

DALI iO

WHITEPAPER



IN ADMIRATION OF MUSIC



LISTEN TO HIFI

DALI enters the headphone market for the very first time with DALI IO-4 and DALI IO-6.

With over 30 years of experience in creating high quality loudspeakers, we decided to use our passion and expertise to create two headphone models dedicated to today's music lovers.

The DALI IO-4 and DALI IO-6 are wireless, battery rechargeable hi-fi headphones. Both models are over-ear (circumaural), closed-back designs, engineered to offer extremely high quality sound reproduction. Both will be available in four colour finishes: Iron Black, Caramel White, Army Green and Chalk White.

The IO-6 differs from the IO-4 by incorporating active noise cancellation (ANC) that also includes a 'transparency' mode. However, by forgoing ANC the IO-4 is able to offer an incredible battery life of up to 60 hours per charge.

Today, we spend more and more time on the go, whether it be commuting to work or traveling for business and pleasure. All of this time we spend 'on the go' can also become time to spend doing what we enjoy, whether that being listening to our favourite music or watching a great film.

The DALI IO headphones are intended to be the perfect travel companion for those 'on the go' situations. There is always an opportunity to LISTEN TO HIFI.



BACKGROUND

The way we listen to music today has changed radically since DALI was established in 1983.

Hi-fi systems with their separate components were once at the centre of our music consumption. Mobile phones have now overtaken as the dominant element, and for most people are their primary music source. Thanks to mobile phones and streaming services we now listen to more music than ever before. 75% of all music consumption is now via mobile phones and streaming services*.

With phones now being our primary source of music, we no longer have to accept being constrained to our favourite listening room and chair to experience our favourite music

in hi-fi sound quality. Hi-fi sound quality can now travel with us wherever we go.

With our passion for music reproduction, we were convinced that we could do with headphones what we have done with speakers; provide a better sounding product that delivers music experiences superior to the established competition.

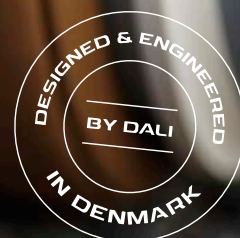
We thought: "fundamentally, headphones are essentially loudspeakers mounted on each side of the head". They are a personal set of portable hi-fi speakers that enable you to take that fabulous DALI sound with you wherever you go.

“ Headphones are essentially loudspeakers mounted on each side of the head.





“ How hard
can it be?



DESIGNED AND ENGINEERED IN DENMARK

Like many, we probably didn't appreciate the sheer complexity of headphones before we started the IO project.

We quickly realised that to create a headphone worthy of carrying the DALI logo, we would have to dedicate an R&D team to look into every aspect and detail of the design, audio performance and construction.

Our dedication has paid off; the DALI IO-4 and DALI IO-6 are true DALI products, made with an extreme attention to detail. Every single component in the IO headphones is unique. They have been created to the highest possible standard in terms of design, durability, comfort, functionality and of course, sound quality.

From the beginning we set a clear goal; DALI headphones must deliver the best possible sound quality, as well as being comfortable to wear for a long period of time.

