# Insight Type 8601-S

In today's competitive automotive industry, it is crucial to quickly and accurately evaluate the noise and vibration perceived by vehicle occupants. Based on customers' expectations, automotive engineers start designing and developing the automobile using the concept and brand value definitions.

The source path contribution (SPC) system allows parallel evaluation of design alternatives and product variants throughout the vehicle development process – this can help automotive engineers and managers improve the engineering decision process.

Time-domain SPC enables engineers to calculate, listen to, and modify individual contributions to the vehicle occupants (both airborne and structure-borne), and assists with design and validation of program NVH targets.

110484

Insight Type 8601-S is the ideal playback and analysis system for the time-domain results of SPC Time Domain analysis. Insight is also used together with the CAE Auditioner software to listen to the results of CAE analysis. The CAE analysis results can be 'brought to life' in the Insight playback and analysis software.
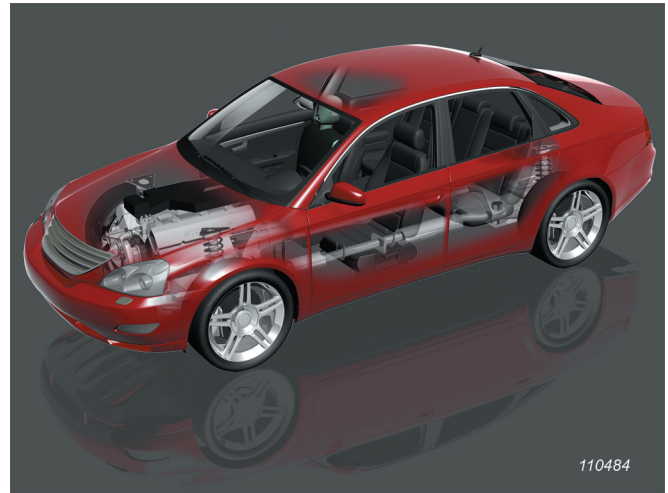
Uses and Features

Uses
- Evaluate time-domain source path contribution analysis results (transfer functions and operating conditions) for airborne or structure-borne paths, calculated by any source path contribution method
- Listen to and modify contributions
- Management of sources, paths and receivers in a structured model
- Easy management of models
- Easy comparisons for target setting
- Evaluation of design alternatives and their effects
- Evaluate any set of time files

Features
- Listen to contributions synchronised for time, speed or rpm
- Perform A/B comparisons
- Record and store modified sounds
- Perform spectral analysis of sources and contributions – view spectra of source level, path sensitivity and contribution off-line or in real time during playback
- Full suite of filters

- Filters can be applied to source or to path, for easy modelling of design changes
- Easy interface for all task operations – model creation, data assignment, calculations and analysis
- Cascading tree structure for easy viewing and organisation
- Export data for further post-analysis, such as order extraction with BK Connect®
- Same look and feel as NVH Simulator
- Use Insight projects within NVH Simulator with the same functionality as in Insight
- Easily upgraded to the full NVH Simulator
- Stream data to BK Connect in real time for additional displays and pseudo-real-time advanced calculations, including sound quality metrics

Brüel & Kjær

Introduction

Time-domain source path contribution offers many benefits and possibilities over traditional frequency domain techniques. The foremost amongst these is the ability to listen to any contribution or combinations of contributions. Additionally, source and path analysis for transient signals is now possible where it was not feasible in the past with frequency domain techniques. With the ability to listen to contributions comes the ability to easily communicate results and design alternatives to other engineers, managers and anyone else who needs to understand them.

Insight Type 8601-S is a part of the SPC Time Domain Type 7798-E system. It includes advanced listening, mixing and filtering tools and allows inspection of data in the time and frequency domains. For more information on SPC Time Domain, see the Source Path Contribution Type 7798 product data, BP 2086.

Insight Type 8601-S also supports the NVH Simulator CAE Auditioner Type 8601-X system. For more information, see the CAE Auditioner Type 8601-X product data, BP 2525.

