PRODUCT DATA

Investigator™ — Type 2260-D with BZ-7204 and Qualifier Type 7830, Investigator — Type 2260-G with BZ-7207 and Qualifier Light Type 7831

The combined features of Investigator Types 2260-D with Qualifier Type 7830 PC Software, or 2260-G with Qualifier Light Type 7831 provide ideal facilities for architectural and building acoustic measurements.

USES AND FEATURES

USES

- Architectural and building acoustic measurements of:
  - Airborne sound insulation
  - Impact sound insulation
  - Reverberation time

FEATURES (2260-D)

- Complete hand-held building acoustics analyzer
- Measures level and reverberation time spectra
- Built-in pink and white noise generator
- On the spot calculation of airborne sound insulation curves and indexes
- Façade insulation calculations
- Satisfies ISO and national standards
- 2-channel measurements
- Measures reverberation time with impulse or interrupted noise excitation
- Displays reverberation time and decay curves
- Serial measurement
- Complete system using available accessories

FEATURES (2260-G)

- Measures reverberation time with impulse or interrupted noise excitation
- Displays reverberation time and decay curves
- Interrupted noise or impulse excitation
- Calculates broadband average reverberation time
- Economical and compact solution

FEATURES (7830)

- Calculates sound insulation curves and indexes
- Edits measurement results, including manual input of data
- Documentation and reporting facilities

FEATURES (7831)

- Calculates reverberation time
- Edits measurement results, including manual input of data
- Documentation and reporting facilities

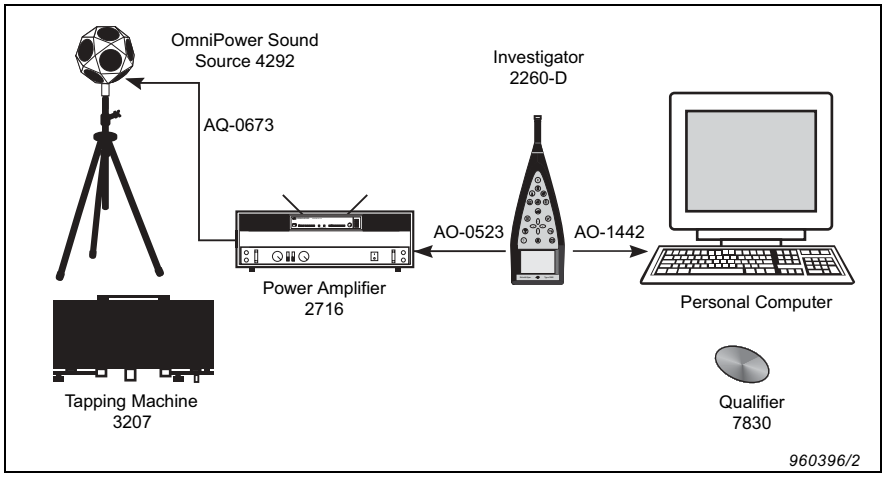
A Complete Measurement System for Architectural and Building Acoustics

The combination of well proven, reliable hardware and tailor-made software effectively avoids the necessity of a PC in the field. In addition, the calculation of sound insulation curves and indexes can be provided on-the-spot.

The following additional components complete the system:
- OmniPower Sound Source™ Type 4292
- Power Amplifier Type 2716
- Flight Case KE-0348
- Tapping Machine Type 3207

See also Sound Sources for Building Acoustics Product Data (BP 1689). A typical configuration is shown in Fig. 1.

Fig. 1
Typical measurement setup also showing optional equipment available from Brüel & Kjær to cover your requirements for measuring and analysing architectural and building acoustics



Investigator 2260-D

This is the standard Investigator loaded with the supplied BZ-7204 software. The use of this software for a typical application is described here.

Using 2260-D/BZ-7204

The main purposes of BZ-7204 software are to measure the building-acoustic parameters needed, and to make sound insulation calculations.

Measurement

Calculation of airborne sound insulation normally requires measurement of:
- L1: Source room level
- L2: Receiving room level
- B2: Background noise in receiving room
- T2: Reverberation time in receiving room

Depending upon standard and calculation formula, it may not be necessary to measure B2 and/or T2. Also, L1 measurements are not used in impact sound insulation.

BZ-7204 allows measurement of all these parameters in any order required.

In level measurements (L1, L2 and B2) it is the L_{eq}-value that is recorded. The measurement time can be specified in steps of 1 second.

In reverberation time measurements (T2) a short-time L_{eq} (down to 8 ms) is used to record a multispectrum for calculating reverberation time.

Data Bookkeeping

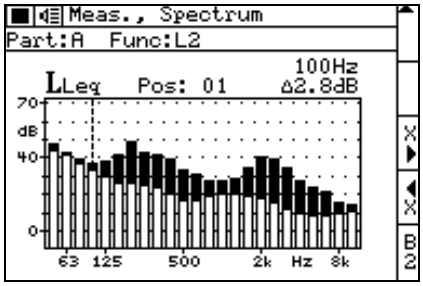


Fig. 2
Screen shot showing the measurements of L2 and B2

BZ-7204 has an automatic data bookkeeping system, that saves you the task of remembering file names, etc. It is a hierarchical system with a "Job" record at the top level. A Job is denoted by a four digit number. As an example, this could relate to a certain measurement location.

Within a Job, one Task is performed, e.g., airborne sound insulation, impact sound insulation or reverberation time.

Measurements for several partitions (denoted by a letter, A to Z), for example, walls and floors, can be contained in one job. Each partition has a set of (L1), L2, B2 and T2 that consist of one or more positions of each. For each partition the sound insulation can be calculated on the basis of the average of all positions of (L1), L2, B2 and T2.

Four measurement displays are available in airborne sound insulation: L1, L2, B2 and T2. A clear indication of which one has been selected is shown on the 2260 screen. It is easy to change between them by pressing a key.

Positions and Average

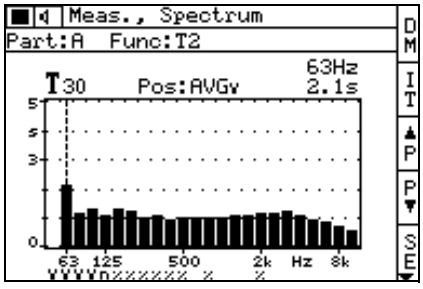


Fig. 3
Screen shot showing the spectrum of reverberation times

It is possible to measure and store up to 25 positions each for L1, L2, B2 and T2. The positions are measured one at a time and the spectra can be viewed continuously on the screen. Positions can be stored automatically with automatically incremented position numbers. Alternatively, positions can be stored manually in any position number. When the first position is stored (either manually or automatically) some setup parameters, for example, the bandwidth, are "frozen" to make sure that all the positions for the job will be compatible. Every time a new position is stored the average is calculated.

