DALI DACAPO

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

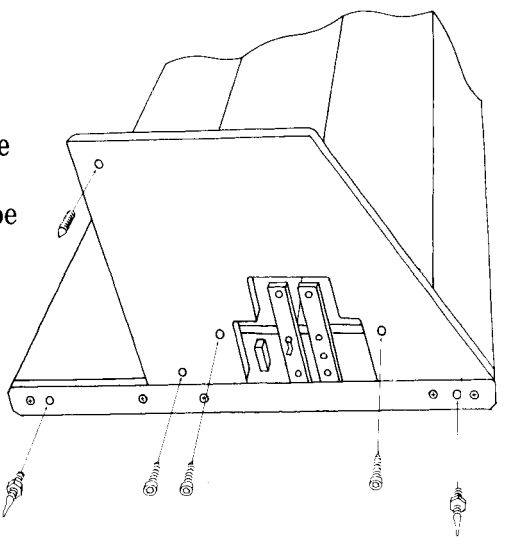
INDEX

UNPACKING THE DALI DACAPO

Each DALI DaCapo is packed individually with the base removed. The loudspeaker should be placed face down. Mount the base on the loudspeaker using the tools enclosed with the right loudspeaker. The two shiny spikes are then mounted on the bottom aluminium panel. The spikes are then fastened with nuts.

The tilt-adjustment screw is then mounted in the hole at the rear of the base.

All screws and nuts should be tightened to eliminate any slackness or possibility of vibration.



WARNING

Tools, sharp metal objects, etc., should be kept well away from the ribbon area of the DALI DaCapo because the magnetic field generated by the loudspeaker is very powerful. The magnetic field may also affect television sets, computers, magnetic tapes, etc.

POSITIONING

Do not neglect this procedure. It is the most cost effective »upgrade« to the sound of your system. Once the speakers have been unpacked and assembled, the following recommendations for room placement should be observed.

DISTANCE FROM THE REAR WALL

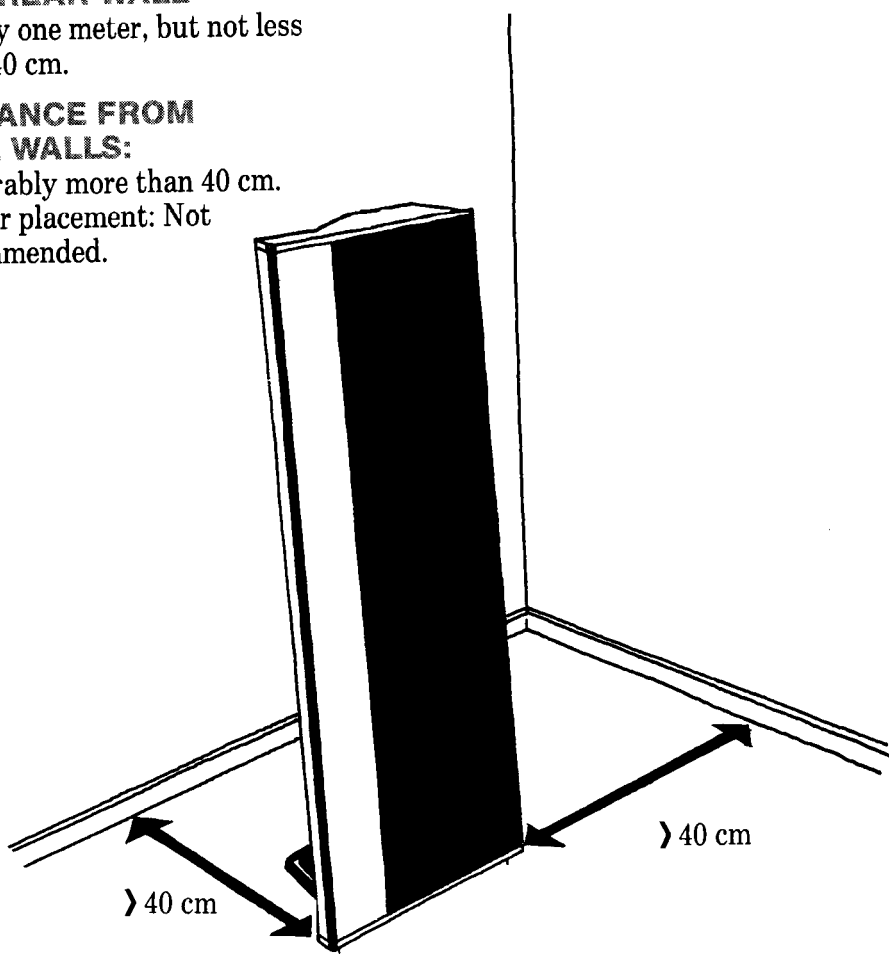
Ideally one meter, but not less than 40 cm.

