DALI

TYPE 18
HIGH FIDELITY LOUDSPEAKER

MANUAL

DALI 18

Congratulations on your fine judgement. In its class the DALI 18 is one of the very finest loudspeakers on the market. To get the maximum performance from DALI 18 we recommend, that you read this manual before installing your new speakers.

INDEX

POSITIONING

DISTANCE FROM WALLS AND FLOOR

DALI 18 is a floor speaker, which, in order to allow free radiation from the bass reflex port, must not be placed at less than 20 cm (8 in) from the back wall. The distance to the side walls should not be of less than 50 cm (20 in).

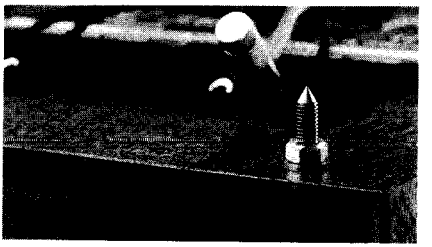
Please note that DALI 18 is provided in mirror-imaged pairs. The right speaker has oblique bevelling on the left, and the left speaker has oblique bevelling on the right.

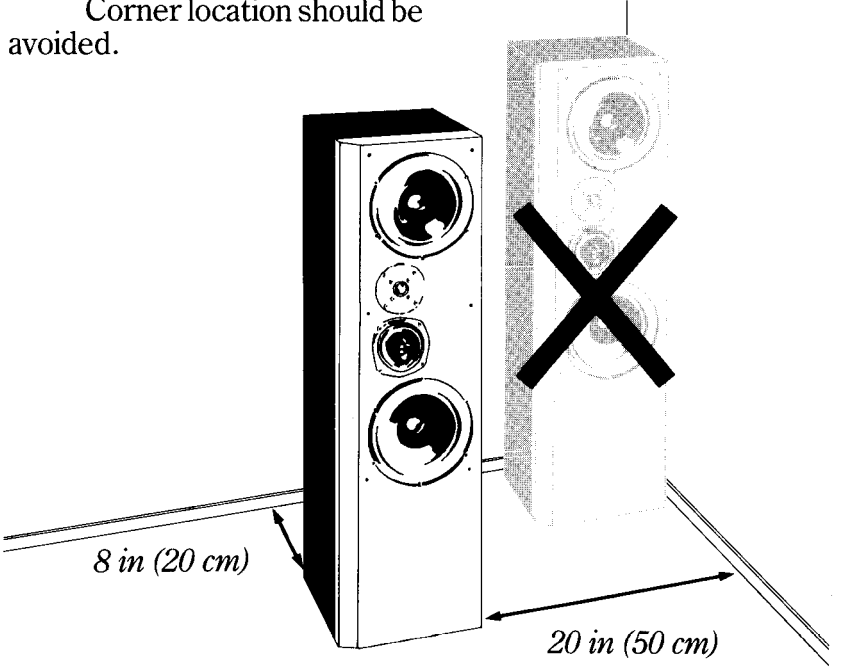
Naturally, DALI 18 should always be placed vertically.

Corner location should be avoided.

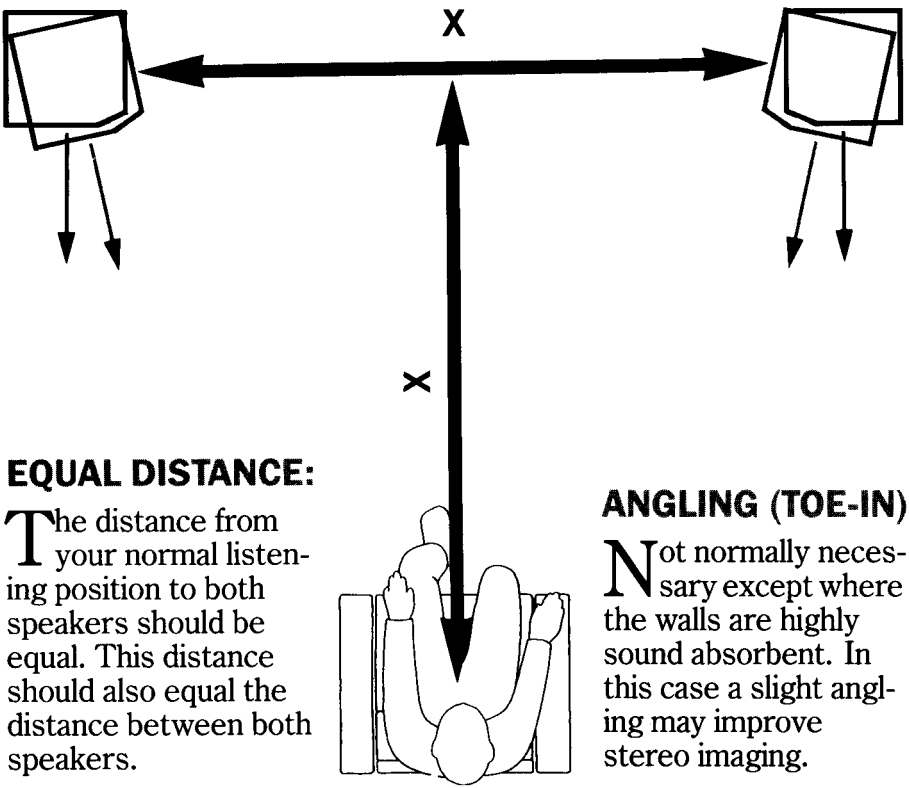
CAUTION!

