USER MANUAL

LMS SOUND CAMERA

Version 2

CONTENTS

GENERAL CONDITIONS

LMS Sound Camera systems are products of:

Siemens Industry Software B.V.
Simulation and Test Solutions
Weidehek 53
4824 AT Breda
The Netherlands

This manual forms an integral part of the product. It gives information about the day-to-day use of the LMS Sound Camera. Familiarize yourself with this information, and make sure that you understand it before using the LMS Sound Camera.

IN THIS PART:

- ▶ Copyright
- ▶ Conditions of change
- ▶ Licenses and trademarks
- ▶ Conformity

COPYRIGHT

CONDITIONS OF CHANGE

Siemens reserves the right to change parts at any moment without prior notice or direct notification. This manual may also be subject to change without prior notice.

Changes and/or modifications to the product (to be conducted by the owner) may only be conducted after explicit prior written instruction, permission and/or approval by Siemens. Non-conformance to this rule will void the authority to further use of the product. Furthermore, any consequential damage, loss or costs thereof is the responsibility of the proprietor and user.

LICENSES AND TRADEMARKS

Any software, described in this manual and/or delivered with the LMS Sound Camera, is provided under license and may only be used in accordance with the conditions, stated in the licenses concerned.

The firmware of the LMS Sound Camera may contain components under GNU licenses. The GNU General Public License (GPL) and Lesser General Public License (LGPL) are respected. Currently these licenses are available at http://opensource.org/licenses. The relevant source code under GPL and LPGL licenses are available upon request.

Company and product names in this manual are trademarks or registered trademarks of their respective owners.

CONFORMITY

The following applies:

ABOUT THIS MANUAL

This manual provides information for the safe and correct use of the LMS Sound Camera. Make sure to read the instructions you need to use the LMS Sound Camera in accordance with its purpose and intended use.

IN THIS PART:

▶ Availability
▶ Target audience
▶ Conventions

AVAILABILITY

This manual forms an integral part of the LMS Sound Camera. Upon delivery, copies are supplied in accordance with regulations and/or specific terms of delivery. If necessary, Siemens can supply additional copies upon request. Copies of the manual are normally supplied in electronic format. Keep this manual available for the users of the LMS Sound Camera. In case of re-commissioning or transfer of ownership the User Manual of the LMS Sound Camera must be handed over too

TARGET AUDIENCE

This User Manual is primarily aimed at experienced Test Engineers who have gained a level of proficiency through education, training and experience. Knowledge of other SCADAS products is an advantage. When you work with the LMS Sound Camera it is assumed that you have appropriate knowledge of the hardware and software required to accomplish your task(s). These may include: computers and computer networks, LMS Test.Lab, front-end and recording devices, sensors and instrumentation.

CONVENTIONS

Standard font	The majority of the content in this manual is presented in standard font.
Special Bold	Table and figure titles are presented in **Special Bold** font. Also printed captions on the product are presented in **Special Bold** font.
Emphasis	Where necessary, words or phrases are *emphasized* in italic print.
Special elements	Elements that need extra attention by the reader, such as Notes and Warnings. An example is shown below.
	Important: Carry out procedures in the sequence given.

INTRODUCTION

This chapter gives generic information about the LMS Sound Camera. The purpose of this chapter is to inform the user about what the LMS Sound Camera is meant for, and what the product comprises of. It is the responsibility of the user to use the LMS Sound Camera in accordance with its purpose and intended use.

IN THIS CHAPTER:

- ▶ Main functions and intended use
- ▶ Use in accordance with purpose
- ▶ What did you get?

MAIN FUNCTIONS AND INTENDED USE

The LMS Sound Camera is a High Definition Acoustic Camera. It is a member of the Siemens Acoustic Testing product family, as the compact and handheld Acoustic Camera. It is a made up by a microphone antenna declined in 3 sizes for large and small object combined to an analysis software.

The system is designed for accurate noise source localization, in near-field and in far-field. It allows describing quickly the noise source distribution of an object by looking at its Pressure / Intensity map under run-up, impulsive or steady conditions.

The antenna contains a camera with a wide angle lens. LMS Sound Camera takes a video or a picture of the source object and corrects it automatically for the wide angle distortion. The antenna has also an IR sensor that for user's convenience automatically measures the distance between the antenna and the source.

The antenna is available in three versions: a basic central antenna (32cm diameter) which has 45 microphones, a 60cm diameter array composed of the central antenna and 9 short-arm extensions with a total of 81 microphones and a 150cm diameter array composed of the central antenna and 9 long-arm extensions with a total of 117 microphones.

Furthermore, the LMS Sound Camera has been designed to be compatible with the LMS Test.Lab HD Acoustic Camera software package.

USE IN ACCORDANCE WITH PURPOSE

The LMS Sound Camera systems must only be used for the specific purpose described above. Any attempt to alter or modify an LMS Sound Camera system or its use for any other purpose will be considered not to be in accordance with its purpose, and regarded as misuse. Misuse may result in injury to personnel or serious damage to equipment. In all cases any warranty in force will be invalidated, while Siemens will not accept any liability for misuse.

WHAT DID YOU GET?

The LMS Sound Camera is delivered along with a set of standard accessories; the list below gives the relevant details. Each system is inspected and tested before shipment. The shipment that you received must contain the items that were ordered, undamaged and fully operational.

LMS Sound Camera – Standard supplied items list

Item	Quantity
Center digital array with foam cover [HW-SSL-SC45]	1
Power-over-Ethernet Adapter 48-56V with localized mains power connector	1
STP cable to PoE (5m)	1
STP cable PoE to PC (1m)	1
Sound Camera battery power supply cable (2m) with BNC connector for IRIG-B synchronization	1
AUX 4-channel BNC input cable	1
Tripod, compact light version	1
Handle	1
Transport case	1
Documentation	
Checklist contents (signed)	1
Quality Control sheet: with reference to test report (verification report)	1
Plastified packing instruction	1
User manual	1
Optional: LMS Sound Camera Short Extensions Set [HW-SSL-SCASET4]	1
Short extensions with foam cover	9
Optional: LMS Sound Camera Long Extensions Set [HW-SSL-SCASET8]	1
Long extensions with foam cover	9
Screws to fasten the long extensions on the center array	9

| Tripod to support array with long extensions | 1 |
| Transport case with customized foam for transport of long extensions & tripod | 1 |

All of the above parts are required to be examined and supplied only by Siemens or local Siemens representative.

INSPECTION OF RECEIVED GOODS

We recommend that you inspect the shipment upon receipt for completeness and signs of damage.

In case the shipment is not complete, please contact your local Siemens representative.

In case parts are damaged and/or defective:

▸ Save all packing materials in case of return shipment.

▸ File a claim with the carrier.

▸ Contact your local Siemens representative for further instructions.

TRANSPORTATION OF GOODS

The information in this part is given as a guideline; we recommend that you act accordingly.

In case you need to return parts to Siemens for repair, you are requested to contact your local Siemens representative first. You will be informed about the applicable procedures and follow-up.

In case parts need to be transported:

▸ Preferably use the original factory packaging.

▸ In case the original factory packaging is not available, use packaging of identical construction (available via your local Siemens representative).

▸ In case you need to provide packaging yourself:

  ▸ Use a double-wall carton box – or similar container – of the correct dimensions.

  ▸ Put the part in an anti-static plastic envelope.

  ▸ Use cushion material to keep the part from moving in the box.

▸ Mark the container FRAGILE to ensure careful handling.

SAFETY INFORMATION

Chapter 2

This chapter gives safety information about the LMS Sound Camera. The purpose of this chapter is to make the user aware of relevant safety aspects, when working with the LMS Sound Camera. It is the responsibility of the user to read this information before working with the LMS Sound Camera, to make sure that it is used correctly and safely.

IN THIS CHAPTER:

- Hazards and remaining risks
- Safety provisions
- Safety precautions

HAZARDS AND REMAINING RISKS

The digital array has been designed in such a way that known potential hazards have been eliminated to the highest possible extent. Where elimination of risks proved not (completely) feasible, safety provisions have been implemented to reduce the risks to an acceptable level. However, some risks still exist. During normal operation personnel who work with the digital array must obey the safety precautions and follow the instructions in this manual. It is important to meet these conditions to assure personal safety and system integrity.

Important: All safety related measures described in this manual are based on the intended use of the product. Make sure to use the product in accordance with its purpose.
The user has to adhere to the specifications, and work according to the safety precautions.

SAFETY PROVISIONS

By design, the LMS Sound Camera has a number of safety provisions to establish the required level of personal safety. Furthermore, the owner of the LMS Sound Camera has the responsibility to provide a safe environment to work in.

These safety provisions are divided in groups as listed below:
- Covering
- Electrical safety
- Components and accessories
- Safety labels
- Pollution

COVERING

During normal operation – i.e. the casing fully encloses the unit and the windshield foam is used – the user is not exposed to any hazards from the unit. The user should not remove the windshield foam, for normal operation it is not necessary to do so. The windshield foams can be removed from the system only to clean them; they should be always on the system otherwise. Moreover, the casing cannot be removed without the use of specialist tools. There is no part of the system that can be repaired by the user; only the authorized personal can repair the system.

ELECTRICAL SAFETY

English:

▸ The digital array complies with international safety standards and local regulations.
▸ All circuits are adequately protected when used within limits.
▸ It is not necessary to ground the digital array.
▸ The digital array is designed to operate with a PoE (Power over Ethernet, complying with the standard IEEE 802.3at/af) adapter.
▸ The digital array accepts temporary overvoltage occurring on the mains power supply.

Input nominal voltage: 48-56V ⎓
Power: 14 W

COMPONENTS AND ACCESSORIES

To assure the required level of personal safety and product integrity Siemens applies approved and certified components and accessories. For the LMS Sound Camera the most prominent items are:
▸ State-of-art connectors that provide a high level of protection against intrusion.
▸ Cables that are approved by Siemens for use with the LMS Sound Camera.

SAFETY LABELS

To assure the required level of user awareness with respect to remaining hazards, the digital array has the safety labels:

Label	Location	Description
$C\epsilon$	On product type plate	CE marking. Indicates that the product complies with the applicable EEC directives.
FC	On product type plate	FCC marking. Certifies that the electromagnetic interference from the device is under limits approved by the Federal Communications Commission.

