MAESTRO® CI System

Hear & Communicate in Any Situation
The MAESTRO CI System

The World’s First Single-Unit Processor
The World’s Smallest and Lightest BTE Audio Processor
The World’s Smallest Titanium Cochlear Implant
The World’s Softest and Most Flexible Electrode Arrays

Performance with Proven Results

Independent clinical studies
The leader in hearing implant technology

With You for a Lifetime

Understanding the basics & daily life with a CI
Every step of the way, resources that make a difference
Innovative solutions, today and in the future
Welcome

A cochlear implant is the first replacement of a sense, the sense of hearing. If you or someone you care about is affected by profound hearing loss, the MAESTRO CI System may help you to once again hear and comprehend sounds.

Grandparents can once again hear the tiny voices of their grandchildren. Children born with a severe to profound hearing loss can learn to speak and develop language much like their hearing peers.

No matter your interest in cochlear implants, we invite you to explore the MAESTRO CI System and to learn more about why its unique technologies offer the most clear and detailed hearing experience available.

For Parents
If you are the parent of a small child affected by severe to profound hearing loss, we understand that your first priority is the health and safety of your child.

Choosing MED-EL means choosing a design philosophy built around the importance of protecting your child’s hearing potential both today and in the future. We invite you to learn more about the unique product attributes only available from MAESTRO which can help to ensure the hearing future of your child.

Ensuring a Hearing Future®
The MAESTRO Cochlear Implant System is uniquely suited to allow you to not only hear, but comprehend sound. Featuring technologies only available from MED-EL, MAESTRO helps you to hear your best in changing and challenging listening situations. Hear what you’ve been missing.

The Right Audio Processor for You!

**NEW**

**RONDO**
Single-Unit Processor
*The World’s First CI Single-Unit Processor*
- Advanced sound processing for superior hearing
- Compact and fully integrated
- Convenient and off the ear, disappears easily under the hair
- Just put it on and go!

*Learn more on page 5*

**OPUS 2**
BTE Audio Processor
*The World’s Smallest and Lightest BTE Processor*
- Advanced sound processing for superior hearing
- Multiple wearing options, colours and optional assistive listening devices
- Improved toughness against dirt, dust and sweat

*Learn more on page 9*

**CONCERTO Implant**
The World’s Smallest Titanium Cochlear Implant
- 25% thinner than the previous generation
- Reduced weight, now 7.6g
- Impact resistant titanium
- The most flexible electrodes available for the preservation of delicate inner ear structures

*Learn more on page 19*
The All New, All-in-One RONDO®

RONDO integrates traditional audio processor components into one single unit. Worn just off the ear, it is especially comfortable for individuals who regularly wear glasses of any kind. RONDO is powered by the proven OPUS platform featuring FineHearing and Automatic Sound Management.

**Single-Unit Design**
Coil, control unit and battery pack are fully integrated.

**Cable Free**
Fewer parts and no cable connecting them for enhanced durability.

**Status Light**
Flashes a series of patterns.

**Private Alert**
Discreetly informs if your battery is low.

**SoundGuard**
Protects against program loss should a problem arise.

**Tamper Resistant**
Release lever and lockable parts.

**Implant Identification**
Your personal audio processor only works with your implant.

**All-in-One, Single-Unit Design!**
Control unit, battery pack, and coil are combined into one single unit, offering the wearer convenience and superior hearing that is all in one.

**Dimensions and Weight**
18.5g (as delivered with standard magnet and batteries)*

* Weight may vary slightly based on the selected magnet strength and brand of battery.

**New**

![RONDO Actual Size](image)
RONDO® Single-Unit Processor

Fully Integrated, Convenient, and Off the Ear

For the first time, RONDO delivers the freedom of a CI audio processor with room behind the ear. RONDO features a revolutionary single-unit design, comfortable wear and and the proven performance of the OPUS platform.

Just Put it On and Go!
Getting up in the morning and tuning in to a world of sound has never been easier. Attaching the one piece RONDO is simple and straightforward. With nothing resting on the ear, you may quickly forget you are even wearing it!

Blends in with Your Hair
Four colours designed especially to blend in with your natural hair colour make wearing RONDO virtually invisible.

Easy to Conceal
RONDO can be hidden easily under longer hair. The integrated design, with no ear hook or separate coil, makes wearing RONDO less obvious.

Free Your Ear!
RONDO makes space for glasses, sunglasses or your favourite accessory.

Using the Phone with RONDO is Easy!
Phone friends and family using the integrated microphone or access the telecoil function to connect to telecoil-ready phones or other assistive listening devices (ALDs).

Additional Security for Your Favourite Activities
RONDO comes available with an activity clip for additional fixation, as well as a protective cover. Both can be worn optionally during vigorous activities.
Direct Connection with Mini Battery Pack

Additional connectivity options are available via the Mini Battery Pack, allowing you to connect directly to a variety of assistive listening devices (ALDs).
The World's Smallest & Lightest Behind-the-Ear Processor

OPUS 2 Audio Processor

The OPUS 2 is the ideal choice for children and adults. It is the world's smallest and lightest behind-the-ear (BTE) audio processor, making it especially suitable for little ears and all ears. Packed with features designed for best performance, it offers users a rich, detailed hearing experience in all listening situations.

Safety Locks
Tamper-resistant battery packs and lockable parts.

Status Light
Flashes a series of patterns to help you troubleshoot.

Private Alert
Discreetly informs you if your battery is low.

SoundGuard
Protects against program loss should a problem arise.

Implant Identification
Your personal audio processor only works with your implant.

Energy Efficient D Coil
Provides up to 50% longer battery life.

The OPUS 2XS: The Smallest, Most Discreet BTE Audio Processor

25% lighter and 10mm shorter than the standard battery pack, the XS battery pack makes the OPUS 2XS the smallest, most compact behind-the-ear audio processor available.

