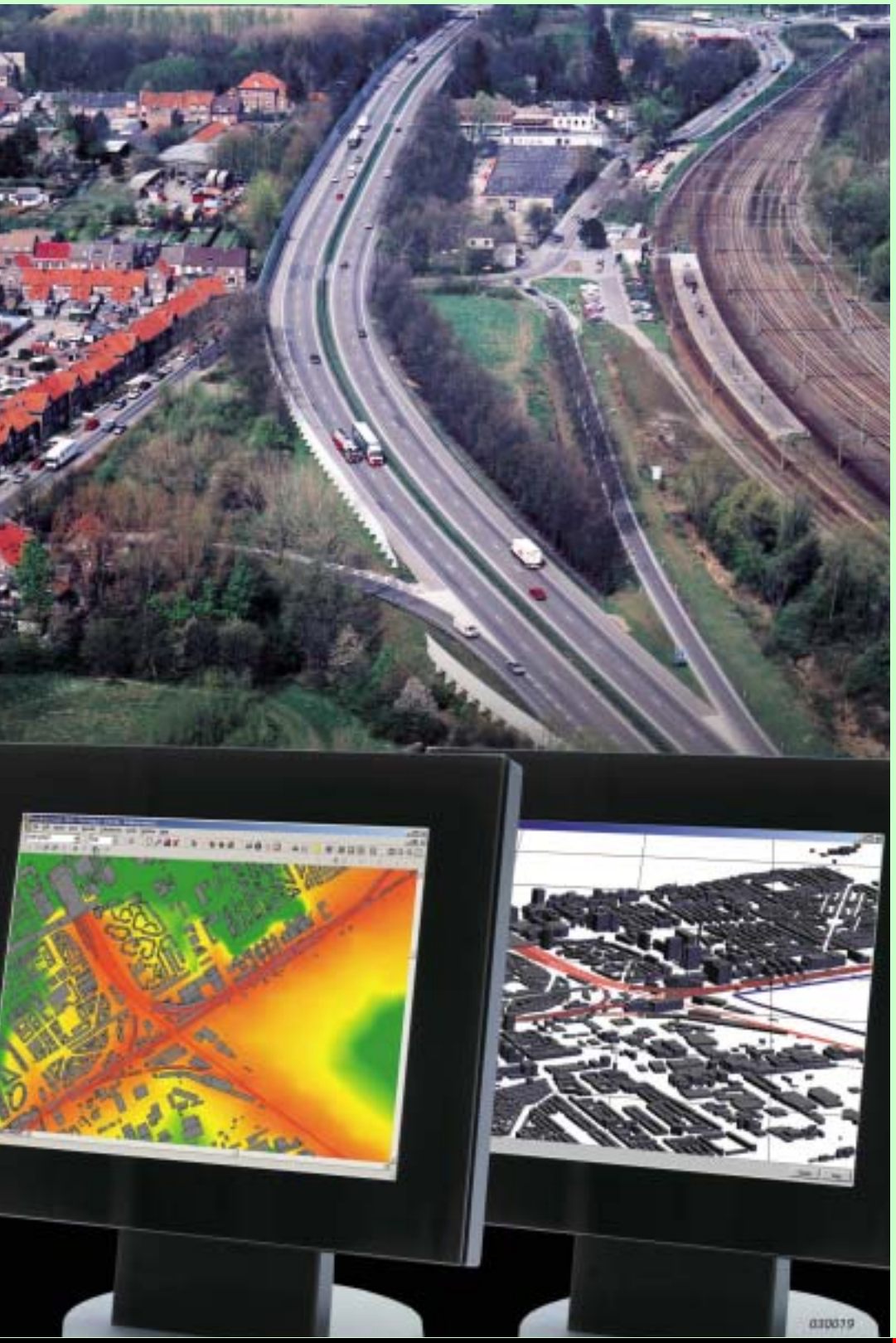
PRODUCT DATA

Predictor — Type 7810 Version 4.0
Software for Prediction, Presentation and Management of Environmental Noise



What is Predictor?

