acoem

Acoem Smart Building Acoustics Solution

Building acoustics by Acoem

Simply Productive!

The field of building acoustics is governed by a complex set of measurement and calculation standards for assessing the acoustic performance of buildings. Various equipment are required to make a measurement (sound level meters, sound sources, tapping machine...) and may well need several people. Furthermore, the equipment must be moved around the building repeatedly to carry out a measurement campaign. A rigorous approach is thus essential in order to conduct a campaign efficiently.

Acoem Smart Building Acoustics Solution enables building acoustics technicians to enhance their productivity in the field and also in the office. The 01dB solution comprises a embedded module in a sound level meter (FUSION or DUO), dBInside software running on a PC, a sound source and a tapping machine (LS01, LS02, TM01, etc.). Each component of the solution is designed to eliminate superfluous actions, avoid errors and optimize work through smart organization of measurements, automatic identification of each measurement, on-the-fly calculation of standardized indicators when the measurements are imported into dBInside, a one-click automatic report in Microsoft® Excel, and all-in-one noise sources for easier transportation and use!

Acoem Smart Building Acoustics Solution will boost your efficiency in the field, thus optimize your costs.

Main Applications

Acoem Smart Building Acoustics Solution enables all acoustics technicians to respond to all building acoustics measurement requirements:

- Reverberation time
- Insulation from airborne noise
- Facade insulation
- Impact noise level
- Equipment noise

Main Characteristics

- Smart organization of measurements for effective post-processing
- Reuse of previous measurement data
- Automatic detection of the type of measurement performed
- Measurement quality indicators for reverberation time (ISO 3382 standard)
- Display of decay on the built-in display
- Storage of the time history and fast time history of all instantaneous and spectral parameters for each measurement
- Parallel recording of audio signal
- Three-button control keypad
- Remote control via a mobile device (smartphone, tablet, computer PC/MAC, etc.)
- Recording of audio comments
- Automatic distribution of measurements for each test
- Ratings calculated immediately in the field in the sound level meter and on data transfer, without user intervention
- On-the-fly calculation of ratings as changes are made
- Comparison with regulatory values
- One-click report covering all tests
- Can be used with any sound source and tapping machine without requiring any control interface between the sound level meter and the source

Performance and simplicity

Acoem Ecosystem

FUSION, CUBE and DUO are members the new Acoem product range sharing the same ecosystem focused on improving your productivity. Being familiar with one of them just means mastering the other ones. Same built-in screen, same web interface, same accessories, same software tools... everything is designed in order to optimize the time you need to use these instruments.

Your first purchase from the Acoem range? You will appreciate its simplicity of use, its degree of remote controllability and the power of its processing software.

Simplified ergonomics

FUSION and DUO can be used with its context keys and high-definition built-in colour screen. It is therefore possible to load a stored configuration, to start an acquisition, to mark an event and start an audio recording, to do a calibration and to access stored measurements ...

No more need for a computer keyboard to manage the whole set of measurement campaigns!

An innovative solution for two exceptional devices

The new Acoem Smart Building Acoustics Solution is available for FUSION and DUO sound level meters.

DUO Smart Noise Monitor was the new generation of instruments and a breakthrough in the field of environmental noise assessment.. DUO is completely modular and offers the most comprehensive range of options so to be able to use the same unit as sound level meter or a full-fledged noise monitoring station.

FUSION Smart Noise & Vibration Analyzer is the new sound level meter of Acoem brand simply unique. FUSION is ready for field operations.. Powerful functions, including vibration measurements, are integrated to meet your needs for on-site analysis, making FUSION the most innovative sound level meter and an exceptionally communicating tool, increasing your productivity

Certified Class 1 solution according to IEC 61672, FUSION and DUO offer the highest standard in metrological quality for your data

Remote communication

Using a communicating tool (smartphone, tablet, laptop...) you can access FUSION or DUO using a simple internet browser. Thanks to the embedded webserver FUSION and DUO offer direct access to any of the available functions: configuration, coding, acoustic calibration and electrical check, real time display of instant values...) without the need of further specific applications.

Remote connection is possible using Ethernet, Wi-Fi or 3G integrated modem (option). Therefore remote access to your instrument is possible from wherever you are.

Wireless in your office

Direct access to FUSION or DUO is possible from your office WIFI network without additional software. Any of your collaborators can thus have hands on one or several instruments using WIFI access.

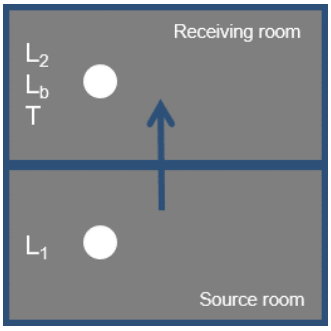
Measured data are collected at a glance and you can already schedule your next measurement campaign!

Organization and efficiency

Building acoustics: a quick overview

In building acoustics, ratings are calculated on the basis of a set of measurements made on site. Typical ratings include the insulation of a wall or the sound level of equipment noise. For example, determining the airborne sound insulation provided by a ceiling between two rooms (vertical insulation) will involve four measurements:

- L1 : Noise level in the source room (where the noise source is located) while the noise source is operating.
- L2 : Noise level in the receiving room while the noise source is operating.
- Lb : Background noise in the receiving room when the noise source is not operating.
- T : Reverberation time in the receiving room.



More measurements may be required (several locations in each room) depending on local legislation and standards, but the principle remains the same.

All the measurements results have one thing in common: the receiving room. This is a strategic element of the measurement process and, most importantly, productivity can be increased by an appropriate choice of receiving room. Three of the measurements (L2, Lb and T) are taken in this room, and two of them (Lb and T) ca be reused for different types of measurement results (airborne noise insulation or impact noise level, receiving of equipment noise, etc.). These measurements can thus be reused in several tests without needing to repeat them!

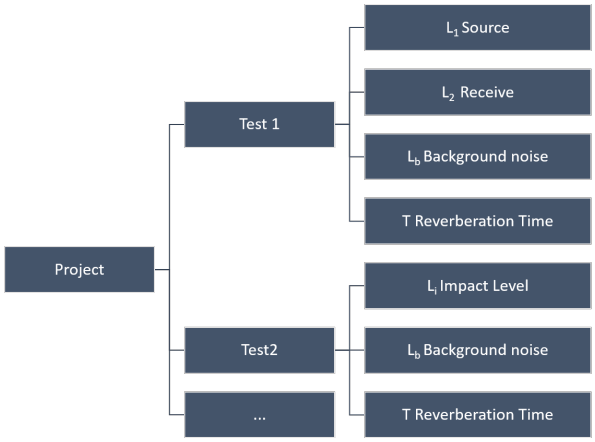
Choose how you measure

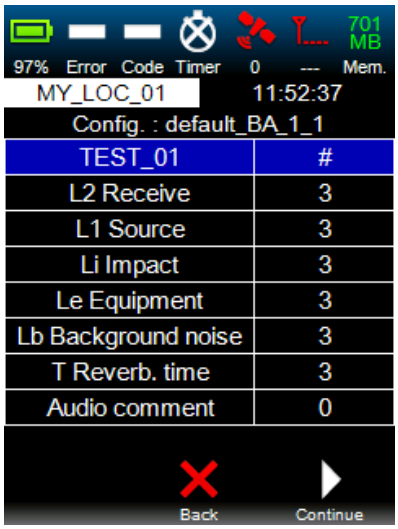
As part of the preparation for a measurement campaign, acoustic consultants need to select measurement configurations that are expected to be representative within the building and also those most at risk in terms of non-conformance. The final choice often focuses on a group of rooms in a cross arrangement, in which all receiving measurements are taken in the central room.

Accordingly Acoem has decided to organize measurements around this receiving room.

Description of the data organization

The measurement campaign in the embedded “Building acoustics” module for FUSION and DUO is organized as follows:





A measurement campaign for a real estate operation is named a “Project”. The project groups a number of “Test” containers, each of which will contain the measurements from one or more tests. This is where the power of the 01dB solution comes into play: there is only one constraint on the test container, namely that it must refer to a single receiving room.

