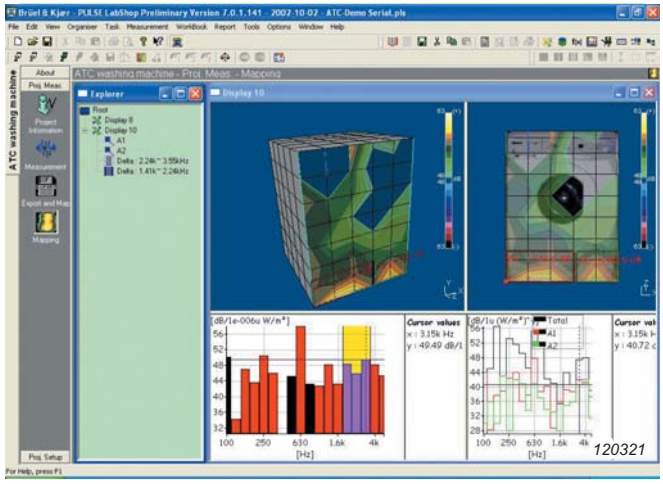
Acoustic Test Consultant with Noise Source Identification Type 7761 with Robot Option BZ-5370 and PULSE Position Detection Option for Acoustic Test Consultant BZ-5611

Acoustic Test Consultant™ (ATC) with Noise Source Identification is a PULSE™ application that has been developed to simplify multipoint acoustic measurements. With the production of reliable test data another primary objective, it also reduces test time and works with PULSE to support all aspects of the measurement process. The system comprises the basic ATC software with a separate robot option for making the measurement process fully automatic, or position detection option for determining the positions of microphones in a hand-held microphone array, and a Noise Source Identification Package.

Noise Source Identification is mapping software enabling identification and quantification of noise sources. Interrelated spectra and maps can be used to identify phenomena that cause noise problems. Sound power values are a useful tool for quantifying noise sources, to help establish where refinement of the product under test is most beneficial.



Uses and Features

Uses

- Sound pressure and sound intensity mapping
- Acquisition of acoustic data for Acoustical Holography, Beamforming and Spherical Beamforming applications, for both stationary and transient sounds
- Sound power determination and ranking
- Contribution analysis

Features

- Task-oriented software
- Automated measurement sequencing
- Easy-to-use geometry generator
- User-definable validation criteria with status notification during measurements
- Robot option for automatic testing or test in “no entry” areas
- Position detection option for use with hand-held microphone array
- Automatic data storage
- Guarantees the efficient and reliable acquisition of complex, multipoint 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

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Introduction

Acoustic Test Consultant (ATC) with Noise Source Identification Type 7761 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 repetition of 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.

The Noise Source Identification mapping software is fully integrated with ATC to provide intuitive visualisation of measurement results via colour-contour mapping in 2 and 3 dimensions. This provides helpful information on sources and sinks on the measurement surface and on where noise sources are located on the product under test.

Intensity Mapping – Manual

Data Acquisition

Acoustic Test Consultant comes with 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 templates for specific tests, making setup quick and easy and reducing test time.

Geometry Driven

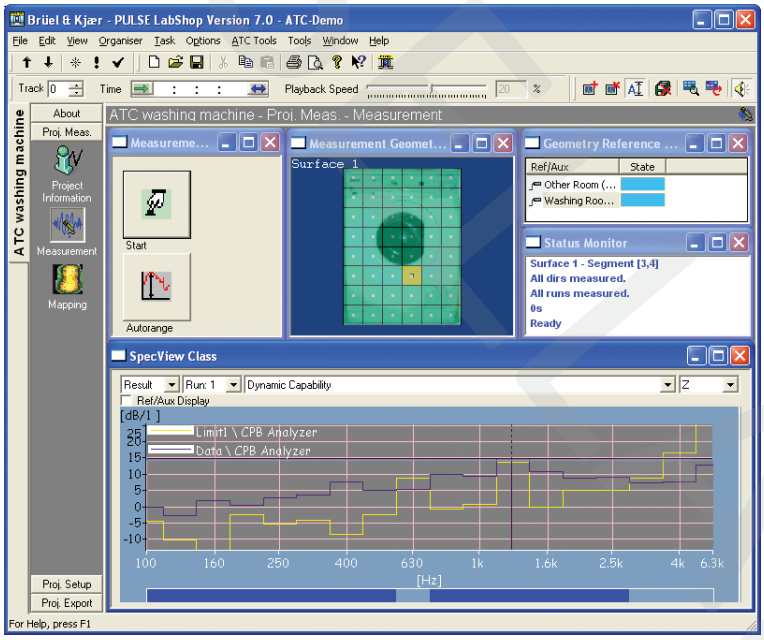

Fig. 1
Measurement task including measurement controls and display of status, spectra and geometry for a specific measurement point. The measurement is validated (for dynamic capability)

