Portable Real-Time Sound Camera

SeeSV-S205/S205W/S206W

User Guide

SM Instruments Inc.

Contents

Components Description(SeeSV-S205)

1. Main Body

Front side

The front plane of sound camera has got pentagonal shape, which serves as a nice design peace, mechanical protection and accommodates:

- 30 digital MEMS microphones

- Optical Camera
- LED ring indicator reflecting current state of device.

Side

Here you can notice the ergonomic shape of the body, with optical camera sticking out of the center while being protected from scratches by a plastic capsule.

Rear side

The back side of sound camera enables you to be mobile and you can see the 3 handles more clearly.

The handles have 3 functionality

- Holding the body by 2 hands
- Resting the camera on a flat surface
- Holding the body by 1 hand.

From the bottom of the camera, it is possible to attach the body to a standard tripod.

2. Physical Connection

Power Supply

Power Supply will energize Sound Camera. In case of wired sound camera SeeSV-S205, it is of 12V DC while 24V DC for wireless model. LEMO to LEMO cables are different respectively: two pins( ) for wired and three pins( ) for wireless model.

LEMO to LEMO cable

Cable with push-pull connectors, so-called LEMO cable enables communication between a PoE controller and a Sound Camera.

Network cable

RJ45 LAN cable. The cable enables data communication between a PoE controller and a PC.

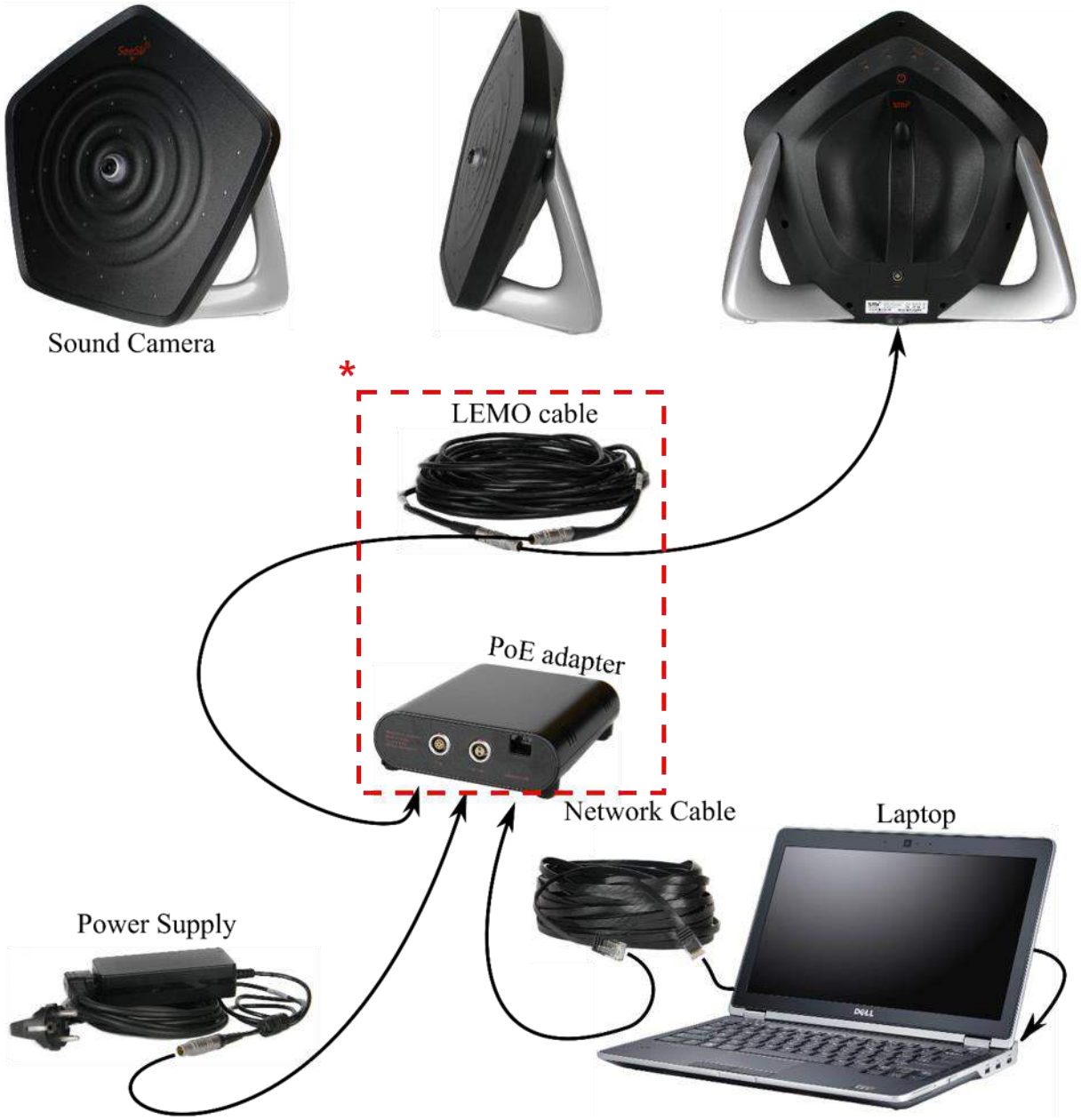
Power over Ethernet controller (PoE controller)*

PoE delivers power to the sound camera over PoE LEMO socket. It also arranges connectivity between a CPU and a sound camera over network cable on the side of a CPU and over LEMO cable on the side of sound camera. It is powered by the LEMO cable from the power supply.

*PoE controller and LEMO to LEMO cable are only for SeeSV-S205, not SeeSV-S205W.

Hardware Installation

1. System Connectivity



* Items in the box ⬚ are not for SeeSV-S205W. Power Supply and Network Cable is directly connected to the Sound Camera body in case of the device.

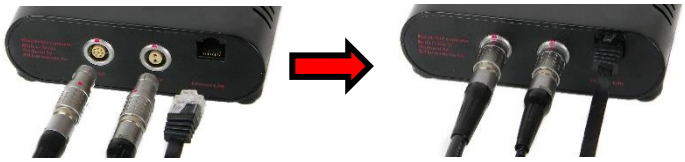
2. Connection Steps

PoE Controller (SeeSV-S205 only)

Connect appropriate cables to the sockets on a PoE controller. From left to right, connect:

1. **LEMO to LEMO cable** to **LEMO socket** denoted as PoE
2. **Power Supply LEMO cable** to **LEMO socket** denoted as DC 12
3. **RJ45 Network cable** to **RJ45 socket**. The other end of the cable connects to your PC LAN port.

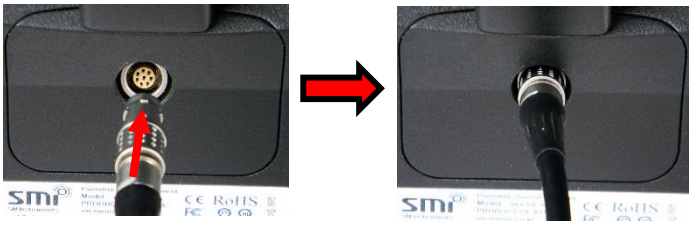
When connecting **LEMO to LEMO cable**, align the red dots on the silver LEMO plug and on the silver LEMO socket as seen on the left picture below. Then push all connectors in until a click sound is heard.



SeeSV-S205

Sound Camera Body

Connect **LEMO to LEMO cable** to **LEMO socket** located below the center handle at the rear side of the main body. Align the red dots on the plug and socket, and push it in until a click sound is heard.



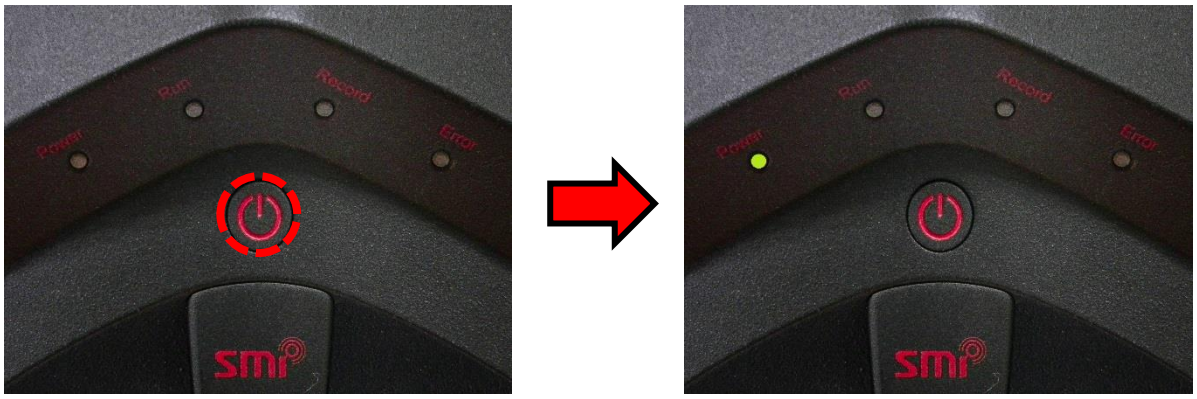
SeeSV-S205W*

***** Directly connect Power Supply and Network Cable to the Sound Camera Body as to wireless SeeSV-S205W.

1. 3. Turning the camera ON & OFF

Power Switch

In order to turn the power ON or OFF, push the power button for 2~3 seconds until you hear a click sound and the control power LED light on the left of the button toggles between green (ON) and gray (OFF) .



