

# Audiological bulletin No. 5:

## Fitting a CROS or BiCROS hearing aid system

For individuals with asymmetric hearing loss, a CROS or BiCROS hearing aid system can be a good solution to provide better hearing in noisy environments and to localise sound sources. This audiological bulletin gives a brief overview of CROS and BiCROS systems and describes the solutions provided by Widex. You also find instructions on how to fit a Widex CROS or BiCROS system.

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### When is a CROS or BiCROS hearing aid required?

CROS and BiCROS hearing aid systems enable clients to hear sounds from both sides of the head when the hearing ability in one ear is so reduced that it cannot be helped by traditional hearing aid solutions. The typical candidate for a CROS system (Contralateral Routing Of Signals) has no functional hearing in one ear and normal hearing in the other ear. A typical candidate for a BiCROS system (Bilateral Contralateral Routing Of Signals) has no functional hearing in one ear and hearing loss in the other ear.

### CROS hearing aid systems

#### What is a CROS hearing aid system?

A CROS hearing aid system picks up sound from the side of the head with no functional hearing and feeds it to a modified hearing aid at the ear with normal hearing, without amplification. The ear with normal hearing receives sounds from both sides; sound picked up by the microphone at the non-hearing ear and natural sound picked up by the ear with normal hearing. This may help the individual to hear better in noisy environments and to localise sound sources.

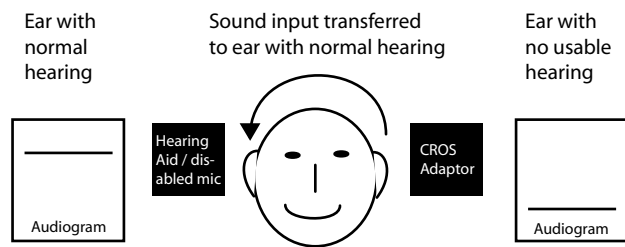


Figure 1. A CROS system is used when there is almost no hearing in one ear and normal hearing in the other ear. The sound from the non-hearing ear is routed to the ear with normal hearing.

The CROS system is very robust towards feedback, because the physical distance between the CROS adaptor microphone located on one side of the head and the receiver in the hearing aid located on the other side of the head is sufficiently large. Feedback is reduced by up to 20 dB in the high-frequency range due to the head shadow effect.

The basic part of a CROS hearing aid system is a CROS adaptor. The adaptor is a BTE housing containing only a microphone to pick up sounds, and a hearing aid, in which the microphone is disabled. The sound picked up by the CROS adaptor is routed to the amplifier and receiver in the hearing aid at the normal-hearing ear. An open earmould connected to the modified hearing aid ensures that natural sound enters the normal-hearing ear directly. The CROS adaptor is powered by the battery in the hearing aid on the ear with normal hearing and is kept in place on the ear by an open earmould.

The following items are part of a CROS hearing aid system:
CROS adaptor and an open earmould
CROS adaptor cable
Audio shoe
BTE hearing aid with a disabled microphone and an open earmould or vent size 2.5 mm or bigger

For a CROS system, a BTE hearing aid of the Bravo series is recommended. A Bravo BTE hearing aid can easily provide the needed gain, which is 5 to 15 dB. In a CROS system the sound is redirected from the ear with almost no usable hearing to the ear with normal hearing; therefore sophisticated signal processing, like feedback cancelling or directional microphones, is not needed.

#### Order information for Widex CROS systems

The following table gives an overview of the audio shoes and CROS adaptor needed for Bravo CROS hearing aid systems.

Hearing aid model	Audio shoe number	Order number, delivered in a box	Order number, audio shoe only
Bravo B1, B2	Widex 1	7 525 0110 000	4 012 1801 OBB
		7 525 0110 001	4 012 1801 ONA
Bravo B11, B12	Widex 2	7 525 0105 000	4 012 1101 OBE
		7 525 0105 001	4 012 1101 OTR
Bravo B32	Widex 3	4 012 1201 OBB	7 525 0106 000
CROS adaptor		4 132 9000 plus colour information	

Table 1. Audio shoes and CROS adaptor for CROS hearing aid systems

### Fitting a CROS hearing aid system

When fitting a CROS hearing aid system, the hearing aid should not amplify sounds unnecessarily. Its task is to transfer sound from the side of the head with no hearing to the normal-hearing ear.

