



Equipment Guide

TEMPO+ and OPUS I
Speech Processors


BRIDGE
to better communication



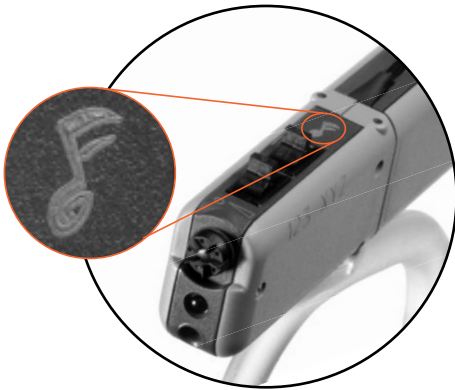
INTRODUCTION

If you're working with a child who listens with a MED-EL Cochlear Implant System, you'll soon want assistance in how to handle the equipment, how to verify that the device is working properly, and what to do if the system isn't working properly.

This guide is designed to help you become confident in handling and assembling the parts of the TEMPO+ and OPUS I speech processors, understanding all of the available wearing options, and objectively verifying that the device is working properly. It will provide step-by-step instructions to help identify and solve any problems that may arise, and will assist you in understanding how to care for the system properly.

The OPUS I and TEMPO+ speech processors look the same. You can differentiate a TEMPO+ from an OPUS I speech processor easily: the OPUS I has a small music note etched on its surface, near the switches marked x-y-z and 1-2-3. The OPUS I Speech Processor contains a microchip that has the capability to implement newer sound coding technology (although this new technology may or may not be activated for a particular child). Techniques for managing and troubleshooting both processors discussed in this guide are the same.

Although the audiologist or the child's implant center typically handles advanced troubleshooting, many classroom teachers and therapists find that minor problems can be quickly and easily managed without disrupting the day's learning plan if they are comfortable troubleshooting and handling the equipment. Please keep this guide in a handy place, and refer to it whenever problems may arise.



The OPUS I speech processor has a "Fine Structure" symbol etched on its surface. The TEMPO+ speech processor does not.

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NOTE:

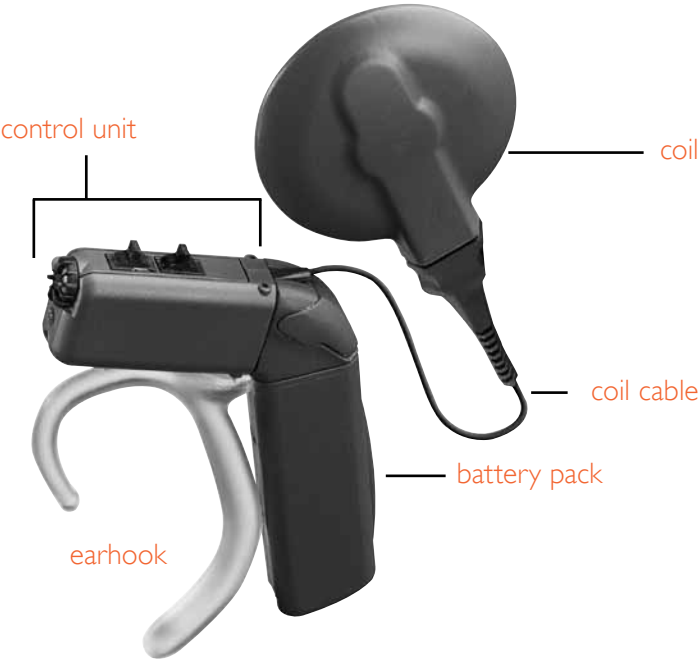
This Guide deals with the TEMPO+ and OPUS I speech processors. If you are working with an OPUS 2 processor (pictured above), please refer to the *Equipment Guide for OPUS 2*.



GETTING TO KNOW THE TEMPO+ AND OPUS I SPEECH PROCESSORS

PARTS OF THE SYSTEM

The MED-EL TEMPO+ and OPUS I speech processors consist of four main parts: a control unit, a battery pack, a coil and a coil cable. The system is modular, so the parts can be combined in different ways, and the system can be worn differently from day to day depending on the needs of each particular child. In addition, each child receives a patient kit that contains a variety of accessories. Each wearing option will have the following parts:



Control unit

The control unit is just like a tiny computer. Inside, an electronic chip controls the entire system. It can hold several different programs (also called 'maps'), which contain the specific hearing settings for each child. It has controls that can change the way the system operates:

Program switch :: The program switch (labeled '1-2-3') allows the user to switch between different programs. An experienced listener might have specific programs for different listening environments. For example, one program might be used when there is a lot of background noise, and another might be used for talking on the phone.

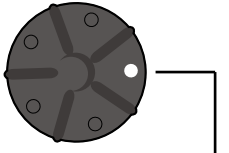
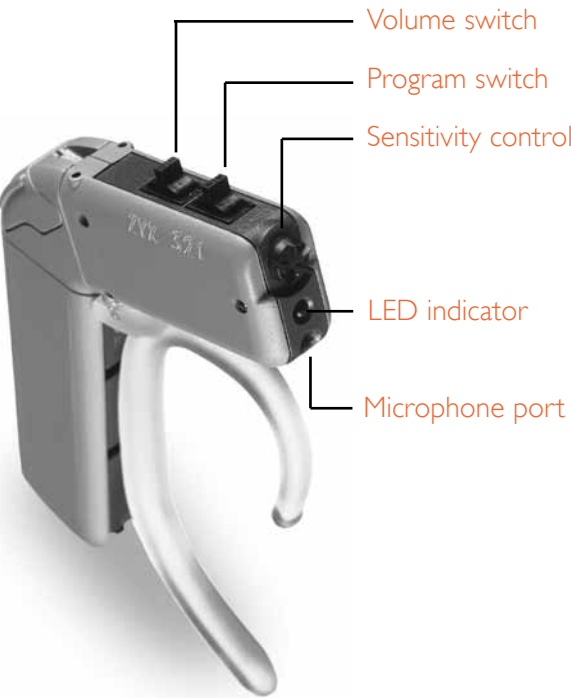
Volume switch :: The volume switch (labeled 'X-Y-Z') allows the user to switch between different volumes for each program. Usually the processor is programmed so that the 'X' setting is loudest, and the 'Z' setting is softest. Please refer to the child's implant center for specific information on how the processor was programmed.

Sensitivity control :: The sensitivity control determines how sensitive the microphone is at any given time, and in particular, how it handles medium and loud sounds to be sure that the user is always hearing at a comfortable level. Generally the sensitivity control is set at the mid-point. At the mid-point, the red dot should be at approximately 2 or 3 o'clock when looking directly at the sensitivity control knob (holding the processor with the volume and program switches facing up). This setting provides hearing sensitivity at a significant distance without overly amplifying medium and soft sounds; if the dial is set higher, the system may pick up sounds from greater distance, but soft sounds may be presented at louder levels than necessary. Experienced listeners find the sensitivity control to be useful in customizing their listening experience, but for children, it is typically recommended to set the dial at mid-point.

Microphone port :: This tiny opening on the front of the processor is where sound enters the processor. The microphone is most sensitive to sounds coming from the front, although it is able to pick up sounds from a wide area.

LED indicator :: This small red light indicates a variety of different status and error conditions. Normally it should only illuminate when the speech processor is first turned on. If it begins flashing during normal use, please refer to the table on page 25 for troubleshooting assistance.

NOTE: Because the speech processor settings are specific to one child only, never switch processors between two different implant users or between ears for a bilateral user. No two ears have the same program settings! The use of a processor belonging to another user could result in overstimulation.



At the mid-point, the red dot should be at approximately 2 or 3 o'clock when looking directly at the sensitivity control knob

Battery packs

Each battery pack contains the batteries, has an ON/OFF switch, and (for three of the battery packs) an input for assistive listening devices. The battery packs are separate from the speech processor. The different wearing options are created by connecting a given battery pack with the speech processor. Five different battery packs support six different wearing options. Each wearing option and corresponding battery pack is described in detail in the next section. For information on changing the batteries, see the “Batteries” section on page 8.

Coil

The coil is a round disk about the size of two stacked quarters. It is responsible for sending the electronic code across the skin to the implanted device. The coil contains some electronics, as well as a magnetic disk. This magnetic disk is attracted to the magnet in the implanted portion, and thus holds the coil against the skin in the appropriate position. The magnetic strength inside the disk can be adjusted by the implant center if necessary. If you notice any signs of skin irritation in the area of the coil, contact the child’s parents or implant center. When the coil is placed over the implant site, you should be able to feel the magnetic attraction to the internal device when the coil is directly over the implant. The coil will only ‘stick’ in the correct place so that the transmitter and receiver align properly – there is no way to put it in the wrong location.

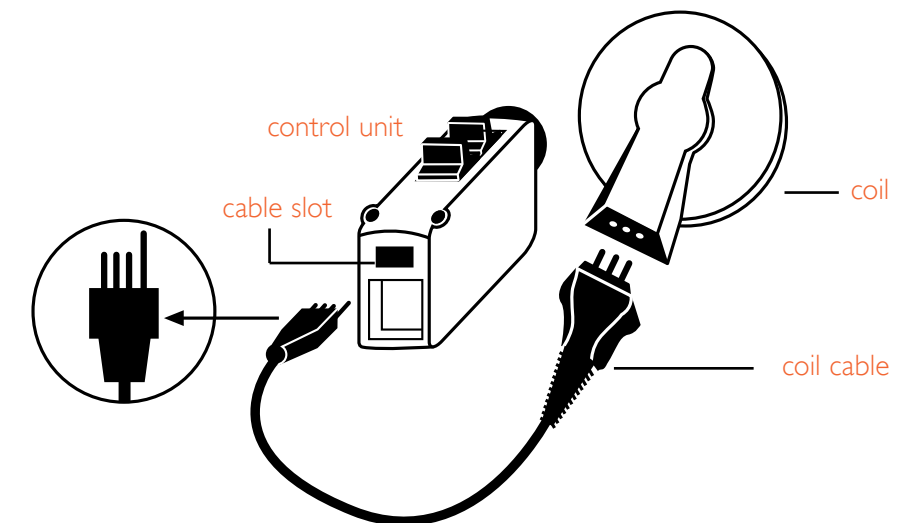
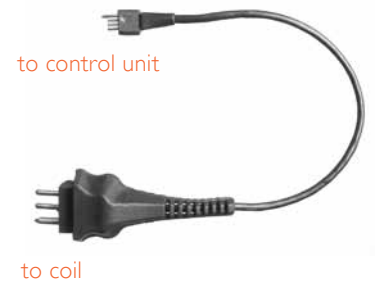
Several types of coils are available to meet individual needs – some have stronger magnets, others have lower power requirements while still others are for special situations. Do not switch coils between children without direction from the cochlear implant center. The implant audiologist can easily adjust the magnetic strength of the coil.



The coil cable

The coil and the speech processor are connected by the coil cable, which carries information between the two components. The coil cable is available in different lengths, from 9 cm up to 28 cm (used for the BabyBTE™ configuration, or to place the processor on the opposite ear from the implanted ear). There is only one correct way to insert the cable into the speech processor and the coil (see right). The coil end of the cable has a particular shape that only fits one way into the coil – note the shape of the plug and the shape of the plug receptacle on the coil. On the processor end, special care should be taken to be sure that the cable is inserted properly, so that the longer pin is inserted into the proper side of the plug.

TIP: One of the coil pins is somewhat longer than the other two. When looking at the top of the processor (where the program and volume controls are located) with the microphone pointing away from you, the cable should plug in so that the largest prong is on the right-hand side.





Locking U-pin
with fixation nuts



Earhooks for
straight battery pack (L)
and angled battery pack (R)



Earhook for
DaCapo battery pack

Connection accessory

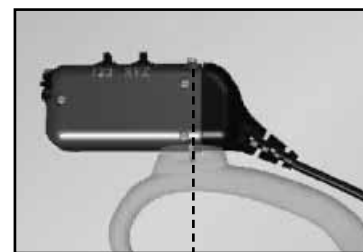
For all wearing options, the battery pack (or battery pack cable) is connected to the speech processor by an earhook (which fits around the back of the ear) or a small device called a 'u-pin'. In either case, the connection accessory has two long metal pins that slide through two tiny holes in the processor and battery pack. These holes line up when the processor, coil cable, and battery pack are assembled.

There are two main types of standard earhooks: one for the straight battery pack, and one for the children's or angled battery pack. The two differ in the direction of the pins, and each results in slightly different microphone and processor placement on the ear. A special third earhook type is used to connect the DaCapo battery pack to the control unit.

Earhooks are available in a variety of sizes. Child-sized earhooks are also available in a 'locking' configuration that prevents active toddlers from taking the processor and battery pack apart. When inserted into the processor/battery pack assembly, the **locking earhook** pins protrude slightly from the other side of the processor. There are two ways to lock the earhook in place: fixation nuts or a safety lock. Two small metal fixation nuts screw onto the tips of the pins, making it virtually impossible for most children to remove the earhook. A small jeweler's screwdriver is helpful when applying or removing the fixation nuts (a screwdriver is provided in the user kit). When the fixation nuts are in place, the child is prevented from taking the speech processor apart or removing the coil cable. Batteries can still be changed without removing the locking earhook from its secure position.