In level measurements (L1, L2 and B2) it is possible to view the following displays:

- Instantaneous level
- Current position
- Single positions
- Average of all positions

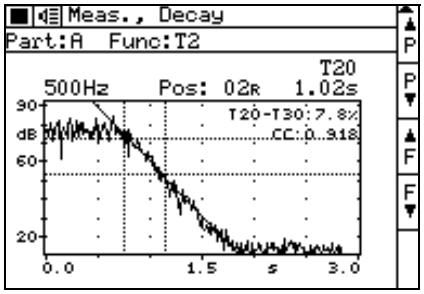


Fig. 4
Decay at 500 Hz for a typical measurement

These are shown as spectra. When looking at L2, the B2-curve may also be shown (and vice versa) to indicate the distance to the background noise.

Reverberation time measurement is made using interrupted noise or impulse excitation (e.g., pistol shot). With impulsive noise, the user enters a trigger level, and the 2260 will, when triggered, automatically record the decay and perform backwards integration (Schroeder method). This method gives a smooth decay comparable to the average of a large number of interrupted noise decays.

With interrupted noise, ensemble averaging is used on multiple decays in the same position. Averaging of reverberation times (T20 and T30) is used across positions to provide fast

averaging results. To check the quality of decays, it is possible for each position to look at the decay in each frequency band.

The broadband average T20 and T30 of user selected frequency bands can be calculated.

Reuse

To save measurement time, L1, B2 and T2 may be copied from another measurement. This is relevant when several partitions have common source- or receiving room.

Generator

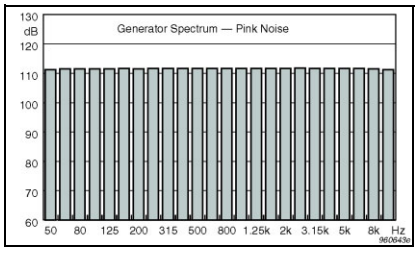


Fig. 5
1/3-octave spectrum of the internal generator output for pink noise set to 50 Hz – 10 kHz. Measured in 1/3-octaves 50 Hz – 10 kHz

The built-in generator can supply pink noise or white noise in the bandwidth used for the measurement. The signal is switched on and off automatically in accordance with the performed measurement.

The noise signal may be connected to a power amplifier and loudspeaker. Alternatively, an on/off output signal can be selected, to control an external generator.

Calculations

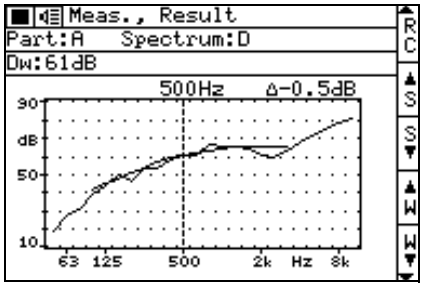


Fig. 6
Screen shot showing the calculation of airborne sound insulation according to ISO standard

As soon as just one position of L1, L2, (B2) and T2 has been measured, the sound reduction index (spectrum and weighted) can be calculated. Generally the sound insulation is calculated (for each partition) from the average of all the positions of L1, L2, B2 and T2. It is possible to exclude positions from the average to see what effect certain positions have on the result. Several calculation formulae can be selected, depending on the selected standard.

The following standards can be selected: ISO, DIN, BS, SS, ÖNORM, Sia, UNI, NF, NBE, NEN, BREW and ASTM. For standards and parameters, see Tables 1 and 2.

Printing

Printing is possible in several formats for on-the-spot documentation. All screen pictures can be sent to a printer from Type 2260-D. The type of print-out depends on the current display – Spectrum, Overview, Result or Setup. The scope of printed data may be selected as one Partition, or the entire Job.

Data Transfer to a PC

Measurement data can be transferred to a PC for post processing using the Qualifier™ Type 7830 software. Furthermore, data can be transferred in formats suitable for processing in a spreadsheet.

Fig. 7
Example of print-out from Type 2260-D to Portable Printer Type 2322. Result spectra and weighted results are shown for an ISO measurement

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          Brüel & Kjær
      Sound Analyzer Type 2260
  Building Acoustics Software BZ7204
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Job                            1

Partition                      A
Task                    Airborne

LLeq  Results
Freq.    D       Dn R     DrT R    R' R
  Hz     dB        dB       dB       dB
--------------------------------------
   50   19.5          Y          Y       Y
   63   27.2    28.4 R   33.4 R   28.4 R
   80   31.1    29.7 R   34.8 R   29.7 R
  100   38.8    38.1 R   43.1 R   38.1 R
  125   44.2    42.6 n   47.6 n   42.6 n
  160   50.2    49.4 %   54.4 %   49.4 %
  200   45.9    44.7 %   49.8 %   44.7 %
  250   53.5    51.6 %   56.6 %   51.6 %
  315   53.1    51.4 %   56.5 %   51.4 %
  400   58.0    55.8 %   60.9 %   55.8 %
  500   60.5    58.4 %   63.4 %   58.4 %
  630   61.3    59.5     64.5     59.5
  800   66.6    64.6 %   69.6 %   64.6 %
   1k   65.6    63.7     68.8     63.7
1.25k   65.9    64.3     69.4     64.3
 1.6k   64.8    63.2     68.2     63.2
   2k   60.7    59.2 %   64.3 %   59.2 %
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          Brüel & Kjær
      Sound Analyzer Type 2260
  Building Acoustics Software BZ7204
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Job                            1

Partition                      A
Task                    Airborne

LLeq  Results
Freq.    D       Dn R     DrT R    R' R
  Hz     dB        dB       dB       dB
--------------------------------------
   50   19.5          Y          Y       Y
   63   27.2    28.4 R   33.4 R   28.4 R
   80   31.1    29.7 R   34.8 R   29.7 R
  100   38.8    38.1 R   43.1 R   38.1 R
  125   44.2    42.6 n   47.6 n   42.6 n
  160   50.2    49.4 %   54.4 %   49.4 %
  200   45.9    44.7 %   49.8 %   44.7 %
  250   53.5    51.6 %   56.6 %   51.6 %
  315   53.1    51.4 %   56.5 %   51.4 %
  400   58.0    55.8 %   60.9 %   55.8 %
  500   60.5    58.4 %   63.4 %   58.4 %
  630   61.3    59.5     64.5     59.5
  800   66.6    64.6 %   69.6 %   64.6 %
   1k   65.6    63.7     68.8     63.7
1.25k   65.9    64.3     69.4     64.3
 1.6k   64.8    63.2     68.2     63.2
   2k   60.7    59.2 %   64.3 %   59.2 %
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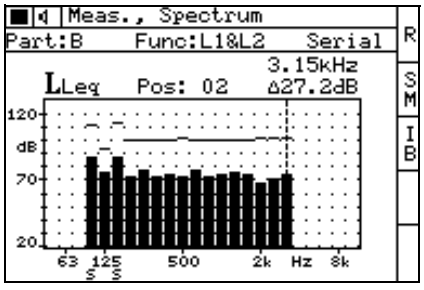
Fig. 8
2260 screen with two bands measured serially (2-channels)



