The FONIX® 7000

Hearing Aid Test System

The FONIX 7000 test system combines unbeatable accuracy, speed, and innovative measurements that fit the needs of any hearing health professional.

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The FONIX 7000 Hearing Aid Test System is used by leading hearing health professionals across the industry including hospitals, clinics, universities, schools for the deaf, researchers, and manufacturers. It provides basic and advanced measurements of hearing aids through coupler and optional real-ear tests.

Automation

The 7000 Hearing Aid Test System can be purchased with ANSI, IEC, JIS, or a combination of these automated test sequences. When ANSI is ordered, ANSI 87, ANSI 92, ANSI 96, and ANSI 03 are all included, so you can always use the appropriate standard for the hearing aid being tested.

Alternately, you can build your own test sequence with the Auto Test feature. With Auto Test, you can program the source type and amplitude of up to 10 different coupler frequency response measurements. You can even add pauses to the test sequence to give you time to adjust the hearing aid in between measurements. Three different custom test sequences for each user can be stored into the analyzer's permanent memory. These tests can be loaded automatically, creating a very simple one-button test sequence that is completely customizable to the needs of the clinic.

Computer Compatibility

The 7000 Test System comes standard with RS232 computer compatibility. This means that it can be used with all current FONIX software programs, including the FONIX NOAH Module, which gives it complete NOAH 3 compatibility. Other supported software products include WinCHAP and FONIX Press & Go. You can also develop your own custom software program. Existing custom programs that have been used with the 6500-CX analyzer need only small changes for migration to the 7000.

Enhanced DSP

Enhanced DSP is an innovative new test useful for both analog and digital hearing aids. It consists of a test for signal processing delay and a test for phase. Signal processing delay (also known as group delay) is the amount of time it takes for the digital hearing aid to process sound. This is an important measurement if the patient has a monaural or open vent fitting because sound can travel to the unaided ear faster than through the aided ear, possibly creating an echoing effect. This measurement is becoming very important with all of the advanced open ear hearing aids that are being fit!

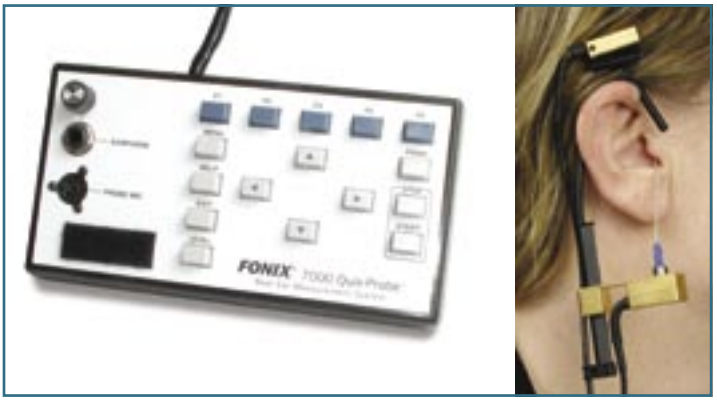
Phase is a measurement of how the hearing aid pushes and pulls sound. For a pair of aids in a binaural set to be working properly together, both aids must be "pushing" and "pulling" sound in the same manner. If they aren't in phase with each other, it's possible that a part in the aid was wired backwards during assembly. The phase measurement will give you the ability to quickly determine if the aids are working together as a team.

Real-ear Testing

The Real-Ear Option on the 7000 Test System gives you the ability to see precisely how the aid is performing inside your patient's ear. It comes with a remote module that allows you to perform real-ear measurements while you move around your patient freely.

Three real-ear testing methods are supported: Insertion Gain, SPL-o-gram, and Visible Speech. The Insertion Gain method is the traditional way to perform real-ear measurements. A real-ear unaided response and up to four different aided responses can be measured using a choice of input signals and input levels. When the NAL-NL1 non-linear fitting rule is selected, the target will automatically adjust to the current selected input signal.

