CADNA/SAK
for Windows

Computerprogram for the calculation of

- sound distribution,
- room acoustic parameters and
- sound pressure level at work places

for rooms

SAK®

Cadna

http://www.datakustik.de

About CadnaSAK

The softwareprogram **CadnaSAK** is a powerful tool to calculate noise in industrial halls. Starting point are sound power levels of machinery and equipment. From these the noise distribution is calculated and presented as noise maps and the levels of defined workplaces can be printed in tables.
CadnaSAK was developed 1990-1992. It is a 16 Bit-application and it was not further adapted to newer developments in the last year. So our clients must know that it is a stand-alone version that will be replaced by a complete new development in 2003.

This new program for interior noise will be based on exactly our existing program **CadnaA** for outdoor noise propagation. All our clients who buy **CadnaSAK** from now will pay only the difference if the new interior noise model (CadnaR) is available.
The new interior noise model will take into account

- local distribution of absorption
- screening of objects
- diffractions statistically

and communicate completely with **CadnaA**.
About the existing **CadnaSAK** - look to the attached specification.

DataKustik

DataKustik GmbH
Software
Technische Dokumentation
und Ausbildung
für den Immissionsschutz

Gräfelfinger Str. 133 A
D-81375 München
Telefon +(0)89/7007629-0
Telefax +(0)89/7007629-89
email: info@datakustik.de

DataKustik GmbH
Software
Technical Dokumentation
and Training for
Immission Protection

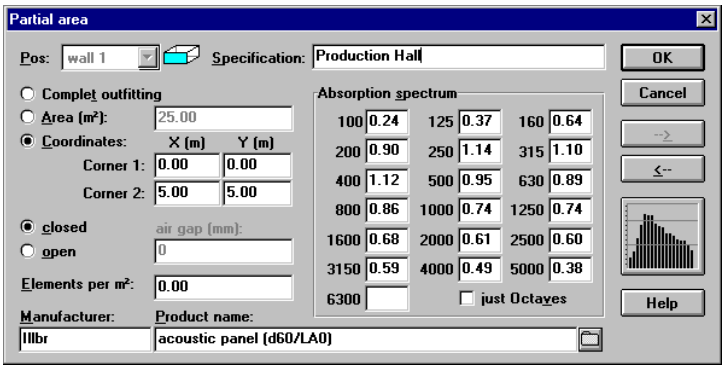
Gewerbering 5
D-86926 Greifenberg
Fon ++49(0)8192/93308-0
Fax ++49(0)8192/93308-89
email: info@datakustik.de

Acoustical assessment of rooms and industrial halls and optimisation of the absorbent lining of walls and ceilings

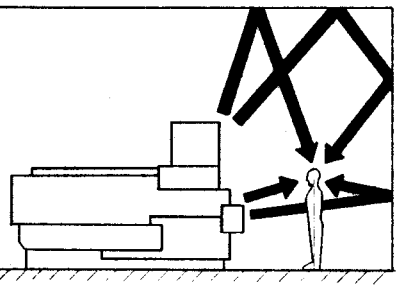
All those, who are responsible for the planning, installation or investigation of noise abatement measures in rooms with workplaces, are now effectively supported by the computerprogram **CADNA SAK**.

Its grafic screen representations, the clear structure of the input and output tables and diagrams represent a high standard in ergonomical operation. It is therefore a powerful tool for

- acousticians,
- authorities with responsibility for noise impacts or even
- for architects and suppliers of acoustic material.



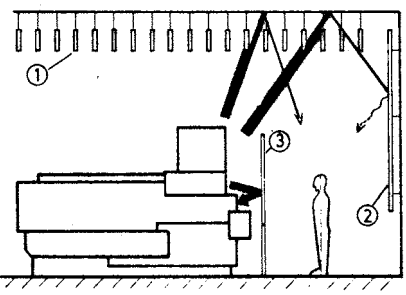
Room Parameters



Without acoustical linings the sound pressure level would rise by reflections at the walls or ceilings.