DALI 18 is mounted with spikes in order to improve stereo imaging. Do not forget the spikes when moving DALI 18 around on your floor - the spikes may damage the floor and the carpet, if you just pull DALI 18 around!





POSITIONING



EQUAL DISTANCE:

The distance from your normal listening position to both speakers should be equal. This distance should also equal the distance between both speakers.

ANGLING (TOE-IN):

Not normally necessary except where the walls are highly sound absorbent. In this case a slight angling may improve stereo imaging.

SIGNAL SOURCES:

We recommend the use of the best speaker cables and, especially, a very good turntable or CD-player.

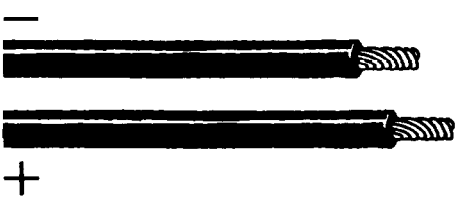
Limited sound reproduction is often caused by misadjustment and/or weak signal equipment.

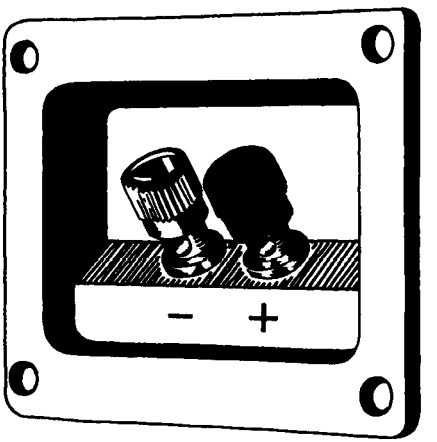
CONNECTION

The gold plated terminal on DALI 18 makes it possible to use banana plugs or heavy bared wires for amplifier connection.

IMPORTANT!

Turn off the amplifier when you are working at loudspeaker connection!

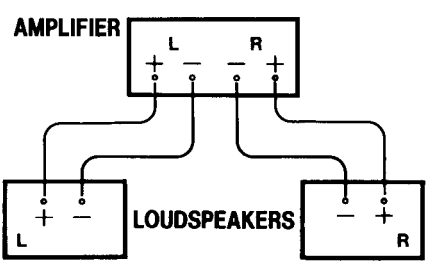




PHASING

To get a true stereo-reproduction it is necessary, that the loudspeakers are phased correctly. Connect always the amplifiers + to the loudspeakers +, and the ampliers – to the loudspeakers –. As shown on this figure.

On most speaker wires one of the leaders will have an indication making it easy to do this in the right way.



DAILY USE

The main point here is: enjoy the music! The only regular maintenance required is occassional cleaning of the surfaces:

WOOD:

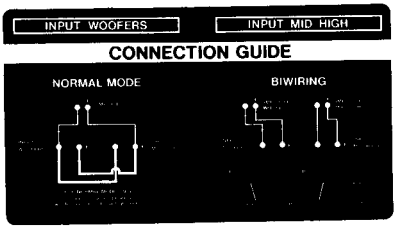
Dust with cloth, protect with first-rate furniture oil.

TEXTILE FRONT:

Brush with a clothes-brush or vacuum clean with a brush mouthpiece.

