DALI® IKON® Phantom

Technical Whitepaper

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Introduction: DALI IKON Phantom

A discreet, compact speaker solution is now available in the IKON series: The IKON Phantom in-wall speaker. Combined with a subwoofer it will compete traditional stand mount speakers or floor standers. It is worthwhile to consider, if you have a limited amount of space or want a discreet and compact speaker solution.

The basic design principles for IKON Phantom are the same as in Euphonia and Helicon Phantoms, which have already set standards for what sound can be achieved in compact, in-wall speaker solutions. IKON Phantom differs from the Euphonia and Helicon, when it comes to driver technology, crossover and form factor. These features have been adopted from the other IKON speakers.

In the following sections, you will be able to read about the technical details and solutions used in IKON Phantom.

In-wall Speakers vs. Traditional Speakers

In-wall loudspeakers differ from traditional floor standing or bookshelf loudspeakers. Traditional loudspeakers are placed some distance away from the walls and the ceiling/floor. The distance from the walls/ceiling/floor cause

reflections and varied coupling to the room, depending on, where the loudspeaker is placed in the listening room.

In-wall loudspeakers are usually flush-mounted in the walls and/or the ceiling of the listening room. The mounting method can significantly reduce the number of reflections from the wall behind the loudspeaker. Also, in-wall mounting will amplify low frequency output from the loudspeaker because the loudspeaker is “baffled” by the wall/ceiling.

Floor standing or bookshelf loudspeakers usually use cabinets made of rigid, vibration-inert materials. Thus, colouration of the sound is less likely to happen because of vibration of the cabinet.

In-wall loudspeakers are mounted in a wall, where a (hidden) cabinet can seem less important. Some in-wall loudspeaker manufacturers omit the use of a cabinet, probably to save costs and because it is not visible to the customer. However, this will seriously compromise the performance of the loudspeaker, because the acoustical environment (the cavity in the wall), which the loudspeaker drivers will radiate sound into, can vary significantly.

To avoid the varying performance due to the lack of a cabinet, DALI IKON Phantom use a cabinet. The cabinet is made of die cast aluminium combined with a Medium Density Fibre board (MDF) baffle and vibration absorbent materials within the cabinet.

Installation of in-wall speakers will impact the performance of your in-wall speakers. It is important, that the walls are inert to build-up of vibrations. If not, the Newton forces generated by the speaker will excite the whole wall, causing coloration of the sound.

IKON Phantom Components

Aluminium Cabinet

A rigid, die cast aluminium cabinet has been used for the IKON Phantom. This will ensure identical working conditions for the 6.5” bass/midrange driver no matter which wall cavity the speaker is mounted in. Inside the cabinet is used a bituminous material to make it inert to resonances. Ribs in the die cast aluminium and the coupling to the MDF baffle will also prevent build-up of resonances.

By using the cabinet, it is possible to use a bass/midrange driver with soft, low loss rubber surround and a spider causing a low resonance frequency for the driver. This would not have been possible without the rear cabinet, because the surround and spider thus would have to be less soft to be able to control the movement of the bass/midrange driver with compromised performance as consequence.

Because of the small form factor of the speaker it is very difficult for standing waves to build-up. Combined with strategically positioned materials inside the cabinet, standing waves are reduced to an absolute minimum.

Driver Technology

The drivers of the IKON series are designed in Denmark to make them live up to high requirements for audio reproduction. All parts of the drivers have been carefully selected, designed and optimised to the IKON speakers.

6½" Woofer

The 6½" woofer in DALI IKON Phantom is designed to be able to meet the DALI Sound Principles.

The cone and dust cap can move very fast, because it is made of a mixture of paper pulp and wooden fibres (a very light composite). The composite is rather stiff, which to some extent will cause break-ups of the cone at certain frequencies. These break-ups are eliminated by using a coating on the cone.

The moving parts of the woofer (diaphragm, spider and surround), are mounted in a rigid, die cast aluminium chassis, where air compression has been minimized. This is done to prevent the counteracting forces on the amplifier signal, which are to be reproduced. To reduce air compression further, there is

a vent in the yoke of the magnet system, and openings on both sides of the spider.

The magnet system is optimized to obtain low distortion by offering a linear, saturated magnet field. It is essential, that the magnet system does not modulate (as a reaction to the field which is made by the voice coil). The magnet system has been optimised to achieve these characteristics.