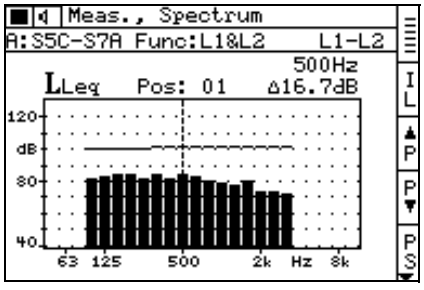
Serial Measurement

If the background noise in some frequency bands is too high, those bands can be measured serially, i.e., one by one in automatic sequence. The total output of the internal noise generator remains the same, so the level in each band will increase (by up to 10 dB) and thus improve the signal to noise ratio. This signal works for functions L1, L2 and T2 (it is not relevant for B2) for both one and two channels.

2-channel Measurement

The levels L1 and L2 on either side of the partition can be measured simultaneously. This is useful when making facade insulation measurements with traffic noise as a source, since this noise varies over time. 2-channel measurement can also be used to speed up measurements, or to simplify the measurement procedure.

Fig. 9
2260 screen with 2-channel spectrum



To connect two microphones, add another Prepolarized Free-field ½-inch Microphone Type 4189 and Preamplifier ZC-0026, and connect the two preamplifiers via Dual 10-pole Adaptor JP-1041. Alternatively, if a second microphone signal is already available, it can be connected via the AC input of 2260 Investigator.

Fig. 10
Setup for 2-channel measurement. Type 2260 microphone and preamplifier is used for one channel, and one additional microphone and preamplifier for the other channel

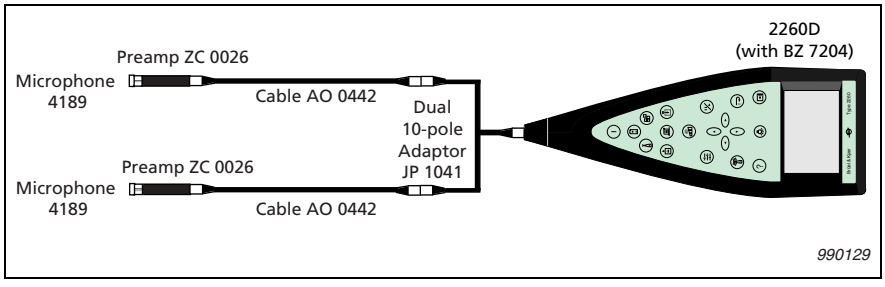
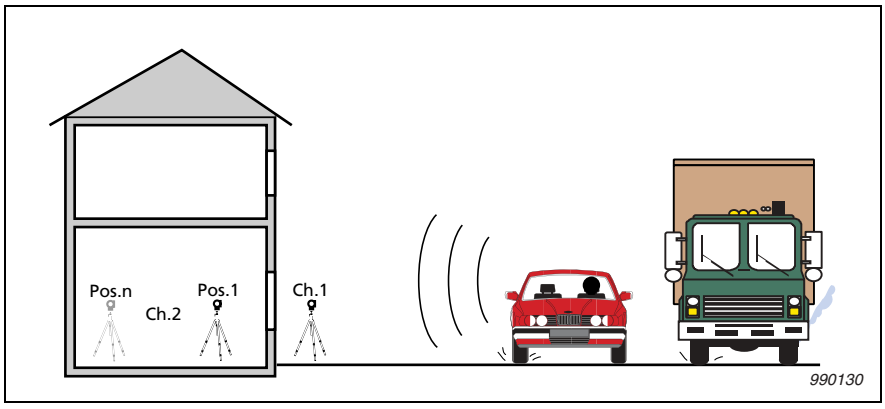


Fig. 11
Measuring sound pressure outside and inside the façade simultaneously – 2-channel measurement

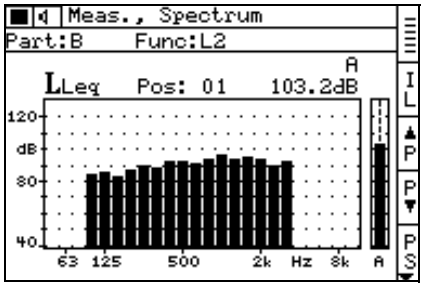


Special Features

A number of features are included in response to special needs in certain countries, and they can be useful for general application.

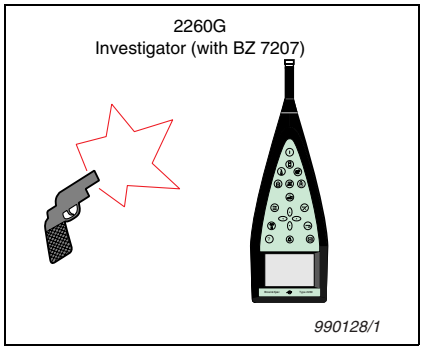
- Broadband A-weighted value for L1, L2 and B2. The instantaneous dB (A) value is shown on the 2260 screen for one channel (but not stored)
- Correction spectrum can be entered by the user. This applies to both channels (if used)
- Manual entry of reverberation time in any frequency band. You can return to the measured value at any time