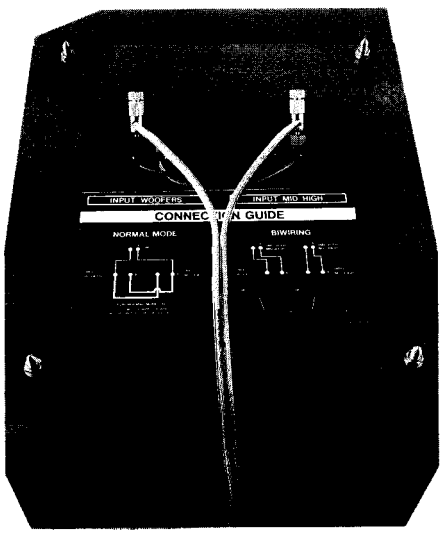
INPUT

The input terminal is divided into two sections: On the left input for WOOFER section and on the right input for MID-RANGE/HIGH section.



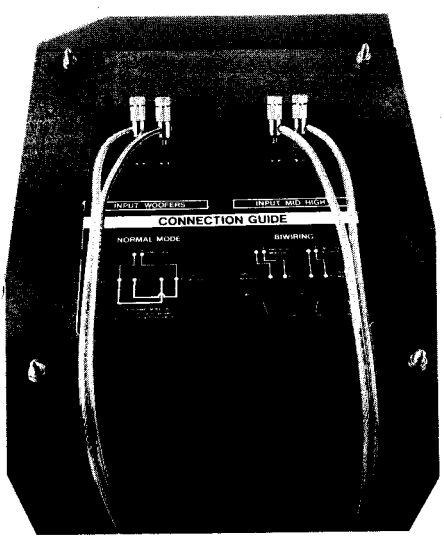
NORMAL MODE

Normal connection of one amplifier. The input terminals for woofers and midrange/high are coupled by + + and − − respectively.



BIWIRING

Two separate amplifiers are used: One for the woofer section, and one for the midrange/high section. When used in biwiring mode the coupling of + + and − − between the two input sections are removed.



DALI 18 is the first loudspeaker constructed by us by means of advanced modal analysis - a measuring system at a price of approximately 1 million DKr. The modal analysis gives a very detailed impression of the behaviour of a dynamic structure when exposed to vibration, stroke, or shock. The system is for instance employed for examining the possible motion of drilling rigs when exposed to wind or waves. A constructional error in this field may cause the rig to break down, if certain unfortunate impacts are produced! Modal Analysis is also used in other fields, for example in hulls, high-speed diesel trains, cars, aeroplane wings, and engines. In the following example we have modal-analysed a loudspeaker cabinet.

In view of todays loudspeaker technology two elements are mainly of interest: the dispersion in the room and the unintended dispersion from the cabinet. The first point has been discussed a great deal within the DALI company. DALI 7 was our first loudspeaker with "Linear Directivity" crossover network, and this technique is also found in 2a, 3a, 4a, 15, and of course, in DALI 40. We have also tested the cabinet dispersion by means of an accelerometer, but this technique is not sufficiently precise. The most illustrative measuring technique is modal analyses. But what does this technique consist in?

DALI 18 starred in an animated cartoon

In short modal analysis consists in a number of measurements effected on the cabinet and being loaded into a computer, which again produces an animated cartoon of the cabinet movements on a viewing screen.

In technical terms modal analysis involves a twin channel FFT analyser, an impulse hammer or a shaking table, a strong computer, and various kinds of technical equipment. The cabinet is influenced either by strokes made with a special hammer from Brüel & Kjær (the most expensive hammer in the world!), or by shaking in one point by means of a special shaking table. The FFT analyser now measures the impact on one channel and the result somewhere on the other channel. The measurement is made by means of an accelerometer. The cabinet is now divided into points of measurement according to a three-dimensional curve system, and a number of measurements is effected. On DALI 18 we made 82 points of measurement, which we averaged over 10 measurements, that is a total of 820 separate measurements. After this the measurements were processed by the computer. This calculation has 82 equations and 10-12 unknowns, and consequently, it takes some time. After the computer processing a listing is issued giving the frequences having an impact. It may for instance be 356 Hz, 408 Hz, 517 Hz, and 756 Hz. Thereafter it is possible to see how the cabinet "moves" on the computer screen. You can see the cabinet twisting from side to side in awkward windings like a snake... When the enthusiasm produced by the problem indication provided by this superior measuring instrument has calmed down, the big question arises:

What can be done to prevent this?