Hybrid Tweeter Module

The tweeter module in IKON Phantom consist of a 1.1”/28mm soft dome tweeter and a 0.7x1.8”/17x45mm ribbon super tweeter. Two tweeters are used to obtain wide dispersion characteristics and thereby obey the wide dispersion design philosophy. The dispersion from the soft dome tweeter will decrease above 14 kHz, which is normal for a soft dome tweeter. Above that frequency, the ribbon super tweeter will be gently rolled in. The ribbon super tweeter has better dispersion characteristics at high frequencies, so it will support the loudspeaker, when listening off axis.

Soft Dome Tweeter

The 1.1”/28mm soft dome tweeter is designed with the strongest magnet material available, namely neodymium. An aluminium heat sink is mounted on the magnet to ensure cooling and increased power handling in the event of

large loads of the loudspeaker. Moreover, low viscosity ferrofluid is used in the voice coil gab for even better cooling and lowering of the resonance frequency of the tweeter.

The geometry of the soft dome diaphragm and the surrounding face plate is carefully designed to have optimum dispersion characteristics as well as a smooth frequency response.

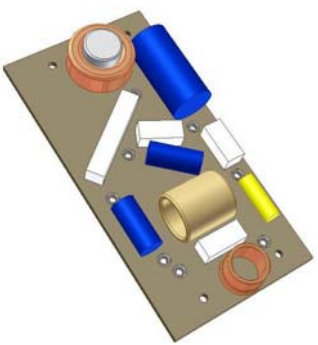
Ribbon Super Tweeter

Like in the absolute top of the line loudspeaker, DALI MegaLine, a ribbon super tweeter is used in DALI IKON Phantom. The ribbon super tweeter is gently rolled in from approximately 14 kHz, where it will support the soft dome tweeter. The ribbon super tweeter is an advanced construction. Three powerful neodymium magnets are used to make the magnet field, which will interact with the electrical field generated by the electrical conductors of the low mass diaphragm. The components of the ribbon tweeter enable very rapid movements of the diaphragm and thereby high bandwidth ranging above the limit of human hearing.

On the rear side of the ribbon tweeter is an acoustical chamber, filled with a material for acoustical treatment.

To obtain perfect dispersion characteristics and optimum energy transfer at the highs, a special acoustical lens will lead the energy from the diaphragm to the open. Numerous simulations and experiments have been conducted to carefully optimise the pattern and geometry of the acoustical lens.

The loudspeaker drivers in the IKON series is build on the DALI philosophy about low loss drivers. Consequences of the low loss principle are that all breaking forces and damping mechanisms in the moving parts of the drivers are sought minimized. Also, the moving mass is minimized to be able to make drivers with high bandwidth. As a consequence it is possible for the diaphragms to reproduce small signals from the amplifier. The result is good dynamics, where the fine details in the music are audible. The rubber surround of the 6½" driver is made of a carefully selected soft, low loss material, which do not absorb the energy, which instead will be transformed to air motion.



Crossover

All components in the crossover are hardwired to each other to minimize loss and make the most direct connection possible between each component. The alternative would be a printed circuit board, where there would be loss in the copper traces that would connect each component to each other. All components are either glued or strapped/glued to the base plate to avoid mechanical rattle noise, which is prone to occur when the components are

subjected to high sound pressure, which can occur inside the loudspeaker cabinet.

The crossover of the loudspeaker is made of high quality components, which are hardwired and glued/strapped on a stable base plate, which will ensure high mechanical strength and eliminate rattle noise from loose components.

The inductors of the crossover have a large cross-section to minimize loss and heating of the inductors in the event of high loads of the speaker. The position and direction of the inductors are carefully selected, so the interaction of the electrical fields, which are surrounding the inductors, will interact as little as possible.

The capacitors are either high quality polypropylene foil capacitors or bipolar capacitors. The capacitors have been carefully selected to obtain excellent sonic performance in collaboration with the inductors and the rest of the loudspeaker construction. The resistors used in the crossover are a ceramic power type.

Binding Posts

The gold plated binding posts are developed particularly for DALI IKON Phantom. The binding posts have one single conducting part (short signal path and less contact resistance) instead of multiple parts. The loudspeaker cable is

secured by spring-locking mechanisms, which will ensure constant tension on the cable to secure a long lasting and reliable electrical connection. The binding posts are bolted directly to the rear cabinet of the loudspeaker.

Amplifier Friendly

The amplifier to loudspeaker interface is influenced by the impedance characteristics of the speaker. Loudspeakers with poor impedance characteristics can force amplifiers (stress the amplifier unnecessarily) to perform badly. A stressed amplifier will typically add more distortion to the music.

The IKON Phantom drivers are optimised so that the impedance loads of the loudspeakers are very close to a pure resistive load, minimizing amplifier stress (a flat frequency response above the resonance frequency of the woofer).