TIP: If you are having difficulty handling the fixation nuts with the screwdriver, try using a bit of the soft, moldable material used for hanging posters, or modeling clay, to pick up and hold the fixation nuts while you are positioning them.

When using the DaCapo Rechargeable Battery System, a **safety lock** is used to lock the components together. The safety lock accomplishes the same job as the fixation nuts. It fits over the protruding pins of the locking (long pin) earhook, and a small black lever inside the safety lock can be engaged using a pointed object (a paper clip works nicely). Simply slide the lever as shown in the photo (at right) to engage or disengage the safety lock.



The earhook has two long metal pins that slide through tiny holes in the processor and battery pack.

Fixation bar (optional)

For some wearing options, an additional fixation bar or clip is used to attach a part of the processor to the child's clothing. Three of the battery packs (straight, angled, and children's battery packs) have two tiny threaded sleeves on the side of the battery pack, near the serial number.

ON/OFF switch

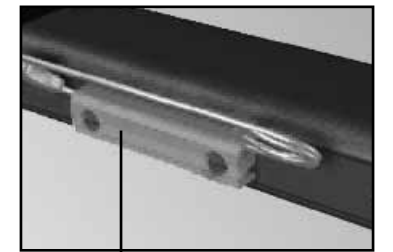
The power switch is located in the following places:

Angled, children's and straight battery packs: At the tip of the battery pack next to the latch that opens the battery door. It is labeled " | " for ON and " O " for OFF. Keep in mind that the children's battery pack is attached to the end of its own cable.

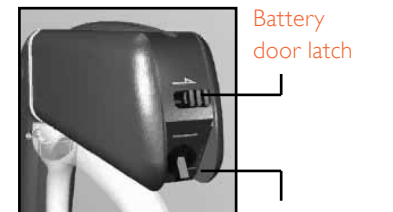


Remote battery pack: On the base of the battery pack labeled "ON/OFF."

DaCapo battery pack: The battery pack lock functions as the on/off switch. When the battery pack lock is in the down position (closed), the speech processor is on.



The **fixation bar** can be used to secure a safety pin so that the processor can be attached to a child's clothing.



Battery
door latch

ON/OFF
switch

Battery door

Battery doors have a small latch, and some are designed to discourage children from tampering with the batteries. To open the battery compartment:

Angled, straight and children's battery packs:

A small latch at the end of the battery compartment slides to disengage the battery door. With the thumb of one hand, slide the latch in the direction of the arrow to release it, and hold it in the open position. Holding the battery pack between the thumb and index finger of the opposite hand, slide the battery door towards the end with the latch. The cover should release and open just a few millimeters. Lift the battery cover completely off.

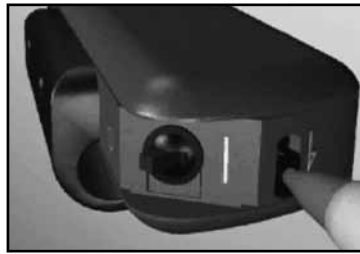
When replacing the battery door, make sure that all batteries are inserted in the proper orientation. The flat side of the battery (usually marked "+") should be facing outward. Do not slide the battery door over all of the batteries or attempt to snap it into place. Instead, simply place it directly over the batteries, as if it were almost closed, and gently slide it into place. It is not necessary to manipulate the latch when closing the battery door cover.



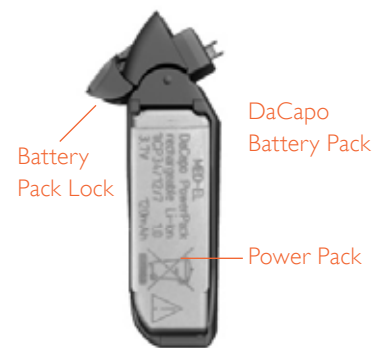
Batteries are inserted with "+" facing outward.



Place the battery door directly over the batteries, as if it were almost closed, and gently slide it into place.



The children's battery pack has a **locking battery compartment**, to prevent young children from opening the battery pack.



Locking battery compartment: The children's battery pack latch is designed to be slightly more difficult to open, as it is often used with toddlers and small children who are more likely to attempt to open the battery pack. It is necessary to insert a small object, such as a ballpoint pen or the tip of a paper clip, into the latch in order to slide it in the direction of the arrow.

Remote battery pack: The battery door latch is on the side of the remote battery pack, labeled "unlock." Slide the latch downward, holding it down, and the top of the battery pack will slide open to reveal the battery compartment. Insert the battery according to the diagram in the compartment. Slide the lid back into place.

DaCapo battery pack: The battery pack cover on the DaCapo is built like a sleeve, and the DaCapo FM-CS battery pack cover also includes input for assistive listening devices. The battery pack lock functions as the on/off switch. Flip the battery pack lock up (this turns the processor off), and slide the entire battery pack cover off the battery pack.

Batteries

MED-EL cochlear implant systems have a patented power-efficient design that supports long battery life averaging 3-5 days using three size 675 high-powered hearing aid batteries. Using the **DaCapo** ear-level rechargeable battery pack, users can expect an average of 10-12 hours. Another alternative is the **Remote Battery Pack** which averages 1.5 days for a rechargeable AA and 2-3 days for an alkaline AA battery. Battery life is not dramatically affected by individual map settings, so all users are assured of being able to enjoy long battery life.

Note: Used batteries should be disposed of according to local regulations. Generally, it is best not to dispose of batteries with other garbage, as they can contaminate the environment. Batteries are toxic; if a child swallows a battery, call the nearest poison control center immediately. It is advisable to remove batteries from the battery pack if it will be stored for a long period of time.

Button batteries (size 675 HP)

For children using the straight, angled, children's or BabyBTE™ wearing options, high power hearing aid batteries, size 675, are required. It is critical that the batteries are labeled "high power;" as high power batteries tend to provide more consistent power over a long period of time. Some newer battery brands are labeled "ultra" or "extra" instead of "high power;" MED-EL is continually evaluating battery brands. Please contact the implant center or MED-EL for recommendations of specific battery brands.



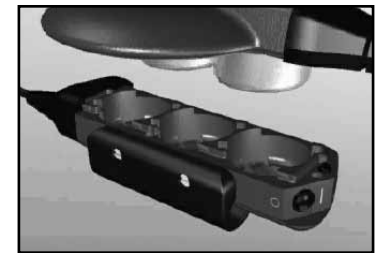
Most 675 hearing aid batteries are of the "zinc-air" variety. The power source is activated by the influx of air through tiny holes on the flat side of the battery. These batteries have a peel-off sticker that covers the holes until it is time to use the battery. When the sticker is removed, the batteries are activated and their useful lifetime begins. Zinc air batteries have a long shelf life as long as the sticker is intact. Once the sticker is removed, it must be used and cannot be deactivated (i.e., replacing the sticker will not conserve its useful lifetime or stop it from discharging).

AA batteries

The remote (rechargeable) battery pack utilizes one AA battery. The remote battery pack uses one AA-size battery, either the rechargeable NiMH or non-rechargeable alkaline type. Each child receives 3 NiMH rechargeable batteries and a charger in the user kit. These batteries have a life of approximately 1000 charges each, and a charge should last 1 to 1.5 days. When the rechargeable batteries have reached the end of their useful lifetime, they can be replaced through MED-EL. Some families purchase rechargeable batteries locally. MED-EL cannot vouch for the quality of these batteries, but does not discourage families from trying other brands if desired. Regular alkaline AA batteries can also be used and should last 2-3 days. **Alkaline (non-rechargeable) batteries must NEVER be placed in the battery charger.**

DaCapo PowerPack

To replace the DaCapo PowerPack (see image on previous page), you will need to have a fully charged replacement PowerPack on hand. In the event that you do not have access to a replacement PowerPack, any of the other battery pack options described in this guide may be used interchangeably.



A handy way to remove the used 675 batteries from the processor is to place the flat side of the coil against the open battery compartment. The magnet inside the coil will attract the batteries, removing them from the compartment.

Changing the batteries

All battery packs have a small latch mechanism that makes the battery door tamper resistant (see page 7 for instructions on opening the battery compartment and removing the batteries). For battery packs using size 675 batteries, be sure the flat side of the battery (+) is facing you before closing the battery door.

NOTE: When changing the batteries, be sure to turn the processor off and back on again with fresh batteries in place. If the processor is not reset, the LED will continue to flash as if the battery power were low.

Changing the DaCapo rechargeable PowerPack



- 1 Open the battery pack lock to switch the processor off.
- 2 Slide the battery pack cover off the DaCapo Frame.
- 3 Remove the small white PowerPack from the battery frame.
- 4 Add a fresh, fully charged PowerPack.
- 5 Slide the battery pack cover over the DaCapo Frame and close the battery pack lock to switch the processor on.
- 6 The battery pack does not need to be disconnected to change the PowerPack.

For more information on the DaCapo Rechargeable System, see page 19.

WEARING OPTIONS

Ear level processors provide a compelling sense of freedom for parents and small children not to be encumbered by a large box worn on the belt or in a harness. The various wearing options provide the opportunity to wear the system in ways that are more secure to the body than the average ear-level system. The wearing options also allow the child to grow into a traditional ear-level placement as time and maturity permit, while taking advantage of all of the features of the advanced processing capability of the system.

In choosing a wearing option, the parent will probably consider factors such as:

- :: Will the processor be likely to fall off if the child is active?
- :: Will the child attempt to remove the batteries or change the controls?
- :: Do we want all, part or none of the processor on the child's ear?
- :: Is sweating or moisture a problem?
- :: Do we prefer to use disposable or rechargeable batteries?
- :: Do we plan to use assistive listening devices?

It is important to remember that the speech processor consists of one control unit, with five different battery packs, that can be combined for six different wearing options:

- :: **Angled battery pack** – all-at-the-ear configuration with direct input for assistive listening devices
- :: **Straight battery pack** – BabyBTE™ securely placed on the clothing or straight configuration worn at the ear
- :: **Children's battery pack** – microphone placement at the ear with the added security of the battery pack attached to the clothing
- :: **Remote (rechargeable) battery pack** – low-cost alternative with direct input for assistive listening devices
- :: **DaCapo Rechargeable Battery System** - combines the cost savings of a rechargeable battery with the convenience of an ear-level placement and direct input for assistive listening devices.

The five battery packs can produce six different wearing options to facilitate wearing the system comfortably and securely regardless of age or activity level. Each wearing option and its assembly is described in detail on the next page.

THE WEARING OPTIONS
ALSO ALLOW THE CHILD
TO GROW INTO A
TRADITIONAL EAR-LEVEL
PLACEMENT AS TIME AND
MATURITY PERMIT.

.A variety of options for infants, young children, and adults

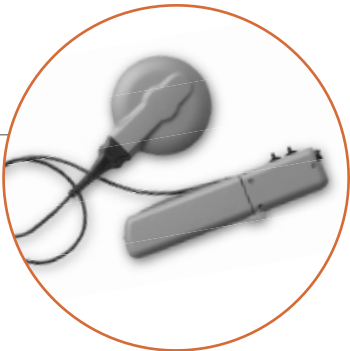
Angled Battery Pack

- Traditional BTE style
Input jack for external devices
- CONTROL UNIT
 - ANGLED BATTERY PACK



BabyBTE™

- BabyBTE™ (for infants)
Activity pack for adults
- CONTROL UNIT
 - STRAIGHT BATTERY PACK
 - LONG COIL CABLE



Children's Battery Pack

- Excellent for young children
- CONTROL UNIT
 - CHILDREN'S BATTERY PACK



Straight Battery Pack

- Streamlined alternative to traditional BTE style
- CONTROL UNIT
 - STRAIGHT BATTERY PACK



Remote Battery Pack

- Cost saving and efficient
Input jack for external devices
- CONTROL UNIT
 - REMOTE BATTERY PACK
 - REMOTE BATTERY PACK CABLE



