

PRODUCT DATA

Acoustic Test Consultant — Type 7761
with Robot Option BZ5370



The Acoustic Test Consultant™ (ATC) is a PULSE™ application that has been developed to simplify complex acoustic measurement tasks. With the production of reliable test data another primary objective, it also reduces test times and works with PULSE to support all aspects of the measurement process.

ATC works off a task-bar setup to support workflow in a straightforward, logical fashion. The system comprises the basic ATC software with a separate robot option for making the measurement process fully automatic.

7761

- USES**
- Pressure-mapping
 - Intensity-mapping
 - Acquisition of acoustic data for other applications
 - Measurement in areas that are normally out of bounds due to dangerous or awkward operating conditions

- FEATURES**
- Task-oriented software
 - Automated measurement sequencing
 - Easy-to-use geometry generator for 2D planar surfaces
 - Status notification during measurements
 - User-definable validation tool for specifying criteria that guarantee measurement quality
 - Measurement data easily exported for post-processing
 - Robot for automatic testing
 - Automatic data-storage
 - Runs under Windows NT[®] and Windows 2000[®]
 - Guarantees the efficient and reliable acquisition of complex, multiple-point acoustic measurements
 - Geometry-controlled, data-acquisition system for single or multiple microphones or intensity probes
 - Part of a complete system available from Brüel & Kjær including:
 - high-quality transducers and accessories
 - robot- and microphone-positioning systems
 - conditioning, measurement and analysis using the PULSE multi-analyzer platform

Introduction

Acoustic Test Consultant works with PULSE to provide a dedicated measurement environment for acoustic measurements. With emphasis on the production of reliable test data in the minimum of time, it supports all aspects of the measurement process including measurement control, validation of results, data handling and measurement repetition in the event of bad measurements.

ATC works off a task-bar setup to support workflow in a straightforward, logical fashion. The system comprises the basic ATC software with a separate robot option for making the measurement process fully automatic.

Interface and Layout

The Acoustic Test Consultant works on top of any PULSE configuration. Its user interface is a generic Windows interface that comes with a task bar down the left-hand side of the screen. The task bar's constituent icons each comprise a single step in the measurement procedure described here under Tasks and Tools on page 4.

The task bar takes the form of several stacked menus, or task groups. Each menu has a series of tasks associated with it, which are activated by clicking on the relevant icons in the task bar. These icons can be rearranged as required, allowing you to customise the measurement sequence, e.g., removing any unnecessary steps.

Fig. 1
Measurement task including measurement controls and display of status, spectra and geometry for a specific measurement point. The measurement is validated (for dynamic capability)

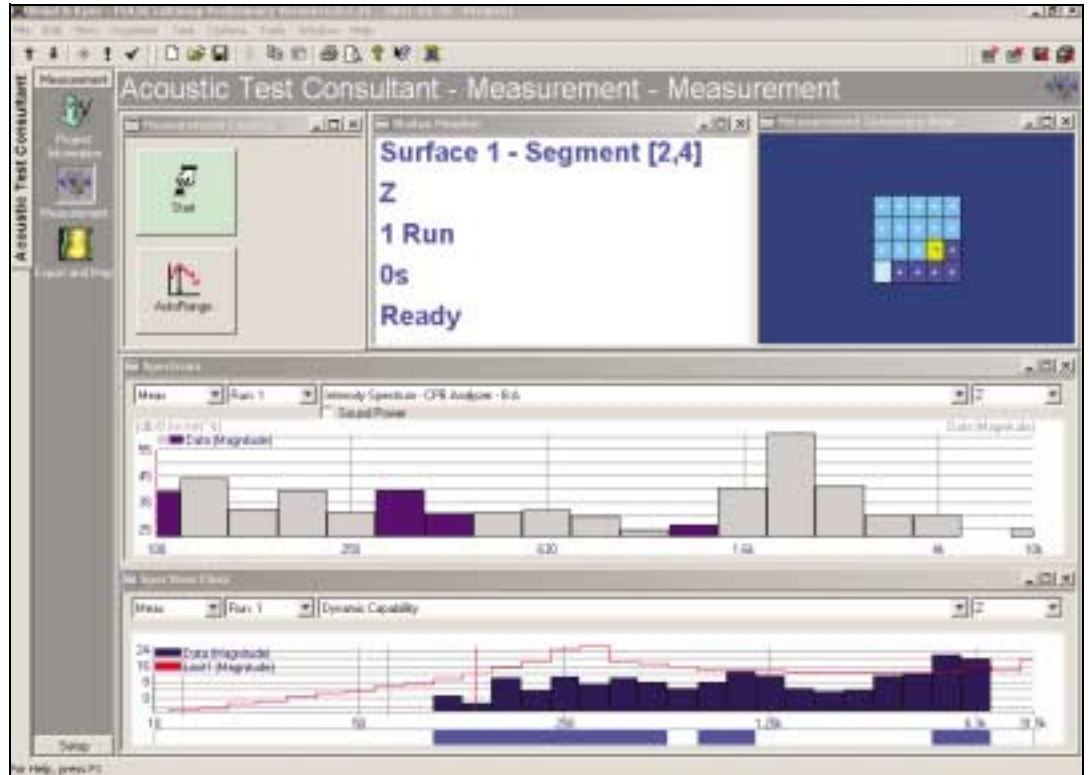


Fig. 2
Measurement export to Noise Source Identification Type 7752 with colour-contour map display