In the example below, the project is called MY_LOC_01 and the TEST_01 container contains three measurements of:

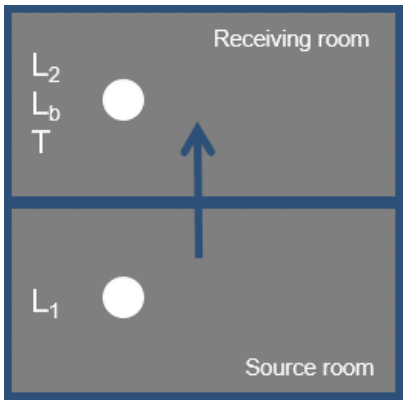
- Source levels
- Receive levels
- Impact noise levels
- Equipment noise levels
- Background noise levels
- Reverberation times

On this basis, dBInside software will automatically calculate the standardized rating values without assistance from the user.

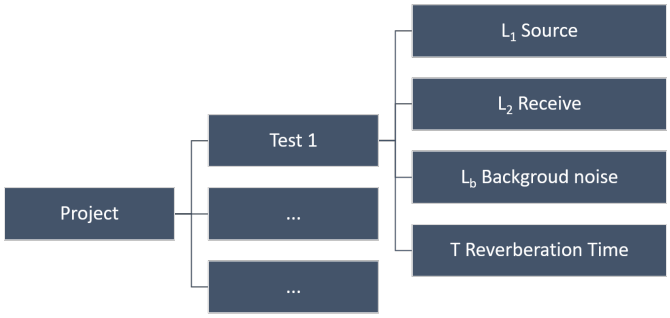
Advantages of this data organization

The user of the Acoem solution can opt for various measurement possibilities:

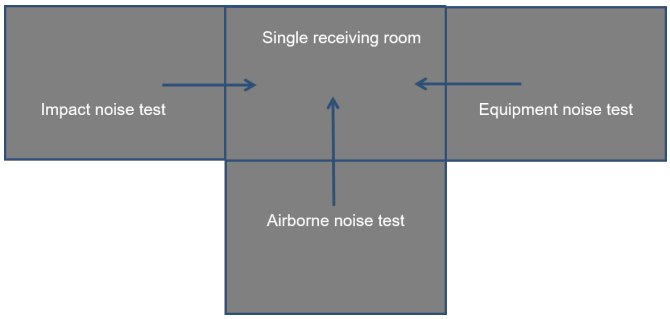
Case 1; individual test: The user chooses to store a single test in the test container (see diagram below). For airborne sound insulation for instance, four measurements will be performed (L1, L2, Lb and T) and stored in “Test 1”. When the data is uploaded to dBInside, the program will directly recognize an airborne sound insulation test and will directly calculate the standardized value as a function of the selected default standard.



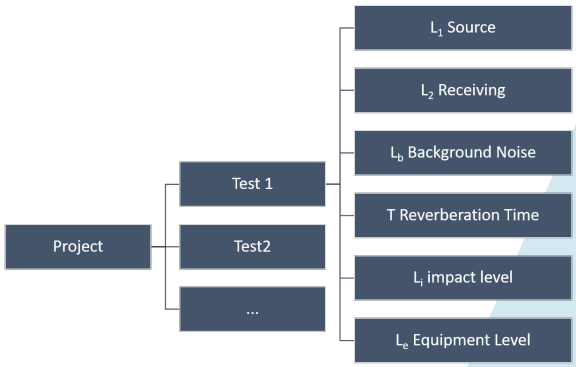
The organization in the instrument is shown in the diagram below:



Case 2; common receiving room: The user chooses to conduct several tests of different types (airborne, impact, equipment), all with the same receiving room (see diagram below).



The organization in the instrument is shown in the diagram below:



The advantage of this configuration is that, when the data is transferred to dBInside, the program will separate the container into three individual test results:

- One airborne sound insulation test
- One impact noise level test
- One equipment noise level test

For each test, dBInside program uses the same background noise and reverberation time measurements. The three rating values will be calculated on the fly once the measurements have been uploaded into the program.

Note: If the user needs to perform several measurements of the same type in a room (e.g. several source levels), dBInside program will automatically (without user intervention) calculate the average of the measurements of the same type.

Case 3: The user can also decide to place all these measurements in a single test container with different receiving rooms. This solution will require the user to assign each measurement to a test in dBInside program. This solution is not recommended by Acoem.

Smart detection

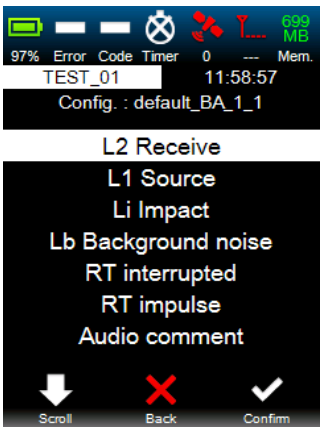
No need to program what you are measuring...

Of course, with a measurement campaign organized in this way, dBInside software needs to know the type of each measurement: Source, receive, reverberation time, impact or equipment. Defining these types is often complex in the instrument interface and a waste of time on site.

Acoem Smart Building Acoustics Solution eliminates this step to improve your productivity.

Simply perform a measurement and then, when it is complete, your sound level meter automatically detects the type of measurement:

- L1 Source level
- L2 Receive level
- Li Impact noise level
- Lb Background noise
- T Reverberation time with interrupted source
- T Reverberation time with impulsive source



Confirm and proceed with the next measurement.

Acoem Smart recognition*

To achieve this, Acoem brings to bear its extensive experience in the automatic recognition of noise sources and in advanced detection techniques implemented in its latest-generation of sound level meters. This innovation, which tests several conditions, correctly recognizes over 90% of signals measured.

If the recognition is not correct, simply use the left button to select the type of measurement carried out.

Acoem includes this productivity-enhancing innovation as a standard feature in the building acoustics module for FUSION and DUO.

*Note: Acoem has a patent pending to protect this technological innovation.

Interface details

Simplicity first and foremost

The information displayed on the screen of a sound level meter must be designed with care. While it is possible to display a multitude of information, it is preferable to be selective and show only the information that is most important for the user, to avoid having an adverse effect on productivity.

The Acoem solution gives the user access to essential information:

01 – Status bar (identical to environment mode)

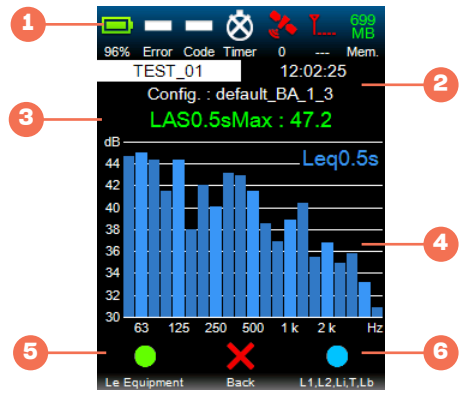
02 – Name of configuration used

03 – Global acoustic indicator

04 – Instantaneous spectrum (for one-third octave measurements, the light blue indicates the central frequency)

05 – Equipment noise measurement selection

06 – Multispectrum measurement selection (source, receive, background noise, reverberation time)



Confirm and proceed with the next measurement.

Multispectrum measurement

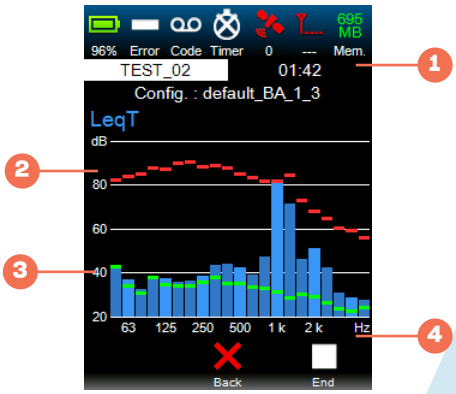
If a multispectrum measurement type is selected (button), the user can display the following data while the measurement is in progress:

01 – Measurement duration counter

02 – Maximum spectrum (red lines)

03 – Instantaneous spectrum (blue bargraph)

04 – Minimum spectrum (green lines)



Reverberation time

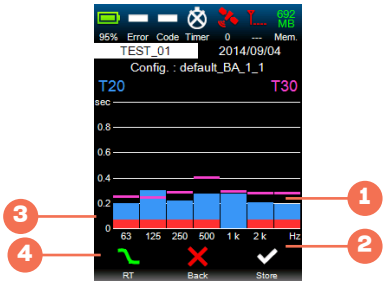
After a reverberation time measurement, the screen below is displayed showing the user all relevant information:

