PRODUCT DATA

PULSE Multichannel Sound Power — Type 7748
Version 1.2

Multichannel Sound Power offers the easiest way yet to measure sound power and other important sound characteristics of products according to the widely used ISO 3744, 7779, and 11201 standards, or according to user-defined settings. Type 7748 controls PULSE™, the Multi-analyzer System, making it the first sound power system to offer powerful multichannel and multi-analysis capabilities together in one package.

The program is based on an easy-to-follow flowchart that guides you step by step through every part of the measurement process, from setup, calibration and measurement to displaying results and generating reports.

Type 7748 also includes advanced batch-measurement capabilities for saving time and improving the consistency and quality of your results.

7748

Brüel & Kjær

Uses and Features

USES

- ❍ Uses PULSE, the Multi-analyzer System Type 3560 to make multichannel, multi-analysis measurements
- ❍ Determination of sound-pressure-based sound power according to ISO 3744 (1994), the most general and frequently used standard for measuring the sound power of a wide range of products
- ❍ Determination of sound-pressure-based sound power assuming an essentially free field over a reflecting plane but not according to any standard
- ❍ Determination of the directivity index at every measurement surface microphone position
- ❍ Measurement of sound pressure levels and calculation of the impulsive noise index at operator and bystander (workstation) positions according to ISO 7779 (1999) and ISO 11201 (1995)
- ❍ Detection of discrete tones at workstation positions according to ANSI S1.13 (Prominence Ratio) and ISO 7779 (1999) (Tone-to-Noise Ratio)

FEATURES

- ❍ Runs under Microsoft® Windows NT®
- ❍ Runs with both Stationary PULSE Type 3560 A and Portable PULSE Type 3560 C
- ❍ Clear and intuitive user interface based on a flowchart that leads you through the initial setup, calibration, measurement, and displaying and reporting of results
- ❍ Advanced batch-measurement capabilities
- ❍ Measurements in single or multiple passes: division into passes occurs automatically according to system resources and channel number license. Manual setup is possible
- ❍ Automatic notification of non-compliance with ISO standards
- ❍ Easy to generate reports in Microsoft Word
- ❍ Easy export of data to Microsoft Excel for further post-processing
- ❍ On-line, context-sensitive Help and User Manual

Introduction

A combination of increasing legislation and customer pressure is making noise emissions a significant product differentiator. For instance, in the European Union, some EU directives, which set requirements that must be met by certain categories of product sold in the EU, include requirements for declarations of noise emission. Directive 1998/37/EC (Machinery Directive), which applies to any machine with moving parts, requires the declaration of sound pressure levels and sound power levels when the sound pressure level exceeds 85 dB. Directive 2000/14/EC, which applies to equipment used outdoors (mainly construction and garden equipment), requires declaration of the guaranteed sound power level, measured based on the methods of ISO 3744 (1994).

When speaking of product sound measurements driven by customer demands, not only is the sound power level of concern, but also characteristics of the sound field that can cause great discomfort to the human listener, such as audible discrete tones and impulsive noise. Discrete tones are audible sounds of a single frequency; impulsive noise is noise of short duration and relatively high amplitude.

Another important parameter that characterises the sound field is directivity, which is defined as the spatial variation of the sound field. A sound field is highly directive if a disproportionately large amount of sound generation occurs in a relatively small area, such as around an exhaust pipe.

Multichannel Sound Power is an OLE-based application that interfaces with PULSE, the Multi-analyzer System Type 3560 to use its advanced features to calibrate, measure, display results and generate reports.

Flowchart

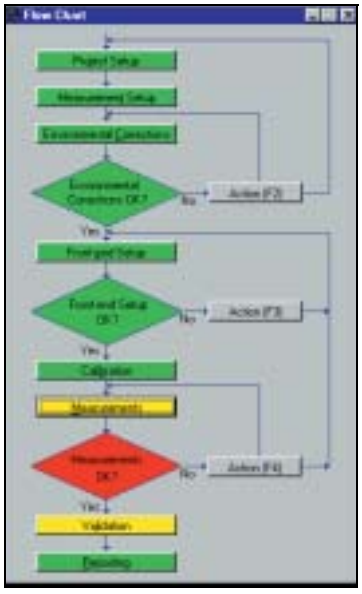


Fig. 1
The Multichannel Sound Power flowchart. *The colours for each step indicate the current status. If an error occurs, such as a faulty calibration or a microphone overload, the appropriate status monitors (the diamond shapes on the flowchart) and/or steps turn red or yellow according to the type of error. You then click the status monitor's* ***Action*** *button for help on any problems encountered*

The basis of Multichannel Sound Power's Windows interface is a flowchart that is used to set up and execute Type 7748 projects and then generate reports of the results. A Type 7748 Project exists as a working path in which all project data are stored, including setup parameters, environmental corrections, calibration results, background noise measurements, batch-item measurements, and report templates. Below is a description of how the Multichannel Sound Power flowchart leads you from the start to finish of surface and workstation measurements with a number of easy-to-follow steps.