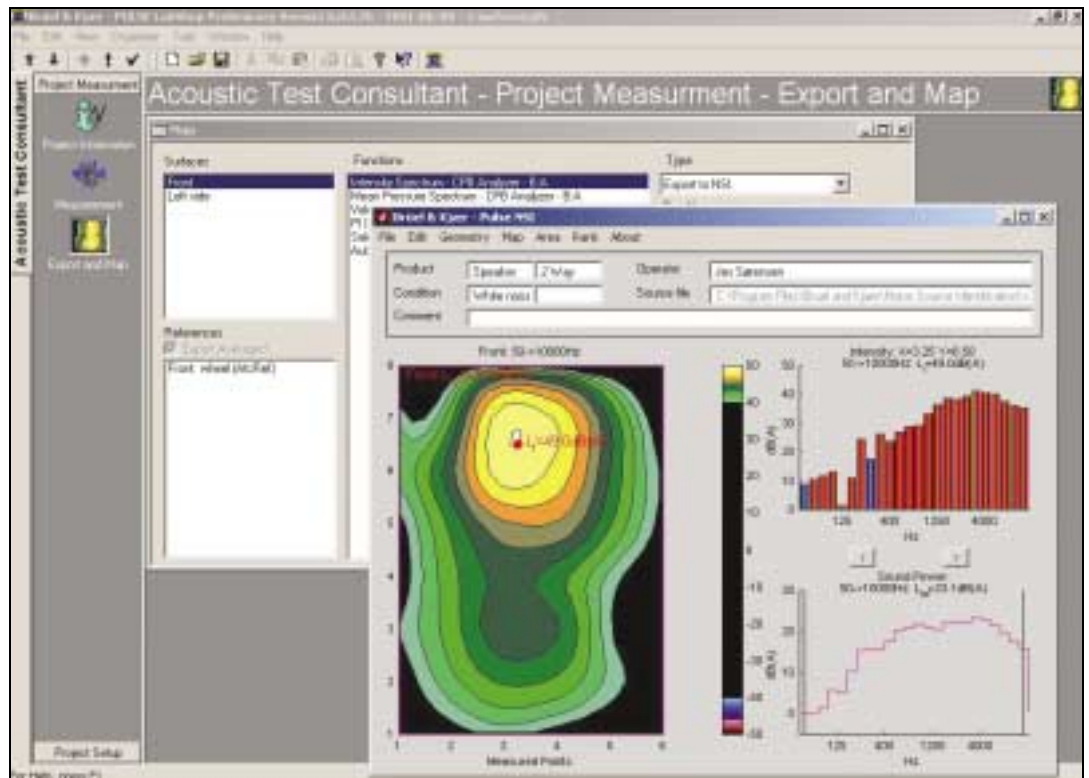
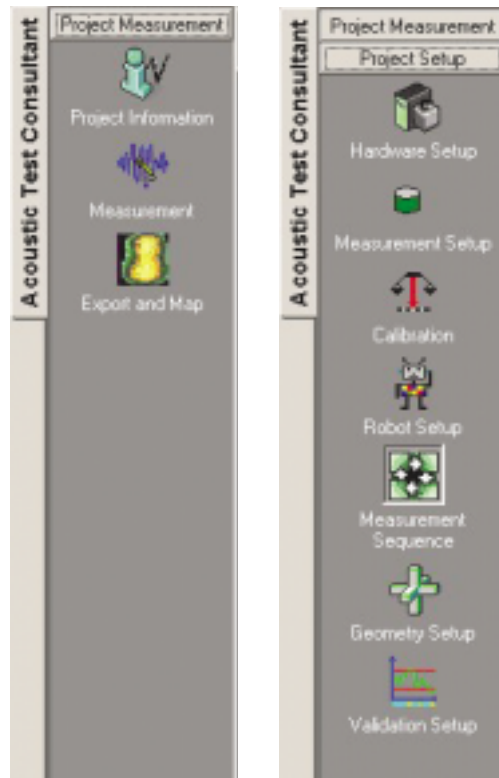


Fig. 3
 Typical measurement sequence showing the different tasks in project setup and project measurement



These features make the measurement process both linear and intuitive. By simply working through the menus and associated tasks, all required setup and measurement tasks are performed.

