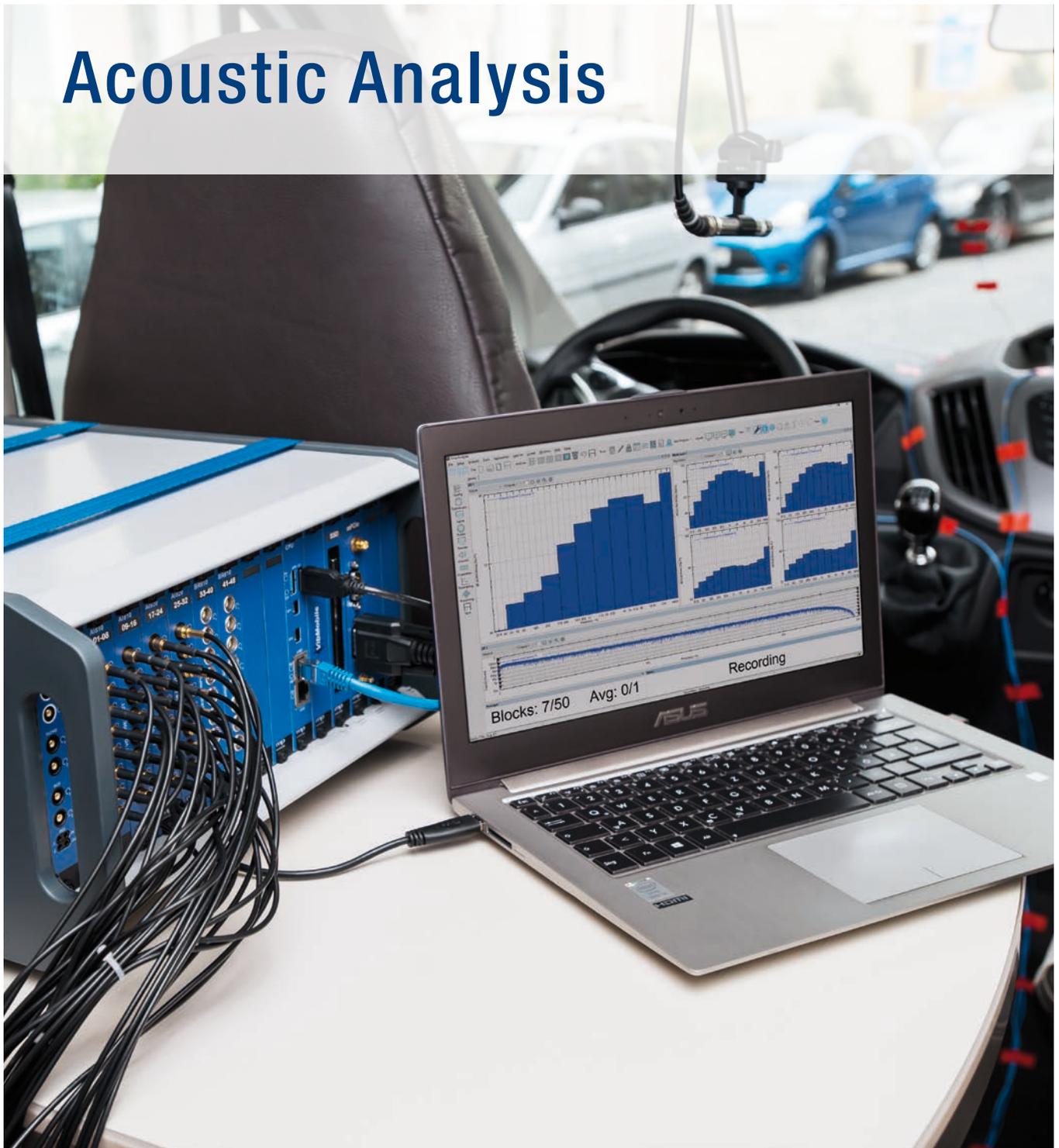


# Acoustic Analysis



Noise is increasingly the subject of new regulations for the protection of human health and safety as well as for improving the environment in general. As well as sound levels, the perceived sound quality of products from washing machines to vehicles is often an important part of the customer purchasing decision and must be considered during product development.

m+p Analyzer provides a full range of capability for these applications. Real-time fractional octave filters satisfy all acoustic applications from simple sound pressure, sound power for equipment legislative requirements, intensity mapping to isolate sources to sound quality metrics for

product refinement. All this in parallel with narrowband analysis and time history throughput to disc for fully detailed analysis online and offline post-processing of any data source.