Initialization Indicator

When power is off, an optical camera ring control light indicator has whitish color as default. After about 40 seconds from launching the sound camera by the power button, the ring control light around the camera lens turns orange, what indicates an initializing state. The sound camera is ready to be used when the ring control light changes to green. It will take about 40 seconds more from the initialization state.

The whole process of starting from the pushing the power button takes about 1 and half minute.

Power off **Initialization** **Ready**

Components description(SeeSV-S206W)

1. Main body

Front side

The front panel of the camera has got pentagonal shape, which serves as a nice design piece, mechanical protection and accommodates:

- 96 digital MEMS microphones

- Optical Camera
- LED ring indicator reflecting current state of device.

Side

Here you can notice the ergonomic shape of the body with the optical camera sticking out of the center while being protected from scratches by a plastic capsule.

Rear side

The back side of the Sound Camera enables you to be mobile and you can see the 3 handles clearly.

The handles have 3 functionalities;

- Holding the body by two hands
- Resting the camera on a flat surface
- Holding the body by one hand.

From the bottom of the Sound Camera, it is possible to attach to a standard tripod.

2. Physical connection

Power supply

A power supply will change the Sound Camera. For the model SeeSV-S206, it is 24V DC and three pins of LEMO to LEMO cables.

Network cable

RJ45 LAN cable. The cable enables data communication between the Sound Camera and a PC for wired mode only.

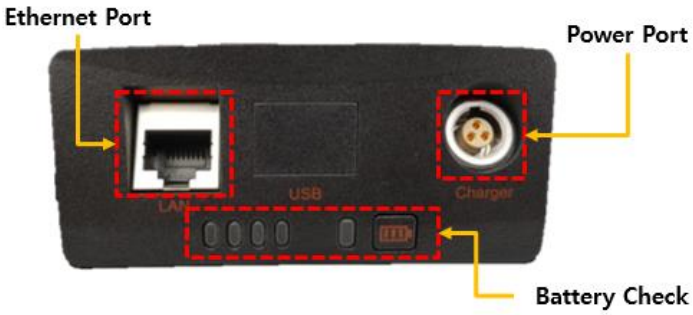
Hardware installation

3. System connectivity

- The Sound Camera SeeSV-S206 can select communication mode between wired and wireless.

4. Connection steps

Interface port



Power port

Power supply LEMO cable to LEMO socket denoted as DC 24. Align the red dots on the plug and socket, and push it in until a click sound is heard.

LED bar indicates the battery level and charging state. The battery status indicator uses two LEDs as green and red.

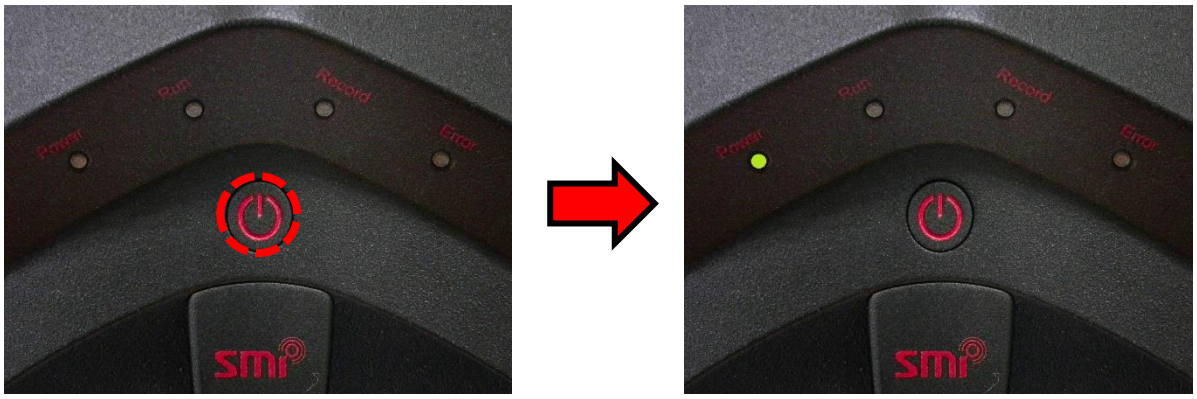
Ethernet port (wired mode only)

RJ45 LAN cable to LAN socket. The other end of the cable connects to your PC LAN port.

5. Turning the camera ON & OFF

Power switch

In order to turn the power ON or OFF, push the power button for 2~3 seconds until you hear a click sound and the control power LED light on the left of the button toggles between green (ON) and gray (OFF).



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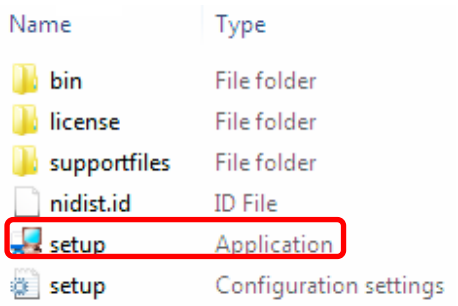
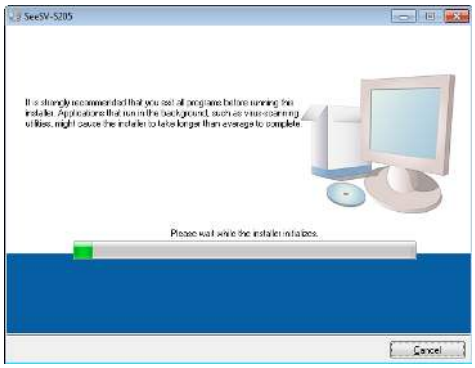
Power off **Initialization** **Ready**

Software Installation and Activation

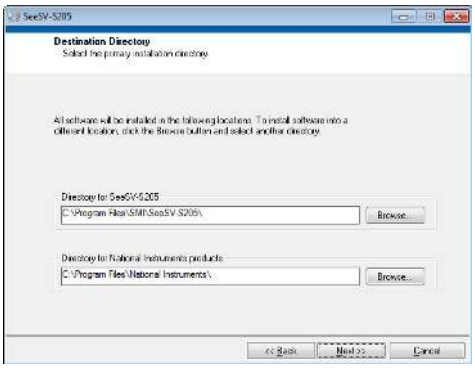
1. Software Installation



Run setup by double clicking the icon or hitting enter button when selected.

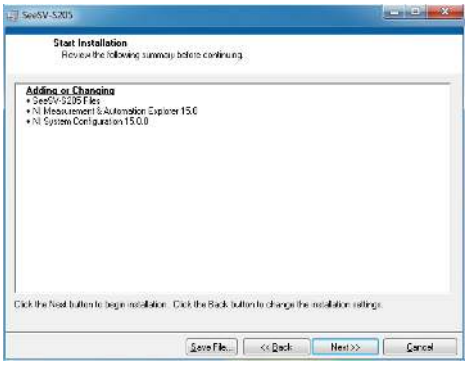


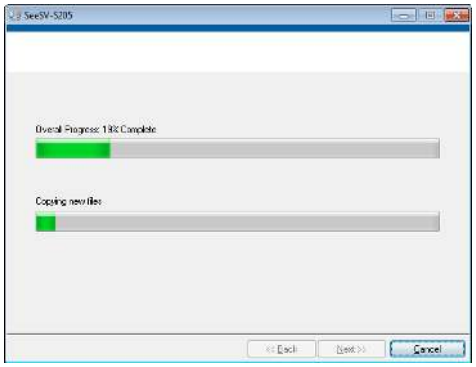
Please exit all programs prior proceeding this installation in order to shorten installation time.



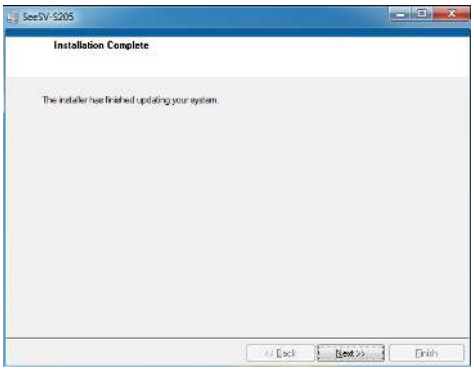
Confirm destination directory or choose destination directory by the Browse... button or confirm default one by clicking Next >>.

You should check "I accept the License Agreement" and agree with license agreement. You confirm the license agreement page by clicking Next >> and then confirm items to be installed by clicking Next >>.

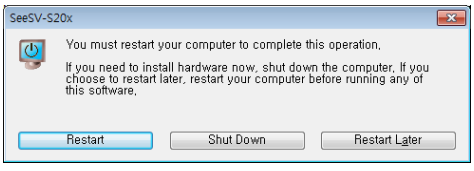




Installation is proceeding, it should take a few minutes depending on performance of your PC.



Installation is complete. Click Next >>.



If this is the first time to install the software, you will be requested to restart your PC. Click Restart and the software installation will be completed.

2. Software Activation

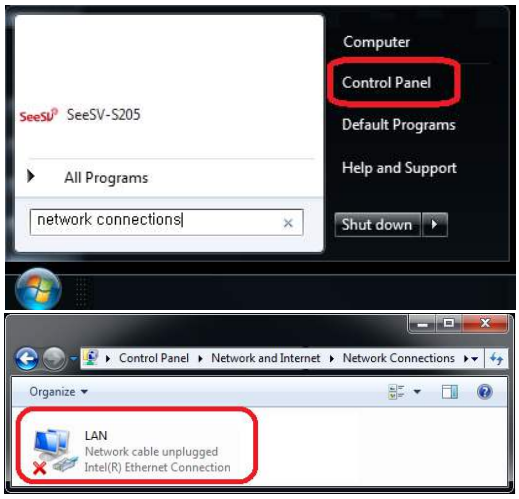
To launch the software, find shortcut icon on your PC or go to your installation destination folder and select "SeeSV-S205.exe". If you left the path unchanged, you find it under following directory:

Computer \ Local Disk (C:) \ Program Files \ SMI \SeeSV-S205

If the software is being installed for the first time, the software license confirmation window will appear. You may choose ➪ **Evaluate SeeSV S205** to try the software for free for 30 days, but if you got your license, click the➪ **Activate SeeSV S205**. Supposing you have got internet connection, select ➪ **Activate SeeSV S205 Online**, or click appropriate option if otherwise.

