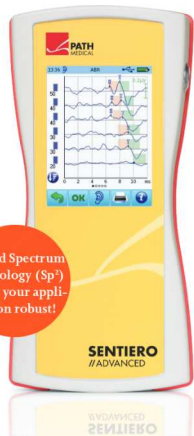


# All-in-one: ABR, ASSR, OAE, Audio in the palm of your hands



Spread Spectrum technology (Sp<sup>2</sup>) makes your application robust!

## What is a spread spectrum stimulus and how do we benefit from it when recording evoked potentials?

In telecommunication and radio communication, spread-spectrum techniques are methods by which a signal generated with a particular bandwidth is deliberately spread in the frequency domain, resulting in a signal with a wider bandwidth. This increases resistance to natural interference, noise and signal jamming, to prevent detection, and to limit power flux density.

Recording evoked potentials means recording signals in the range of nV! Even small sources of interference (mobile phones, lights, computers, elevators in the vicinity, monitors, any electrical equipment) might influence and disturb the recording. SENTIERO users do not need to worry about this problem as spread spectrum technology takes care of these interferences!

If you do not believe it: Try and compare against any competing device in any environment. SENTIERO can record faster and with less interference from environmental conditions.

SENTIERO can also be an all-in-one integrated handheld instrument with ASSR, Distortion Product Otoacoustic Emissions (DPOAE), TEOAE and Pure Tone Audiometry. Many speech audiometry options are available too!

With SENTIERO, the user can customize DPOAE protocols with twelve frequencies or more up to 30 points per octave between 800 Hz and 10 kHz. Mapping the cochlea is much faster using patented FMDPOAE® (frequency modulated DPOAE), multichannel technology and conducting measurements on both ears simultaneously using the dual probe feature.

### Key Features:

- Multiple tests in one unit (ABR, ASSR, OAE, air & bone & speech audiometry, Tympanometry)
- Multichannel FMDPOAE®
- Patented cochlear audiogram & scissor paradigm: varies the intensity difference between the two stimuli to maximize response amplitude!
- Customizable protocols for each module. E.g. DPOAE protocols between 800 Hz – 10 kHz with up to 30 points per octave allow you to get as much interoctave information as needed
- and much more - just turn this page!



Remote control and live display of results!



### SENTIERO IS THE TECHNOLOGY LEADER!

Developed by the award winning group of engineers at PATH MEDICAL, SENTIERO was introduced in 2009 as the first touch screen based audiometry & OAE device in the world. In 2013 the first touch screen based tympanometer was introduced on the SENTIERO platform tool. Now everything becomes united: again world's first and unique feature. PATH MEDICAL's engineering team is unmatched: the same engineers who developed the EchoScreen in 1998 contributed with their experience and professionalism and they still contribute today. Where do you find this reliability? At PATH MEDICAL in Germany!



Available from"  
[www.R-Binstruments.com](http://www.R-Binstruments.com)  
800-533-7234

September 2016

# ABR and ASSR screening made easy and robust!



Sp<sup>2</sup>ABR inside - world's most robust ABR recording!

Made in Germany

Available from  
[www.R-Binstruments.com](http://www.R-Binstruments.com)



THE SOUND OF SCIENCE.

# SCREENING, RECONFIRMATION AND FOLLOW UP DIAGNOSTICS: ALL IN ONE SINGLE DEVICE

## NON SEDATED ABR - SIMPLE, FAST & EASY TO OPERATE!

SENTIERO is not a simple newborn hearing screener - it's much more! From pre-term or risk babies to reconfirmation diagnostics - the ABR Quick function is dedicated to suit the needs of fast and reliable automated ABR recordings.

Configurations are offered to suit your NHS program. Select your favorite configuration to suit your needs: Combine TEOAE with ABR and use your regional preset protocols.

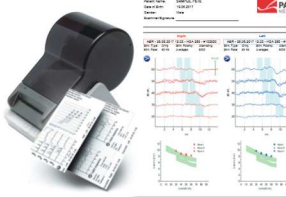
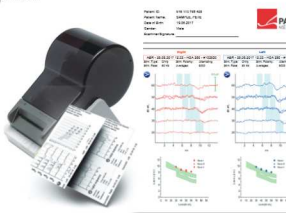
If you participate in a NHS program, SENTIERO enables you to send all data out-of-the-box to your tracking center and receive updates automatically too. Using our 3G wireless modem enables you to keep highest data security level while utilizing a SSL secured and bidirectional data transmission.

Please review all its possibilities online on our homepage in the section PATHTRACK.  
[www.path-medical.de/support/#brochures](http://www.path-medical.de/support/#brochures)



## MULTIFREQUENCY AND MULTIRATE ASSR STIMULI - ADVANTAGES:

It is well known that multiple stimulus frequencies can be applied at the same time binaurally with ASSR. However, the user normally has to choose the setup for sleeping/awake patients or babies/adults. SENTIERO is the first to introduce varying modulation rate from 37 to 163 Hz. Optimized to your individual setup, the EEG is analyzed and spread spectrum technology is applied to receive the optimal recording conditions and results. Get your ASSR Threshold within a few minutes only! Reports are printed either via label printer or via pdf direct print directly to your PC / office printer.



