This product may be purchased from Connevans Limited secure online store at www.DeafEquipment.co.uk
The FONIX 7000 test system combines unbeatable accuracy, speed, and innovative measurements that fit the needs of any hearing health professional.
The FONIX® 7000

Hearing Aid Test System

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.

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**Specifications**

**Acoustic Drive Signal**
- Frequencies: 200-8000 Hz in 100 Hz intervals
- 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 3.8 cm).
- Noise Isolation: 45 dB at 1 kHz
- Size: 13.5" x 18" x 11.5" (34.3 x 45.7 x 29.2 cm).
- Weight: 36 lbs (16.3 kg)

**Shipping Weight**
- Standard: 77 lbs (35 kg)
- Including Real-ear Option: 97 lbs (45 kg)

**Safety/Quality**

**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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We have improved the sound chamber for our FONIX Hearing Aid Test Systems—the 7020 Sound Chamber for the 7000 and 6500-CX. Anyone who orders a new 7000 will get the improved sound chamber at no additional charge. The new FONIX chamber has a number of significant improvements over the older 6020 design.

- A major advantage of the newer chamber is the **improved isolation** from ambient noise, both through the air and from the surface on which it is placed.

- The chamber’s **internal physical layout** has also been improved. The test surface upon which the hearing aid is placed is now a large, flat surface, easing the task of device placement. Basic directional hearing aid testing is more easily done.

- The chamber’s new design virtually eliminates the need for sharp bends in the microphone cord. This means you are likely to have less damage to your microphones. The purchase of two exchange microphones will pay for a new sound chamber. Please consider replacing the chamber at one of your production stations and see how long your microphones will last at that station.

- The **battery replacement module** has been relocated to the right hand side of the chamber. The battery type selection has been updated to include the newer 5a size and the elimination of the now obsolete mercury types.

- **Servicing of the sound box** is now simpler. The test surface with its battery replacement circuit board is held in place with a velcro fastener system.

- A **durable woven fiber screen** replaces the thinner foam of the old chamber.

- **New connectors** with easier access.

- Optional **spring damper assembly** for smoother opening and closing.

The 6050 is completely compatible with the 6020 and thus can be retrofitted to older 6500 analyzers already in the field. As with the 6020, cabling is kept simple. Only two cables connect the chamber with the electronics module. Well-determined battery substitution supply impedance is retained. Internal acoustic reflections are low, making measurements fast and accurate. The built in magnetic test coil and Telewand interface jack are still there.
ADVANCED COUPLER TESTS on the FONIX 7000 Hearing Aid Test System

In addition to the Enhanced DSP test of group delay and phase, the FONIX 7000 Test System has three advanced coupler measurement screens: Battery Current, Coupler I/O, and Attack & Release. Together, these screens will help you determine important information about the characteristics of the hearing aid that the ANSI and IEC standards do not provide.

Battery Current Test
The battery current test screen gives you extensive information on how much battery current the hearing aid drains. There are three main tests:

- Estimated battery life
- Battery current drain by frequency (mA/Freq)
- Battery current drain by amplitude (mA/Ampl)

The estimated battery life tells you how many hours you can expect a battery to last inside the hearing aid. The mA/Freq test determines if the hearing aid drains more battery current at some frequencies than at other frequencies. The mA/Ampl test tells you how the battery current varies when exposed to signals of different amplitudes. Together, this tells you just about everything you need to know about the battery current drain of the hearing aid. You can pass on this knowledge to your client so they will know how long a battery should last in his hearing aid and which situations might cause this to vary.

Coupler I/O
The Coupler I/O test screen allows you to test the hearing aid’s compression at any frequency between 200 and 8000 Hz (in 100 Hz intervals). This will also allow you to verify the crossover frequencies of the hearing aid and determine if the channels of the hearing aid are working independently. Results are displayed in both graphical and data format.

Attack & Release
Measure the hearing aid’s attack and release characteristics at the frequency of your choice, completely outside the ANSI test sequence. Test results are given in graphical format, allowing you to see exactly how the hearing aid reacts in the critical milliseconds following large changes in amplitude. You can rescale both the attack and the release graphs independently, allowing you to zoom in on the important parts of the test.

