

APPLICATION NOTE

2-channel Measurement using 2260 Investigator
— Facade Insulation with Traffic Noise
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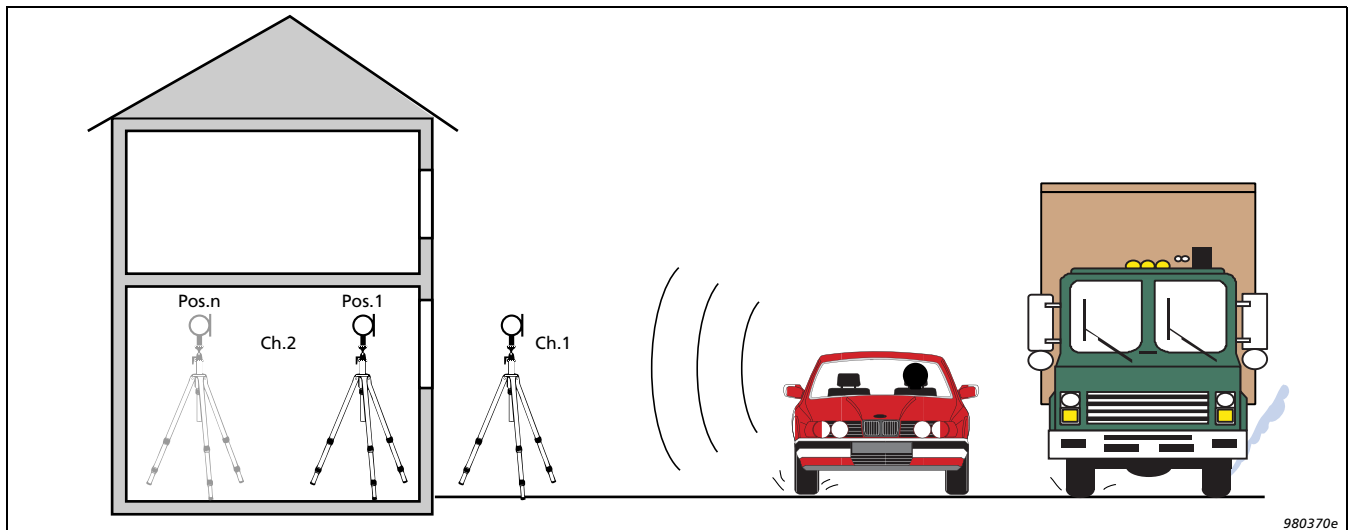
To measure facade insulation using traffic noise you need to measure sound pressure outside and inside the facade simultaneously, i.e., 2-channel measurement. This can be done using 2260 Investigator™ with Sound Intensity Software module BZ 7205. In addition you need the reverberation time inside the facade, and this can be measured using 2260 Investigator Building Acoustics Software BZ 7204.

2260

Measuring Facade Insulation with Traffic Noise

Facade insulation can be measured using a loudspeaker in front of the facade, but using the actual traffic noise is more realistic and may reduce problems with background noise. However, since traffic noise is not stationary, you need to measure the sound pressure outside and inside the facade simultaneously i.e., you need 2-channel measurement. This may be done using 2260 Investigator with Sound Intensity Software BZ 7205. In addition you need the reverberation time inside the facade, and this can be measured using 2260 Investigator with Building Acoustics Software BZ 7204.

Fig. 1 Measuring sound pressure outside and inside the facade simultaneously – 2-channel measurement

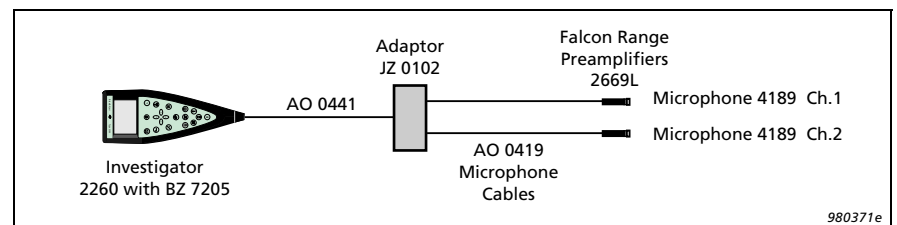


Connecting Two Channels to 2260 Investigator

2260 Investigator is supplied with a set consisting of microphone and preamplifier, but is designed to use two sets for special purposes, for instance when measuring sound intensity, employing a two-microphone probe. For 2-channel measurements we need two separate sets of microphone/preamplifier, and this can be done either by using two Falcon Range[®] 1/2" Microphone Preamplifiers or one Type 2642 Microphone Preamplifier and the 2260's preamplifier.