The Geometry Setup is where you define your test geometry. It is where you define your acquisition surface, with ATC able to handle multiple 2D planes. This means that measurements can be made over a model consisting of a number of planar surfaces, representing, for example, a box. Each surface can contain areas representing sub-surfaces of special interest. Together with the Measurement Sequence, which you can define to optimise the measurement time, the Geometry Setup determines how you will perform measurements.

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Validation

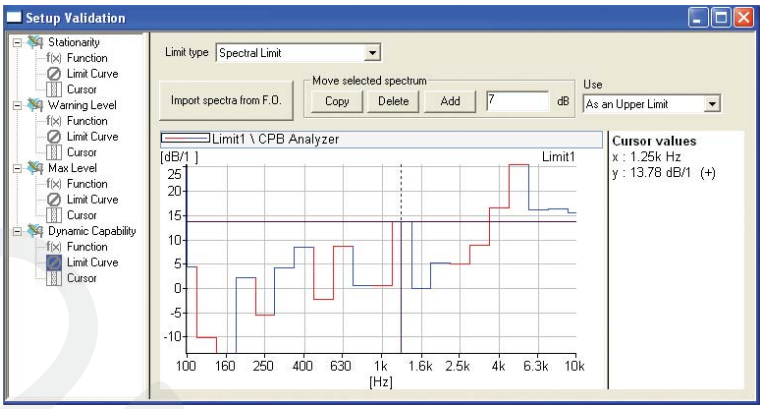

Fig. 2
Validation tools can be defined to ensure the quality of measurement data

Validation 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.

Mapping with Noise Source Identification

Using ATC with Noise Source Identification, all measured data are automatically available for viewing purposes. Using information submitted earlier in ATC's Project Information function, mapping of your test data occurs automatically and is displayed as a 2D and 3D colour-contour map.

Explorer

Using the explorer window, it is possible to create, view and toggle between multiple 2D and 3D displays for comprehensive mapping. You can create several map displays, add sound power areas and define Main and/or Delta cursor positions on the colour-contour map and corresponding spectra.

Displays

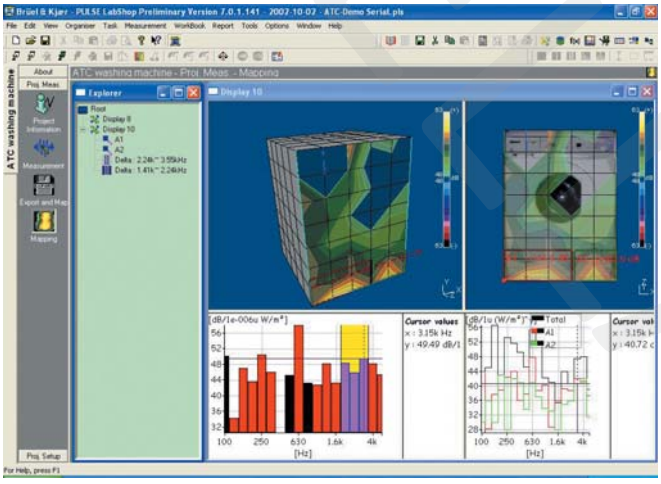

Fig. 3
Contour plot with related intensity spectrum and sound power spectrum for a woofer displayed using Noise Source Identification

Once measurements have been made, result data can be displayed using the mapping software (see Fig. 3).

The software displays a colour-contour map of each planar surface, illustrating where noise sources and sinks are present. Displays of related intensity spectra and sound-power spectra for areas are fully synchronised with the colour-contour map. The mapping displays' properties can be altered for ease of use.

In the intensity spectra, you can choose to map specific frequencies or frequency bands and display the related sound power in the band in relation to the total power.

Mapping is, however, not limited to intensity only; any measured function, such as mean sound pressure, Pressure-Intensity Index, etc., can be mapped.

Sound Power

For multiple, planar surfaces, the software calculates the total sound power for all surfaces as well as the partial sound power for each surface or named area. Multiple surfaces or named areas can be displayed in the sound-power spectra.