Acoustic Test Consultant has a series of ready-made templates, for both array-based measurements and intensity-based measurements, to help in test setup. These project templates can be modified and saved as your own dedicated template for specific tests. The available templates are divided into two task groups: setup and measurement (see Fig.3). Once the setup groups, which comprise setup tasks such as Geometry setup, Hardware setup, Robot setup, Measurement setup, Validation setup and Measurement Sequence setup, have been defined and an appropriate template adopted, the measurement task groups (where the specific project information is entered) can be used to control testing. Once the measurements are performed, result data can be exported in various file formats or by the mapping software.

Tasks and Tools

Measurement Tasks

When new projects are set up, you need only to finalise the following steps to complete your measurement tasks:

Project Information

This deals with the recording of details such as test personnel, configuration, dates, running conditions and other general project data. It is based upon an embedded, customisable Microsoft® Excel file where the project information is entered and stored. Specific details such as product information, condition, operator and comments can be automatically transferred to the optional Noise Source Identification software package Type 7752.

Fig. 4
 Project information is described in an Excel sheet that takes advantage of Excel's many features. Illustrations can also be embedded if desired



Measurement

This task is designed to simplify the measurement process. The key issue here is object handling which can be performed in two modes: Manual and Robot. In Manual mode, you can complete measurements in one step using just one button. If you encounter problems, then Restart, Cancel, Continue and Store options allow you to recover. In Robot mode, the measurement process is automatically performed. Once the measurement is complete, you can have the robot repeat bad measurements or repeat them yourself manually.

You can view your measurement data in real time in **Spectrum View** where a drop-down list allows you to show historical or real-time measurement data, and you can view the validations specified earlier in the **Validation Setup**. Failures are flagged and the option of retaking the measurement offered. The geometry also, simultaneously, displays the overall progress of the measurement process (see Fig. 1).

Export and Map

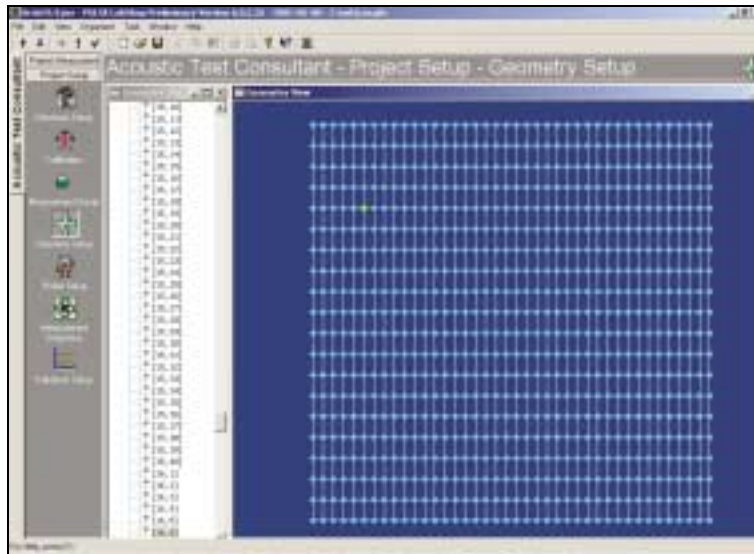
ATC is ideal for working with Brüel&Kjær's Noise Source Identification Type 7752 to which data can be automatically transferred for viewing purposes. Using information submitted earlier in the **Project Information** step, mapping of your test data occurs automatically and is displayed as a colour contour once measurement has ceased. For other types of analysis, it is open to data-sharing with other programs via such industry-standard file formats as UFF binary, UFF ASCII and PULSE ASCII formats. Both PC and UNIX platforms are catered for (see Fig. 2).

Setup Tasks

To set up a project, you can use a sequence of tasks that intuitively prepares for your measurement.

Geometry Setup

Fig. 5
ATC geometry setup showing a 20 × 40-node measurement surface in point mode



Geometry setup is where you define your test geometry. This function enables you to determine how you perform your test measurement. It is where you define your acquisition surface, with ATC able to handle multiple 2D planes. The surfaces can be measured in segment or point mode, and you can define the relationship between your acquisition surface and the surrounding environment.

In Segment Mode, the measurement point is situated in the middle of the area segment. This is primarily aimed at applications where single microphones and intensity probes are used and where you often need to further refine your measurements. In segment mode, you can enter areas where obstacles on or about the measurement object make it otherwise impossible to perform a measurement.

In Point Mode, the measurement points are placed at the nodes of a grid. This mode is primarily used for array-type applications where many microphones are used.

Hardware Setup

This function has two main purposes:

- defining the nature of the transducers used in measurements
- defining the connection between the transducers, the front-end, and the other system hardware

Two transducer types exist – fixed and movable. Fixed transducers can be used as reference transducers where your results are based on signals, e.g., as with selective intensity. They can also be used in cases where your results are based upon movable transducers and you want to use fixed transducers to verify your results, e.g., as with an object's stationarity.

The hardware setup includes automatic detection of channels. In this way, you can automatically detect which transducers are connected to which channels on your front-end. This is especially convenient for measurement situations where whole arrays of transducers are involved.