Predictor™ is a PC-based, multi-user noise prediction software package. It allows you to electronically model outdoor noise levels and contours from various noise sources such as industry or traffic in a geographical area.

New Features of Version 4.0

- New NMPB calculation module – recommended for noise mapping by the European Commission
- New CRTN–L_{Aeq} calculation module for noise mapping as recommended by DEFRA–UK
- 3 to 10 times faster calculations in normal non-optimised mode (compared to Version 3.0)
- Optimisation options for large models to further reduce calculation time
- Models up to 250000 grid points
- Enhanced batch mode for calculation of multiple models during evening and night time
- Automatic creation of polyline items (barriers, roads, etc.) from a DXF file
- Visualisation of the effect of group reductions on all results including noise contours
- Customised and dockable toolbars with all menu options
- Colour-graded noise contours

7810

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Uses and Features

USES

- Creating noise maps based on predictions using real data
- Identifying prominent noise sources
- Proposing and showing the effect of noise-reduction solutions prior to implementation
- Ranking noise sources by SPL
- Monitoring and controlling the noise environment of a geographical area
- Fulfilling EU IPPC Directive 96/61/EEC and Environmental Noise Directive 2002/49/EC

FEATURES

- Software modules for ISO 9613.1/9613.2, DAL 32 (Nordic industry), RLM2 (Dutch rail), CRTN–L10 (UK road), CRTN–LAeq (UK road) and NMPB (French road) standards available in one license
- Automatic creation of point noise-sources and receiver points in model with measured data (L_W, L_{eq}, L_{10} and L_{90}) taken with 2260 Investigator™
- Import DXF files for easy creation of geographical features
- 'Acoustic eye' ensures consistency between input and result
- Easy-to-use Microsoft® Windows®-based interface. Windows NT® 4.0, Windows® 2000 and Windows®XP are all supported
- Multi-user database for all geographical and acoustic data
- Integrated sound power database for the creation of your own database of standard sources
- Information exchange with GIS through SHP files

Noise Modelling

Basic Concept

The Predictor software package is a PC-based, Windows-compatible, environmental noise-modelling programme. Predictor is used to make an electronic model of the acoustic environment of a geographical area, for the prediction and control of outdoor noise.

Noise level prediction is a widely used tool for predicting the noise impact of changes in the noise environment, such as land development, changes to machinery or building use. This technique is also used to plan or design environments where noise management is necessary.

Predictor differs from other software packages in the ease with which a model is created and maintained, and how clearly major contributors to an environment's noise are identified. Predictor's architecture allows it to be used by many types of customer, e.g.:

- Authorities – to aid their duty as environmental noise watchdogs
- Industry – to ensure compliance with environmental legislation
- Consulting engineers – to identify and provide solutions to noise problems
- Educational institutions – to show the principles of noise propagation in the environment

Data Entry

To create your model in Predictor, a geographical model of the area in question must be generated. You do this using a standard Windows® interface. The input data can take the form of topographical maps in BMP/DXF file format, or digitised maps loaded directly into Predictor. You assign values to noise sources. These can be 'real' values measured using 2260 Investigator, and downloaded directly into Predictor, along with GPS positional data. Other sources of noise can be taken from a catalogue of noise sources available in Predictor or imported from Acoustic Determinator Type 7816 (see Fig. 1). Roads can be modelled according to traffic flow.

As the majority of the data required in the model can be input electronically, you can build up a model very quickly. Polyline items can also be connected for more accurate modelling of intersections and hills. Noise receiver points can be automatically positioned at a defined, fixed distance from landmarks in your model, such as buildings and roads, to speed the modelling process. Predictor also offers the choice of displaying up to 6 receiver heights on the same vertical scale at the one time.

Successive model items of the same type are automatically identified and numbered incrementally if desired.