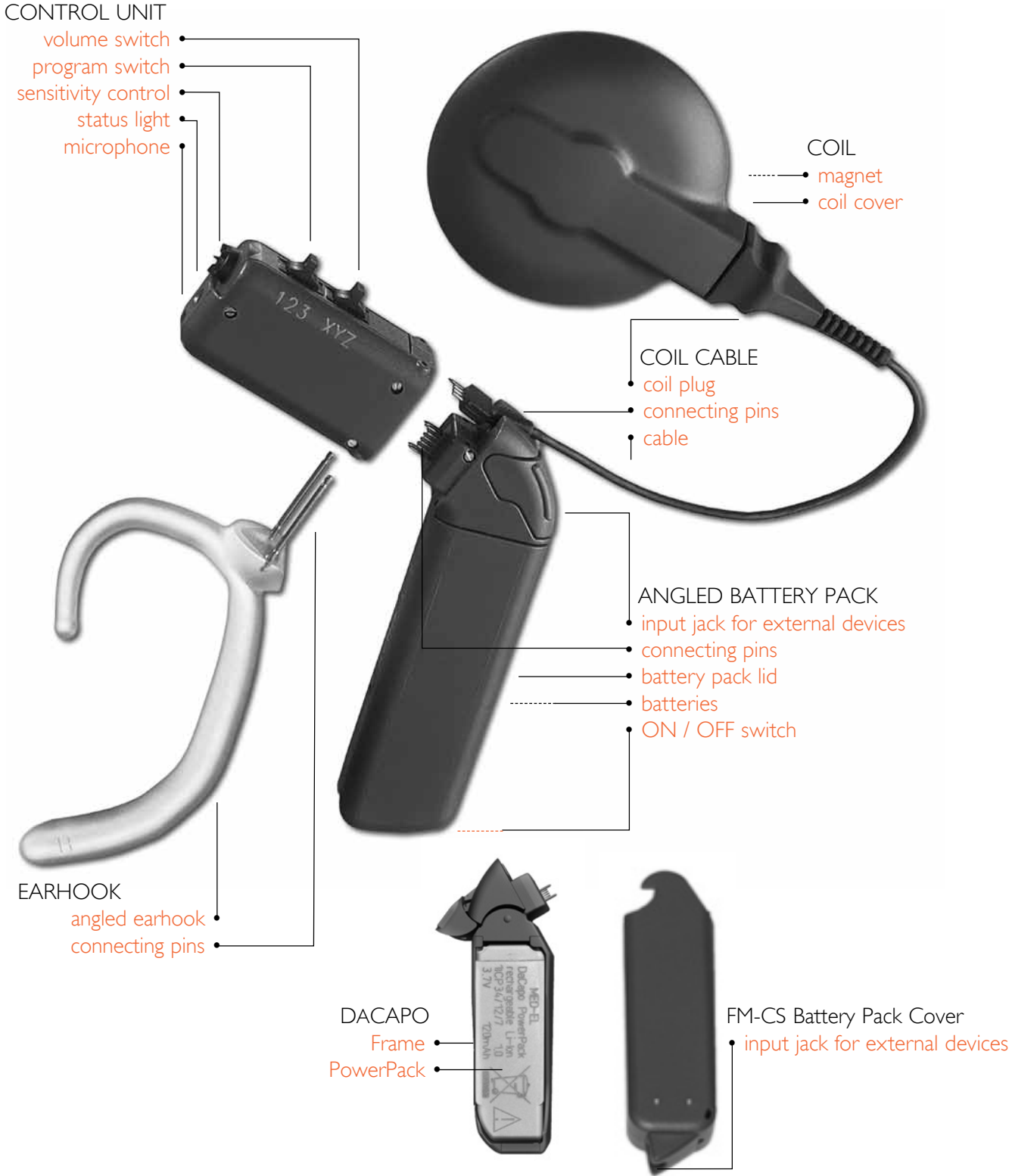
DaCapo Rechargeable Battery System

- Cost-savings combined with the convenience of ear-level placement
Optional input for assistive listening devices
- CONTROL UNIT
 - DACAPO BATTERY PACK



TEMPO+ or OPUS | Speech Processor

Enlarged to show detail



BABYBTE™ (ALSO CALLED THE 'ACTIVITY PACK')

Who should use the BabyBTE™?

MED-EL's signature wearing option for infants and young children is the BabyBTE™. The BabyBTE™ has the advantage of allowing a young child to begin using the same ear-level speech processor that he or she will use for the long term, while still accommodating a baby's small ear and activity level. For this wearing option, the entire BTE processor is placed on the clothing, and only the coil is placed over the implant on the head. The BabyBTE™ can also be used as an 'activity pack' for children or adults who participate in sports or other activities where a very secure placement is desired. For example, if the child is involved in an activity that requires wearing a helmet, using the activity pack allows the microphone of the speech processor to be positioned outside the helmet, with only the coil and cable fitting underneath.

When using the BabyBTE™, it is important to be aware of the position of the microphone; it should be positioned in such a way that the majority of sound will be directed at the microphone, including the child's own voice. Usually the best option is to position the BabyBTE™ on the child's shoulder; with the microphone facing forward.

How do I assemble the BabyBTE™?

- 1 Connect the coil cable to the coil. A longer coil cable (28 cm) is used for this configuration than the ear-level wearing options to allow for flexibility in processor placement on the clothing.
- 2 Connect the opposite end of the cable into the processor. See page 5.
- 3 Add the straight battery pack, with the cable slot positioned to accommodate the coil cable.
- 4 Insert the u-pin into the two small holes next to the speech processor serial number.
- 5 Add the desired fixation bar by attaching it to the two screw taps next to the serial number of the battery pack, using the screwdriver to tighten it into place.
- 6 Add fresh batteries.
- 7 Position the BabyBTE™ on the child, pinning or clipping it into place on the clothing. If possible, try to position the processor so that it is out of the child's reach, but with the microphone facing forward. Many parents choose to place the processor on the shoulder, facing up or forward.
- 8 Choose the desired program and volume setting, check the position of the sensitivity control, turn the processor on (located on the tip of the battery pack), and position the coil on the head.
- 9 The red LED should illuminate briefly to indicate that the system is functioning.



THE BABYBTE™ HAS THE
ADVANTAGE OF ALLOWING
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PROCESSOR THAT HE OR
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LONG TERM, WHILE STILL
ACCOMMODATING A
BABY'S SMALL EAR
AND ACTIVITY LEVEL.

CHILDREN'S BATTERY PACK

Who should use the children's battery pack?

The children's battery pack is the ideal configuration for active toddlers and preschoolers, or older children who still require the security of a system that is attached to the clothing. The speech processor is worn on an earhook at the ear, which provides optimal microphone placement and easy visibility of the LED indicator. The microphone placement can be altered slightly by choosing either the straight or angled earhook.

A cable allows the battery pack to be attached to the child's clothing. This cable is hard-wired into the battery pack and cannot be disconnected and replaced. If the cable is damaged, the entire battery pack should be replaced.

How do I assemble the children's battery pack?

- 1 Connect the standard 3.5 cm coil cable to the coil.
- 2 Connect the opposite end of the cable into the processor. See page 5.
- 3 Add the children's battery pack, fitting the cable plug into the speech processor with the cable slot positioned to accommodate the coil cable.
- 4 Choose the desired earhook and insert the pins into the small holes next to the speech processor serial number, so that the microphone will be facing forward when the child wears the system. If the earhook is a 'locking' type, add the fixation nuts to the tips of the earhook pins once they are in place.
- 5 Add the desired fixation bar to the battery pack, using the screwdriver to tighten the accessory into place.
- 6 Add fresh batteries.
- 7 Position the speech processor/earhook assembly on the child's ear and position the battery pack on the clothing in an inconspicuous place.
- 8 Choose the desired program and volume setting, check the position of the sensitivity control, turn the processor on (located on the tip of the battery pack), and position the coil on the head.
- 9 The red LED should illuminate briefly to indicate that the system is functioning.



THE CHILDREN'S BATTERY
PACK IS THE IDEAL
CONFIGURATION FOR
ACTIVE TODDLERS AND
PRESCHOOLERS, OR OLDER
CHILDREN WHO STILL
REQUIRE THE SECURITY
OF A SYSTEM THAT
IS ATTACHED TO THE
CLOTHING.



A huggie-aid or an earmold may help keep the processor in position on the ear. Contact the implant clinic or audiologist for assistance.



THE ANGLED
BATTERY PACK IS THE
MOST COMMON
CONFIGURATION FOR
OLDER CHILDREN
AND ADULTS.

ANGLED BATTERY PACK

Who should use the angled battery pack?

The angled battery pack is the most common configuration for older children and adults. This configuration allows the entire processor to be worn at the ear. In addition, a small doorway in the bend of the battery pack conceals an input port that enables direct connection to assistive listening devices.

How do I assemble the angled battery pack?

- 1 Connect the standard 3.5 cm coil cable to the coil.
- 2 Connect the opposite end of the cable into the processor. See page 5.
- 3 Add the angled battery pack, fitting the battery pack into the speech processor port with the cable slot positioned to accommodate the coil cable.
- 4 Choose the earhook for the angled battery pack and insert the pins into the small holes next to the speech processor serial number, so that the microphone will be facing forward when the child wears the system. If the earhook is a 'locking' type, add the fixation nuts to the tips of the earhook pins once they are in place. The earhook should fit snugly into the bend of the battery pack.
- 5 Add fresh batteries.
- 6 Position the speech processor/earhook assembly on the child's ear.
- 7 Choose the desired program and volume setting, check the position of the sensitivity control, turn the processor on (located on the tip of the battery pack), and position the coil on the head.
- 8 The red LED should illuminate briefly to indicate that the system is functioning.
- 9 To use the direct input function, it is necessary to open the small door in the bend of the angled battery pack. To open the doorway, grasp the battery pack in your left hand, grasp the door cover between the thumb and forefinger of your right hand, and pull the door cover directly out. Once the door has disengaged from its seat, you will be able to swing it up to reveal the plug beneath. See "Connecting the Patch Cable" sidebar on page 39 for more detailed instructions. MED-EL provides a variety of patch cables for connection to battery-operated external listening systems. For more information on direct input, see current FM literature from MED-EL.

STRAIGHT BATTERY PACK

Who should use the straight configuration?

The straight configuration combines the speech processor with the straight battery pack, all at the ear level. Some children and adults like the straight battery pack for its non-traditional look.

How do I assemble the straight configuration?

- 1 Connect the standard 3.5 cm coil cable to the coil.
- 2 Connect the opposite end of the cable into the processor. See page 5.
- 3 Add the straight battery pack, fitting the battery pack into the speech processor port with the cable slot positioned to accommodate the coil cable.
- 4 Choose the desired earhook (for the straight battery pack) and insert the pins into the small holes next to the speech processor serial number, so that the microphone will be facing forward when the child wears the system. If the earhook is a 'locking' type, add the fixation nuts to the tips of the earhook pins once they are in place.
- 5 Add fresh batteries.
- 6 Position the speech processor/earhook assembly on the child's ear.
- 7 Choose the desired program and volume setting, check the position of the sensitivity control, turn the processor on (located on the tip of the battery pack), and position the coil on the head.
- 8 The red LED should illuminate briefly to indicate that the system is functioning.



SOME CHILDREN AND
ADULTS LIKE THE
STRAIGHT BATTERY
PACK FOR ITS NON-
TRADITIONAL LOOK.

SPECIAL CONSIDERATIONS FOR SMALL CHILDREN

The speech processor has several features that are particularly designed for small children. Among them:

Locking earhooks, which use screws or a safety lock to secure the earhook in place on the processor. See page 6.

Tamper-resistant battery covers on all battery packs, with a locking lever on the children's battery pack. See page 8.

Flexible programming to prevent accidental program or volume change. It is possible to program each position and volume setting to the same map. In this configuration, changing the program or volume has no effect on the child's listening experience. Contact the implant clinic for assistance.

A plastic **activity cover** is available that covers the controls of the speech processor and provides some protection against moisture and impact. The activity cover can fit the straight and BabyBTE™ wearing options. Contact the implant clinic or MED-EL to purchase an activity cover.

Wearing options for small ears that remove the speech processor from the head and place it securely on the clothing. See page 14.




REMOTE (RECHARGEABLE) BATTERY PACK

Who should use the remote (rechargeable) configuration?

The remote configuration is ideal when cost is an issue, or when dexterity problems preclude the use of the smaller battery packs. Families are provided with three rechargeable size “AA” batteries and a charger, which will provide several years of use before the batteries will need to be replaced. They can also use off-the-shelf alkaline (non-rechargeable) AA batteries. The battery pack is worn in a pocket or attached to the clothing or belt using the small clip supplied with the system. The cable can be replaced separately from the battery pack. The remote battery pack provides a direct input port for connection to assistive listening devices.

How do I assemble the remote (rechargeable) configuration?

- 1 Connect the standard 3.5 cm coil cable to the coil.
- 2 Connect the opposite end of the cable into the processor. See page 5.
- 3 Add the remote battery pack cable, fitting the cable plug into the speech processor port with the cable slot positioned to accommodate the coil cable.
- 4 Choose the desired earhook (straight or angled depending on desired microphone placement) and insert the pins into the small holes next to the speech processor serial number, so that the microphone will be facing forward when the child wears the system. If the earhook is a ‘locking’ type, add the fixation nuts to the tips of the earhook pins once they are in place.
- 5 Add a fresh or fully charged battery.
- 6 Position the speech processor/earhook assembly on the child's ear.
- 7 Choose the desired program and volume setting, check the position of the sensitivity control, turn the processor on (located on the remote battery pack), and position the coil on the head.
- 8 The red LED should illuminate briefly to indicate that the system is functioning.
- 9 To use the direct input function, locate the input port on the battery pack, labeled with the symbol , under a small plastic cover. The input port is a standard 3.5 mm (1/8”) stereo headphone jack. Next to the input port is a small switch labeled EXT/MIX. This switch provides an opportunity to choose whether the incoming signal will be mixed with the signal from the TEMPO+ or OPUS I microphone (on the head) or the accessory device alone. MED-EL provides a variety of patch cables for connection to assistive listening devices and FM systems. For more information, see current FM literature from MED-EL.