01 – In pink, the reverberation time T30

02 – In blue, the reverberation time T20

03 – In red, if at least one ISO 3382 indicator is not met

04 – Access to decay information

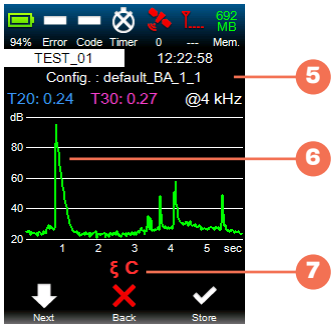


Pressing the decay button displays the decay data for each frequency band measured, with non-compliance indicator(s) including ISO 3382:

05 – Frequency band considered

06 – Decay

07 – ISO 3382 non-compliance indicator(s)



The ISO 3382 non-compliance indicators are as follows:

Name	Quality indicator	Description, default values
N	Background noise level too high*	Low dynamic range (T20 between 31-35 dB)
D	Calculation impossible*	Insufficient dynamic (< 41 dB for T30; < 31 dB for T20)
<	Reverberation time too low*	Tr < 0.24 seconds (scaled by logging period = 20 ms)
ξ	Non-linearity*	Non-linearity parameter ξ >1%
C	Curvature*	C > 10% or C < 0
L	Linearity of the sound source	Difference between adjacent 1/1 or 1/3 octave bands > 6 dB

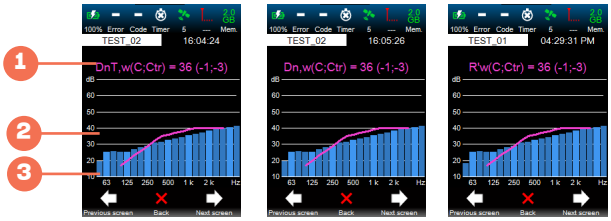
Sound insulation

Standardized and normalized sound insulation, and apparent sound reduction are calculated on the spot in the device; results are displayed per frequency spectrum as well as single index ratings according to ISO 717:

01 – Single index according to ISO 717

02 – Position of the reference curve

03 – Result spectrum



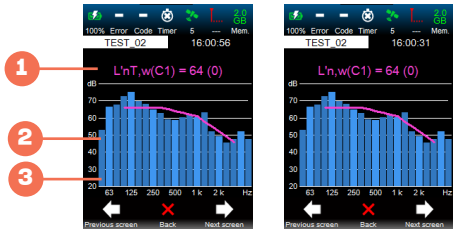
Impact noise level

Standardized and normalized impact noise levels are calculated on the spot in the device; results are displayed per frequency spectrum as well as single index according to ISO 717:

01 – Single index according to ISO 717

02 – Position of the reference curve

03 – Result spectrum



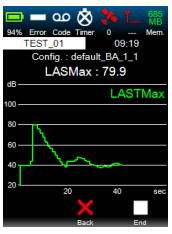
Equipment noise

If an equipment noise measurement type is selected (button), the user can display the following data while the measurement is in progress:

01 – Measurement duration counter

02 – Measured LAsmax

03 – Time history of LAs



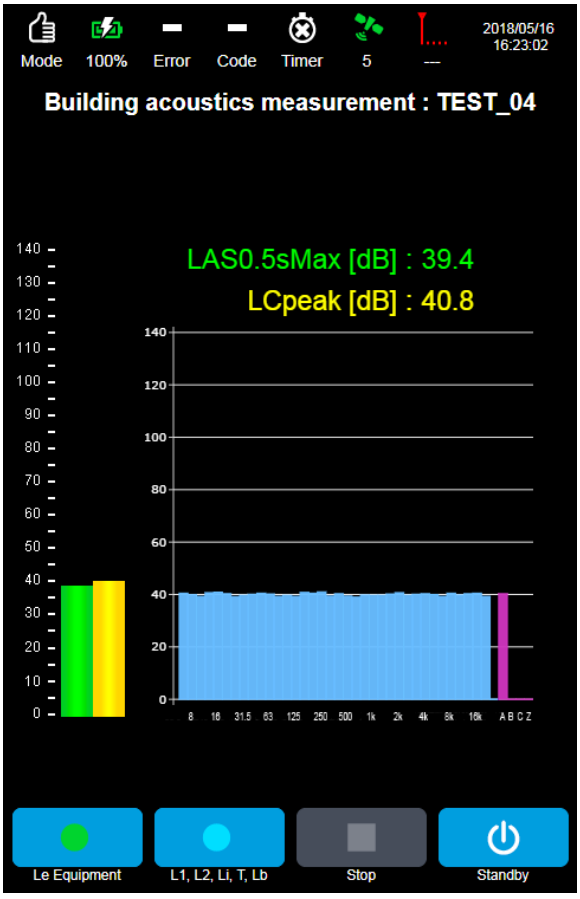
Even more smart features

Remote control of FUSION and DUO

The FUSION and DUO sound level meters include an embedded Wi-Fi module that can be used to operate remotely via a dedicated web interface. Using a smartphone, tablet or computer, the user can access all parameters and also start, view or stop current measurements:

01 – Start a multispectrum measurement

02 – Start an equipment noise measurement

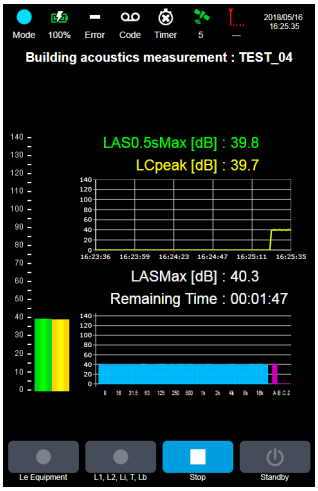


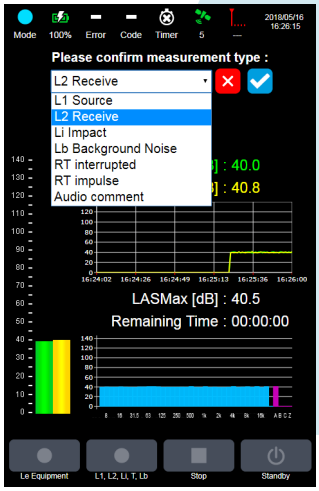
Remote controlled or handheld unit

This unique feature enables all users to choose how they wish to control their measurements: either using FUSION or DUO's built-in interface, or remotely.

Remote control offers numerous possibilities, including:

- no need to stay in the source or receive room
- control two FUSION or DUO for simultaneous measurements
- control the measurement from where you are (a lift, toilet, etc.). Measurement can be triggered and classified (subject to Wi-Fi range) remotely, avoiding the need for two operators to conduct this type of measurement and high noise exposure to the user (when the sound level meter is in the source room).





dBInside high-performance software

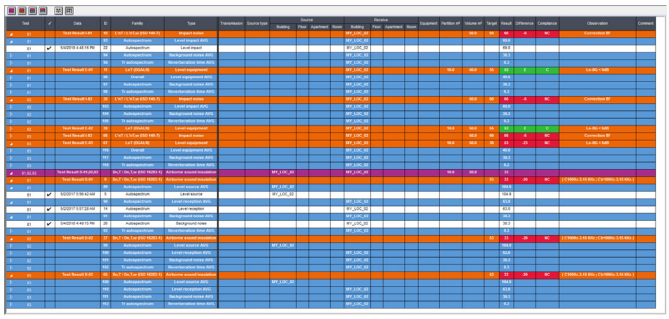
General presentation

dBInside program has a new interface designed to enhance acoustics consultants' efficiency and productivity. The purpose is to reduce the time spent on:

- data entry related to the measurements (measurement location and details, etc.),
- calculation of standardized indicators (unique indices)
- generation of measurement reports.