<table>
<thead>
<tr>
<th>OPUS 2XS</th>
<th>Competitor 1</th>
<th>Competitor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4 g</td>
<td>15.5 g</td>
<td>10.9 g</td>
</tr>
<tr>
<td>2 zinc-air batteries</td>
<td>Rechargeable battery</td>
<td>Rechargeable battery</td>
</tr>
<tr>
<td>8.7 mm width</td>
<td>13.0 mm width</td>
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</table>

OPUS 2XS Actual Size
MAESTRO is designed for your lifestyle. Stand out or be discreet with the OPUS 2 featuring an XS battery pack. Available in a variety of wearing options designed for children’s unique needs or for the active lifestyles of adults, the OPUS 2 audio processor is made to be worn every day.

Big Ears, Small Ears, All Ears
Wireless Access with Telecoil
The OPUS 2 has an integrated state-of-the-art telecoil, a miniature receiver that can be used with a wide variety of telephones, public sound systems and induction loop systems. MAESTRO users can also benefit from third-party accessories (neckloops, etc.) to further enhance their listening experience.

Direct Connection with Audio Cable
The standard input jack can be used to directly connect external devices to your OPUS 2 using a cable. Both unilateral and bilateral audio cables are available.

Wireless Access with FM Battery Pack
The standard input jack on the FM Battery Cover provides you with the widest variety of connectivity options with different wireless receivers that are commonly used in FM systems.
OPUS 2 BTE Audio Processor

Options Especially for Children

A modular design allows users to wear the OPUS 2 in a variety of ways, depending on the activity or personal preference. In seconds, battery packs can be easily exchanged, or the processor can be affixed to a child’s garment. Special wearing options are also available for active lifestyles and enable greater mobility.

Children’s Battery Pack
The Children’s Battery Pack combines the advantages of wearing the processor at ear level with the security of attaching the battery pack to the clothing. For small children, this configuration is ideal because only the tiny, ultralight (4g) control unit is worn on the ear. The battery pack is placed comfortably on the collar or clothing.

The attached battery pack provides additional security, especially during playtime. A safe attachment ensures that the processor will not fall to the ground or become lost.

The BabyBTE
The BabyBTE is the most popular wearing option for infants and young children. The entire processor, including batteries, is worn on the baby’s clothing, with no equipment on the ear. Tamper proof and featuring a status light, the BabyBTE allows parents to easily check that the processor is functioning correctly.

NEW! OPUS 2 Battery Pack XS
Especially suited for the youngest users, the XS features improved balance for best fit. Small enough to blend in and available in colour options to match your hair or skin type, the OPUS 2XS is a discreet choice. For those who prefer to stand out, the XS is available in brighter tones as well.

NEW! Mini Battery Pack
The Mini Battery Pack is a new body worn alternative to the standard behind-the-ear (BTE) power-supply wearing option. It has all of the advantages of the Standard Battery Pack wearing option but it is lighter and smaller. The Mini Battery Pack is especially suitable for young children. It is powered by one AAA battery or the DaCapo system.
OPUS 2 BTE Audio Processor

Anti-Dirt, Anti-Dust, Anti-Sweat

Hear your best enjoying the activities that you love. Jog, hike, bike or dance with confidence thanks to improved protection against moisture, dirt and dust.

Engineered to be Robust

Improved insulation and moisture protection make the XS the toughest OPUS 2 available. To minimise the effects of moisture on electronic components, the circuit boards used in MED-EL audio processors are coated to effectively shield the electronics.

Optimised device housing is designed to act as a barrier to fluids and water vapour but is not hermetically sealed—this effectively prevents corrosion by allowing any internal moisture to dry out rather than remain trapped inside. This effective strategy protects audio processors from moisture-related damage and ensures the user’s ability to reliably access quality hearing anywhere.

Great for Sports

For sports, fitness and other high-energy activities, ensuring that the processor is both secure and dry is an important consideration for optimal hearing. With ActiveWear, adult users can benefit from a wearing configuration in which the batteries and processor are worn on the clothing, away from the ear.

For sports requiring the use of a helmet, the ActiveWear option is especially convenient. Because the microphone is not covered, hearing is in no way affected.
OPUS 2 BTE Audio Processor

Simple & Easy to Use

MAESTRO’s features are designed to make your daily life with a CI more comfortable and enjoyable. With colours to fit your lifestyle, a remote control for easy adjustments, and energy efficiency that keeps the processor on your ear where it belongs, the MAESTRO CI System is designed for you.

FineTuner Remote Control
The small, slim FineTuner fits easily into your pocket if you wish to carry it with you at all times. Changes made via the remote control allow the user to keep the audio processor on the ear for uninterrupted hearing.

- Large buttons for simple use
- Clearly labeled buttons make it easy to change settings
- Controls both audio processors independently for bilateral use
- Designed for individuals of all ages
Express Yourself

13 Great Colours to Choose from
The OPUS 2 is available in a variety of colours. The audio processor can be worn discreetly to match a variety of hair colours, but is also available in brighter shades that make a statement.

Available colours include:
- Anthracite
- Sienna Brown
- Pacific Blue
- Bordeaux Red
- Nordic Grey
- Ebony
- Crème
- Beige
- White
- Green
- Orange
- Baby Blue
- Baby Pink

Energy Efficiency

Standard Battery Pack
Up to 90 Hours of Continuous Energy
Use the Standard Battery Pack and benefit from longer battery life and direct connectivity.

DaCapo Rechargeable Battery System
The DaCapo runs for up to 16 hours when used in combination with the new energy-efficient D Coil. Batteries can be recharged quickly to provide a full day of use.

OPUS 2 with XS Battery Pack
Up to 60 Hours of Energy
The smaller, more discreet OPUS 2XS gives you long battery life in a smaller, more compact size.

The New D Coil
Lower-Profile and Thinner
The D Coil makes the OPUS 2 up to 50% more energy efficient. Users save money and enjoy the same great listening experience longer.

50% Longer Battery Life!

NEW
The World's Smallest Titanium CI

CONCERTO Implant

Tough, impact resistant and robust enough to respond to the needs of daily use, CONCERTO is reliable and powerful, relaying information to the electrode contacts in the cochlea at high speed and with great accuracy. Engineered according to the strictest safety standards and built for longevity, CONCERTO is the world's smallest and lightest titanium cochlear implant.

25% Thinner
Optimised for surgeries performed on children and older adults.

Only 7.6g
The lightest titanium CI.