	On product type plate	DC marking. Indicates that power supply is done by a Direct Current external module.
	On product type plate	Attention! Read the manual before use; it gives important safety information.
	On product type plate	WEEE conformity.

POLLUTION

POLLUTION DEGREE of the intended environment (POLLUTION DEGREE 2 in most cases).

SAFETY PRECAUTIONS

The presence of safety provisions alone is no guarantee against injury. This section gives instructions and guidelines to help the user to work safely. The users of the LMS Sound Camera are always responsible for their actions, their own safety and that of others.

Any repair on the system parts must be performed by the system manufacturer or authorized personal only.

To prevent injury, obey these rules when you work with the LMS Sound Camera:

▶ Use the instrument in accordance with its purpose and within its design specifications.
▶ Only use original and approved devices, components and accessories.
▶ Prevent actions that can result in unsafe situations.
▶ Avoid – direct and indirect – contact with live electrical parts.
▶ Dispose of used equipment and components in accordance with local regulations.
▶ Keep the instrument away from: open fire, flammable and/or combustible materials, aggressive chemicals, heat sources.
▶ Indoor use only
▶ Do not immerse in and/or expose to liquids.
▶ Do not expose to humidity over 95% at 23°C.
▶ Do not operate the system at altitude over 2000 meters (6562 feet) or at atmospheric pressure under 790hPa (0.79Bar).
▶ Do not operate the instrument at extreme temperatures. Operate the system in environments where the temperature is between -10°C and +50°C.
▶ Store the system in environments where the temperature is between -20°C and +70°C.
▶ Do not cover the unit and make sure it can dissipate generated heat.
▶ Always use the windshield foams when using the system and its extensions.
▶ Do not drop the instrument, and avoid situations in which it can get crushed or damaged.
▶ Always place the unit in a stable position; if necessary, secure the instrument.

▶ Always place the unit in an open environment.
▶ Don't put the unit mounted on tripod at a height more than 1.5m.
▶ Always carry the system in its carrying case when traveling, entering and leaving the area of use.
▶ Do not open the system.
▶ Do not connect a damaged cable.
▶ Do not connect a damaged arm extension.
▶ Replacement of non-removable parts is to be undertaken by authorized personnel only.

EXTENTENSIONS MANIPULATION

Do not plug or unplug the extensions while the system is powered on.

SYSTEM DESCRIPTION

This chapter gives information about the features and functions of the LMS Sound Camera. The purpose of this chapter is to make the user familiar with what these features and functions mean.

IN THIS CHAPTER:

▸ Main features
▸ Modes of operation
▸ Connectivity

MAIN FEATURES

Two sides of the LMS Sound Camera have features that are important to the user. These features are shown below, and described in detail in the next paragraphs.

Information about how to use these features is described elsewhere; refer to Operation.

REAR CONNECTIONS

The picture below shows an overview of the rear connections of the digital array. Details of connectors are described in the next section.

MULTI 8-pin connector	IRIGB and external power connection - separated extra-low voltage (selv) limited power
DATA 8-pin connector	LAN and power connection – Power Supply by external PoE
AUX IN 8-pin connector	External channels connection – selv limited power source
FUNC Push button	For firmware update
⏻	Status LED of power
✓	Status LED of system
🖧	Status LED of network activity
REC	Status LED of acquisition

LED STATUS

The table below highlights the main features of the LED on digital array.

LED symbol	⏻	Power
LED state	⚫	OFF
	🟢	ON

	⊞	Network activity
	⚫	OFF
	🟢	Connection OK between computer and digital array
	🟢🔴	Flashing : indicate network activity

| LED symbol	✓	System check
LED state	🟢	System ready
	🟡	Self-check in progress
	🔴	Error

	REC	Acquisition
	🟢	Ready for acquisition
	🟢⚪	Flashing: indicate acquisition
	🔴	Acquisition error

MICROPHONES IDENTIFICATION

The figure below shows the identification number of each microphone on the digital array and the three areas corresponding to each configuration with short and long extensions functionality.
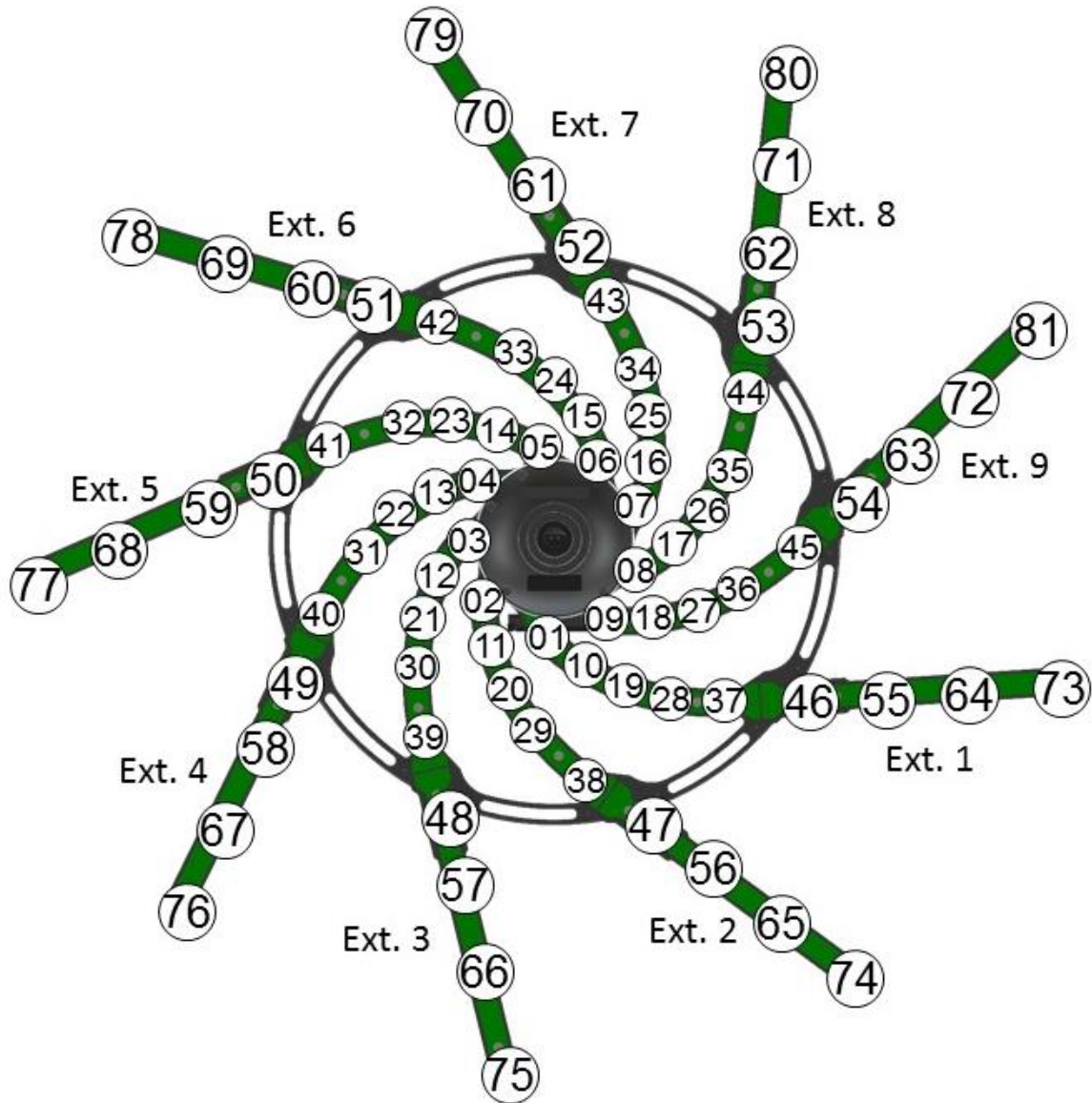
With short extensions plugged-in
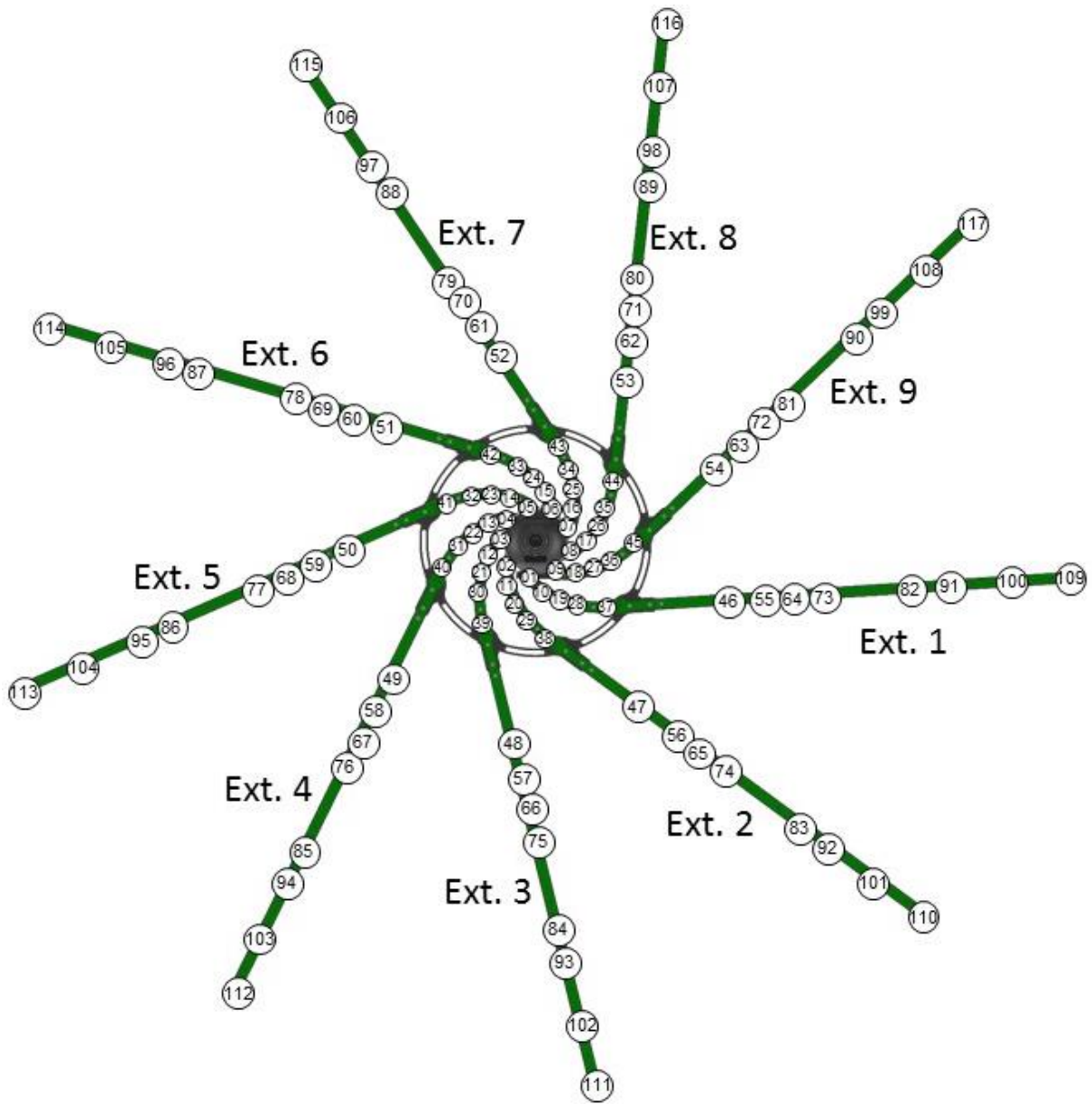
With long extensions plugged-in