Calculations can be interrupted, refined, and then resumed without loss of existing calculation files, reducing total calculation time. Your Predictor database can be compressed/decompressed as required, saving disk space and quickening database exchange.

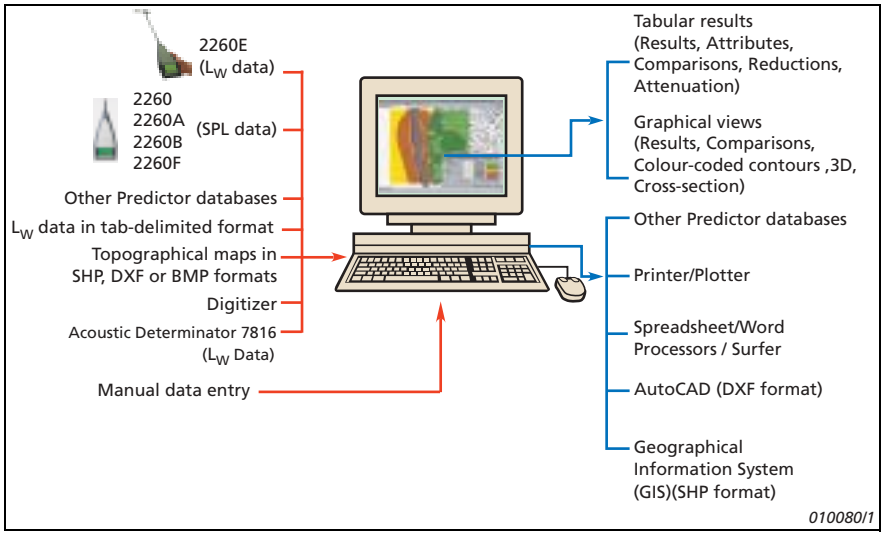


Fig. 1
Predictor's inputs and outputs

Predictor is designed to accept vast amounts of data about the real world using actual noise measurements (captured using 2260 Investigator™ or post-processed using Acoustic Determinator 7816), detailed topographical maps (e.g., 3D AutoCad® DXF files or GIS data), and other, perhaps smaller, more localised Predictor models. The results can be graphical or tabular, exportable to various types of software and peripherals

Model Refinement

Once you have created a model in Predictor, you can compare predicted values with real readings taken on-site with 2260 Investigator. This helps you to refine your model. Receiver points can be created automatically with control values from 2260 Investigator measurements. This speeds the building of your model while guaranteeing the accuracy of the receiver points.

It is possible to isolate individual sections of the model for calculations, eliminating the need to recalculate the entire system for every small change. Individual source-receiver combinations can be investigated in detail, showing all the attenuation terms, for assessment of the model and the calculation.

Multi-edit of sources and other model items is available for rapid model adjustment while other simple but powerful tools such as cross-sections, distance measurement and 3D visualisations help you build an accurate model.

Predictor guards all modifications in a model. Only the results that become invalid due to acoustic-relevant modifications need to be recalculated. This unique 'acoustic eye' feature of Predictor not only reduces calculation time but, more importantly, ensures consistency between input and results.

Results

The result of calculations can be displayed graphically or as a suite of result tables (see Fig. 2). You can now very quickly verify that the model represents reality, and identify noise problems by comparing predicted values to legal limits. In addition, source, receiver and attenuation levels for each source-receiver combination can be viewed to evaluate the quality of the calculations and as a help to determine how to reduce noise levels.