Fig. 12
2260 screen with L2 measurement and A weighting



Investigator 2260-G

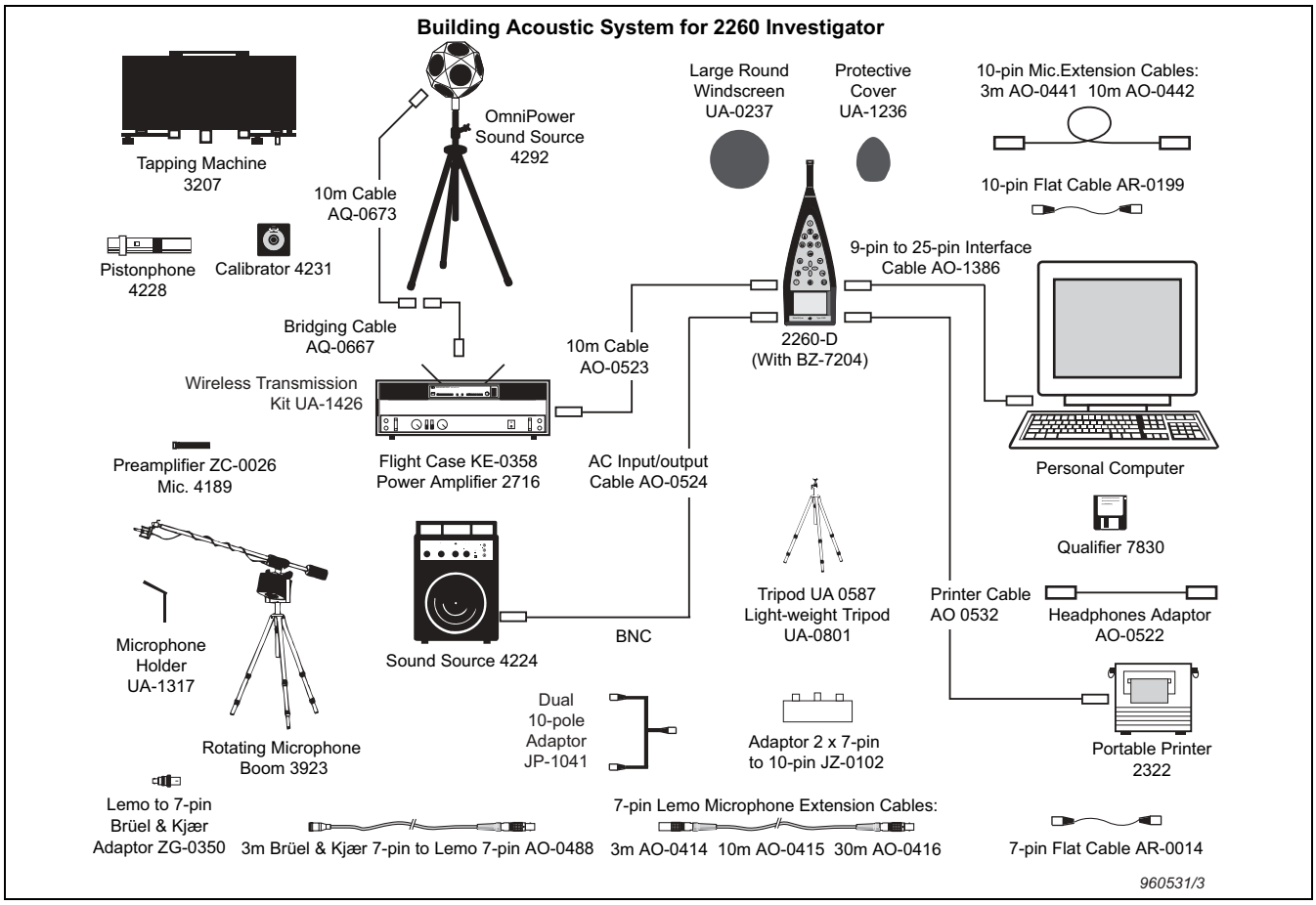
Fig. 13
Type 2260-G will measure reverberation time using just a starting pistol or other impulse sound source



Ideal for Room Acoustics

Type 2260-G (including software BZ-7207) is ideal for applications that only require measurement of reverberation time, such as acceptance test of rooms, noise reduction in workplaces or determination of room corrections. 2260-G works like 2260-D but with the reverberation time task only. For these applications, you need to carry no more than 2260-G and a starting pistol. However, you can, of course, also use the built-in generator and a sound source. The calculation of broadband average reverberation time is of particular interest. After measurement, you select the bands you want included in the average, and the average is shown on screen (but not stored). The decay curves may be exported to a spreadsheet for detailed analysis. For reviewing, editing and reporting, Qualifier Light Type 7831 is recommended, and when ordered with 2260-G or BZ-7207, forms an economical and total solution.

Fig. 14 *Accessories for Investigator Types 2260-D and 2260-G*



Qualifier Type 7830

Qualifier Type 7830 PC-software provides the perfect solution for post-processing and documentation of measurement results.

Data Transfer

You can either transfer data from Type 2260-D to the PC on-the-spot or back in the office.

Transfer from Type 2260-D is either direct, via its RS – 232 serial interface, or indirect, via PC-cards. A Serial Interface Cable AO-1442 is available for data output to a PC via the serial interface. Data are transferred maintaining the job and partition groupings that were made with Type 2260-D.

Qualifier Calculations

Qualifier Type 7830 works with the same bookkeeping system as Type 2260. This means that when data has been transferred to the PC you see the same results as in the 2260, including selected standard, excluded positions and other setup parameters.

Qualifier Type 7830 fulfils the same standards as listed for BZ-7204. See Tables 1 and 2. With Qualifier Type 7830, it is possible to display the reverberation measurements as 3D-multispectra. This provides a complete overview of the frequency-dependent reverberation curves.

Using Qualifier's spreadsheet-like data sheets, it is also possible to manually adjust data used in calculations, for example, to change levels or reverberation times. The result can be observed immediately.

Reverberation times can be modified by drawing a new slope line with the mouse across a displayed decay curve.

For diagnostic purposes, the reduction curve can be modified and the single value will adjust accordingly. And because manual input of data is possible, modifications for walls and rooms can be simulated.

Flexible Reverberation Averaging

Reverberation-time measurements may be averaged in two ways:

- Averaging of reverberation times (T20 and T30) or
- Averaging of decay curves (multispectra), also called ensemble averaging. This mode has the advantage of producing an average decay curve (multispectrum) for each frequency band

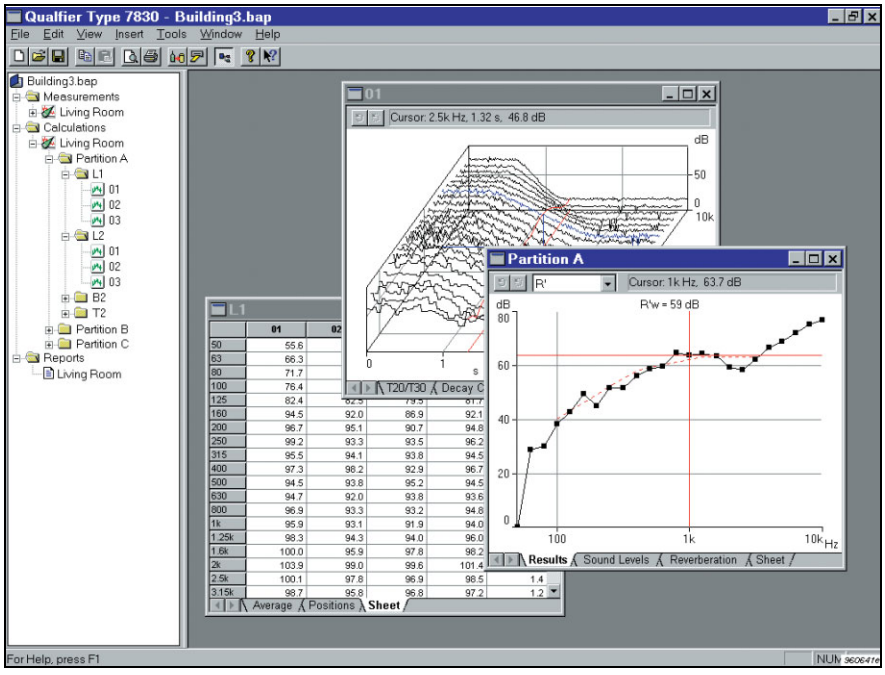


Fig. 15
Typical screen view of Qualifier Type 7830. On the left is a Project Tree, and on the right, an airborne sound reduction curve with index, a 3D reverberation time plot and a table

Documentation

Extensive documentation facilities are available. These allow items such as graphs and text to be entered into a report and sent to the printer. Graphs can also be exported via the clipboard.