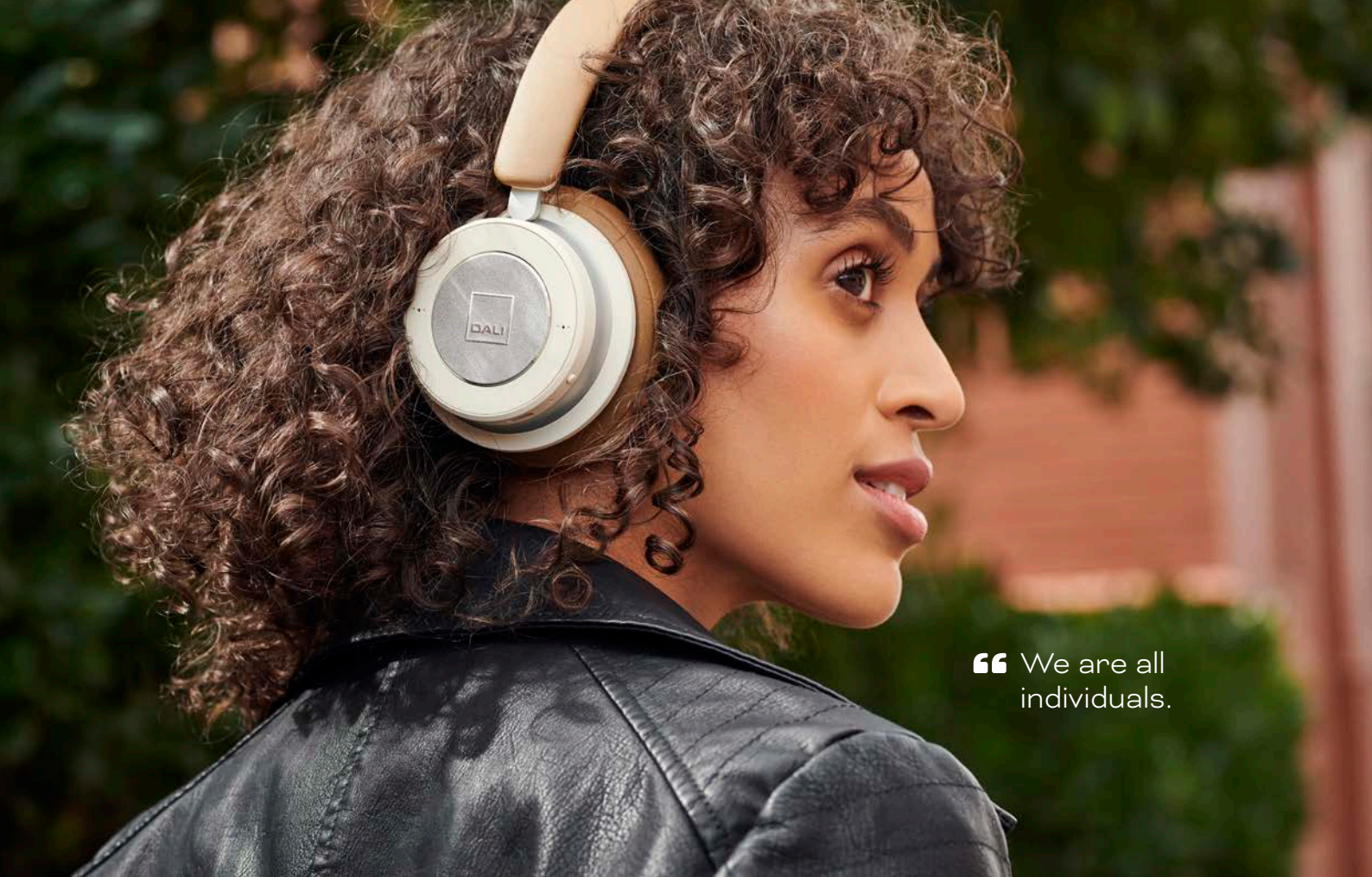
It was quickly decided that the first DALI headphones should be of the over-ear (circumaural) format, that encloses the entire ear and rests on the side of the head.

Circumaural format has the twin advantages of optimising comfort and reducing air-leak variation from user to user. This is hugely important to ensure that all users experience the same fantastic sound quality.

Circumaural format has also allowed us to choose a bigger and better driver for maximum sound quality. It was clear that our headphones had to be of the closed back type in order to offer the best possible passive noise isolation (PNI), and a fundamental requirement for active noise cancellation (ANC).

Closed back circumaural headphones are fundamentally bulkier than other types, so one of the huge design challenges was to strike the right balance between elegance, performance and size.

Through several design concepts, prototypes, and user tests groups, we believe we have designed headphones of a universal and timeless appeal, without compromising comfort or sound quality.



“ We are all individuals.

COMFORT

Every one of us is unique; we all have different sized heads and ears.

DALI IO headphones have been ergonomically optimised to ensure they comfortably fit as many people as possible. This required numerous prototypes, and analysis of different combinations of ear pads, headband curves and ear-cup angles.

The result is a design with the right amount of adjustability required to provide a natural fit to anyone.

“ Softly does it.

The ear pad is the primary contact point between the user's head and the headphones. It is an incredibly important component, not only for comfort but also for acoustic performance.

For a consistent acoustic performance, the ear pad needs to create a seal to the head. For maximum comfort, it must be soft and compliant to distribute the headband pressure evenly.