Compact Design
A smaller implant means that your surgeon can perform the surgery in less time and in a smaller area.

Titanium Housing
Proven design that is impact resistant and robust.

Reinforced Lead
Ensures a solid connection between the implant housing and the soft, flexible intra-cochlear electrode array.

The Reliable Messenger
Acting as a conduit between the externally worn audio processor and the nerve fibres in the cochlea.

I100 Electronics Microchip
Featuring sophisticated I100 electronics capable of parallel processing at a very high rate of stimulation.

The Smallest Titanium CI
Tough and robust, but also compact. Below is a comparison between CONCERTO and other CIs.
No two cochleas are alike. For this reason, MED-EL has created a variety of electrode arrays designed for gentle insertion. MED-EL’s unique design philosophy ensures that the surgeon has the right electrode design, in the right length, to preserve both residual hearing and cochlear integrity.
MED-EL is the leader in providing soft, flexible electrode arrays which ensure maximum protection of the delicate structures in the cochlea. Preserving residual hearing enables users to benefit from future technologies and therapies.

Electrode Arrays Designed for Gentle Insertion

**FLEX-Tip Technology**
Unique FLEX-Tip Technology features single contacts at the leading end, ultra-flexible wave-shaped wires, and a tapered tip for increased mechanical flexibility.

**Wave-Shaped Wires**
Ultra-flexible wave-shaped platinum-iridium wires significantly reduce rigidity in comparison to a straight-wire design.

**Free-Fitting Oval-Shaped Array**
Free-fitting FLEX electrode arrays feature a unique oval-shaped design which allows the electrode array to self-orient during insertion.

**Optimal Number of Contacts**
A balanced number and spacing of contacts ensures increased mechanical flexibility as well as reduced channel interaction.

**Largest Electrode Variety**
MED-EL offers the largest selection of electrode arrays. Each implant recipient can be sure to receive the best possible electrode array for their unique cochlear anatomy.

**Complete Cochlear Coverage (CCC)**
Complete Cochlear Coverage means stimulating the cochlea from the base to the apical region in order to stimulate a maximum number of nerve fibres. Users benefit from superior outcomes in speech perception and sound quality. CCC is made possible by MED-EL’s especially long, soft, and flexible electrode arrays.

*Learn more on CCC on page 40*
Hearing Preservation
Now and for the Future

Your future is equally as important as your present wellbeing. This philosophy has driven MED-EL to design the softest and most flexible electrode arrays available to help preserve the delicate structures of the cochlea during implantation.

Helping to ensure that neural tissues are left undamaged is seen as critical for all cochlear implant patients, but especially for young children who may face multiple implantations in their lifetime. It is likely that any future interventions, be they device, biological, or pharmaceutical in nature, will be more successful in a cochlea that has received minimal trauma during implantation.

MED-EL engineers understand the importance of protecting cochlear structures and residual hearing, to ensure you retain your natural capacity for sound perception today and for the world of tomorrow.

Best Hearing Performance Now
Best performance with a cochlear implant means preserving the delicate neural structures of the cochlea during implantation.

Best Hearing Performance for a Lifetime
Decades down the line, as technologies continue to advance, stay open to future therapies by insisting that your doctor use only the most atraumatic electrode arrays for gentle insertion.

Ensuring a Hearing Future®
Honest, Transparent, Up-to-Date

Product Reliability Reporting

MAESTRO offers total system reliability including both the external and the internal components. Honest, transparent, and up-to-date reliability reporting shows that MAESTRO is the most reliable CI system available.

MED-EL reliability reporting standards far exceed reporting methods used by competitors. Our reliability data are prepared in accordance with ISO 5841-2:2000 which governs the reliability reporting of pacemakers.2

MED-EL is the only company to report on all implant and processor related failures. Getting the most reliable implant also means getting the most reliable audio processor. The OPUS 2 has the lowest service rate of any audio processor and therefore offers users the best value.

<table>
<thead>
<tr>
<th>Competitor 1</th>
<th>Competitor 2</th>
<th>MED-EL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent Reporting on all Implant Failures</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Including but not limited to device and accident-related failures, as well as medical and surgical root causes for malfunction of the implant.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reporting on Reliability of Processors</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Up-to-Date Reliability Data</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Compare MED-EL’s product reliability with that of our competitors. While doing so, please keep in mind that effective comparisons should include:
- Comparable number of products in use
- Same time frame
- Actual, current data
- Similar product generations
- Openness and completeness of data presented using the same failure categories, including total number of explanted devices.

24
Best-In-Class Implant Reliability

CONCERTO, MED-EL’s newest titanium implant, features a 99.46% reliability rating after 24 months. Thinner and lighter than its predecessor, CONCERTO is based on a proven, robust design with an outstanding track record of reliability.

Reliability you can Count on

The OPUS 2 delivers reliability for everyday use. Continuous device testing according to the highest quality standards ensures that your OPUS 2 is durable and resistant to the effects of time and daily use. With an average monthly service rate of 0.74%, the OPUS 2 stays on your ear providing you with quality hearing day after day.

MED-EL audio processors have always been reliable. Each generation is more reliable thanks to constant design improvements.
Peac of Mind

Future Ready Technology

Rest assured that the MAESTRO CI System you receive today will also be compatible with the components of tomorrow as technology improves.

The Audio Processor of Tomorrow

With superior forward compatibility, the cochlear implant of today is designed for the audio processor of tomorrow. This means that down the line you can receive a new audio processor that works with your current implant as technology improves. MED-EL’s forward thinking engineering ensures that individuals with a MED-EL cochlear implant can always take advantage of the latest technology.

Safety & Security

IRIS
Individual Recognition of Implant System (IRIS) provides bilateral users with extra peace of mind. If an audio processor is placed on the wrong ear, stimulation does not occur. This is also a great advantage for preventing mix-ups in schools where more than one child uses a cochlear implant.

SoundGuard
The OPUS 2 audio processor monitors data continuously to protect against everyday problems like electrostatic discharge (ESD). If a problem is detected, SoundGuard immediately stops stimulation and a status light flashes.

Safety Locks
MED-EL audio processors can be locked to ensure that small children are unable to disassemble the processor or tamper with the batteries. The FineTuner can also be locked or programmed so that settings can’t be changed inadvertently.