In the SPL-o-gram real-ear method, the patient's thresholds values, uncomfortable values, and real-ear target are converted into dB SPL and displayed on one large graph. This allows all the real-ear measurements to be directly compared to the patient's audiometric information so that you can make sure that soft signals are amplified above the patient's thresholds and loud signals



produce amplification lower than the uncomfortable levels. Up to three targets can be displayed on the screen, allowing you to match the targets at soft, medium, and loud levels.

The real-ear unaided response can also be measured in this screen. Once measured, the REUR Auto-Adjust feature will automatically adjust the unaided response to the current input signal. This means that as you perform aided measurements, the unaided response curve will be directly comparable to the current aided response measurement, allowing you to make sure that the hearing aid is always providing amplification above the unaided response. This will be especially useful for patients with mild to moderate hearing losses.

Visible Speech

The Visible Speech screen allows you to use live voice as the input signal to the hearing aid. As in the Real-ear SPL screen, the patient's thresholds, uncomfortable levels, and real-ear targets are displayed together on one large SPL graph. When the Visible Speech measurement is running, the real-time measurement curve updates many times a second, showing you the short-term dynamics of the response of the hearing aid to the speech signal. A second curve showing the long term average of the measurement over the time of the test is also continually updated. The longer the test runs, the more the average curve stabilizes. The maximum and minimum response per frequency are also displayed. Together, these four curves give you a very complete picture of the hearing aid.

When you stop the measurement, the real-time curve disappears and is replaced with a shaded boundary containing the standard deviation around the average response of the hearing aid. This shows you the area containing most of the frequency response of the hearing aid during the test. A lighter region bounded by the maximum and minimum response of the hearing aid is also shown. The Visible Speech test can use any live voice or other external input signal.

Testing Digital Aids

The Digital Speech signal is a modulated real-time signal designed for testing digital hearing aids quickly and accurately. Many digital hearing aids have noise suppression technology that analyses the input signal to determine if the signal is speech-like and should be amplified or noise-like and should be suppressed. Conventional test signals, such as pure-tone sweeps and the Composite signal, are regarded as noise signals. These signals are not amplified as much as a speech-like signal. The Digital Speech signal, however, is modulated, randomly turning itself on and off in a random staccato pattern. This causes the hearing aid to amplify the signal as it would speech.

One of the advantages of Digital Speech is that it produces a very stable frequency response extremely quickly, updating multiple times a second. Any change made to the hearing aid programming while the signal is running is instantly shown in the frequency response. It is also directly comparable against the continuous Composite signal. This allows you to compare the frequency response of the hearing aid when exposed to a noise-like signal to its response when exposed to a speech-like signal. This can make a very good demonstration of the advantages of the digital hearing aid to your patient.

You can also add a bias signal to the Digital Speech signal. A bias signal is a continuous pure-tone signal introduced during the Digital Speech signal. The bias signal can demonstrate how the frequency response to a noise introduced at a particular hearing aid. You can see if noise introduced in one channel of the hearing aid affects the amplification of the signal in the other channels of the aid. This fascinating test can give you very useful information about how the hearing aid amplifies and suppresses noise.

Testing Open Fit Aids

Open Fit hearing aids are easily tested by the 7000 Hearing Aid Test System. Open Fit hearing aids can cause real-ear testing problems by interfering with the reference microphone measurement outside the ear. However, with the FONIX 7000, this reference microphone is easily disabled, eliminating the source of the problem. All measurements of open ear hearing aids can then be done normally.

Frye Electronics has also introduced a new Open Ear coupler. This coupler was designed to provide an easy way to test open fit hearing aids that are not suited for the standard HA-1 and HA-2 coupler designs. The basket of the speaker unit fits into the opening of the coupler just

is required. Although this coupler cannot be used to compare against hearing aid manufacturing specifications, it provides a quick and easy way to get a realistic frequency response of the open fit hearing aid.

Advanced Testing

High end users such as researchers often need to be able to perform specific coupler measurements that are usually included as part of an automated test sequence. For those users, the FONIX 7000 has the Input/Output, Attack & Release, and Battery Current test screens.