MODES OF OPERATION

The LMS Sound Camera can operate in these modes of operation:

- ▶ Front-end mode
- ▶ Stand-alone mode

Important: Items mentioned in this section may be optional.

STAND-ALONE MODE

In stand-alone mode the LMS Sound Camera is connected to a host PC that has LMS Sound Camera software installed. Connection is established over Ethernet.

In this set-up the LMS Sound Camera typically is powered via an external power unit over Ethernet (POE). Details are described elsewhere in this chapter, see the relevant Use cases in this paragraph.

FRONT-END MODE

In front-end mode the LMS Sound Camera is connected to a PC that has LMS Test.Lab installed. Connection is established over Ethernet. LMS Test.Lab will be in full control during data acquisition.

In this mode of operation the LMS Sound Camera is powered via an external power unit over Ethernet (POE) and operates similar to other LMS SCADAS products.

CONNECTIVITY

The LMS Sound Camera supports this method of data communication:

- ▶ Ethernet – Power over Ethernet module to connect the LMS Sound Camera to a PC that has either LMS Sound Camera software or LMS Test.Lab installed. Use the connection cable provided in the package.

COMPONENT DESCRIPTION

COMPONENT OVERVIEW

The table below presents all the elements that are necessary for use of the instrument. The quantity of each element is indicated after the "-" symbol.

Center digital array – Quantity: 1	Foam cover for center digital array – Quantity: 1
STP cable array to PoE (5m) – Quantity: 1	**Power-over-Ethernet Adapter 48-56V – Quantity: 1**

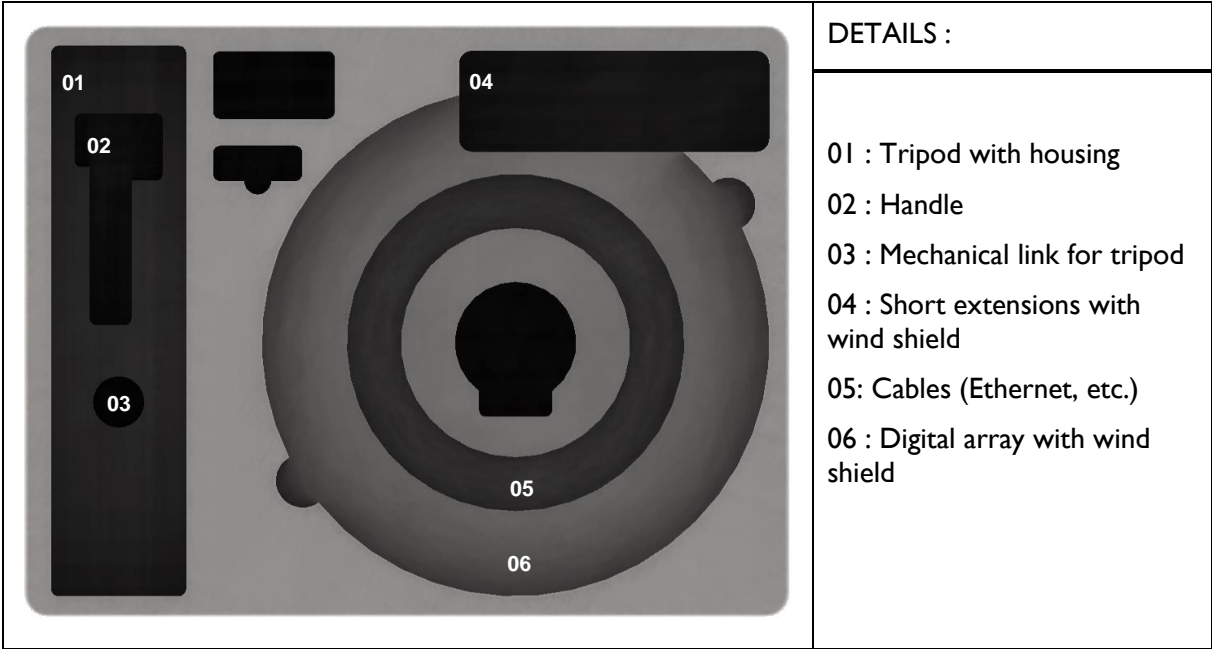| Tripod, compact light version – Quantity: 1	Handle – Quantity: 1
Localized power cord for PoE adapter – Quantity: 1	**STP cable PoE to PC (1m) - Quantity: 1**
AUX 4-channel BNC input cable - Quantity: 1	**Sound Camera battery power supply cable (2m) with BNC connector for IRIG-B synchronization - Quantity: 1**

The optional short and long extensions sets consist of the following:

Optional: Short extensions – Quantity: 9	Optional: Long extensions – Quantity: 9

Short extensions windshield – Quantity: 9	Long extensions windshield – Quantity: 9

CARRYING CASE

The figure below presents the configuration of the carrying case for the digital array.

	DETAILS :
	01 : Tripod with housing 02 : Handle 03 : Mechanical link for tripod 04 : Short extensions with wind shield 05: Cables (Ethernet, etc.) 06 : Digital array with wind shield

Chapter 5

OPERATION

This chapter gives information about the operation of the LMS Sound Camera. The purpose of this chapter is to guide the user to use the LMS Sound Camera correctly and safely.

IN THIS CHAPTER:

▶ Prerequisites and considerations
▶ Preparation
▶ Test set-up – examples

PREREQUISITIES AND CONSIDERATIONS

The user of LMS Sound Camera is expected to:

▶ Have the required skills, experience and knowledge.
▶ Be familiar with the intended use, functions and safety aspects LMS Sound Camera.
▶ Take the required preparations as described in this chapter.
▶ Use approved equipment only.

The information in this chapter – about the required Preparation and Test set-up – examples – is restricted to the specific use of the LMS Sound Camera itself. Information about the use of other equipment is not included, but may be referred to.

PREPARATION

This section describes what is required to prepare the LMS Sound Camera for operation. Where applicable, distinction is made on topic level between:
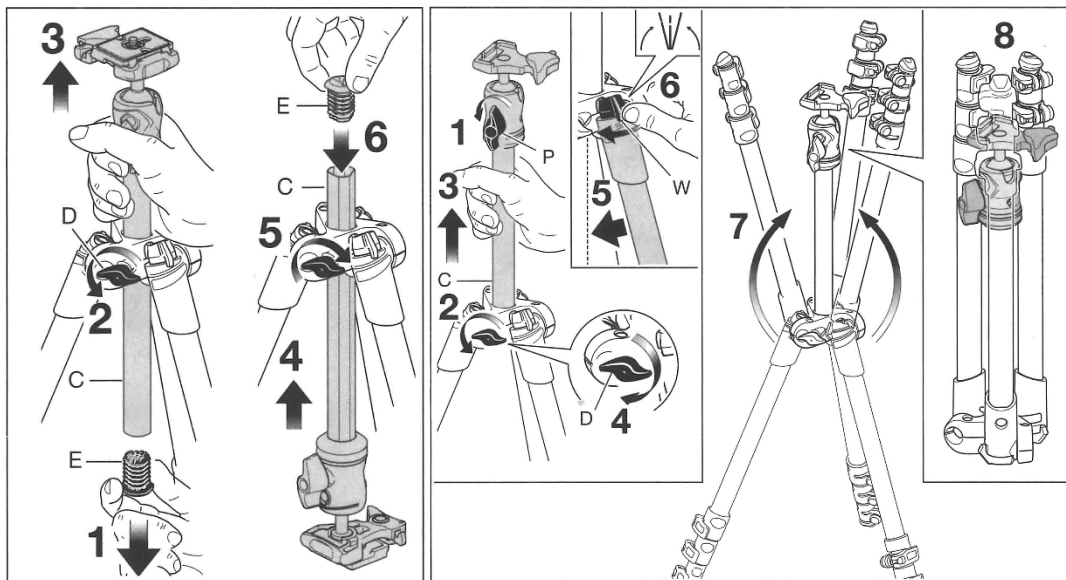
▶ Prepare for first use – to be done once for new equipment.
▶ Prepare for operation – to be done before an operational scenario is started.

INSTALLATION

The following section instructs the user in the assembly procedure for the correct use of the instrument.