Forward >> Backward
MAESTRO System Software currently supports multiple audio processor generations. This software is used to enable your audio processor with the latest, most advanced coding strategies for superior hearing. With over 18 years of CI legacy support, users can continue to benefit from software-based advancements available after a simple fitting from an audiologist.
Performance with Proven Results

MAESTRO is designed for real life. Hear your best in difficult listening situations or transition from a quiet environment to a noisy environment. Enjoy the fine details of sound for better music appreciation and a differentiated listening experience. MED-EL’s signature technologies offer you the best possible hearing experience wherever your day takes you.

Proven Performance

Independent Clinical Studies Show MAESTRO Outperforms

- Multiple studies, only one clear winner
- 30% better performance in noise than any other tested system
- 20% higher speech perception scores

Learn more on page 30

Advanced Technology

The Leader in Hearing Implant Technology

- Hear your best in any situation with Automatic Sound Management
- Fine details of sound with FineHearing
- The shade, tone and colour of sound for a better music experience
- Enhanced sound coding explained
- The bilateral advantage

Learn more on page 32
Proven Performance

Multiple Studies
Only One Clear Winner

The successful combination of FineHearing technology, Automatic Sound Management and Complete Cochlear Coverage has been proven by independent clinical studies to improve performance in CI users. With all major cochlear implant brands tested, the MAESTRO CI System outperformed all other implant systems.

In a study simulating real-life situations, participants were surrounded by different levels of noise. Only MED-EL users continued to improve and were still able to understand 50% of speech, as the listening situation became progressively more challenging.

In a unique study comparing device performance among current generation audio processors as well as older generation audio processors, the MED-EL MAESTRO CI System performed better than any other tested system. Additionally, results indicate that users upgrading to an OPUS audio processor experience the most benefit from upgrading to a current generation processor.

Up to 30%
Better Performance in Noise than Other Tested Systems

MED-EL OPUS 2

Competitor 1

Competitor 2

20% Higher Speech Perception Scores for Users of the MAESTRO® CI System
Signature Technologies

ASM

In Any Situation
Automatic Sound Management (ASM) allows users to hear their best no matter the situation or level of background noise. ASM features a Dual-Loop AGC for switch-free transitions from room to room as well as Automatic Volume Control for comfortable conversations in background noise.

Learn more on page 32

FineHearing

The Fine Details of Sound
FineHearing technology delivers the subtle details of sound that are essential for the appreciation of music and for the timing cues which contribute to better spatial hearing. It is the most accurate and powerful coding strategy available, delivering more complete sound information and a satisfying hearing experience.

Learn more on page 34

Complete Cochlear Coverage

Maximise the Potential of the Cochlea
Complete Cochlear Coverage (CCC) provides a richer, more natural sound quality. MED-EL’s uniquely long and soft electrode arrays are capable of stimulating a maximum number of nerve fibres in the cochlea.

Learn more on page 40

Mona | OPUS 2 | Germany
Mona is passionate about playing the violin. Unique technologies, only available with MAESTRO, help her to hear the subtle differences in the tones which are essential for not only hearing, but performing music.
Automatic Sound Management (ASM) is one of the signature features of the MAESTRO CI System. It allows users to hear their best no matter the situation or level of background noise.

**Best in Noisy Environments**
Go from a quiet setting to a noisy environment without the need to switch programs. ASM makes all adjustments automatically. This makes it easy to exit out of a library into a busy street without the need for adjustment, all while still enjoying optimal hearing.

**Best for Music at any Volume**
When listening to music, ASM processes sounds ranging from very soft to very loud, allowing the user to enjoy the singing of a bird, as well as loud portions of symphonic or modern music, without distortion.

Learn more about how MAESTRO can enhance your music listening experience on page 36.

**Dual-Loop AGC**
Transition from one listening environment to the other without the need for setting changes.

**Automatic Volume Control**
Comfortably listen to conversations in the presence of background noise.
For cochlear implant sound processing to be truly effective, it is essential to compress the large (120 dB) acoustical dynamic range of normal hearing into an acceptable range for electrical stimulation (45 dB). Automatic Sound Management accomplishes this goal. This unique front-end processing strategy consists of two critical components: The Automatic Gain Control (AGC) providing a wide input Dynamic Range (IDR) and Automatic Volume Control.

### Dual-Loop AGC

The dual-loop Automatic Gain Control manages the transitions between listening environments with no manual input from the user. This is managed within a 75 dB input range called the Input Dynamic Range. Therefore all signals within the range of 25 dB and 100 dB SPL are processed. Sounds are captured by the “Automatically Adaptive Sound Window” which detects a range of 55 dB where most incoming sounds occur. This allows for fine and detailed processing (i.e. compression) of an initially wide range. This sound window is adaptive and moves within the 75 dB range. The result for the listener is that soft sounds are appropriately soft and loud sounds are proportionately loud. Specific program or setting changes are no longer necessary to accommodate the differences between noisy environments, music, quiet environments or speech as the primary signal.

In practical terms, dual stage Automatic Gain Control allows users to hear a very loud sound, such as an airplane or even a very quiet sound, such as a whisper, at a comfortable volume level. Dual stage also ensures that a sudden increase in loudness does not result in an uncomfortable change in volume for the user. Similarly, dual stage also prevents overly muffled sounds following an initial loud signal. Sounds are always presented to maximise speech comprehension and to preserve the subtle difference in loudness from one sound to the next.

### Automatic Volume Control

Automatic Volume Control deals with the wide range of input levels occurring in every day life, including soft speech and loud speech. Automatic volume control assures that speech perception in background noise is largely immune to variations in speech level, meaning that users of the OPUS processor can understand soft and loud speech equally well as normal speech.

With Automatic Sound Management featuring a wide IDR and Automatic Volume Control, users can experience optimal hearing whether in an airport, a concert hall, a business meeting, a restaurant, or simply at home.

