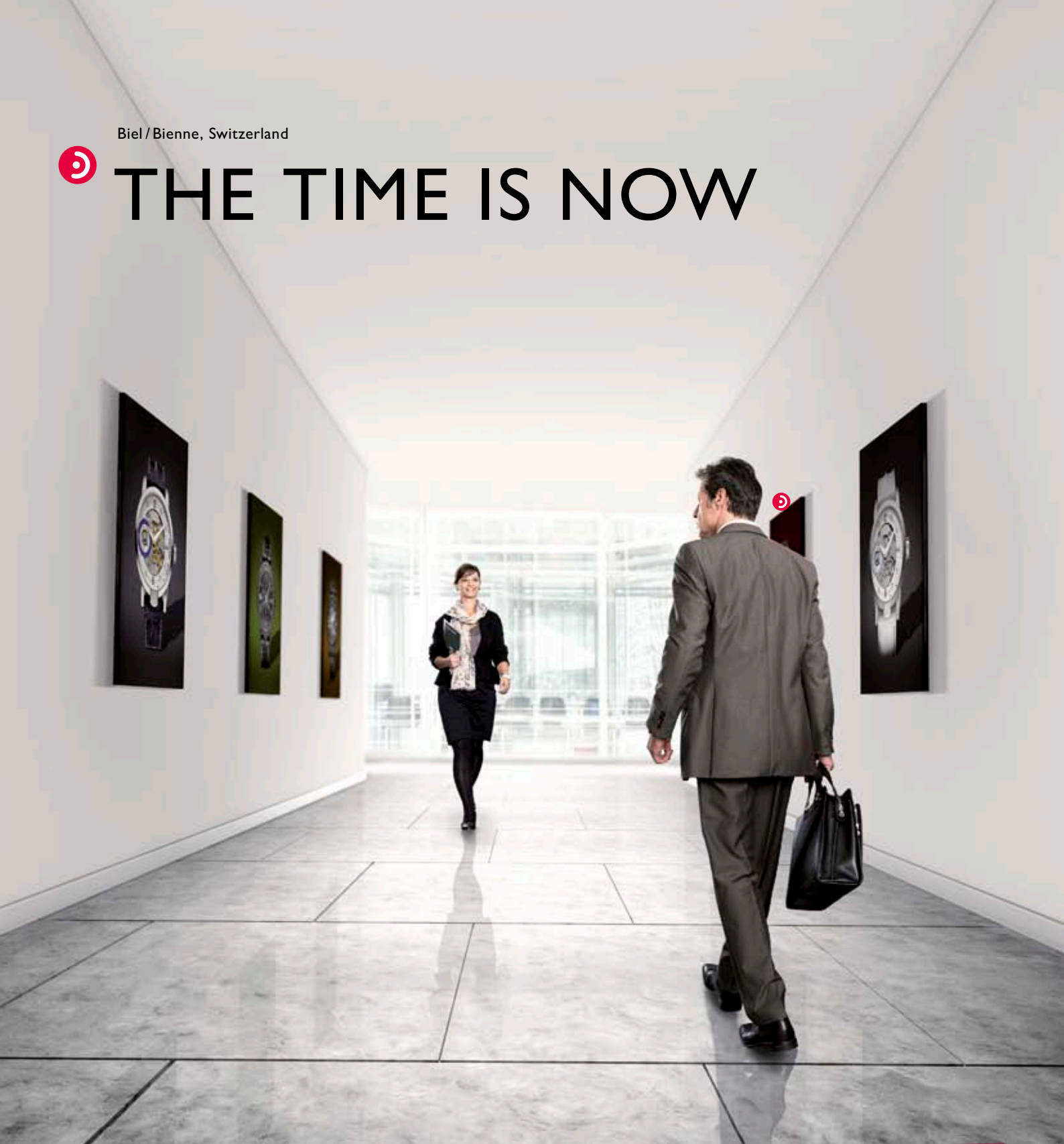


Biel / Bienne, Switzerland



# THE TIME IS NOW



CHRONOS 9 | 7 | 5



AUDIO  
EFFICIENCY™

[www.bernafon.com](http://www.bernafon.com)

**bernafon**<sup>®</sup>  
Your hearing • Our passion





# Chronos




## Sounds in ProperTime

You know what to expect from Swiss engineered precision instruments: exactness, reliability, and longevity. Precisely the qualities you can expect from Chronos hearing systems.