Detail of the input port, EXT/MIX and ON/OFF switches of the remote battery pack.

DACAPO RECHARGEABLE BATTERY SYSTEM

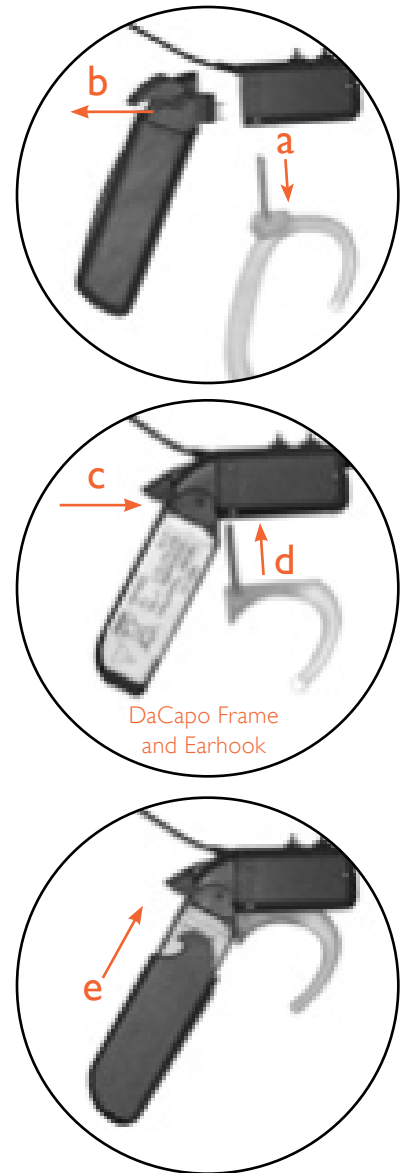
Who should use the DaCapo rechargeable system?

As with the remote rechargeable unit, the DaCapo rechargeable battery system provides a cost effective choice for families, but offers the convenience of an ear-level placement. This option includes three rechargeable PowerPacks and a charger that will provide several years of use before the PowerPacks will need to be replaced. The PowerPack provides 10-12 hours of continuous operation. The DaCapo system can be compatible with FM systems and other external devices such as MP3 players, by using a special FM-CS battery pack cover that includes the same input jack found in the angled battery pack.

How do I connect the DaCapo battery frame?

A special earhook is required to connect the DaCapo battery frame to the OPUS I or TEMPO+ speech processor. To connect the DaCapo Frame to the Control Unit, proceed as follows:

- 1 Pull the earhook straight out (a).
- 2 Pull the connected battery pack back until it completely detaches from the Control Unit (b).
- 3 Push the DaCapo Frame onto the Control Unit (c).
- 4 To secure this connection insert the two pins of the earhook for the DaCapo Frame into the two holes on the bottom of the Control Unit. The pins must be inserted completely (d).
- 5 Slide the battery pack cover over the DaCapo Frame and close the battery pack lock to switch the processor on (e).
- 6 Use the same procedure whenever changing battery packs. The battery pack does not need to be disconnected when changing the DaCapo PowerPack. Always make sure to use the appropriate earhook.





IS IT WORKING? A TROUBLESHOOTING PRIMER

DAILY LISTENING CHECKS

In order to feel confident that the system is working and the child is receiving the best sound possible, it is advisable to formally check the system every day. It is helpful to think about this from two viewpoints, the viewpoint of **functioning equipment** and also the viewpoint of good **auditory discrimination**. Obviously the child doesn't hear properly if the equipment itself is not working. But it is also important to consider whether the child's hearing is optimal throughout the day and from day to day as well.

In order to establish a consistent and replicable method of evaluating the equipment and the child's auditory discrimination, many parents, therapists, and educators do a routine daily listening check, preferably at the beginning of the day or session. This quick check should take no more than 1-2 minutes, and will help to establish your comfort zone about the function of the device and the child's ability to make use of audition. In addition, some educators find it beneficial when working with very young children to repeat the listening check after PE or recess. The listening check should also be employed any time there is suspicion that the child is not responding in his or her typical fashion.

Verifying auditory detection and discrimination

Because we are checking for auditory ability, it is critical that the child has no access to visual cues during the daily listening check. Ideally, the child should be positioned next to and slightly in front of you (with the implant side nearest you) so that no speechreading cues are available. Another option for removing visual cues is to fashion a 'listening screen' from an embroidery hoop stretched with a lightweight but opaque fabric, such as 2 layers of stereo speaker cloth. Do not use paper or cardboard, as the sound will be deflected, making the hearing task more difficult.

Many professionals like to use a popular quick test called the "Six Sound Test" developed by the late Daniel Ling. This quick stimulus/response test uses isolated speech sounds that cover the entire frequency spectrum of speech. The six sounds are:

"mm" as in "mmm that's good" (not "em" as in "the letter M")

"ah" as in "father".

"ee" as in "bee"

"oo" as in "boot"

"ss" (not 'ess')

and "sh"

The teacher should present each sound, one at a time, and expect the child to indicate that it was heard. Each sound should be presented using the same intonation and duration so the child can't guess the sound based on those clues. For example, using a rising intonation for one sound and not others will cue the child, as will using a longer presentation of "mm", "ss" or "sh" than for the vowels. The presentation order needs to be varied, and additional (unexpected) stimuli included from time to time, such as the child's name or other familiar words, so that the task is not overly predictable.

Responses will vary depending on the age, maturity and listening level of the child. In the very beginning, the response may be inconsistent and will need to be encouraged and taught. New implant users will not typically hear the difference between sounds – only that a sound was made. This is referred to as the ability to **detect** a sound. At this level, the listener is expected to indicate she has heard the stimulus by giving a simple response. The response can be anything you choose to teach: pointing to the ear, dropping a toy into a container, turning to look at you, vocalizing, etc.

Soon we expect the child to move on to a higher level of auditory ability: **discrimination**. This means the child is beginning to recognize that sounds are different. For the purposes of these early tasks, we are expecting the child to detect and discriminate a set of **phonemes**, which are the individual sounds that make up the complex body of spoken language. During the discrimination phase, the child may begin to identify each phoneme as evidenced by her ability to repeat what is said to her. For example, the adult may say one of the six sounds (oo) and the child consistently repeats back, "oo." This is an exciting development because it demonstrates that for this phoneme, the child is able to detect (hear the phoneme), discriminate (distinguish it from other phonemes) and identify (label it by virtue of repeating it).

As the child's auditory skills increase and the ability to repeat a sound develops, you want to move toward having the child repeat back each speech sound after you say it. When the child first attempts to repeat the sounds you say, their approximation may not even resemble your model, but a vocalization is an indication a sound was heard and should be encouraged. As the child's ability to modify his or her own speech to match your model improves, the responses to the various sounds should begin to sound different, and should come closer and closer to accurately pronouncing the sound.

The important thing to remember here is this: if the child can't consistently repeat sounds accurately in general, but can indicate that a sound was heard, then you are measuring **detection**. Any indication that the child heard the sound is good. Once the child can consistently indicate that sounds are different from each other, you begin measuring **discrimination**. If the task is performed regularly, you will become familiar with the child's typical responses, and this quick test becomes even more useful. Once a consistent response is achieved, any changes from this baseline response, such as a change in the child's typical pronunciation, take on added meaning, and may indicate there is a need for a change in the map.

NOTE: Keep in mind the difference between discrimination difficulties and speech production difficulties. It is common for children with developing articulation skills to mispronounce or to be unable to pronounce certain speech sounds, even though the sound is heard. By experimenting with detecting and discriminating the target sound along with the mispronunciation, you may be able to determine whether the child can hear the sound, but just can't produce it accurately.

This very quick and simple method of evaluating detection and discrimination can provide a great deal of insight into the child's hearing acuity without any additional equipment. It can also be a fun way to reinforce listening skills and help the child experience success. Once the child knows the routine and the task, you will have a good sense of their hearing function from day to day, and small changes in hearing will quickly become apparent. Many educators turn the daily listening check into a fun game, often allowing the child a turn to be the speaker as well. This can provide a short one-on-one opportunity to praise and build confidence in the child's developing listening skills.

A daily listening check can also be used to teach the child to indicate when the device is not working properly. Children with cochlear implants should be encouraged to become their own strongest advocates for good hearing. It is a good idea to teach the vocabulary of listening as the child's listening skills begin to improve. Here are some target sentences and phrases that can help the child become responsible for the device and its sound quality:

"I need new batteries."

"My speech processor sounds different."

"The sound is going on and off."

"Your voice sounds funny."

"I can hear well today."

"What is that sound?"

"I heard that but I didn't understand it."

"My speech processor is not working" or "My speech processor is broken."

With an older child or more experienced child after presentation of the Ling Sounds to determine accuracy of discrimination and production, you may want to use the following target sentences. "Can you hear me" or "Can you hear me well." "Tell me what you hear" and have him repeat several short sentences. Vary your sentences from day to day to decrease the chance of prediction on the part of the child.

Verifying normal equipment function

Along with the importance of assessing the child's detection and discrimination, it is important to check the equipment for proper settings and function. One child's settings may be very different than another child's settings, so exact settings should be obtained from the implant center (and should be updated after each mapping visit) for each child. Be sure to check the individual settings for each processor for the child with bilateral cochlear implants.

A normally functioning system has the following characteristics:

- ∴ The **red LED** only illuminates for 4-5 seconds when the system is first turned on and when the program/volume switch is changed. Otherwise, it should not light or blink.
 - ∴ The **ON/OFF switch** is set to "ON" or " | " (depending on the battery pack used). If in doubt, switch it off and then back on again. The red light should illuminate briefly to indicate the processor is on.
 - ∴ The **sensitivity control** is set at approximately the halfway point (for most users). When looking directly at the sensitivity control, the red dot will be at approximately 2 or 3 o'clock. If in doubt, simply turn the sensitivity control all the way off (counter-clockwise) and all the way back on (clockwise) to find the endpoints of the dial, and then set the dial mid-way between the two endpoints. Now check to see if the red dot is at approximately 2 or 3 o'clock.
- NOTE: Keep in mind that the sensitivity control can be turned all the way to the 'off' position (you will feel a click). In this position, sound input is significantly dampened and the child will most likely have no sound awareness.
- ∴ **The program (1-2-3) and volume (X-Y-Z) switches** on the control unit should be set to the child's usual settings. These settings are determined by the implant clinic during mapping sessions and may vary depending on the programs loaded into the processor.

- ∴ **Placing the coil next to the speech processor test device** (see page 26) should produce a red flashing light on the test device, which roughly blinks in the pattern of your speech or other sounds.



See page 2-5 for a detailed diagram of the speech processor.

TROUBLESHOOTING FEATURES

The processor has a number of built-in features to facilitate troubleshooting the equipment.

LED indicator: Troubleshooting the batteries and speech processor

The red LED on the front of the speech processor flashes four different patterns to indicate different error conditions. If the LED begins flashing, use the following table to determine the cause.

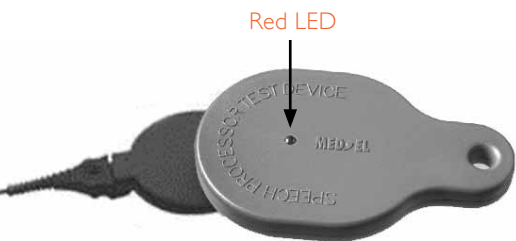


BLINKING PATTERN	MEANING	ACTION TO TAKE	REMARKS
On 4-5 seconds	Processor just switched on	None	The LED comes on continuously for 4-5 seconds
•-•-•-•-•-•-•	Batteries low	Switch processor off. Change the batteries (be sure to use high power 675 batteries). Switch processor back on.	If the processor is not switched off while changing the batteries, the LED will continue to blink, even with new batteries in place. If the blinking still persists and the batteries are brand new, the problem may be a bad battery pack. Ensure that the 675 batteries are "high power" batteries.
•-•-•-•-•-•-• or •••-•••-•••-•••	Electronic problem or temporary processor disturbance	Switch processor off. Switch processor back on.	If the blinking persists, the speech processor should be replaced*.
••-••-••-••-••	Selected position is not programmed, or there has been a program failure	Switch processor off. Select another position. Switch processor back on.	If the blinking persists, the processor should be reprogrammed by the clinic. The processor must be switched off before selecting another program, otherwise the light will continue to blink and the processor will not work.