Robot Setup

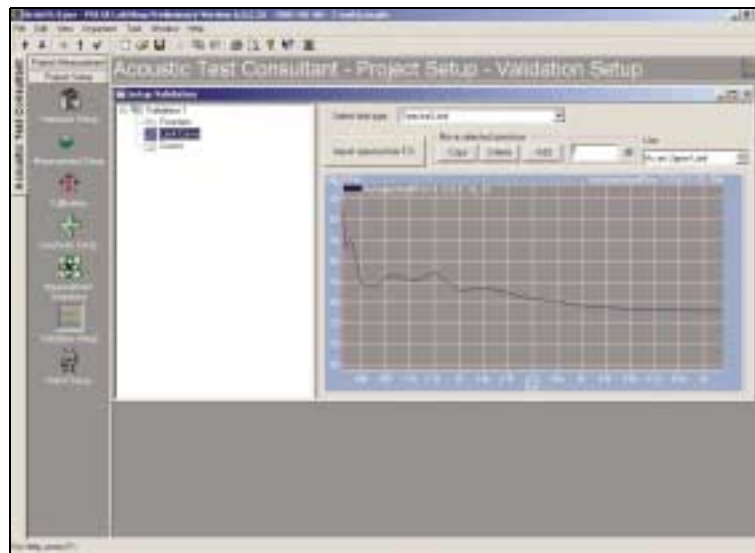
The software supports both automatic and manual movement of the transducers. Robot setup is where you set up the necessary parameters for performing the measurement sequence automatically. With Robot Option BZ 5370, transducers can be attached to a microphone-positioning system which is controlled by a robot. It requires a user-defined 'home' position from where the robot moves to successive measuring positions, as determined by the operator in the **Geometry Setup** and the **Measurement Sequence**.

Measurement Setup

This is where you define what functions you wish to record. The Measurement Setup doesn't deal with individual signals, rather with whole *classes* of transducers. You can define functions for fixed transducers alone, movable transducers alone, or as cross-functions between the two transducer types. Since much of the work is performed automatically by interaction with the PULSE system, the time saved on otherwise complex setups is considerable.

Validation Setup

Fig. 6
Validation tools can be defined to ensure the quality of measurement data



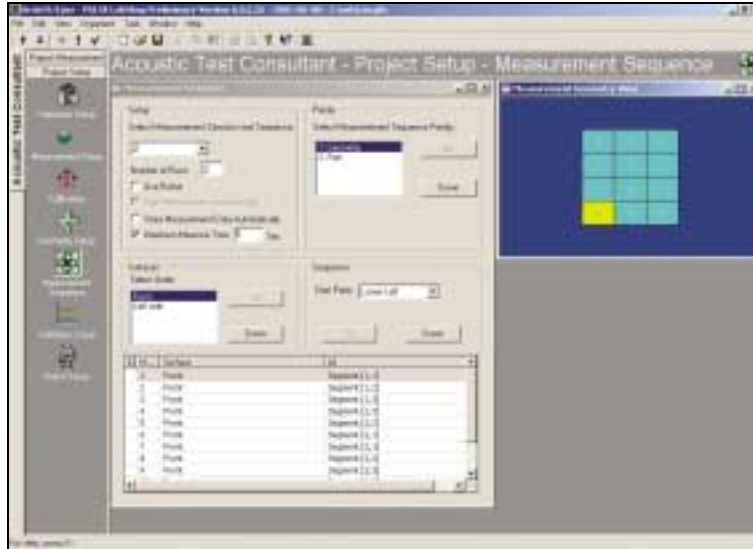
This function ensures that measurements are reliable. It sets up the test criteria that are applied to measurement data and contains a **Validation Tool** which verifies that test data values follow standards or good measurement practice such as with dynamic capability, stationarity checks and other parameters. You can run validations against spectra, such as dynamic capability, to check for extraneous

noise events, or use constant limits, or check values between measurements or measurement runs to monitor stationarity and/or repeatability. Based on these validation decisions, the option of remeasuring specific measurement runs can be taken.

Measurement Sequence

This is where you define the sequence of your measurements, usually with the goal of having as few manual movements of transducers as possible. For example, if you have a 2D robot, you want to complete measurements on one surface completely before moving to another. Measurement points that, for various reasons, cannot be measured can be excluded from the sequence. There is also a learning mode that can help the robot reorientate itself from one acquisition surface to another.

Fig. 7
Measurement tasks including measurement control, geometry view (segment mode) status monitoring and spectrum view for the specific measurement point

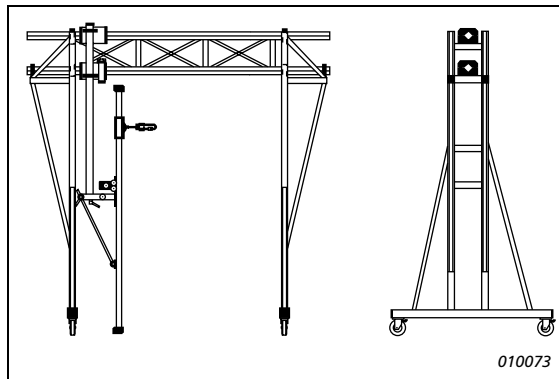


Robot and Microphone-positioning Systems

ATC supports the use of automated microphone-positioning systems working on planar surfaces with Robot Option BZ 5370.