Input License ID & password in appropriate boxes. This information you find on the envelope of your CD. After clicking **Continue** ➪, the software is be successfully activated the sound camera is ready for use.

3. IP Configuration

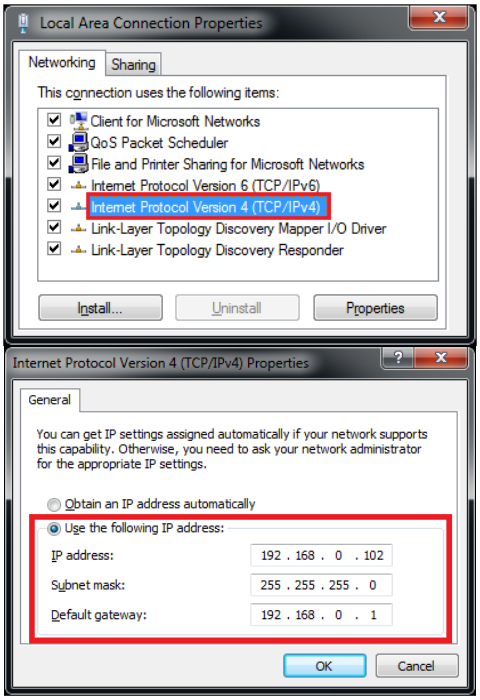


Open Network Connections by either of the following:

- Clicking the start button or hitting the Window Key, and then typing "Network Connections" and hitting enter.
- Clicking the start button or hitting the Window Key,
- then clicking Control Panel and Network and Sharing Centre and choose to Change adapter settings.

If you see the icon as on the left, your PC is connected to the PoE controller correctly.

If you did not connect properly, you see icon with red cross.



After checking your connectivity, configure your LAN adapter for communication between your PC and the sound camera. Right click on the icon and choose Properties, the left window will appear on your PC screen. After highlighting Internet Protocol Version 4 (TCP/IPv4) by clicking on it, proceed to Properties.

In this setting, set the communication between your PC and the sound camera, by choosing Use the following IP address: and writing IP address fields as below the numbers:

IP address: 192.168.0.102*

Subnet mask: 255.255.255.0

Default gateway: 192.168.0.1

*The last three digits can be any number except 6, 10, 90.

Confirm entries by clicking OK button and close the previously opened windows. The communication is set.

To check the communication connection between your PC and the Sound Camera, turn on the Sound Camera by and run the SeeSV software SeeSV. First, the power LED indicator turns green on the back of the sound camera and then the optical camera ring indicator turns green. If the connection was set up correctly, the Camera and DAQ indicator will turn orange in your user interface.

4. Wi-Fi Setting (SeeSV-S205W only)

Wi-Fi Setting is another method for making sound camera ready to work.

Power on the sound camera for connecting it with computer. Find SSID as SeeSV-S205W_XXX in the list of devices available in Wi-Fi pane. The last three numbers are coming from those of your sound camera serial number.

The password for the device is 110205XXX and XXX here is same as above.

If you are successful, you will see the yellow marks on Camera and DAQ button in the second page of the software.

After following the step, open the Real-time software and check Camera and DAQ buttons are yellow meaning that the software is ready to be operated.

Disconnected	Connected
	

Lastly taking a same step of **3. IP Configuration** in order to make the condition even more stable. Set the IP address and then you can conduct your work with the wireless sound camera SeeSV-S205W!

*If it is limited to access Wi-Fi or have troubles in doing in this way, please connect the devices directly with Ethernet cable.

5. Status Check

You can check status of Sound Camera based on combination of

- LED ring indicator
- Control LEDs on the back of sound camera body
- Software LED indicators of optical camera and data acquisition system

Status Indicator table

Power OFF.

Power ON.
Data acquisition is set.
Optical camera is initializing.

Sound Camera is ready.

Recording in progress.

Software Functions

1. User Interface

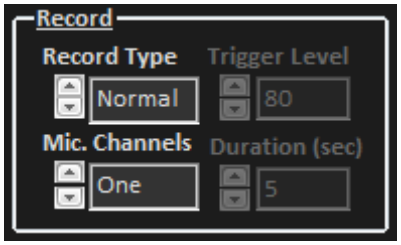
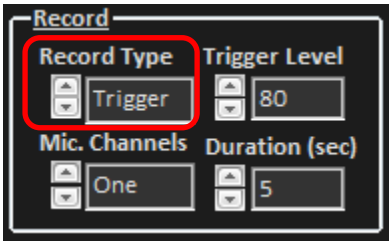
After launching SeeSV execution file, the window below prompts out. The menu of the user interface (UI) is designed around the video display window ①. The top left menu bar ② gives you the flexibility to control replay or record mode. The bottom left chart ③ serves for analysing and viewing sound in time and frequency domain. The right pane ④ is multifunctional and you access those options by clicking on the number enclosed by circle ❶ ❷ ❸ on bottom left of the pane ④.

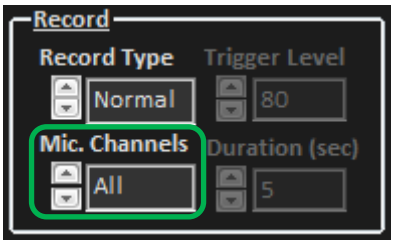
2. Record Mode

The mode allows the user to record a measurement, take a snapshot of video with beamforming map and open help folder. If unchanged, all data are saved into a default folder located in:

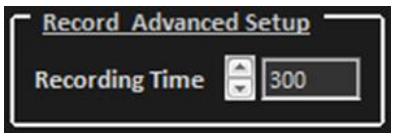
"C: \Users\User's Name\ Documents\SMI\SeeSV"

Hint: To find the path to your default folder, click the help button ? in this menu bar and then go one folder up.

Icon	Button	Action
	Record mode	If you see the yellow record icon, the record mode is set. Hitting it toggles between record or replay mode.
	Recording button	Starts saving measurement data including its user defined settings. Frequency limits will also save and cannot be changed in Replay Mode.
		Recording tab found under pane ② has got 2 main options to choose from: • Record type • Mic. Channels
		Recording may be launched by 2 ways. Normal **Normal record mode** Start and stop recording by clicking appropriate buttons. Thus you have immediate control over recording time. Trigger **Trigger record mode** Start recording automatically when an event louder than set "Trigger level" (dB) is detected. Duration of trigger recording time is set by the "Duration (sec)". You can stop recording before by hitting recording button. 

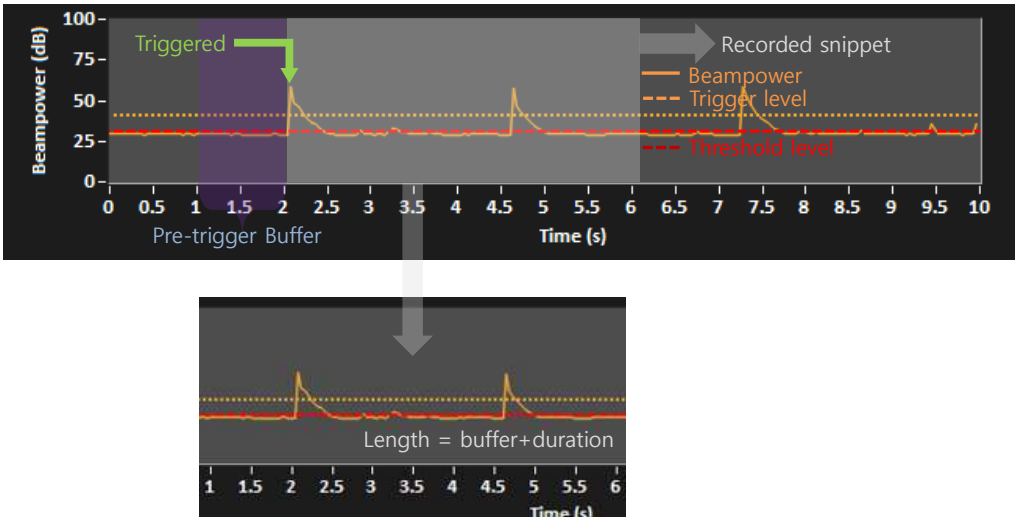


Another option for recording, let you decide whether to keep in memory only single channel or all 30 microphone channels. All functions for in replay mode will still work also with single channel.

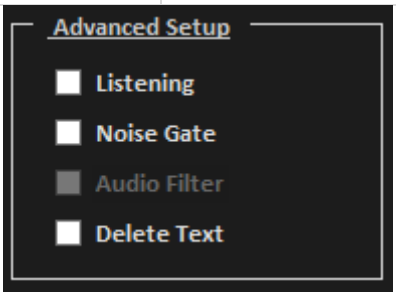
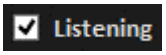
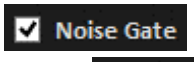
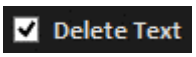


In advanced setting under pane ❸ you can change recording time up to 300 seconds that will force any kind of recording to stop by your set value.