TRIPOD
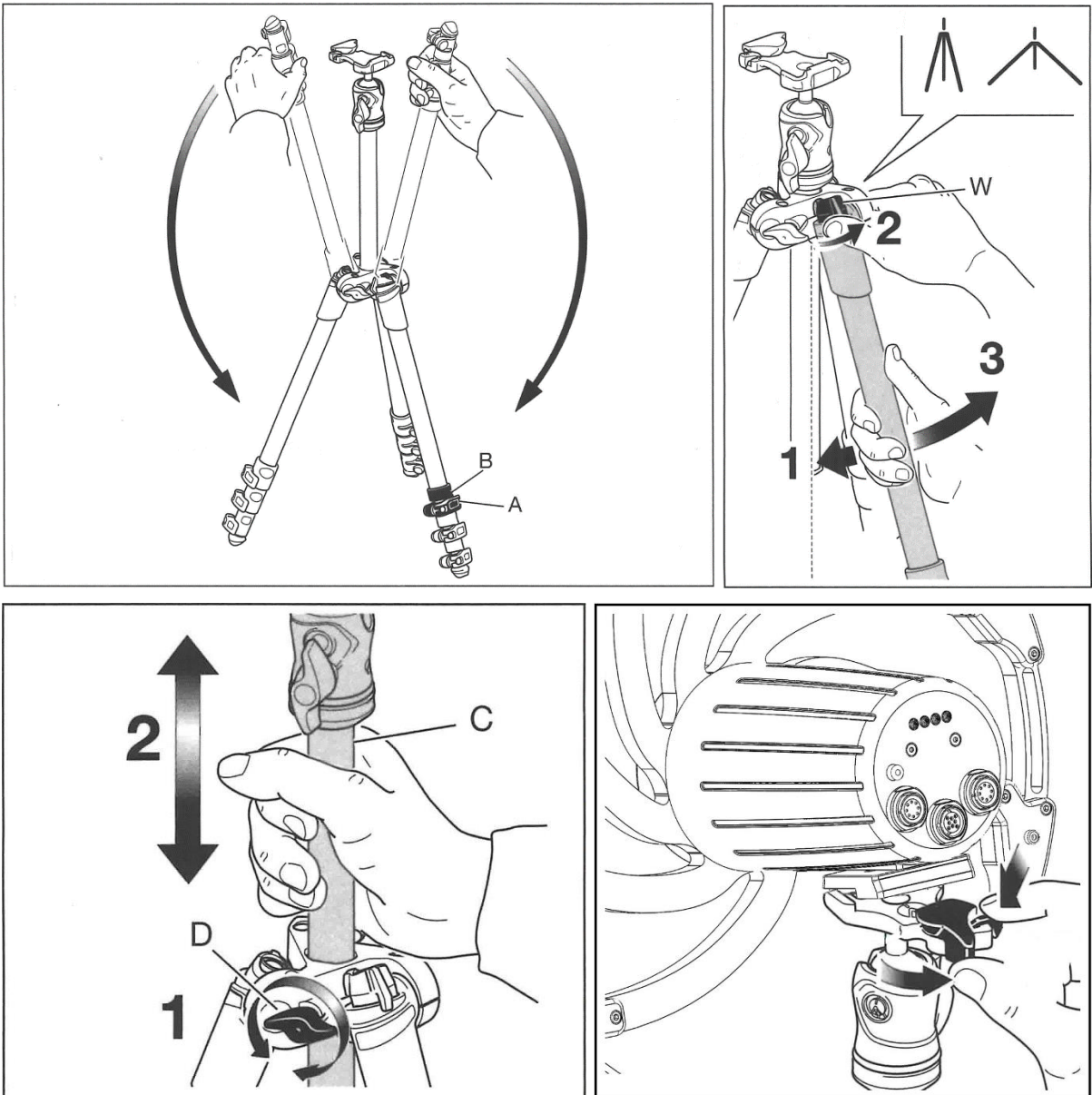
EXTENSION ASSEMBLING

Please manipulate the extensions with precaution, do not press on the electronic part of the extension.

1: Plug the extension in the socket on the digital array

2: A "click" is heard when the extension is plugged

3: For fix the extensions in position you can screw the black screw. For the long extensions, is recommended to keep the screw all time.


Push

Click !
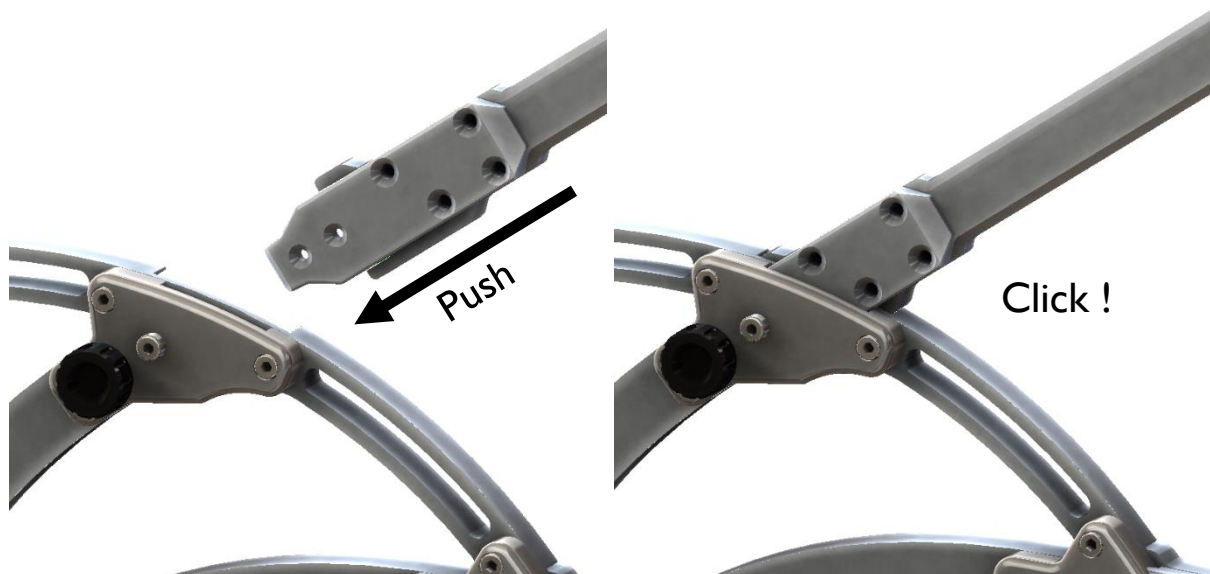
POWER

When powered from the mains supply, make sure to use the appropriate PoE adapter. Use of this component is essential to achieve the expected system behavior according to system design. The procedures below assume the correct use of this component.

STANDALONE MODE COMMUNICATION

To enable the digital array to communicate with the LMS Sound Camera software on a PC:

▸ Connect a RJ45 Ethernet cable between the computer network gigabit adapter and the DATA IN port on the PoE adapter.
▸ Connect the data cable between the DATA port on the digital array and the power and data OUT on the PoE adapter.
▸ Power on the PoE adapter by plugging it to the power sector.
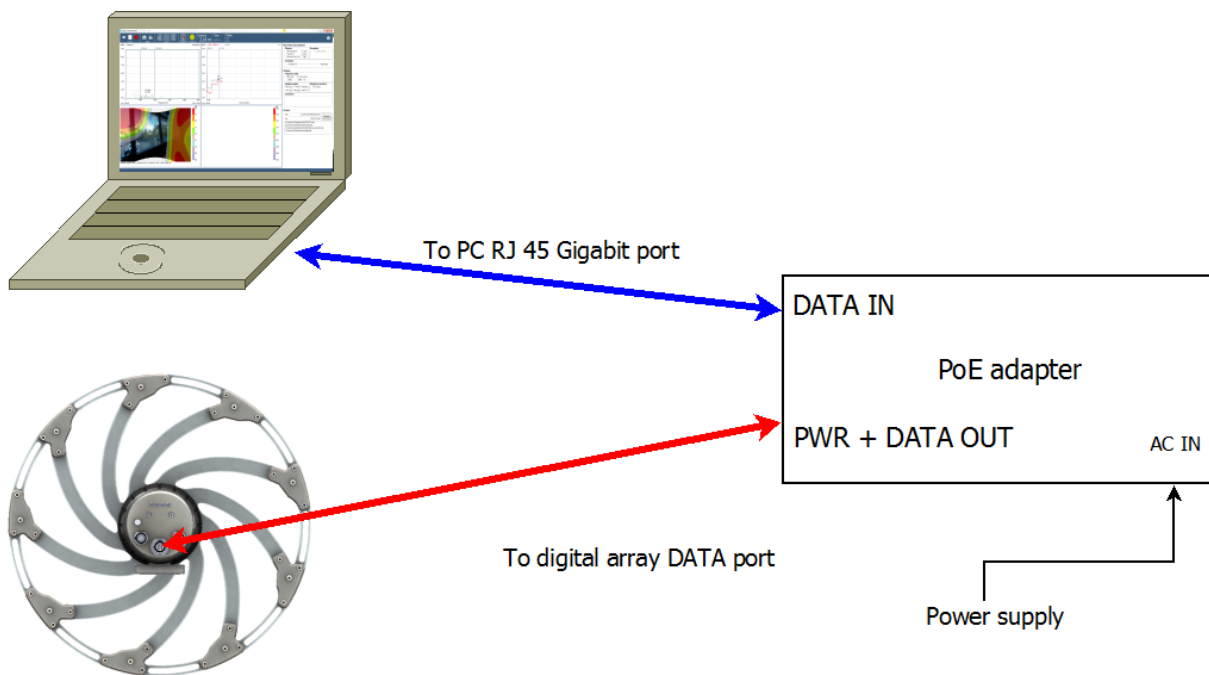
Linksys network adapter: It is strongly advised to use the Linksys USB 3.0 network adapter provided with the LMS Sound Camera to connect the RJ45 Ethernet cable to the computer.