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**Adaptive Sound Window**

Automatically moves within the IDR

**Input Dynamic Range (IDR)**

**Normal Hearing Dynamic Range**

**Decibels (dB)**

- Quiet
- Normal Hearing Dynamic Range
- Adaptive Sound Window (55 dB)
- Input Dynamic Range, IDR (75 dB)
- Loud

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100
- 110
- 120
Take Advantage of All Sound

FineHearing

FineHearing technology combines 250 spectral bands and fine structure sound information to deliver the subtlety and detail of sound that is essential for comprehending speech and appreciating music. It is the most powerful and accurate sound coding strategy available.

250 Unique Pitches

FineHearing is like a set of paints with 250 colours, when an average set has half as many. Access to more unique pitches means the spaces between different frequencies of sound can be filled in more thoroughly. This helps the listener to distinguish the nuances of shade and tone, and realise a more colourful listening experience.

Fine Structure

Like a fine-tipped brush, access to the fine structure of sound unlocks the potential for detail within these unique pitches. It reveals information about pitch and tone quality that transform sounds into vivid and precise works of art. FineHearing is the only technology that provides the fine structure sound information, essential for appreciating music or speech comprehension in difficult listening situations.

The Elements of Sound

Envelope
The envelope is the loudness contour of the sound signal and is essential for speech understanding.

Fine Structure
The fine structure contains the subtle details of a sound signal and enhances pitch and sound quality.
Best for Bilateral Users

Synchronised Stimulation
Bilateral users can benefit from improved directional or spatial hearing. Increased temporal accuracy allows nuanced representation of the tiny temporal offsets occurring in binaural hearing when a sound is heard by the first ear and then by the second. These timing offsets are essential for directional hearing.

Focus in Background Noise
Subtle timing differences between each ear allow bilateral users to better concentrate on the speaker in front of them, especially in the presence of background noise.

Learn more about bilateral implantation on page 39

<table>
<thead>
<tr>
<th>Listening Task or Situation</th>
<th>Sound Component</th>
<th>Traditional Speech Coding</th>
<th>FineHearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech in Quiet</td>
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<td>Yes</td>
</tr>
<tr>
<td>Music &amp; Tonal Languages</td>
<td>Fine Structure</td>
<td>No</td>
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<tr>
<td>Speech in Noise</td>
<td>Envelope &amp; Fine Structure</td>
<td>No</td>
<td>Yes</td>
</tr>
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</table>
Listen & Enjoy Music

Access to Tone & Colour of Sound

By providing the shades of tone and colour of sound, FineHearing Technology makes listening to music with the MAESTRO CI System easier and more enjoyable.

The soundtrack of your life is playing all around you. No matter what kind of music you enjoy most, hear it better with FineHearing technology. More fine structure sound information allows cochlear implant users the opportunity to listen to and enjoy music like they remember it.

For children growing up listening to music with a cochlear implant, more detailed sound information means a more detailed listening experience as they learn and develop with music as part of their growing lives.

Results for FineHearing
The advantage of using FineHearing technology to improve music appreciation was investigated in a study conducted in 2006/07. The study examined users’ appreciation of music with FineHearing as compared to previous technologies.

This study is of particular importance, as 84% of users reported that with FineHearing they listened to music at least once a week, if not every day.

Always Ready for Music
There is no need to change a setting or push a button to switch between listening to speech versus music.
Music and Listening Perception are Closer to Natural Hearing than Ever Before

91% of users reported that music was a pleasant experience
84% of users reported that they listened to music at least once a week, if not everyday
67% of users reported that music sounded more natural
62% reported improved ability to recognise individual instruments in a known piece of music

Hanna | OPUS 2 | UK
“I like playing music because I like playing with other people and I like meeting new friends. I do get nervous when I am up on stage, so I just like playing with other people.”

Hanna was given an award for her musical achievements in 2010.
The Science Behind Sound Coding

In order to convert sounds from the environment into electrical signals that the brain can understand as sound, the processor of the cochlear implant is responsible for coding sound into a special pattern of electrical signals. This process is called sound coding. Electrical signals are passed on to the brain via the cochlear implant.

Sound coding from MED-EL is aided by a suite of technologies called FineHearing. FineHearing provides fine structure processing as well as place coding, which respects the concept of tonotopicity and presents sound across 250 spectral bands.

Correct Frequency at the Right Place and Time

To better understand sound coding, it is important to also appreciate how the ear receives and understands sounds. In natural hearing, a sound creates activity at a certain location within the cochlea. This location is characteristic for the frequency of the sound. The principal relationship between frequency and location within the cochlea is called tonotopicity or place coding.

Sound information, as it is received, creates neural activity. Fascinatingly, neural activity created by incoming sound information has the same frequency as the incoming signal. This principle is called temporal coding and is significant because the envelope and the fine structure of a sound are represented within the “cochlear activity” in both place and time. Optimally providing stimulation, in the correct frequency in the correct place, provides the user with a superior hearing experience.

Delivering the Envelope and the Fine Structure

In the past, the “envelope approach” has enabled most users of cochlear implant systems to achieve good levels of speech understanding in a quiet environment. However, focusing on the envelope portion of sound alone cannot provide best results for more complex auditory tasks such as hearing in the presence of significant background noise or when listening to music. Many individuals report having difficulty when hearing with a cochlear implant in these particular areas.

Providing the cochlea with the fine structure information of sound, in addition to the envelope, is like adding the outline and the shading to a drawing. These additional details contain important information on pitch and quality, for an enhanced listening experience.
The beat of a drum or the plucking of a bass guitar are examples of low-frequency sounds, while the top of the range for an opera singer, or birds chirping, or a whistling kettle, produce high-pitched or high-frequency sounds. To process the full range of sounds, nerve fibres in the cochlea are specialised. For optimal stimulation, MED-EL has designed its electrode arrays to take advantage of the full natural layout of the cochlea, from the base to the apical region, and its capacity for frequency-specific stimulation. Studies show that a fully inserted electrode array has a distinct benefit for performance in speech understanding. This is a significant factor for young children, especially during the critical period of cortical (brain) development in their early years.

Complete Cochlear Coverage is the stimulation of a maximum number of nerve fibres within the cochlea. Because MED-EL electrode arrays are soft and flexible, a long array can be inserted into the apical region of the cochlea without damaging the delicate structures. This ensures complete coverage of the full range of natural frequencies available in the cochlea.