CADNA SAK allows the quick calculation of the important acoustic parameters for rooms with any surface treatment of walls and ceilings and therefore a judgement of possible noise reduction by the installation of further absorbent systems.

The basis of **CADNA SAK** is a catalogue of absorption coefficients for many products that can be used for noise abatement in new and existing buildings. New data can be added by the user.



With acoustical linings, the sound pressure level cannot rise by reflections at the room surfaces

It is a pleasure to equip a hall or room at the computer-screen with absorbent materials by clicking to the product in the catalogue. Such a simple click has the consequence that all the absorption data of the material are connected with the marked surface coordinates of the room. The necessary time for this is very short, independent of the task - no matter if the optimal reverberation time for a class-room or a recommended sound decay for an industrial hall with hundreds of working places shall be achieved.

The time expenditure is counted in minutes.

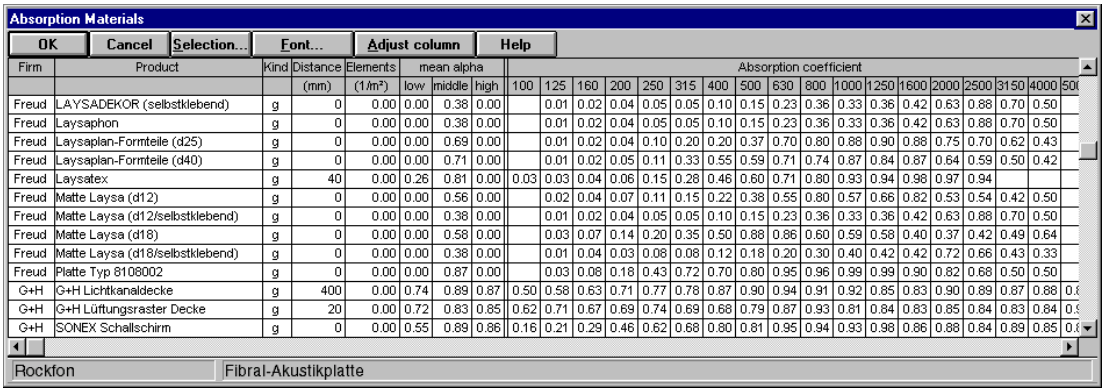
It is therefore very easy to test more than one alternative and to find out the solution with the best relation of noise reduction and cost.

The results of the calculation are represented by tables and diagrams and are therefore a complete and easy understandable documentation of a project.

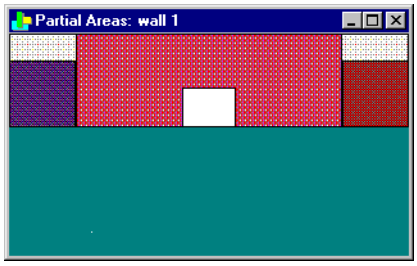
Currently **CADNA SAK** consists of three main blocks of performance:

- the calculation of reverberation time
- the calculation of the sound decay curve
- the calculation of noise levels at work places or as noise map with noise contour lines from the emission data of the sources (e.g. machines).

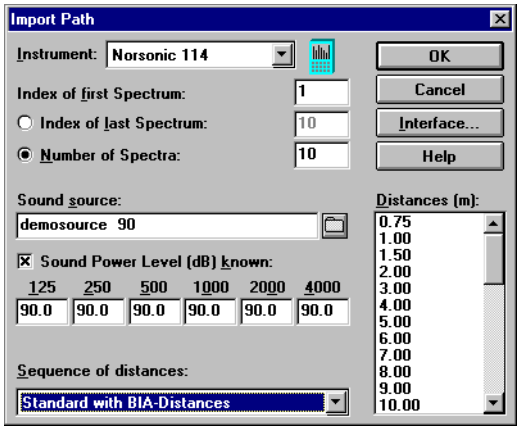
CADNA SAK can read the sound pressure level by RS232 Interface, if a sound decay curve has been measured .