Chronos' small size conceals its grandeur of precision and proven soundness. Equipped with our new proprietary **Audio Efficiency™** technology, Chronos maps your client's sound world as accurately as a Swiss watch tells time.

Designed to last, Chronos' symphony of cutting-edge technology harmonizes speech understanding and listening comfort – never missing a beat in time.

**SWISS**   
Engineering

# Audio Efficiency™ – A Technology Ahead of the Times

An efficient system is only as strong as the sum of its parts; and a hearing instrument system can be treated no differently.

The ability to process incoming signals quickly and efficiently in all listening environments, without compromise, is a challenge for any listener, but even more so for the hearing-impaired person.

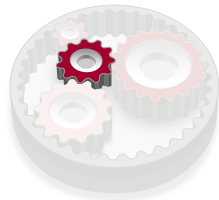
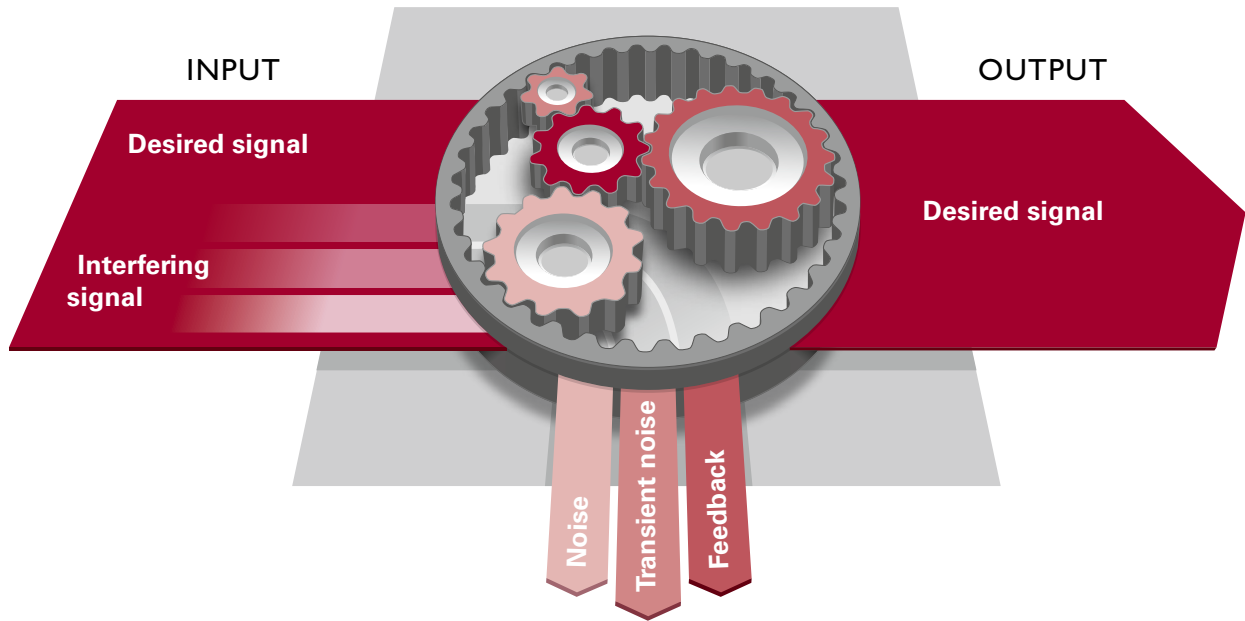
Combining the most sophisticated speech and comfort technologies in the hearing instrument industry, our newest family of hearing systems, Chronos, offers the best of both worlds with its new **Audio Efficiency™** technology.

In addition to **ChannelFree™**'s high temporal and frequency resolution to improve speech understanding, Audio Efficiency™ in Chronos also provides highest levels of listening comfort with the integration of **Transient Noise Reduction, Adaptive Feedback Canceller Plus**, and **Adaptive** and **True Directionality™**.