DISTANCE FROM SIDE WALLS:

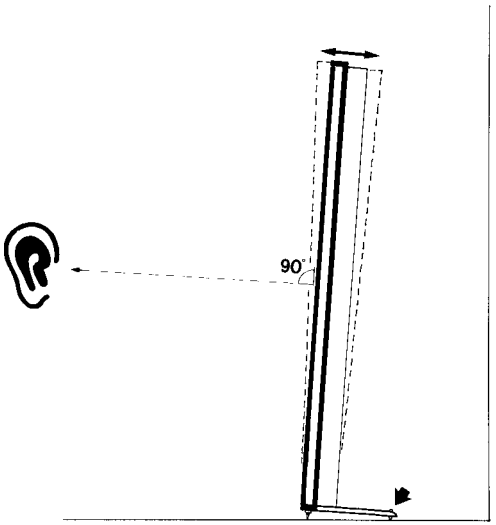
Preferably more than 40 cm.
Corner placement: Not recommended.

CAUTION

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

We recommend turning the DaCapo slightly inward toward the listening position. Start with moderate toe-in and continue in small increments.

Vertical tilt: The DaCapo's perpendicular angle can be adjusted using the screw at the rear of the base. If more tilt is required, the front screws may also be adjusted. The loudspeaker should be tilted so that the center of the ribbon points directly at the listener's head.

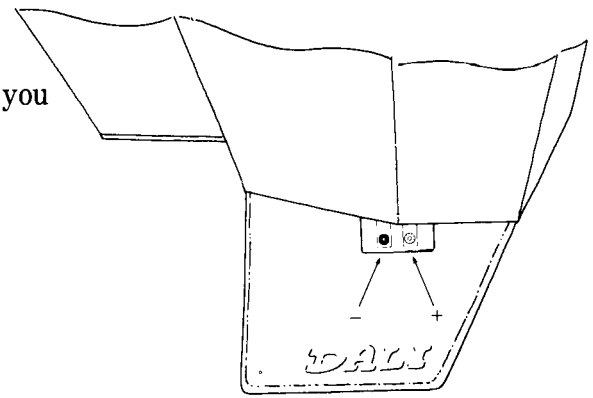
SIGNAL SOURCES

Because of DALI DaCapo's unique faithfulness to the input signal, we recommend the finest signal sources and amplification available. DALI DaCapo will expose weaknesses in the signal chain that previously went unnoticed, e.g. cartridge mistracking, cable deficiencies etc.

CONNECTION

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

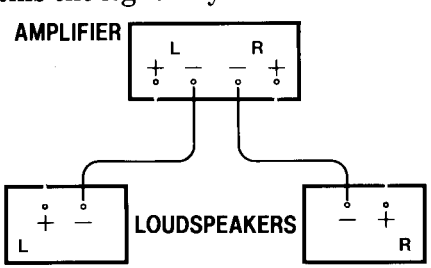
IMPORTANT!
Turn off the amplifier when you are working at loudspeaker connection!



PHASING

To get true stereo-reproduction it is necessary that the loudspeakers are phased correctly. Always connect the amplifier + to the loudspeaker +, and the amplifier — to the loudspeaker —.

On most speaker cables one of the leads will have an indication making it easy to do this the right way.



DAILY USE

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

ALUMINIUM:
Dust with cloth, clean with normal soap.

THE IRON BASE:
Dust with a moist cloth.

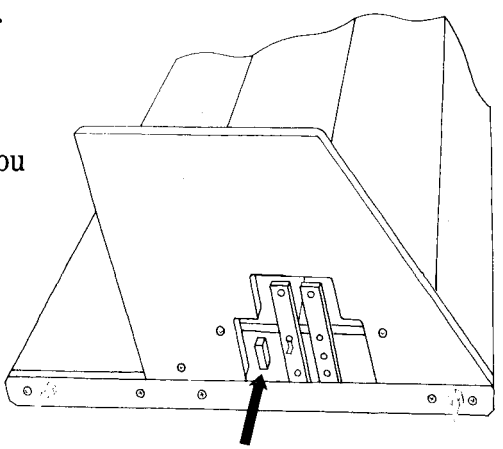
THE CLOTH COVER:
Brush with a soft nonmagnetic brush.

