

# Acoustic Camera

## Nor848A

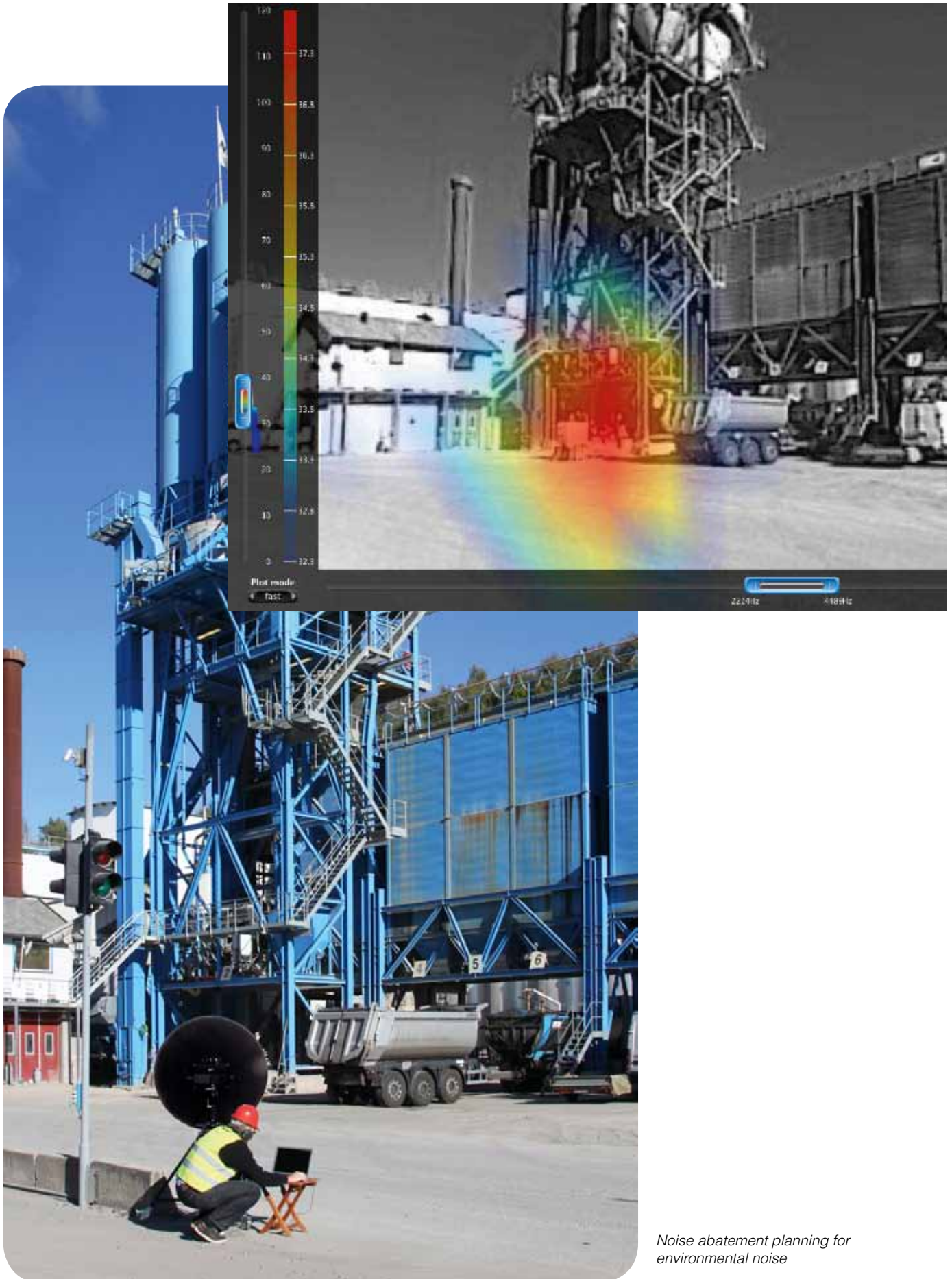
- **Three array sizes with up to 384 microphones available**
- **Real time virtual microphone**
- **Digital microphones, no extra acquisition unit needed**
- **Intuitive software**
- **Plug and play within 5 minutes**