Project Setup

All setup steps on the flowchart prior to ***Front-end Setup*** may be carried out remotely from the computer running PULSE.

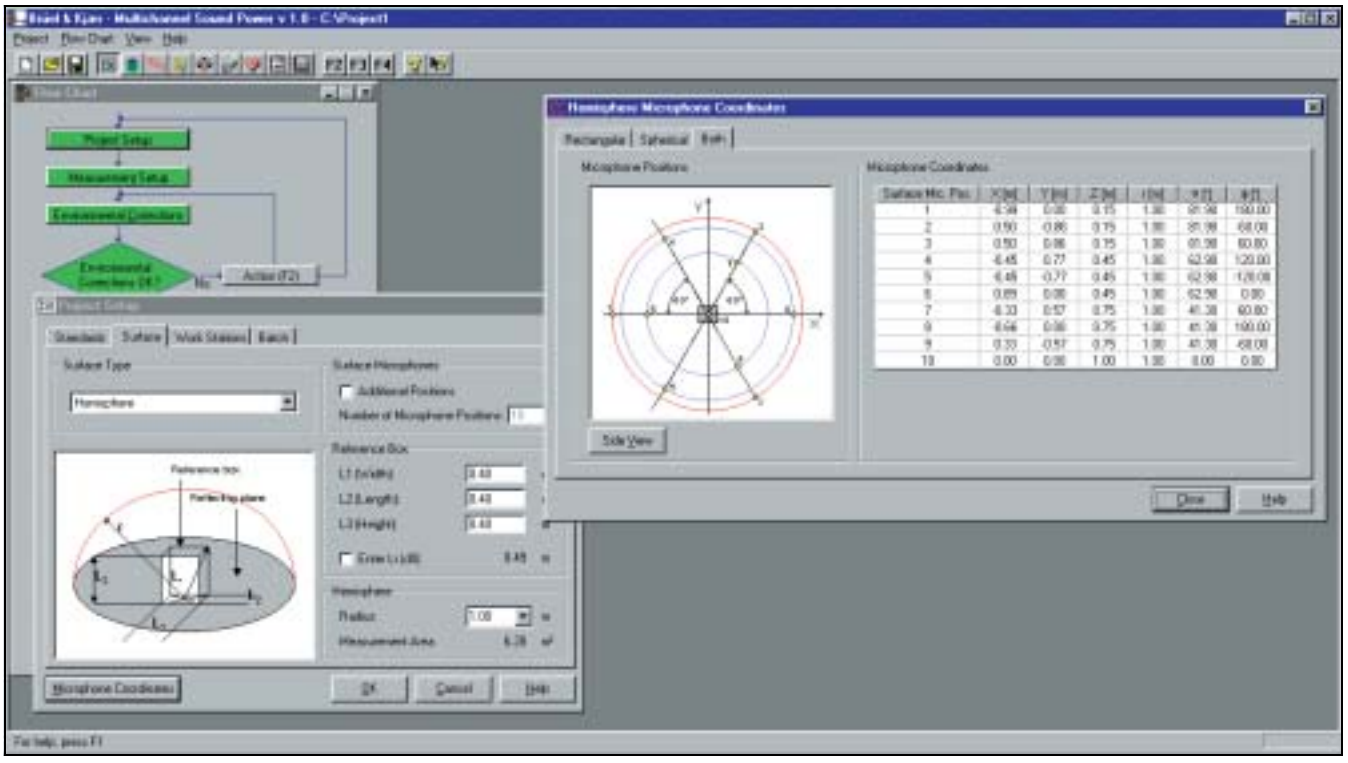
The first step in the Multichannel Sound Power flowchart is Project Setup. Here you decide whether to measure according to existing standards or your own custom configuration and whether to measure at the measurement surface and/or the workstation positions. All physical parameters for the measurement surface and workstation positions are also configured here. Finally, you can configure a batch list for any number of measurement items that use an identical setup and define the allowed deviation of background noise level and calibration results before and after a batch measurement.

Measurement Setup

PULSE is a multi-analyzer system, meaning that multiple analysis types such as CPB (i.e., 1/n-octave), FFT, or Overall analysis can be configured and executed simultaneously from the Multichannel Sound Power software.