Qualifier Light Type 7831

Qualifier Light is like Qualifier but handles just the reverberation task. It provides an economical and convenient way of viewing, editing and reporting data from 2260-G measurements, as well as Reverberation Task data from the 2260-D.

Building Acoustic Standards

Table1 *Building acoustic standards*

			Sweden	Germany	Austria	UK	England Wales	Switz	Italy	France	Spain	Holland	USA
Measurement		**ISO**	**SS**	**DIN**	**ÖNORM**	**BS**	**BREW**	**Sia**	**UNI**	**NF-S31**	**NBE**	**NEN**	**ASTM**
Typical Parameters		*R´ L´n*	*R´ L´n*	*R L´n*	*DnT L´nT*	*DnT L´nT*	*DnT*	*DnT L´nT*	*Dn Ln*	*DnAT LnAT*	*DnAT LnAT*	*Ilu Ico*	FTL *Ln*
Airborne	**Lab**	140-3	EN20140-3	EN20140-3	S5101	EN20140-3			8270-1	051	74-040-84/3		
	Field	140-4	EN20140-4	52210-1	S5100-1	2750-4	BREW	181	8270-4	054, -057	74-040-84/4	5077	E336-90
	Façade	140-5	EN20140-5	52210-5	S5100-3	2750-5		181	8270-5	055, -057	74-040-84/5	5077	E966-90
Impact	**Lab**	140-6	EN20140-6	52210-1	S5101	2750-6			8270-6	-052	74-040-84/6		
	Field	140-7	EN20140-7	52210-1	S5100-2	2750-7		181	8270-4	056, -057	74-040-84/7	5077	E1007-90
RT		3382 354		52212								5077	
Rating	**Air**	717-1	SS-ISO717-1	52210-4	S5100-1	5821-1,-3	BS EN 717-1	181	8270-7	-057	NBECA-88	5077	E413-73 E1332-90
	Impact	717-2	SS-ISO717-2	52210-4	S5100-2	5821-2		181	8270-7	-057	NBECA-88	5077	E989

Calculated Parameters

Table2 *Calculated parameters*

Standard	**ISO**	**SS**	**DIN ÖNORM BS UNI**	**BREW**	**Sia**	**NF**	**NBE**	**NEN**	**ASTM**	**None**
Airborne Calculated parameters	D Dw Dn Dnw DnT DnTw R´ R´w R Rw DnTw +C +Ctr +$C_{50\text{-}3150}$ +$C_{50\text{-}5000}$ +$C_{100\text{-}5000}$ +$Ctr_{50\text{-}3150}$ +$Ctr_{100\text{-}5000}$ +$Ctr_{50\text{-}5000}$ R´w or Rw +C +Ctr +$C_{50\text{-}3150}$ +$C_{50\text{-}5000}$ +$C_{100\text{-}5000}$ +$Ctr_{50\text{-}3150}$ +$Ctr_{100\text{-}5000}$ +$Ctr_{50\text{-}5000}$	ISO plus R´w8 Rw8 Dw8 DnTw8	See ISO	DnT DnTw +C +Ctr	ISO plus To variable	D DnT DnATrose DnATroute R Rrose Rroute	DA DnAT Dw +C +Ctr Dnw +C +Ctr DnT DnTw +C +Ctr R´w or Rw +C +Ctr +$C_{50\text{-}3150}$ +$C_{50\text{-}5000}$ +$C_{100\text{-}5000}$ +$Ctr_{50\text{-}3150}$ +$Ctr_{100\text{-}5000}$ +$Ctr_{50\text{-}5000}$ RA R´A	DnT Ilu Ilu;k	NR NIC NNR NNIC FTL FSTC	D Dn DnT R´ R
Facade Calculated parameters	Dls,2m Dls,2m,w Dls,2m,nT Dls,2m,nT,w Dls,2m,nT,w +C +Ctr Dls,2m,n Dls,2m,n,w Dtr,2m Dtr,2m,w Dtr,2m,nT Dtr,2m,nT,w +C +Ctr Dtr2m,n Dtr,2m,n,w R´45° R´tr,s R´45°w or R´tr,s,w +C +Ctr +$C_{50\text{-}3150}$ +$C_{50\text{-}5000}$ +$C_{100\text{-}5000}$ +$Ctr_{50\text{-}3150}$ +$Ctr_{100\text{-}5000}$ +$Ctr_{50\text{-}5000}$	See ISO	See ISO		See ISO	DnT45° DnATroute 45° DnTtr DnATroute	ISO plus: Dls,2m,n,w +C +Ctr Dls,2m,A Dls,2m,nAT Dtr,2m,A Dtr,2m,nAT R´+A45°	Gi G_A $G_{A,K}$	OILR OITL OITC	R´45° R´tr,s Dls,2m,nT Dls,2m,n Dtr,2m,nT Dtr,2m,n
Impact: Calculated parameters	L´nt L´nTw L´n L´nw Ln Lnw L´nw, Lnw or L´nTw + Ci Ci $_{50\text{-}2500}$	ISO plus L´nw8 Lnw8 L´nTw8	See ISO		ISO plusTo variable	LnT Ln LnAT LnA	ISO plus LnAT LnA	LnT Ico	Ln IIC	L´nT L´n Ln

Sound Intensity for Building Acoustics (using 2260-E)

Building acoustics applications such as reduction indices and leakage detection benefit enormously from the intensity technique. 2260-E Investigator with Intensity Probe Kit Type 3595 form a hand-held solution for this application.

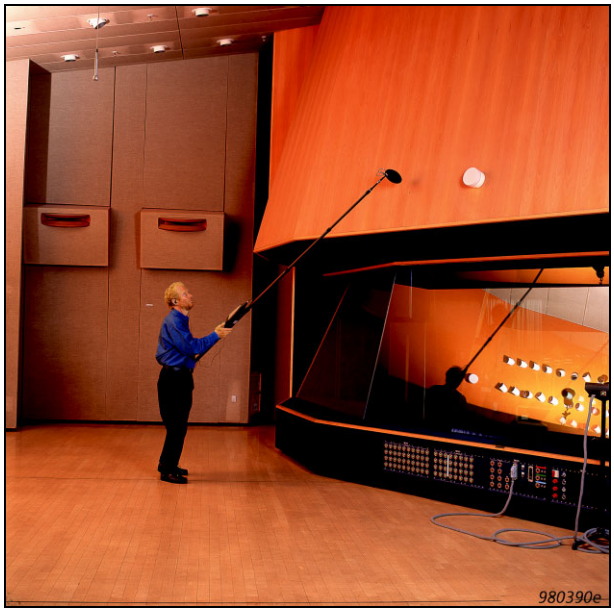


Fig. 16
Mapping the sound reduction to find leakages between studio and control room

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, $R_{I,c}$ 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. 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 corrected intensity sound reduction index, $R_{I,c}$ for both the wall material and for the window can be found.