When using the Linksys network adapter, it is also advised to switch off the power saving mode of the adapter in windows.
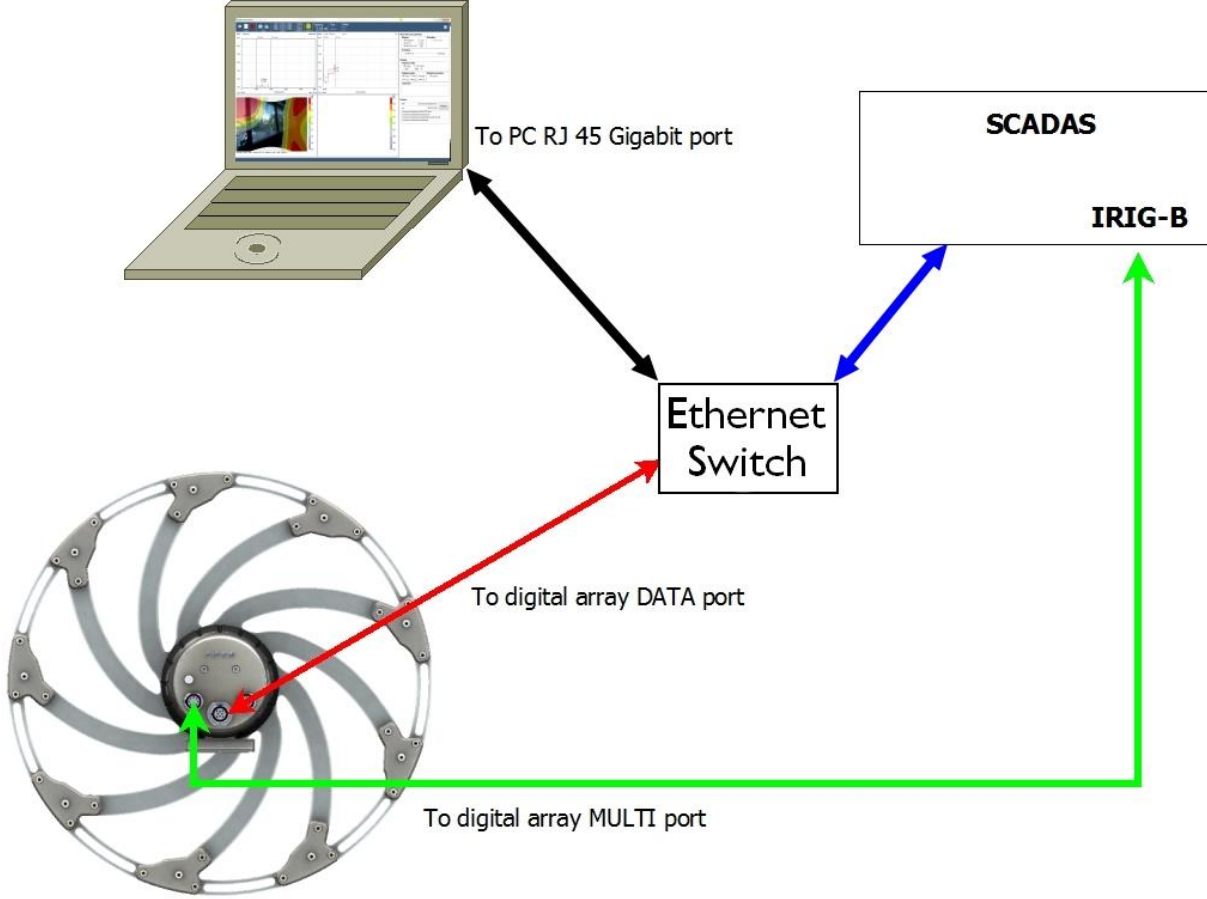
To do so:

• Open the Device manager panel.

• Open the Properties tab on the line Linksys USB3GIGV1 under the Network adapter section.

• In the *Power Management* tab, disable the option: *Allow the computer to turn off this device to save power* as shown on the picture below.
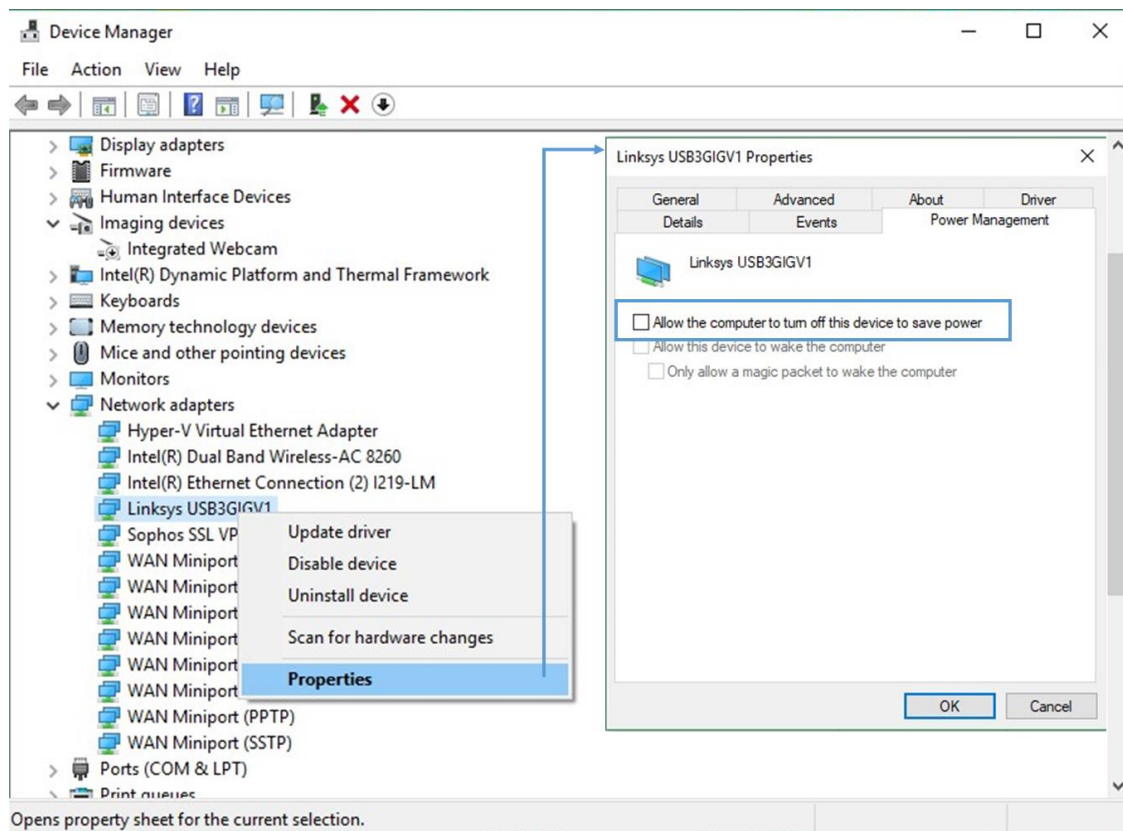
FRONTEND MODE COMMUNICATION

To enable the digital array to communicate with the LMS Sound Camera software on a LMS SCADAS:

▶ Connect a RJ45 Ethernet cable between the **computer** network gigabit adapter and one of the network port of the **SCADAS**.
▶ Connect the data cable between the RJ45 Ethernet port on the **USB to UTP adapter** and the **DATA** port on the **LMS Sound Camera**.
▶ Connect the USB cable between the **USB to UTP adapter** to a USB port of the **computer**.
▶   Connect the **MULTI** 8-pin connector cable between **MULTI** port on the **LMS Sound Camera** to the IRIG-B port of the **SCADAS**.

To PC RJ 45 Gigabit port

SCADAS

IRIG-B

Ethernet
Switch

To digital array DATA port

To digital array MULTI port

LMS SOUND CAMERA SOFTWARE USE

SYSTEM REQUIREMENTS TO USE LMS SOUND CAMERA SOFTWARE

Important: a dedicated video card is highly recommended as the CPU might not be able to perform both the calculations and the video rendering alone. If possible, disable the CPU/GPU power management from the computer BIOS/UEFI or in the video card driver.

To run the LMS Sound Camera software correctly, please make sure that the computer used matches the requirements below.

MINIMUM REQUIREMENTS

Operating system	**Windows 7/8.x/10 (64-bit OS required)**
CPU	Intel Core i5 Quad-Core 2.5 GHz or equivalent
RAM	8 Giga Byte DDR3
Video card	NVIDIA GTX 750 1GB / AMD Radeon HD 7870 2GB or equivalent
Free disk space	500 Megabytes for system, 5 Gigabytes minimum for data
Network adapter speed	1 Gigabits/second

RECOMMENDED REQUIREMENTS

Operating system	**Windows 7/8.x/10 (64-bit OS required)**
CPU	Intel Core i7 Quad-Core 3 GHz or equivalent
RAM	16 Gigabyte DDR3
Video card	NVIDIA GTX 980 4GB / AMD Radeon R9 4GB or equivalent
Free disk space	500 Megabytes for system, 50 Gigabytes minimum for data
Network adapter speed	1 Gigabits/second

PREPARE FOR FIRST USE

SOFTWARE INSTALLATION

With administrator privileges, run the installer file and follow the on-screen instructions.

For standard windows firewall users:

The installer will attempt to include an exception to the firewall in order to allow communication with the digital array.

The first time the software is launched, a firewall authorization may be asked to the user.

For other firewalls users:

An exception must be manually added for software LmsSoundCamera.exe and Diagnosis Tool.exe for the IP range 169.254.x.x for all ports.
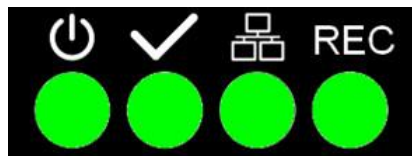
PREPARE FOR OPERATION

BEFORE STARTING THE LMS SOUND CAMERA SOFTWARE

Start the digital array device by turning it on.

Wait for 10-20s after all LED to turn on green.

In case of difficulties when starting the digital array, please refer to the Troubleshooting section.

TEST SET-UP – EXAMPLES

FIRST USE OF THE ARRAY ON THE USER'S COMPUTER

LMS SOUND CAMERA

When the user's computer gets connected to the array for the first time with the LMS Sound Camera software, he will be asked to set angles correction for the optical camera.

The following message will be displayed:

No camera angles correction factor found in the configuration file for device xx:xx:xx:xx:xx:xx.
Taking '0' as default values.
Please edit the configuration file and set the camera angles correction factor under the tag xx:xx:xx:xx:xx:xx.