### Features

- Robust camera front-end based on a circular carbon fibre disc, three sizes available:
  - 128 microphones 0.4 meter array, only 2.5 kg weight
  - 256 microphones 1 meter array, only 11 kg weight
  - 384 microphones 1.6 meter array for lower frequency analysis
- No interface box between array and laptop, direct connection with LAN cable
- Listen to and analyse real time audio from virtual microphone position
- Virtual microphone enables you to listen to the sound contribution from any source real time, filtered with your selected frequency range
- Microphones on a disc prevent sound and echo from behind
- Low self-noise and large measurement range
- RPM option for analysing rotating machines.
- High-performance optical video camera is included in the camera front-end unit
- The distribution of the high number of microphones ensures high resolving power and reduces the problems due to side lobe effects compared to most other acoustic cameras
- Digital microphones ensure large dynamic range and high stability
- Simple connection to the included MacBook Pro computer through a single LAN-cable.
- All parts are integrated in the camera frontend – no need for a signal processing interface box
- Operated on mains or DC input
- Records the signal from every microphone





Noise abatement planning for environmental noise



The Norsonic Nor848A sets a new standard for acoustical cameras. The large number of microphones eliminates the problems of ghost-spots, compared to traditional acoustical cameras where the relatively low number of microphones increases the side lobe effect, resulting in the so called ghost-spot effect where you may measure a non-existing source. The Nor848A software is extremely intuitive and easy to use. Just after a few minutes of training, the user is able to operate the system and do real measurements. Three camera frontends are available. A 0.4m array with 128 microphones, a 1 meter array holding 256 microphones and a 1.6 meter array with 384 microphones! The system enables the user to perform noise analysis with a clear view of the spatial distribution of the sound in real time!

The system is easy to set up in the field. Just power the self-contained unit from mains or battery and connect the LAN cable to the computer. The system is ready to measure in just a few minutes after entering the site.

The sound signal from every microphone as well as the video from the integrated optical camera are recorded and stored in the computer. Both live level plots as well as post-processed analysis with refined resolution are available with the user friendly software package that runs on the included state-of-the-art MacBook Pro computer.

By moving the cursor in the picture you may analyse and listen to the sound in the selected directions – in real time! This enables the user to identify the problem, whether it is an annoying sound, a leakage or other difficult noise problems in just a fraction of time compared to traditional methods.

## Easy operation

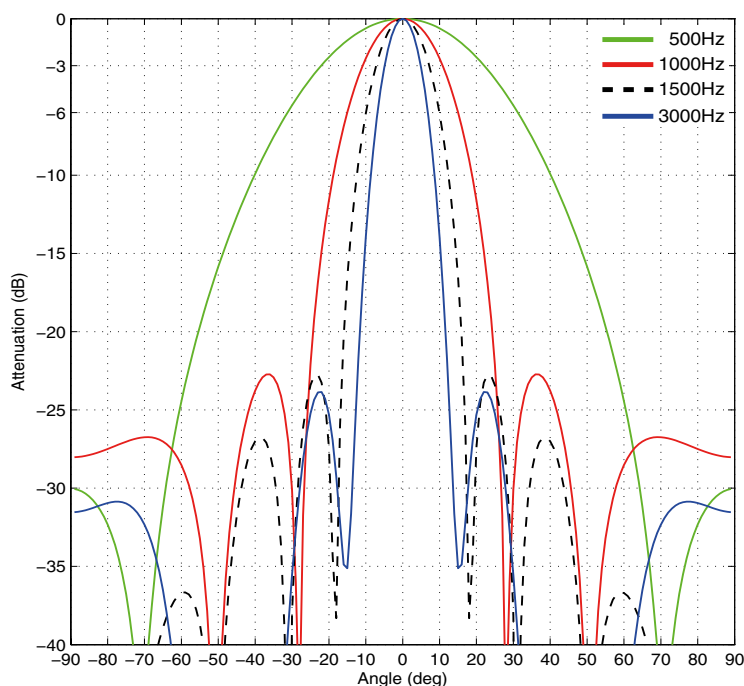
The acoustic camera Nor848 has been designed with the operator in mind and is very simple to operate

- Set up the front-end in the desired direction
- Connect the LAN cable between frontend and computer
- Power the frontend and computer – mains or battery
- View the noise sources in real-time
- Press the start record button to save a measurement recording for further analysis

The video from the wide-angle optical camera and the signal from all microphones are recorded on the hard-disk of the computer. The filename is automatically picked from the time of the day and may eventually be given a more descriptive name.