SPC Time Domain with Insight

The basis of the SPC technique is to calculate tactile and acoustic responses under specific operating conditions. These responses are contributions from various sources and paths. Whether operating in the frequency domain or the time domain, the goal is the same: to understand how the sound and vibration travel from the sources to the receivers in order to better control the sound or vibration at the receiver locations. Time-domain SPC enables the calculation of source strengths and contributions in the time domain.

To perform a time-domain SPC analysis, the process begins with recording time data, processing in SPC using time domain techniques, basic playback and analysis within SPC, then exporting to Insight, BK Connect, NVH Vehicle Simulator or other software for more in-depth analysis and playback.

Insight Type 8601-S provides all the tools necessary to playback and analyse the results of a SPC Time Domain calculation. It embodies an interactive, intuitive approach to understand and evaluate SPC results. Through highly advanced playback and modification methods, you can easily analyse and comprehend SPC results, and make modifications to simulate engineering changes.

With Type 8601-S, you can:
- Play contributions simultaneously, in groups or individually
- Toggle contributions or groups of contributions on and off during playback
- Perform back-to-back comparison using multiple sets of contributions, for example, different vehicles, or different design alternatives. These datasets can be synchronised to various parameters, including time, rpm and speed
- Select a range of data for playback, which can be looped to play continuously. This range can be selected using time, rpm, vehicle speed or other parameters
- Apply a comprehensive set of filters including high-pass, low-pass, notch, user-defined FIR and others, making editing and modification easy and intuitive
- Save and load filters, and apply them in real time, off-line, or mixed together

CAE Audtioner with Insight

NVH Simulator CAE Auditioner Type 8601-X allows NVH design engineers to easily experience their data to evaluate the data in a realistic context and in the presence of other sound/vibration components of the vehicle. Engineers have all the standard tools from Insight at their disposal (for example, switching on and off contributions, applying filters to source strengths and transfer functions, visualization tools, etc.) in order to fully understand the model. Early in a vehicle programme, this approach results in a clear, quantifiable set of cascaded targets for subsequent CAE design iterations. Later, non-experts as well as experts can choose between design alternatives.

The CAE Auditioner is closely integrated with Insight Type 8601-S. CAE Auditioner will automatically create Insight models from the CAE result sets processed in CAE Auditioner.

Prior to analysing and playing back the results in Insight, you create models, measure the data and perform SPC calculations in SPC Time Domain Type 7798-E. When you load a model in Insight, the interface organises it in a tree structure with sound objects containing both time-domain data for sources and contributions, and frequency-domain data for path sensitivity functions. You select contributions in the model for playback and analysis as you would in Type 7798-E.

Models can easily be modified, combined, organised and stored.

Model Creation

Insight models are most often generated within SPC Time Domain Type 7798-E. In this case, the sound objects are automatically defined by SPC and data is automatically assigned.

Alternatively, you can manually create and modify models in Insight. This opens the possibility of adding data from any source (SPC Time Domain or another program).

Multiple assembly models can be used for playback at one time, facilitating back-to-back playback of different models and different sets of data.