Note the MAC address (xx:xx:xx:xx:xx:xx) and click on the OK button.

The configuration file will be opened in the Notepad.

The user must enter the correction values in the corresponding fields under the MAC address tag.

[xxxxxxxxxxx]

AngleCorrectionX=0

AngleCorrectionY=0

After entering the values, close the Notepad software.

The Sound Camera software will then start.

CHANGING SAMPLING FREQUENCY

The LMS Sound Camera digital array samples data at a maximum of 51.2 kHz.

It is possible to change the sampling frequency. It can be set in the file LmsSoundCamera.ini located in the following directory: C:\Users\[UserName]\AppData\Local\LMS

The DownSampling factor can be found under the [Acquisition] section.

The possible values are: 1, 2 or 4.

When this value is set to:

- 1, the sampling frequency is 51.2 kHz.

- 2, the sampling frequency is 25.6 kHz.

- 4, the sampling frequency is 12.8 kHz.

Once the value is modified, save the file LmsSoundCamera.ini and restart LMS Camera Software.

By default, the factor is set to 2 which corresponds to a sampling frequency of 25.6 kHz.

In case long arms are connected the maximum sampling frequency allowed is 25.6 kHz.

SOFTWARE OVERVIEW
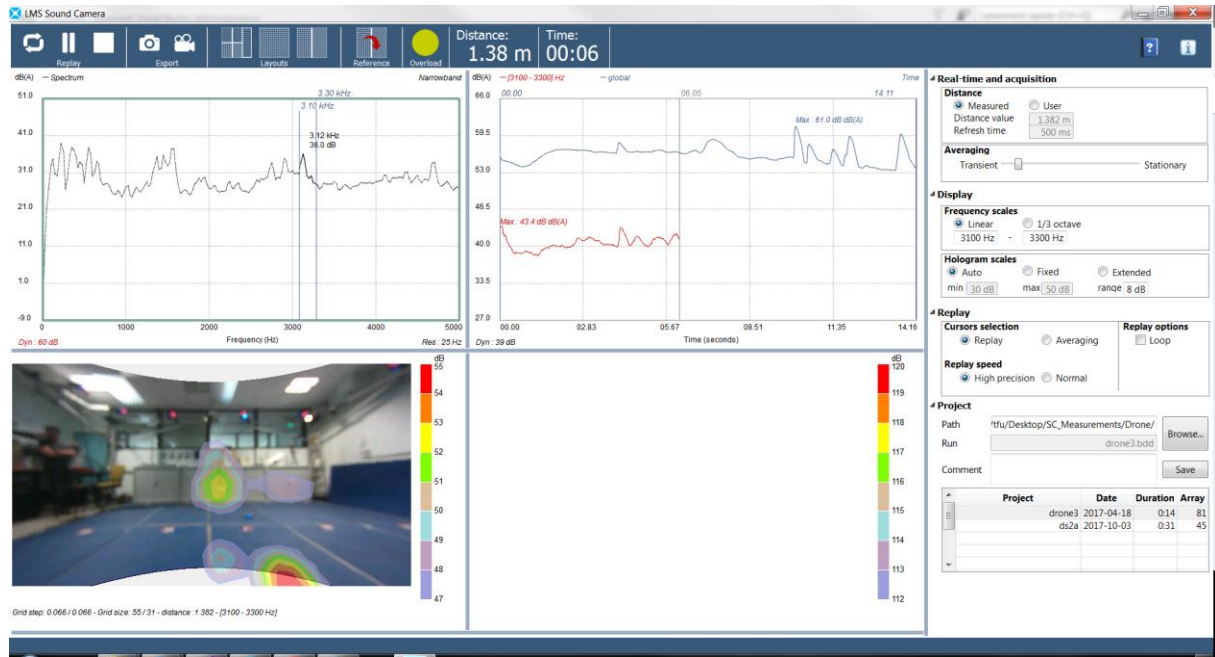
The software is available in two modes:

- **Preview**: allows the user to acquire data as soon as it is transmitted from the digital array to the LMS Sound Camera software. The acquired data can be recorded on the system memory from the software by clicking on the record button. There are several parameters on the right panel to adjust to the user's needs.

- **Replay**: allows play back of recorded data. The data can be observed in the same manner as the preview mode, by adjusting the relevant parameters.
  Note: the use of this mode doesn't require the connection to the Digital Array. It is possible to replay data offline.

To switch between the two modes, use the [icon] / [icon] button.

DATA PREVIEW

When starting the LMS Sound Camera software, the preview mode will automatically begin the data acquisition. The video, the audio signal analysis and sound source localization will be displayed as soon as they are received.

The data preview can be started and stopped using the ▶ / ☐ buttons.

The overload of the signal is indicated with the [Overload] indicator. The indicator will turn to red in case of signal overload. In preview mode, it can be reset by clicking on it.

DATA RECORDING

To record the previewed data:

- Go to the Preview mode by clicking the ⟳ button.

- Choose a recording directory and name in the right panel. Use the Browse button or enter the path and name manually.

◢ **Project**		
Path	C:/Users/user/Measures	Browse...
Run	measure-001	
Comment		Save

- Click on the ● button to start the recording.

- The program now records the data on the system memory.

- Click on the ■ button to stop the recording.

- The recorded project will be saved in the chosen directory.

DATA REPLAY

To review recorded data, go to the **Playback** mode by clicking the 👁 button.

Select the project to review by using the Browse button or by selecting a measurement from the project list then click the *Play* button.

Use the ▶ button to Play/Pause the data.

Calculation parameters can be applied to the reviewed data, in a similar way to the preview mode.

The project list contains the ten most recent measurements opened or measured. Additional information are displayed when moving the mouse over the measurement.

ADD COMMENT TO YOUR MEASUREMENT

To add a comment to an existing measurement:

- Open the measurement by using the Browse button or select it from the project list.

- Enter text in the Comment field.

- Click on the Save button.

The comment is stored with your measurement and will be displayed whenever this measurement is opened or when moving the mouse cursor over the measurement in the project list.

This comment can be updated or removed at any time by changing the text in the Comment field and clicking on the Save button.

PARAMETERS

CHANGING THE LAYOUT

It is possible to change the program view layout manually by using the sliders around the views or by using a preset template by using the preset buttons.
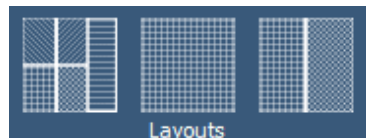
REAL-TIME ACQUISITION

Distance: Acquires the distance to the source from a proximity sensor or can be set manually by the user. The Refresh time parameter can be set to increase or decrease the rate at which the distance value will be updated when using the Measured distance option. This parameter is not available in Replay mode.

Averaging: This parameter corresponds to the number of time window of the moving average used to compute the displayed hologram. This parameter allows to either focus on the non-stationary components of the source with a cursor close to *Transient* (e.g. door slam) or on the stationary components with a cursor close to *Stationary* (e.g. engine test bench on a fixed engine speed).

DISPLAY

Frequency scale: Sets the frequency parameters and bandwidth.

Hologram scales: Those parameters are detailed in the Hologram view section.

REPLAY

These options are only available in replay mode.

CURSORS SELECTION

Replay (default parameter): when this parameter is selected, the measurement will be replayed between the time cursors set in the time view.

Averaging: when this parameter is selected, setting a time segment in the time view using the cursors will calculate the averaged hologram for the given time segment and display it.

REPLAY SPEED

High precision (default parameter): All measured data will be replayed. With large frequency segment, the speed of the replay can become slower.

Normal: the measurement will be replayed as fast as in preview mode. Some data blocks of the measurement may be skipped to avoid slowing down the replay.
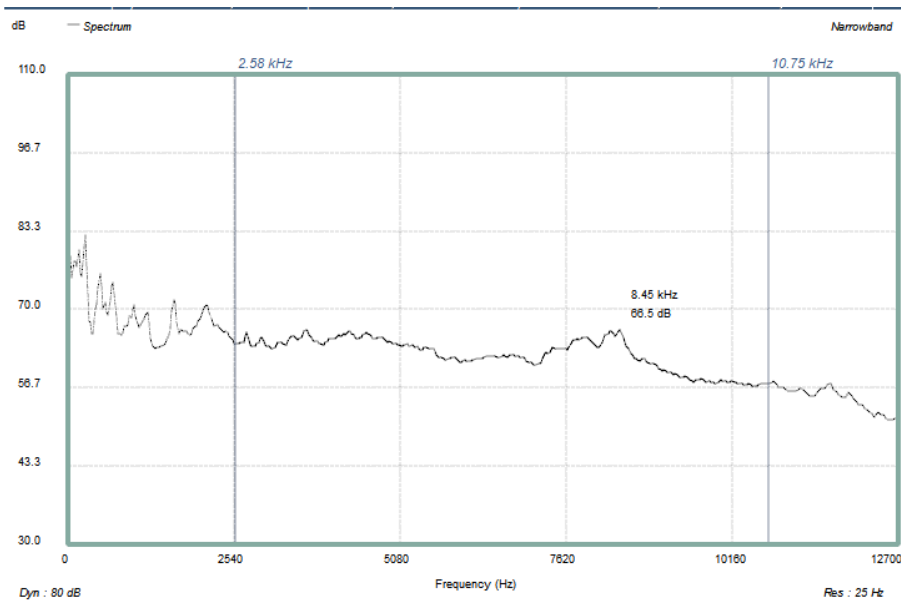
REPLAY OPTIONS

Loop (unchecked by default): when this parameter is checked, the measurement will be replayed in loop between the temporal cursors.

VIEWS

SPECTRUM VIEW

The spectrum view, located on the top left area of the LMS Sound Camera software, displays the averaged sound pressure spectrum measured on the Digital array for the current time window.

CHANGING FROM LINEAR TO A-WEIGHTING

Click on the *dB* or *dB(A)* text located on the top left corner of the view to switch from linear weighting to A-weighting.

CHANGING FROM NARROWBAND TO THIRD OCTAVE BAND

Click on the *Narrowband* or *1/3 Octave* text located on the top right corner of the view to switch from Narrowband display to third octave band display.