Select a virtual microphone position by the cursor position and the focus distance and listen to the signal and perform a frequency analysis – in real time or after the measurement. Many operators have found that listening by the ears and looking at the level picture is very useful in finding noise sources.

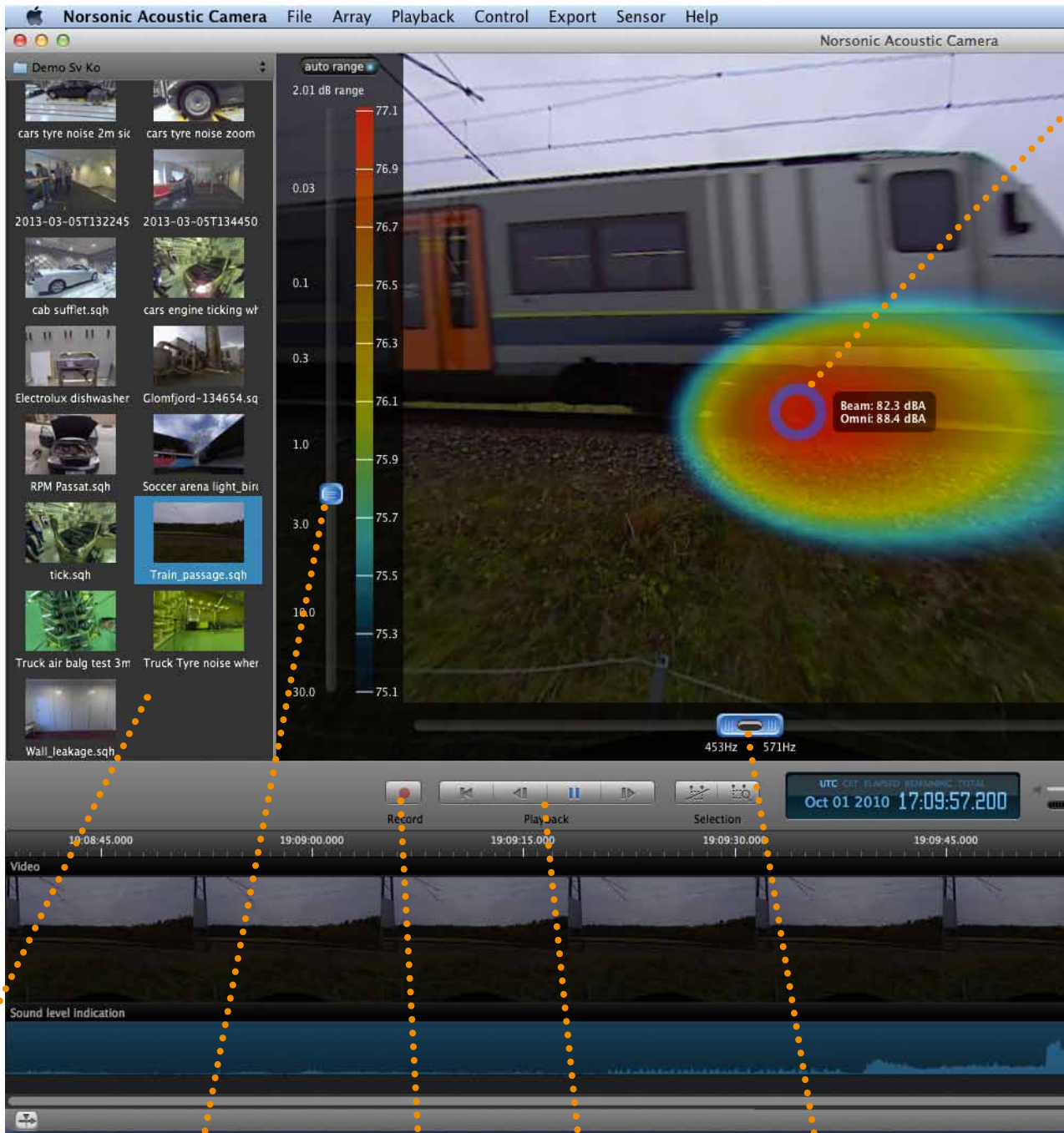
Essentially, only the placement of the frontend is important for a good recording since all parameters like focal distance and level- and frequency-range may be selected at any later time. There is no initial setting that can be made wrong