- In the Input/Output test screen, you can measure the compression characteristics of the hearing aid at any frequency between 200 and 8000 Hz in 100 Hz intervals. Alternately, you can choose to use the broadband Composite signal.
- In the Attack & Release test screen, you can measure the attack and release compression characteristics of the hearing aid. The amplitude levels and frequency used by each tone in the test can be set, allowing great flexibility.
- In the Battery Current test screen, the battery current is measured as a function of frequency and of amplitude, so that you can determine the situations in which the hearing aid may be using more battery current. An estimate of the battery life of the hearing aid is also given.

Together, these tests let you explore all of the standard features of the hearing aid. The analyzer can be configured to perform exactly the test that you want to measure.

Specifications

ACOUSTIC DRIVE SIGNAL

Frequencies:	200-8000 Hz in 100 Hz intervals
Amplitude:	
Chamber	40-100 dB SPL in 5-dB steps
Sound Field	40-90 dB SPL in 5-dB steps

TELECOIL DRIVE SIGNAL 1, 1.78, 3.16, 5.62, 10, 17.8, 31.6, 56.2, 100 mA/meter, ANSI S3.22

DIGITAL READOUT OF SOUND PRESSURE LEVEL

Frequency Range:	200-8000 Hz.
Amplitude Range:	0-150 dB SPL
Resolution:	0.1 dB.
Accuracy (M1950E only):	±1 (300-5000 Hz), ±2 (all other frequencies)
SPL Equivalent Input Noise:	Less than 50 dB RMS (M1950E only)

BATTERY CURRENT MEASUREMENT

Range:	0-25 mA
Accuracy:	± 3%
Resolution:	0.01 mA
Test modes:	Standard, mA vs Frequency, mA vs Amplitude, Estimated battery life

HARMONIC DISTORTION ANALYZER

Type:	2nd, 3rd, Total (2nd plus 3rd)
Resolution:	0.1%

ATTACK/RELEASE TIME

Range:	1.25-5000 ms.
Accuracy:	± 10%
Signals:	Composite, Puretone: 200-8000 Hz in 100 Hz intervals, or by standard specification

TEST STIMULI Composite, Puretone, Digital Speech

FILTERS ANSI, ICRA, Flat

TEST SEQUENCES Choose one with instrument. Others can be added as options. ANSI 3.22 (87/96/03), ANSI S3.42 (included with ANSI), IEC 60118-7 (94/05), JIS

ADDITIONAL SCREENS Enhanced DSP (group delay and phase), Input/Output, Attack & Release, Battery Current, Coupler Multicurve

REAL EAR SCREENS Audiogram Entry, Target Edit, Insertion Gain, Real-ear SPL, Visible Speech

PRIMARY POWER 100-240 VAC, 50/60 Hz. Power requirement is 50 VA.

DIMENSIONS (MAIN MODULE)

Size:	17.4"W x 6.5"H x 14.6"D (44.2 x 16.5 x 37.1 cm).
Weight:	17 lbs.(7.7 kg).

PRINTER

Internal:	High speed thermal, 4.41" (112 mm) width, 80 mm/s speed
External (optional):	Parallel, HPCL v3 or Epson Stylus series

TEST CHAMBER

Type:	FONIX FC 7020
Test Area:	7"x 7.5"x 1.5 deep (17.8 x 19.1 x 3.8cm).
Noise Isolation:	45 dB at 1 kHz
Size:	13.5" x 18" x 11.5" (34.3 x 45.7 x 29.2cm).
Weight:	36 lbs (16.3 kg)

SHIPPING WEIGHT
Standard: 77 lbs (35 kg)
Including Real-ear Option: 97 lbs (45 kg)

SAFETY/QUALITY IEC 60601-1, ISO 13485: 2003, 93/42/EEC

GUARANTEE The FONIX 7000 and its accessories are guaranteed to be free from manufacturing defects that would prevent the products from meeting these specifications for a period of one year from date of purchase.

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