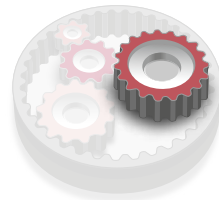


CHRONOS  
**PERFORM**

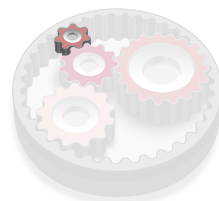
## AUDIO EFFICIENCY™



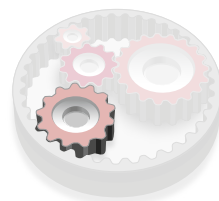
**ChannelFree™ signal processing** works at the phonemic level: it analyzes the incoming signal as a whole and applies gain 20,000 times per second. The result is clear and natural sound.



**Transient Noise Reduction** applies sophisticated algorithms to identify transient noise as it surfaces only to then immediately suppress it; critical speech information is preserved.



The **Adaptive Feedback Canceller Plus** continuously measures all incoming signals for oscillations, and immediately suppresses all identified feedback paths with high-speed Phase Cancellation. Its proactive approach eliminates feedback before it can become audible.



**Adaptive and True Directionality™** reproduce the manner in which low and high frequency sounds are propagated through the auditory system. As a result, sound is perceived as if naturally.

# Audio Efficiency™ Seeks Out Speech

## ChannelFree™ signal processing

The benchmark of all successful hearing instrument fittings corresponds to your client's most pressing need: understanding speech – clearly and without the extra effort.

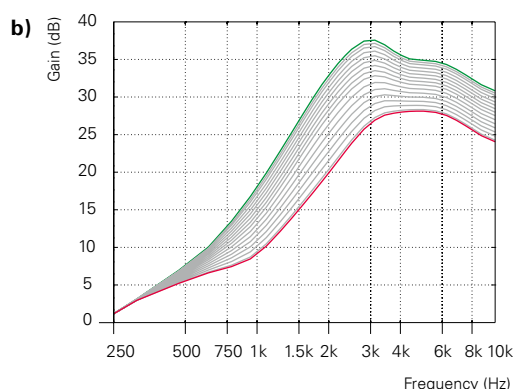
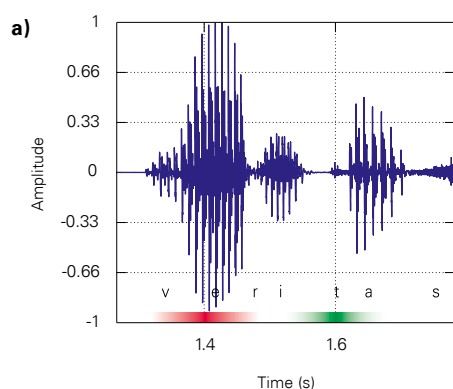
Since the intensities of speech sounds vary dramatically over time, these signals need precise identification and adequate amplification to ensure maximum speech intelligibility.

Yet speech is highly complex. Taken apart, a conversation amounts to sentences, fragments, words, syllables, and – in its smallest – phonemes. And it is precisely there, at the phonemic level, that each signal must be processed independently.

Traditional processing systems, however, monitor signals at the syllabic level: they deliver compression based only on the minimal intensity variations of syllables.

In contrast, Bernafon's exclusive **ChannelFree™ signal processing** works at the phonemic level. It analyzes the incoming signal as a whole and applies gain 20,000 times per second. At such a fast rate, ChannelFree™ can treat each phoneme independently and, as a result, ensure that appropriate gain is applied – even to the smallest units of speech. This is critical for speech understanding.

By identifying and amplifying even the softest sounds, ChannelFree™ signal processing in Chronos provides your client with clear and natural sound.



ChannelFree™ signal processing rapidly identifies incoming signal levels (a), and accurately applies the appropriate amount of gain (b) to ensure that neither speech cues nor environmental information is lost.



CHANNELFREE™  
SIGNAL PROCESSING



AUDIO  
EFFICIENCY™



CHRONOS

SYNCHRONIZE

# Audio Efficiency™ Keeps Comfort In and Feedback Out

## Feedback management

Although inherent to electronic amplifying systems, feedback is not necessarily always audible. Its annoying whistling sound only results if poorly identified or improperly addressed – often found in conventional phase cancellation systems that react too late.