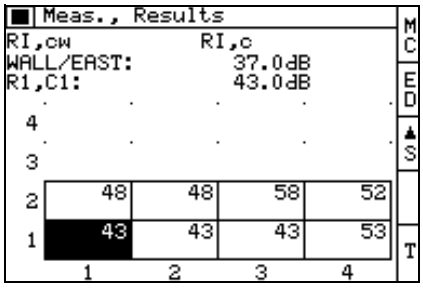


Fig. 17
The $R_{I,cw}$ in surface display

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.

More Information

For more information about the Hand-held Intensity System, including sound power applications, please refer to Product Data BP 1755.

More About the Investigator Type 2260 Platform

The 2260 Investigator is a unique concept within the field of hand-held noise measurements. A range of software can be installed into an analyzer platform and dedicated PC software is available for post-processing the data.

Examples of Other Applications

Basic Sound Analysis Software BZ-7210 is pre-installed on all 2260 types making them Type 1 Sound Level Meters with real-time 1/3-octave frequency analysis and broadband statistical distributions.

Enhanced Sound Analysis 20 kHz Software BZ-7206, with octave and 1/3-octave band filters, converts Type 2260 into a precision sound analyzer. Besides a vast array of concurrently measured parameters, including statistics, direct interfacing with a PC enables remote control as well as data downloading using optional Brüel & Kjær PC software or Windows®/MS-DOS® programs.

Noise Profile Software BZ-7203 effectively converts Type 2260 into an electronic level recorder which measures and logs noise levels over a 110 dB dynamic range. It also has extensive capabilities for on-the-spot analysis including measurement annotation. Evaluator™ Type 7820 PC software is available for editing and combining measurement data into a Rating Level.

If you install BZ-7205 Sound Intensity software in your 2260 Investigator and mount the sound intensity probe, then you have a complete hand-held sound intensity measuring system. Automatic measurement guidance and aural feedback during measurements enable you to concentrate on making smooth scans of the surface. The system produces on-the-spot analyses of sound intensity and sound power for small as well as large objects. The sound intensity system can also be used to measure sound insulation and calculates the sound reduction index on the spot. It is ideal for measuring single building elements or for locating faults.

Acoustically Streamlined

The acoustically "streamlined" body of Type 2260 minimises the effect that the analyzer has on the sound field to within 0.4 dB throughout its working frequency range; well within IEC Type 1 tolerances. This, coupled with excellent directional characteristics, ensures that the validity of your measurements is unaffected by the presence of the Investigator in the sound field.

Microphone and Preamplifier

Investigator is supplied with a robust Falcon Range® microphone and preamplifier which conform with IEC and ANSI Type 1 standards.

The preamplifier is detachable and able to drive a 100 m long cable; a valuable asset when remote location of the microphone is necessary.

Calibration

Internal and external calibration facilities are allowed. Both are semi-automatic. The external method makes use of an external reference sound source, for example from the Brüel & Kjær Sound Calibrator Type 4231. Furthermore, Type 2260-D "remembers" its initial calibration (and the serial number of the microphone provided). An accredited initial calibration (EK-0462) is made only at the factory. If you need one, or need to replace an existing one, contact your Brüel & Kjær representative.

Compliance with Standards

CE, C-Tick	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand.
Safety	EN/IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111–1: Standard for Safety – Electrical measuring and test equipment.
EMC Emission	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments. EN/IEC 61000–6–4: Generic emission standard for industrial environments. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
EMC Immunity	EN/IEC 61000–6–1: Generic standards – Immunity for residential, commercial and light industrial environments. EN/IEC 61000–6–2: Generic standards – Immunity for industrial environments. **Note 1:** The above is guaranteed using accessories listed in this Product Data sheet only. **Note 2:** The above is guaranteed only when the AC output is not in use.

Specifications – Investigator Type 2260-D

Specifications are given for Type 2260 fitted with Prepolarized Free-field 1/2″ Microphone Type 4189 and Input Stage ZC-0026

SOUND LEVEL METER STANDARDS
Conforms with the relevant parts of the following:
IEC 651 (1979) Type 1 plus Amendment 1
IEC 1260 (1995) Octave and 1/3-octave Bands Class 0
ANSI S1.4 (1983) Type 1
ANSI S1.11-1986 Octave and 1/3-octave Bands, Order 3, Type 0-C, Optional Range

MEASUREMENT AND CALCULATION STANDARDS
Measurement and calculations can be made according to the following standards: ISO, DIN, BS, NBE, SS, Sia, ÖNORM, NF, UNI, ASTM, BREW and NEN. See Tables 1 and 2

SUPPLIED MICROPHONE
Prepolarized Free-field 1/2″ Microphone Type 4189
Type: Prepolarized condenser
Nominal sensitivity: −26 dB ±1.5 dB re 1 V/Pa
Capacitance: 14 pF (at 250 Hz)

SUPPLIED INPUT STAGE
ZC 0026
Input Impedance: 10 GΩ||<1 pF
Extension Cables: Up to 100 m in length between the input stage and Type 2260 can be driven by the input stage without affecting measurements

MEASURING RANGE
Octave and 1/3-octave: 90 dB **A-weighted:** 80 dB
Adjustable readings from 70 dB to 130 dB in 10 dB steps (A-weighted: 80 dB range)
Max. peak level 3 dB above full scale reading
Passive Attenuation: Microphone Attenuator ZF-0023 (included) effectively increases all full-scale readings by 20 dB

UNDERRANGE INDICATION
Octave and 1/3-octave: 90dB below upper limit for each range setting, corresponding to less than 0.5 dB error

CHANNELS
L1 and L2 (Airborne Task) can be measured using 2 channels, which can be connected using any combination of preamplifier inputs and AC inputs. The two channels have independent gain and calibration settings. A correction spectrum can be entered manually for each channel

FREQUENCY WEIGHTING
Lin frequency weighting
A-weighting Instantaneous Fast (displayed, not stored)

OCTAVE AND 1/3-OCTAVE BAND FILTERS
Conform to IEC 1260 (1995), and ANSI S1.11-1986