Wide Dispersion

Unlike many of our competitors, the sound distribution from the IKON loudspeakers is designed so that if you listen at off axis positions, the frequency characteristics are flat and smooth.
There are a number of advantages by these principles:

- This will ensure that the timbre is almost the same in a large area of your listening room, meaning that you will not need to be on the exact centre axis to fully enjoy your music.

- The integration between the loudspeaker and the listening room is better, because reflected sound will have almost the same frequency characteristics as sound, which is radiated directly from the loudspeaker. This will cause the sound to be more natural to listen to.

- The wide dispersion characteristics make it unnecessary to toe-in or pivot the speakers so that they are pointing towards a specific listening position.

- Distortion is reduced when the loudspeaker is listened to off axis. Distortion and diffraction phenomena are most pronounced on axis, so you will experience better performance with off-axis listening.

Time Coherence / 3D Audio

In the IKON series, a lot of efforts are made to time align the sound from the different drivers to obtain a natural sound reproduction in the entire frequency range of the loudspeaker. This is normally very difficult in the crossover regions where two or more drivers will contribute to the total sound. However,

due to the special design of the drivers, and the crossover, it is possible to optimise the time coherence so that there are no abrupt passages in the crossover regions, where one driver can be heard more than the other. Correct timing will make it easier to hear the 3 dimensions of the soundstage.

Installing IKON Phantom

Principles

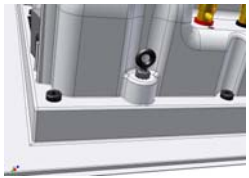
The loudspeakers are developed so they can be mounted without any disassembling of the loudspeaker/bracket/bezel for easy and fast installation.

Doglegs

The speaker is tightened to the wall by using six doglegs on the rear side of the cabinet, which are screw-mounted from the front of the loudspeaker.

Eyebolt Fixings

Two crash eyebolt fixings are positioned on the rear side of IKON Phantom, which must be used for optimum safety, if sudden incidents such as



earthquake, fire or mechanical breakdown of building parts occur. The eyebolts must be connected to solid building parts with steel wire or other fireproof fixing.

Painting

If the speakers should be painted to match the interior décor of a home the speaker/grille can be spray painted. Please notice, that the grille must be removed from the speaker before painting. A painting mask will make the process fast and easy.

Use a Subwoofer with Phantom Speakers

It cannot be emphasized enough: DALI recommend the use of a subwoofer together with the Phantom speakers. DALI IKON SUB is recommended for the IKON Phantom speakers.

High performance can be achieved with a subwoofer if some time is spent on adjustment/integration of the subwoofer.

Accessories

Cut-out Template

IKON Phantom comes with a cut-out template, which will make marking for the wall cut-out easy. Also, it can be taped to the wall to have a preview of the loudspeaker setup before the Phantoms are mounted.

Allen Bit/Hex Key

IKON Phantom comes with a 3mm Allen key and a 3mm Allen bit for easy installation.

Painting Mask

A painting mask makes the task of painting the speaker very fast and easy. Disassembling/masking the drivers can be avoided by simply positioning the painting mask over the baffle and paint the speaker with spray paint. The painting mask must first be removed when the paint has dried.

Logo Badge

A spare logo badge is supplied with all speakers for use, if the speaker/grille will be painted.

Installer Manual

A manual in English and Danish will follow each speaker to give good advice on safety precautions, installation and care of DALI IKON Phantom. The manual is also available at www.dali.dk.

Packaging

IKON Phantom is delivered in cartons of 1 piece, making odd-numbered installations possible without breaking a two-piece carton.

Technical Specifications

	IKON Phantom
Frequency range +/- 3dB (Hz)	64 – 30.000
Sensitivity (2.83V/1m)(dB)	88
Nominal impedance (Ω)	8
Maximum SPL (dB)	106
Crossover frequencies (Hz)	3.000, 14.000
Bass reflex tuning frequency (Hz)	106
Enclosure type	Closed
Recommended placement	In wall
Amplifier power (Watt)	30 – 110
Amplifier	-
High frequency driver(s)	1 x 28 mm soft dome 1 x 17 x 45 mm ribbon
Low frequency driver(s)	1 x 6½”
Connection input(s)	Single wire
Dimensions (HxWxD)(cm)	43,6 x 27,4 x 11,3
Dimensions (HxWxD)(inch)	17,2 x 10,8 x 4,4
Function(s)	-
Weight (kg/lb)	5,7/12,6
Finish	NCS S0502-Y, gloss 20

Need for more Information?

If you need further information or have questions, please consult your nearest DALI Embassy or go to our website: www.dali.dk

Also, please have a look at our other in-wall products – go to www.dali.dk