Now you can see how the trigger option handles the recording. Under pane ❶, you find **Level Trend** chart as seen below. If "Trigger record mode" is chosen, additionally to threshold level limiting the color map on the screen, dashed line of trigger level appears and senses when beampower level exceeds set value. Once this occurs, recording starts 1s before and ends after a user specified time duration. Once you run trigger mode, after first measurement ends, it repeatedly launches next measurement when consequent event occurs.

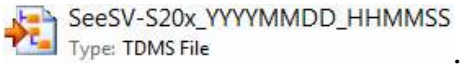
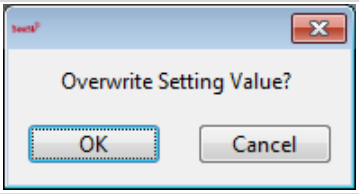


After pressing record button, the menu changes its appearance, and play button together with record mode button gray out.

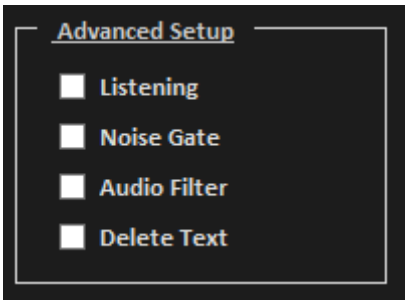
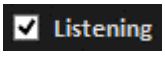
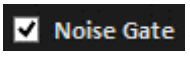
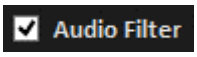
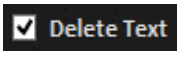
Icon	Button	Action
	Stop	Stops and saves the measurement. The data will be saved in special TDMS format and have the following label: SeeSV-S20x_YYYYMMDD_HHMMSS Type: TDMS File Where YYYY stands for year, MM month, DD day, HH hour (24h clock format), MM minute, SS second.
	Snapshot	Takes a snapshot of the camera screen with overlaid beamforming map and corresponding text.
	Help	Opens folder with • SeeSV-S205 User's Manual • SeeSV-S205 Quick Start Manual • SeeSV-S205 Application Guide • Read Me SeeSV-S205
		To hear sound of the selected location on the screen, check the box "Listening" as  To hear sound of Eliminate background noise, check the box "Noise Gate" as  By "Delete text" option,  you can delete information as frequency range, decibel, or etc. on the screen. *Audio Filter function is not available under Recording Mode.

3. Replay Mode

Replay option gives you the opportunity to study and analyze your measurement data more closely. You load the previously recorded data and may save it as a video file (.avi) or take a snapshot (*.jpeg) of the camera screen with beamforming map.

Icon	Button	Action
	Replay mode	If the blue icon is seen, replay mode is allowed. Toggles between record and replay mode.
	Open Data File	Open folder to access saved data in default folder of format: 
		After loading a file, this pop-up window appears, because with the measurement data, you are also loading user's defined settings used when previously when recording.

When a file is loaded into the software, the menu bar changes its appearance as seen below.

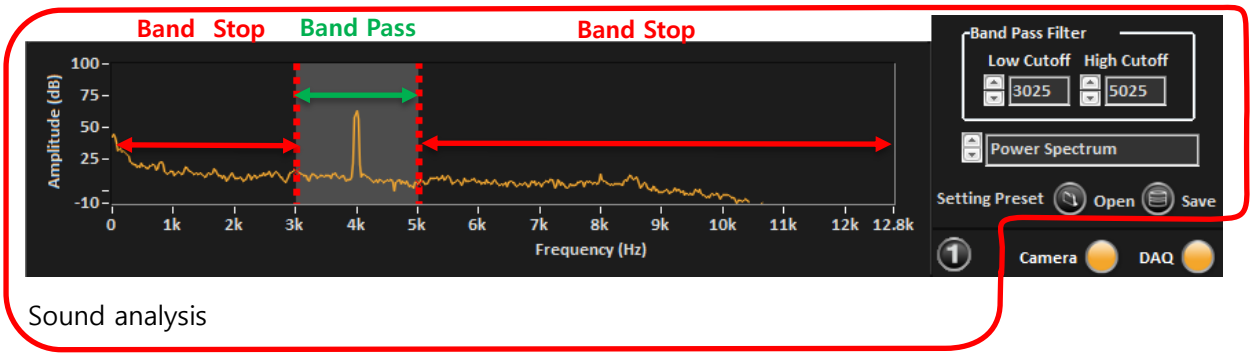
	Replay/Pause	Launches a whole recorded video or a time frame set by red dashed cursors in **Time Signal** window.
	Converting to AVI/TDMS	Saves chosen section of beamforming video into .avi or .tdms format to have the data for further analysis afterward by the form of video or tdms file.
	Snapshot	As for the **Record Mode**, it takes a snapshot of the camera screen with overlaid beamforming map and corresponding text.
	Play Speed	You can change the replaying speed by dividing its standard speed with factor n from 1 to 10 • Normal speed : n=1 • N times slower speed n>1 The frequency content of a recorded sound is shifted in frequency domain also by dividing with factor n. Therefore for n=2, 1,000 Hz tone would be heard as 500 Hz tone and so on.
	Help	As for the **Record Mode**, it opens folder with • SeeSV-S205 User's Guide • SeeSV-S205 Quick Start Manual • SeeSV-S205 Application Guide • Read Me SeeSV-S205
		To hear sound of the selected location on the screen, check the box "Listening" as  . To hear sound of Eliminate background noise, check the box "Noise Gate" as  . To hear limited frequency band of your sound clip, check the box "audio filter" as  . By "Delete text" option,  you can delete information as frequency range, decibel, or etc. on the screen.

4. Sound Analysis Menu

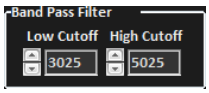
The graph below the beamforming screen together with bottom part of the pane ① offers an options for adjusting frequency spectrum that is fed for the beamforming analysis.

Power Spectrum

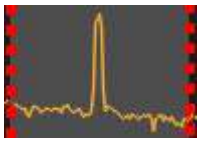
By default, the window is open on the page of Power Spectrum.



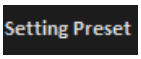
Sound analysis



The frequency limits for band pass filter can be adjusted with step of 25 Hz. You can do so either by typing into or stepping through the indicators under **Band Pass Filter** option.



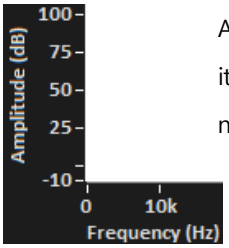
The other approach let you interact with the Power Spectrum cursors and you can drag them along the frequency scale as you wish. The yellow line shows the power spectrum values and the greyed region indicates the pass-band frequencies.



You can save 

and open 

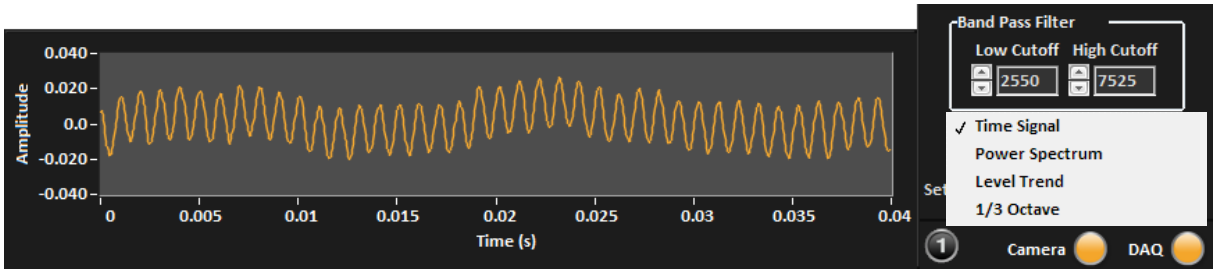
your favorite pre-sets as well. Unique folder named "Setting Preset" will be created and all preset files will be kept there unless you manually define the location. Current Threshold, Image Range, Image Average, and Band Pass Filter setting values will be saved.



Axes of graphs can be arbitrarily changed by double clicking the lowest or highest number, it will highlight all digits and you can directly enter a numerical value. Clicking once on the number will let you correct any digit.

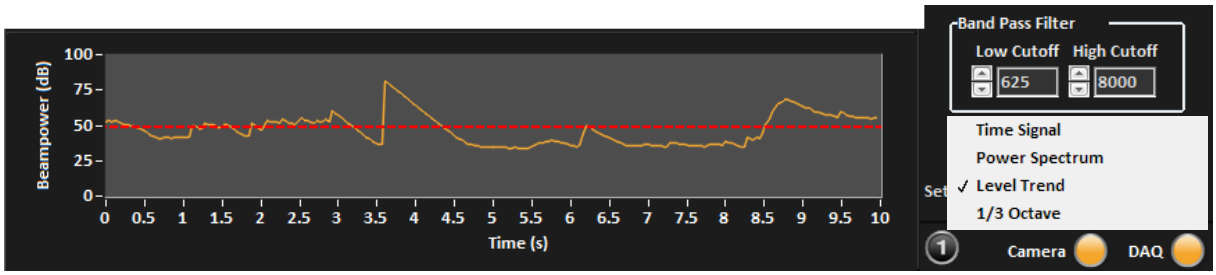
Time Signal

In the time signal window, you can see time course of sound pressure data measured by a microphone in units of Pascal (Pa). It is good to note that the time data are not band-passed by the filter specifications and whole frequency range from 50 Hz up to 12.8 kHz is displayed on the graph.