The beat of a drum or the plucking of a bass guitar are examples of low-frequency sounds, while the top of the range for an opera singer, or birds chirping, or a whistling kettle, produce high-pitched or high-frequency sounds. To process the full range of sounds, nerve fibres in the cochlea are specialised.

Nerve fibres located near the opening of the cochlea are specialised for high-frequency sounds, whereas nerve fibres located at the top of the cochlea are responsible for low-frequency sounds. An electrode array that is inserted deeply, yet atraumatically, ensures that specialised nerve fibres located throughout the cochlea are stimulated.
Only MED-EL Designs Arrays to Stimulate the Full Range of Natural Hearing

Long and flexible, only MED-EL electrodes can stimulate the apical region

MED-EL
Standard Electrode 31mm

Competitor 1

Competitor 2
Two Ears are Better than One

The Bilateral Advantage

A variety of technical features make the MED-EL CI System especially well-suited for stereo hearing. In particular, the combination of Fine Structure Processing, 250 spectral bands for more precise localisation, and specially designed flexible electrodes that allow deep insertion into the cochlea provides users with a maximum amount of sound information.

The fine structure of a sound is the main carrier of timing information facilitating localisation of sound sources in space. Fine Structure Processing more closely represents the function of the normal cochlea and has been found to be beneficial in speech understanding. FineHearing allows representation of the tiny temporal offsets occurring in binaural hearing when a sound travels from one ear to the other ear.

![Graph showing percent correct CNC for different test intervals and ear conditions.]

Synchronised Stimulation
Bilateral users can benefit from improved directional or spatial hearing. Increased temporal accuracy allows nuanced representation of the tiny temporal offsets occurring in binaural hearing when a sound travels from one ear to the other. These timing offsets are essential for directional hearing.

Concentrate in Background Noise
For bilateral users, subtle timing differences between each ear allow users to better concentrate on the speaker in front of them, especially in the presence of background noise.
With You for a Lifetime

If you are new to the subject of hearing loss, please use the following pages to find answers to many common questions about cochlear implants and hearing loss. Along your journey to cochlear implantation, MED-EL is there to guide, inform, and support you.

Hearing & Hearing Loss
Understanding the Basics & Daily Life with a CI
- How the MAESTRO CI System works
- Receiving a CI
- Everyday life with a CI
Learn more on page 46

Support & Rehabilitation
Every Step of the Way, Resources that Make a Difference
- Support for a lifetime
- Community support
- Online resources
Learn more on page 52

Trusted Leadership
Innovative Solutions, Today & in the Future
- Who we are
- Humble beginnings, global reach
- Timeline
- The world of MED-EL
Learn more on page 58
While the ear “picks up” the vibrations made by sounds, it is the brain itself that recognises and catalogues sound. Of the literally infinite number of different sounds, the brain is able to compare and discriminate between familiar and unfamiliar sounds.

In this way, individuals, especially the young, learn to hear and comprehend sound.

Ears are extraordinary organs. Unlike eyes, they never sleep, and you cannot close them or give them a break. Ears pick up sound waves and change them into information that the brain can interpret.

Hearing & Hearing Loss

How We Hear

1. The external ear collects sound waves.
2. The ear canal carries sound waves to the eardrum, a membrane that separates the outer and middle ear.
3. The eardrum vibrates in response to sound waves, and sends these vibrations to the middle ear.
4. The middle ear bones receive vibrations from the eardrum and transmit them to the fluid-filled cochlea.
5. Inside the cochlea, hair cells convert the mechanical vibrations into electrical pulses.
6. The hearing nerve carries electrical pulses from the cochlea to the brain, where they are interpreted as sound.

Anatomic illustration is not shown to scale
Children and Hearing

Children with normal hearing learn to catalogue the variety of sounds around them. Even if they can’t see the action creating the sound, they learn to tell the difference between someone tapping on the wall behind them or a person running down the hallway on the floor above them. As children progress through a variety of developmental stages, they are able to process and comprehend increasingly difficult auditory tasks, such as learning to speak a language. During this key developmental stage, the brain is particularly able to learn. Like a sponge, the brain soaks up and catalogues sounds. Though it develops naturally, hearing must be exercised over a lifetime in order to remain effective. If left unused, hearing can deteriorate over time and the brain may not learn to receive sounds via the auditory nerve. For this reason, professionals recommend that the duration of hearing loss be minimised, especially for children.
Hearing & Hearing Loss

Types of Hearing Loss

Each individual type of hearing loss is further classified according to severity. Some individuals have a mild or moderate hearing loss, meaning that they may not be able to hear certain sounds at a particular loudness under most circumstances. Individuals affected by severe or profound hearing loss would be unable to hear many sounds regardless of the loudness or, in many cases, no sound whatsoever.

Sensorineural Hearing Loss
The cochlea does not function properly and is unable to change sounds into the electrical pulses that the auditory nerve needs.

Neural Hearing Loss
The auditory nerve is damaged or missing. Neural pulses cannot be transmitted to the brain.

Conductive Hearing Loss
A blockage or deformity in the middle ear can prevent the bones from vibrating properly.

Mixed Hearing Loss
A mixed hearing loss is a combination of sensorineural and conductive hearing loss.
Solutions for Hearing Loss

Hearing Aids

The Most Common Solution
Most people are familiar with hearing aids. They are by far the most common solution for hearing loss. Individuals who benefit from a hearing aid often have a form of hearing loss that can be enhanced by amplifying the sounds that they can already hear. These individuals may hear well when using in-ear headphones or stereo headphones where the source of the noise is close to the ear canal. They may also be able to hear and enjoy music through speakers when played loud enough. However, classic candidates for hearing aids often struggle in difficult listening situations where there is substantial background noise or when there are multiple conversation partners. They may also have trouble hearing people in different rooms or when the speaker is simply too far away. The job of the hearing aid is to amplify or turn up the volume on sounds that individuals can hear naturally so that the wearer can more successfully follow conversation or hear sound in many conditions.