ZOOM/UN-ZOOM FREQUENCY AXIS

Move the mouse cursor over the frequency axis.

The background of the axis should turn blue.

Use the mouse wheel to zoom or un-zoom.
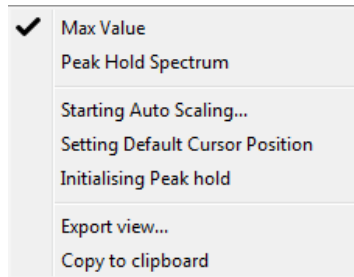
ZOOM/UN-ZOOM SOUND PRESSURE LEVEL AXIS

Move the mouse cursor over the *Dyn:* located on the bottom left of the view.

The background of the axis should turn blue.

Use the mouse wheel to zoom or un-zoom.

CONTEXT MENU

The context menu is accessed by right clicking on the view.

Max value: Show/hide the maximum value of the spectra for the current frequency selection.

Peak Hold Spectrum: Show/hide the maximum spectrum for the selected frequency band. This features gives a good overview of the current spectrum level compared to the maximum spectrum level obtained for the time data already replayed.
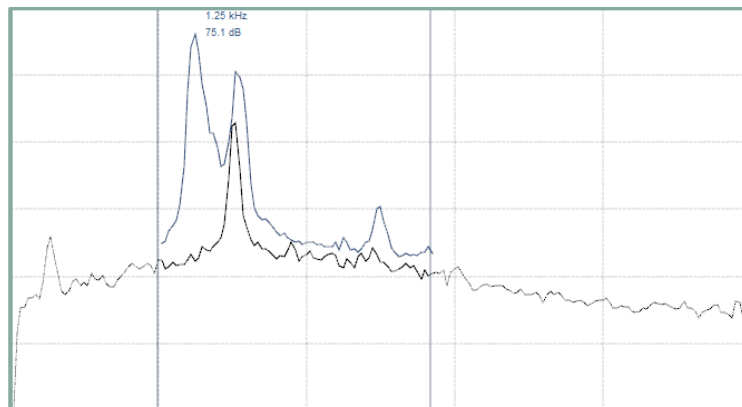
Starting Auto Scaling…: Launch the automatic scaling of the sound pressure level axis.

Setting Default Cursor Position: Set the cursor position to the minimum and maximum frequency values of the current view.

Initialising Peak Hold: Reset the display of the maximum spectrum.

Export view…: Export the view as a .jpg image file.

Copy To Clipboard: Copy the spectrum view into the clipboard in order to be able to paste the image of the view in another document.

TIME VIEW

The time view, located on the top right area of the LMS Sound Camera software, displays the evolution of the sound pressure level over time. The blue curve corresponds to the overall sound pressure level measured for each time window. The red curve corresponds to the sound pressure level integrated on the current frequency selection. The red curve is updated with the replay cursor.
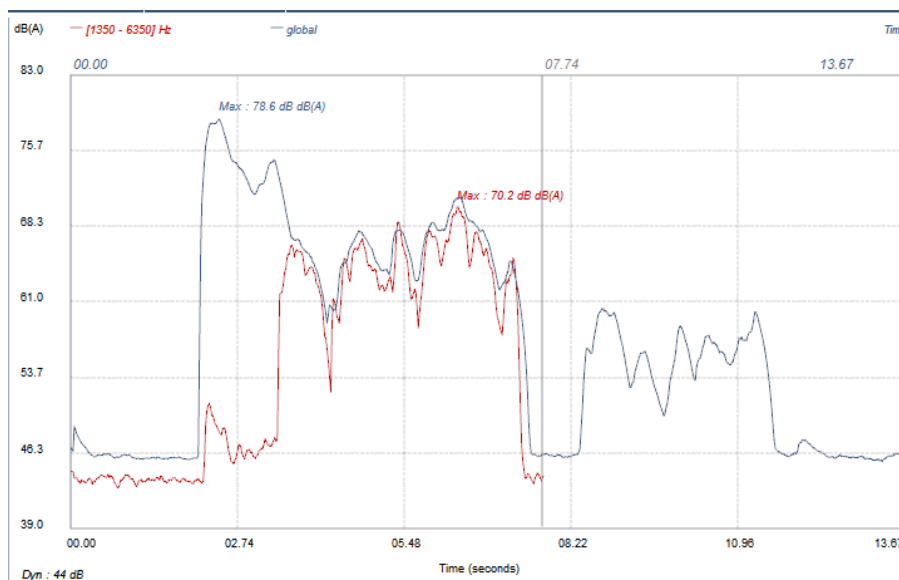
CHANGING FROM LINEAR TO A-WEIGHTING

Click on the *dB* or *dB(A)* text located on the top left corner of the view to switch from linear weighting to A-weighting.

ZOOM/UN-ZOOM ON LEVEL AXIS

Move the mouse cursor on the sound pressure level axis.

The background of the axis should turn blue.

Use the mouse wheel to zoom or un-zoom.

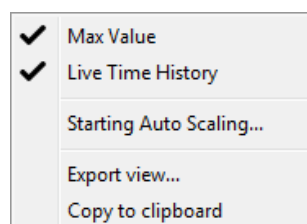### ZOOM/UN-ZOOM SOUND PRESSURE LEVEL AXIS

Move the mouse cursor on the *Dyn:* test located on the bottom left of the view

The background of the axis should turn blue.

Use the mouse wheel to zoom or un-zoom.

CONTEXT MENU

The context menu is accessed by right clicking on the view.

Max value: Show/hide the maximum value of the sound pressure level for the current time selection.

Starting Auto Scaling…: Launch the automatic scaling of the sound pressure level axis.

Export view…: Export the view as a .jpg image file.

Copy To Clipboard: Copy the time view into the clipboard in order to be able to paste the image of the view in another document.

HOLOGRAM VIEW

The hologram view, located on the bottom left area of the LMS Sound Camera software, displays the current sound pressure map corresponding to the frequency selection and time cursor or time selection.

Grid step: 0.042 / 0.042 - Grid size: 55 / 31 - distance :0.873 - [3100 - 5025 Hz]

The main parameter which modifies the hologram display is the dynamic scale. This parameter corresponds to the relationship between the colour displayed on the hologram and the sound pressure level. This parameter can be modified in the **Hologram scales** menu of the **Display** section**.**


Auto: The dynamic scale of the hologram is automatically set to match with the maximum sound pressure level of the hologram. The dynamic range can be set with the *range* field. In the example shown above, the maximum sound pressure level is 91dB. The dynamic range is set at 8dB, which means that only the sound pressure levels between 91 dB and 83 dB will be displayed. This default option is mainly used to focus on the main noise sources.
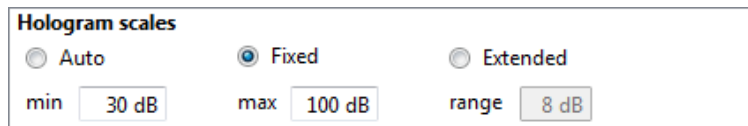
Fixed: The dynamic scale of the hologram is fixed with a minimum and maximum values which can be modified by the user. All the sound pressure level values between the maximum and the minimum of the dynamic scales will be displayed. This option is used to have an overview of all the noise sources but can be difficult to analyse.
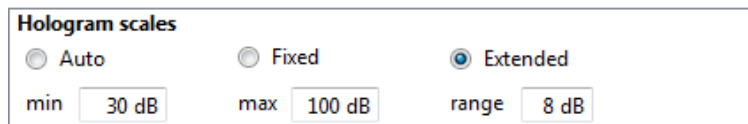
Extended: The dynamic scale can go from a minimum value up to a maximum value but is only displayed for the dynamic range value. This option can be used when the noise level varies a lot during the measurement like for instance for engine run-up or when comparing results with a reference hologram.

CONTEXT MENU

The context menu is accessed by right clicking on the view.
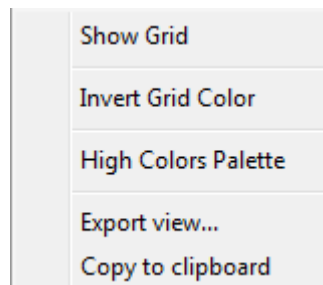
Show Grid: Show/hide the calculation grid on the hologram.

Remark: In order to maintain optimal results in terms of dynamic and optimal calculation time over the whole frequency range, the calculation grid is updated automatically by LMS Sound Camera software depending on the array used and the frequency selection. An example of calculation grids is shown below for two frequency selections: 1500-2000Hz on the left and 5000-5500Hz
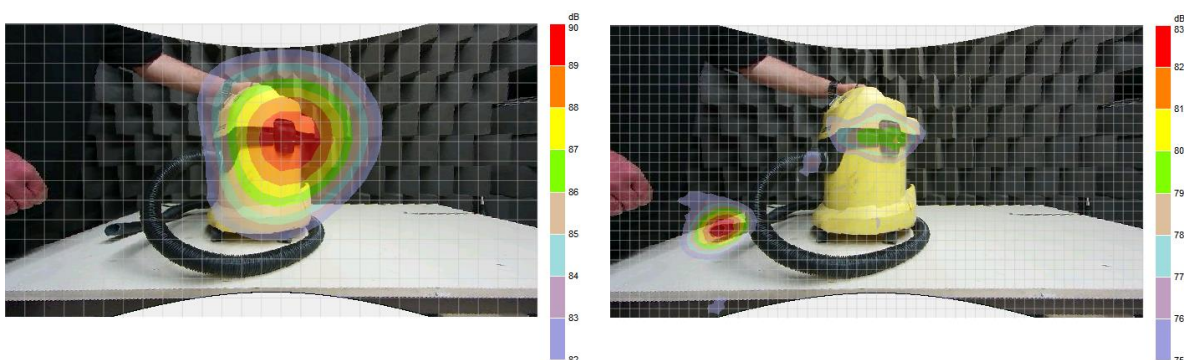
Invert Grid Colour: Switch the colour of the calculation grid from black to white.