MALFUNCTION

In case of any failure, first determine whether the error is in the loudspeaker by switching leads between the left and right speakers. If the malfunction then moves to the other speaker, then the error lies elsewhere in your system.

If there is no treble and midrange, examine the fuse in the base near the loudspeaker terminals. If the fuse is blown, replace it with a fuse of identical value (1,6 A fast blow) and turn the sound up slowly. If the ribbon section now operates normally, your problem is solved. You have probably driven your amplifier into clipping, causing the fuse in the DALI DaCapo to blow in order to avoid damage to the loudspeaker.

If there is still no sound from the ribbon section, or if you have any other problems or questions, please feel free to contact your authorized DALI dealer.



1,6 A FAST BLOW

The DALI DaCapo is the result of years of painstaking labour in the DALI laboratories and listening rooms. The vast resources lavished on this project are a tacit acknowledgment of its unique, ground-breaking nature. We had to seek out radically new solutions to some fundamental problems before we were satisfied with the fruits of our labours.

Why a ribbon?

Our enthusiasm for certain outstanding aspects of the performance of electrostatic and ribbon loudspeakers inspired us to experiment with these principles. Electrostatic designs have several advantages, along with some serious drawbacks, requiring electric power and a transformer operating at high currents, making electrostatics difficult, expensive and not undangerous to deal with. For these and other reasons, we decided on the ribbon principle, which offers many fine qualities and very few disadvantages. In conventional cone and dome drivers the diaphragm is driven by a voice coil mounted on the diaphragm either along its perimeter or in a ring near its center. Due to the rigidity of the diaphragm, energy from the voice coil is distributed throughout the entire diaphragm surface. But, if the diaphragm is not sufficiently rigid, break-ups will occur, i.e., different sections of the diaphragm will be in randomly varying phase relationships.

In a ribbon driver the current path is the full surface of the diaphragm with equal energy distribution at all points, thus eliminating the need for a rigid diaphragm, since the type of break-up familiar from dynamic drivers cannot occur.

The elimination of the rigidity requirement entails the further advantage that the weight of the voice coil and diaphragm, relative to the surface area of the diaphragm, can be reduced to an absolute minimum. The DaCapo ribbon weighs less than one gram, in spite of a surface area greater than that of fifty ¾" dome tweeters. This is part of the explanation behind the amazing transient response of our ribbon driver: a low-mass element can stop and start very fast.

Evaluation of reflections

The DALI research and development team have devoted considerable effort to examining the significance of loudspeaker dispersion characteristics as a parameter in subjective listening evaluations. As a result of this research, all of our loudspeaker designs are based on the Linear Directivity Principle, for linear frequency response not only on-axis, but also off-axis at angles up to 70 degrees. Smooth off-axis response measurements are important because most of the sound perceived at a normal listening position is reflected, rather than direct. The reflections must be in tonal balance with the direct sound or else the brain will receive conflicting input, making it difficult to maintain the illusion of live music. The problem is complicated by the fact that reflected sound comes in »waves«. A distinction must be made between early (0-30 milliseconds) and late (30-400 milliseconds) reflections, of which early reflections are particularly odious and should be eliminated as far as possible, since they tend to reduce clarity and slur image specificity. Early reflections are primarily a product of the loudspeaker cabinet, the floor and, potentially, the side walls as well, if the speakers are placed too close to them. In a properly designed enclosure, with no protruding surfaces, etc., cabinet reflections can be kept to an absolute minimum. Floor reflections are, of course, impossible to eliminate entirely, but it is possible to reduce their level drastically at positions beyond the upper and lower edges of the driver, by designing the mid/treble driver as a finite line source. Consequently, floor reflections would be much less harmful, but the listener would have to be seated in order to experience the correct sound image. We decided to accept this minor limitation, since our loudspeaker is intended for serious music listening and not as a generator of »sonic wallpaper«. Early wall reflections can, of course, be reduced by placing the speaker well out into the room (highly recommended, by the way), but few of us have the space this solution demands. One possible solution is to design the ribbon as a dipole with a figure-8 dispersion pattern which does not radiate sound to the sides.