Fig. 1 Model creation in Insight
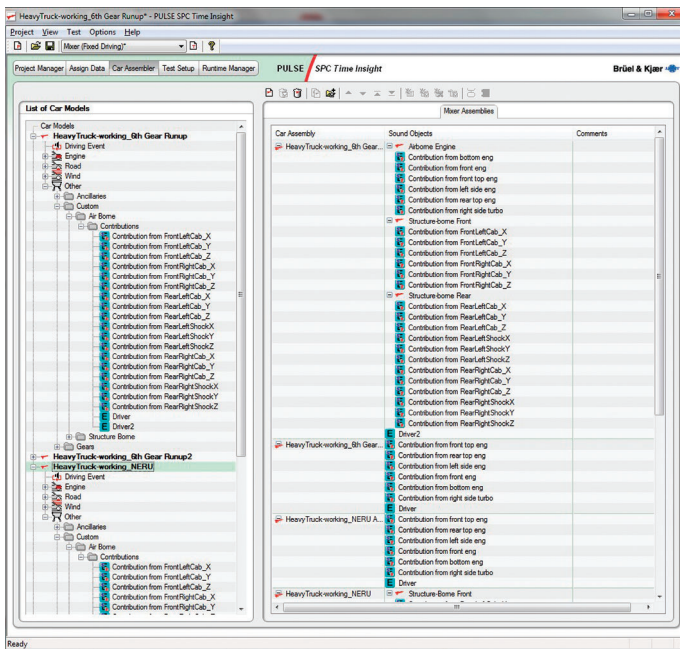
Playback and Real-time Modification and Analysis

Playback

Playback is simple and intuitive. Load individual or multiple assemblies into the interface's Mixer for back-to-back comparison. Select from the Mixer list the contributions and sound objects you wish to listen to. There are various options for selecting, grouping, playing sound objects/contributions individually and turning sound objects on and off. You can also select a specific range for playback, toggle continuous looping and set up sound synchronisation with another dataset based on a specific parameter (such as engine rpm).

**Fig. 2** Playback. Using the Mixer and spectra display
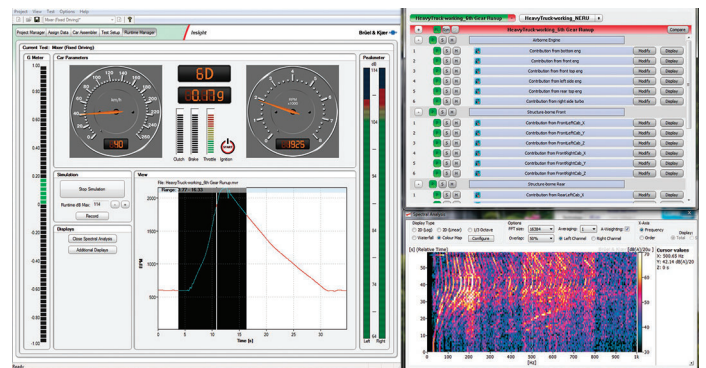
Analysis

For vehicle models, engine rpm and vehicle speed are easily shown. These and other vehicle parameters can be displayed as quantity vs time plots at the top of the Mixer display. A spectral display can be configured to display 2D frequency spectra in linear, log and 1/3-octave formats, and can be configured for 3D waterfall and contour displays.

Spectra can be 'frozen' to compare to other datasets, other sets of contributions, or other points in time of the playback. Individual contributions can be overlaid with the overall spectrum in the spectra display, making it easy to see exactly how much a single contribution is affecting the total sound level. In addition, a triple spectra display is employed to show levels of source, path and contribution simultaneously during playback. These are in real time, updating as the sound is played.

3

**Fig. 3** *Analysis. Real-time spectra for source, path and contribution during playback*
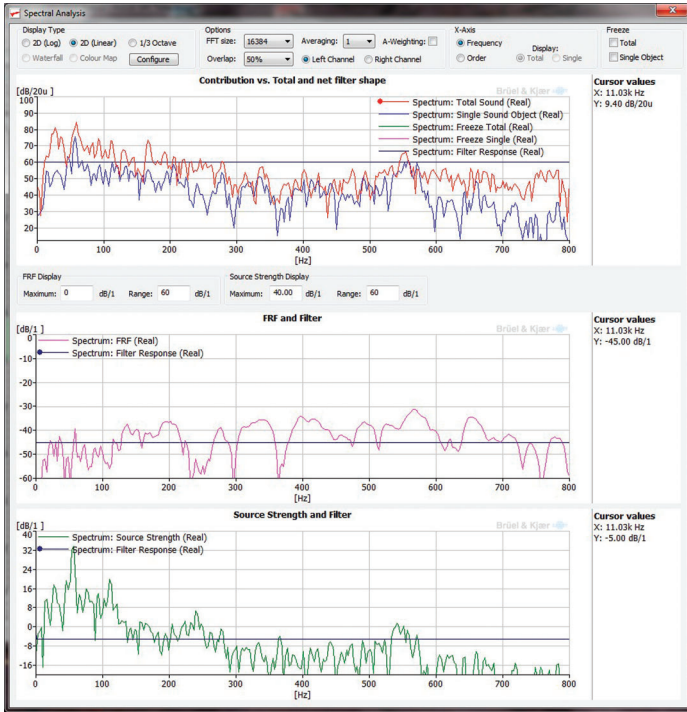
Modifications