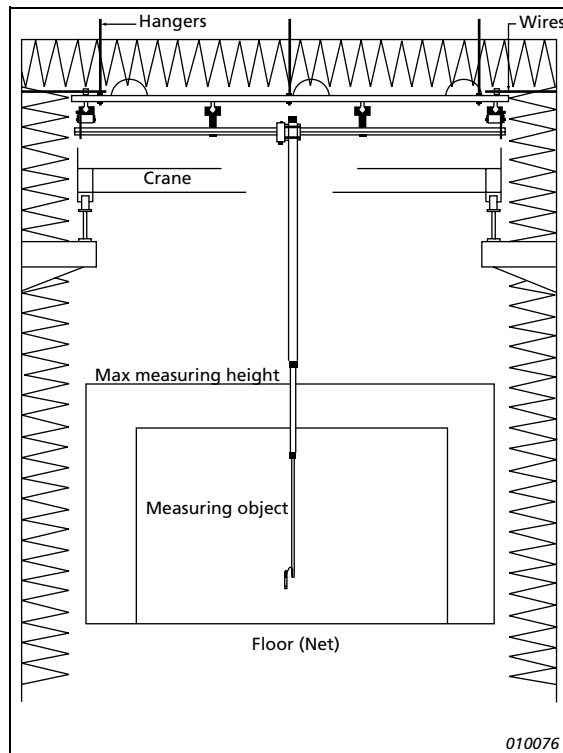
The Robot Option controls 2 to 8 motors allowing you to orientate a microphone-positioning system in up to five directions (X, Y, Z, Phi and Theta), thereby making it possible to measure all planar surfaces around an object.

Fig. 8
Biaxial robot microphone-positioning system for intensity measurements



Typical microphone system configurations involve a biaxial (X and Y axes) system for measurement on one plane. This can be fitted with both single transducers or arrays of transducers and probes. The microphone-positioning system can be mounted on wheels and tilted to accommodate required measurement positions. It can perform semi-automatic measurements around a test object if it is moved manually between surfaces.

Fig. 9
Five-axis robot as mounted in anechoic rooms for simple pressure-mapping



A fully automatic system is normally based on a five-axis robot for single microphones, intensity probes or smaller arrays.

As these types of robot need special specifications to suit the customer's requirements and test setups, these systems are specified in close cooperation with Brüel&Kjær to ensure the best measurement solution.

Recommended Systems

Brüel & Kjær supplies the complete range of equipment needed for acoustic measurements including transducers, cables, microphone-positioning systems, front-ends and analyzers. This list also includes Noise Source Identification Software Type 7752 for displaying your measurement results.

The ATC can be used for a variety of acoustic measurements. As examples, two different configurations are shown below:

- Intensity-based Noise Source Identification
- Pressure-based Noise Source Identification

For both configurations, it is possible to use the robot-controlled, microphone-positioning system.

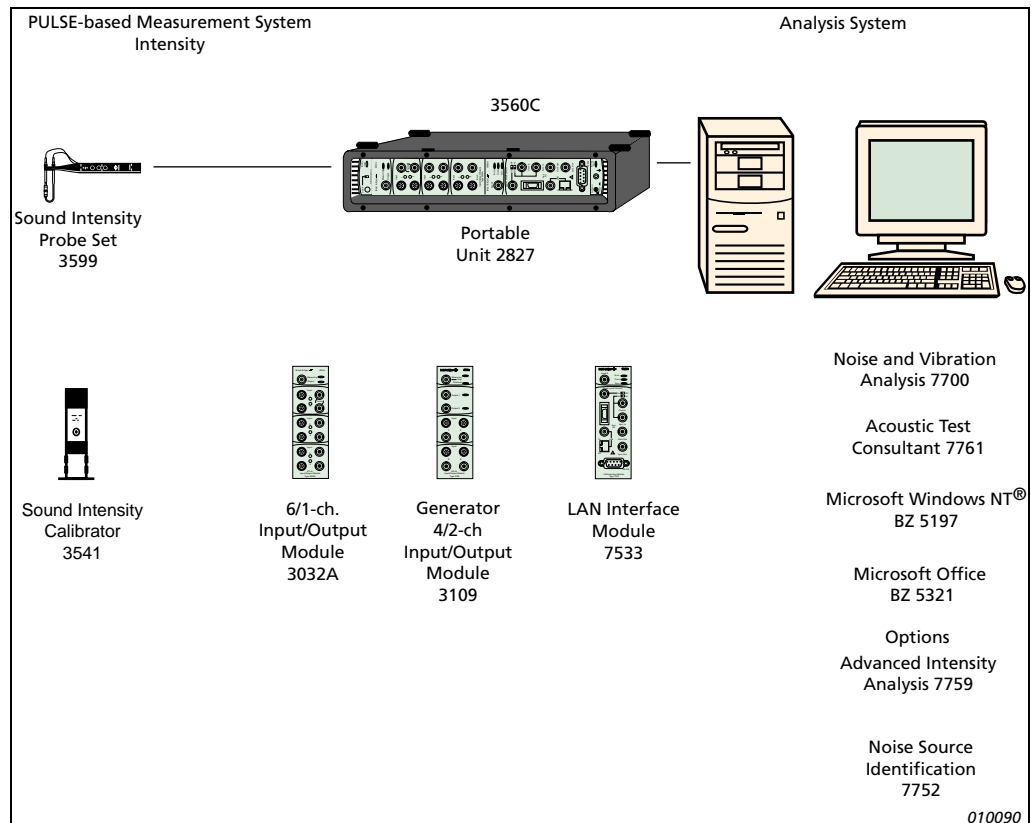
Intensity-based Noise Source Identification