The estimated battery life tells you how many hours you can expect a battery to last inside the hearing aid. The mA/Freq test determines if the hearing aid drains more battery current at some frequencies than at other frequencies. The mA/Ampl test tells you how the battery current varies when exposed to signals of different amplitudes. Together, this tells you just about everything you need to know about the battery current drain of the hearing aid. You can pass on this knowledge to your client so they will know how long a battery should last in his hearing aid and which situations might cause this to vary.
Recent Improvements to the FONIX® 7000

Real-ear
- New integrated probe microphone design: Smaller, lighter, more adjustable!
- Visible Speech: Great test for live speech measurements!
- NAL-NL1 non-linear targets: Automatically adjust to the selected input signal.

Coupler
- IEC 2005: Expanded standard with more information about the hearing aid.
- Auto-test improvements: Improved one-button test functionality.
- Battery Test screen: Estimates battery life, tests battery as a function of frequency and amplitude.
- Coupler I/O screen: Test any frequency 200-8000 Hz in 100 Hz intervals.
- Attack & Release screen: Test any frequency 200-8000 Hz in 100 Hz intervals. Zoom in on test results.

User Interface
- Expanded default settings: More settings available allowing more flexibility.
- Configurable navigation: Adjust screen navigation to fit your needs.
- Improved help messages: New test screens have expanded help text.
Includes Improvements to Navigation, Auto Mode, and Default Settings

Software version 1.60 brings lots of improvements that will benefit hearing health clinicians. Here's a short description of the most important of those improvements.

- Added IEC 2005 Automated Test Sequence: This is the new version of the IEC 60118-7 standard commonly used for quality testing internationally. The 2005 version of the IEC standard has many similarities to the ANSI S3.22-2003 standard.

- Improved Coupler Auto Mode: The Auto Mode allows the 7000 user to program in a custom test sequence. This custom test sequence can be saved into the analyzer’s permanent memory. With the new software version, these saved test sequences can now be automatically loaded in the Coupler Multicurve screen, making this useful feature even faster and easier.

- Improved Navigation: Many of the function keys on the Opening Screen are now user configurable. This allows for quick navigation to the most commonly used test screens.

- Expanded Default Settings: The Default Settings Menu has been expanded and improved, allowing the user to configure the analyzer to fit the particular needs of the clinic. Five different default setups are possible. The setup can now easily be changed from the Opening screen.

- Configurable Function Keys: In the Coupler Multicurve screen, F7/F8 are now configurable, allowing the user to assign commonly used functions, such as changing the display between Gain and SPL.
Special news for Hearing Aid Manufacturers: Expanded RS232 Commands

With the release of software version 1.60, we have released an expanded RS232 method for performing automated test sequences. With the current method (pre-1.60) performing ANSI, IEC, and JIS automated test sequence, if it was desired by the manufacturer to perform individual measurements without repeating the entire sequence, it was necessary to “roll your own” test sequence. This requires the manufacturers to research and implement the individual measurements across three separate screens (Coupler Multicurve, Coupler I/O, and Attack & Release). This takes both development time and extra time running the tests in production.

Version 1.60 includes a new expanded RS232 method for implementing the IEC 2005 automated test sequence. With the expanded RS232 method, it is now possible to perform individual measurements within the automated test sequence screen. This will allow the manufacturer to repeat specific measurements within the automated test screen without having to repeat the entire test sequence. This means that manufacturers do not have to spend developer time researching and implementing individual measurements of an automated test sequence. It is only necessary to implement the new calls to the individual tests in the IEC 05 test screen. The new RS232 method will also make testing time considerably faster because the analyzer will not have to spend any time switching between screens.