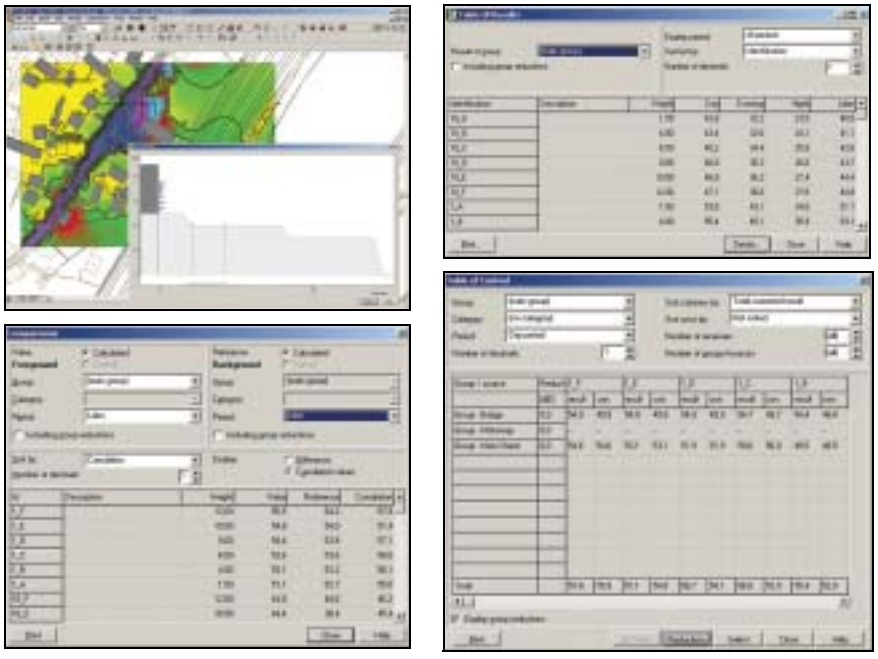


Fig. 2
Some of the model views and various output results available with Predictor

There are three types of tables available for showing the sound level at receiving points:

- Tables of results that present actual data, ranked if necessary, to find the maximum sound level (see Fig. 2)
- Tables of comparison, showing compared results from the current model with measured levels, noise limits or another model. With this option it is also possible to cumulate the results of 2 models, e.g., industrial noise with road traffic noise
- Tables of control, showing the calculated results compared to control values, for example, permitted values

In all tables the effect of reducing a group of sources when planning reductions can be shown directly.

Noise Reduction and Noise Management

Ranking and Reduction

In complex environments, it can be difficult with traditional techniques to see exactly how much noise each source contributes to the overall noise picture. Predictor does this by ranking the individual noise sources to clearly show the importance of each source.

The effect of noise reduction can also be studied by introducing a reduction to the emission of a source (or groups of sources). Predictor makes available immediate 'what if' results, for example, 'what if all exhaust ventilators are reduced by 6 dB?' Moreover, colour-coded, sound pressure contours (see screen picture on front cover) visualise the situation in an easy to understand way.

Problem Identification – Source and Owner

With traditional measurements, it is often impossible to accurately measure the noise emission of a single factory or road due to the existence of other noise sources which cannot be shut off, for example, a neighbouring factory. In such cases, sound-power levels can be measured with Type 2260 and the results assigned to a factory group created in the Predictor model. Predictor then takes account of the contribution from the various noise sources, and is able to 'switch off' specific sources allowing easy identification and isolation of a noise source, and indications of potential noise problems.

Scenario Comparison

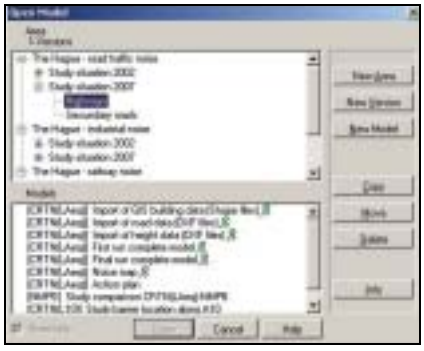


Fig. 3
Model Manager window

For an existing factory, road infrastructure or area, its future development with respect to noise can be managed. With Predictor's Model Manager (see Fig. 3) you create a new scenario for the area to show its development over a period of time and to study various alternatives at any given time. New models, based on existing models, can be created and modified so that you can assign proposed noise reductions to different sources to see the effect. In addition, you can compare the noise environment with legal limits.