Intensity-based mapping is a convenient and powerful technique to use for noise-source identification (see Fig. 10 for details).

Sound Intensity Probe Kit Type 3599 is a two-microphone probe kit for measuring sound intensity that can be used with both Portable and Stationary PULSE configurations. The probe kit includes Remote Control Unit ZH 0632 and 1/2-inch Sound Intensity Microphone Pair Type 4197.

Sound Intensity Calibrator Type 3541 enables the calibration of intensity-measuring instruments by using a coupler designed especially for sound-intensity calibrations. The intensity-probe sensitivity for sound intensity, sound pressure, particle velocity as well as the pressure-residual intensity index can then be calibrated or verified.

Fig. 10
Recommended
system for
intensity-based
mapping
applications



The PULSE acquisition system also consists of a front-end which supports both the IDA^e- and DSP-based PULSE configurations.

The PULSE analysis system comprises a computer with Windows NT 4.0 or Windows 2000 installed together with Microsoft Office. Noise and Vibration Analysis Type 7700 is required to perform the necessary multi-analysis such as, e.g., FFT and 1/3-octave real-time analysis.

Noise Source Identification Type 7752 is mapping software that can be used to analyse and visually represent measurements on rectangular surfaces for the identification and location of noise sources (see Type 7752's Brüel & Kjær Product Data sheet, literature number BP 1860). Colour-contour mapping of the intensity spectra provides helpful information as to where sources and sinks are located on the measurement surface and where the noise sources are located on the product under test. The intensity-spectra data and the mapping of specific frequencies and frequency bands in specific areas can be used to identify the phenomena that cause the noise problem. Finally, sound-power values are a useful tool for identifying noise sources and help to establish their strength and where refinement of the product under test is most required.

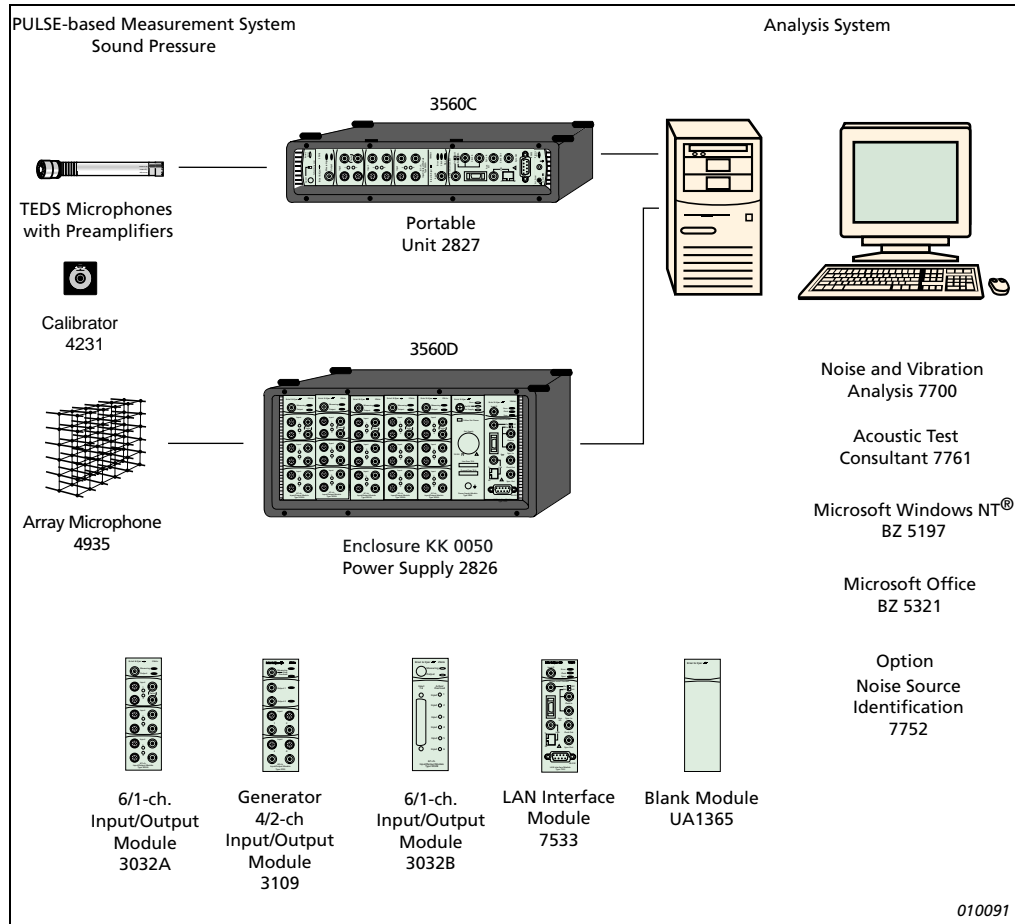
There is also a selective-intensity function included in PULSE Advanced Intensity Analysis Type 7759 that can be used to determine the internal root causes of the noise sources observed at an object's surface using reference transducers.