NOT FOR RESALE

Documentation of Results
You can print or copy any of the views or use PULSE's Report Organiser for automatic report generation in Microsoft® Word.

Robot-controlled Mapping

ATC fully supports measurements with Robot Option BZ-5370 and an associated microphone positioning system:

- Controls two to eight motors allowing you to orient a microphone-positioning system in up to five directions (X, Y, Z, Phi and Theta), making it possible to measure all surfaces around an object
- Obstacle handling – to define positions where it is not possible to measure and areas to which the robot should not move
- Safe paths – to avoid collisions with the measurement object and/or any objects around it
- Max. torque – will stop the robot to avoid breakage due to collisions

Fig. 4
Biaxial robot microphone-positioning system fitted with a 6×4 microphone array for acoustic holography 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.

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Fig. 5
Five-axis robot as mounted with a sound intensity probe

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

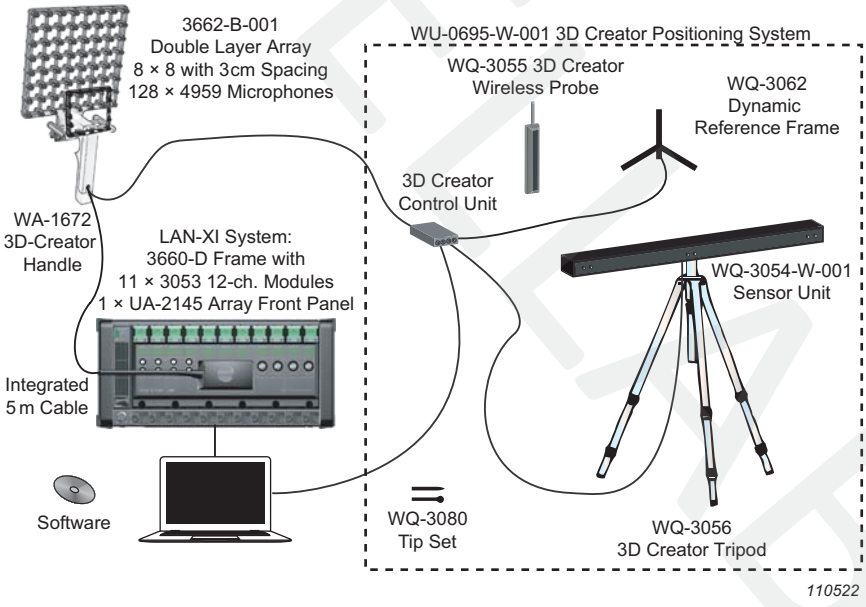
As these types of robots need special specifications to suit the customer's requirements and test setups, these systems are specified in close cooperation with Brüel & Kjær to ensure the best measurement solution.

PULSE Position Detection Option for ATC

ATC supports patch measurements with PULSE Position Detection Option for ATC BZ-5611 and an associated hand-held microphone array with integrated positioning system:

- Determination of microphone positions in three dimensions
- 3D Creator Positioning System based on infrared emitters and sensors

Fig. 6
Typical hand-held double-layer array for noise source conformal mapping using 3D Creator Positioning System



The array handle incorporates multiple infrared emitters that the sensor unit tracks and measures.

Based on output from the positioning system, the software keeps track of the actual measurement positions, providing data that can be used in applications such as conformal mapping using SONAH and patch holography.

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Other Applications

ATC with Noise Source Identification not only allows you to use the classical method of intensity mapping, it also works with other, more advanced applications, such as:

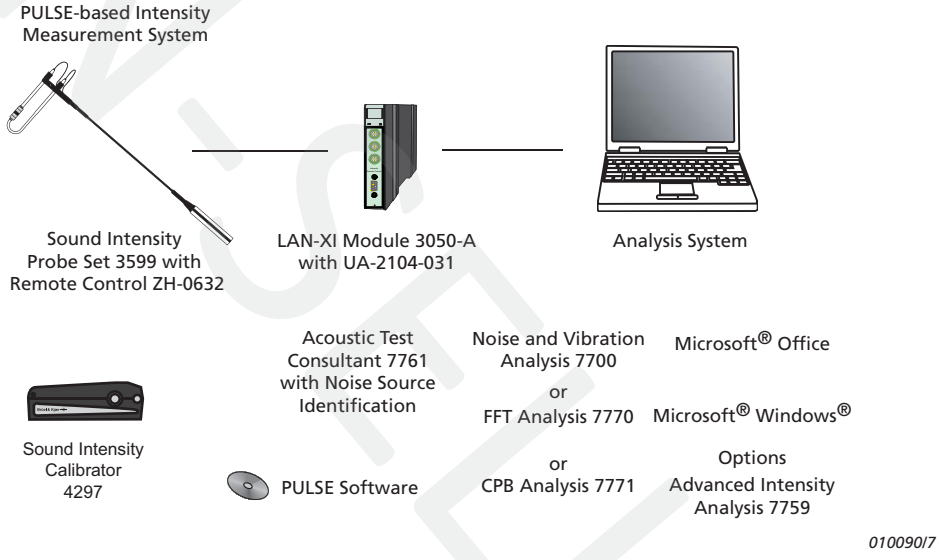
- Beamforming Type 8606
- Acoustic Holography Type 8607
- Spherical Beamforming Type 8608
- Indoor Pass-by Noise Measurement Type 7793