Cochlear Implant Systems

For Severe to Profound Hearing Loss
Cochlear Implant Systems are designed to restore hearing to individuals who can no longer benefit from hearing aids. These individuals have a severe to profound sensorineural hearing loss. Individuals with this type of hearing loss would likely be unable to hear an airplane landing or taking off nearby. Hearing aids would provide little or no benefit because they are designed to amplify sounds that the person can still naturally hear.

Cochlear implants electrically stimulate nerve fibres located in the cochlea. This sound information is relayed to the brain where it is recognised as sound.
Hearing & Hearing Loss

How the MAESTRO® CI System Works

The MAESTRO Cochlear Implant System bypasses the damaged structures of the inner ear, providing direct stimulation in the form of electric pulses to nerve fibres in the cochlea. The implant continuously stimulates at a very high rate. As the brain receives sound information in real time, sounds are heard as they occur.

A cochlear implant system is like a tiny computer. Part of this computer, the implant, is placed underneath the skin behind the ear during a surgical procedure. The implant contains a magnet. A key component of the implant is the electrode array, which is gently inserted into the spiral-shaped inner ear (cochlea) during surgery.

The audio processor is the external component of the system. This small, lightweight device sits behind the ear and is responsible for gathering sound and converting it into digital information that is passed on to the implant via the coil. The coil is a round magnetic component which sits firmly on the hair over the skin. The audio processor contains the processing unit and the power supply.

1. Sounds are picked up by the microphone in the audio processor.
2. The audio processor analyses and codes sounds into a special pattern of digital information.
3. This information is sent to the coil and is transmitted across the skin to the implant.
4. The implant interprets the code and sends electrical pulses to the electrodes in the cochlea.
5. Electrode contacts stimulate nerve fibres in the cochlea.
6. The hearing nerve picks up the signals and sends them to the auditory centre in the brain. The brain recognises these signals as sound.
Delivering Sound Signals Directly to the Hearing Nerve
For over 20 years, both children and adults have benefited from receiving a cochlear implant from MED-EL. Over 100,000 people have been implanted with a cochlear implant worldwide. Your journey to receiving a cochlear implant varies according to local practice.

CI Candidacy
Candidacy is established following a series of hearing tests and medical evaluations. In many countries around the world, every newborn child is screened using a “Newborn Hearing Screening”. This painless procedure measures the infant's response to auditory stimulation by monitoring brain activity while the child is asleep. For adults and children of any age, hearing loss may manifest itself either suddenly or gradually over time. Close consultation with a professional such as an Ear, Nose, and Throat (ENT) doctor can help to identify hearing loss.

Prior to implantation, many doctors recommend that individuals continue to use hearing aids. This is because any amount of auditory stimulation that the brain receives helps to ensure the health of the hearing nerve.

Surgery
The actual medical procedure, in which the implant is surgically placed underneath the skin behind the ear, takes around 2 hours and can be performed under general anaesthesia. For ENT surgeons specialising in cochlear implantation, this procedure is routine. Recovery is generally fast, allowing individuals to resume normal activities within 3-5 days. In some countries, patients are allowed to return home the same day.

First Fitting
Approximately four to six weeks after implantation, recipients will have their “first fitting”. During a visit to an audiologist or other professional, the individual is “fitted” with the audio processor for the first time. Using special software, the audiologist programs by controlling pitch and loudness. It is here that the individual experiences auditory sensations with a cochlear implant for the first time.
Who can Benefit?

Children
Children of almost any age can benefit from a cochlear implant. Receiving a cochlear implant at a very young age is especially predictive of future hearing success. This is true because children learn to receive auditory information at a time when the brain is particularly ready to learn. Children with a profound hearing impairment that are implanted early enough often develop speech and language skills much like a normal hearing child.

For children who have heard normally but have lost their hearing at a later point in their childhood, the period of deafness is significant. The shorter the duration of deafness, the more likely that the child will benefit from the cochlear implant. Due to improved surgical procedures, and the fact that research supports the benefits for young children, age at implantation is becoming younger and younger.

Adults
Adults of any age can benefit from receiving a cochlear implant. Restoring the sense of hearing can allow adults to become reintegrated within the hearing world. Importantly, it can also alleviate many of the problems that adults experience as a result of their hearing loss.

In addition to a boost in self-confidence, the ability to socialise with others and to participate more easily in activities with both family and friends is an essential part of the human experience. Emotional health is important at any age.

Receiving a cochlear implant also allows many adults to once again use the telephone to communicate with loved ones, resume their careers, or to listen to and appreciate music.
A cochlear implant can provide you with quality of life every day. Reconnect with people you may have lost contact with or attend family events or social gatherings with confidence once again. Beyond social events, many individuals find that it is the small things they have been missing, like new sounds that they had never heard before.

Hearing with a cochlear implant can allow you to reconnect with the hearing world. Users report hearing sounds that they have never heard before. The benchmark for hearing with a cochlear implant used to be speech understanding. With today’s improvements to cochlear implant technologies and the new coding strategies such as FS4, the latest generation of FineHearing technology, hearing well in noise and listening to music are attainable goals for many users.

For young children who receive a cochlear implant, especially during the critical period of language development, many studies suggest that they learn to hear with a CI at a time when the brain is particularly ready to learn. Results for many of these children are very promising. Many are able to attend mainstream schools with their hearing peers.

A cochlear implant not only allows individuals to follow conversations both on one on one or in public, it also allows them to actively participate in conversation. Words expressed in dialogue during a conversation with friends and family allows cochlear implant recipients to once again connect to family and friends. This often helps to break up the feelings of isolation and depression experienced by many individuals affected by hearing loss.

Practice, All Day Every Day

Best performance with the MAESTRO System is dependent on consistent daily use during all waking hours. When you first receive your cochlear implant, your audiologist will recommend that you stay committed to hearing with your CI from the very start.

This will not only get you into a routine of wearing your CI, but it will also condition your brain to learning to hear with the cochlear implant. Following the excitement of “switch on”, sounds may be initially confusing or simply too new. This can feel overwhelming as your brain learns to sort through and manage sounds information received. Voices may sound “tinny”, high-pitched, or even muted making it difficult to distinguish individual voices.

With time, however, the brain will adapt to the many new sounds being heard. Voices will become clearer and more distinct, everyday sounds will become recognisable and even music can be enjoyed when specifically trained.
How Well Will I Hear with a Cochlear Implant?