## General for ABR:

- Artifact rejection: weighted averaging, notch filter (50/60 Hz, self-tuning)
- Residual noise calculation: collecting noise energy from each frame, calculating residual noise level (RMS value in nV)
- Response detection: auto peakmarker, template matching
- Normative latencies for different age & transducer types
- Display & storage of waveform, impedance, residual noise, averages; standard + peak marker (editable)
- Electrode impedance check
- Continuous monitoring of electrode impedance
- Auto start after impedance OK (optional):  $R \leq 4 \text{ k}\Omega$ ,  $AR \leq 2 \text{ k}\Omega$
- Sample rate: 48 kHz (stimulus), 16 kHz (response)

## Quick ABR - screening

### (order #100337 monaural):

- Stimulus type: Chirp (broadband, 1 to 8 kHz)
- Stimulus polarity: alternating
- Stimulus rate: 85 Hz
- Stimulus level: 35 to 55 dB eHL (step size: 5 dB), ask before test (enables additional stimulus levels 25 and 30 dB eHL)
- Please note: dB eHL = dB nHL + 10 dB (typical ABR detection threshold for normal hearing subject at 0 dB eHL)
- Spread spectrum

## ABR diagnostics (order #100424)

- Stimulus types: Click (0.7 to 6 kHz), Chirp (broadband, 1 to 8 kHz); with ABRFS license: + low-Chirp (100 to 850 Hz), Mid-Chirp (850 Hz to 3 kHz), High-Chirp (3 to 10 kHz), Tone Burst (500 Hz, 750 Hz, 1 kHz, 1.5 kHz, 2 kHz, 3 kHz, 4 kHz); waveform: 2 up, 1 plateau, 2 down
- Stimulus polarity: condensation, rarefaction, alternating
- Stimulus rate: 10, 1, 20, 3, 30, 7, 40, 3, 69, 9, 81, 2, 90, 4 Hz (default) + user-specific stimulus rate from 10 to 100 Hz; rate mode: 10, 20, 30, 40, 69, 81, 90 Hz
- Stimulus levels: 0 to max. 95 dB nHL or transducer limits, no stimulus; step size: 5 dB
- Rate mode: 10 to 90 dB in steps of 5 dB
- Masking noise offset levels (white noise): -50 to +50 dB
- Averages: 1000 up to 20000; step size: 1000
- Noise stop criterion: 0, 10, 15, 20, 30, 40, 50, 60, 80 nV
- Automated wave 5 detection with minimum wave 5 criterion: 0, 20, 30, 40, 50, 70, 100, 150, 200 nVpp (optional)
- Plot range (fixed): 0 to inter-stimulus interval + 1.5 ms (minimum 10.5 ms, maximum: 15 ms)
- Additional parameters: Spread spectrum, auto proceed, auto stop, rate mode

## ASSR

- Fixed level procedure
- Adaptive level procedure (threshold estimation)
- Stimulus bandwidths: 1/2 octave, 1 octave, 2 octaves
- Stimulus rate:  $41 \pm 1.5 \text{ Hz}$  (40 Hz ASSR) and  $85 \pm 1.5 \text{ Hz}$  (80 Hz ASSR), automatic (37 to 163 Hz, dependent on frequency); spread spectrum:  $\pm 2\%$
- Stimulus level (fixed): 10 to max. 100 dB nHL or transducer limits (see Table 11 for 1/2 octave stimuli); single or multiple level selections possible; step size: 10 dB
- Stimulus level adaptive: 10 to max. 100 dB nHL or transducer limits (see Table 11 for 1/2 octave stimuli); step size: 10 dB
- Response detection: weighted averaging, phase statistics including up to 7 overtones
- Frequencies: 0.25, 0.5, 1, 1.5, 2, 3, 4, 6, 8 kHz (with increasing stimulus bandwidth, less frequencies are available)
- Number of averages: 45 to 900; step size: 15 s
- Noise stop criterion: 0 to 20 nV; step size: 1 nV
- Display and storage of statistics graph, impedance, artifact threshold, modulation frequency
- Contralateral masking noise (optional): 0 to 60 dB nHL; step size: 5 dB
- Electrode impedance check: see ABR
- Different protocols defaults - see quick start guide available online: [www.path-medical.de/learn](http://www.path-medical.de/learn)

## eABR (order #100424 + trigger cable #100849)

- TTL level trigger input from CI fitting system
- 20µs trigger resolution
- 10...100Hz trigger rate
- recording bandwidth 10Hz...2kHz
- up to 15 traces per test
- auto-trace-switch on trigger pause
- optional trace smoothing
- configurable plot scales

## eCochG (order #100901)

- Display of alternating, condensation, rarefaction traces
- click & configurable tone bursts
- 8...100Hz stimulus rate
- recording bandwidth 10Hz...2kHz
- intuitive wave editing & evaluation
- insert phones and headphone support
- fast weighted averaging
- optional SpreadSpectrum (SP<sup>2</sup>)