Follow the instructions below to set up a CROS hearing aid system:

1. Disable the microphone in the hearing aid for the normal-hearing ear.
2. Place the hearing aid on the ear with normal hearing. Use an open earmould to allow natural sound to enter the ear and avoid occlusion.
3. Place the CROS adaptor with a open earmould on the ear with no hearing.
4. Connect the CROS adaptor to the hearing aid using the CROS cable and the recommended audio shoe (see table 1).

The pictures in Figure 2 show a CROS hearing aid system with a CROS adaptor on the left ear and a modified hearing aid on the right ear. The earmould at the right ear must be an open earmould to allow natural sound to enter the ear with normal hearing.



*Figure 2. A CROS adaptor on the left ear and a hearing aid with an audio shoe on the right ear; a CROS adaptor cable connects the two units.*

Follow the instructions below to fit a CROS hearing aid system:

1. Pre-fit the hearing aid to a hearing threshold level of 10 dB above the client's hearing threshold. The hearing threshold of a normal-hearing person lies in the range of 0 to 20 dB HL.
2. Present sounds at different levels to the ear with normal hearing, and then to the ear with no hearing. Fine tune gain using the fine-tuning parameters LF and HF, until the client is satisfied with the sound from the CROS hearing aid system.

Because a CROS hearing aid system overcomes the head shadow effect, it increases intelligibility in noisy environments when speech comes from the side with the ear with almost no hearing left. When speech comes from the side with the ear with normal hearing, the signal from the CROS adaptor may reduce intelligibility. Take this into consideration during the fitting.

### Need to know for the CROS system user

With a CROS hearing aid system, sounds coming from all directions are audible in the ear with normal hearing. After a period of getting used to wearing a CROS hearing aid system, and by training the good ear, some users may experience an improved ability to localise sound sources. The localisation builds on the differentiation between the sound coming from the CROS adaptor and the natural and non-amplified sound entering the normal-hearing ear.

## BiCROS hearing aid systems

### What is a BiCROS hearing aid system?

A BiCROS hearing aid system picks up sounds from both sides and transmits them to the better ear. The sounds coming from both sides of the head are amplified to compensate for the hearing loss at the better ear. This may help the individual with asymmetric hearing loss to hear better in noisy environments and to localise sound sources.

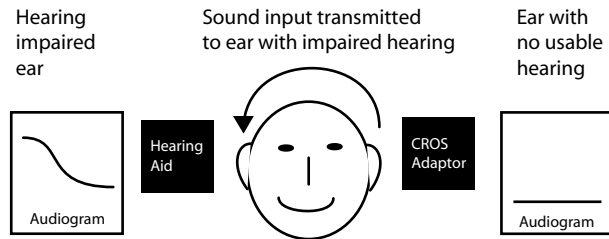


Figure 3. A BiCROS system is used when there is almost no hearing in one ear and hearing loss in the other ear. The sound from the poorer ear is transmitted to the better ear. At the better ear, sounds coming from both ears are amplified to compensate for the hearing loss.

The basic parts of a Widex BiCROS hearing aid system are a CROS adaptor and a regular hearing aid without any modifications. The BiCROS hearing aid system therefore has two microphones, one in the CROS adaptor and one in the hearing aid; both are connected to the amplifier and receiver of the hearing aid. In other words, the hearing aid receives an additional Direct Audio Input from the CROS adaptor.

<b>A BiCROS hearing aid system consists of:</b>
CROS adaptor with open earmould
CROS adaptor cable
Audio shoe
BTE hearing aid with earmould appropriate for the hearing loss

Most Widex BTE hearing aids can be used in a BiCROS hearing aid system. The hearing aids Senso C9 and C19 are not recommended because the hearing aid microphones are always in directional mode.

### Order information for Widex BiCROS hearing aid systems

Table 2 gives an overview of the audio shoes and CROS adaptor needed for hearing aids used for BiCROS hearing aid systems.