The main interface is organized as a table of information on tests results and measurements, including:

- Measurement type
- Transmission type (vertical, horizontal, diagonal, facade)
- Source measurement location
- Reception measurement location, etc

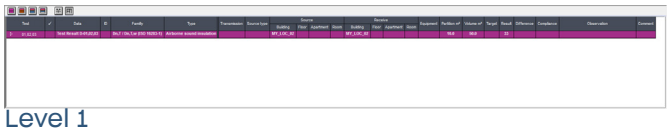


This interface comprises 4 levels which may be expanded simply by clicking on an icon. These 4 levels correspond to:

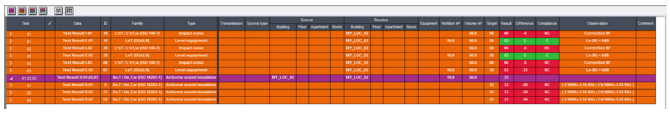
- Level 0: ISO 16283 group tests results to average results according to that standard
- Level 1: concatenated: Standardized test results
- Level 2: more information: add of averaged measurements
- Level 3: all information: add of all stored measured data

An example of the four levels is shown below:

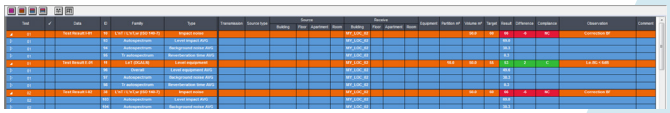
Level 0 (ISO 16283 only)



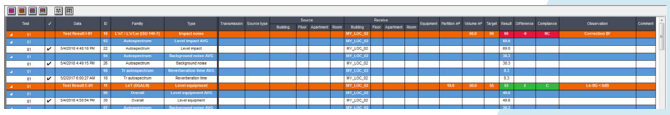
Level 1



Level 2



Level 3



Smart organization

The measurements organization in FUSION and DUO is effective when used with dBInside program. If the user opts for case 2 (page 6), they will have three tests (insulation, impact and equipment) with a single receiving room, in a single test container.

dBInside program will automatically understand that the container contains three separate tests and will accordingly assign the measurements to three test types, but using the same background noise level and the same reverberation time for each.

In the example below, the two tests are from a single test container with the same receiving room.

Test	#	Data	Family	Type	Transmission	Source type	Source				Receive			
							Building	Floor	Apartment	Room	Building	Floor	Apartment	Room
01		Test Result D-1	Dn,T / Dn,Tw (ISO 140-4)	Insulation	Horizontal	Noise source	A	1	111	Kitchen	A	1	112	Bedroom
01		Test Result I-1	L'nT / L'nT,w (ISO 140-7)	Impact noise	Horizontal		A	2	212	Bedroom	A	1	112	Bedroom

This feature makes it possible to process measurements more quickly by avoiding unnecessary operations.

Optimization of calculation time

This organization enables dBInside program to automatically calculate standardized ratings as a function of the selected standard, once the measurements are transferred. These indicators will be displayed in the test result line.

Target	Result	Difference	Compliance
	36		
	34		
	44.8		

The indicator will automatically be recalculated if any change is made to the test, such as recalculating a new average measurement result and test results accordingly if one or several measurements are deleted.

The user can also enter a target value in accordance with the local country regulations. dBInside program automatically shows the difference between the result and the target value. A change of color (green if compliance is fulfilled and red if not) provides a visual indication for quick identification.

Target	Result	Difference	Compliance
53	36	-17	NO
58	34	24	YES
35	44.8	-10	NO

Note: The second result in the table below is a standardized impact noise level.

Smart data entry

On-site entry of location information for all measurements is a tedious and laborious operation. However, this information is essential in order to produce test reports. With 01dB, this data is entered in dBInside program via a smart method.

The user simply enters the measurement location information in the testresult lines (orange cells in the table below).

Source				Receive			
Building	Floor	Apartment	Room	Building	Floor	Apartment	Room

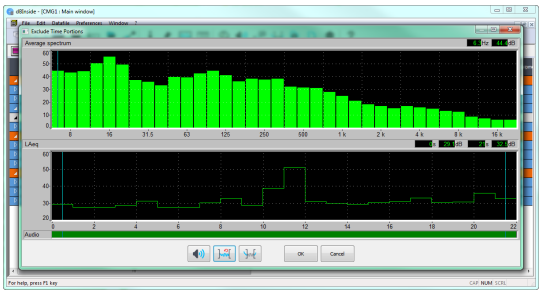
When the cell is filled in, the program automatically copies the information entered into the average results and into each measurement. This quickly produces the following table, for example:

Source				Receive			
Building	Floor	Apartment	Room	Building	Floor	Apartment	Room
A	**2**	**212**	**Bedroom**	**A**	**1**	**112**	**Bedroom**
A	**2**	**212**	**Bedroom**	**A**	**1**	**112**	**Bedroom**
A	2	212	Bedroom	A	1	112	Bedroom
A	2	212	Bedroom	A	1	112	Bedroom
				A	**1**	**112**	**Bedroom**
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	**1**	**112**	**Bedroom**
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	1	112	Bedroom
				A	1	112	Bedroom

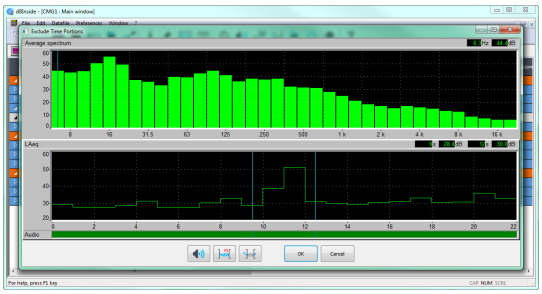
All the cells have been completed automatically by dBInside based on the orange cells.

Powerful tme history partial exclusion

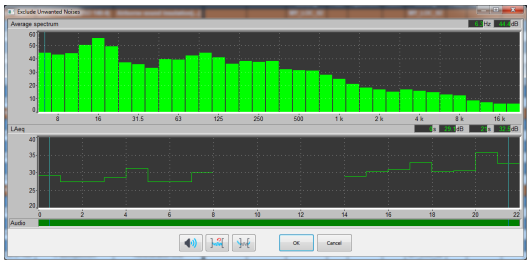
Sometimes in the field occurs unexpected noise; result is that the measurement is not valid. With the exclusion function it is now possible to playback the sound and on request, if an unexpected event is identified, a new overall spectrum is recalculated taking into account an partial exclusion selected between cursors. This feature can be used in all measurements except reverberation time:



Complete time history and average spectrum initial



Identification of the portion between cursors that needs to be excluded

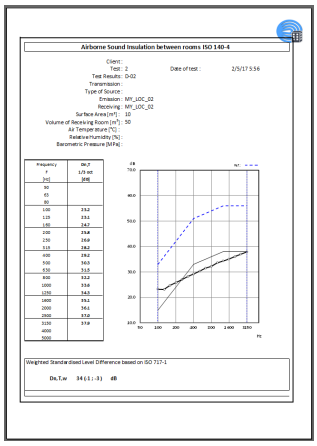


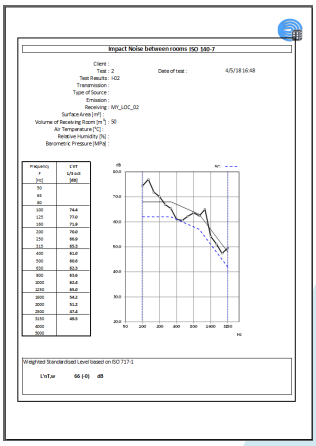
Recalculated average spectrum result

Reporting

Once all results have been validated by the user, standardized reports can be produced.

The test reports are generated in Microsoft® EXCEL using a template based on the ISO 140 standard.





These reports can be customized by the user.

In addition to the test report, the user can also access a summary table showing a simple view of all test results.

Test	Résultat d'essai	Transmission	Emission				Réception				Isolement		Conforme	Commentaire
			Bâtiment	Etage	Appartement	Pièce	Bâtiment	Etage	Appartement	Pièce	Minimum	Mesuré	O/N	
1	D-1	Horizontal	A	1	111	Chambre	A	1	112	Chambre	53	54	OUI	
2	D-2	Vertical	A	2	111	Chambre	A	1	211	Chambre	53	55	OUI	
3	D-3	Horizontal	A	2	120	Cuisine	A	1	121	Cuisine	50	51	OUI	
4	D-4	Horizontal	A	3	305	Cuisine	A	1	306	Chambre	53	52	OUI	

Main accessories

A number of accessories are used for building acoustics measurements, including noise sources:

- Unidirectional and omnidirectional airborne noise sources
- Tapping machine
- Tripod
- Facade measurement poles
- Microphone extenders, etc.

The following sections describe the noise sources:

Note: See the accessories data sheets for more information.

Tapping machine TM01

The TM01 tapping machine consists of an aluminium frame standing on 3 rubber feet, the height of which can be adjusted. It includes a camshaft that drives 5 hammers with a mass of 500g each, set 10 cm apart one from another. The TM01 machine allows for the hammers falling from a 40-mm effective height with a time interval of 100 ms between the drop of each hammer.

The TM01 machine includes a lead-acid gel battery that allows for an optimum and standardised continuous operation time of 2 hours.