* The speech processor can be replaced by the cochlear implant center. Many children have backup speech processors at home, keeping them 'on the air' while their primary processor is being repaired or replaced.



The speech processor test device for the TEMPO+ is a **dark charcoal gray** (anthracite) color. In contrast, the speech processor test device for the OPUS I processor is a **light gray** color. It is important to use the correct speech processor test device for the child's processor to avoid erroneous test results.



Red LED

Speech processor test device: Troubleshooting the cables and coil

The speech processor test device is an accessory that is part of every patient kit. Additional test devices can be purchased from MED-EL or the implant clinic. The speech processor test device (SPTD) assesses the integrity of the cable and coil. There are two versions of speech processor test device. The newer version is a light gray color, and is compatible with the TEMPO+ and OPUS I processors. The older version is a dark charcoal gray (anthracite) color, and is only compatible with the TEMPO+. If used with the OPUS I, the dark gray speech processor test device may provide inaccurate results.

Remove the coil from the child's head. Ensure that the processor is on, and the sensitivity control is set at approximately midpoint.

Place the flat side of the coil (the side that would be against the child's skin) against the side of the SPTD that does not have the light indicator on it.

Speak into the microphone on the speech processor. You should see the red light on the SPTD flash to your voice. If the red light flashes with speech, the coil is sending a data stream to the **implant**.

If the red light is on constantly, and there is no sound input (i.e., there is no sound in the environment), there could be a problem with the microphone. Be sure that you are in a completely quiet environment – the microphone is very sensitive and may pick up sounds you aren't especially aware of, such as a ventilation fan or a computer keyboard.

If the red light does not flash, or flashes intermittently even though there is constant sound input, there is a problem with the cable or coil. Sometimes it is possible to identify a short circuit in a cable by running your fingers down the cable while watching the red light of the SPTD, although care needs to be taken not to initiate sounds that may trigger the microphone. A flickering light may indicate a faulty cable.

It is important not to adjust controls on the processor during testing with the speech processor test device. If the processor's program, volume or sensitivity controls are inadvertently changed after you have begun testing, you may need to reset the speech processor test device by moving it a short distance away from the coil. Wait a few seconds, and then reposition the two and continue testing.

If there is a problem with the equipment, the most likely culprit is the cable. Cables are the weakest point of any system and are vulnerable to excessive movement or force.

Microphone test device: Verifying microphone function

A microphone test device (MTD) is available to assist in determining whether the microphone is providing an adequate signal. The MTD can be purchased from MED-EL or from the implant clinic. To use the MTD, remove the connector (earhook or u-pin) from the processor, and remove the battery pack. Plug the MTD cable into the processor as if it were a remote battery pack. Plug the accompanying earphones into the earphone jack of the MTD. Using the earphones, speak into the microphone and listen to the quality of your voice. The MTD has a volume control so that the sound level can be adjusted for the listener. If the sound is scratchy or of poor quality, the microphone may need to be cleaned or repaired. Contact MED-EL or the implant center for repair or replacement options.

NOTE: If no signal is heard, push the Self-Test button on the MTD. If the MTD is working properly, a beeping sound will be present. The MTD features an LED that emits a green light if the MTD battery is good, and a red light if the battery is low. The MTD uses one rechargeable or alkaline AA battery.

It is important to use the MTD only in an environment that is quiet. A noisy environment may trigger the speech processor's system of handling loud noises. To someone who is not an implant user, this may change the sound quality that is heard through the MTD. It is also important to be sure the sensitivity control of the speech processor is set to the midpoint. If it is set at minimum, no sound will be heard. If the signal is perceived to be of poor quality, check to be sure the headphones are working properly to rule them out as the cause of the problem. The headphones can be checked by plugging them into any typical device (i.e., a portable CD player or some other device that uses stereo headphones). Further instructions are included with the MTD kit.



MTD Headphones
(Photo courtesy of
SONY Corporation)

A STEP-BY-STEP TROUBLESHOOTING GUIDE

Most routine problems that occur with the speech processor will be easy to solve in the classroom. The batteries need to be replaced every 3-5 days (for size 675) or daily (for size AA). The power pack for the DaCapo rechargeable system needs to be replaced with a new fully charged pack every 10-12 hours. Cables are also prone to normal wear and tear, and will need to be replaced from time to time.

TIP: When troubleshooting the system using spare parts, it is best to try changing just one part at a time. If you swap out several parts at once, it is difficult to be completely sure of the original cause of the problem, and functioning equipment may be discarded unnecessarily.

TIP: When troubleshooting using spare parts, it is helpful to keep spare equipment separate from the questionable equipment as you change out each part. It is very easy to get the two sets confused!

Problem: LED is flashing.

Solution: Refer to LED table (page 25).

Problem: Batteries have been changed and the LED is still flashing.

Solution: Be sure to switch the processor off and back on to reset the LED.

If you are certain the batteries are fresh, and the processor has been reset, it is possible that the battery pack or the connection between the battery pack and processor is faulty. This problem needs to be investigated further with spare equipment (a spare battery pack and possibly a spare processor) to determine the fault.

Problem: Battery life is very short when using size 675 batteries (substantially less than 3 days).

Solution: Check battery life after each step:

- ⚡ Check to see that the correct battery type is used. It is important to use only batteries that are identified as "high-power." For a specific battery brand recommendation, you may contact MED-EL or the implant clinic. Batteries that do not carry the "high-power" designation may be fully charged but may not maintain enough voltage to adequately supply the speech processor.
- ⚡ Check the battery compartment. When the cover is in place, you should still be able to see a very thin opening where the battery cover meets the battery pack. The batteries need air circulation in order to maintain power.
- ⚡ Check to see that the battery door is not too loose. If the tabs that hold the battery door in place become worn, the battery door may not hold tightly enough, resulting in poor contact between the batteries and the contacts in the battery pack. A spare battery door is provided in the patient kit, or can be obtained from MED-EL or the implant clinic.

Problem: The system appears to be working (no flashing lights) but the child is not responding to sound.

Solution: After each step, check to see whether sound is restored:

- ⚡ Switch the processor off and back on. If you see the power-up light (4-5 seconds continuous LED), then you know the batteries are reasonably good.
- ⚡ Check to see that the sensitivity control is set to approximately mid-point (2 or 3 o'clock). If the setting is too low, the child may not be able to detect sound at normal levels.
- ⚡ Be sure the processor program (1-2-3) and volume (X-Y-Z) switches are set to the child's typical daily use settings.
- ⚡ Use the speech processor test device to determine whether the coil is sending any information to the implant. See page 26 for instructions.
- ⚡ Use the microphone test device (if available) to verify that the child's microphone is functioning properly. See page 27 for instructions.
- ⚡ If there is no flashing light on the Speech Processor Test Device, try a spare cable. See pages 5 and 11 – 19 for instruction on assembling/disassembling the system, depending on the child's wearing option, in order to change the cable.
- ⚡ If a spare cable does not solve the problem, it is a more complex issue. Further troubleshooting will require a spare battery pack, coil, and possibly a control unit.
- ⚡ If, after these steps, you cannot determine the problem, contact the child's parent, the implant center, or MED-EL Corporation for further assistance.

Problem: The child is detecting sound, but discrimination is poorer than usual.

Solution: Check discrimination after each step:

- ⚡ Check to see that the sensitivity control is set at mid-point (2 or 3 o'clock).
- ⚡ Check to see that the child is using his or her typical daily use program and volume.
- ⚡ Use the microphone test device (if available) to assess the integrity of the microphone.
- ⚡ Contact the implant center to discuss whether a mapping visit is appropriate. Important feedback to the center will include:
 - The type of errors the child appears to be making
 - Whether the problem was of sudden or gradual onset
 - The child's overall performance level

Problem: Parts of the equipment seem to be broken (earhook, battery door cover, etc).

Solution: Contact the parent, the implant team, or MED-EL for assistance in replacing parts.

KEEPING SPARE EQUIPMENT ON HAND

The following basic “kit” will handle most routine problems and replacements for basic trouble shooting. Items specific to the device (i.e. cables, earhooks and fixation devices) can be obtained from the parent, the implant clinic or from MED-EL. It is best to keep everything together in a small plastic container where they are easily accessible:

- ∴ **High power zinc air batteries** have a long shelf life, so there is little concern that the useful lifetime will diminish, as long as the stick-on tab that covers the air vents has never been removed. Once the tab has been removed, however, the battery life will drain even if the tab is replaced.
- ∴ **A spare coil cable** is also extremely useful to have on hand. Although the system is designed to be durable, cables are particularly subject to wear and tear and need to be replaced from time to time.
- ∴ Consider keeping a **spare earhook** or other fixation device on hand.
- ∴ **Small screwdriver**, like those used on eyeglasses, for detaching locked fixation devices or earhooks.
- ∴ If the child uses the **children’s battery pack** or the safety lock, consider keeping something that will open the recessed lock. The screwdriver mentioned above will work, or an unfolded paper clip. Even a ballpoint pen will do the job.
- ∴ **Laminated troubleshooting card** “MED-EL Made Easy.” This is a smaller sized copy of the chart on page 25. These can be obtained at no charge from MED-EL or the implant center.
- ∴ If the child **uses the DaCapo battery pack**, consider whether it makes sense to keep a spare PowerPack on hand. A charger will be needed to maintain a charge. Alternatively, a spare battery pack that uses standard 675 batteries might be useful (ensure that you have all the necessary accessories for connection, including an earhook).

For more advanced troubleshooting, a spare battery pack, coil and pre-programmed control unit will be needed (unless your facility provides mapping services). MED-EL offers families the option of purchasing a spare processor at the time of implantation, and many implant centers and families opt to do this. If the child has a complete, functioning spare system, problems can be solved instantly and troubleshooting one part at a time is much easier. If the family does not have a spare system, additional troubleshooting equipment may be purchased from the implant clinic or from MED-EL if desired.

Additional troubleshooting tools, such as the speech processor test device (SPTD) or the microphone test device (MTD) can be particularly helpful. All patient kits contain one SPTD, and additional test devices can be purchased from the clinic or from MED-EL. The MTD is purchased separately. Please call MED-EL for current pricing and ordering information.

MED-EL offers the **EarGear troubleshooting kits**, designed especially for schools. EarGear kits are offered in three levels, depending on the needs of the school. They contain all that the educator needs to do basic troubleshooting, and some kits offer options for more advanced troubleshooting. Please refer to MED-EL’s BRIDGE to Better Communication product catalog at www.medel.com for a complete description and pricing or call MED-EL for information. (NOTE: This service is only available the USA.)



WHAT TO DO IF YOU DON'T FEEL COMFORTABLE WITH THE CHILD'S EQUIPMENT

If, after the above sections, you are still not comfortable handling the child’s equipment, there are a number of available resources. The parents or implant center may be able to provide assistance. You may also call MED-EL for telephone assistance or to schedule an in-service visit.

A WORD ABOUT WARRANTIES

MED-EL offers several warranty options to assist families in keeping equipment in good working order. These options include the manufacturer’s warranty, the extended warranty, and a choice of loss and damage coverage. Warranty information is provided in the patient’s kit.

Manufacturer’s Warranty: The external equipment (coil, speech processor, and all battery packs) carries a 3-year warranty that is effective at the time of initial stimulation of the implant. The manufacturer’s warranty ensures timely equipment replacement in the event of equipment failure that is not due to obvious misuse or negligence.

Extended Service Contract: After the 3-year manufacturer’s warranty has expired, MED-EL offers an extended service contract that essentially continues the warranty. Families whose insurance coverage does not prohibit extended service contracts can purchase this option.

Theft, Loss and Accidental Damage: MED-EL offers a one-time replacement of a lost or damaged system during the 3-year manufacturer’s warranty. Families can elect to purchase a comprehensive theft, loss and accidental damage coverage plan through MED-EL or ESCO. ESCO is an independent hearing aid insurance company. You may contact the implant center, MED-EL, or ESCO directly (www.earserv.com) for more information about ESCO’s policies. (NOTE: This service is only available the USA.)

For more information on any of the above warranty options, please contact the implant center or MED-EL.



CARING FOR THE SYSTEM

MOISTURE

The speech processor is an electronic device, and therefore it is susceptible to problems if it is exposed to moisture or perspiration. It is advisable to take precautions to protect the system from moisture if the child will be in a wet environment. The external device should be removed altogether prior to swimming, bathing or other water-related activities where the system may become wet. If moisture is allowed to enter the microphone port, the microphone sound quality may eventually be degraded. Repeated or significant exposure to moisture may cause corrosion of the internal electrical components and require repair or replacement of the system. It is wise to develop a habit of wiping down the speech processor and coil after the child has been playing outside. If a child has a tendency to sweat excessively, it may be worthwhile to consider using a wearing option that moves the speech processor away from the ear or source of sweat.