Pressure-based Noise Source Identification

A single microphone or an array of microphones can be used for sound pressure-based noise-source identification.

A recommended system is shown in Fig. 11 for both single microphones and an array of microphones.

Fig. 11
 Recommended system for pressure-based mapping applications using either single microphones or arrays of microphones



For single-microphone or array applications, the whole Falcon[®] range of microphones is available including Types 4188, 4189 and 4190 (see Ordering Information for more details). Free-field 1/2-inch Microphone Type 4190 is an externally polarized, free-field microphone. It requires a polarization voltage of 200 V which is provided by the instrument or analyzer powering the associated preamplifier, Type 2669. 1/2-inch microphones Types 4188 and 4189 are prepolarized, free-field microphones which differ mainly in frequency range and sensitivity. These microphones offer significant advantages when used with instruments not designed to produce a polarization voltage. Another advantage is the greater reliability of the associated preamplifier, Type 2671, in humid and polluted conditions.

Type 4935 array microphones are recommended for use with arrays as they are specially designed for such an application. This 7 mm (approx. 1/4 inch) prepolarized microphone has built-in DeltaTron[®] preamplifier and transducer identification. When used for the simultaneous measurement of a large number of signals as, for example, with STSF measurements, the microphone can be clipped into a strong, yet light, grid network to form a complete array.

Sound Level Calibrator Type 4231 is a pocket-sized sound-source for accurate instrument calibration using 1/2-inch and 1-inch microphones. Additional adaptors are available for 1/4-inch and 1/8-inch microphones and intensity probes.

For array-based measurements, the data acquisition system 3560 D is the recommended acquisition front-end although both IDA^e- and DSP-based PULSE systems can also be used.

Again, the PULSE analysis system requires Windows NT or Windows 2000, and Microsoft Office, plus Noise and Vibration Analysis software Type 7700, while Noise Source Identification software Type 7752 is recommended for visually representing the results.

Specifications – Acoustic Test Consultant Type 7761

System Requirements

PULSE version 6.0 or later, Windows NT (SP6 or later), Windows 2000 (SP1 or later), Microsoft Office 97/2000 or later.

PC Requirements: The PC requirements for PULSE must be fulfilled

User Interface: Microsoft Windows-based with task bar

Measurement Setup

GEOMETRY SETUP

- Multiple planar, 2D surfaces can be created, edited and deleted with 2 modes available:
 - Segment-based planes - segment refinement; obstacle marking
 - Point-based modes (for array-based applications) where measurements are taken at the nodes of gridlines with obstacles not being allowed
- Pan and zoom for viewing geometry is supported
- Global/local coordinate support for each plane
- Editable surface names
- Views - tree view; graphic view; reference view

HARDWARE SETUP

- Automatic front-end detection
- Automatic transducer detection using IEEE 1451.4 for IDA^e-based systems
- Definition of reference transducers/signals
- Array transducers may be single microphones or evenly spaced microphone arrays
- Automatic detection of channels and transducers
- View of transducer arrays

ANALYZER SETUP

As with PULSE

FUNCTION SETUP

- Definition of functions to be measured:
 - on or between reference transducers
 - on or between array transducers
 - between array and reference transducers
- Definition of functions to be stored in the results of each measurement point

VALIDATION SETUP

- Addition of validation methods according to:
 - a spectrum
 - constant limits (upper and/or lower)
- Specification of validation criteria in specific bands
- Editable colours for on-line display of validation
- Editable validation names
- Definition of validation priorities

MEASUREMENT SEQUENCE

- Automatic definition of measurement point sequence per surface including working around obstacles
- obstacle handling for robot movement
- Handling of arrays and measurement points with different row and column spacing
- Manually editable sequencing

- Exclusion of measurement points
 - Definition and sequencing of number of measurements at each point (runs), and measurement directions (for intensity probes)
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Measurement