In ***Measurement Setup***, you specify the analysis parameters for the types of measurement to be made. This includes the CPB analysis parameters for the sound pressure measurements that are used to calculate sound power, and FFT and Overall analysis parameters used to determine discrete tones and impulsiveness respectively.

Fig. 2 Selecting a hemispherical measurement surface in Multichannel Sound Power. *Once you have entered the radius of the hemisphere, simply click on Microphone Coordinates and an illustration (top or side view) appears. You can then choose to view the rectangular and/or spherical coordinates of all surface microphone positions*



Environmental Corrections

Here, environmental correction factors K2 and K3 are entered to account for the influence of the test environment at the measurement surface and specified workstation positions respectively. Environmental corrections can also be imported from other projects.

Environmental Corrections OK?

If the correction factors exceed the tolerances for the measurement defined in Project Setup, the ***Environmental Corrections OK?*** status monitor will turn red to indicate that the correction factors are too high for the selected frequency range. A red indicator does not mean you cannot continue with the measurement, rather it indicates that the measurement made will not be acceptable according to the standard's or user-defined tolerances.

Front-end Setup

A pass is a part of a measurement in which only some of the microphone positions are measured and/or certain types of analysis carried out. Any measurement configuration can be measured with any PULSE configuration, the only consideration being the number of passes (and therefore time) needed to complete a single measurement. This means that you can acquire an economical, entry-level system to which you can easily add more microphones, input modules and calculation power in the future to speed up measurement time.

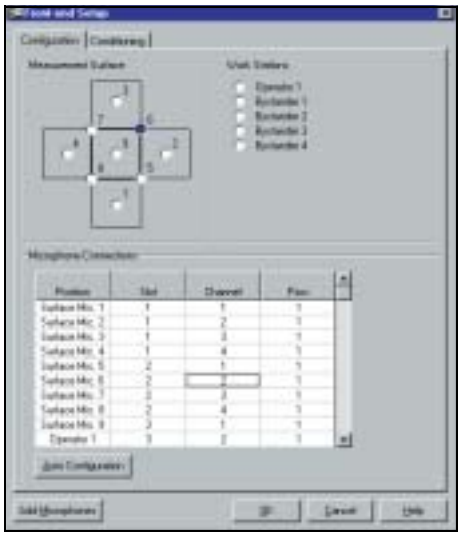


Fig. 3 ***Front-end Setup,*** *with a chart for configuring the front-end address and pass information for each microphone position*

When you reach this step of the flowchart, the PC must be connected to the front-end. In ***Front-end Setup***, you configure the physical connections and conditioning for the microphones on the front-end. Multiple passes can be manually or automatically configured according to the front-end configuration and the number of channels for which your license is valid. After clicking ***OK***, the software will warn you if further serialisation of the measurement is necessary, according to the system resources available. See the specifications for a detailed description of the calculation power required for the specified analysis as a function of the number of channels.

Front-end Setup OK?

When ***OK*** is clicked in ***Front-end Setup***, the software checks PULSE for the selected setup parameters and loads a dedicated PULSE project to ensure that sufficient processing resources are available. If there are no problems, ***Front-end Setup OK?*** turns green and you can continue with the next step. If not, it turns red, in which case you can click the Action button to the right to display Help on the specific problem encountered.

Calibration

Once the measurement parameters and PULSE have been properly set up, the next step is calibration. When making a new calibration, Multichannel Sound Power minimises and PULSE LabShop appears on the screen with the Calibration Master ready to calibrate. Once finished, the gain adjustments and status results appear in a calibration table in Multichannel Sound Power where they can either be accepted or rejected individually. Previous calibrations can also be imported from other projects.

Measurements

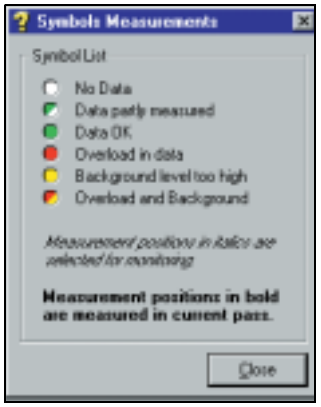


Fig. 4 ***Measurements*** *offers simplicity and flexibility regardless of your PULSE configuration. The figure shows how status is indicated for measurements throughout Multichannel Sound Power*

Now you are ready to measure. The Batch List appears and indicates the status for all items. Before measuring, you can autorange the channels on the front-end first for the background noise level and then while the measurement object is operating to find the correct input levels. The first entry on the batch list is always the background noise because measuring it allows the software to adjust the results to obtain the true sound power of the objects (batch items) measured. A background noise measurement can also be imported from another project.