Predictor also allows you to compare different variants of the same model in tabular form. This enables you to analyse and document the differences between models, e.g., differences in traffic flow, additional buildings, etc. A model's foreground and background variations can also be displayed in a table of comparisons showing the differences in sound levels at receiver points while the model itself can be shown on-screen with all receiver points displaying their two variant levels for comprehensive comparison and analysis.

Shared Information

Predictor is a multi-user system, allowing several employees to work on different parts of the same Predictor project simultaneously. It is also an integrated package, meaning that the same user interface is used to access the different types of data. There is no need for the users to be concerned about where files are stored, or even if they are saved; they can simply concentrate on their job.

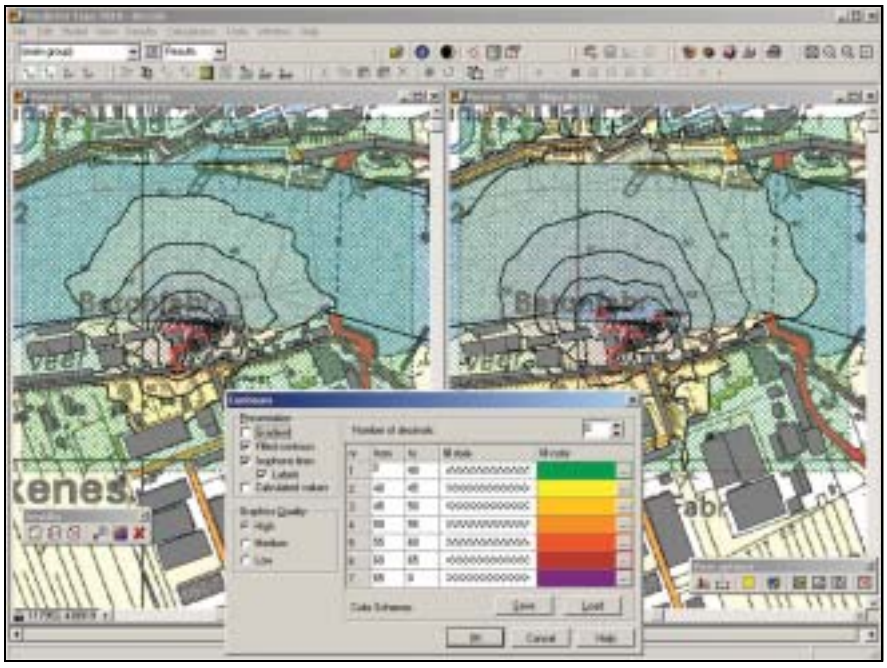
Reporting

When a set of results has been calculated for a particular scenario, it can be printed or exported into presentation programs or spreadsheets. Predictor can also export results in ASCII, SHP and DXF formats and into GIS software packages. For example, when Predictor data is made available to a demographic model in GIS, sound level predictions can be integrated with population density to show how many people will be affected by proposed changes to a site.

Predictor can also be used to fulfil the requirements of the EU IPPC Directive for reporting and archiving information of all noise sources and the resulting noise map.

Fig. 4
Isophone maps
The two maps show the same geographical area, centred on a concrete works by a waterway

The left-hand map shows the noise environment if a proposal to allow ships to dock and begin loading concrete is permitted. Two ships are active, each has two noise sources – a loading crane and a ventilation system. There is a noise-sensitive site on the North bank of the waterway. You can see that the noise level here has increased from below 40 dB (see right-hand map) to 40 – 45 dB



Noise Mapping

Noise mapping, normally understood as mapping over a large area (for example, a large town or even an entire country – see Fig. 5), typically involves the presentation of simple acoustic parameters, possibly combined with demographic factors such as population or house prices, in varying levels of detail. The task is often quite demanding, both in terms of computer capability and time. Accurate models often take several days to calculate, so getting the input data right is important as is the ability to make smaller models and combine them into larger models.