Hearing aid model	Audio shoe	Order number (delivered in a box)	Order number for audio shoe only
Senso Diva SD-9	Widex 1	7 525 0110 000 7 525 0110 001	4 012 1801 0BB 4 012 1801 0NA
Senso Diva SD-19	Widex 5	7 525 0112 000	
Senso Vita SV-9	Widex 1	7 525 0110 000 7 525 0110 001	4 012 1801 0BB 4 012 1801 0NA
Senso Vita SV-19	Widex 5	7 525 0112 000	
Senso Vita SV-38	Widex 3 II	4 012 2300	
Senso C8+, C18+	Widex 2	7 525 0105 000 7 525 0105 001	4 012 1101 0BE 4 012 1101 0TR
Senso P7, P8	Widex 1	7 525 0110 000 7 525 0110 001	4 012 1801 0BB 4 012 1801 0NA
Senso P37, P38	Widex 3	4 012 1201 0BB	7 525 0106 000
Digital A3, A4	Widex 1	7 525 0110 000 7 525 0110 001	4 012 1801 0BB 4 012 1801 0NA
Bravo B1, B2	Widex 1	7 525 0110 000 7 525 0110 001	4 012 1801 0BB 4 012 1801 0NA
Bravo B11, B12	Widex 2	7 525 0105 000 7 525 0105 001	4 012 1101 0BE 4 012 1101 0TR
Bravo B32	Widex 3	4 012 1201 0BB	7 525 0106 000
LOGO L6, L8, L9, L12	Widex 2	7 525 0105 000 7 525 0105 001	4 012 1101 0BE 4 012 1101 0TR
Logo L26E, L32	Widex 3	4 012 1201 0BB	7 525 0106 000
CROS adaptor		4 132 9000 plus colour information	

Table 2. Recommended audio shoes and CROS adaptor for hearing aids used in BiCROS hearing aid systems

### **Fitting a BiCROS hearing aid system**

When fitting a BiCROS hearing aid system, the hearing aid's task is to amplify sounds coming from the ear with almost no hearing together with the sounds coming from the better ear. Typically the CROS adaptor is fitted simultaneously with the hearing aid. Then the client can use the hearing aid alone or together with the CROS adaptor. Some hearing aid users may not want to use the CROS adaptor all the time, but only on certain occasions.

Follow the instructions below to place and fit a BiCROS hearing aid system:

1. Perform a regular hearing aid fitting using Compass or the SP3 programmer for the ear to be fitted with the hearing aid.
2. Place the CROS adaptor on the ear with no hearing.
3. Connect the CROS adaptor to the hearing aid using the CROS cable and the recommended audio shoe.
4. Present sound samples to the hearing aid user with the CROS adaptor and the hearing aid in place and use the fine-tuning parameters to find the best settings for the hearing aid user.
5. **For all Widex hearing aids, except the Senso Vita series:**  
Increase the gain of the hearing aid manually to compensate for the attenuation of 2-3 dB per microphone. This attenuation is a result of two microphone inputs in one hearing aid.

#### **For Senso Vita:**

In a BiCROS fitting you can increase or decrease the contribution from the CROS adaptor without affecting amplification of other sounds by using the DAI program gain parameter (Direct Audio Input). For more information, see the Senso Vita manual.

**Note:** When the CROS adaptor is plugged in, the hearing aid changes automatically from ordinary use to use with a CROS adaptor. For the Senso Vita hearing aid series it is different. When a Senso Vita BTE hearing aid is used in a BiCROS system, the hearing aid user must activate one of the listening programs with telecoil (MT or T), as the CROS adaptor input replaces the telecoil input.

### Need to know for the BiCROS system user

With a BiCROS hearing aid system, sounds coming from all directions are audible in the ear with hearing loss. Widex hearing aids react differently when an audio shoe is connected for use in a BiCROS system. For details on how hearing aids react see Table 3.

Widex hearing aid series	Reaction when an audio shoe is connected	CROS adaptor signal audible	CROS adaptor signal not audible
Senso Diva	Switches off the Locator system when an audio shoe is connected. The hearing-aid microphone is in omnidirectional mode.	Listening programs M, MT and Music	Listening program T
Senso+ and Bravo	No behavioural change.	Listening programs M or MT	Listening program T
Senso Vita	No behavioural change. The Senso Vita hearing aid must be set to a listening program with telecoil.	Listening programs MT or T	Listening program Quiet (M) or Noise

*Table 3. Hearing aid behaviour when connecting an audio shoe.*