To measure, you simply turn on the measurement object, select the correct batch item from the list, select a pass (if more than one) and click ***Start***. Passes can also be set to be measured automatically for individual batch items. Batch items and passes can be measured in any order. In addition, as a time-saver if you have a limited number of microphones, one or more passes can be made on all batch items before changing the microphone positions to measure the other passes.

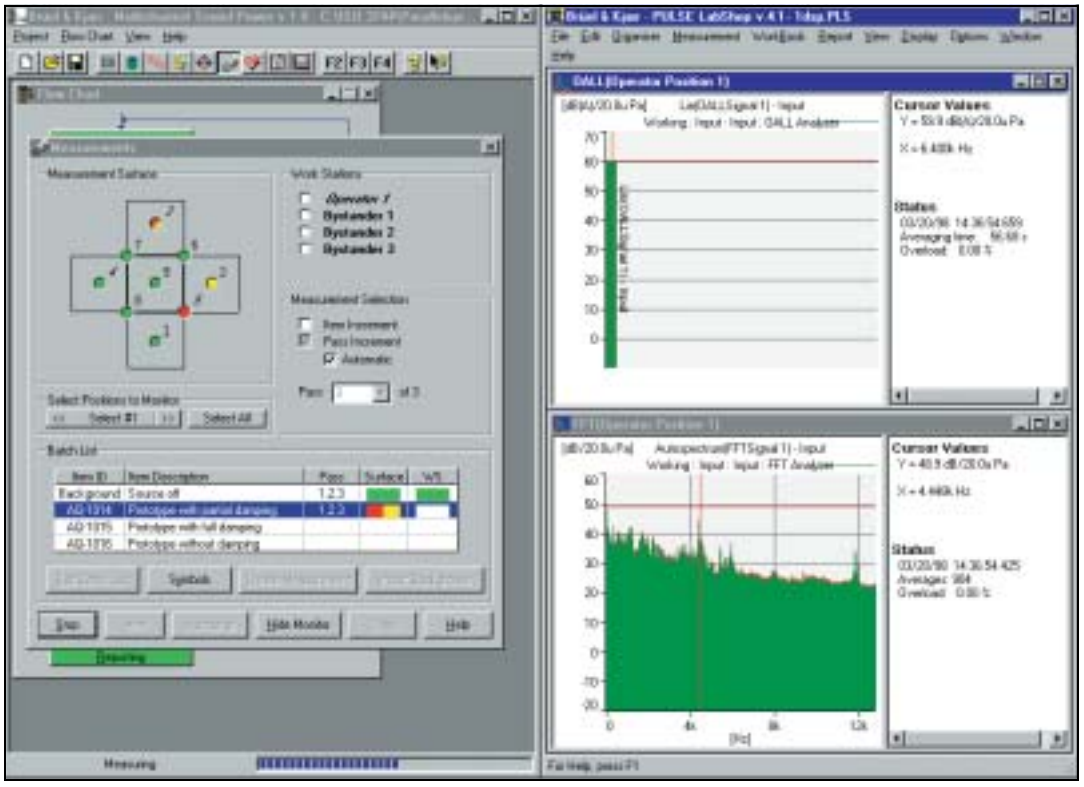


Fig. 5
Real-time measurement display. While measuring, you can select any microphone position(s) and view the real-time progress by clicking ***Show Monitor****. This reduces the size of the Multichannel Sound Power window so that it only fills the left-hand side of the screen and displays PULSE LabShop on the right with real-time graphs for any combination of the microphones being used. As passes are completed, the status is indicated for measurement surface and workstation positions*

Measurements OK?

While measuring, Multichannel Sound Power continuously updates the Batch List with the status of the measurements.

Measurements OK? is a more general status monitor that turns red if the background noise level recorded for the batch is too high, or if an overload occurs during measurement. Clicking the ***Action*** button to the right provides help on the specific problem encountered.

Validation

This step allows you to confirm the validity of the background noise measurement and calibration results used for the batch before accepting all the results for the batch of measurements.

Say, for example, that you perform the last of ten measurements, recalibrate, and find that one or more of the microphones has a radically different gain adjustment than it did before. The entire batch of measurements should then be repeated until you can get pre-measurement and post-measurement calibration results that are within the allowed gain deviation you have defined for the batch. The same should be followed if if you discover that the background noise level has dramatically changed since starting the batch of measurements.