High Colours Palette: Switch between Basic colour palette (left hologram) and high colours palette (right hologram) to display the sound pressure level.
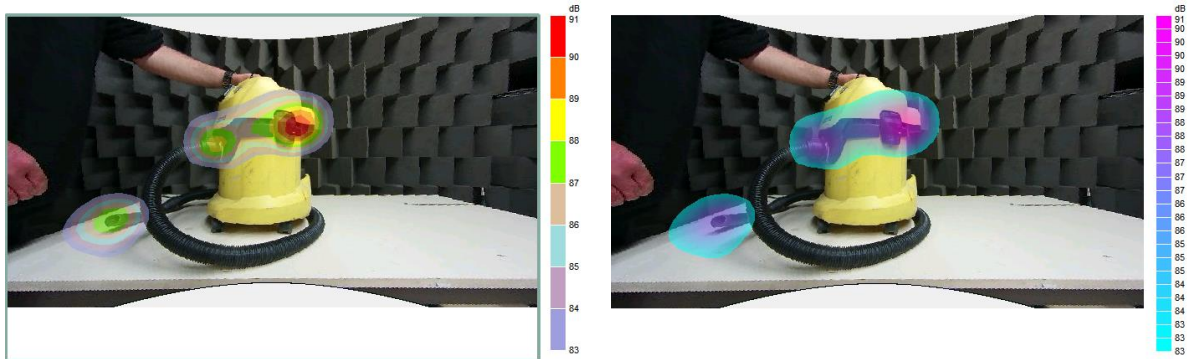
Export view…: Export the view as a .jpg image file.

Copy To Clipboard: Copy the hologram view into the clipboard in order to be able to paste the image of the view in another document.

REFERENCE HOLOGRAM VIEW

At the bottom right area of Sound Camera software, a second hologram view is available. This view corresponds to the reference hologram view. At any time, it is possible to define the current hologram view as a reference by clicking
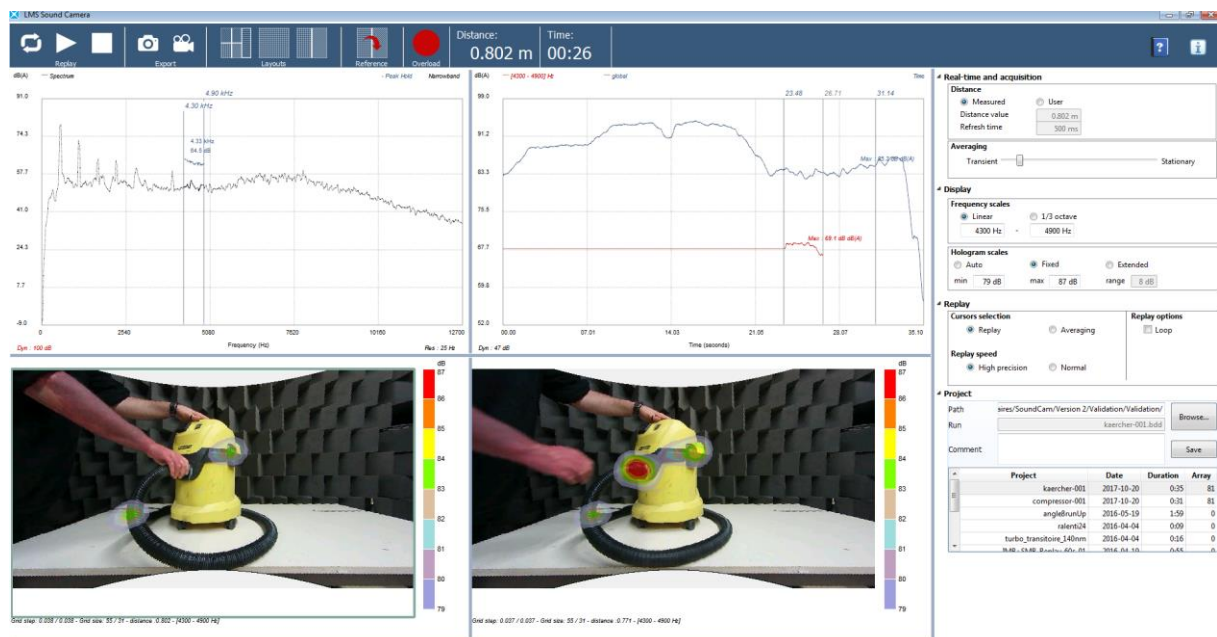
The goal of this feature is to be able to quickly compare the current hologram result with a reference hologram. On the picture above we can see an example of configuration comparison. The reference was set for the initial state of the vacuum cleaner on which we can clearly see a leakage at the hose connection. Later in the measurement we tried to remove that leakage by changing the hose position. With the reference hologram feature it becomes very easy to compare the two configurations and see that indeed the leakage has been removed.

This feature can also be used to compare the holograms obtained for two different frequency selections as shown below
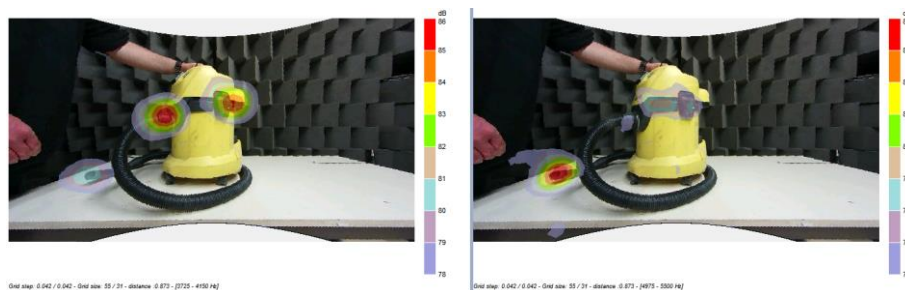
DATA EXPORT

It is possible to export data using the following buttons:

EXPORT VIEW TO IMAGE

To export a view to an image, press on the selected view first, then press the *Export view to image* button.

The selected view will be exported as a picture file to the file directory set in the parameters section, located in the right-hand panel.

It is also possible to export any of the four view by using the context menu:

- Use the right mouse button on one of the view
- Select Export view… or Copy to clipboard option
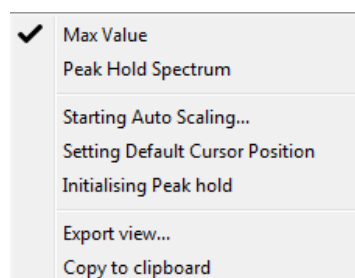
EXPORT HOLOGRAM VIEW TO VIDEO FILE

The hologram is the visual representation of the acoustic sources received by the digital array.

The hologram export is only available in replay mode in an opened project.

To start the hologram view to video file export, press the *Export view to image* button .

The project will then start playing and will be recorded as a video file.

The hologram view will be exported as a hologram video file in the file directory set in the parameters section, located in the right-hand panel.

The video is exported in .avi format. This video file can be directly opened with VLC media player but requires additional codec to be opened with Windows media player or to be integrated in Powerpoints. This codec can be downloaded freely at:

- https://xiph.org/downloads/
- http://downloads.xiph.org/releases/oggdsf/oggcodecs_0.83.17220-win32.exe

TROUBLESHOOTING

THE DIGITAL ARRAY DOESN'T SEEM TO TURN ON (NO LED IS ON)

Check if the PoE adapter is powered, ensure that the PoE adapter is connected to a functioning external power supply.

Ensure all cables are correctly plugged in and check the Communication section of this manual.

Ensure the cables are not damaged. If so, please contact us for parts replacement. Use the Contact part for contact information.

THE SYSTEM CHECK LED ON THE DIGITAL ARRAY IS RED

Try to restart the system by turning it off and on.

If the problem persists, please contact us. You will find information on how to do so in the Contact section of this manual.

THE SOFTWARE CANNOT DISCOVER THE DIGITAL ARRAY

Check whether the digital array has started. See: The digital array doesn't seem to turn on (No LED is on)

Check whether the digital array is ready for acquisition. See: The system check led on the digital array is red

If the problem persists, please contact us. You will find information in the Contact section of this manual.

THE CAMERA STREAM IS NOT STARTING, EVEN WHEN RETRYING SEVERAL TIMES

Close the SoundCamera software, shutdown the digital array and restart it.

Once the device has started, wait for 60 seconds and start the SoundCamera software.

If the video stream is still not available, try to disable Window's firewall or another firewall running on the user's computer and start the previous steps again.

If the issue remains, please contact us. You will find information in the Contact section of this manual.

SYSTEM MAINTENANCE Chapter 6

There is no part of the system that can be repaired by the user; only the authorized personal can repair the system. Any repair on the system parts must be performed by the system manufacturer or authorized personal only.

The only maintenance allowed for the user are those of cleaning.

CLEANING THE SYSTEM

Do not use any liquid or solvent to clean the system parts. All operations described below must be performed with a non-powered system.

COVERING METAL PARTS

Clean up with a dry piece of cloth (microfiber).

LENS

Clean up carefully with a lint-free microfiber cloth.

ACCESSIBLE ELECTRONICAL PARTS

Clean up with a dry piece of lint-free anti-static cloth without the user touching the electronical parts directly. Do not use any liquid or solvent to clean the system parts.

WINDSHIELD FOAM

Use a dry piece of cloth to remove the dust.

RISKS

PRODUCT-SPECIFIC RISKS

Insofar the safety instructions for cleaning are met (no liquid or solvent, non-powered system), there's no risk that may affect the service personnel.

VERIFICATION

The verification of the safe state of the Digital Array after cleaning must be done by following instructions detailed in OPERATION-PREPARATION. A verification of correct operation of the system (camera alignment, correct source localization) can also be performed using a user reference test case.

SUPPORT AND FEEDBACK

SUPPORT

Thank you for consulting this User Manual. The content of this manual has been designed and written with the aim of supporting you, the user, in the day-to-day use of the LMS Sound Camera. In case you need specific information that is not described in this manual, please do not hesitate to contact your local representative for support. We are dedicated to help you accomplish your goals and tasks.

FEEDBACK

Although the utmost care has been taken to achieve the highest level of quality for this manual, it may contain information that is not (fully) clear and/or accurate. Should you find any element to be unclear, or any inaccuracies, please report this to us. Should you have suggestions for improvement, we invite you to share your ideas with us.

INDEX