Octave Band Centre Frequencies
Nominal: 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz
1/3-octave Band Centre Frequencies
Nominal: 50 Hz, 63 Hz, 80 Hz, 100 Hz, 125 Hz, 160 Hz, 200 Hz, 250 Hz, 315 Hz, 400 Hz, 500 Hz, 630 Hz, 800 Hz, 1 kHz, 1.25 kHz, 1.6 kHz, 2 kHz, 2.5 kHz, 3.15 kHz, 4 kHz, 5 kHz, 6.3 kHz, 8 kHz, 10 kHz
Real-time Frequency Range: 50 Hz to 10 kHz centre frequencies

INHERENT NOISE LEVEL
(Inherent noise is the combination of the electrical noise and the thermal noise from the microphone at 20°C.) Typical values using a microphone Type 4189 with a nominal sensitivity:
1/3-octaves: 2 dB at 1 kHz, 8 dB at 10 kHz
1/1-octaves: 6 dB at 1 kHz, 12 dB at 8 kHz

DETECTORS
The analyzer contains several detectors working in parallel on every measurement:
Octave Band Filters (8) or 1/3-octave Band Filters (24): Pre-weighted by Lin., each with a detector channel containing one linear averaging detector
Overload Detector: Monitors the overload condition
A-weighted: Broadband detector channel with Fast exponential time weighting. Single-channel only

INTERNAL GENERATOR
Built-in pseudo-random noise generator
Spectrum: Selectable between Pink and White
Crest Factor:
Pink noise: 4.4 (13 dB)
White noise: 3.6 (11 dB)
Bandwidth: Follows measurement bandwidth
Lower limit: 50 Hz (1/3-oct.) or 63 Hz (oct.),
Upper limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)
Output Level: Independent of bandwidth
Max.: $1V_{rms}$ (0 dB)
May be set in 1 dB steps 0 – 60 dB
When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level
Turn-on time and Turn-off time: Equivalent to RT = 70 ms
Repetition Period: 175 s
Output Connector: Auxiliary 1 output
Control: See Measurement Control

EXTERNAL GENERATOR
Selectable as alternative to Internal Generator
For controlling external noise generator
Levels: 0 V (Generator off), 4.5 V (Generator on)
Rise-time and Fall-time: 10 μs
Control: See Measurement Control.

MEASUREMENTS
Instantaneous: For display, no storage
"Live" spectrum – L_{eq} with a short averaging time
Range: Follows setting in Levels and Reverberation Time
Generator: Turned on and off manually
Levels: For Display and Storage
L_{eq}: (L1, L2, B2) in octave or 1/3-octave bands
L1 and L2 simultaneously or as single channels
Averaging time: 1 s to 59 min. 59 s
Range: Manual range or Autorange
Generator: Controlled automatically
Averaging: Up to 25 measurements may be averaged
Status indications: Overload, underrange, start time
Reverberation Time: T20 and T30 in octave or 1/3-octave bands
Decays are measured and stored, using averaging times between 8 and 96 ms, depending on bandwidth and decay time

- Manual entry: After measurement, the value in each band, for each position, may be changed by user entry
- Broadband average: The arithmetic average of the Reverberation Time for selected bands is calculated and displayed (not stored)
- Impulse excitation: When level (say from starter pistol) exceeds user selected trigger level, the decay is recorded and backwards integration performed (Schroeder method)
- The decay curves can be exported to a spreadsheet for detailed analysis
- Generator: Controlled automatically
- Repetition: Decays can be repeated automatically up to 99 times (ensemble averaging)
- Averaging: up to 25 T20 and T30 measurements can be averaged (arithmetic averaging)
- T20 and T30 calculation: From slope in evaluation range
- Slope estimation: Least squares approximation
- Status indications: Overload, underrange, start time, T20 – T30%, Correlation Coefficient; extensive list of Status codes
- RT range: Max. 30.00 s, min. 0.1 – 0.7 s, depending on bandwidth

CALIBRATION
External (acoustic): Using the Multifunction Acoustic Calibrator Type 4226, Pistonphone Type 4228 or Sound Calibrator Type 4231
Internal (electrical): Uses internally generated electrical signal combined with keyed-in value of microphone sensitivity
Initial calibration stored for comparison with later calibrations
Initial factory calibration traceable in conjunction with ISO 9001 certification

MEASUREMENT CONTROL
Manual or semi-automatic. Measurements are started manually and can be automatically stored on completion of measurement. The noise generator is turned on and off automatically
With Inst. spectrum on display, the generator can be turned on and off manually for checking
Selected frequency bands can be measured serially, i.e., one by one in automatic sequence. This feature works for the functions L1, L2 and T2 and for single as well as 2 channels

MEASUREMENT DISPLAYS
L1: Shows the spectrum of the level measured in the source room
L2: Shows the spectrum of the level measured in the receiving room. A dimmed curve shows background noise
L1 and L2: 2-channel measurements, L1 and L2 are displayed simultaneously
B2: Shows the spectrum of the background level measured in the receiving room. A dimmed curve shows the L2 level
T2: Shows the spectrum of reverberation times (T20 or T30) measured in the receiving room. Also, decay curve can be shown for each centre frequency
Spectrum: Octave or 1/3-octave band spectrum. Y-axis can be zoomed
dB(A): Instantaneous level is shown as a column next to the spectrum, with cursor read-out. Single-channel only
The graphical displays have cursor read-out facilities

DISPLAY RESOLUTION
Levels: 0.1 dB
Reverberation Time: 0.01 s

RESULT DISPLAY
Shows the sound reduction index (spectrum and weighted) according to the selected standard, along with the reference curve (if any)

STORAGE SYSTEM
Internal disk for storing application software, user-defined setups and measurement data. Setups and data can be recalled for further analysis
Capacity (32 MB disk): The supplied application software requires approximately 2 MB
Measurement data space requirements: 65 kB for typical Job (one partition)
Application Card: For installation of application software
External Memory Card: For Store/Recall of measurement data and transfer of data to and from a PC (SRAM or ATA flash cards)
MS-DOS®: Compatible file system (from Ver. 3.3)

SERIAL PRINTER/OUTPUT
Setups and measurement data can be printed on an IBM® Proprinter® (or compatible) or a Portable Printer Type 2322. The formats can be screen dumps or tables
Measurement data can be output in spreadsheet format for post-processing on a PC

REMOTE/LOCAL
Transfer of measurement data in binary form to a PC for use with Brüel & Kjær Type 7830 application software
Transfer time to 7830: 30 s for typical Job.
Baud Rates: 1200, 2400, 4800, 9600, 19200, 38400 and 115200

HELP
Concise context-sensitive help for keys and menus

LANGUAGES
All software available in English, German, French, Italian, Spanish and Czech

DISPLAY
Update Rate: Instantaneous – typically 5 times per second

AUXILIARY OUTPUTS
Aux. 1: noise generator output
Aux. 2: 'Input' signal monitor output
can be set to either monitor 'Input' signal with variable attenuation from 0 to –80 dB in 1 dB steps, or can be switched Off to reduce power consumption

AC INPUTS/OUTPUTS
Signal Output: Buffered, unweighted microphone signal
Signal Input: From an external source such as a tape recorder
See also specifications in platform manual

SETTLING TIME
From Power On: Approx. 25 s

EFFECT OF VIBRATION
Less than 72 dB for a 50 Hz vibration at a level of 1 m/s^2

EFFECT OF TEMPERATURE
Operation: < 0.5 dB from –10°C to +50°C (+14°F to +122°F)
Storage (without batteries): –20°C to +70°C (4°F to +158°F)

EFFECT OF MAGNETIC FIELDS
80 A/m (1 Ørsted) at 50 Hz causing a reading of:
63 Hz Octave-band filter: < 30 dB

EFFECT OF HUMIDITY
Operation: < 0.5 dB for 30% < RH < 90% (at 40°C and 1 kHz)
Storage: Cool, dry environment recommended to avoid formation of mould etc.