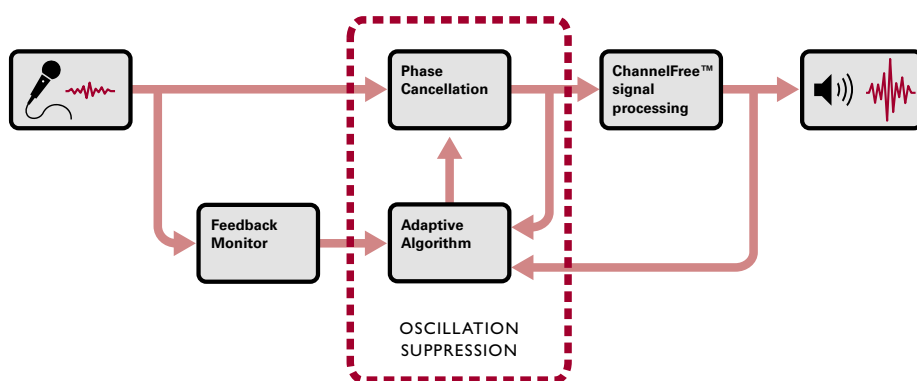
To ensure accurate identification of unstable signals, the Feedback Monitor of Chronos' new **Adaptive Feedback Canceller Plus (AFC Plus)** continuously measures all incoming signals for oscillations, and instantaneously suppresses all identified feedback paths with high-speed Phase Cancellation.

Proactive in its unique approach, the AFC Plus eliminates feedback before it can be heard.

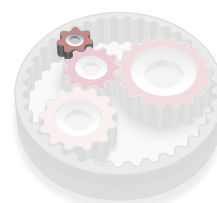
By applying the 3-step cancelling method below, Chronos' AFC Plus nips feedback in the bud:

- The **Feedback Monitor** continuously monitors the incoming signals every 25 msec to identify any feedback-like characteristics. Previously amplified signals are marked and tracked so that if they should reappear, they can be eliminated instantaneously.
- The **Adaptive Algorithm** analyzes the information provided by the Feedback Monitor and determines how the signal is to be treated.
- The **Phase Cancellation** method instantaneously suppresses any feedback so that it cannot become audible.

Compromising neither speech nor comfort, Chronos provides feedback-free fittings for every acoustic environment.



The Bernafon AFC Plus' Feedback Monitor monitors the frequency content of incoming signals, and sends information to the Oscillation Suppression block to cancel feedback components before they can become audible.



FEEDBACK  
MANAGEMENT

CHRONOS  
MONITOR





AUDIO  
EFFICIENCY™



CHRONOS  
**REACT**



AUDIO  
EFFICIENCY™

# Audio Efficiency™ Performs on Cue

## Transient Noise Reduction

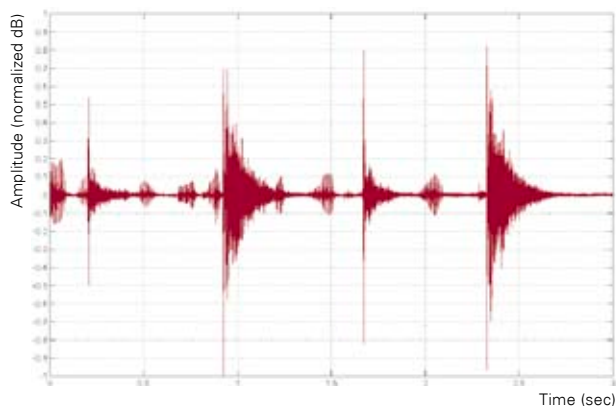
In digital hearing instruments, noise reduction systems effectively manage continuous noise sources such as traffic, vacuum cleaners, and power mowers. The handling of transient noise signals – such as glass breaking, newspaper rustling, or rattling silverware – however, exceeds the capacities of most systems.

Hearing instrument wearers, both experienced and new, name transients among the most uncomfortable environmental sounds experienced.

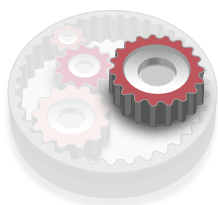
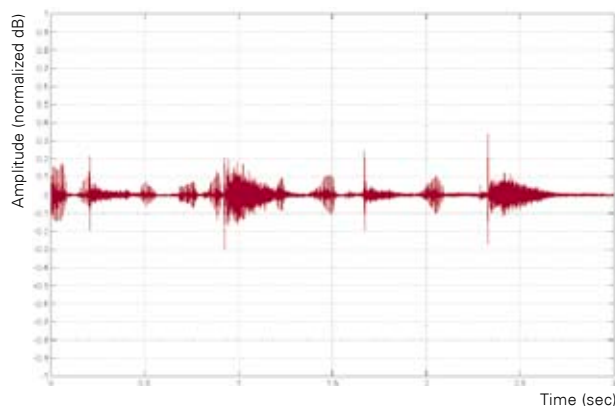
The key to handling transient sounds is to detect and provide appropriate suppression while maintaining and preserving important speech cues. Since transients are unexpected, of short duration and high intensity, traditional compression characteristics fail to address them adequately.