If the speech processor does get wet, its function and the sound quality of the signal may be compromised. The child may report a “crackling” sound, intermittency, or other unpleasant sound sensations. Remove the system, turn it off, wipe off any excess moisture, and let it dry completely before attempting to assess whether it is permanently damaged. The best way to dry the internal components of the processor is to use a commercially available hearing aid drying kit. One drying kit is supplied with each patient kit, but they are readily available from hearing aid dealers, the implant center or MED-EL at nominal cost. These kits contain absorbent silicone, which is placed in an airtight container with the entire system (batteries removed) and left to dry for several hours or overnight. Disassembling the parts of the processor may promote faster drying.

ELECTROSTATIC DISCHARGE (ESD OR STATIC ELECTRICITY)

As an electronic device, the speech processor is susceptible to influence by electrostatic discharge (ESD). Static electrical energy can build up naturally on an object or on the human body. It usually occurs in dry environments when there is friction between two objects. Synthetic materials are common sources of static electricity build up. Some electronic equipment, such as computer and TV screens, actively create static electricity. This static buildup is generally not noticed until it is discharged. All of us experience this at one time or another, perhaps most often when walking on a carpeted floor and then touching another object. This discharge, or ESD, happens when two objects that have different charge levels come into contact, and the charge equalizes between the two objects. Children who have cochlear implants don’t build up static charge any differently than people without cochlear implants.

Although the MED-EL implants and speech processors have several internal safety features designed to reduce ESD, there is a small risk that either the external or internal equipment can be damaged if the static discharge flows through the external equipment. Switching off the processor will not prevent damage from occurring. Electrostatic charge due to friction is usually mild and generally will cause the processor to switch off. In rare cases, the user may experience uncomfortably loud hearing sensations. Electrostatic charge from contact with plastic play equipment can build up to greater levels and requires a few additional precautions mentioned below.

The following safety precautions will ensure long life of both the internal and external equipment.

Following the listed guidelines below can reduce the probability of ESD:

- ⚡ If you believe the child is statically charged, have them discharge by touching a radiator, a watertap, or any other grounded metal object.
- ⚡ Do not allow another person to touch the external parts of the implant system unless the person and the child are discharged.
- ⚡ The child should discharge (touch another person) before taking off or putting on the speech processor. Have them use the two-step approach:
 1. Touch the person’s body.
 2. Touch the equipment.
- ⚡ When picking up the processor from a table:
 1. Touch the table.
 2. Touch the processor.

- ⚡ The child should be “discharged” when leaving a car. Touching the door is a good way to discharge. The processor or any cables should never touch the door or other parts of the car body.
- ⚡ When working on a computer, the computer should be grounded (grounded outlets have a three-pronged plug receptacle).
- ⚡ An antistatic mat under a work area may reduce static buildup.
- ⚡ The child should not directly touch the screen of the computer or TV. The risk of problems from computer screens is very small, but may be further reduced by using an antistatic screen over the monitor.
- ⚡ Using an antistatic spray for upholstery, TV or computer screens can reduce static buildup. These sprays are also available for carpets and clothes.
- ⚡ The processor should be removed before dressing and undressing, especially if garments include synthetic fibers. Generally cotton or natural fibers are preferred since they are less likely to cause ESD problems. Fabric softeners will also reduce static. When getting dressed, put the processor on last of all, and remove it first when undressing, in order to avoid ESD.

Plastic play equipment

The speech processor should be removed before touching plastic play equipment such as plastic slides, crawling tunnels, or pools of plastic balls. Friction with this type of play equipment can generate surprisingly large static voltages. Switching off the speech processor is not enough to prevent damage from occurring! The processor must be completely removed from the body. Afterwards, do not touch an implanted child at the site of the implant. Have them touch another person or grounded object to discharge before touching the speech processor. If there is any doubt about a particular material, it is best to err on the side of caution and have the child remove the speech processor.

Static electricity generators (Van de Graaff generators)

Some school science classrooms do experiments using static electricity. Before experimenting with static electricity or high voltages, the speech processor must be removed. **Implant users must not operate Van de Graaff generators at all, as they produce very high levels of static electricity.** A Van de Graaff generator looks like a globe that produces static electricity or “lightning,” they are sometimes found in science exhibits or museums.

In the case of an ESD event

If the speech processor stops working and you suspect an ESD event (static electricity) as the reason, switch off the processor, wait for 10 to 20 minutes and switch it on again. The programs should be restored. The MED-EL cochlear implant system features a unique SoundGuard™ system that protects against program loss due to ESD events. This is reassuring to families and educators because it dramatically reduces the potential for the child to be without sound or the need to return to the implant center for a re-mapping session. In the rare case that the programs are not restored, the red LED will flash a double-blinking pattern (II...II...II). Try switching the processor off and changing to a different program (using the switch labeled “1-2-3”); it is possible that one of the program positions will function. If not, contact the parent and/or the implant center.

SPORTS

Contact sports that might result in severe blows to the head or continuous pressure on the implant should be avoided, as they may damage the implant. Other physical activity is generally allowed, however, the external equipment should be worn securely (see Wearing Options), and protected from physical damage. Sports that generally require a helmet are also acceptable if they do not exceed the given capabilities of the child. The use of a helmet is strongly advised, as this will help protect the implant site from any blows. The helmet should be of high quality and may need to be modified to meet the child's needs. For specific questions about contact sports, especially with respect to a particular child's medical history, contact the parent or implant team.

Most water sports are allowed as long as the external parts of the implant system are removed. The family should consult with the implanting physician prior to snorkeling and scuba diving.

METAL DETECTORS

Metal detectors and some anti-theft devices may produce a soft sound perceptible to the implant user, whether they are near or walking through the magnetic field. The speech processor should be switched off when walking through metal detectors. Any sound sensation should cease when the speech processor is switched off. The implant itself may trigger a metal detector.



CONNECTING TO ACCESSORY DEVICES

The angled, remote and DaCapo battery packs provide a direct input connection to external accessories and assistive listening devices. These three battery packs can be safely connected to any external device that is battery operated. The system must not be connected to external devices that are plugged into the wall or a power strip.

MED-EL provides a variety of patch cables to facilitate connection to various battery operated external equipment, such as a portable tape or CD player, MP3 player, FM system, a laptop computer (as long as it is running on battery power), etc. All implant users receive patch cables that are compatible with battery-operated equipment that uses a stereo headphone jack. You can identify a stereo headphone jack by looking at the plug of the headphone that would normally plug into the jack. If the plug is sized 3.5 mm (1/8 inch), and has two black rings along the shank of the plug, it is a stereo jack. If there is only one black ring, it is a mono jack and the device should not be used, as the patch cables are designed to connect to a stereo jack. Most modern portable audio devices utilize a stereo jack.

MED-EL provides detailed product ordering information, along with pricing, and instructions for use of various FM patch cables. You can find information on connecting specific FM systems, along with the necessary patch cables and settings for each, on MED-EL's website. An interactive **Assistive Listening Device Database** is available there which contains the most up-to-date information on available FM systems and OPUS I/TEMPO+ connection options..

WHEN TO USE ACCESSORY DEVICES SUCH AS FM SYSTEMS

FM systems are assistive listening devices that help amplify and focus the child on the teacher's voice. The teacher wears a microphone and transmitter; and the child wears a receiver that is connected to the speech processor. These "direct input" FM systems can be very effective in improving the child's ability to hear in a noisy environment, and can successfully reduce the effect of distance and

reverberation between speaker and listener. Each FM system has different settings and connection capabilities. For specific information on connecting a particular FM system to the processor; see MED-EL's **Assistive Listening Device Database** at www.medel.com.

Although direct input FM systems can be very helpful, they also have some drawbacks. More equipment can sometimes mean more equipment to troubleshoot. Unfortunately, the child is the only person who can truly indicate whether the sound quality through the FM, coupled to the cochlear implant system, sounds acceptable. For this reason, we strongly recommend that direct input FM systems are only used with children who are good at reporting when equipment is or is not functioning normally. We also recommend that the school audiologist or implant center verify the FM settings to ensure that speech perception skills are at least as good while using the FM as they are without it.

In situations where the child is not a good reporter, a sound field system can be an excellent solution. With these systems, the teacher wears a microphone and transmitter; and the child sits next to a small desktop speaker. The problems of distance and background noise are reduced, and the teacher can verify that the system is working properly.

It is important to remember that when a child is listening through an FM system, they are effectively connected auditorally to the teacher. In other words, the FM can be very appropriate for teacher-directed activities or group lecture, but it is not effective (and can actually degrade the learning experience) when the teacher is not the focal point. For example, if the class is doing small-group work, where the teacher is moving from group-to-group, it is not effective for the child to be listening to the teacher's voice in another group while trying to concentrate on his/her own group's work. In addition, FM is often unnecessary in one-on-one situations, such as speech-language or auditory therapy, where distance and background noise are not a concern. Conscientious use of the FM in appropriate situations can greatly assist a child; blanket use of the FM without fully understanding its advantages and disadvantages may detract from the child's ability to make the most of the classroom environment.

MIXING OPTIONS

Mixing refers to the ability to combine the input from an assistive listening device (such as an FM system) with the sound input from the speech processor. In general, mixing is almost universally preferred over external input only, because it allows a child to monitor his or her own voice, and to hear the voices of other children in the classroom through the processor; in addition to receiving the benefit of the assistive device.



Mixing and non-mixing cables are available for use with the angled battery pack.

For the angled and DaCapo battery packs, you can choose either a “mixing” or “non-mixing” patch cable. Mixing cables allow the child to hear both signals, with the input from the speech processor microphone (environmental sound and their own voice) mixed one-to-one along with the sound from the external device. Non-mixing cables provide sound input only from the external device. The standard patient kit patch cable for the angled battery pack is a mixing cable (a yellow colored ring is visible on the plug).

The remote battery pack has the mixing option built into the battery pack. The sliding switch labeled “EXT/MIX” on the base of the battery pack allows the user to choose whether to combine the speech processor microphone input along with the external system (MIX) or simply listen to the external system alone (EXT). If nothing is plugged into the direct audio input port of the battery pack, the position of the sliding switch has no effect.


When plugging into any external device (in this example, a MP3 player), follow these steps:



The remote battery pack has the **mixing option** built into the battery pack

STEP BY STEP CONNECTION GUIDE

Remote battery pack

The remote battery pack provides a direct input port for connection to assistive listening devices. This port is located on the battery pack, labeled , under a small plastic cover. The input port is a standard 3.5 mm (1/8”) stereo headphone jack.

- 1 Ensure that the MP3 player is functional and the batteries are fully charged.
- 2 Ensure that you have the correct patch cable (refer to MED-EL literature, the implant center, or the company).
- 3 Plug the patch cable into the remote battery pack. Then, skip to step 6 under “Angled battery pack” on the next page.

DaCapo battery pack

The DaCapo battery pack allows direct input when using the special FM-CS battery pack cover. The input port is located on a small wedge at the bottom of the battery pack.

- 1 Ensure that the MP3 player is battery operated and the batteries are fully charged.
- 2 Ensure that you have the correct patch cable (refer to MED-EL literature, the implant center, or the company).
- 3 Ensure that the correct FM-CS battery pack cover (shown at left) is in use.
- 4 Plug the patch cable into the small 4-pin connector on the wedge at the bottom of the battery pack. Then, skip to step 6 under “Angled battery pack” on next page.

Angled battery pack

- 1 Ensure that the MP3 player is battery operated (not plugged into a wall outlet), that the batteries are charged, and it is fully functional.
- 2 Ensure that you have the appropriate patch cable for the player and battery pack. Refer to current MED-EL FM literature for ordering information on specific cables and settings for FM systems. For all other battery operated devices, contact the parent, clinic or MED-EL for assistance in obtaining the correct cable.
- 3 The cable's small angled connector should be plugged into the external audio input socket of the processor's angled battery pack. You may connect the cable while the battery pack is connected to the processor unit of the speech processor (i.e., while the earhook is in place). To do this:
- 4 Open the small door in the bend of the angled battery pack. To open the doorway, pull the door cover directly out. Once the doorway has disengaged from its seat, you will be able to swing the doorway up to reveal the plug beneath. Most people first try to simply swing the doorway up and cannot successfully open the door. Remembering to first pull the door cover out, away from the processor, will allow it to properly swing open on a small hinge.
- 5 Insert the cable into the socket with the red dot pointing upward. Gently push the cover back down until it rests on the connector.
- 6 Decrease the volume on the MP3 player as much as possible. Connect the other end of the cable into the MP3 player's headphone jack. Turn the processor on and place the processor and transmitter on the child. Set the speech processor at normal use volume and sensitivity. Increase the volume of the MP3 to a comfortable level.
- 7 Sound from the speech processor microphone will be somewhat softer than during normal listening.

CONNECTING THE PATCH CABLE



Pull the doorway outward to disengage it from its seat.



Swing the doorway up to reveal the plug beneath.



Insert the cable into the socket with the red dot pointing upward. It is not necessary to force the cable in the socket.