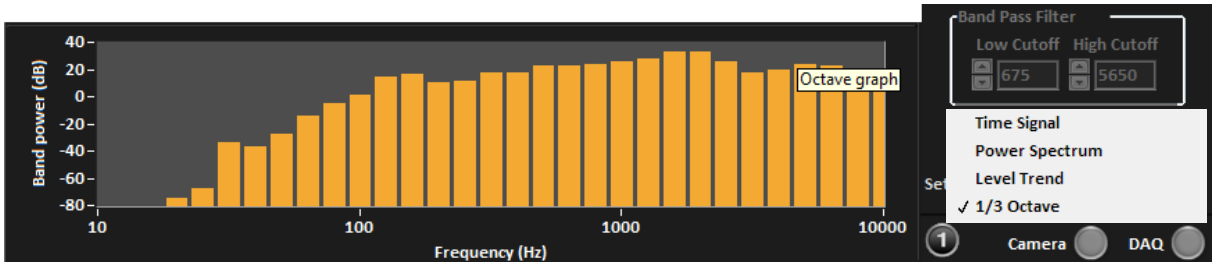
Level Trend

Captures history of beampower ——— that is basically a beampower maximum of sound event captured at each time frame. This window is especially useful when you want to check the beampower threshold from which the beamforming is displayed. The horizontal red dashed line - - - - represents the threshold value.



1/3 Octave

In order to see averaged frequency information over 1/3 octave bands, choose **1/3 Octave** option. This window is not interactive as Power Spectrum though. The center of each frequency band is noted in the table below in units of Hz.



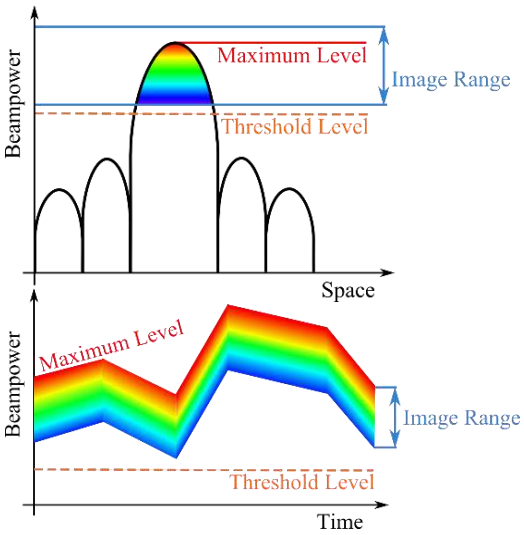
16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000

5. Beamforming visualization control

Now we get to the core of how beamforming data are displayed. The bottom indicators and controls take care of sound representation and together with the highlighted controls on the right, it gives you the tools to analyse and view the sound in form of beamforming map overlapping the optical camera video. If a sound event exceeds certain threshold level, the calculated beampower map is superimposed on the video frames in form of 2D surface graph.

Beampower

The 2D colourful surface map you see is beampower, i.e. amount of sound pressure acquired in the corresponding direction. This quantity can be also interpreted as sound in corresponding position on the video frame exceeding certain threshold. The video frame resolution having 640x480=307,200 points is given by the optical camera which shoots 25 frames per second. The beampower map is defined by 40x30=1200 points on the 2D video frame which is also calculated 25 times a second, therefore acquiring continuous smooth video.



In order to correctly visualize the sound information, you need to be aware of a few parameters described in the diagrams on the left. Beampower is the quantity we visualize on the screen. **Threshold Level** set by user defines the weakest sound to be shown, the **Maximum Level** is continuously detected from 1200 points in each frame. The **Image Range** also defines weakest sound to be shown, supposing the difference between **Maximum Level** and **Threshold Level** exceeds the **Image Range** level. The color map indicates sound level from highest (red) to lowest (blue) level. It can be interpreted over beampower in space or also in time.

Threshold

As you have already seen in the **Level Trend** window, the threshold selects the level of sound to be displayed on the Camera & Beamforming window.

The threshold value in decibels (dB) can be changed either by typing in to the numerical control, or dragging the yellow dot along the threshold knob. The minimum and maximum levels of the knob can be changed by double clicking the minimum or maximum in recording mode, but they are fixed in the review mode.

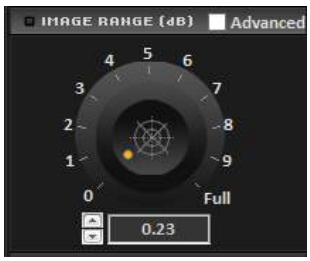
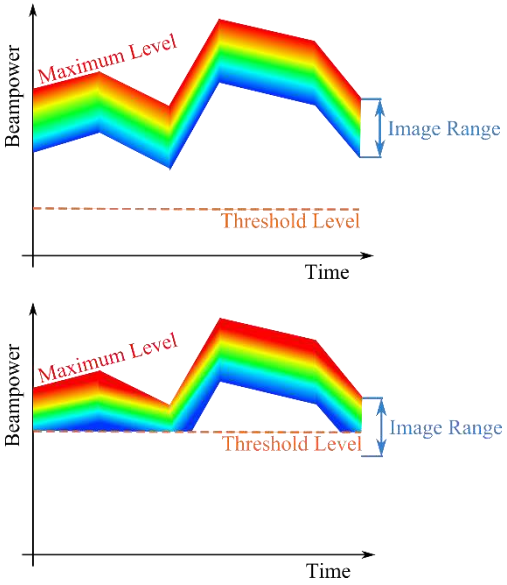


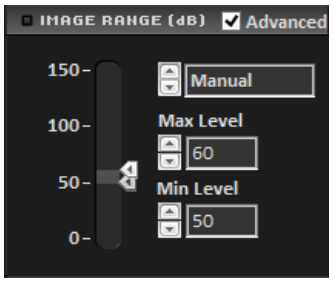
Image Range

As the threshold decides what lowest limit it shows on the sound image, the range between the smallest and largest value on the beamforming map that is seen on the screen is selected by this knob. Auto selection defines the range from maximum to minimum level.



Now, suppose that **Image Range** is set to a number which does not decline below **Threshold Level**, then the beamforming color map will look as on the top graph on the left. The maximum value is continuously calculated and **Image Range** defines the lowest value to be displayed. Therefore, the height of the rainbow graph is the **Image Range** defined by user.

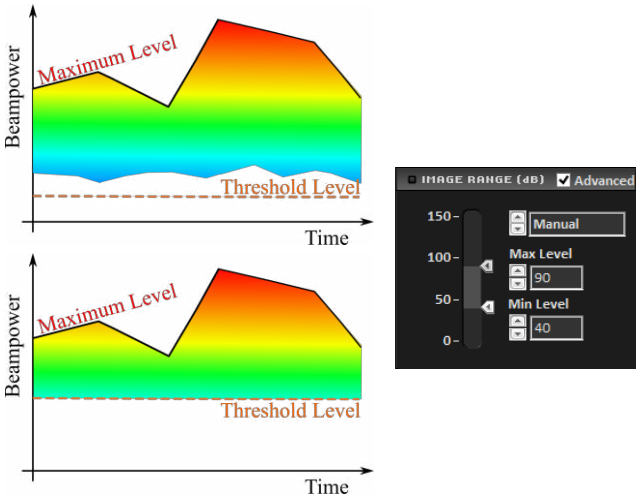
If the **Threshold Level** is raised though, the threshold value defines the lowest value where **Image Range** is does not fit in between **Maximum Level** and **Threshold Level**. In this manner, **Threshold** affects **Image Range** and the height or image range varies according to the headroom above threshold Level.



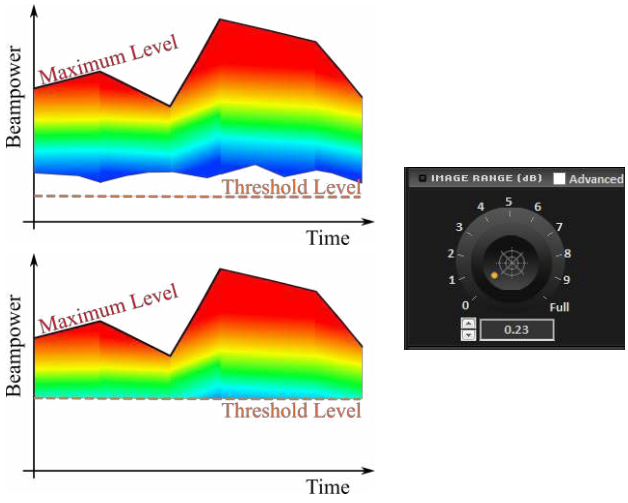
You have the capability of setting the image range manually after clicking Advanced check box. The function makes a big difference, since the peaks are not anymore automatically marked red, but you can relate the static color scale to defined static decibel scale. Supposing you set your **Image Range** in the way that the lowest level would be below the threshold, it will take the threshold value as the lower limit, but it will assign a color corresponding to the decibel scale and not the lowest color as in the default auto mode.

Below you may compare how approximately the difference between manual, automatic, dynamic min/max and accumulate image range is projected into the display method. Two threshold cases are demonstrated for each mode.

