number of microphones in order to achieve high spatial resolution at low frequencies. A set of photo sensors supplies the trigger signal with accurate positioning for moving noise sources.



Features

Hardware

- Large Diameter Array, (6.2m and 2.4m)
- ¼" Condenser Microphone
- NI-PXI-based Measurement System
- Trigger with Photo Sensors
- Multi-Connecting Cable for Easy Installation

Software

- Optimized Moving Source Beamforming (MSBF) Algorithm
- Automatic Speed and Trigger Detection
- Load Source Image and Mapping
- Automatic De-Dopplerization
- A, B, C Frequency Weighting
- User Selection of Analysis Area by Mouse Click

Applications

- High Speed Train Noise Imaging
- Pass-by-Noise Measurement Vehicles
- Aircraft Noise Imaging

Specifications

Microphone Array		
Mic. Type	¼" Condenser Mic.	
Mic. Sensitivity	70 mV/Pa	
Frequency Range	Min. 50 Hz	
	Max. 8kHz	
	Recommended 50Hz ~ 6 kHz	
Meas. Distance	1.5 m ~ 34 m (Recommended)	

Data Acquisition and Processing	
Sampling Rate	25.6 kS/s, 12.8 kS/s
Imaging Algorithm	MSBF
Image Ranging	Automatic/Manual

Environmental Condition	
Operating Temp.	0 °C ~ 50°C
Humidity	10~ 85 %

Model Configuration		
Model Name	M105	M100
Number of Mic.	144	98
Diameter	6.0m	2.4m

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