Chronos' **Transient Noise Reduction** system applies sophisticated algorithms to identify transient noise as it surfaces only to then immediately suppress it. Consequently, your client receives all critical speech information, without compromising listening comfort.

Transient Noise Reduction **off**



Transient Noise Reduction **on**



NOISE MANAGEMENT



AUDIO  
EFFICIENCY™

# Audio Efficiency™ Locates Sounds

## Adaptive and True Directionality™

At all times, we are immersed by sounds. And by knowing their approximate whereabouts, we feel at ease.

The healthy ear can locate any sound's direction – be it from the front, back, or the sides – because of the manner in which sound travels around our body, head, and outer ears.

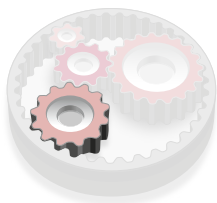
In hearing instruments, microphones substitute the pinna's ability to filter sound. In BTEs, however, the microphones sit too high on the ear thus impairing the listener's ability to locate sounds.

Chronos' **True Directionality™** eliminates such confusion, because it reproduces the manner in which low and high frequency sounds are naturally propagated through the auditory system. By keeping low frequency signals audible while maintaining sensitivity to high frequency signals, it allows your client to perceive sound as if naturally.

True Directionality™, paired with Chronos' **Adaptive Directionality**, further enhances your client's natural listening experience.

Depending on the type and level of noise present, the Adaptive Directionality system uses a 4-frequency-band design to improve the signal-to-noise ratio (SNR) of your client's acoustic scene. A fast-acting adaptive mode selection algorithm automatically switches between two variable directionality modes, and thereby the system fades between full directionality and adaptive high frequency directionality.

As a result, sensations of loudness are restored, and the important environmental sounds that keep your clients connected to their surroundings remain perceptible.



DIRECTIONALITY

ARMIN  
BY  
*Armin Strom*



AUDIO  
EFFICIENCY™

Armin  
MANUFACTURE D'HORL.



YOUR PERFECT PITCH: SWISS-ENGINEERED HEARING SOLUTIONS

ARMIN

*Timepiece*





# Chronos – Redefines the Relationship with Time

## Automatics

The more precise a hearing instrument's environment classification system, the more efficient are its automatic features. And the better the instrument's ability to cater to your client's specific needs.

In Chronos BTE and custom instruments, the multi-environment program ensures that incoming signals are evaluated and assigned to their respective environments: speech or comfort, either in noise or in quiet.

Accurate signal detection and classification enable Chronos to select the appropriate automatic feature and process signals accordingly. Through its continuous adjustments, Chronos allows your client to comfortably move from one acoustic scene into another. All day long.

By selecting one of the four listening environments offered by the **Environmental Optimizer** control, you enable Chronos to apply the settings tailored to your client's preferred auditory scene.

Chronos provides optimal comfort:

**Speech in noise** refines the information of the speech envelope, providing your client with essential speech cues.

**Speech in quiet** slightly increases the amplification of speech signals, ensuring intelligibility in quiet listening environments.

**Comfort in noise**, paired with noise management, slightly reduces overall gain to maximize your client's listening comfort in noise.

**Comfort in quiet** slightly reduces overall gain to maximize your client's listening comfort, and to minimize the temptation to take the instruments off in quiet surroundings.



*Armin Strom*  
THE GRAND TRADITION OF SKELETON TIMEPIECES



# Chronos – Made to Be Customized

## Software personalization options

Our proprietary fitting software, Oasis, offers the unique ability to learn your clients' particular listening preferences.

In Chronos hearing solutions, it thereby allows you to easily make fine-tuning decisions that meet your clients' demanding needs.

### Data logging

The data logging system found in Chronos keeps track of your clients' daily hearing instrument use. With this valuable information, fine-tuning becomes quick and easy.