Templates are, of course, provided for each of these applications.

The Intensity Mapping application can also be used with data exported from Hand-held Sound Intensity System Type 2270-G using Measurement Partner Suite BZ-5503.

Recommended System for Intensity Measurements

Fig. 7
Recommended system for intensity-based mapping applications



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System Requirements

The PC requirements for PULSE must be fulfilled (see the System Data for PULSE, BU 0229)

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
- 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
- Obstacle handling for robot movement

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, evenly spaced microphone arrays for STSF or other arrays for beamforming
- 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)
  - variability between measurements
- 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
- 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)

Measurement

MEASUREMENT VIEW

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

EXPORT

- Data Export for selected surfaces, functions, runs and directions via ASCII and Binary UFF dataset 58 and PULSE ASCII.

Robot Option BZ-5370

- Requires Acoustic Test Consultant Type 7761
- Supports measurements on multiple 2D planes
- Supports Robot Controller WB-1477
- RS–232 connection to Robot Controller
- 2 to 8 motors
- Torque and polarity of motors definable
- 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
- Calibration of robot movement
- Probe offset definition

PULSE Position Detection Option for ATC BZ-5611

- Requires Acoustic Test Consultant Type 7761
- Position detection system integrated in handle of hand-held array
- Supports determination of microphone position in 3D
- Supports fixed-frame or flexible ultrasound emitters

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Specifications – Noise Source Identification

Software

DATA
- Maps any data (e.g., intensity) as measured by PULSE ATC or Type 2270
- Universal files (.UFF data set 58), e.g., PULSE multispectra
- 1/nth octave, FFT or synthesised any spectra

DOCUMENTATION OF RESULTS
- Hard copy of display or all displays in a window
- Copy and Paste of display or all displays in a window
- PULSE Report Organiser
- Includes product and project condition details

DATA INTERPOLATION
- Cubic
- Spline
- Linear
- Nearest

MODEL
- Multiple planar surfaces

SOUND POWER
- Total model
- Individual surfaces
- User-selectable areas

DISPLAYS
- Colour-contour map
- 2D and 3D mapping
- Spectral sound power
- Fully synchronised displays

Ordering Information

Type 7761-X*	PULSE Acoustic Test Consultant with Noise Source Identification
BZ-5370-X*	PULSE Robot Option for Acoustic Test Consultant
BZ-5611-X*	PULSE Position Detection Option for Acoustic Test Consultant

Recommended Standard Configurations

For further information on standard configurations, please refer to the PULSE Analyzers & Solutions Catalogue (BF 0209), available on the PULSE Overview page of the Brüel & Kjær website.

Required Software

Type 7700-X*	PULSE FFT & CPB Analysis
or	
Type 7770-X*	PULSE FFT Analysis
or	
Type 7771-X*	PULSE CPB Analysis

Additional Hardware and Software

OPTIONAL SOFTWARE

Type 7707-X*	PULSE Analysis Engine
Type 7759-X*	PULSE Advanced Intensity Analysis

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 3599	Sound Intensity Probe

CALIBRATORS

Type 4231	Sound Calibrator
Type 3541-A	Sound Intensity Calibrator
Type 4297	Sound Intensity Calibrator

Maintenance and Upgrade Agreements

M1-7761-X*	Acoustic Test Consultant Software Maintenance and Support Agreement
M1-5370-X*	Robot Option for Acoustic Test Consultant Software Maintenance and Support Agreement
M1-5611-X*	Position Detection Option for Acoustic Test Consultant Software Maintenance and Support Agreement

* 'X' indicates the license model, either: node locked (N) or floating (F).

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