Just a double-click with the mouse and the absorption data are combined



The partial view window comfortable allows a quick check about the outfit of a room surface. The reached absorption coefficient is represented by colour. More layers (baffles under flat absorbend ceiling) are calculated correctly.



The measured data can be imported from sound olevel meters directly or by a file for determination of the acoustic parameters of the sound decay curve.

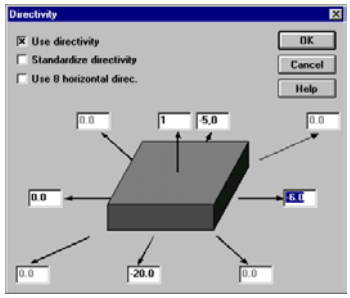
CADNA SAK is bilingual - it can be run in either English or German language.

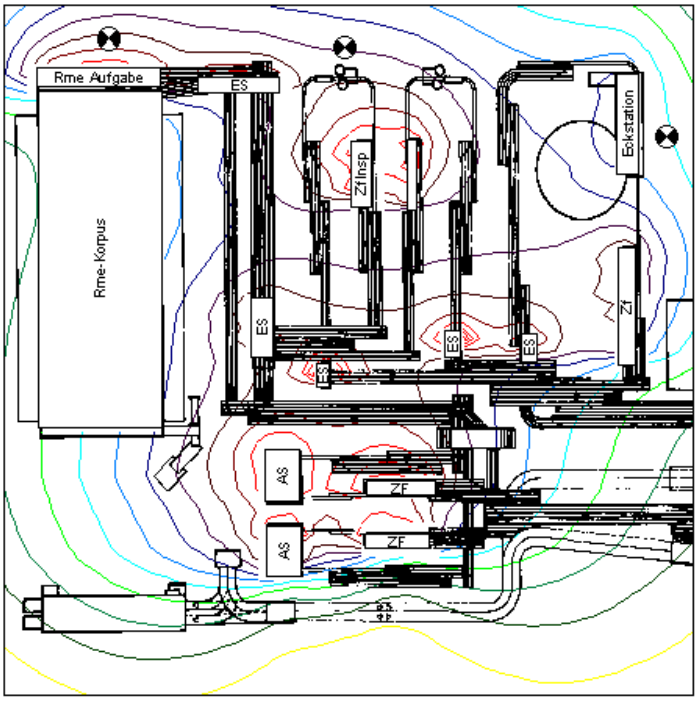
Calculation of noise levels from the emission data of the machines

This module for the calculation of sound pressure levels in rooms is a very comfortable tool for the acoustic planning of work places in production halls or in other rooms with noise sources.

Input data are the sound emission levels related to ISO 3742 - 3746 (sound power levels, emission sound pressure levels) with frequency spectra and directivity. The program calculates the sound pressure levels at defineable points - e.g. for all work stations - or for the complete hall on a selectable grid. The output of lines with constant noise levels shows that the machines are not simulated by single point sources, but by a complete emission of the total machine surface.

Input possibility for determination of the directivity of sound sources.





Output of sound level distribution by coloured areas or Iso-dB-lines. Like usual in WINDOWS, the graphic can be imported and processed further on by „copy“ and „insert“ in other text and draw programs. The transfer to CAD programs is possible by DXF-Format.

Cadna SAK®

Specifications

System requirements:

- IBM-compatible PC at least 386 with VGA-screen
- MS-DOS/PC-DOS 3.3 or higher
- Microsoft Windows 3.1x, Windows 95/NT
- 2 MB RAM (4 MB recommended)
- disc 3,5"-HD
- Microsoft-compatible mouse and printer

Calculation of sound decay:

- statistical theory (Sabine)
- mirror image method with calculation of diffraction by the theory of Kuttruff and Jovicic (German VDI-guideline 3760)
- Interface to sound level meters for direct data input:
- Rion realtime octave analysator
- Norsonic type 114 (ask for the actual possible instrument-interfaces at DataKustik)

Room description

- Approximation by box-shape (in accordance to ISO)
- default values of absorption coefficients for reflecting surfaces
- no limitation for the number of surface areas with different absorption for walls and ceilings
- selection of spectral absorption coefficients from the product library (German market)
- different handling of open absorption systems (baffle systems) and closed absorbent surfaces
- overlapping absorbent layers are recognized - the absorption of an open baffle structure in front of other absorbent surfaces is treated as a combined system and calculated correctly
- machines and other fittings are taken into account by the fitting density, defined by Kuttruff (VDI-guideline 3760)
- simplified estimation of fitting densities by a predefined selection for different machine-arrangements.