### Volume control (VC) learning

Logging your clients' volume preferences in each program, Chronos can apply them automatically. In Oasis, you can set learning limits at different levels to have an additional control over VC learning.

### Smart Volume Control

The Smart Volume Control function gives your clients the peace of mind of knowing that any volume adjustments will never cause feedback, because Smart VC gives rise to volume only in feedback-free frequency regions.

### EasyFit

For faster hearing aid fittings, the optional EasyFit button minimizes the number of controls to just a few quick fitting steps, including controls for Overall Gain, Soft Sounds, Loud Sounds, and Speech. The EasyFit control is available in all Chronos instruments.

### nEARcom

For the convenience of wireless hearing instrument programming, wireless-enabled Chronos models, including Compact Power, Micro and Nano BTEs, and ITCDs, can be fitted with our nEARcom fitting system.





# Chronos – Creates Closeness

## Connectivity at all times

Chronos is more than just a hearing instrument. Chronos is the missing link in your client's daily routine: combined with our cutting-edge technology for wireless communication, Chronos caters to all your client's communication needs, both mobile and stationary.

The key to wireless connectivity is **SoundGate**, the easy-to-use interface between Chronos hearing instruments and external audio sources. Using wireless Bluetooth® technology, SoundGate transmits electronic media signals directly to your client's hearing instruments. Alternatively, external sound source devices can also be plugged into SoundGate for direct audio input.

Paired with SoundGate, Chronos gives your client full flexibility and freedom of choice. Benefits include:

- hands-free mobile phone connection
- standby to receive phone calls
- binaural wireless listening of mobile or electronic media
- binaural remote volume control and program control operation

### TV adapter

With Chronos, we offer an optional TV adapter for the binaural wireless reception of TV audio signals via SoundGate.

### Phone adapter

Chronos can also be used as the binaural wireless link between SoundGate and landline telephones to make conversations easier.





CHRONOS  
**INVOLVE**

# Chronos – Captures the Moment

## Live Music and Cinema Programs

Sounds – even more so than images – trigger emotional reactions, especially in movie theatres and concert halls.

For hearing instrument wearers to also fully appreciate live music and films on the big screen, signal processing needs to account for these particular acoustic scenes. Typically, movies and concerts are very loud, and include large variations in SPL levels as well as heavy sound engineering and editing.

Yet common processing systems clip the parts of a signal that exceed the SPL level of 95 dB. Chronos' **Live Music and Cinema Programs** resist such premature clipping and process sounds with SPL levels of up to 110 dB, thereby preserving the wide dynamic range typical of movies and music.

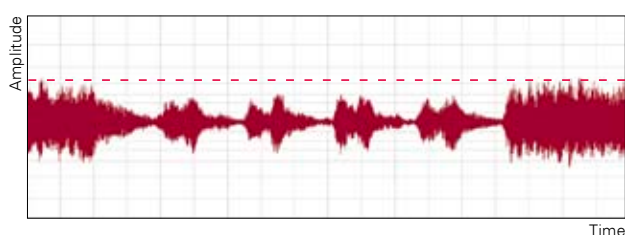
### Cinema Program

Chronos' rapid level estimation identifies SPL levels and precisely determines the amount of gain needed at each moment in time. Paired with Live Music Dynamics and the optional telecoil input, the Cinema Program further enhances your client's cinematic enjoyment.

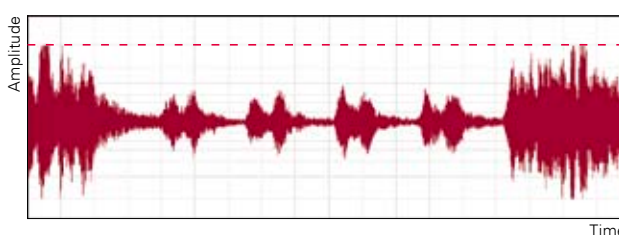
### Live Music Program

The Live Music Program featured in Chronos increases the peak input limiting level, which accounts for the dynamic range of music. By preventing premature limiting of musical signals, music sounds natural again.

Amplified music signal without Live Music Dynamics.



Amplified music signal **with** Live Music Dynamics.



Hockley N.S., Bahlmann F., & Chasin M. (2010) Programming hearing instruments to make live music more enjoyable. *The Hearing Journal*;63(9) pp 30–38.