## Octave Analysis

Fully compliant with ANSI S1.4 and IEC 61672 type 1 sound meter specifications including A/B/C weighting and 1/1 to 1/24 octave spacing from 1 Hz to 100 kHz even with high channel counts. Response types include fast, slow, impulse, custom, linear average and LEQ.

## YOUR BENEFITS

- Traditional 1/3 octave sound meter features plus fractional octaves to cover all needs
- Traditional microphones and intensity probe measurements for flexibility
- Sound power procedures for all popular measurement methods with full validity analysis
- Sound power using intensity probe for use within noisy backgrounds
- Sound intensity mapping to identify and visualize noise sources
- Sound quality evaluation to refine your products
- Transmission loss, pitch, warble and tonality to develop your own quality metrics
- LOFAR and DEMON analysis for sonar applications

### Sound Meter Functions

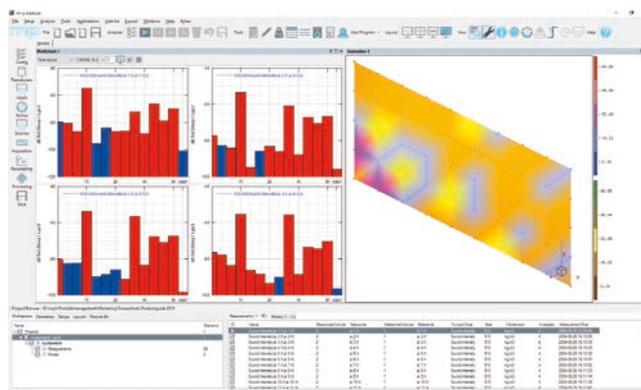
With m+p Analyzer there is no need for a separate sound level meter as these functions are already built-in with fast, slow and impulse settings, LEQ, peak hold by band or OASPL. Sound pressure histories and trends over long periods can be captured continuously or sampled.

### Sound Intensity

Sound (or acoustic) intensity can be measured in any sound field. Real-time sound intensity measurements use a standard dual microphone intensity probe calculating real-time pressure, intensity and pressure residual intensity index. This technique is directionally sensitive making it ideal for source localization or background noise cancellation. It enables accurate measurements directly in the field without the need for expensive acoustic laboratories.

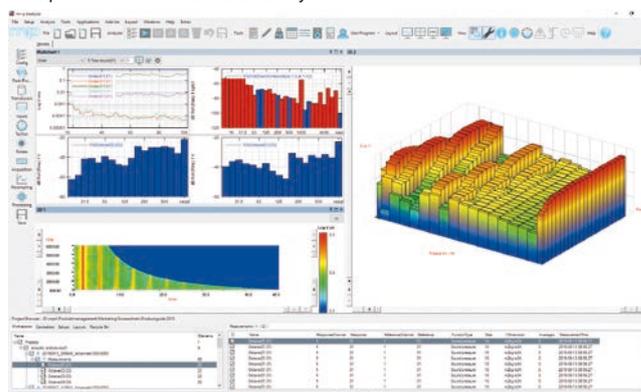
### Sound Intensity Mapping

A wire frame 3D model of your equipment under test is used to guide an operator around a sequence of sound intensity measurements. These results are then mapped to the colour coded 3D image for identification of the principal sound sources and their levels.



Sound intensity measurements

Comprehensive acoustic data analysis



*Using m+p's system, we were able quickly to identify the issues and the effect of component modifications, which saved us time and money. We are now looking to see how we can use the system to investigate other noise and vibration issues with a view to further improvements in design, including forthcoming electric vehicles.*

Amit Satav, Mechanical Design Engineer at The London Taxi Company, Coventry, UK



Identifying the root cause of sound issues helps making the right decisions at the design stage

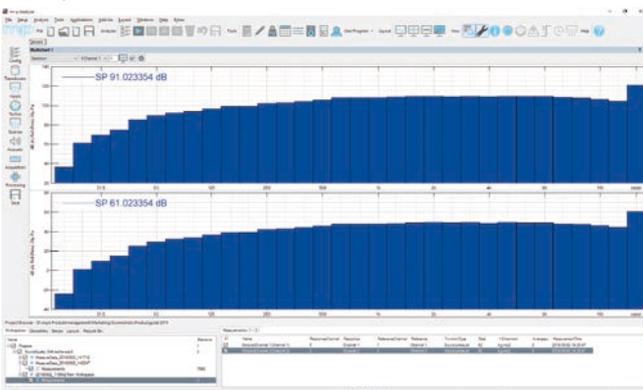
### Sound Power

Sound power is an absolute measure to determine the noise emissions of a product. All equipment from PC fans to heavy machinery must have published sound power emission levels for environmental regulation. m+p Analyzer wizards guide the operator through the maze of requirements in the ISO 374x standards and, using the intensity measurements, the ISO 9614 standards. The latter method has high tolerance to background or reverberation effects so is suitable for use in most on-site environments rather than needing expensive anechoic chambers or field sites. More specialized applications such as wind farm methods like IEC standard 61400-11 and tonality using ECMA-74 are also available.