*The large number of microphone elements applied in Nor848 is the basis for high angular resolving power and the low side-lobes – typically more than 25 dB below the main lobe. This reduces the amount of ghost-spots and makes the pictures easier to analyse.*



## Online analysing software - intuitive and easy to use!



Thumbnails of recordings

Select the colour range

Record button

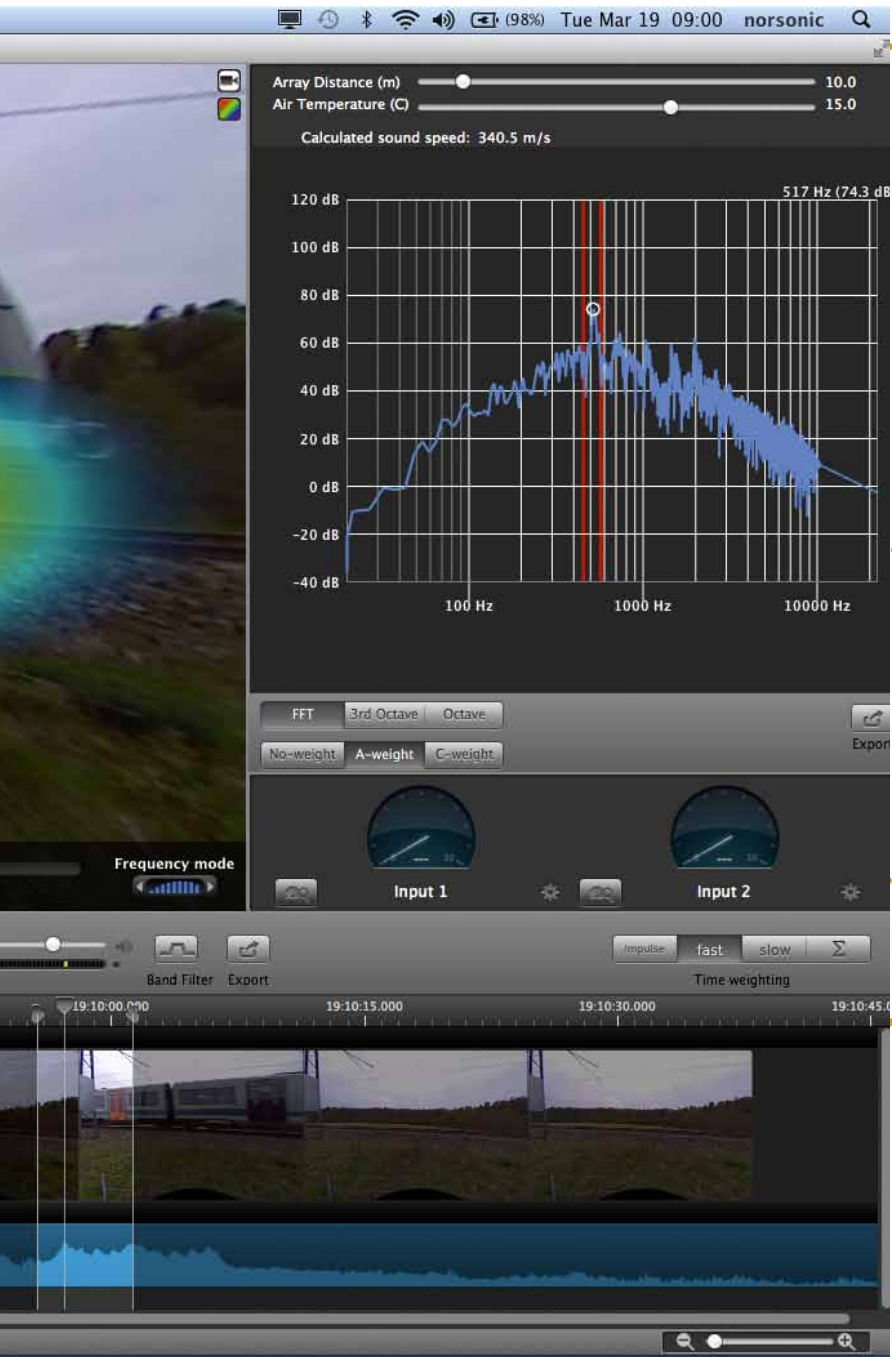
Playback control

Set the frequency range for analysis



Virtual microphone position selected by the cursor.  
Used for analysis and listening

Set the focal distance



Display the spectrum as FFT,  
1/3 or 1/1 octave

A, C or flat weighting selection

RPM and order tracking

Video frames for quick navigation  
within recording

Sound level history

Time axis

Listen to broadband or selected  
frequency band





The digital microphone elements are protected behind the disc-shaped carbon fibre enclosure. A dust and water repellent mesh is protecting the microphones from dust and moisture. The robust and sturdy construction also ensures that all microphones are kept in the correct position – important for field applications. The small distance between the microphones in the inner circle is important for low spatial aliasing at higher frequencies.