Gently push the cover back down until it rests on the connector. When the cable “clicks” in place, the connection is secured.



Connect the other end of the cable into the battery-operated device's headphone jack.



The **Telemic** is used with inductive loop systems and as an external microphone.

THE TELEMIC ACCESSORY

The Telemic is an accessory that allows the user to access additional accessory devices. It has two functions 1) as a pickup for inductive loop systems, such as those used in places of worship and theaters and, 2) as an external microphone.

The Telemic has two controls: a 3-position switch labeled “O-T-M”, and a volume control.

“O”– **Off** :: The Telemic is inactive. The processor will still function normally even if the Telemic is connected to the processor.

“T”– **Telecoil** :: The system is sensitive to certain telephones and induction loop systems.

“M”– **Microphone** :: The Telemic microphone is active.

Volume :: Active when the O-T-M switch is in telecoil or microphone mode. This adjusts the volume of the Telemic input to suit the user’s needs.

The internal microphone of the speech processor remains active even when the Telemic is connected, although its volume is slightly reduced to emphasize the signal coming from the Telemic. If the child needs to listen at normal speech processor volume, the Telemic should be switched off. To connect the Telemic, simply follow the same instructions for connecting accessory cables (see page 39).

The Telemic does not require a battery and should not significantly impact the battery life of the speech processor.

Telecoil operation

Many public places are equipped with induction loop systems that provide hearing aid users with access to the signal of interest. Loop systems exist in places of worship, museums, and many theaters. The signal perceived through the loop system is free of room noise and echoes. Also, most public telephones and landline phones emit a similar inductive signal.

In a public place, such as a theater, it may be necessary to ask if the system is switched on, and determine whether there are certain seats that are better served by the signal.

To use the telecoil most effectively, the child will need to be a good reporter and will need to be able to manipulate the position of the telecoil for the best reception. Be sure to switch the Telemic to “T” position. The position of the telecoil in relation to the surrounding loop field will have a significant effect on the loudness and quality of the signal. The child should connect the telecoil and set it at 3/4 volume, then move the telecoil itself until the best reception is obtained. At that point, a final volume adjustment can be made. Sometimes the best position is when the telecoil is held horizontally.

When using the telecoil with a telephone, it is first necessary to verify that the phone emits an electromagnetic field. The Telemic should be held against the earpiece of the phone; the child may have to experiment with positioning to obtain the best signal. Keep in mind that many implant users successfully talk on the telephone without accessories simply by holding the phone in normal speaking position, with a slight adjustment of the earpiece so that sound is directed toward the speech processor microphone.

Microphone operation

The microphone feature can be helpful in reducing background noise when the implant user is in a small group. In a noisy restaurant, or in the car, the user can clip the microphone to the speaker’s lapel, thus reducing interfering noise. The microphone should be approximately 8 inches (20 cm) from the speaker’s mouth for best reception. Be sure to switch the Telemic to “M” position.

AVAILABLE ACCESSORIES FOR THE TEMPO+ AND OPUS I

A number of accessories are available for the TEMPO+ and OPUS I. Please contact MED-EL for a comprehensive listing and current prices.



THE TELEMIC IS AN ACCESSORY THAT IS USED WITH INDUCTIVE LOOP SYSTEMS, SUCH AS THOSE USED IN CHURCHES AND THEATERS.



GLOSSARY OF TERMS RELATED TO MED-EL COCHLEAR IMPLANT SYSTEMS

Apical region :: The apical region is the tip of the 'snail shell' shape of the cochlea. This region is responsible for sensing low-pitched sounds. MED-EL cochlear implants are the only implant systems that reach deep enough into the cochlea to stimulate the apical region and the part of the system that is 'tuned' to low pitched sounds.

Audiogram :: The audiologist does an audiogram (sometimes called audiometry) to determine the softest levels that a child can hear across low and high pitches. Often, the audiologist will also assess how well the child perceives speech sounds, which is called speech perception testing. Additionally, the audiologist may measure how softly a child can understand speech.

Audiologist :: An audiologist is a specialist in the diagnosis and non-medical treatment of hearing and balance problems. Audiologists obtain either a Master's or Doctoral level degree, and then complete a training fellowship prior to entering practice.

Auditory brainstem response testing (ABR) :: An audiologic test that roughly measures hearing acuity without any participation from the child. As the child sleeps, a clicking sound is presented to the ear, and the resulting brain activity is measured. This measure is used extensively for diagnosing hearing problems in infants and young children who are unable to respond behaviorally.

Auditory habilitation specialist :: This term is used in this handbook to refer to the wide variety of professionals who become specialists in teaching deaf children to use their residual hearing with hearing aids or cochlear implants. It is well accepted that children with hearing loss need special assistance to develop auditory skills. An auditory habilitation specialist can be a speech-language pathologist, a teacher of the deaf/hard of hearing, a certified auditory-verbal therapist, an audiologist – any one of a variety of related professions – who has specialized in the habilitative aspect of hearing loss.

Auditory nerve Response Telemetry (ART™) :: This is a test done by the audiologist that allows visual confirmation of the auditory nerve firing in response to stimulation from the implant. The ART measurement helps the clinician make a "rough guess" as to the sound level required to trigger the auditory nerve; although this measurement isn't completely predictive of the levels he or she will need to set in the child's processor program, it does provide confirmation that stimulation levels are roughly in the audible range for the child. ART measurements can be helpful in cases where a child cannot give adequate feedback during fitting sessions.

Automatic gain control (AGC) :: The AGC is a system the speech processor uses to manage sounds of different loudness. The child with a cochlear implant does not have a wide range of sound tolerance, as does a person with hearing. The AGC ensures that very loud and very soft sounds are processed accurately so that they fit into the range of hearing of the implant user.

BabyBTE™ :: A unique wearing option available with all MED-EL speech processors that allows the entire speech processor to be attached to the clothing for security.

Basal region :: The basal region of the cochlea is the high-pitched region. This is the area that would be considered the base of the 'snail shell' shape, and is the area closest to where sound first enters the inner ear.

Batteries :: MED-EL speech processors are unique in that they have very long battery life. Several pack configurations run on size 675 batteries (for an average battery life of 3-5 days). These batteries can be purchased from MED-EL or at many drugstores and hearing aid dealers. It is critical that they are labeled as "high power" batteries. Size 675 batteries that are not labeled "high power" will result in very short battery life because their power levels fluctuate enough to signal a dead battery to the processor, even though the batteries may be fully charged. The remote battery pack uses one size AA battery (either rechargeable or alkaline).

Battery pack :: A modular component of the speech processor that houses the batteries that power the system.

Channel :: A channel refers to one of the 12 electrode pairs that are arranged along the array. The channels are numbered consecutively, with channel 1 being the lowest in pitch, and channel 12 being the highest in pitch. Not all children use all available channels, however. Channels can be deactivated for various reasons without any negative overall effect.

Coding strategy :: A coding strategy is a series of calculations used by the cochlear implant system to measure the sound that is presented to the microphone, analyze its components, and then determine which electrodes should be stimulated and how they should be stimulated to best represent the original sound. Next, it generates a code that is sent to the implanted portion of the system. This code tells the implant which channel to stimulate within the cochlea, when to stimulate it, and how loud that stimulation should be to accurately represent the sound at the microphone.

Coil :: The coil sends the coded information from the speech processor to the internal implant. It uses radio signals to send this message across the skin. The radio signals produced by the coil are a special frequency that is the only frequency understood by the implant receiver. The coil also contains a magnet that holds it against the correct area of the head so that it is aligned properly with the implanted portion.

Coil cable :: The cable that connects the coil to the speech processor.

Control unit :: The computerized part of the speech processor that does the work of transforming sound into a code that can be sent to the implant.

Connecting Piece :: A connection accessory that allows a battery pack to be connected to the processor. All wearing options use some form of connecting piece; in some configurations, the connecting piece may also be the earhook. A special locking Connecting Piece safely locks the control unit and battery pack which keeps a small child from removing it from the processor.

Communication methodology :: The form that communication (and education) takes. Speaking, listening, using a signed or cueing system, or a complete signed language are all various communication methodologies.

DaCapo System :: The DaCapo Rechargeable Battery System can be directly connected to the control unit. The system makes the processor even lighter and preserves the slim design. It is compatible with FM and other external devices. The rechargeable battery cell provides 10-12 hours of continuous operation.

Decibels (dB) :: The decibel is the measure of a sound's loudness. The range of normal human hearing is typically 0-120 dB, with 0 dB being barely audible and 120 dB being barely tolerable. Conversational speech is fairly loud, at around 50 dB.

Detection :: An auditory response that indicates a sound was heard. A child might indicate he or she detects a sound with a head turn, nodding, raising a hand, putting a toy in a container, etc. The fact that a child detects a sound does not necessarily mean he or she can discriminate it from other sounds – detection is simply an indication of the presence or absence of a sound.

Diagnostic therapy :: Diagnostic therapy refers to the process of using the therapy environment to gain an understanding of a child's level of speech, language or auditory development. Through a series of fun activities, the auditory habilitation specialist may attempt to determine how well the child is making use of hearing through a hearing aid or an implant, without the use of formal test measures.

Direct input :: Direct input refers to plugging an external sound source directly into the speech processor using a patch cable. Any battery-operated device can be connected to the MED-EL speech processors.

Discrimination :: The ability of a child to understand a sound, word, or sentence. Usually speech discrimination is measured by asking the child to point to various objects or repeat various words or sentences.

Dynamic range :: A term used to define the loudness difference between the softest sound a person can hear, and the loudest sound they can still comfortably tolerate. The dynamic range of hearing is about 120 dB for most people with typical hearing. The dynamic range of the implant user is about 30 dB. The Automatic Sound Management system allows a sound range of 25-100 dB to be represented accurately by the speech processor, giving the implant user an expanded dynamic range of 75 dB.

Earhook :: The earhook has a dual purpose: it holds the speech processor on the ear, and in the case of the TEMPO+/OPUS I, it connects the battery pack (or battery pack cable) to the speech processor. The earhook can be ordered in a locking configuration to keep a child from removing it.

Educational specialist :: In this guide, the term refers to a professional who specializes in educating children with cochlear implants in a wide variety of educational settings. This professional may provide advice and support to a child's educational team, or evaluate a child's readiness for a certain type of educational approach. The educational specialist could be a teacher of the deaf/hard of hearing, an educational audiologist, or other related professional.

Electrical auditory brainstem response testing (EABR) :: This is a method of obtaining an ABR but using the sound generated by the implant. Because head movement can obscure the response, children are often lightly sedated for the test. This test assists in determining how well the auditory system is responding to the stimulation generated by the implant.

Electrical stapedius reflex test (ESRT) :: An objective measure that can be useful in establishing an MCL measurement in children who are unable to provide feedback to the audiologist about the loudness of sound. A small probe is placed in the opposite ear. The stimulation level of the implant is increased until a small muscle reflex is seen in the opposite ear. This muscle reflex is present in most people, and occurs at a level that is loud, but still comfortable. The level at which this reflex occurs correlates well with the MCL level of the map.

Electrode array :: The implanted device has a long, flexible portion that is inserted into the cochlea through a small opening. This portion of the device is called the electrode array.

Electrode contacts :: Electrode contacts are small oval-shaped disks made of platinum that are arranged along the electrode array. In MED-EL implants, they are arranged in 12 pairs. Each pair stimulates a different frequency region in the cochlea.

Electrostatic discharge (ESD) or static electricity :: A build-up of charge difference between a person and an object, often caused by friction between synthetic materials, or electronic equipment (such as TV screens), usually felt as a “shock” when the statically charged person touches a grounded object. The cochlear implant user does not feel the “shock” any differently from a non-user. A good example is the shock that occurs when touching a light switch after walking on the carpet. ESD tends to be worse in a dry environment. ESD can cause damage to electronic equipment of all kinds. MED-EL speech processors have built-in safeguards to protect the processor from program loss due to ESD. Please refer to the *Equipment Guide* for the child’s speech processor for more discussion on ESD.

Expressive language :: The ability of the child to produce language to communicate with others.

FineTuner :: The FineTuner is the remote control device for use with the OPUS 2 control unit. It is used for changing sensitivity, volume and program settings.

Fixation device :: A small accessory that is attached to the battery pack that allows it to be connected to the clothing. The fixation bar can accommodate a small safety pin or diaper pin. The fixation clip can be clipped directly to clothing.

FM system :: An assistive device that consists of a microphone and transmitter worn by the speaker, and a receiver worn by the listener. In the case of the implant, the receiver must somehow connect to the speech processor with a patch cable, or with direct connection to the OPUS 2 FM battery cover. An FM system sends the speaker’s voice to the listener using FM radio waves to help overcome the problems of distance and background noise.

Hair cells :: The hair cells in the inner ear sense the pitch and intensity of sound waves that travel through the fluid of the inner ear. In most instances of deafness, the hair cells or some part of the anatomy associated with them do not function properly and cannot send signals accurately to the brain. The cochlear implant attempts to mimic the function of the hair cells by generating a signal similar to what the brain might normally receive from the inner ear.