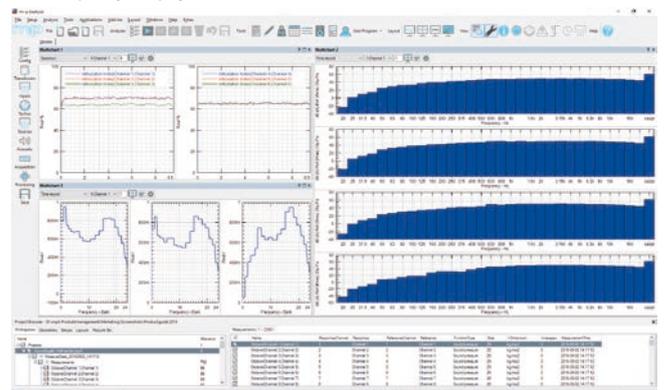
### Sound Quality

Human perception is critical in improving product competitiveness: Designers face a challenging task in that they not only have to reduce the product noise level, but also have to find the “right” sound that attracts the customer. Sound quality metrics can be used to rank and evaluate different product designs. The basis of the m+p Analyzer Sound Quality Analysis is Zwicker loudness according to ISO-532 and DIN-45631. The following metrics are available both online and for post-processing and can be computed from either narrowband or octave band spectra:

Sound power measurements



Sound quality for psychoacoustic noise evaluation



- Specific loudness and transient loudness (in terms of sones and bark)
- Loudness and percentile loudness time history
- Articulation index and extended articulation index time history
- Sharpness time history
- Pitch and warble analysis wizards for squeak and rattle analysis
- Statistical analysis of any function, e. g. LSF, L(10), L(50), L(90), L(n)

These functions can be viewed as 2D, 3D charts or as colour maps (spectrograms) for further detailed analysis. Other statistical tools are available for least-squares curve fitting and trend analysis which are useful, for example, in squeak and rattle evaluation.



Finding the best possible sound

### Human Vibration

Alongside environmental noise, evaluation of other human factors such as hand-arm vibration from the use of power tools or the evaluation of whole body vibration from riding in vehicles as per the various ISO and BS standards are available. These include C/D/H/K weighting and functions such as VDV (vibration dose value) calculations. In conjunction with sound quality algorithms, these vibration results can form a comprehensive set of metrics for vehicle comfort assessment and refinement engineering.

### Impedance Tube Testing

With its optional Impedance Tube Testing software package, m+p Analyzer allows the calculation of important acoustic characteristics of materials such as absorption coefficient, reflection coefficient, acoustic impedance and transmission loss coefficients based on impedance tube measurements. Measurements and calculations are possible in compliance with ISO 10534-2, ASTM E2611-12 and ASTM E2611-17. Depending on the test standard, measurements are taken in two different ways using either two or four microphones. The latter method allows calculation of the transmission loss as two microphones are placed on either side of the specimen. The software package uses pre-test



Measurement and evaluation of human vibrations with the aim of reducing the exposure to these vibrations

measurements to establish the signal-to-noise ratio, the appropriate volume of the speaker and the calibration coefficients for microphone mismatch correction. The measurement results are displayed online and the desired acoustic coefficients are calculated. Of course, all results can be gathered together into a report, including the setup, the results and specific information of the test.

Impedance tube testing using m+p Analyzer software and m+p VibPilot front-end





## **m+p international**

Founded in Hannover, Germany in 1980, m+p international develops and manufactures test and measurement systems for vibration testing, dynamic signal analysis, multi-channel data acquisition and monitoring and test stand engineering. Our product reputation and broad experience coupled with valuable user feedback have led to significant market share in numerous key industries worldwide.

The company has its headquarters in Hannover, Germany with sales/marketing subsidiaries in New Jersey (USA), England, France and China, along with representatives and agents in many countries.

Learn more on the full range of m+p international products and services and their applications. Select the m+p literature library on our website and download the desired product literature.

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