Reporting

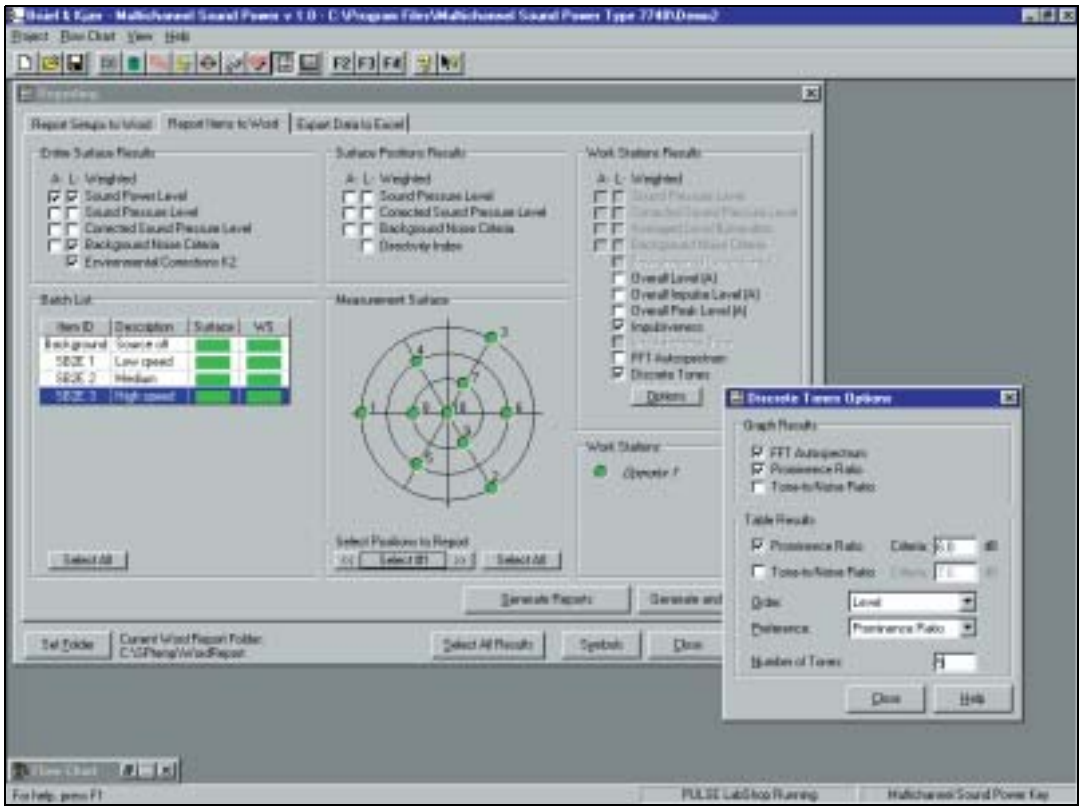


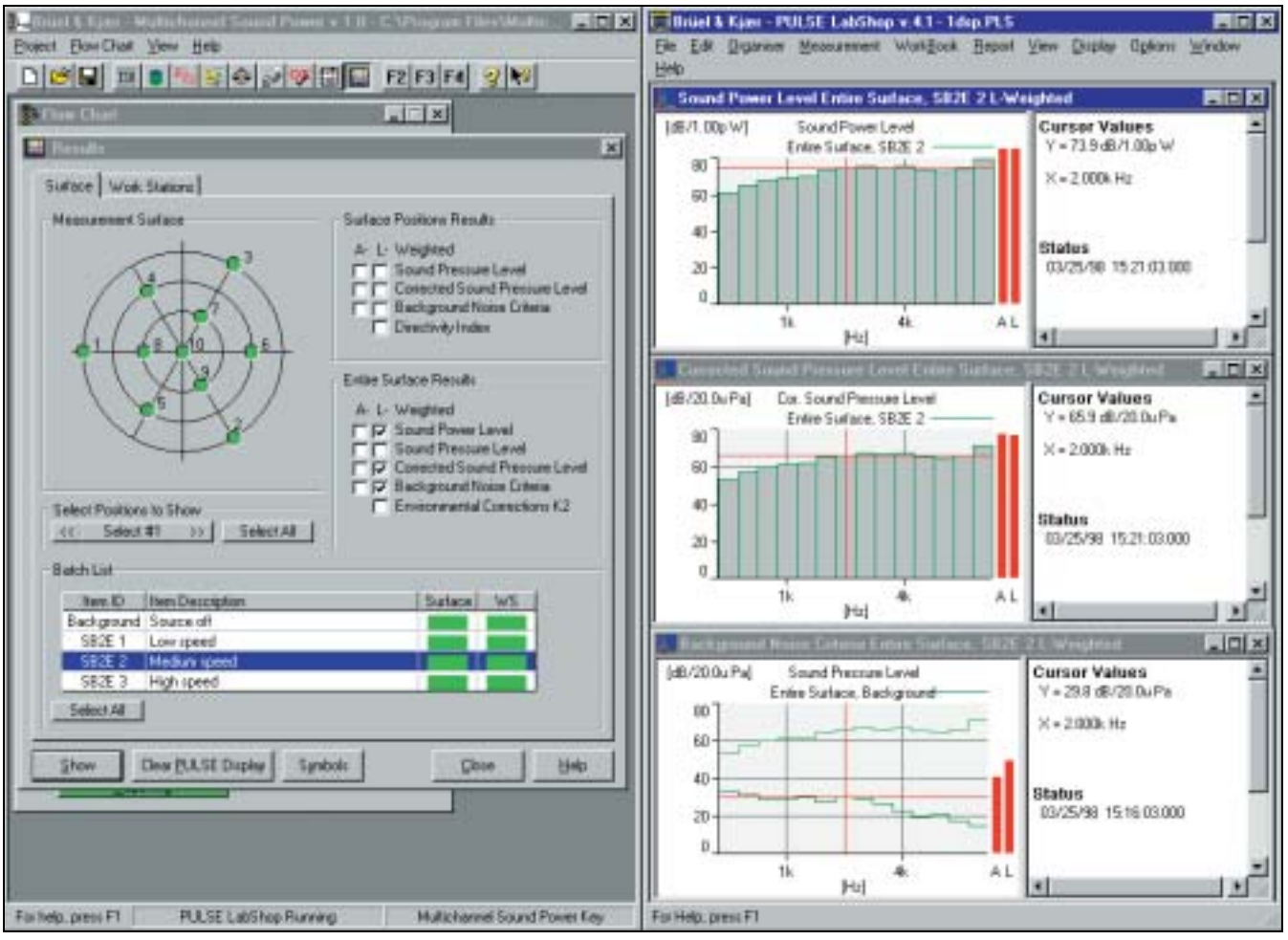
Fig. 6 Reporting. *Multichannel Sound Power provides a vast array of reporting options for any combination of results for individual microphone positions or averaged over the entire surface. Just select which items to report on and click* ***Generate Reports*** *and a report is automatically generated in Microsoft Word*

In ***Reporting***, you generate reports in Microsoft Word. Whether the measurement surface and workstation measurements are valid or invalid because of, for example, excessive background noise or large environmental corrections, all reporting options are always available. For the entire batch, you can generate reports based on the setup, calibration results and validation information that is of interest. For the individual items, you can generate reports that show measurement results you have selected (as indicated in Fig. 6). Data can also be exported to Microsoft Excel spreadsheets for further post-processing.

Results

During the measurement process, Multichannel Sound Power generates a set of "results" that can be viewed in PULSE software using its advanced display features. When you open ***Results***, PULSE LabShop appears on the right side of the screen and displays whatever result types you select for any number of batch items. You can view averaged values for the entire measurement surface, or values for individual measurement surfaces and workstation positions. Again, the status is shown for the selected individual microphones on the measurement surface, the selected workstation positions and the selected batch items as a whole.