For some years a great number of producers have tried using cabinets supports but only to discover that the problems were moved to other frequency areas, and having perhaps 10 "critical" frequencies a cabinet with 150 supports would not at all be unlikely. Mr. Ole Døssing, a modal analysis expert from Brüel & Kjær, was very helpful in solving this problem. To begin with we had to estimate which movemnets caused real problems, and which could be left out of question. After thorough evaluations and calculations of the playing of the supports, we changed the DALI cabinet and analysed once again - this was repeated several times! At last we had found a cabinet, which reacted in the desired way, and the supports of this cabinet are ones used in the specimens produced of the DALI 18 loudspeaker.

DALI 18 is based on DALI 40

DALI 18 is constructed on the basis of the experiences we have gained from DALI 40. The midrange element is thus the same in both speakers, i.e. a 4½" TPX unit with suspension made of the totally "dead" material, Norsorex. TPX is a material with a high degree of attenuation, a very low volume, and a high rigidity. The velocity of sound in the material is adapted in a way as to make the wawe band front homogeneous. If the sound transmitted by the voice coil has been dispersed 2 cm. forward it will have reached 2 cm. into the diaphragm, this diaphragm being exponentially conical.

Norsorex is a kind of gum having the property that ball of Norsorex thrown from a height of 1 metre falls completely "dead" unto a concrete floor. Consequently, Norsorex has a high dampening effect and is suitable for solving the problems always involved in the termination of the diaphragm. Above the magnetic core a conical extension is placed. This eliminates all problems concerning resonances created in the stagnant air above the core.

The tweeter unit in DALI 18 is the same as in DALI 40, i.e. a 1" coated textile dome with a light voice coil in a strong and accurately processed magnetic field. The dome itself has a rather large vault, which ensures perfectly decoupled qualities. Consequently, the fidelity of the DALI 40/18 dome is completely free from the resonant character, which most of the 1" domes on the market in the tone field above 10 KHz show signs of.

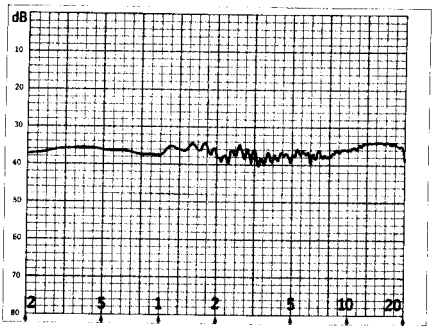
The woofer system of DALI 18 is a QB3 tuned in bass reflex system including two very strong 8" units. These are units with large magnetic systems and voice coils wound up in a height of 25 mm. This gives a length of stroke of twice what an ordinary 8" unit of a good quality can manage. Of course, this also means that the unit can move more air and thus play louder - the two 8" units in DALI 18 can provide a sound pressure equal to that of a 15" unit in a 120 litre cabinet. However, it is far more important that the distortion caused by a non-linear magnetic field is much lower than the one caused by normal commutator technology.

The placing of the crossover network and the units in DALI 18 is chosen out of the desire to be capable of controlling the sound emission both on the vertical and on the horizontal plane. The sound emission on the horizontal plane can be specified to be ±70 degrees, and in the vertical plane ±7 degrees (a departure of ±2 dB from the main axis). The crossover network has asymmetric roll-offs like all other DALI Linear Directivity networks. Twenty components of the finest quality are used, and the network includes impedance correction in the woofer units and inherent resonance counterbalancing in the tweeter units.

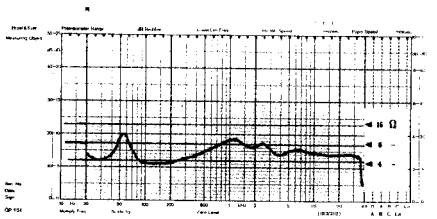
DALI 18 has biwiring

As for design DALI 18 resumes the thread of DALI 15, which has, incidentally, become a huge succes. The front board is made of 50 mm. fibre board with inclined milling off, this partly from design based reasons and partly from acoustic diffusion reasons. The backboard consists a 2 cm. thick fibre board. The sides are, of course, made of first-grade beech, walnut, or Brazilian rosewood. Under the pedestral two gold terminal are placed; DALI 18 is intended for biwiring. Biwiring is a possibility of operating with two separate output power amplifiers, one in the woofer section and one in the midrange/tweeter section. The preamplifier feeds two stereo amplifiers and from one of these wires are led to terminal 1 and from the other amplifier to terminal 2. Biwiring provides two advantages: 1) The sound reproduction becomes more dynamic with two amplifiers than with one. 2) It makes it possible to choose an amplifier with especially good woofer qualities and a special midrange/tweeter quality to obtain optimum sonority and tone. At normal operation the two terminals are interconnected.