Quality of hearing with a cochlear implant is highly individual and subject to a number of factors. These include: type of hearing loss, personal expectations, commitment to practicing hearing with a cochlear implant, length of deafness prior to implantation, additional handicaps, and a myriad of other factors. Because no two people are alike, even drawing comparisons between any two individuals using the same system with a similar medical history can be difficult.

Because no one can tell you in advance how you will perform hearing with a cochlear implant, the best thing to do to ensure success is to control for the factors that are up to you. Amongst these are practicing listening to both speech and music, consulting with rehabilitation professionals in order to find an optimal program to fit your needs, and make sure that you receive a fitting that maximises your ability to hear well. Regular fittings will be a part of your initial experience with cochlear implants. During this period, your audiologist will work with you to find settings that allow you to hear your best. Excellent communication with your audiologist is therefore a key component.

In general, the improvement in performance following cochlear implantation varies widely from user to user. The majority of users can understand open-set speech, and have better understanding in noise due to the latest speech-coding strategies. With FineHearing, many users enjoy music, noting that it is more natural and pleasant than before.

Reconnect with the Hearing World
Support & Rehabilitation

What to Expect

Receiving a cochlear implant is a life changing experience. Many individuals experience the benefits of improved language and social skills, independence, speech understanding, telephone use or even the ability to appreciate music.

Every Step of the Way

Learning to hear with a cochlear implant is a process. As the brain gets used to processing the multitude of new sounds, the quality of the sound improves. Voices that may once have sounded tinny, or high-pitched become natural and individual voices can once again be recognised.

Many users concentrate on developing excellent speech and language skills first, before concentrating on more complex listening tasks like music enjoyment. Over time, all listening skills improve through consistent use and a commitment to practice listening.

For this reason, MED-EL has developed a range of materials to support your hearing journey. Developed in concert with experts from the fields of audiology and speech therapy, these materials are developed especially to help users hone their skills.

Additionally, online interactive listening activities like SoundScape can help individuals of all ages to practice their listening skills. A special area called “Kids' Corner” is also available to help explain the optimal use of hearing implants to children. We invite you to explore our catalogue of materials, online listening activities and much more at medel.com.
BRIDGE Support Resources

The BRIDGE program consists of a large variety of support materials for teachers, therapists, and implant users. Coupled with SoundScape, our interactive online listening games, MED-EL makes learning to use a hearing implant fun!

MED-EL's Online Resources

Visit us online at medel.com for more information or to stay up-to-date about the latest product developments and resources available exclusively online.

You can also connect with other users and candidates at our Facebook page, stay updated with Twitter, or watch videos and testimonials at our YouTube page.

www.facebook.com/medel.hearlife
MED-EL

Who We Are

Internationally recognised as the driving force in the advancement of hearing implant technology, MED-EL is as true to its roots today as it was when it started with a handful of employees more than two decades ago. Today, MED-EL is an international company with more than 1400 employees worldwide dedicated to providing hearing implant solutions in more than 100 countries. Under the steadfast leadership of Dr. Ingeborg Hochmair, who pioneered cochlear implants during her university studies, the company continues to offer the most important innovations first. For expert-level attention to detail, ground-breaking technology and best-in-class hearing performance, we encourage you to trust the leader in implantable hearing solutions.

Humble beginnings, global reach

Together, founders Ingeborg and Erwin Hochmair developed the world’s first multi-channel cochlear implant. Working with volunteers, who were themselves hearing implant pioneers, Ingeborg and Erwin helped individuals with total hearing loss to understand and recognise complete sentences. With time, practice, and hard work these early breakthroughs helped to establish the promise of this fascinating new technology. The cochlear implant became the world’s first replacement for a human sense, the sense of hearing.

Today, the benchmarks for hearing with a cochlear implant have advanced from speech perception to music appreciation. The company’s strong foundation in research and development and the industry’s broadest portfolio of hearing implant solutions continue to be its major competitive strengths.

1975  Cochlear implant development started by MED-EL founders Ingeborg and Erwin Hochmair.

1977  Implantation of the world’s first hybrid multi-channel cochlear implant in Vienna.

1989  Introduction of the COMFORT cochlear implant.

1991  MED-EL launches the world’s first BTE (behind-the-ear) speech processor.

1994  Introduction of the COMBI 40, the world’s first multi-channel high-rate cochlear implant.

1995  Introduction of the CIS LINK system.

1996  Introduction of the COMBI 40+, the thinnest cochlear implant available.

1999  Launch of the TEMPO+ behind-the-ear (BTE) speech processor.

2003  Acquisition of the Vibrant Soundbridge®, the first implantable middle ear hearing device for mild-to-severe sensorineural hearing loss.

2004  MED-EL launches the PULSAR cochlear implant, providing future-ready electronics in a ceramic housing.

2005  Introduction of the DUET EAS® Audio Processor in Europe, the first hearing implant system worldwide to integrate cochlear implant audio processing and acoustic amplification in one compact device.
2006
MED-EL launches the OPUS family of speech processors. The SONATA cochlear implant, with new small titanium housing, and the FLEX electrode arrays for all implant types are introduced.

2007
Approval of EAS®, the ideal solution for partial deafness, and the Vibrant Soundbridge® for conductive and mixed hearing losses in Europe. Launch of the DaCapo rechargeable battery system.

2009
EAS® in the 2nd generation. European launch of the DUET 2 Audio Processor. Amadé, the new audio processor of the Vibrant Soundbridge® is introduced in Europe.

2010
New MAESTRO® system introduced in Europe including the CONCERTO Cochlear Implant and MAESTRO System Software 4.0 featuring the new FS4 and FS4:p coding strategies.

2012

2013
The RONDO is introduced. It is the world’s first Single-Unit Processor for cochlear implants.

MED-EL was there at the beginning and they will be there for you today, tomorrow and in the future offering state-of-the-art hearing implant solutions that are comfortable to wear and easy to use.

Ensuring a Hearing Future®
Active in over 100 countries, MED-EL’s staff of hearing loss professionals fuels the development of industry-changing innovations that have made the company the fastest growing hearing implant company in the world.