A pushbutton is used to manage the operation of the machine. Depending on the length of time the button is pressed, the following actions can be achieved:

- Power-up of the machine: Short push (< 850 ms)
- Operating for 5 min: Short push
- Operating for 20 min: Long push (850-2,500 ms)
- Turn-off of the machine: Long push (> 2,500 ms)

The TM01 machine is supplied with a radio frequency remote control that allows for remote start and stop. The remote control is effective through the walls and floors normally built in residential and office buildings (the emitter's range in direct field is greater than 100 m).

Omnidirectional noise sources LS01/LS02

01dB offers 2 omnidirectional sources, LS01 and LS02, compliant with standards ISO 140 and ISO 3382.

Both sources have the same design. They consist of a 12-loudspeaker dodecahedron and contain each:

- a power amplifier
- a noise generator

Robust, compact and easy to implement, both sources LS01/LS02 can be driven using a remote control. In addition to starting and stopping the sources, the user can control:

- the volume level by +/-2 dB steps or with a known gain (0 dB, -8 dB, -30 dB...).
- the type of noise: pink, white, swept sine according to different frequency ranges

The LS01 source is delivered with a battery pack that provides more than 1 hour of operating time.

Noise source GDB-S

GDB-S is a compact unidirectional noise source including the following main elements:

- A power amplifier
- A pink noise generator
- A speaker

Hosted in a robust chassis, GDB-S is powered up by batteries that provide the user with 10 hours of continuous operating time.

The user can use the wireless remote control provided in order to start and stop the source.

Options available for fusion and duo instruments

Details of all options available for FUSION and DUO instruments are given in the corresponding instrument data sheets.

FSN2009000 - FUSION Option – Building Acoustics

For the FUSION Smart Noise & Vibration Analyzer, activation of parameters, acquisition and storage of building acoustics measurements (1/1 or 1/3 octave) including:

- spectrum of average levels in the source room during operation of the noise source
- spectrum of average levels in the receiving room during operation of the noise source
- spectrum of average levels in the receiving room during operation of the shock generator
- spectrum of average background noise in the receiving room
- reverberation time T20 & T30 with information regarding compliance of indicators with the ISO 3382-2 standard
- measurement of maximum equipment noise level

Parallel recording of audio signal, time history and fast logging time history of all instantaneous and instantaneous spectral parameters for each measurement

DUO2022000 - DUO Option – Building Acoustics

For the DUO Smart Noise Monitor, activation of parameters, acquisition and storage of building acoustics measurements (1/1 or 1/3 octave) including:

- spectrum of average levels in the source room during operation of the noise source
- spectrum of average levels in the receiving room during operation of the noise source
- spectrum of average levels in the receiving room during operation of the shock generator
- spectrum of average background noise in the receiving room
- reverberation time T20 & T30 with information regarding compliance of indicators with the ISO 3382-2 standard
- measurement of maximum equipment noise level

Parallel recording of audio signal, time history and fast logging time history of all instantaneous and instantaneous spectral parameters for each measurement

Fusion packages

Overall specifications

All FUSION packages contain the minimum following specifications:

- Point to point Wi-Fi connection
- Ethernet connection
- Wi-Fi data transfer
- Ethernet data transfer
- GPS location
- GPS or NTP time synchronization
- Periodic electrical check
- (multi CIC 5 frequencies, 2 levels)
- USB connection(mass storage)
- SD card reader
- 0° reference direction
- Web interface for remote control
- dBFileManager software for manual data transfer
- SLM mode (Start/Stop)
- LOG mode (time history)
- Instantaneous values (up to 44 values in parallel)
- Global values
- Global statistical values (7 Ln values)
- Back erase (mode SLM)
- Timer functions : immediate, delayed, daily periodic

Available packages

It is possible to order separately one or several options (for the delivery or as evolutions).

	FSN2001000 Logger	FSN2002000 Multispectra	FSN2003000 Audio Recording	FSN2004000 Triggers	FSN2006000 3G Modem	FSN2010000 Extended Triggers	FSN2005000 Advanced Indicators	FSN2011000 PNL/PNLT Indicators	FSN2007000 Weather	FSN2012000 http commands	FSN2013000 Push Data	FSN2008000 Vibration signal recording	FSN2009000 Building Acoustics
FSN3030000 Logger 3G	•	○	○	•	•	○	•	•	○	○	•	○	○
FSN3031000 Analyser 3G	•	•	○	•	•	○	•	•	○	○	•	○	○
FSN3032000 Expert 3G	•	•	•	•	•	•	•	•	○	○	•	○	○
FSN3014000 Building Wi-Fi	○	○	○	○	○	○	○	○	○	○	○	○	•

Packages

DUO overall specifications

All DUO packages contain:

- Point to point Wi-Fi connection
- Ethernet connection
- 3G Modem
- Wi-Fi data transfer
- Ethernet data transfer
- GPS location
- Integrators HTTP commands
- GPS or NTP time synchronization
- Periodic electrical check (multi CIC 5 frequencies, 2 levels)
- USB connection(mass storage)
- SD card reader
- 0° reference direction
- 90° reference direction
- Remote control by web interface
- Automatic data transfer in push mode
- dBFileManager software for manual data transfer
- SLM mode (Start/Stop)
- LOG mode (time history)
- Instantaneous values (up to 44 values in parallel)
- Global values
- 1/1 or 1/3 octave
- Global statistical values (7 Ln values)
- PNL/PNLT indicators
- Sliding LAeq, sliding Ln and exposure level
- Audio recording
- Back erase (mode SLM)
- Timer functions : immediate, delayed, daily periodic
- 5 user-definable events

Available kits

It is possible to order separately one or several options (for the delivery or as evolutions).

	DUO2020000 Logger	DUO2001020 Multispectra	DUO2002000 Audio recording	DUO2003000 Triggers	DUO2004000 3G modem	DUO2005000 Extended Triggers	DUO2006000 Advanced Indicators	DUO2007000 PNL/PNLT Indicators	DUO2008000 Weather	DUO2009000 Http commands	DUO2019000 Push Data	DUO3026000 Vibration signal recording	DUO2022000 Building Acoustics
DUO3032000 Advanced 3G	•	•	•	•	•	•	•	•	•	•	•	○	○

Technical specifications – fusion/duo building solution

FUSION/DUO Software

Product Code

FSN2009000: Building option for FUSION

DU02022000: Building option for DUO

Frequency-based analysis

1/1 or 1/3 octave, 50 to 5000 Hz

Levels L_1, L_2, L_i (Source room, Receiving room, Impact noise)

Calculation of the mean spectrum LZeq over the specific coding duration, detected automatically (source on duration)

Post-processing:

According to ISO717: DnT,w(C;Ctr), Dn,w(C;Ctr), R'w(C;Ctr), L'nT,w(CI), L'n,w(CI)

Background noise level Lb

Calculation of the mean spectrum over the entire measurement duration

Integration times (IT)

1 second; 20 milliseconds

Maximum averaging time for spectra L_1, L_2, L_b and L_i

120 seconds

Maximum measurement time for equipment noise

600 seconds

Simultaneous audio recording

Sampling frequency: 51.2 kHz, 25.6 kHz, 12.8 kHz, 6.4 kHz, 3.2 kHz, 1.6 kHz

Equipment noise levels

Selection of the maximum level for one of the following parameters: LXYMax where X = A, C or Z and Y = F, S or I

Calculation of reverberation times

Fine IT 20 ms for decay analysis

Simultaneous calculation of T20 and T30

Automatic detection of interrupted or pulsed noise sources

Schroeder integration for pulsed sources

Estimate by least squares approximation

Calculation of quality indicators (ISO 3382)

Name	Indicator	Description
N	Background noise level too high*	Low dynamic range (between 41 and 45 dB for T30; between 31 and 35 dB for T20)
D	Calculation impossible*	Insufficient dynamic range (< 41 dB for T30; < 31 dB for T20)
<	Reverberation time too low	Tr < 0.24 seconds (scaled by logging period = 20 ms)
ξ	Non-linearity*	Non-linearity parameter ξ >1%
C	Curvature*	C > 10% or C < 0; see [1] appendix B.3
L	Linearity of the sound source linearity	Difference between adjacent 1/1 or 1/3 octave bands > 6 dB

*: ISO 3382-2 standard indicator

Invalid indicators displayed on the Tr spectrum and stated on decay

Audio comments

Used to store a voice comment, with the same sampling frequency as for the measurement

dBInside software

Product Code

SBU2001000: dBInside software for PC

SBU3001000: dBBATI to dBInside update

Language

French

English

Data transfer

- USB interface
- Ethernet interface
- Wi-Fi link
- SD card reader

Organization

- All measurements and results are displayed in a four-level table:
- Results of the averaged standardized calculation for a test (ISO 16283)
- Results of the standardized calculation
- Result of the average level of all measurements of a given type for a single test
- Individual measurement for each microphone position

Display of spectral values

The four 1/1 or 1/3 octave level types (described above) may be displayed as bars, line (stair mode) or line (mountain mode).