***Fig. 7 Results**. This window offers an ideal way to scan results before reporting or to check and compare batch items*



On-line, Context-sensitive Help

Multichannel Sound Power comes equipped with extensive, on-line Help capabilities, including a quick reference to the relevant ISO standards and glossary of terms. Context-sensitive Help is available for every menu item, flowchart step, window, etc., in the program.

The Help system includes guided tours that guide you from start to finish through the entire process of giving your product a sound power rating and directivity characteristics, sound pressure level, impulsiveness and discrete-tone rating at workstation positions.

Demo projects, complete with measurement data for typical measurements are supplied with Multichannel Sound Power for investigating the software's broad functionality.

Specifications – Multichannel Sound Power Type 7748, version 1.2

Type 7748 is an application for use with PULSE, the Multi-analyzer System Type 3560. Version 1.2 runs with both Stationary PULSE Type 3560 A and Portable PULSE Type 3560 C provided that Noise and Vibration Analysis Type 7700 version 5.2 is installed

SYSTEM REQUIREMENTS FOR STATIONARY PULSE
The PC requirements for Stationary PULSE, Type 3560 A, must be fulfilled
Noise and Vibration Analysis Type 7700 (Version 5.2 or later) must be installed
SVGA Monitor with 1024×768 resolution (or better)
128 MB RAM (or better)
Modules Supported
- 25.6 kHz Input Module Type 3015
- 4-channel Input Module Type 3022
- 4-channel Microphone Module Type 3028