Fig. 5
Noise map and population exposure statistics of a large area

Predictor makes these noise maps either on its own or in combination with GIS tools such as ArcView™. Large-scale maps with medium-range resolution or small-scale maps with high resolution can be made using Predictor alone. Larger maps, or a combination with demography for population exposure, can be done through Predictor's interface, as can the import of digital data. Using Predictor allows the user to focus on acoustic modelling with familiar tools, thus saving time and energy and offering a well-defined and documented interface between the acoustic model and other software. Different types of high-quality data analysis and presentation are available, depending on whether Predictor is used alone or not.

Predictor's advanced model management tools ease the development of current and future scenarios by doing them in parallel using common data.

You have full control over the level of detail in the map. Small-scale maps can be extracted to check details and later integrated back into larger maps. In addition, you can also combine the physical levels from different maps in different ways to indicate multi-source annoyance.

All relevant source types are covered using recognised algorithms such as the Dutch railway noise method, and existing digital data such as topography, traffic flow and measured noise levels, can be used to save time and prevent errors.

Software Support for Predictor

Predictor Software Support is a service offered by Brüel & Kjær. It is your guarantee for quick and professional help when you need it – saving you time and cost. If you ever have a software problem with Predictor, the Software Support agreement entitles you to help by:

- E-mail
- Fax
- Telephone

Brüel & Kjær will send you a response with the answer to your Predictor problem no more than 2 working days[1] after we have received your request.

1. All working days from 09.00 – 17.00 Central European Time (Closed at weekends and Danish Public Holidays)
   America: + time difference to CET
   Far East and Asia: + time difference to CET

Specifications – Type 7810

Functional Specifications

CALCULATION METHOD
Depending on which specific option is chosen, the algorithm for calculating the propagation of sound from source to receiver via intermediate items is based upon:
- ISO 9613.1 and 9613.2
- DAL 32 (Nordic industry method)
- CRTN-88 (L_{10}) (UK road method)
- RLM2 (Dutch rail method)
- NMPB (French road method)
- CRTN–88 with TRL–2002 L_w correction (UK road method)

MODEL PROPERTIES
Model Area: Expressed in metres to 2 decimal places; defined by user when a new area is created. Maximum size in x and y direction is 2000 km × 2000 km
Model Items: Up to 50000 items (sources, receiver points, buildings, grids, etc.) with up to 250000 receiver points in each grid

MODEL ITEMS
(Including important item parameters)
Types of items available and their nomenclature are dependent on the calculation module
Point Source:
% emission per hour, emission; 1/1-oct. bands from 31 Hz to 8 kHz, L_w (dB(A)), reduction (dB) and $L_{w(tot)}$(dB(A))
Line Sources: Polyline source, parameters as point source but L_w is defined per metre
Road (ISO 9613): Polyline source, distribution (daily traffic flow and its distribution over periods, and 4 vehicle types), or traffic flow (number of vehicles, 4 types), speed, gradient and surface
Road (NMPB): Polyline source, distribution of traffic flow per period or per hour (light and heavy vehicles), slope and flow type
Road (CRTN): Polyline source or traffic flow (light and heavy vehicles), speed, gradient and surface
Railway (RLM2): Track construction, flow-per-train category, speed, stop-fraction
Building: profile correction (0 or 2 dB), reflection; 1/1-oct. bands
Barrier: Polyline, reflection factor
Ground Region: Ground factor
Housing Region: Surface density (%)
Industrial Site: Attenuation (dB/km); 1/1-oct. bands
Foliage Region: Height above ground level
Point Receiver: Height above ground level
Grid Receivers: Distance between receivers, number of receivers
Surface Contour: Defined by 3D coordinates

VIEW PROPERTIES
Zoom: In and out of specified rectangular area
Items: Specification of colour, internal hatching, symbol, line style, text labels
Background: Topographical maps in DXF or BMP format imported onto model area as a model base
Cross-section: Elevation view of surface contours at a defined line
3D View: Perspective view of chosen area from a user-defined viewpoint