A cursor can be used to display the values for each band.

Display of reverberation times

For reverberation time measurements, the decay values for each frequency band measured can be displayed.

List of values

The values of each result or measurement may be displayed as a table of values.

Output : Graphical or tabular; may be printed directly.

It is also possible to copy and paste images and values into office tools such as the Microsoft® Office suite.

Reports

Reports are generated via an interface with Microsoft® Excel 2010.

All reports may be customized by the user.

Technical specifications - fusion

IEC class:

IEC 61672-1 (2002-2005) (0° and 90° reference direction)

IEC 61620 (1995) NF EN 61260/A1 (2002)

Sound Level Meter, Integrating Sound Level Meter with storage, group X.

Type approval

LNE-27092 rev0 20th March 2014

PTB (soon available)

Dynamic range

21-139 dB (A, B), 26-139 dB (C), 31-137 dB (Z),

1 single range for a rated sensitivity of 40 mV/Pa

Linear operating range for A weighting (5 frequencies)

31,5 Hz : 26-98 dB

1 kHz : 23-138 dB

4 kHz : 23-138 dB

8 kHz : 23-134 dB

12,5 kHz : 23-130 dB

Dynamic range Peak

61-140 dBC, 1 single range

Time weightings

Slow, Fast, Impulse, Peak

Frequency weightings

X=A, B, C, Z; Y=S, F, I for LXeq and LXY

X=A; Y=S, F, I for LXYTd

X=C, Z for LXpk

Instantaneous broadband values stored

LnsT (sliding Ln)

LAeqsT (sliding LAeq)

LAexPT (exposure level)

	LXY				LXYeq				LXYTd	LXYMinMax			
	A	B	C	Z	A	B	C	Z	A	A	B	C	Z
F	X	X	X	X	X	X	X	X	X	X	X	X	X
S	X	X	X	X	X	X	X	X	X	X	X	X	X
I	X	X	X	X	X	X	X	X	X	X	X	X	X
Pk			X	X									

Instantaneous weather data stored

Wind speed [m/s]

Wind direction [°]

Rain intensity [mm/h]

Barometric pressure [hPa]

Air temperature [°C]

Humidity [%HR]

Noise logging period T

Mini 20ms - maxi 3600s, 5 ms steps

Short logging period: mini 20ms – max standard T,

5 ms steps.

Short logging period applicable during events

Short logging period must be a divisor of T

Weather logging period

Weather logging period is a multiple of T with a minimum of 1 second

Spectral analysis

Parallel measurement and storage of Leq and LY (Y=F, S, I)

Filters

1/1 (8Hz-16kHz) et 1/3 (6.3Hz-20kHz)

Statistics

7 selectable Ln in parallel from L1 to L99, 1 dB class

Samples for calculation: T if Leq or 20 ms if LXY,

0.1 dB resolution

Back erase

0, 5s or 10s, SLM mode only

Input high pass filter

0,3 Hz / 10 Hz

Reference directions

0° on internal input

0° and 90°, selectable built-in correction on external input (with a DMK01 external microphone)

Reference point for microphone

Centre of the protection grid (with or without nose cone)

Reference level

94 dB

Starting point for linearity tests

Reference level, i.e. 94 dB

Data storage modes

SLM (hand-held sound level meter) and LOG (logging sound level meter)

Audio recording

Uncompressed metrological signal, Fs = 51200 Hz

Sampling frequencies: 51200, 25600, 12800, 6400, 3200, 1600 Hz

Pre-trigger = 10s at Fs=51200 Hz

LEMO output connector

Vibration

Signal: Metrological, Fs = 12,800 Hz

Pre-trigger = 0 sec

1 (Z) or 3-axis(X, Y and Z)

Audio recording triggers

Simultaneously with events and manual (using FUSION integrated key and web interface for remote control)

Events (automatic coding)

1 user-definable event: codes 6 to 10

24 user-definable time periods

Triggers

Settings for pre-trigger, post-trigger, minimum time, end time

Types: on instant acoustic and weather values (except wind direction), instant spectral values, TTL input

Manual markers

On the instrument: 1 code “code 1”

On web interface: 5 codes: “codes 1 to 5”

Timers

Immediate, differed, daily periodic

Audio: periodic

Typical background noise

(with 40CE mounted on FUSION)

	Background noise (dB)		Expanded uncertainly (k=2) (dB)
	Electronic	Total	
LpA,F	13	18.5	0.3
LpA,S			
LAeq			
LpC,F	13.5	19.1	
LpC,S			
LpZ,F	18.5	20.5	
LpZ,S			

Preamplifier

Integrated, not removable

External type PRE22 (included in DMK01) on external input (standard 10 m lemo extension cable)

Integrated keys

4 silent keys: on/stand-by/off and 3 multi-functions keys

Status indicators

LED red (overload)

LED blue (Wi-Fi connection)

LED green (power ON, blinking on on-going measurement, charge ON)

Display

High contrast colour screen 38*50mm resolution 320*240 pixels

3 sets of colours (day, contrast, night)

Display rate: 0.1s, Display resolution: 0.1dB

USB connection

Type 2.0; mass storage mode, charge on USB

Ethernet connection

Connector RJ45, Speed: 100 MB/s

DHCP mode

Wi-Fi Connection:

IEEE 801.11b, g

Point-to-point connection and infrastructure mode

Cellular network connection

Embedded modem 3.5G compatible with 4-band GSM/GPRS/EDGE and 3-band UMTS/HSDPA

Data connectivity

Integrated Network protected http server for web interface

Integrated FTP server for data access

Voice activation on cellular network

Possibility to call the instrument phone number with « voice » subscription to listen to the on-going measurement; Gain 20dB gain, signal compression in modem

SMS alarms

- On event: SMS text with DUO serial #, location, date and time, user defined text, IP address:http port
- On low battery (10%): SMS text with DUO serial #, location, date and time, % remaining battery
- On movement: SMS text with DUO serial #, location, date and time, GPS coordinates, distance from previous location, IP address:http port (the alarm trigs if DUO has moved more than the user defined distance)

Automatic SMS actions

- Sending “IP” by SMS to instrument makes it reply by sending an SMS with instrument serial #, location, date and time, IP:port address and automatically sends a new SMS at every new IP address in case of floating IP

Actions on SMS sent to the instrument

- On SMS sent “IP”, the instrument replies by sending an SMS with the instrument serial #, location, date and time, IP:port address
- On SMS sent “stop”, the instrument stops replying new SMS if IP has changed
- On SMS “reboot”, the instrument reboots to establish a new connection and replies with an SMS with instrument serial #, location, date and time, IP :port address

Web interface refresh rate webpages

Standard: twice per second

Mobile: once per second

Analogue output

Audio output A, B, C or Z (+/-10Vpp R=2000hms)

Adjustable gain: 0, 10, 20, 30, 40, 50 dB

Electrical check

Programmable periodicity: 1, 2 or 4 times per day (0h,0h-12h, 0h, 6h, 12h, 18h)

3 pre-set frequencies (1000 Hz, 2000 Hz, and 4000 Hz) and 2 user-defined frequencies (between 10 Hz and 20 kHz)

2 user-defined excitation levels, maximum level 5 V (100%)

External microphone input

For DMK01, PRE22 (R = 560kOms / 22Vpp (+/- 11V)

TTL output

R = 100 Ohms / 0 / 5V

TTL input

R = 100 kOhms / 0...1V = "0" 1.8...5V ="1"

Battery

Type lithium polymer

Voltage 3.7V

Capacity 6750 mAh

Non removable, charging time approximately 3 hours

Typical power consumption

Without communication: < 800 mW

+ Wi-Fi : < 1,600 mW

+ Modem : < 3,500 mW

Operating lifetime

20 hours with Wi-Fi connection (during 10% of measurement time)

15 hours with active 3G connection (during 10% of measurement time)

(for temperatures ranging from 10°C to 50°C, in LOG mode with IT = 1 s, fine IT 100 ms, 1/3 octave and audio recording on threshold during 10% of the measurement time)

External power supply

DC 8 to 28 V on charge input

DC 5 V on USB input (slow charge)

Memory

SD, SDHC or SDXC card, 2 GB or higher (2GB standard delivery) for measured data and signals. Minimum recommended requirement: ≥ class 10. Please note only SD cards provided by 01dB should be used.