Modifications can be performed on the individual contributions (not the overall sound) through the application of any of the available filter types in the Modification List, including high-pass, low-pass, band-pass, band-stop, notch (cut or boost), or user-definable FIR filter. The user-definable FIR filter can use a profile imported from another application. Additionally, simple level adjustments are also easily accomplished through the Modification List.

Modifications can also be applied to either the source level or the path. These features enable the simulation of engineering changes in a realistic manner and in a way paralleling the actual physical changes to the physical system.

Fig. 4 *Modifications. Applying a Notch Filter to the source level of a single contribution*
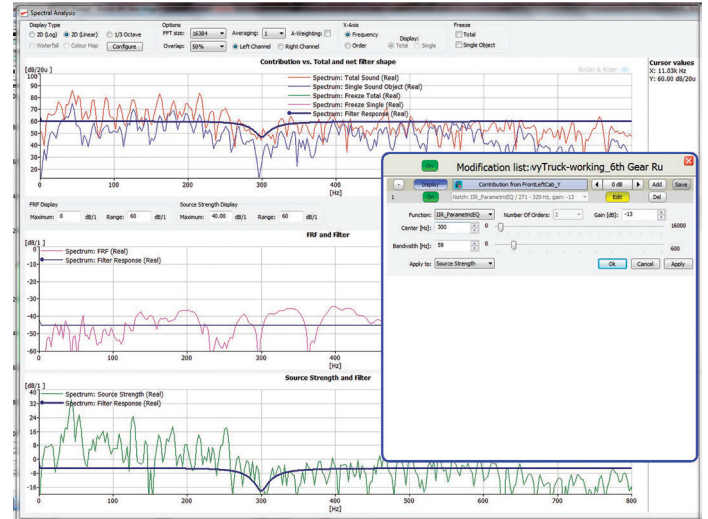
Off-line Data Display and Analysis

Data can also be viewed either in the time domain or frequency domain using the off-line data display tools. Source, path and contribution levels can be plotted and analysed, with synchronised cursors between contribution, source and path sensitivity FRF. Contributions can be added together and displayed and compared to measured response data. The sum of the paths can be exported as a new time history.

Fig. 5 *Off-line display and spectral analysis of source strengths, paths, contributions and summed contributions*
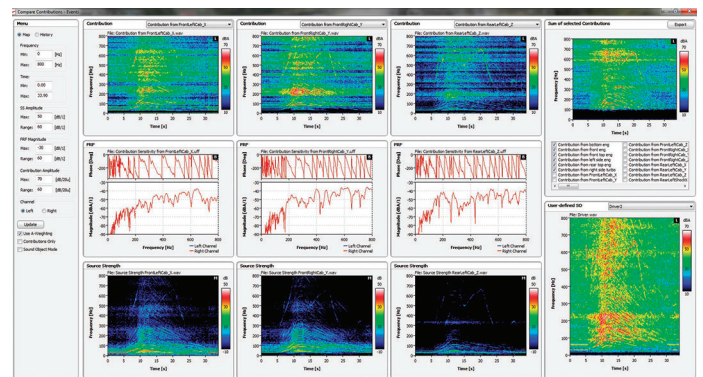
Source Path Contribution Type 7798 solutions, including SPC Time Domain Type 7798-E and Insight Type 8601-S, are NVH analysis software tools