The ear pads of the DALI IO headphones are made from memory foam that naturally shapes to the head, therefore creating the best possible seal.

The pads are covered in soft synthetic leather, chosen for maximum comfort and durability.

“ Weight watching.

The DALI IO headphones have been designed with the lowest possible weight in mind. The weight of the headphones was an extremely important factor for long term comfort over long periods of use. The material choice of every individual component has been carefully selected in order to achieve minimum weight without compromising quality or durability.

DURABILITY

Headphones live an incredibly tough life and are not always handled with care.

They are put on and taken off multiple times a day, get twisted and pulled, knocked and stuffed in bags, used inside and outside, in rain and snow. The fact is, most headphone failures are due to mechanical components not being strong enough to withstand rigorous real life use. As a result, we have made sure the DALI IO headphones are extremely durable and robust.

The DALI IO headphones have been designed with real use in mind and have been tested to meet all the challenges that

real life can throw at them. For example, the headphone ear cups are able to rotate ± 90 degrees in order to fold flat for compact storage or to hang comfortably around the neck.

One of the main components that will get worn by daily use are the ear pads. Therefore, we have designed the ear pads with a bayonet fit for quick and easy user replacement. The other main wear component is the headband padding. This has been made from soft silicon rubber, chosen for its comfort and durability, and ability to be cleaned if needed.



INTUITIVE UI

DALI IO headphones have been specifically designed to be as intuitive to operate as possible. No need to read the manual, just switch them on, connect to a source and start enjoying the music.

Many headphones on the market often appear as though they have been designed without taking the realworld user into account. The buttons are often too small and positioned haphazardly, resulting in a clumsy and un-intuitive user interface (UI).

Creating an intuitive UI was therefore a clear part of the DALI IO design brief from the start.

The user should not have to search for the main buttons. The buttons should be easily found and operated, even with cold fingers on a rainy November morning or with thin gloves. However, this would seem to require big buttons which would typically not be very attractive or easy to integrate with a tightly focussed overall design.

The solution to this challenge was to have the three main control buttons elegantly integrated into the design of the right ear cup.

The logo plate is the multi-function button for controlling Play, Pause, Next, Previous, Take Call and End Call. The upper and lower part of the ear cup outer ring, which surrounds the logo plate, control Volume Up and Down respectively.

- Play/ pause/ skip track /take call: press the Logo
- Volume up: press upper part of outer ring
- Volume down: press lower part of outer ring

The remaining buttons; "Power/ BT pair" and "ANC" (IO-6 only), are placed more conventionally, but are still easy to locate.

To support the user experience, the IO headphones features voice prompts that report the state of operation, connectivity, battery level and ANC mode (IO-6 only).

On/Off, Pairing and Battery Level are also indicated visually by two multicolour LED indicators on the right ear cup.



CONNECTIVITY

DALI IO headphones are designed primarily with wireless Bluetooth use in mind.

For the best possible Bluetooth performance, they support the latest high quality audio codecs: AptX, AptX HD and Apple AAC.

For battery charging and best possible quality, DALI IO headphones use a USB-C connector. This supports digital audio and allows music to be streamed in CD quality from a Windows or Mac OS computer. Use of a USB-C connector avoids the common failures with micro-USB connectors resulting from their incorrect insertion.

In addition to Bluetooth and USB connection, IO headphones also incorporate a traditional wired analogue jack input located on the left ear cup.

The wired input enables connection to legacy sources and in-flight entertainment systems and works when the headphones are switched either on or off.

When the headphones are switched "off" they operate in a simple passive mode; none of their control functions will be operational.

Use in passive mode means that an exhausted battery need not mean an end to headphone listening.

DALI SOUND

With DALI IO headphones, users benefit from over 30 years of experience designing some of the finest hi-fi loudspeakers in the world. DALI IO headphones are designed and engineered by the same team and informed by the same basic principles as any other DALI loudspeaker. The aim is to create the most natural and authentic sound possible and to reproduce music exactly as intended by the artist. All done, "In admiration of music".

Headphone acoustics

Headphone acoustics are somewhat different from traditional loudspeakers, yet the design challenges are strangely familiar. The basic principles that must be followed to achieve high performance audio quality are the still true.