BATTERIES
Type: 6 × LR14/C-size 1.5 V alkaline, QB 0009

Lifetime (at 20°C): 8 hours of typical use (decreases significantly at low temperatures)

EXTERNAL DC POWER SUPPLY
Voltage: Regulated or smoothed 10 to 14 V, maximum ripple 100 mV
Power: 3.5 W, current: 300 mA, Inrush current: 1000 mA
Socket: Ø5.5 mm with Ø2 mm pin (positive)

WEIGHT
1.2 kg including batteries, Input Stage ZC 0026 and Prepolarized Free-field 1/2″ Microphone Type 4189

DIMENSIONS
375 × 120 × 52 mm including Input Stage ZC 0026 and Prepolarized Free-field 1/2″ Microphone Type 4189

Specifications – Investigator Type 2260-G

Please refer to the sections in 2260-D Specifications relevant for Reverberation Time measurements.

Specifications – Qualifier Type 7830

STANDARDS
See Tables 1 and 2

LANGUAGES
English, French and German

PLATFORM
32-bit software for Windows® 2000/XP

VIEWS
- Result level views:
  A collection of views showing the resulting single values, reduction curve and underlying average curves (L1, L2, B2 and T20/T30)
- Average level views:
  Each of the parameters L1, L2 and B2 has a corresponding view showing all of the measurement curves included in the average calculation and a view of the resulting average curve
  In T20/T30 average mode it is possible to see all of the T20/T30s included in the average calculation. In ensemble average mode it is possible to see the averaged 3D and averaged single frequency decay curves. Both modes gives the user the ability to see the resulting T20/T30 spectrum
- Position level views:
  Each of the level measurements (L1, L2 and B2) can be viewed as a spectrum. In addition, the T2 reverberation measurement can be viewed as 3D-multispectra and as single frequency decay curves. Furthermore it is possible to see the calculated T20/T30 spectrum
- Data sheets:
  All of the measurement and the most relevant intermediate and final results can be viewed as values in a table (not decays)

CURSOR READ-OUT:
All curves have cursor read-out

MANUAL INPUT
Allows graphical input and modification of the regression line in reverberation decay curves. Calculated sound reduction curves can also be adjusted graphically (The impact on the single value index is shown simultaneously). To give maximum flexibility, position, average and calculated data can be overridden by manually inputting data in the data sheets

CALCULATIONS
Supports calculation of insulation and reverberation tasks. Insulation calculations include airborne and impact sound insulation (lab/field). In addition, airborne facade calculation is supported.

REPORT GENERATION
Based on document templates it is possible to make reports conforming to the supported standards

OUTPUT
Relevant views and sheets can be printed or exported to the clipboard Text or graphs may be transferred to word processors in RTF (Rich Text Format)

HELP
On-line context-sensitive and user-guide

DATA TRANSFER
The software accepts data from the Investigator Type 2260:
- Via RS–232 serial interface. Speeds from 1200 bps to 115200 bps
- Via PC-card

RECOMMENDED COMPUTER
Pentium® III (or equivalent) PC, 256 MB RAM, SVGA graphics display/adaptor, sound card, CD ROM drive, mouse, USB and Windows® XP
Note: A PC-card slot is necessary to make PC-card data transfers

Specifications – Qualifier Light Type 7831

Please refer to the section in Qualifier Type 7830 specifications relevant to Reverberation Time

Ordering Information

Type 2260-D Investigator (with Building Acoustic Software BZ-7204)
Type 7830 Qualifier

Type 2260-G Investigator (with Room Acoustics Software BZ-7207)
Type 7831 Qualifier Light

Accessories included with Type 7830/7831:
Software Pack (CD-ROM)
Security Key

Accessories included with Type 2260-D and 2260-G:

Type 4189	Prepolarized Free-field ½″ Microphone
ZC-0026	Input Stage
ZF-0023	20 dB Capacitive Attenuator
UA-1236	Protective Cover
DH-0696	Wrist Strap
KE-0342	Shoulder Bag (with room for 2260-D and 4231)
6 × QB-0009	1.5 V LR 14/C size alkaline cells
BZ-5298	Software Pack (CD-ROM) for installation of application software

Literature:

BP 1689	Sound Sources for Building Acoustics Product Data

Optional Accessories

Software

BZ-7204-100	Upgrade to latest version of BZ-7204
BZ-7204-00	Upgrade from BZ-7207 to BZ-7204
7830-X-100	Upgrade from Qualifier Light to Qualifier

Calibration

Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone
Type 4231	Sound Calibrator (fits in KE-0342)
2260–CAI	Accredited Initial Calibration of Type 2260

Interfacing

Type 2322	Portable Printer
AO-1442	9-pin to 25-pin Interface Cable for use with PC or serial printer
UL-1008	32 Mbyte Memory Card

Mains Power Supplies

ZG-0386	EU Version
ZG-0387	UK Version
ZG-0388	US Version

Measuring

UA-0237	Large Round Windscreen
UA-0459	Small Round Windscreen
UA-0587	Tripod
UA-1317	Microphone Holder
AO-0440	AC Input/output Cable
AO-0441	3 m Microphone Ext. Cable
AO-0442	10 m Microphone Ext. Cable
JP-1041	Dual 10-pole Adaptor
ZC-0026	Preamplifier for 2260
Type 4189	Prepolarized Free-field ½″ Microphone
AR-0199	10-pin Flat Cable
AO-0522	Headphones Adaptor
UA-0801	Microphone Tripod
Type 3207	Tapping Machine
Type 4292	OmniPower Sound Source with Tripod
Type 2716	Power Amplifier
KE-0358	Flight Case
AO-0523	10 m Cable from 2260 to 2716
AQ-0667	Bridging Cable for 2716 output
AQ-0673	10 m Cable from 2716 to 4296

Note: For sound sources, please see separate Product Data BP 1689

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BP 1691 – 17 2006-05 Rosendahls Bogtrykkeri