Product library

- spectral absorption coefficients (one third octave band and octave band) for many well known surfaces as wood, glass, brick, plaster etc.
- absorption data of a lot of products (German market) for the absorption of sound, determined in accordance with DIN and ISO. This library can be supplemented by the user
- many selection possibilities by setting of attribute filters (mechanical stability, response against humidity, heat etc.)
- comfortable support of the library by insert/delete/edit-functions.
- continuously varying graphic and numeric display of absorption-spectrum by scrolling through the library
- possibility of switching from octave band to third octave band representation for graphic and numeric displays

Mean absorption coefficient:

- calculation display and output report of the mean spectral absorption coefficient and as one number value for a selected sound pressure frequency spectrum (typical SPL spectrum in the room)

Reverberation time:

- calculation of reverberation time in one third octave bands
- display and output as diagram (reverberation time over frequency) and as table
- calculation of an effective reverberation time as one number value for preselected SPL-reference-spectrum

Calculation of sound decay:

- determination of sound decay curve by calculation of the sound pressure levels in different distances from a uniformly radiating pointsource
- calculation by statistical theory or by mirror image methode with diffraction defined by Kuttruff
- possibility to define an individual path by editing coordinates of source and two points for path direction
- calculation to high orders of reflection, so that a fault of 0,5 dB for the neglected higher orders is not exceeded
- calculation of the sound decay curve for a predefined or a user edited SPL-frequency-spectrum
- graphic screen representation and output of the sound decay diagram for a selected frequency band or for a preselected or user defined SPL-frequency-spectrum
- analysis of the sound decay curve and calculation of DL2 (sound decay by doubling of distance) and DLf (sound level exess) to free field conditions

Sound decay measurement:

- direct reading of octave-band-spectrum, that are stored in a realtime octave analyser (RION/Norsonic) by a RS 232 interface and by files (Norsonic 110, 830; Bruel & Kjaer 2144, CEL CL 30 - ask for current information)
- input of measured octave band values by keybord
- parallel representation of measured and calculated sound decay curves in the same diagram (measured curve for the existing hall and calculated curve for the recommended noise reduction measures)
- selection of the distances used from a predefined list (supplementable by the user)
- display analysis and output of measured sound decay curve and parameters, as described under "calculation of sound decay curve"

Calculation of noise levels

- calculation of noise levels at work places and of noise level distributions (Iso-dB-lines to find out the noisy areas) from the sound emission levels of machines
- input of the sound emission data PWL and SPL in accordance with ISO 3742 - 3746
- frequency spectrum, directivity and structural dimensions of the machines are taken into account
- calculation by the German VDI 3760 method (mirror image method with diffraction and damping proposed by Kuttruff and Jovicic), by Sabine's statistical theory
- calculation of sound pressure levels at defined points (list of work stations) or for distributed points on a defineable grid with output of Iso-dB-lines.

Some applications of Cadna/SAK

- Determination of the acoustic quality of rooms with work places by comparison of measured (existing halls) or calculated (planned halls) values with recommended values
- reaching the recommended values for rooms with noisy areas
- a mean absorption coefficient of 0,3 or higher
- sound decay per doubling of distance 3,5 dB or more
- sound pressure level excess 8 dB or less
- reverberation time of 1 second or shorter
- calculation of reverberation time for otherwise used rooms (cinemas, theatres, meetingrooms etc.) and equipping with absorption surfaces till recommended values are reached
- calculation of the sound pressure level that is caused by machines

Munich, September 1998