MEASUREMENTS

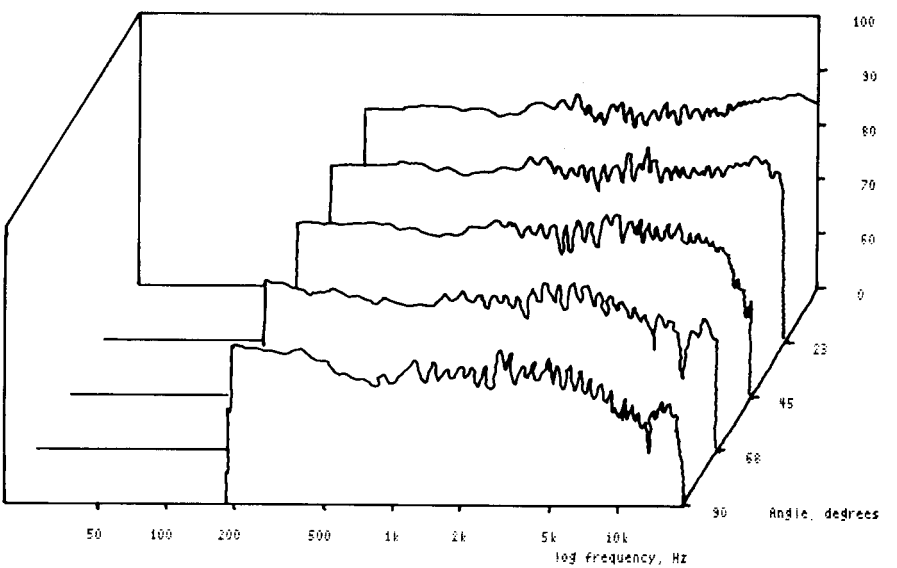


Frequency response.



Input impedance.

Directional characteristics.



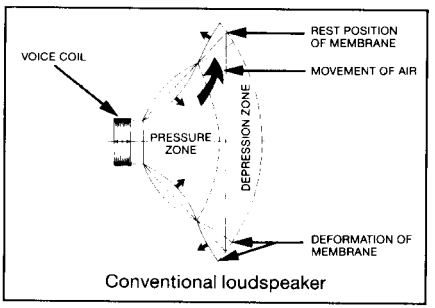
SPECIFICATIONS

Cabinet type ..... QB3 bassreflex
Drivers
Woofer .... 2 x 8" polypropylene, super long throgh)
Midrange ..... 4 1/2", TPX
Tweeter ..... 1", textile dome
Crossover ... Linear Directivity. 1st quality components
Crossover frequencies ..... 800 Hz, 3000 Hz
Impedance ..... 8 ohms
System resonance ..... 25 Hz
Frequency response ±3dB ..... 34-20.000 Hz
Listening window ±2dB hor. ..... 140°
ver. ..... +9°, -7°
Sensitivity 93dB/1W/1m
Recommended amplifier
power ratings ..... 20 to 250 W/channel
Dimensions
Height ..... 100 cm (39 1/3")
Width ..... 30 cm (12")
Depth ..... 36 cm (14 1/4")
Net weight ..... 36 kg

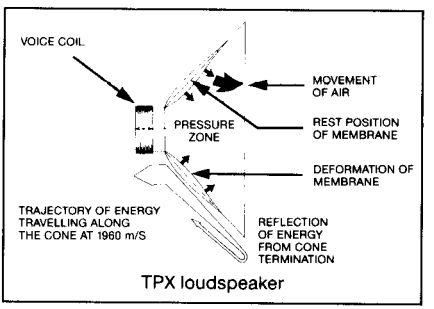
Specifications are subject to change without notice in the course of product improvement.

OTHER DATA

The figures show wave propogation and deformation through both a conventional cone and a TPX cone. Part of the energy reaches the edge of the cone at the surround and is reflected back towards the centre, producing standing waves. The sum of transmitted and reflected waves gives rise to "pealing phenomena" causing distortion, Note the similarity with the input signal for the TPX cone, whilst the conventional cone is strongly distorted by "pealing".



Conventional loudspeaker



TPX loudspeaker

At the tone-bursts below you see the reproduction of the frequencies 850 Hz. 2 KHZ and 3 KHZ.

Note the TPX-speakers confirmity with the generatorsignal, unlike the conventional speaker.