# Chronos – Up-to-the-Minute in Style

## There is a Chronos for everyone

Timeless in design, the 3 complete Chronos hearing instrument families reflect the purity and precision found in traditional Swiss Engineering. Fashioned with meticulous attention to style details, Chronos BTE and custom instruments make time for your client's hearing needs.

Full fitting flexibility is a given: Chronos BTE models can be fitted either with our discreet Spira Flex thin tube system (0.9 or 1.3 mm tubing), or with conventional earhooks and custom ear-molds.

All performance-enhanced Chronos hearing solutions are available in 3 different performance and price categories, allowing you to cater to an even wider range of specific client needs.



CHRONOS

CHOOSE





# Model Overview



## CHRONOS 9 | 7 | 5

Instrument models	●	●	●	●	●	●	●	●	●	●
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### HARDWARE

Directionality	dual omni	dir	dir	dir	dir	dir	dir	omni	omni	omni
Program selector	●	●	●	●*	○	○	○	○		
Volume control	●	●	●	*	○	○	○	○		
Spira Flex thin tube	●	●	●	●						
Earhook	●	●	●	●						
Telecoil	●	●	●		○	○	○	○		
Auto Telephone (detection)	●	●	●		●	○	○	○		
Battery size	13	13	312	312	312	13	312	312	10	10

### ACCESSORIES

Remote control (RC-P)	○	○	○	○	○					
SoundGate (Bluetooth®)	○	○	○	○	○					
TV adapter	○	○	○	○	○					
Phone adapter	○	○	○	○	○					
DAI adapter	○	○	○							
FM adapter	○	○	○							

### PERFORMANCE (EAR SIMULATOR)

OSPL 90, peak dB SPL	138	134	126	127	123	133	129	130	129	118
OSPL 90, 1600 Hz dB SPL	136	130	120	127	115	128	122	122	121	109
Full-on gain, peak dB	75	66	62	55	56	65	62	63	61	49
Full-on gain, 1600 Hz dB	72	63	56	55	47	65	62	62	58	40
Reference test gain dB	60	55	46	48	39	53	47	47	45	33

\* Push button can be programmed for volume control use

● standard ○ optional

# Feature Overview

	CHRONOS 9	CHRONOS 7	CHRONOS 5
<b>AUDIO EFFICIENCY™</b>			
ChannelFree™ signal processing	●	●	●
Adaptive Feedback Canceller Plus	●	●	●
Transient Noise Reduction	●	●	
Adaptive Noise Reduction	4 control states	3 control states	2 control states
Adaptive Directionality	●	●	●
True Directionality™/Adaptive High-frequency Dir.	●		
<b>BINAURAL COORDINATION</b>			
Volume control, program change	●	●	●
Environment classification	●	●	
Non-telephone ear attenuation	●		
<b>PERFORMANCE</b>			
Frequency bandwidth	10 kHz	10 kHz	8 kHz
<b>ENTERTAINMENT</b>			
Live Music Program	●		
Cinema Program	●		
<b>CONVENIENCE FEATURES</b>			
Volume control clicks	●	●	●
Mute via push button	●	●	●
Configurable start-up delay	●	●	●
<b>PERSONALIZATION</b>			
Program options/slots	13/4	11/4	11/4
Data logging	●	●	●
VC learning	●	●	
Environment Optimizer	1/4	1/1	
Smart VC	●		
<b>WIRELESS ACCESSORIES (OPTIONAL)</b>			
Remote control (RC-P)	○	○	○
SoundGate (Bluetooth®)	○	○	○
TV adapter	○	○	○
Phone adapter	○	○	○

● standard ○ optional

Since 1946, we have been passionate about developing quality hearing systems that enable people with hearing difficulties to enjoy authentic listening experiences. With Swiss Engineering, precision technology, and our commitment to individual service, we strive to exceed our customers' expectations. Our aim is to provide extra value to our partners every day. Bernafon representatives and employees in over 70 countries fulfill our vision to help people with impaired hearing communicate again without limitations.

Bernafon's photo shooting took place in Switzerland on November 29, 30 and December 1, 2010 in corporation with Armin Strom AG in Biel.

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**SWISS**   
Engineering

#### **Bernafon Companies**

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Your hearing • Our passion