System set-up using two Microphone Preamplifiers Type 2669

Fig. 2 The set-up used for measuring sound intensity, employing a two-microphone probe

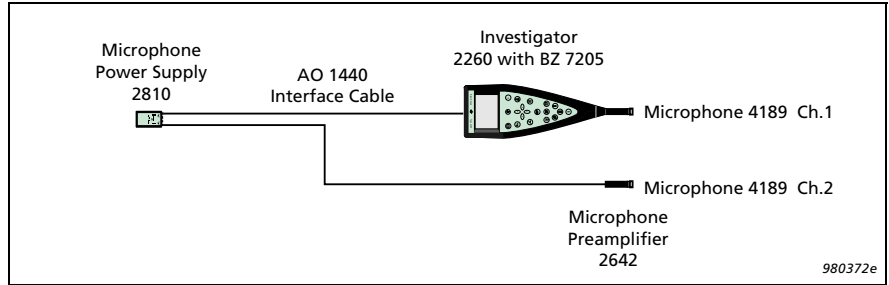


- Adaptor JZ0102 converts from 2260 Investigator's single 10-pole socket to 2 × 7-pole preamplifier sockets, so standard Brüel & Kjær preamplifiers can be used

- Range and sensitivity is similar to specifications for single channel 2260 operation
- A range of cables is available (see the Table below)
- Microphone Type 4189 from 2260 Investigator is used for Channel 1

System set-up using 2642 Preamplifier

Fig. 3 The system set-up used for making 2-channel measurements



- The pocket-size, 2-channel Microphone Power Supply Type 2810 is a battery power supply for Preamplifier Type 2642 . The power supply gain is adjustable from 0 to 40 dB, and the output connects to the Channel 2 AC input of the 2260
- The dynamic range for the output is 80 dB, so setting the gain to 30 dB will give a range of 20– 100 dB for Channel 2
- A range of cables is available (see the Table)
- Microphone Type 4189 and the preamplifier in the 2260 are used for Channel 1

Cables

| LEMO Connector | Application | 3 m | 10 m | 30 m | Flat Cable |
|----------------|----------------|---------|---------|---------|------------|
| 5-pole | 2642 extension | AO 0175 | AO 0176 | AO 0177 | |
| 7-pole | 2669 extension | AO 0414 | AO 0415 | AO 0416 | AR 0014 |
| 10-pole | 2260 extension | AO 0441 | AO 0442 | | AR 0199 |

2260 Set-up for BZ 7205

The **General 2 Channel** application is selected in the **Create Job** set-up menu, and **Meas.** is set to **Dual Channel**.

It is necessary to define a measuring surface, and a 1 × 1 m grid of 3 × 3 segments will provide 9 measurement positions.

In **Meas. Control**, a **Preset Avg. Time** may be set to, for example, 20 s (or to **Off** for manual control). Setting the **Segment Select** to **Auto** and **Storage Dialogue** to **Off** will speed up measurements.

The **Input** is set up according to the system used. Remember to set the **Pol. Voltage** to **0V**. With the 2642/2810 system, **Input 2** is set to **AC**, and **Preamp. Gain** to the gain of the 2810 (e.g., 30 dB).

Range may be set using autorange (press the dB key), but for varying traffic noise it is better to set it manually in the **Input** menu according to the level ranges expected.

The **Incidence** setting cannot be changed for 2-channel measurements; the default setting is **Frontal**. Since 2-channel measurements are used to calculate the difference between channel spectra, the incidence setting does not influence results.

Calibration

The calibration procedure is straightforward. Just follow the instructions given on the 2260 screen. The two channels are calibrated one after the other.

Note that if the set-up with Preamplifier Type 2642 and Type 2810 Power Supply is used, the gain of the 2810 should not be set above 30 dB, since this would cause overload of both the 2810 and the 2260 with a 94 dB calibrator.