**NEW: TYMPANOMETRY AS ACCESSORY FOR SENTIERO ADVANCED!**  
**CONTACT US FOR**  
**www.R-BINSTRUMENTS.COM**

## DPOAE (order #100110):

- Leak check: analysis of feedback signal (440 Hz probe tone)
- Probe check: limit of maximum sound pressure ("stimulus"), comparison across speakers ("symmetry"), leak check ("probe fit")
- Calibration: in-the-ear calibration with ear-canal volume adjustment
- Noise detection: narrow band noise around  $2f_1$
- Residual noise calculation: weighted averaging, summed weighting factors, artifact rejection: weighted averaging
- Response detection: F-test, F-value at a single point (Fsp), automatic retest option
- Frequency ratio  $f_2/f_1$ : 1.22. Sample rate: 48 kHz (stimulus, response)
- Minimum DPOAE level criterion:  $L_1 - 70 \text{ dB}$
- Measurement interval: 4096 samples
- Stimulus modes with frequency-modulated DPOAE license:  $f_1 = 1.4-1.6 \text{ Hz}$ , modulation depth = 50 Hz @ 1 kHz, 100 Hz @ 4 kHz
- Multi-channel DPOAE: simultaneous measurement of DPOAEs at up to two  $f_1$  frequencies at a time
- Frequencies  $f_1$ : 1, 1.5, 2, 3, 4, 5, 6, 8 kHz
- Linear: 0.8 to 10 kHz (step size: 0.5 kHz from 1 to 10 kHz), steps: 10 to 1000 Hz (step size: 10 Hz)
- Logarithmic: 0.8 to 10 kHz (step size: 0.5 kHz from 1 to 10 kHz), steps: 1 to 30 points per octave (step size: 1 point per octave)
- Stimulus levels  $L_2$ : 30 to 65 dB SPL; step size: 5 dB (single and multiple selections possible)
- Minimum DPOAE level criterion (optional): -20 to 0 dB; step size: 5 dB
- Measurement time: adaptive timeout, manual min/max timeout

## TEOAE (order #100109):

- Noise detection: root mean square (RMS) of non-stimulus intervals
- Residual noise calculation & artifact rejection: weighted averaging
- Response detection TEQUICK: 8 values with changing sign fulfilling a 3 sigma criterion (representing 99.7% statistical significance)
- TEOAE Diagnostic: user-defined stop criterion (SNR: 6 or 9 dB) in 3, 4, or 5 out of 5 frequency bands [1, 1.5, 2, 3, 4 kHz]
- Sample rate: 48 kHz (stimulus), 16 kHz (response)
- Window of analysis: 5 to 13 ms post-stimulus
- Stimulus level: 85 dB peSPL
- Stimulus type: short-term stimulus without direct component (0.7-6 kHz)
- Stimulation protocol: nonlinear

## DPOAE threshold - cochlear audiogram (order #100111):

- Frequencies  $L_1$ : 1, 1.5, 2, 3, 4, 5, 6, 8 kHz
- Stimulus level  $L_2$ : 20 to 65 dB SPL (automated threshold detection)
- Minimum stimulus level  $L_2$ : 20, 25, 30 dB SPL
- $L_2/L_1$  relation: automatic (scissor paradigm)

## Audiometry (order #100113):

- Full 2 channel diagnostic audiometry (DIN EN 60645-1 class 3)
- air - bone - masking
- children audiometry options (MAGIC #100112, MACH #100356, BASD, spondaes and many more)
- Pure Tone Audiometry and Speech tests designed for Children - reinforcement audiometry at its best
- Multiple transducer options including circumaural headphones, insert phones and bone conduction. Multiple upgrades available.

## General features

- Color touch screen (3.5" graphic LCD)
- Ultra-compact: less than 4" wide and only 8.5" high
- QWERTY keyboard allows inputting patient demographics onto the device
- Stores up to 1000 tests
- Long battery life
- Entertainment mode available for all OAE modules
- Software available in English, Spanish, French and many other languages.
- Patient editing software (MIRA) to transfer data to computer via USB and further export functions to other EMR software (optional).
- NOAH compatible
- Printing via label printer, pdf, or using MIRA software
- Transfer all data from the device directly to PATH-TRACK or export to other tracking center software

## Technical Specifications:

Device dimensions: 209 x 98 x 52 mm, ca. 500 g.  
 Display: 240 x 320 pixel, graphic LCD 3.5", resistive touch screen, real time-clock, piezoelectric sound generator, USB, Output voltage and nominal impedance (headphone socket): 5 Vpp, 32  $\Omega$  Power consumption: max. 2 W.  
 Memory capacity: up to 1000 patients, ca. 1000 tests (dependent on test type) Results can be sorted by birthdate, name, patient ID, examiner, date and time.  
 Additional technical specifications can be found in the detailed technical manual (rev 11 per 08/2017) available online <http://pathme.de/support/#manuals>