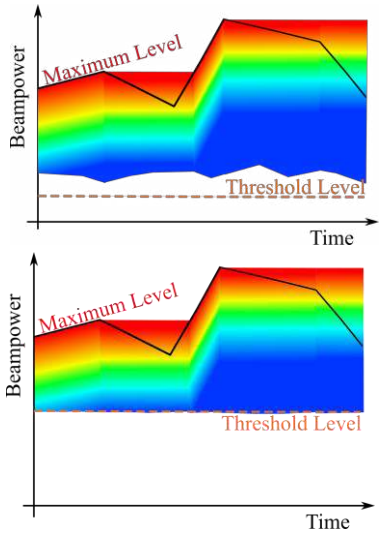
Manual Image Range

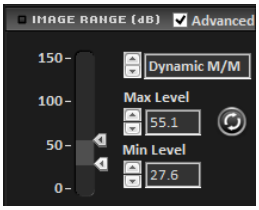


Automatic Image Range



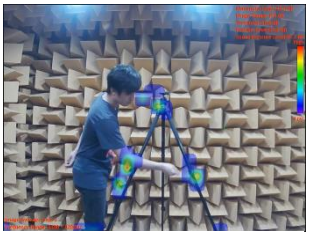
Dynamic Min/Max



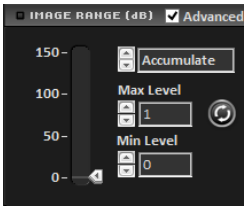


Accumulate

Before



After hitting spots

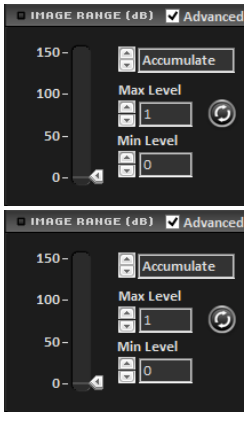


Under Manual Image Range, you can see that each level has corresponding color at all times. If the threshold is higher than the minimum beampower value, it cuts the lower edge off.

Under Automatic Image Range, the color scale assigned that the color varies according to its current beampower dynamic range. The threshold cuts the lower edge off again and does not change the color dynamic scale.

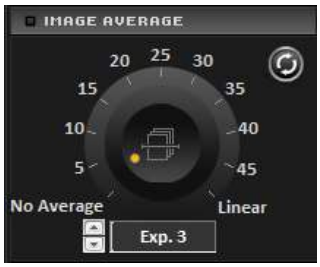
Under Dynamic Min/Max Image Range, you can compare more than two noises with its setting Min/Max value automatically. Max would be set by the biggest beampower value during operation, and Min by real-time background noise beampower level.

Accumulate Image Range is the function to pick how many times noise occurred during measurement and show them in the grid. You can check the frequency of noises occurred at once by the mode.

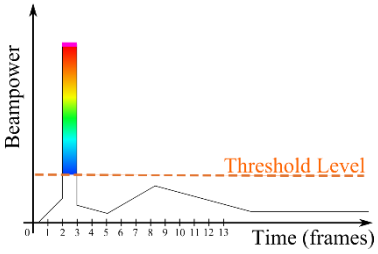


When clicking initialization button  during Dynamic Min/Max and Accumulate mode, Max and Min value will be initialized and so is accumulated image of noise beampower on the screen.

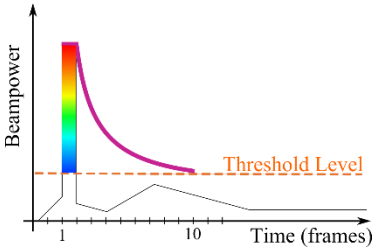
Image Average



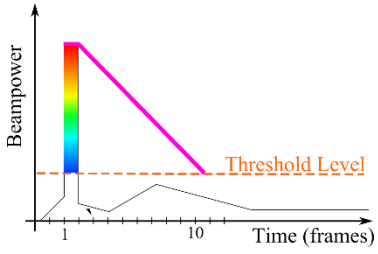
In order to capture impulsive sound events, image average extends the display hold time of beampower map overlaid on the video screen. You can either choose to see the beampower map with no averaging, or select between exponential and linear averaging.



No Average displays only currently present values exceeding threshold level. As demonstrated on the diagram, the impulse represented by the black line will be visible only for the one frame. No average option may be good an indicator realistic duration of sound event, also excellent for fast moving objects, or a good method to see frequency of pulsing sounds that appears at most every 2 time frames (*2*40 ms*) and any integer multiple *n* higher then 2 (for *n>2; n*40 ms*). The highest detectable frequency of sound event is thus approx. 12 Hz, i.e. sound event occurs at most 12 times a second. This is due to the technical limits of the sound camera.

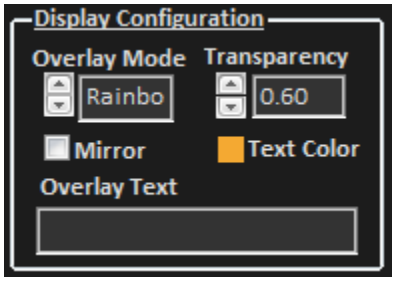


Exponential Average holds the beampower image on the screen for defined period of frames. The Exponential average is automatically set when you choose a number on **Image Average** scale in between 1 and 49. This option is particularly useful for catching very short impulsive sound events.



Linear Average takes the sum of all beampower frames and divides it by number of frames. This ratio defines how rapidly the 2D beampower map will fade out. Linear average is useful for displaying stationary sound sources, where we want to keep the color map information for longer on the screen to get complex map of all sources. For longer measurements, the number of averages will be so large that later sound events will not be displayed on the 2D beampower map, supposing their amplitude is not remarkably high.

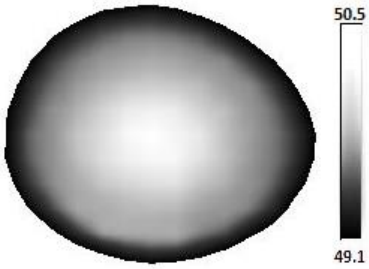
To reset number of linear averages, you hit the reset button  to start averaging from zero again.



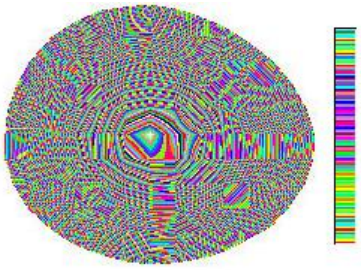
Display Configuration

Overlay Mode

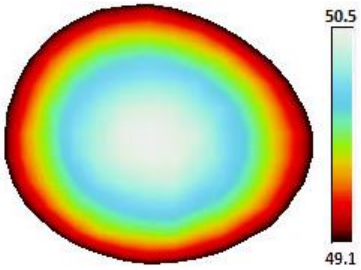
The 2D beampower map can be displayed in 5 different colour modes. You can vary among them based on a character of your background and a color of a targeted sound source:



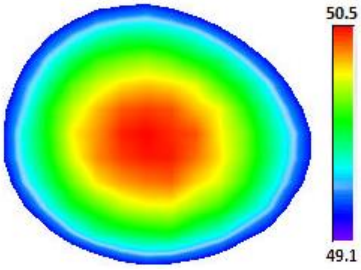
Gray - this mode provides less prominent indices, but can help you to better visualize sound sources in colourful background. The maximum beampower value is whitish and as the amplitude decreases, it darken to black. Values below threshold are transparent.



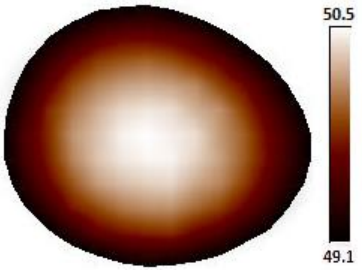
Binary - adds color pixels to the sound region in the way that it creates distortion effect which is good to use where colour modes fail to be a good indicators.



Gradient - distinguishes between strength of sound by a color gradient ranging from the lowest value to highest value by color variations from red, through green, up to blue (RGB) colour.



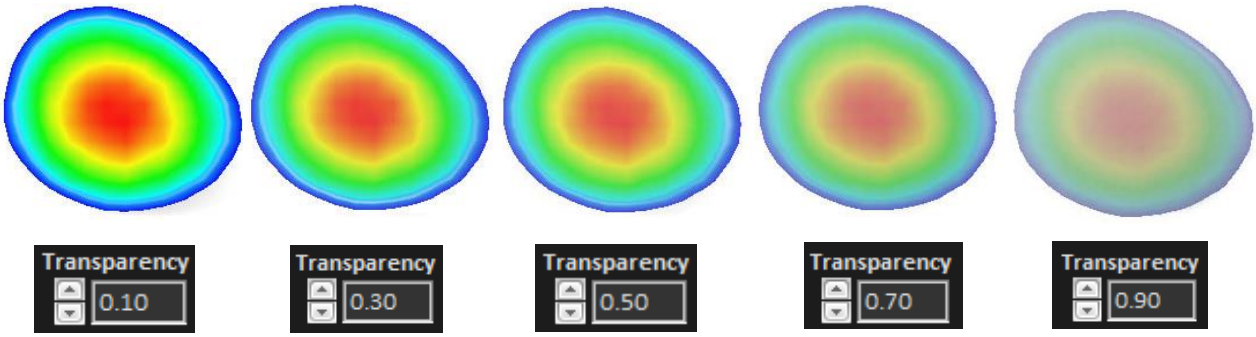
Rainbow - this is a default mode, because it gives an intuitive and easily recognizable pattern where magnitude differences can be well indicated and sound sources easily detectable. As opposite to the gradient, the highest value is represented by red (hot), passing through green, up to blue color (cold) standing for the lowest value.