SYSTEM REQUIREMENTS FOR PORTABLE PULSE
The PC requirements for Portable PULSE, Type 3560 C, must be fulfilled
Noise and Vibration Analysis Type 7700 (Version 5.2 or later) must be installed
SVGA Monitor with 1024×768 resolution (or better)
128MB RAM (or better)
Modules Supported
- Generator, 4/2-ch. Input/Output Module Type 3109 (includes microphone polarization voltage)
- 6-ch. Input Module Type 3032 A (includes microphone polarization voltage)
- 6-ch. Input Module Type 3032 B (does not include microphone polarization voltage)

Multiple Type 2827 front-end configuration is supported: LAN switch UA 0190 is required

Measurement

Type 7748 can make a number of different measurements for microphones placed on a measurement surface or located at workstation positions. Measurements can be performed in a single pass or by using multiple passes

NUMBER OF MICROPHONE POSITIONS
Measurement Surface: 1 to 32
Workstations: 1 to 5
The number of channels allowed for a single-pass measurement depends on the Type 7700 license

ANALYSIS
Measurement results in Type 7748 are based on CPB, Overall and FFT Analysis.
CPB Analysis:
Used for calculating Sound Pressure and Sound Power Levels:
Filter Bandwidth: 1/1- or 1/3-octave
Centre Frequency Range: 16 Hz – 20 kHz (1/3-octave)
16 Hz – 16 kHz (1/1-octave)
Overall Bands: L and A
Acoustic Weighting: L- and A-weighting as post-processing
Averaging Mode: Linear
Averaging Time: 1 – 86400 s (24 hours)
Overall Analysis:
Used for calculating Overall Levels and Impulsiveness:
Frequency Span: 1.563 – 25.6 kHz
Acoustic Weighting: Linear, A or C
Detectors: Linear, Impulse, Peak
Averaging Mode: Linear
Averaging Time: 1 – 86400 s (24 hours)
FFT Analysis:
Used for determining Discrete Tones:
Frequency Lines: 50 – 6400
Frequency Span: 1.56 Hz – 25.6 kHz
Averaging Mode: Linear
Number of Averages: 1 – 100000

Results

Type 7748 offers a large number of result types for the measurement surface and at the workstation positions.

MEASUREMENT SURFACE
Entire Surface:
Sound Power Level
Sound Pressure Level
- as measured
- corrected for background noise and/or measurement environment

Background Noise Criteria
(compares the measured Sound Pressure Level of the item to the Background Noise)
Environmental Correction Factors, K2
Individual Microphone Positions:
Sound Pressure Level
- as measured
- corrected for background noise and/or measurement environment

Background Noise Criteria
(compares the measured Sound Pressure Level of the item to the Background Noise)
Directivity Index

WORKSTATION POSITIONS
Sound Pressure Level
- as measured
- corrected for background noise and/or measurement environment
- corrected and averaged over all bystander positions

Background Noise Criteria
(compares the measured Sound Pressure Level of the item to the Background Noise)
Environmental Correction Factors, K3
Overall Level
Linear, Impulse or Peak detection
L, A or C acoustic weighting
Impulsive Noise Index calculated as $L_{pAI} - L_{pA}$, $L_{pCpeak} - L_{pC}$ according to ISO 7779 (1999) and ISO 11201 (1995)
FFT Autospectrum
Discrete Tones
Tone-to-Noise Ratio according to ISO 7779 (1999)
Prominence Ratio according to ANSI S1.13

Reporting

- Integrated reporting with Microsoft Word 7.0 or later
- Export of Data to Microsoft Excel 7.0 or later

Processing Requirements for Stationary PULSE (No. of DSP boards)

The following tables contain specifications for the minimum number of DSP boards required for the specified analysis as a function of the number of microphones

Measurement Surface: 1/1-octave CPB Analysis								
Centre Frequency Span (Hz)	Number of Microphones*							
	6	*8*	*9*	*10*	*12*	*16*	*17*	*19*
16 – 16 k	2	2	3	3	3			
16 – 8 k	1	1	2	2	2	2	3	3

* The channel numbers in italics represent the typical number of microphones for the standard-based measurement surfaces

Measurement Surface: 1/3-octave CPB Analysis								
Centre Frequency Span (Hz)	Number of Microphones*							
	6	*8*	*9*	*10*	*12*	*16*	*17*	*19*
16 – 20 k	2	2	3	3	3			
16 – 16 k	2	2	3	3	3			
16 – 12.5 k	2	2	3	3	3			
16 – 10 k	1	1	2	2	2	2	3	3

* The channel numbers in italics represent the typical number of microphones for the standard-based measurement surfaces