RESULTS DISPLAY
On-screen: Annotated maps, colour contour maps or tables (see below)
Periods: 4 user-defined plus 1 compound (day, evening, night, 24 hr L_{DN}, L_{DEN}, etc.)
Table of Results: Shows calculated results at each specified receiver, either total or octave values
Table of Comparisons: Shows the difference in SPL between two specified scenarios of the model – a 'before and after' or 'what if' tool, between the model and control values, and the cumulated result of two specified scenarios of the model
Table of Control: Shows calculated values compared to permitted values with ranking to identify possible solutions to noise reduction. Table of control also shows which groups (for example, a specified factory site) that need to reduce noise to fulfil requirements

CALCULATION
Calculation Features: Start; Test; Selective; Stop; Pause; Resume; Batch

Calculation Parameters (ISO 9613):
- Meteorological Correction: C_0
- Ground Attenuation: Factor from 0.00 to 1.00
- Temperature: Kelvin
- Pressure: kPa
- Humidity: Relative %
- Air Absorption: dB/km in 1/1-oct. bands from 31 Hz to 8 kHz

INPUT TO MODEL
Actual Measured Data: Automatic creation of receiver points from L_{eq}, L_{10} and L_{90} measured with 2260 Investigator with GPS positional data
Automatic creation of point sources from L_W measured with 2260 Investigator (with GPS positional data)
Import: From other Predictor databases and from output of Type 7816 Acoustic Determinator software
Digitizer: For specifying item position coordinates, for example, relative to an existing map.
DXF File Import: 3D coordinates extracted from DXF layers to create polyline items such as surface contours, barriers and roads or background map
BMP File Import: Coloured pixel map
SHP File Import: All items (for import from GIS)

SOUND POWER MANAGER
Database of sound power in 1/3-octave
Input: Manual, from spreadsheet or other database via text file, and from the output of Type 7816 Acoustic Determinator software. Direct input of sound power levels with positional data is also possible
Fields: Sources, type, device, industry, sound power, measurement method, measurement date, source height, literature references, notes

Filter Options: By any user-selected field

OUTPUT
On Screen: Results displayed in tabular or graphical form
Clipboard: Tables and screen pictures can be copied for inclusion in other Windows programs
Export: To other Predictor databases and GIS systems (ASCII, SHP, POI and DXF formats)
Printing: Graphical display with extra annotation printable to all standard Windows output devices
Print Model: Print preview available as well as option of selectively removing components, such as GPS reference points and ground regions, from the model as desired. Storing and re-using of multiple plot settings possible

Computer System

RECOMMENDED MINIMUM REQUIREMENTS
Pentium® II 350 MHz with Windows NT® 4.0
64 Mb RAM
At least 50 Mb of free disk space, plus the disk space used as a working area
CD-ROM drive
SVGA graphics display/adaptor
Mouse or other pointing device

For larger Predictor models, these requirements should be greatly exceeded in order to improve data handling speed.

Operating System: Predictor works with Windows NT® 4.0, Windows® 2000 and Windows® XP

Ordering Information

Type 7810 Predictor Version 4.0
includes the following calculation modules:

- General Noise (ISO method)
- Road Traffic Noise (ISO method)
- Industrial Noise (Nordic method)
- Road Traffic Noise (CRTN L_{10} method)
- Road Traffic Noise (CRTN L_{eq} method)
- Railway Noise (Dutch method)
- Road Traffic Noise (French NMPB method)

and includes the following accessories:
Program on CD-ROM (all modules included in the one license)
Program protection key
License files on diskette
User Manual

Accessories Available

Type 2260 Investigator
Type 2260 Observer
Type 7816 Acoustic Determinator Software

Services Available

7810 SIF	Predictor Installation
7810 MS1	Predictor Software Maintenance, Upgrade and Support
7810 ED1	Predictor Basic Training (at Brüel & Kjær HQ, local Brüel & Kjær office or at customer site)

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3D models on front cover courtesy of City council of The Hague, Department of Air and Noise Quality, and TerraImaging BV Amsterdam

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