PROJECT INFORMATION

Supports use of embedded, user-defined, Microsoft EXCEL spreadsheets for entering of information such as device under test and operator

MEASUREMENT VIEW

- Geometry-driven, based on predefined measurement sequences
- Manually interruptible
- Display of measurement state on geometry and references including selected points, obstacle points, excluded measurement points, current measurement points, overloads and validation status
- Multiple display of spectra and validation status of selected measurement points
- Display of measurement results at selected measurement points including run number and direction
- Spectral display of validation status on predefined validation functions
- Control of the measurement process by window, keyboard or remote control
- Start, Pause, Continue, Restart, Cancel and Store measurement functions
- Visual status monitoring for current measurement points including run number, direction, measurement status and validation and overload statuses
- Audible validation and overload status warnings during measurement

EXPORT

- Automatic transfer to Noise Source Identification Type 7752 – includes project information for product, condition, comments and operator
 - Data Export for selected surfaces, functions, runs and directions via ASCII and Binary UFF dataset 58 and PULSE ASCII.
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Robot Option BZ 5370

- Requires Acoustic Test Consultant Type 7761
- Supports measurements on multiple 2D planes in point and segment modes
- Supports Robot Controller WB 1477
- Supports RS-232 and LAN connections to Robot Controller
- Supports 2 to 8 motors
- Torque and polarity of motors definable
- Supports up to 5 axes (X, Y, Z, Theta, Phi)
- Speed and acceleration of axis movement definable
- Robot can be manually manipulated
- Definable Park and Home positions
- Emergency Stop supported
- Calibration of robot movement
- Probe offset definition

Ordering Information

Type 7761 Acoustic Test Consultant

OPTIONS

BZ 5370 Robot Option for Acoustic Test Consultant

MAINTENANCE AND UPGRADE AGREEMENTS

Type 7761-MS1 Acoustic Test Consultant Software Upgrade and Maintenance

Required Software

Type 7700 Noise and Vibration Analysis *or*
Type 7709 Viewer License
BZ 5330 Windows NT *or*
BZ 5372 Windows 2000
BZ 5308-xx MS Office 2000 Small Business Edition *or*
BZ 5309-xx MS Office 2000 Small Business Edition with
Manuals *or*
BZ 5321-xx MS Office 2000 Professional Edition
xx specifies country: GB, DE, FR, ES, IT, SE, US
PC – as recommended for PULSE

Additional Hardware and Software

DSP-BASED DATA ACQUISITION HARDWARE

PC hardware

ZD 0812 300 MFLOPS DAP Board (1 to 4)
ZD 0815 Taxi Interface Module

Acquisition Hardware

Type 2825 Acquisition Front-end
Type 2816 Multichannel Data Acquisition Unit
Type 7521 Signal Analyzer Interface Module
ZB 0017 Remote Control for Stationary PULSE

Input Modules

Type 3015 25 kHz Input Module
Type 3017 Sound Intensity Module *or*
Type 3028 4-channel Microphone Module *or*
WH 3229 4-channel Microphone Module (0.15° phase
matching for sound intensity measurements *or*
Type 3022 4-channel Input Module
FA 1009 Blank Panel

IDA^e-BASED DATA ACQUISITION HARDWARE

Acquisition Hardware

Type 7533 LAN Interface Module
Type 2827 Portable Data Acquisition Unit *or*
Type 2826 including Power Supply Module and
KK 0050 Enclosure
ZH 0632 Remote control for Portable PULSE

Input/Output modules

Type 3109 4/2-channel Input/Output Module *or*
Type 3032 A 6/1-channel Input/Output Module *or*
Type 3032 B 6/1-channel Input/Output Module
UA 1365 Blank Module

Optional Software

IDA^e-based systems

Type 7707 Analysis Engine

MICROPHONE POSITIONING SYSTEMS

Contact Brüel & Kjær

MICROPHONES AND PREAMPLIFIERS

Type 4188 L-001 Prepolarized Free-field 1/2-inch Microphone
with Type 2669 L, TEDS
Type 4188 A-021 Prepolarized Free-field 1/2-inch Microphone
with Type 2671, TEDS
Type 4189 L-001 Prepolarized Free-field 1/2-inch Microphone
with Type 2669 L, TEDS
Type 4189 A-021 Prepolarized Free-field 1/2-inch Microphone
with Type 2671, TEDS
Type 4190 L-001 Free-field 1/2-inch Microphone with 2669 L,
TEDS
Type 4935 Array Microphone
Type 3599 Intensity Probe

CALIBRATORS

Type 4297 Sound Intensity Calibrator
Type 4231 Sound Level Calibrator
Type 3541 Sound Intensity Calibrator

PULSE SOFTWARE

Type 7759 Advanced Intensity Analysis

POST-PROCESSING SOFTWARE

Type 7752 A Noise Source Identification version 2.0 (requires
MATLAB[®] 5.3 or higher)
Type 7752 B Noise Source Identification version 2.0

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