PC Configuration

REQUIRED SOFTWARE
- SPC Viewer Type 7798-A
- SPC Time Domain Type 7798-E

RECOMMENDED PULSE SOFTWARE
- SPC Mount Stiffness and Matrix Methods Type 7798-B
- SPC Matrix Method with PCD Type 7798-C
- SPC Multiple Coherence Method Type 7798-D

RECOMMENDED PC CONFIGURATION
- Intel® Core™ i7 Quad core 3 GHz processor, or better
- 32 GB RAM

- Minimum 480 GB solid state drive (SSD) with 20 GB of free or better
- 1 Gbit Ethernet network
- Microsoft® Windows® 10 Pro or Enterprise (x64) with Current Branch
- Screen resolution of 1920 × 1080 pixels (full HD) minimum
- Dedicated graphics card with minimum 2 GB on-board VRAM, or
- better
- Microsoft® Office 2016 (x32) for systems with BK Connect
- For NVH Vehicle Simulator: Dedicated graphics card with 2 GB on-board VRAM, or better

Software

USER INTERFACE
- Task-driven user interface
- Data-centric architecture
Display Functionality: Advanced graphic tools

Ordering Information

Software with an -*x* suffix are available either as a node-locked or floating licence. Please include licence type when ordering:
- N: node-locked, permanent (example: *8601-S-N*)
- FYG: annual floating lease, global (example: *8601-S-FYG*)
- FYL: annual floating lease, local site (example: *8601-S-FYL*)
- FY1: annual floating lease, Region 1, Americas (example: *8601-S-FY1*)
- FY2: annual floating lease, Region 2, Europe (example: *8601-S-FY2*)
- FY3: annual floating lease, Region 3, Asia (example: *8601-S-FY3*)
Software with an -*y* suffix indicates permanent licences that are either N: node-locked or F: floating (not a lease licence)

Type 8601-S-*x*   **Insight**

Go to bksv.com/nvhsimulator to find out more about Brüel & Kjær's NVH analysis solutions. For a full list of NVH Simulator modules and options, see the product data.

SUPPORT PRODUCTS
Software maintenance and support is included in all annual floating lease licences. For permanent, node-locked licences, the following software maintenance products are required:
M1-8601-S-N   Software Maintenance and Support Agreement for Type 8601-S-N

Recommended Products

RECOMMENDED SOFTWARE

Type 7798-A-*x*	SPC Viewer
Type 7798-E-*x*	SPC Time Domain
Type 8601-X-*x*	NVH Simulator CAE Auditioner
Type 8400-*y*	BK Connect Data Viewer
Type 8400-B-*y*	BK Connect Native File Importers, for importing other Brüel & Kjær data
Type 8400-C-*y*	BK Connect External File Importers
Type 8401-V-*y*	BK Connect Virtual Hardware Setup
Type 8403-*y*	BK Connect Data Processing, includes synthesized CPB, not IEC/ANSI
Type 8403-A-*y*	BK Connect Data Processing (advanced)
Type 8405-C-*y*	BK Connect CPB Option, if IEC/ANSI octave-band calculation needed
Type 8405-E-*y*	BK Connect Order Analysis Option
Type 8405-F-*y*	BK Connect Order Tracking Option
Type 8405-G-*y*	BK Connect Sound Quality Metrics Options

RECOMMENDED HARDWARE

ZH-0677	RME® Fireface UC Audio Interface
HT-0017	Sennheiser HD650 Headphones

Brüel & Kjær offers complete SPC solutions, including transducers, instrumentation and signal processing platforms, SPC analysis software as well as training and engineering services for SPC

Brüel & Kjær ⊕

2019-08

BP 2340 – 14

Brüel & Kjær B⊕K