Workstations: 1/1-octave CPB Analysis					
Centre Frequency Span (Hz)	No. of Microphones				
	1	**2**	**3**	**4**	**5**
16 – 16 k	1	1	1	1	2
16 – 8 k	1	1	1	1	1

Workstations: FFT* and Overall Analysis					
Frequency Span (kHz)	No. of Microphones				
	1	**2**	**3**	**4**	**5**
25.6	1	1	1	1	2

* Frequency lines ≤ 3200

Workstations: 1/3-octave CPB Analysis					
Centre Frequency Span (Hz)	No. of Microphones				
	1	**2**	**3**	**4**	**5**
16 – 20 k	1	1	1	1	2
16 – 16 k	1	1	1	1	2
16 – 12.5 k	1	1	1	1	2
16 – 10 k	1	1	1	1	1

Workstations: FFT* and Overall Analysis					
Frequency Lines	No. of Microphones				
	1	**2**	**3**	**4**	**5**
6400	1	2	2	2	2
3200	1	1	1	1	2

*Frequency Span ≤ 25.6 kHz

Processing Requirements for Portable PULSE (No. of Beats)

The following tables contain specifications for the minimum number of beats[a)] required for the specified analysis as a function of the number of microphones. See the Product Data for Software for Portable PULSE version 5.2 (BU 0229–14) for a definition of beats and Analysis Engine

Measurement Surface: 1/1-octave CPB Analysis							
Centre Frequency Span (Hz)	Number of Microphones						
	2	*4*	*6*	*8*	*9*	*10*	*12*
16 – 16 k	25	50	75				
16 – 8 k	25	25	50	50	75	75	75

Measurement Surface: 1/3-octave CPB Analysis							
Centre Frequency Span (Hz)	Number of Microphones						
	2	*4*	*6*	*8*	*9*	*10*	*12*
16 – 20 k	25	50	75				
16 – 16 k	25	50	75				
16 – 12.5 k	25	50	75				
16 – 10 k	25	25	50	50	75	75	75

Workstations: 1/1-octave CPB Analysis					
Centre Frequency Span (Hz)	No. of Microphones				
	1	**2**	**3**	**4**	**5**
16 – 16 k	25	25	50	50	75
16 – 8 k	25	25	25	25	50

Workstations: FFT* Analysis					
Frequency Span (kHz)	No. of Microphones				
	1	**2**	**3**	**4**	**5**
25.6	25	25	25	25	25

* 67% overlap

Workstations: 1/3-octave CPB Analysis					
Centre Frequency Span (Hz)	No. of Microphones				
	1	**2**	**3**	**4**	**5**
16 – 20 k	25	25	50	50	75
16 – 16 k	25	25	50	50	75
16 – 12.5 k	25	25	50	50	75
16 – 10 k	25	25	25	25	50

Workstations: FFT* and Overall** Analysis					
Frequency Span (kHz)	No. of Microphones				
	1	**2**	**3**	**4**	**5**
25.6	25	25	50	50	75
12.8	25	25	25	25	50

* 67% overlap ** Peak detection included

a) Note:
A Noise and Vibration Analysis Type 7700 license enables 25-beat performance (PII 300 MHz is required)
1 × Type 7707 Analysis Engine license must be added to upgrade the system to 50 beats (PIII 600 MHz is required)
2 × Type 7707 Analysis Engine licenses must be added to upgrade the system to 75 beats (PIII 900 MHz is required)

Ordering Information

Type 7748	Multichannel Sound Power

Recommended PULSE Solutions

SOLUTION 1: ENTRY LEVEL

Type 7700 G	Noise and Vibration Analysis, 2-ch. License
7700 G–MS1	Software Maintenance and Upgrade, 2-ch. License
Type 2827	Portable Data Acquisition Unit
Type 7533	LAN Interface Module
Type 3032 A	6-ch. Input Module
	PIII 300 MHz PC or better (Windows NT 4.0 and Microsoft Office required)

SOLUTION 2

Type 7700 B	Noise and Vibration Analysis, 8-ch. License
7700 B–MS1	Software Maintenance and Upgrade, 8-ch. License
Type 7707	Analysis Engine upgrade to 50 Beats
2 × Type 2827	Acquisition Front-end
2 × Type 7533	LAN Interface Module
2 × Type 3032 A	6-ch. Input Module
UL 0190	LAN Switch
2 × AO 0451	Triaxial Cable (0.2 m)
	PIII 600 MHz PC or better (Windows NT 4.0 and Microsoft Office required)

Brüel & Kjær reserves the right to change specifications and accessories without notice

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