The large number of microphones also contributes to the wide measurement range and the low self-noise. The signal in the selected direction is based on the weighted average of all microphones and is therefore far below the self-noise from a single microphone. Allows measurements of levels below what is achievable with a normal sound level meter.

The backside of front-end contains the connectors DC power or mains via mains adaptor, two external signal input (RPM input) and the computer interface (LAN). The computer runs on the internal battery for about two hours. Alternatively, use the enclosed mains adapter/charger or external battery pack.



LAN-cable

RPM

DC





Leakage localization for building acoustics applications

### Specifications

	0.4 meter array	1 meter array	1.6 meter array
<b>Number of microphones</b>	128	256	384
<b>Type</b>		digital mems	
<b>AD converter</b>		4th order Delta Sigma	
<b>Resolution</b>		16 bit/sample	
<b>Sampling rate per sample</b>	48kHz efficient after downsampling and antialiasing from 2,1 Mhz		
<b>AC coupling 3dB frequency</b>		20 Hz	
<b>Max sound level (re. 20 µPa)</b>		110 dB	
<b>Noise level, A-weighted</b>		10 dB	
<b>Microphone frequency range</b>		20 Hz – 20 kHz	
<b>Mapping frequency range</b>	316 Hz - 15kHz	125 Hz – 15 kHz	80 Hz – 15 kHz
<b>Sampling frequency</b>		44.1 kHz	
<b>Analysing spectrum</b>		1/1 octave or 1/3 octave or FFT	
<b>FFT spectra</b>		4096 lines 11,8 Hz line width	
<b>Focal distance</b>		0,5 m to infinity	
<b>Optical camera resolution</b>		1600 x 1200	
<b>Optical camera frame rate</b>		15 frames/sec	
<b>Optical/acoustic covering angle</b>		± 48,5° horizontal ± 35° vertical	
<b>Temperature range</b>		-10°C to +40 °C	
<b>Humidity range</b>		up to 90 % RH	
<b>Mains supply (via mains adaptor)</b>		100 - 230 V (50-60 Hz)	
<b>DC supply</b>		11–36 V	
<b>Power consumption frontend</b>		Max. 20 W	
<b>Disc diameter</b>	43cm x 4.5 cm	103 cm x 4.5 cm	164 cm x 4.5 cm
<b>Weight (excl. tripod)</b>	2,4 kg	11 kg	16 kg
<b>Ingress protection code</b>		IP 40	





Nor848A 0.4 meter array

### Included in the delivery

- Acoustic camera array Nor848A-0.4, frontend disc with 128 microphones build in optical video camera and electronic interface alternatively acoustic camera array Nor848A-10, frontend disc with 256 microphones build in optical video camera and electronic interface. Alternatively Nor848A-16, frontend disc with 384 microphones, optical video camera and electronic interface and processing unit
- On-line analysing software with recording, measurement and post-processing functions. Supplied with Bose noise cancelling headphones for optimum on-line listening. Ready installed on the MacBook.
- Laptop computer MacBook Pro.
- Mains adapter Nor337/848.
- LAN-cable 5 m.
- Nor848/case - Transport casing for Acoustic camera front-end with space for tripod and accessories.

### Options

- RPM option for analysing rotating machines.

### Accessories

- Battery pack Nor342 with charger Nor343 and cable Nor4574 (>4 hour operation)
- Nor848/Tripod – Rugged tripod for Acoustic camera frontend including detachable wheels and detachable tripod holder for MacBook. Fits all camera discs sizes. Weight 11.4 Kg
- Nor848/TripodL – Light weighted tripod for 0.4m Acoustic Camera Frontend. Weight 2.8 Kg
- Plug for DC input, (Lemo FGG.1K302.CLAC65Z)
- Plug for RPM input, (Lemo FFA.00.250.NTA)
- Nor4575, 10 meter RPM input cable BNC to Lemo