By designing the mid/treble driver as a finite, dipole line source, we reduce the influence of early reflections, resulting in improvements in clarity and stereo perspective as well as less room dependence, making it possible for the speaker to perform well even in a room with a concrete floor.

A long ribbon offers the additional advantage that, even with a taut ribbon, the system's eigenmodes will be well outside the frequency range which the ribbon is intended to reproduce. Once the length of the ribbon is determined, its width must then be defined. In order to achieve acceptable horizontal dispersion the ribbon should be narrow, but for optimum low frequency response at reasonable volume levels the largest possible surface is desirable. Obviously, compromise is inevitable, and we found the best compromise to be a 15 mm wide ribbon with good dispersion over the entire audible frequency range and sufficient surface area to perform well down to a crossover point as low as 450 Hz. This gives the major advantage of one driver covering the entire frequency spectrum from 450-20.000 Hz, completely avoiding a crossover in the midrange, where the human ear is most sensitive.

Ribbon design

Theoretically, there are two approaches to the construction of a ribbon driver: 1) a single, pure aluminium ribbon or 2) several aluminium ribbons electrically connected in series and laid out in parallel on a foil backing. The pure aluminium ribbon has the lowest mass, but also several disadvantages. For one thing, current only passes through the magnetic field once, which means low efficiency, and secondly, the impedance of such a ribbon would be very low, making the loudspeaker compatible with only the most esoteric (and expensive) amplifiers. This would be in conflict with our express intention to make the DALI DaCapo compatible with economically »accessible« amplifiers of good quality. To achieve reasonable efficiency and an acceptable impedance, we opted for 4 aluminium conductor tracks on a foil backing with a thickness of 12 micrometers. This yields an impedance of almost 4 ohms, with virtually no phase angles, making the DaCapo child's play for any quality amplifier.

A magnetic gap in excess of 15 mm will not be uniform, with force decreasing towards the center of the field. Thus the magnetic force exerted on the ribbon closest to the magnets will be greatest, since they are electrically in series. By employing aluminium conductor tracks of different width, we vary the current density, thus compensating for variations in the strength of the magnetic field.

Foil material

The backing foil has to live up to the following demands: light weight, heat conductive, thermically stable and structurally stable. Many modern synthetics and plastics meet these demands, but in the end this was not enough. Early listening tests demonstrated that the backing foil exerted a major influence on sound quality and we auditioned a wide variety of materials before settling on a special thermostable polyester film which fulfilled all our needs.

In a ribbon which must swing back and forth 20.000 times pr. second, the bonding between the polyester film and the aluminium is crucial, since the slightest loss of contact between the two materials will result in a loud buzzing noise from the ribbon. To prevent this, and to ensure perfectly uniform thickness of the aluminium, we asked one of the world's few specialists in the field of technical foils to carry out the lamination process with a special polyurethane binding agent. The magnetic field in which the ribbon is placed is generated by powerful strontium ferrite magnets mounted in 5 mm iron frames with a low carbon content for improved magnetic performance. We could have increased system efficiency by nearly 2 dB with a magnetic short circuit between the frames, but decided not to employ yokes for two reasons. 1) The low mass of the ribbon means that rear reflections are almost entirely undamped. 2) Subjective performance and laboratory measurements are much improved without yokes.

Controlling dispersion

Due to the ear's extreme sensitivity to frequency dependent variations, the single greatest challenge in the design of a hybrid loudspeaker lies in the transition from one transducer principle to another. Naturally, frequency response on-axis must be linear, but this is not enough to ensure a seamless transition from one driver type to another. Equally important is a smooth transition in terms of dispersion patterns, distortion characteristics, impulse response, etc., etc. We solved this problem with a new, patented bass principle which exploits the fact that motion in a limited

volume of air is in phase at sufficiently low frequencies. When a large plastic membrane is mounted in front of the woofer with a well-defined space in between, the captive volume of air behaves like a piston at low frequencies and transforms the surface area and the volume velocity of the woofer. This allows us to define the shape and surface area of the bass driver and, thereby, its dispersion characteristics. As stated earlier, this applies only up to a frequency limit which is determined by the size of the gap between the bass driver and plastic membrane. The dimensions of the DALI DaCapo make feasible an upper frequency limit of 650-700 Hz, so the 450 Hz crossover point lies well within the theoretical »safe operating range«.