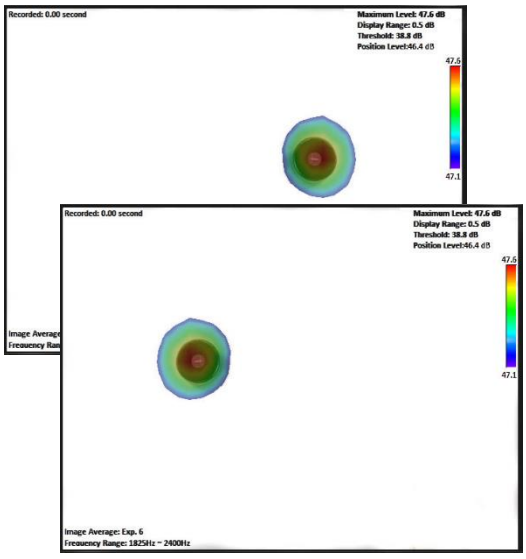


Temperature - a hue of this option is going to red and it is good to be used with greenish and blueish scenes. You can also notice a fixed predefined grid pattern imprinted on the colored region.

Transparency

Beside changing the pattern colors, transparency is usually needed to see what sound source behind the 2D beamforming map is generating the noise. The value is adjustable from 0 (no transparency) to 1 (100% transparency). Default values is set to 60%.





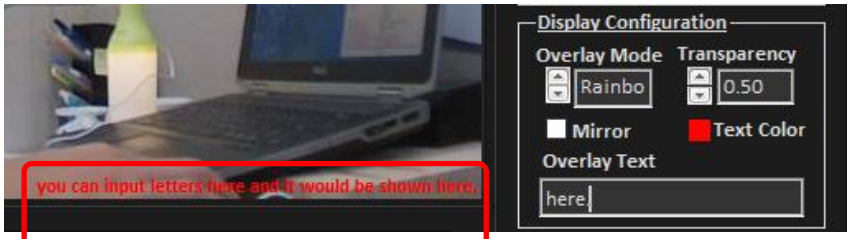
Mirror effect

It flips the display image vertically.

Usually you hold the Sound Camera and pointing to the direction of the sound source. In case you need to come into the scene where sound camera is pointing and at the same time you want to see what is going on on your PC screen, then you want use mirroring to change the perspective. Therefore, if you make a movement on your right when standing in front of the camera, the screen would intuitively show the movement on the right side of the screen as well what would be the opposite if the mirroring is disabled.

Overlay Text and Text Color

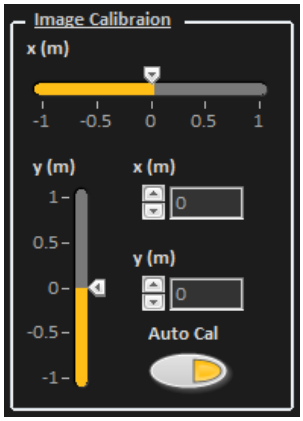
Using Overlay Text, you can input letters on the right bottom side of the screen. At the same time, you can set the color of texts which is initially red. Text color will be applied for all the letters on the screen. Set the color by considering background condition.

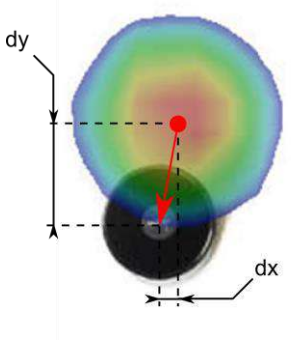


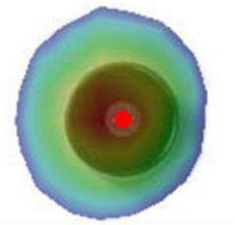
Overlay Texts

Image Calibration

If you experience inaccurate sound detection indicated by a beamforming map not pointing on the actual sound source as in the picture on the right, the sound camera suffers by a bias error that can be corrected for by the **Image Calibration**.





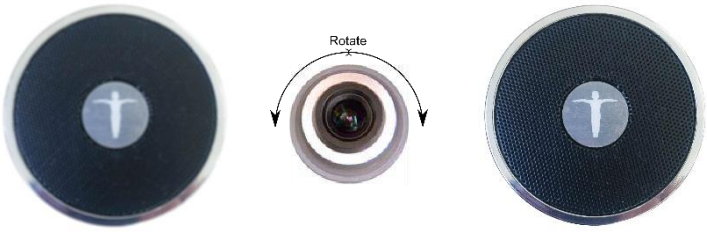


1. Ideally you want to use an easily identifiable sound source as speaker on your smartphone or a small bluetooth speaker playing high frequency tone.
2. To calibrate:
   a. you can either move the sound source indicated by beamforming map to the actual sound source by adjusting separately horizontal x(m) and vertical y(m) axis.
   b. or you can click 

button, and as depicted below, click into centre of current beamforming map, hold the button, and drag to the point where the actual centre of the sound source is. This option automatically set change in x(m) and y(m) by dx(m) and dy(m) and new calibrated map will move to the correct position as seen on the right.

Optical Camera Focus

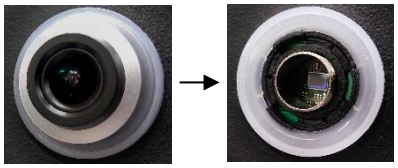
If you experience blurred image, first check whether your lens is free of dust, finger prints etc. In case it did not help, your optical camera is out of focus. You can focus your image by rotating optical length as depicted on the right.



out of focus

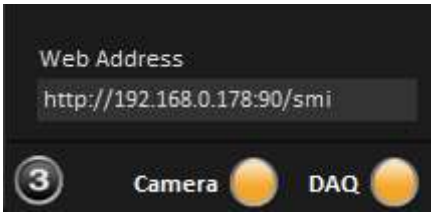
in focus

If focusing the lens did not improved the image, there is low possibility of having optical lens or digital camera sensor covered by an obstacle from the inside. Here you can see the optical lens disassembled.

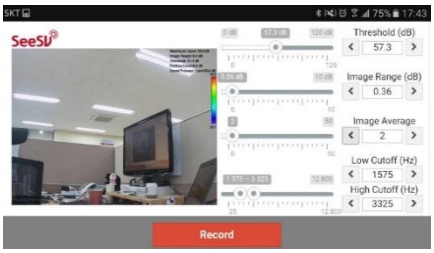


Hint: The lens is attached to a fixed screw, thus if you keep turning anticlockwise all the way, you unscrew the lens completely. Be careful when turning clockwise and stop when you start to feel large strain.

6. Web Service



Allocated Web Address



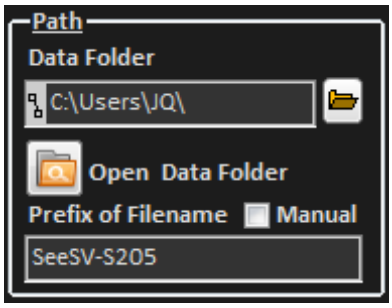
Web Service on mobile phone

The service is available with SeeSV-S205W only. After connecting smartphone with the sound camera through Wi-fi, check Web Address in the third page of the realtime software. Open the page of Web Address with Internet application(Chrome recommended) and then Web Service is ready to use. Having similar software interface in the smartphone including fundamental setting and realtime image of beamforming as you have on your computer.

Be aware that the feature is not usable when Sound Camera is connected by Ethernet cable. In other words, you should link them through Wi-Fi in order to enjoy it.

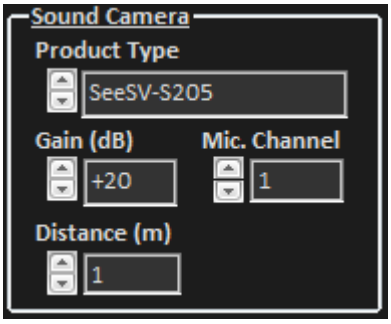
7. Other controls

Under the pane ②, you find general options for setting additional parameters.



Path

By this option, you may change the default location where all data are saved including presets, recordings, snapshots, etc. This will also load files from the defined folder, which by default is set to: "C:\Users\User's Name\Documents\SMI\SeeSV" All newly saved files except pre-sets will have prefix defined in the tab **Prefix of Filename** and if you check the blank box **Manual** as you can specify a different name to be attached before the saved data name.



Sound Camera

Since more models of sound camera are on the market, please choose the "SeeSV-S205" product type.

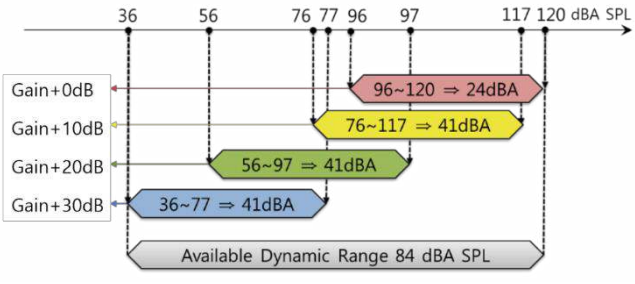
You may select what microphone to record and display in real time graphs. Order of microphones can be seen in the diagram

Gain (dB)

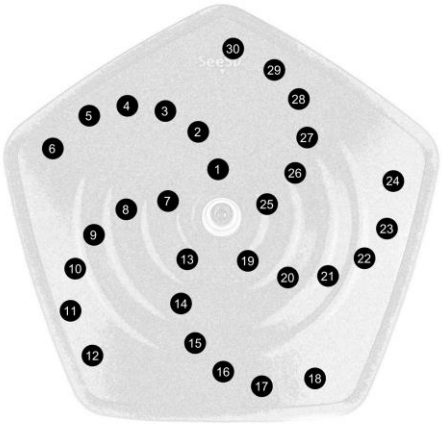
Depending on your dynamic range, you can set Gain (dB) from 0 to +30 dB in 10 dB steps. This limits the lower and higher values of dynamic range as follows:

Dynamic range

Available dynamic range of SeeSV-S205 is 84 dBA. The quietest and loudest measurable sound, which is limited by the MEMS microphones, is 36 dBA SPL (A-weighted Sound Pressure Level in decibel perceived by human ear). In a similar manner, the upper limit of the strongest sound is also limited by MEMS microphone to 120 dBA SPL.