01dB cannot be held responsible for data loss if the SD card used is not delivered by 01dB.

Measured data stored on the SD card every 10 seconds.

Non-volatile memory for configurations, system log (500), calibration data (500) and electrical checks (500)

Clock

GPS PPS, error < 50 milliseconds

Internal clock, error < 0.5 s/24 hours

Localization

Automatic with integrated GPS

Information stored with measurement campaigns

Warm-up time

From power off: < 25 seconds

Operating temperature:

-10°C to +50°C

Humidity

IEC 60068-2-78: damp heat: 90% HR (non condensing at 40°C)

Electromagnetic compatibility

According to Directive 2004/108/EC

NF EN 61000-6-1 NF EN 61000-6-2 NF EN 61000-6-3 NF EN 61000-6-4 (2001)

ETSI EN 300 328 V1.5.1 (2004)

Protection

IP40 in standard use

Influence of vibration

Use with no outdoor microphone:

- For mechanical vibration of an acceleration level of 1 m/s² perpendicular to the microphone diaphragm, at frequencies 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz and 1000 Hz: the lower limit of the linear operating domain for A-weighting becomes 80 dB.
- For mechanical vibration of an acceleration level of 1 m/s² parallel to the microphone diaphragm, at frequencies microphone diaphragm, at frequencies 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz and 1000 Hz: the lower limit of the linear operating domain for A-weighting becomes 60 dB.

Use with outdoor microphone unit DMK01:

- For mechanical vibration of an acceleration level of 1 m/s² perpendicular to the microphone diaphragm, at frequencies microphone diaphragm, at frequencies 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz and 1000 Hz: the lower limit of the linear operating domain for A-weighting becomes 75 dB.

Weight and dimensions

775 g

H x L x P: 300 x70 x 52 mm

Optional Accessories

- Weatherproof external charger IP67 (10m cable)
- Weather station VAISALA type WMT52 specific for the instrument (2 parameters: wind speed and direction)
- Weather station VAISALA type WXT520 (6 parameters: wind speed and direction, rain intensity, relative humidity, air temperature, barometric pressure, Connection cable between weather station and the instrument by mini HDMI cable
- Outdoor microphone unit type DMK01 including preamplifier type PRE22, 10 m cable and nose cone. The use of RAL135 10 m cable does not need any particular correction.
- All weather case DSC01 with option 1 battery (10-days) or 2 batteries (20-days)
- Wireless vibration sensor 3-axis (X, Y, Z) 80g, Weight 280 g, Dimension Ø40 x H115 mm, 8h battery life.

Connecting these accessories has no influence on measurements

Technical specifications - duo

IEC Class

IEC 61672-1 (2002-2005) (0° and 90°), class 1

IEC 61260 (1995) NF EN 61260/A1 (2002)

Type approval (extract)

LNE-21674 rev1 14th September 2012

PTB-1.63-4052726 6th February 2012

Dynamic range

20-137 dB (A, B), 25-137 dB (C), 30-137 dB (Z),

1 single range for a rated sensitivity of 50 mV/Pa (between 46 and 56mV/Pa)

Linear operating range for A weighting (5 frequencies)

31,5 Hz: 20-97 dB

1 kHz: 20-137 dB

4 kHz: 20-137 dB

8 kHz: 20-133 dB

12,5 kHz: 20-129 dB

Dynamic range Peak

60-140 dBC, 1 single range

Time weightings

Slow, Fast, Impulse, Peak

Frequency weightings

X=A, B, C, Z; Y=S, F, I for LXeq and LXY

X=A; Y=S, F, I for LXYTd

X=C, Z for LXpk

Instantaneous broadband values stored

	LXY				LXYeq				LXYTd	LXYMinMax			
	A	B	C	Z	A	B	C	Z	A	A	B	C	Z
F	X	X	X	X	X	X	X	X	X	X	X	X	X
S	X	X	X	X	X	X	X	X	X	X	X	X	X
I	X	X	X	X	X	X	X	X	X	X	X	X	X
Pk			X	X									

PNL and PNLT (Perceived noise level) aircraft and helicopter

LnsT (sliding Ln)

LAeqsT (sliding LAeq)

LAexPT (exposure level)

Instantaneous weather data stored

Wind speed [m/s]

Wind direction [°]

Rain intensity [mm/h]

Barometric pressure [hPa]

Air temperature [°C]

Humidity [%HR]

Noise logging period T

Mini 20ms - maxi 3600s, 5 ms steps

Short logging period: mini 20ms – max standard T, 5 ms steps.

Short logging period applicable during events

Short logging period must be a divisor of T

Weather logging period

Weather logging period is a multiple of T with a minimum of 1 second

Spectral analysis

Parallel measurement and storage of Leq and LY (Y=F, S, I

Filters

1/1 (8Hz-16kHz) et 1/3 (6.3Hz-20kHz)

Statistics

7 selectable Ln in parallel from L1 to L99, 1 dB class

Samples for calculation: T if Leq or 20 ms if LXY,

0.1 dB resolution

Back erase

0, 5s or 10s, SLM mode only

Input high pass filter

0,3 Hz / 10 Hz

Reference directions

0° and 90°, correction applicable for internal input and external input if used with DMK01

Data storage modes

SLM (hand-held sound level meter) and LOG (logging sound level meter)

Audio recording

Uncompressed metrological signal, Fs = 51200 Hz

Sampling frequencies: 51200, 25600, 12800, 6400, 3200, 1600 Hz

Pre-trigger = 10s at Fs=51200 Hz

LEMO output connector

Audio recording triggers

Simultaneously with events and manual (using DUO integrated key and web interface remote control software)

Automatic event detection

5 user-defined events: markers 6 to 10

24 user-defined periods per day

An event is defined by a logic combination of up to 5 different triggers (“and” or “or”)

Triggers

Pre-trigger, post trigger, minimum duration, end duration

Based on instantaneous acoustic (broadband and spectral) and weather data (except wind direction) and TTL input

Manual markers

On DUO instrument: marker 1

On web interface remote interface software: 5 markers 1 to 5

Timers

Immediate, differed, daily periodic

Audio: periodic

All weather microphone + nose con

½’’ pre-polarized GRAS microphone type 40CD

Nose cone RA0208; stainless steel

Background noise (typical)

Microphone (thermal noise): 14.5 dBA, 15.3 dBZ

Electronic: 11 dBA, 18.5 dBZ

Total: 16.1 dBA; 20.2 dBZ

Preamplifier

Integrated, not removable

External type PRE22 (included in DMK01) on external input (standard 10 m lemo extension cable)

Integrated keys

LED red (overload)

LED blue (Wi-Fi connection)

LED green (power ON, blinking on on-going measurement, charge ON)

Status indicators

Weather logging period is a multiple of T with a minimum of 1 second

Display

High contrast colour screen 38*50mm resolution 320*240 pixels

3 sets of colours (day, contrast, night)

Display rate: 0.1s, Display resolution: 0.1dB

USB connection

Type 2.0; mass storage mode, charge on USB

Ethernet connection

Connector RJ45, Speed: 100 MB/s

DHCP mode

Wi-Fi connection

IEEE 801.11b, g standard

Point to point connection only

Cellular network connection

Embedded modem 3.5G compatible with 4-band GSM/GPRS/EDGE and 3-band UMTS/HSDPA

Data connectivity

Integrated Network protected http server for web interface

Integrated FTP server for data access

Voice activation on cellular network

Possibility to call DUO phone number with « voice » subscription to listen to the on-going measurement; Gain 20dB gain, signal compression in modem

SMS alarms

- On event: SMS text with DUO serial #, location, date and time, user defined text, IP address:http port
- On low battery (10%): SMS text with DUO serial #, location, date and time, % remaining battery
- On movement: SMS text with DUO serial #, location, date and time, GPS coordinates, distance from previous location, IP address:http port alarm trigs if DUO has moved more than the user defined distance)

Automatic SMS actions

By sending “IP” by SMS to DUO it replies by sending an SMS with DUO serial #, location, date and time, IP adress: http port and automatically sends a new SMS at every new IP address in case of floating IP

Actions on SMS sent to DUO

- On SMS sent « IP », DUO replies by sending an SMS with DUO serial #, location, date and time, IP:port address
- On SMS sent « stop », DUO stops replying new SMS if IP has changed
- On SMS « reboot », DUO reboots to establish a new connection and replies with an SMS with DUO serial #, location, date and time, IP :port address