Measurement

The measurement is simple – just press **Reset/Start**. Watch out for possible range and background noise problems during measurement. Measurement results can be checked using the display of spectra for Channel 1, for Channel 2, for both or for the difference.

Calculation

The basic measurement result is the difference spectrum **Ch.1 – Ch.2** for each segment (position), and these difference spectra must be averaged (the 2260 does not do this).

The recommended procedure is:

1. Transfer each segment **Ch.1 – Ch.2** to Excel using 2260 Link (or Noise Explorer™ 7815).
2. In Excel, calculate the average difference using
$$D = -10 \log \left(\frac{1}{n} \sum 10^{-(L1-L2)/10} \right).$$
3. Import the reverberation time spectrum into Excel*.
4. Calculate the relevant spectrum (e.g., R'tr,s or Dtr,2m,n).
5. If a weighted result is required, this may be calculated in Excel, or you can have 7830 Qualifier™ do the calculation by manually entering the R'tr or Dtr spectrum into the R' column of the Result sheet*.

* **Note:** The reverberation time can be measured in a job using the Building Acoustics module BZ 7204. A simple dummy BZ 7204 measurement should be made of L1 and L2, so a complete job can be transferred to 7830 Qualifier for extracting the reverberation time and for entering the R' spectrum

Examples of Results

Fig. 4 2260's BZ 7205 display of 2-channel pressure spectra

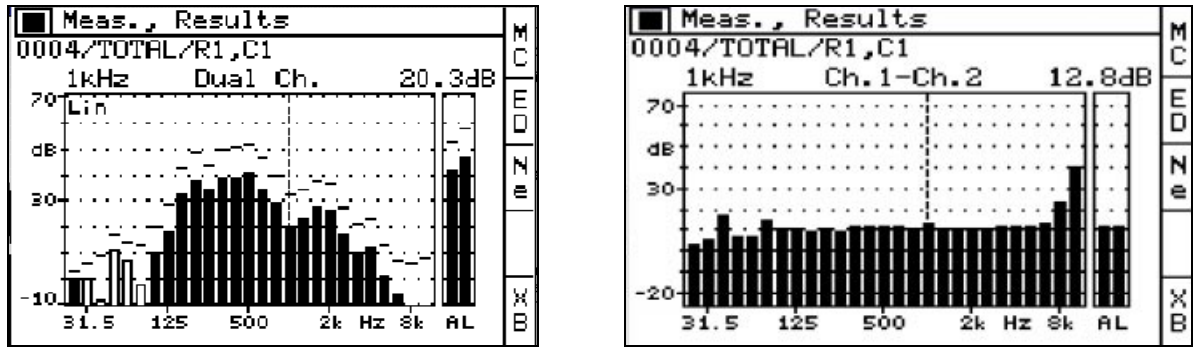


Fig. 5 Excel graph of facade insulation spectra

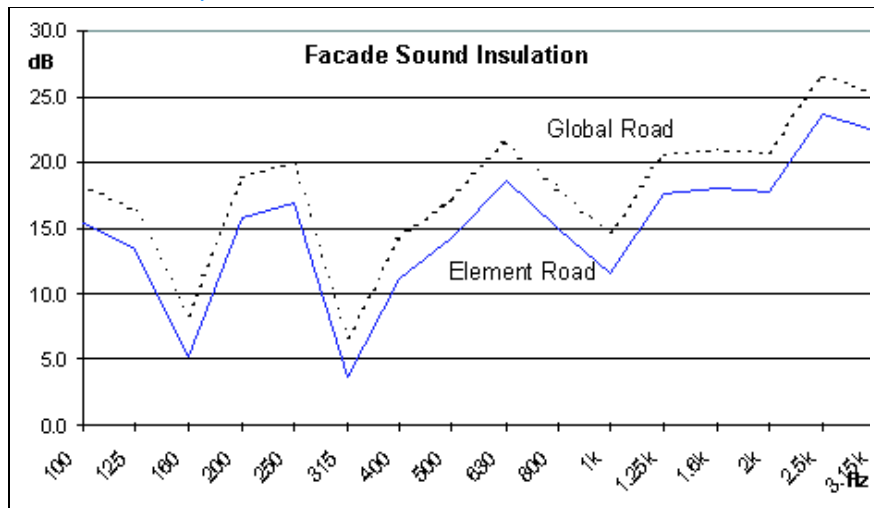
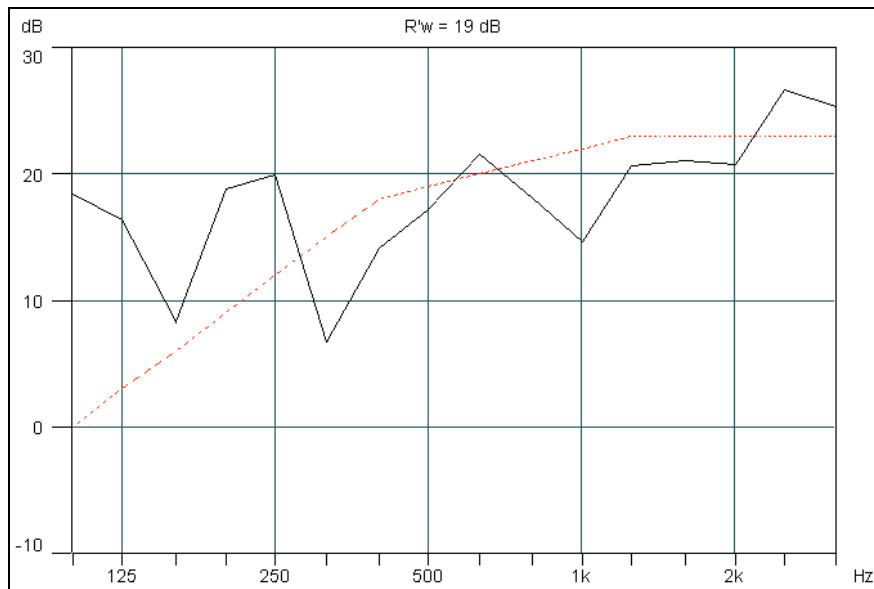


Fig. 6 Qualifier graph of facade insulation spectrum, with weighted result



Sound Intensity Used for Building Acoustics

Fig. 7 Application example: Finding weak spots in sound insulation for a radio studio



2-channel sound pressure measurement is just one of the applications of Sound Intensity Software BZ 7205. Another important application is measurement of sound insulation using the intensity technique. As an alternative to a pressure-based measurement of the apparent sound insulation index R' for a given partition, this measurement system allows the