The whole available range is not accessible at once through our software, because it has been divided into 4 sub-ranges for convenience of focusing on certain dynamic range. The sub-ranges' lower and upper limit can be shifted by dynamic gain in decibels as it is demonstrated in the diagram above.



Microphone Channel

Sound Camera Array has 30 MEMS Microphone on its body. When one channel data acquisition, you can select the one among 30. The position of them is indicated on the left picture.

Distance

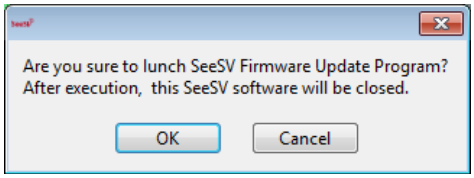
Distance indicates how far the objects are from Sound Camera. It ranges from 0.2 to 10m. It does not influence much on results yet may make it more accurate when set accordingly.

Firmware update

Keeps your sound camera firmware updated or fixes various bugs. Please always discuss with us before updating your firmware to avoid malfunctioning.

At first, you can find your software and Sound Camera firmware version on the second page of software. After checking information, click Firmware Update button for making your device up to date. A pop-up message will show up to inform you about termination of SeeSV software and therefore your current task, so make sure you have saved all data before proceeding. Please make sure your sound camera hardware is connected.

Firmware Information

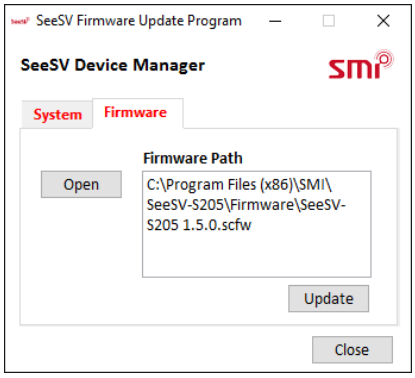


Pop-up message to closing the software for firmware

With SeeSV Device Manager, you can conduct firmware update. Unless you have Firmware Path automatically, please refer to our instruction locating the directory of files:

C:/Program_Files/SMI/SeeSV-S205/Firmware/SeeSV-S205 x.x.x.scfw

It will take up to several minutes according to computer performance.



SeeSV Device Manager

System Requirements

For correct SeeSV-S205 performance, the following minimum requirements must be met:

Criteria	
CPU	Dual-Core 2.2 GHz
Amount of memory	2GB
Hard disk memory	250 GB
Graphics board	256 MB
Screen resolution	1024 X 768
Network	1 Gbit
WLAN card	802.11 a+n

Shortcuts

Key	Action
Ctr+1	Display "Microphone Time Signal" graph
Ctrl+2	Display "Microphone Power Spectrum" graph
Ctrl+3	Display "Level Trend of Beampower" graph
Ctrl+4	Display "1/3 Octave Band Level" Graph
Left Cursor	Move first cursor to left at time signal graph of review mode
Right Cursor	Move first cursor to right at time signal graph of review mode
Ctrl+H	Context Help
Ctrl+W	Quit Sound Camera Software

Specifications

Microphone Array	
Microphone Type	Digital MEMS Microphone
Number of Microphones	30
Microphone Sensitivity	-26 dBFS, at 94 dB SPL
Array Diameter	38 cm
Frequency Range (Full)	350 to 12,000 Hz
Frequency Range (Recommended)	2,000 to 10,000 Hz
Measurement Distance	0.2 to 5.0 m (Recommended)
Weight	2 kg
Data Acquisition and Processing	
Sampling Rate	25.6 kS/s
Image Update Rate	25 FPS
Imaging Algorithm	Beamforming (delay and sum)
Environmental Condition	
Operating Temperature	-20 to 50°C
Operating Humidity	10 to 85 % RH

SeeSV-S205W H/W Additional Specification

Wi-Fi Module	**Battery Pack**
IEEE802.11a/n Wi-Fi	Battery Type: 4-cell, Lithium-Ion Battery
2.4/5GHz	Charging Voltage: DC24V
Speed: Max. 150Mbps	Charging Time: 3 hours
Reconnect in less than 0.05sec.	Battery Life: 2.5 hours

Safety and Hazardous Locations Standards for SeeSV-S205

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use

• EN60950-1:2006+A12:2011

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for sensitive electrical equipment for measurement, control, and laboratory use

• EN 61326-1:2006

• EN 61326-2-2:2006

• EN 61000-3-2:2006+A1+A2:2009

• EN 61000-3-3:2008

• FCC Part 15 Subpart B, Class A

FCC Compliance

This product meets the essential requirements of applicable U.S Directives, as follow

CE Compliance

This product meets the essential requirements of applicable European Directives, as follow

• 2006/95/EC; Low-Voltage Directive(safety)

• 2004/108/EC; Electromagnetic Compatibility Directive(EMC)

KC Compliance

This product is verified that foregoing equipment has been registered under the Clause 3, Article 58-2 of Radio Waves Art.

Safety and Hazardous Locations Standards for SeeSV-S205W

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use

• EN 60950-1 : 2006+A11:2009+A1:2010+A12:2011

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for sensitive electrical equipment for measurement, control, and laboratory use:

• EN 61000-3-2:2014

• EN 61000-3-3:2013

• ETSI EN 301 489-1 V 1.9.2(2011-09)

• ETSI EN 301 489-17V 2.2.1(2012-09)

• EN55024 : 2010

• EN 55022 : 2010

• AC:2011, Class B

• FCC part 15 subpart B, Class B

FCC Compliance

This product meets the essential requirements of applicable U.S Directives, as follow

• FCC Part 15 Subpart B, Class B

• FCC Part 15 Subpart C 15.247

• FCC part 15 Subpart E 15.407

USA/FCC Radio Exposure

The radiated output power of this device is below the FCC radio frequency exposure limits. Nevertheless, this device should be used in such a manner that the potential for human contact during normal operation is minimized. This device has been evaluated for and shown compliant with the FCC RF Exposure limits under **mobile** exposure conditions (antennas are greater than 20cm from a person's body). This device cannot be co-located with any other transmitter unless approved by FCC.

The product does not contain any user serviceable components. Any unauthorized product changes or modifications will invalidate the warranty and all applicable regulatory certifications and approvals.

FCC Interference Statement

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio and television

reception. This equipment has been tested and found to comply with Part 15 of the FCC Rules.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference.
2) This device must accept any interference received, including interference that may cause undesired operation.

This wireless adapter generates, uses, and can radiate radio frequency energy. If the wireless adapter is not installed and used in accordance with the instructions, the wireless adapter may cause harmful interference to radio communications. There is no guarantee, however, that such interference will not occur in a particular installation. If this wireless adapter does cause harmful interference to radio or television reception (which can be determined by turning the equipment off and on), the user is encouraged to try to correct the interference by taking one or more of the following measures:

- Reorient or relocate the receiving antenna of the equipment experiencing the interference.
- Increase the distance between the wireless adapter and the equipment experiencing the interference.
- Connect the equipment into an outlet on a circuit different from that to which the equipment experiencing the interference is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CE Compliance

This product meets the essential requirements of applicable European Directives, as follow

• 2014/35/EU; Low-Voltage Directive(LVD)

• 2014/30/EU; Electromagnetic Compatibility Directive(EMC)

• 2014/53/EU; Radio & Telecommunications Terminal Equipment Directive(R&TTE)

• 2011/65/EU; Restriction of Hazardous Substances Directive(ROHS)

KC Compliance

This product is verified that foregoing equipment has been certificated under the Clause 2, Article 58-2 of Radio Waves Act.

Declaration of Conformity for SeeSV-S205W

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

Caution: Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void user's authority to operate the equipment.

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20㎝ must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

Battery

SeeSV-S205W product uses a Lithium-Ion battery.

Do not use it in a humid, wet and/or corrosive environment. Do not put, store or leave your product in a high temperature location, in strong direct sunlight, in or near a heat source in a microwave oven or in a pressurized container, and do not expose it to temperatures over 122°F / 50°C. Failure to follow these guidelines may cause the battery to leak acid, become hot, explode or ignite and cause injury and/or damage. Do not pierce, open or disassemble the battery. If the battery leaks and you come into contact with the leaked fluids, rinse thoroughly with water and seek medical attention immediately. Charging will not occur at low (below 32°F / 0°C) or high (over 113°F / 45°C) temperatures.

CAUTION: RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE.

Do not remove or attempt to remove the non-user-replaceable battery. If you have a problem with the battery, please contact sales engineer team of SM Instruments.

THE BATTERY CONTAINED IN THE PRODUCT MUST BE DISPOSED OF PROPERLY ACCORDING TO THE LOCAL LAWS AND REGULATIONS.

Support and Service

We, SM Instruments are ready to serve you with any concerns.

Please refer to the webpage www.smins.co.kr for the general information of your product and software.

Should you need more question regardless of their kinds, please let us know via our e-mail or phone below.

Address:

20, Yuseong-daero 1184bein-gil, Yuseong-gu,

Daejeon 34109, Republic of Korea

Tel: +82(0)42-861-7004 Email: sales@smins.co.kr

SM Instruments Inc.