In order to achieve the same dispersion pattern in the vertical plane, the plastic membrane has the same length as the ribbon driver. Once the dispersion characteristics were determined, it was necessary to find a driver which could meet an extraordinary set of demands in terms of efficiency, impedance, resonant frequency, etc. We selected an 8" driver with a coated pulp diaphragm. For optimum compatibility with the ribbon driver in terms of the best possible impulse response, the bass driver is mounted in a 20 liter sealed enclosure with a resonance frequency of 50 Hz and a relatively gentle 12 dB/octave low frequency roll-off, for smooth response in the lower octaves.

Cabinet design

In the DALI DaCapo form reinforces function. The cabinet, a radical departure from the garden-variety loudspeaker enclosure, has side panels of MDF (Medium Density Fibreboard), a material with high density and excellent internal damping. The side panels of the bass section are 28 mm MDF (Medium Density Fibreboard). The same material is used in a 45 mm thickness for the ribbon section. The rear panel is assembled from three sections of the finest quality chipboard which join at odd angles and reinforce each other in an extremely rigid system. The front panel of the DALI DaCapo is also a special sandwich construction, with an outer section which is mechanically isolated from the rest of the cabinet using a visco-elastic damping board. The bass driver is mounted directly on this board for effective damping of cabinet resonances. Internal bracing has been carefully calculated through modal analysis and three adjustable spikes form a solid foundation for the DALI DaCapo, allowing the listener to tilt the speaker at just the right angle for a given listening position.

Crossover

The crossover network is a linear phase 3rd order filter with large air core inductors and capacitors selected after extensive listening tests. The choice of internal cable was also the result of listening sessions: LC-OFC (Linear Crystal Oxygen-Free Copper) for the ribbon driver and 2,5 mm oxygen-free cable for the bass driver. The total system impedance is approximately 4 ohms, but, because of the frequency independent nature of the load, the DALI DaCapo is a suitable partner for any quality amplifier. The crossover, which includes a fuse to protect the ribbon, is conveniently located at the bottom of the loudspeaker. The generous screw terminals accept banana plugs, spade lugs and cable diameters up to 10 mm.

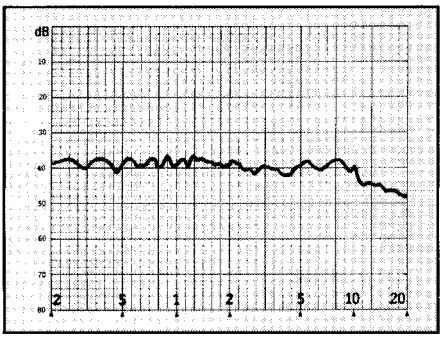
Conclusion

The DALI DaCapo is a supremely neutral musical instrument over a broad frequency band, capable of reproducing an accurate illusion of the natural ambience of the recording venue and of the relative position of the musicians on a stage.

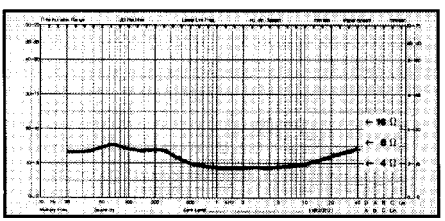
The DALI DaCapo is NOT a high efficiency loudspeaker, nor is it a »loud and proud« party animal. What it CAN do with unparallelled grace and precision is »disappear« on those rare and precious occasions when the artist's performance and the labours of the studio engineers place you in the palpable presence of living music.

If this is the experience you are interested in, then the DALI DaCapo will bring you years of listening pleasure.

MEASUREMENTS



Frequency response on axis and 45° off axis.



Input impedance.

SPECIFICATIONS

Drivers
- Woofer .... 10×40" membrane driven with 8" woofer
- Midrange/tweeter ..... 40" ribbon

Frequency response (± 4 dB) ..... 45-20,000 Hz
Impedance ..... 4 Ohm
Sensitivity (2.83 V) 85 dB/1m
Recommended amplifier ..... 50 to 200 W/channel
Dimensions
- Height ..... 86½" (118 cm)
- Depth (incl. base) ..... 12" (31 cm)
- Width ..... 18" (45 cm)
- Weight ..... 30 kg

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