Corrected intensity sound reduction index

$$R_{I,c} = L_{p1} - 6 - \left(L_{In} + 10 \log \left(\frac{S_m}{S} \right) \right) + 10 \log \left(1 + \frac{S_{b2\lambda}}{8_{v2}} \right) \text{ dB}$$

corrected intensity sound reduction index, $R_{I,c}$ to be measured. This enables extra information regarding the contribution of various flanking and leakage transmissions to be gathered. In a traditional pressure-based measurement you get an apparent sound insulation index R' which takes every type of transmission into account.

Fig. 8 The $R_{I,cw}$ in surface display

| Meas., Results | | M | |
|----------------|--------------------------|---|--|
| RI,cw | RI,c | C | |
| WALL/EAST: | 37.0 dB R | E | |
| R1,C1: | 43.0 dB | D | |
| 4 | . | S | |
| 3 | . | ▲ | |
| 2 | R 48 R 48 58 52 | T | |
| 1 | 43 43 43 R 53 | | |
| | 1 2 3 4 | | |

However, traditional measurements cannot identify individual transmission paths. But with this application you can choose specific details of any particular segment of any given partition or surface. If a compound partition is to be studied, for example a wall containing a window, the respective intensity sound reduction index, $R_{I,c}$ for both the wall material and for the window can be found. The single-number weighted and corrected intensity sound reduction index, $R_{I,cw}$, is automatically calculated for each segment and the whole surface. To create a sound field on one side of the wall (in the source room) use the internal white noise generator together with Power Amplifier Type 2716 and OmniPower™ Sound Source Type 4296.

Leakages

If measurements reveal a leakage problem or “hidden” flanking transmission, the hand-held sound intensity system can conveniently be used for noise source location with respect to either a single band or the whole spectrum.