With headphones, there are no listening room reflections to mask the sound as we are used to with loudspeakers. This means that the user is likely to hear significantly more detail in music recordings than usually possible with traditional speakers.

Additionally with headphones, there are no issues with getting a single driver to play loud enough across the entire frequency band, and therefore no directivity issues requiring multiple drivers and crossover networks.

The main acoustic influencers on headphone acoustic performance are:

- Driver quality
- Leak control
- Cavity design/ material

High performance driver

As with any other loudspeaker, the heart of the headphone is the driver and in order to achieve a natural and undistorted sound, a high performance unit is essential.

Being a loudspeaker company we fully understand the importance of a high performance driver. It was therefore a big surprise for us to discover that within the headphone industry drivers are often considered as cheap commodity components, with no real engineering attention paid to them.

They all appear to be "copies of copies" originating back to the 50's telecom industry and are even often still referred to as the "receiver".

DALI IO headphones utilise a high quality custom designed driver with a large 50mm diaphragm and an optimised neodymium magnet system to achieve low distortion, minimal colouration and accurate dynamics throughout the entire frequency range.





The large diameter driver ensures linear operation with minimum compression. This, together with the well controlled breakups of the fibre paper cone diaphragm, means that even the most minute music details, stands out crystal clear.

It also means that the sound never gets tiring, even after hours of listening.

Leak control

The bass performance of a headphone is incredibly sensitive to leaks between the headphone and the head. Variations in leakage can result in low frequency variations of up to 20dB.

On the DALI IO headphones we have designed the ear pads specifically to achieve minimum leak variation, ensuring that every user will experience the sound as we intended.

Cavity design

Being a closed back headphone, the driver is mounted in an enclosure like a miniature loudspeaker cabinet.

With loudspeakers, the main purpose of the cabinet is to isolate the front and rear surfaces of the diaphragm from one another, in order to create low frequency output. The speaker cabinet simply prevents the air pressure on the front of the diaphragm from being cancelled by the reverse phase air pressure rear of the diaphragm.

With headphones on the other hand, the front and rear side of the diaphragms are isolated by the ear pad, so there is no need for the driver to sit in a sealed enclosure to create bass.

However, if there is no enclosure behind the headphone driver, the only barrier between the ear and the ambient noise will be the thin diaphragm of the driver, and that offers very minimal acoustic isolation. The driver plays as loud on the rear surface as on the front, so with no enclosure the music heard by the headphone user will be equally as audible to everyone.

Although the main purpose of the enclosure is different for headphones compared to loudspeakers, the principles and requirements for good enclosure design are the same.

As with loudspeaker cabinets, the headphone enclosure needs to be as rigid and well damped as possible, because even low levels of enclosure vibration will colour the headphone sound. On the DALI IO headphones, the enclosure design has been optimised and strengthened for minimum resonances. The enclosure material has been specially selected to minimise the enclosure vibration.

Additionally, to improve the passive noise isolation performance, a special vibration damper is incorporated between the driver and rear wall of the enclosure.



ELECTRONICS

The electronics used in the DALI headphones have been chosen for best possible sound quality and support the latest high resolution audio formats, including AptX HD which allows you to hear the music in the best possible quality.

Until very recently, headphones were passive devices. The playback source had very limited output power and no active EQ possibilities. Headphone acoustics were tuned via leak - and enclosure design.

Wireless headphones, by definition, are an active/powered loudspeaker that offers significant opportunities to fine-tune and optimise sound quality. To an extent, that simply isn't possible with a passive headphone.

Active drive helps us achieve exactly the right DALI sound.

Battery

Long battery life means a lot to users, as it grants freedom from worrying about running out of power. The DALI IO-4 and IO-6 uses a very large capacity (1100mAh), high quality, li-ion battery. This provides the IO-6 a best in class matching 30 hour battery life, and the IO-4 an incredible new class leading 60 hour battery life; enough to go for days without charging.

Hands-free call support

DALI IO headphones have built in microphones for hands free calls and voice support.

The CVC (Clear Voice Capture) functionality filters out background noise and ensures that the users voice is heard loud and clear by the receiver.

Active Noise Cancellation (IO-6 only)

We are constantly surrounded by noise in our daily life.

The DALI IO headphones are both closed back units, designed to provide a high level of natural passive noise isolation (PNI). However, low frequency noise cannot be removed passively.