Hertz (Hz) :: A measure of pitch that refers to the number of cycles per second that a sound causes oscillation. The range of human hearing is 20 Hz – 20,000 Hz. Speech information falls roughly in the frequency range 200 Hz – 6000 Hz. “Middle C” on the piano occurs at 262 Hz.

Implant :: The implanted portion of the system. The implant contains the receiver circuitry that decodes the signal from the coil, and also generates the tiny electrical pulses that travel down the electrode array and stimulate the cochlea. This receiver and stimulation circuitry is encased in a thin, and very strong package that sits just under the skin. The electrode array carries the electrical impulse from the implant case to the cochlea. The implant also contains a reference electrode that ensures the appropriate handling of electrical current. The implant contains a magnet, which attracts the external transmitting coil so that it is held in the correct place on the head.

Implant case :: The implanted electronics are hermetically sealed inside the case. MED-EL implants are the thinnest and smallest implants available.

Individualized education plan (IEP) :: Although the IEP has a different name in some states, the term refers to the formal educational plan that is developed for each child who receives special services through a local school district. Federal law requires that schools provide a “free and appropriate” education to all children, including those with special needs. The IEP is a document that defines the services that will be provided to meet that law. The IEP is developed with input from the child’s parents, the child (when appropriate), teachers, school administrators and special service providers.

Inner ear :: The anatomical portion of the hearing system that triggers nerve impulses that travel to the brain. Both the hearing and balance systems are found in the inner ear. The cochlea is a small snail-shaped structure that contains the tiny hair cells that sense sound and send signals to the auditory nerve. The semicircular canals sense balance and position changes and report these changes to the brain.

Input dynamic range (IDR) :: See Dynamic Range. The IDR a measure of the implant system’s ability to handle a wide range of sound inputs accurately. The IDR of the MED-EL system is 75 dB.

LED indicator :: The small red light on the front of the processor will flash in a variety of blinking patterns to indicate different status or error conditions of the processor or batteries.

Localize :: The act of locating the source of a sound.

Magnet :: There are two magnets in the system: one in the coil and the other in the implant case. Together the two hold the coil in place on the head. The implant center audiologist can adjust the magnetic strength of the coil.

Map :: The program stored in the speech processor that tells the system how to process sound on each channel so that it is most audible and comfortable for the individual user. Each implant user's map varies considerably from every other user. Maps also change over time, as the human body also fluctuates slightly in its sensitivity to electrical stimulation over time.

Mapping sessions :: A visit to the implant center where the individual's speech processor program is evaluated and changed if necessary

Mastoid bone :: The area of bone directly behind the ear where the implanted portion of the system is placed.

Microphone port :: The tiny opening on the front corner of the processor is the microphone port.

Microphone test device (MTD) :: An optional accessory that allows a hearing person to listen to the microphone of the processor to determine whether it is functioning adequately.

Middle ear :: The anatomical portion of the ear just beyond the eardrum. The middle ear consists of a small air space that holds the three small bones of hearing (malleus, incus and stapes). The Eustachian tube allows air exchange between the middle ear air space and the outside; when the ears 'pop' during a change in altitude, this is actually the pressure equalizing between the middle ear and the outside. The middle ear is the most common site of an ear infection.

Mixing cables :: "Mixing" refers to a feature of certain assistive listening devices (such as FM systems) that allows the user to combine the signal from the speaker with the signal from the speech processor microphone. The processors support this feature, but it is necessary to ensure that a mixing patch cable is in use.

Most comfortable loudness (MCL) :: MCL refers to a loudness level that is loud, but still comfortable, to the listener. This is an important measurement made on each channel during a mapping session. The final MCL setting of the map sets an upper limit for loudness, and stimulation will never exceed that limit. MCL levels are different for each user; therefore it is important that speech processors are never traded between users.

MRI scan :: Magnetic Resonance Imaging is a medical diagnostic procedure. At the time of printing, MED-EL cochlear implants are FDA approved for 0.2T (Tesla) MRI scanners without the removal of the implant's internal magnet. Only machines of 0.2T strength should be utilized with MED-EL at this time. Additional factors, such as head placement, make it important for the scanning radiologist to contact MED-EL prior to scheduling the MRI scan.

Newborn hearing screening :: A program in place in many hospitals that allows a child's hearing to be evaluated immediately after the baby is born.

ON/OFF switch :: The ON/OFF switch is located on each of the TEMPO+ and OPUS 1 battery packs. The battery pack lock functions as the ON/OFF switch for the OPUS 2.

Otologist/Neurotologist :: An otologist is a physician who first became an ear, nose and throat specialist, and then went on to specialize in just the ears and the area of the head surrounding the ear. An otologist completes over 10 years of medical training and a specialized otology training fellowship prior to entering practice.

Outer ear :: The anatomical portion of the hearing system that includes the pinna (the visible "ear" on the outside of the head), the ear canal, and the eardrum (tympanic membrane).

Phoneme :: The smallest unit in a language that is capable of conveying a change in meaning. For example, the m in mat and the b in bat. There are 41 phonemes in the English language

Phonemic repertoire :: The range of various phonemes (speech sounds) that a child is able to produce. Generally, certain speech sounds seem to develop earlier than others over a period of several years.

Play audiometry :: An audiometric technique that teaches a young child to complete an activity when a sound is heard (such as dropping a block into a container or putting a piece in a puzzle). This facilitates testing the hearing of preschoolers and toddlers.

Program switch :: The program switch on the TEMPO+ and OPUS 1 allows the user to select different programs, or maps. The FineTuner is used to change programs for the OPUS 2 speech processor. Please refer to the implant center audiologist or parent to determine which program should be used most of the time.

Receptive language :: The ability of the child to understand language that is presented to him/her.

Residual hearing :: This is the term used to describe the hearing that remains after a hearing loss occurs. Most people with significant hearing loss still have some residual hearing that can be stimulated by amplifying sound using a hearing aid. However, the remaining hearing often does not provide enough clarity for a hearing aid to be of much benefit. These are the individuals who are candidates for cochlear implantation.

Sensitivity control :: The sensitivity control determines how sensitive the microphone is. High sensitivity settings cause the microphone gain to be increased. This can be good in a quiet environment, but in a noisy environment, it results in poor loudness relationships between soft and loud sounds. The general “rule of thumb” is to keep the sensitivity setting at about half-way on.

Sound field FM system :: An FM system that does not plug into the speech processor. Instead, a small speaker near the listener amplifies the speaker’s voice. A sound field system is a good alternative to regular FM if the child is unable to provide feedback on the quality of a direct FM connection.

Speech awareness threshold (SAT) :: The softest level at which a child can detect a spoken word. However, the child is not required to be able to understand the spoken word.

Speech processor :: A tiny wearable computer that transforms sound into the coding understood by the implant. The TEMPO+ and OPUS 1 processor contain a microphone, a sensitivity control, a program switch, and a volume switch. The OPUS 2 contains a microphone and an on/off switch, with other functions accessible through the FineTuner remote control unit. The processors connect to different battery packs. The term “speech processor” is often used to refer to the entire external part of the system (control unit, battery pack, coil and cable).

Speech reception threshold (SRT) :: The softest level at which a child can hear a spoken word well enough to repeat it back correctly.

Speech-language pathologist :: A speech language pathologist is a specialist in the diagnosis and non-medical treatment of speech and language disorders. An SLP obtains either a Master’s or Doctoral level degree, and then completes a training fellowship prior to entering practice.

Steady state evoked potentials :: An objective measure of hearing that requires no participation from the child. SSEP’s provide detailed information about the child’s hearing acuity. This is a very new measure that does not yet have widespread availability.

Suprasegmental :: The cues of language that come from pitch, intensity and durational differences in the pattern of speech. Suprasegmentals are what allow an English speaker to recognize the inflection of a question, even though the question is asked in another language.

Telecoil :: The OPUS 2 has an integrated telecoil. The telecoil picks up magnetic sound signals coming from telephone receivers or loop systems which are installed in some public buildings, allowing another option for hearing on the phone or receiving input from assistive devices.

Telemetry :: A feature built into the implant system that allows the audiologist to test the function of the implanted portion of the system. This is a quick test that requires no input from the child, and provides valuable information about how well the electrodes are functioning.

Telemic :: An optional accessory to the TEMPO+ and OPUS 1 processors that allows the user to take advantage of two features: a built-in telecoil for accessing certain assistive listening devices, or an external microphone.

Threshold :: Hearing threshold is defined as the level at which a person hears a sound 50% of the time. This means it is so soft, that the listener isn’t even sure the sound is really there. When the audiologist performs an audiogram, he or she is trying to find the child’s threshold of hearing at different pitches across a spectrum from low to high pitch. Threshold can also refer to the softest level of electrical stimulation a child can perceive. In the MED-EL mapping software, the threshold setting of the map is abbreviated as “THR.” However, with MED-EL cochlear implants, threshold is defined as a level below the level where the patient perceives a sound. Threshold measures do not significantly impact the quality of the resulting map, and often are not measured.

Tonotopic organization :: The inner ear and the auditory area of the brain and central nervous system are arranged in pitch order, from low to high. Sounds of different pitches are processed by different hair cells, nerve fibers, or brain synapses. The cochlear implant, therefore, is designed to present pitch information to the areas of the cochlea that are “tuned” to be sensitive to those pitches.

U-pin :: A connection accessory that allows a battery pack to be connected to the speech processor without using an earhook. It is most commonly used in the BabyBTE™ configuration. The u-pin can also be ordered in a “locking” configuration, which keeps a small child from removing it from the processor.

Visually reinforced audiometry (VRA) :: This is a technique for obtaining responses to sounds from children who are not yet able to report what they hear. The child is presented with a sound, and when they respond, they are rewarded with something they can see, such as a puppet or an animated toy. The audiologist attempts to condition the child to look for the toy when a sound is heard, thus providing a method for testing the hearing of small children.

Vocal play :: The act of experimenting with the voice. Babies go through various stages of playing with their voices. This play becomes more and more speech-like until true words emerge. When a young child with a cochlear implant begins experimenting with his or her own voice, it is a good indicator that the child is hearing sound through the implant and is beginning to make the connection between hearing and the voice. With more time and practice, these vocalizations should begin to approximate words or phrases.

Volume switch :: The volume switch (x-y-z) on the TEMPO+ and OPUS 1 allows the user to choose different volume levels for each program. The FineTuner is used to adjust the volume levels for the OPUS 2. The audiologist sets the volume levels, so it is best to consult the child’s parent or implant center for guidance on the correct volume setting for the child.



**A Commitment
to Excellence**

MED-EL is a company that is dedicated to helping improve the lives of individuals with hearing loss through research and development of technologies that restore hearing. We pride ourselves on technological excellence, providing service and support that are second to none. We continue a tradition of innovative research and development that began in 1975.

A Heritage of Industry Firsts

- 2007** **First introduction of EAS™** and approval of the Vibrant Soundbridge® for conductive and mixed hearing losses in Europe. Launch of the DaCapo rechargeable battery system.
- 2006** MED-EL launches the OPUS family of audio processors and introduces the SONATA™ cochlear implant with a new small titanium housing.
- 2005** Introduction of the MED-EL DUET, the **first hearing system** worldwide to integrate cochlear implant audio processing and hearing aid technology in one compact device.
- 2004** MED-EL launches the PULSAR™ cochlear implant, providing future-ready electronics in an optimized ceramic housing.
- 2003** Acquisition of the Vibrant Soundbridge®, the **first implantable middle ear hearing device** for mild-to-severe sensorineural hearing loss.
- 2002** The TEMPO+ is the most widely used high-rate BTE audio processor worldwide.
- 2000** MED-EL founders celebrate 25 years of cochlear implant research and development.
- 1999** Launch of the TEMPO+ behind-the-ear (BTE) audio processor. MED-EL celebrates 10th anniversary and opens new state-of-the-art manufacturing facilities.
- 1997** The COMBI 40+ Split Electrode (GB) first implant to address cases of cochlear ossification.
- 1996** Introduction of the COMBI 40+, the **thinnest cochlear implant available** worldwide.
- 1995** Introduction of the CIS LINK system.
- 1994** Introduction of the COMBI 40, the **world’s first multi-channel high-rate cochlear implant**.
- 1991** MED-EL launches the **world’s first BTE** (behind-the-ear) audio processor.
- 1989** MED-EL is founded in Innsbruck, Austria. Introduction of the COMFORT cochlear implant, containing both the antenna and the electronics in a robust ceramic case.
- 1977** Implantation in Vienna of the **world’s first microelectronic multi-channel cochlear implant**.
- 1975** Cochlear implant development started by MED-EL founders Ingeborg and Erwin Hochmair.

BRIDGE is a program for education and rehabilitation professionals developed by MED-EL.
For more information about BRIDGE products, please visit www.medel.com.



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