Web interface refresh rate webpages

Standard: twice per second

Mobile: once per second

Analog output

Audio: A, B, C or Z

Gain: 0, 10, 20, 30, 40, 50 dB

(Disabled if external input selected)

Electrical check

User defined periods 1, 2 or 4 times a day (0:00; 0:00 and 12:00; 0:00, 6:00, 12:00 and 18:00)

3 predefined frequencies (1000, 2000 and 4000 Hz) and 2 user defined frequencies (between 10 Hz and 20 kHz)

2 user defined excitation levels, max 5V (100%)

External preamplifier input

For DMK01, PRE22; (R=560k0ms / 22Vpp +/- 11V)

TTL output

R = 100 0hms / 0 / 5V

TTL input

R = 100 k0hms / 0...1V = "0" 1.8...5V ="1"

Battery

Type lithium polymer

Voltage 3.7V / Capacity 18.9 Ah

Non removable, charging time around 8 hours

Typical power consumption

Without communication: < 800 mW

+ Wi-Fi: < 1100 mW

+ Modem: <3500 mW

Autonomy

(For temperatures between 10°C and 50°C, in LOG mode with T = 1s, fine T = 100ms, 1/3octave band spectra and audio recording on trigger during 10% of the time)

60 hours with Wi-Fi active communication during 10% of the time

48 hours with 3G active communication during 10% of the time

Memory

32GB (or more) SD-, SDHC- or SDXC-cards (2GB = standard delivery) for measured data and audio. Recommendation is Class 10 minimum.

01dB delivers tested/validated 2GB & 32GB SD-Cards for usage with DUO.

Data stored on DUO SD card every 10 seconds.

Nonvolatile memory for storage of configurations, system log, calibration data (500) and electrical checks (500)

Clock

GPS PPS, error < 50 ms

NTP Synchronisation

Internal clock drift < 0.5s/24h

Localization

Automatic with integrated GPS

Information stored with measurement campaigns

Warm-up time

From power off: < 20 seconds

Operating temperature

-10°C to +50 °C

Humidity

CEI 60068-2-78: damp heat 90% HR (none condensing at 40°C)

Electromagnetic compatibility

According to Directive 2004/108/EC

Protection

IP55 mounted vertically with connectors cover

Weight and dimensions

1100 g - H x L x P: 360 x70 x 52 mm

Accessories

- Weatherproof external charger IP67 (10m cable)
- Weather station Vaisala type WMT52 specific for DUO (2 parameters: wind speed and direction)
- Weather station Vaisala type WXT520 (6 parameters: wind speed and direction, rain intensity, relative humidity, air temperature, barometric pressure
- Connection cable between weather station and DUO, includes weatherproof external charger for powering simultaneously DUO and the weather station
- Outdoor microphone unit type DMK01 including preamplifier type PRE22

Connecting these accessories has no influence on measurements

Technical specifications – noise sources

Tapping Machine TM01

Reference standards

ISO140 parts VI, VII and VIII

ISO 717

DIN 52210

BS 5821

ASTM E-492

ASTM E-1007

EC compliance

EN50081-1 and EN50082-1

Features of the hammers

Number: 5

Material: Stainless steel

Weight: 500 g +/- 6 g

Diameter: 30 mm +/- 0.2 mm

Separating distance: 100 mm

Rated drop height: 40 mm

Rate: 10 impacts per second

Sequence: 1, 3, 5, 2, 4

Calibration

Each machine is delivered with its conformance certificate

Overall dimensions

L x H x D: 650 x 215 x 275 mm (25.6 x 8.6 x 10.8")

Weight

10.2 kg / 22.5 lb (including battery)

Stabilising feet

Number: 3

Adjustable height with provided wrench

Drop height gauge provided

Power supply

External charger

Input: 100-240V CA, 50/60Hz, 1.0A

Output: 18V 2.22A

Consumption: 40W max.

Battery

Type: lead acid gel with no maintenance

Operating life: > 2 continuous hours

(guaranteed impact rate)

Charging time: about 8 hours

Multifunction pushbutton

Short push: ON / Operating (5 min) / Pause

Long push: Operating (20 min)

Longer push: OFF

Remote control

Number of keys: 1

Frequency: 433 MHz, EMC compliant with European standard

Operating range: 100 m in free field

L x H x D: 6.7 x 1.7 x 3.6 mm (0.26 x 0.07 x 0.14")

Weight: 26 g / 0.06 lb

Temperature

Operation: from -10 to +50° C / 90% RH

Storage: from -20 to +70° C / 90% RH

Maintenance

No lubrication required

Conformance checking is advised every 2 years

Warranty

2 years for parts and labour

Available options

FL01 carrying case

Weight: < 5 kg

Dimensions: 705 x 270 x 350 mm (29.5 x 10.6 x 13.8'')

SWT001 remote control for SOLO sound level meter

GDB-S Noise Source

Reference standards

ISO140 / ISO 717

ISO 10052 / ISO3382

DIN 52210

EC compliance

EN 60065 (06/2004) + A1 (01/2007)

Immunity: EN 55024 (09-1998) + A1 (10-2001) + A2 (01-2003)+S1 (03-2008)

Emission : EN 55022 (01-2009)

Dimensions

L x H x P: 310 x 430 x 200 mm

Weight

15 kg (with batteries)

Temperature

Operating: -10 à +40° C / 90% RH

Storage: -20 à +60°C / 90% RH

Remote control

Number of keys: 1

Frequency: 433 MHz EMC compliant European standard

Operating range: 100 m in free field

Masse : 26 g

Power supply

Internal charger 220V/12V with charge limiter and colour LED for charge information.

Batteries

2 batteries 6V

Type: lead acid gel with no maintenance

Operating life: 10 continuous hours

Charge duration: 12 hours

Noise generator

Pink noise

Sound pressure level at 1m

105.5 dB(A) / 107 dB(Z)

Warranty

1 years for parts and labour

Accessories provided

Power supply cable

Remote control

LS01/LS02 Noise Sources

Reference standards

ISO140 / ISO 717

ISO 10052 / ISO3382

DIN 52210

EC compliance

EN 60065 (06/2004) + A1 (01/2007)

Immunity: EN 55024 (09-1998) + A1 (10-2001) + A2 (01-2003)+S1 (03-2008)

Emission : EN 55022 (01-2009)

Dimensions

Ø 33cm

Weight

11.5 kg for LS01

9.5 kg for LS02

Temperature

Operating: from -10 to +40°C / 90% RH

Storage: from -20 to +60°C / 90% RH

Remote control

Number of keys: 16

Frequency: 868 MHz, EMC compliant with European standards

Operating range: 20 m in free field

Dimensions L x h x w: 150 x 20 x 90

Weight: 200 g

Battery pack (only for LS01)

4 x 12/7.2Ah elements

Resettable internal fuse

Battery life: 60 minutes

Dimensions LxWxH: 360x140x115 mm

Weight: 10.8 kg

Power supply

230 VAC ±10% 50 / 60 Hz 300W

Line input

0.7 VRMS

Protection

Fuse: 2.5 A (5x20) -T- “delayed”

Input Impedance

10KΩ

Cooling

Internal fan (2 speeds)

Noise generator

Pink noise, White noise, Swept sine

Fast white, fast pink

LS01 output level

Lw : 122dB, ref 1pW in (Max. output level) (switch position “I”)

Lw : 115dB ref 1pW in (LINEAR) (switch position “II”)

LS02 output level

Lw : 121dB, ref 1pW in (Max. output level) (switch position “I”)

Lw : 115dB ref 1pW in (LINEAR) (switch position “II”)

Frequency response

50-20,000 Hz ± 3 dB switch on “LINEAR” position

Pink noise: 50-20,000 Hz

White noise: 40-20,000 Hz

Swept sine: 100-8,000 Hz

Fast white: 50-20,000 Hz

Fast pink: 40-20,000 Hz

Maintenance

Checking of conformity is advised every 2 years

Warranty

2 years for parts and labour

Accessories provided

Carrying case: 420 x 480 x 420 mm

Aluminium tripod Hmax: 2 m weight: 2.7 kg

Remote control (batteries included)

Battery pack 60 minutes (only for LS01)

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acoem
CREATING ENVIRONMENTS OF POSSIBILITY

Global head office
200 chemin des Ormeaux
69578 Limonest Cedex
Lyon France

+33 4 7252 4800 | info.fr@acoem.com