The DALI IO-6 employs the latest ANC technology to remove background noise and help the user relax and enjoy their favourite music, whether it be at home, in the office, or on an airplane or train.

Along with reducing the annoyance of external noise, noise cancelling improves the audibility of music detail, meaning the user can listen at lower volume – reducing the potential of long term hearing damage.

The DALI IO-6 offers three different ANC modes that enable users to choose how much of the surrounding noise is attenuated.

- ANC ON: Actively cancels low frequency noise.
- TRANSPARENCY: Bypasses the Passive Noise Isolation by feeding external ambient audio into the headphone audio. The headphones effectively become one-way (out to in) acoustically transparent.
- ANC OFF: All noise cancellation functions are switched off. IO-6 battery life is significantly improved when ANC is switched off.

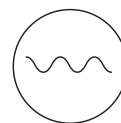
ACCESSORIES

Both DALI IO-4 and DALI IO-6 are supplied with a USB-C cable for charging and computer audio use, as well as a 3.5mm jack cable for connection to traditional audio sources and in-flight entertainment systems.

The IO-6 is supplied with a high quality travel case to protect the headphones when not in use.



GO WITH MUSIC



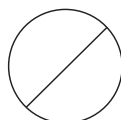
AUTHENTIC DALI SOUND

Our custom-made 50mm drivers deliver an exceptionally lifelike performance. Listen in high definition over Bluetooth or USB and experience your favourite music as you've never heard it before.



ULTIMATE AUDIO COMFORT

Luxuriate in music without limits. DALI IO is built for extended listening with a comfortable, durable design and a natural, transparent sound that never tires.



IMMERSIVE NOISE-CANCELLING*

Silence the distractions and enjoy every detail of your favourite music. Our cutting-edge digital noise cancellation technology delivers a truly immersive listening experience.

*DALI IO-6 only.



LONG BATTERY LIFE

Go for days without recharging. Our advanced lithium-ion battery delivers peerless playback on a single charge. Up to 60 hours for the IO-4 and 30 hours for the IO-6 – even with noise cancelling active.

CONNECTIVITY

As well as wireless Bluetooth connection, the DALI IO also supports wired connections through the USB-C and the 3.5mm mini jack input.

HANDS FREE CALLS AND VOICE ASSIST

The built-in microphones in the DALI IO allow you to use the headphones for hands-free telephone calls and voice control.

TECHNICAL SPECIFICATIONS

	IO-4	IO-6
Headphone principle	Closed back circumaural (over ear)	Closed back circumaural (over ear)
Full Range Driver	50mm free edge paperfibre cone	50mm free edge paperfibre cone
Connection input(s)	Bluetooth (wireless) 3.5mm Mini Jack stereo USB-C	Bluetooth (wireless) 3.5mm Mini Jack stereo USB-C
Wireless inputs	Bluetooth 4.0 AAC aptX aptX HD	Bluetooth 4.0 AAC aptX aptX HD
Functions	Power ON/OFF Bluetooth Pair/ Release Volume up/down Play/pause/skip track Take call	Power ON/OFF Bluetooth Pair/ Release Volume up/down Play/pause/skip track Take call ANC mode (ON/Transparency/Off)
Noise reduction	N/A	Active noise cancellation
Hands-free calls and voice assist	Clear Voice Communication (CVC)	Clear Voice Communication (CVC)
Battery life	Up to 60Hrs	Up to 30Hrs
Accessories included	USB-C cable 3.5mm stereo cable String Bag	USB-C cable 3.5mm stereo cable Flight adaptor Travel case
Finish	Iron Black Caramel White	Iron Black Caramel White
Replaceable earpads	Yes	Yes
Weight	320g	325g
Compact storage	One-way foldable	One-way foldable
Frequency Range (+/-3dB) [Hz]	10Hz-20kHz	10Hz-20kHz
Max SPL [dBA] BT/ USB full scale	100dBA	100dBA
Analogue Input sensitivity for 94dB spl @ 500Hz (Passive mode/ Active mode)	200 mV rms /175 mV rms	200 mV rms /175 mV rms
Impedance (Passive mode)	25 Ohm	25 Ohm

All technical specifications are subject to change without notice.