This new expanded RS232 methodology was created from direct feedback from our hearing aid manufacturing customers, and we have spent a lot of effort making it work logically and efficiently. We hope that it will be greeted with enthusiasm. If we get good feedback, we will also implement it for the ANSI test sequence.
The NAL-NL1 Fitting Rule

On the FONIX 7000 Hearing Aid Test System

The FONIX 7000 Hearing Aid Test System now includes the NAL-NL1 non-linear fitting rule for real-ear measurements. The NAL-RP linear fitting rule has long been the world's most popular method for fitting hearing aids. NAL-NL1 is a more sophisticated replacement, giving the hearing health professional an advanced tool for fitting digital hearing aids.

The NAL-NL1 target includes settings for: patient age, compression kneepoint, number of channels, type of output limiting, fit type (unilateral vs bilateral), sound field azimuth, and reference position. Each of these settings customizes the real-ear target to the test configuration and the patient's hearing aid. Appropriate defaults can be saved to permanent memory on the FONIX 7000.

Three different targets are displayed in the Real-ear SPL screen, prescribing amplification appropriate for multiple input levels. This allows the clinician to ensure the hearing aid amplification is appropriate for the patient at soft, medium, and loud input levels. The Real-ear Insertion gain target also automatically adjusts to the current source level of the input signal.

Also included with software version 1.50: Auto-adjusting real-ear unaided response (REUR). When measuring an aided response in output, the REUR can be set to automatically adjust to the amplitude of the input signal. This allows the clinician to compare the aided response to the projected unaided response at that input level to make sure that the hearing aid is providing enough amplification to overcome the occlusion caused by inserting the hearing aid into the ear canal.
The Visible Speech screen on the FONIX 7000 Hearing Aid Test System allows the clinician to perform real-ear measurements using live speech or other external signals.

During the Visible Speech test, the following data is displayed:

- Real-time curve showing the instantaneous response of the hearing aid to live speech
- Average response of the hearing aid over the time of the test
- Maximum and minimum response per frequency (optional)
- The patient’s HTLs and UCLs
- Real-ear targets at 50, 65, and 80 dB SPL
- Unaided speech banana (LTASS)
- Speech Intelligibility Index for the measurements and the targets

When the test is completed, the real-time measurement curve is replaced with a shaded region around the average curve, showing the region where most of the frequency response of the hearing aid was measured.

Visible Speech gives a comprehensive picture of the live speech measurement.
FONIX 7000 and 6500-CX Comparison

The FONIX 7000 test system is part of the next generation of hearing aid analyzers from Frye Electronics. Meant to replace the 6500-CX, it was designed to have the testing capabilities of the 6500-CX combined with an easy-to-use interface flexible enough to accommodate future innovations.

Here is a listing of the advantages of the 7000:

- Improved user interface with function keys instead of the 6500's fixed buttons.
- Higher resolution display with more colors
- LCD flat panel monitor
- Larger, faster thermal printer
- Parallel external printer port
- Higher accuracy in attack & release measurements
- Redesigned M1750E coupler microphone
- Redesigned 7020 sound chamber (same as the 6500-CX's new 6050 sound chamber model)
- Field-upgradable through RS232 (no more ROM swapping)

Although one of our goals for the 7000 test system is to have all the testing capabilities of the 6500-CX, we still have a few things that need to be added. Here is a listing:

- Coupler targets in the Real-ear mode
- Advanced & Enhanced Attack & Release measurement screens (attack & release measurements are included in the ANSI test screens)
- Separate Battery Current screen (battery current measurements are available in the ANSI and Coupler Multi-curve screen)
- The ability to subtract measurement curves and save reference curves
- NAL-NL1 and DSL I/O fitting formulas

The following table shows a comparison of some of the specifications.

<table>
<thead>
<tr>
<th>Source</th>
<th>7000</th>
<th>6500-CX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual sine frequencies</td>
<td>200 Hz through 8000 Hz 100 Hz intervals</td>
<td>100 Hz through 8000 Hz 100 Hz intervals</td>
</tr>
<tr>
<td>Sine sweep frequencies</td>
<td>200–8000 Hz 1/12 Octave nearest 100 Hz interval</td>
<td>200–8000 Hz 100 Hz intervals 15 frequencies omitted</td>
</tr>
<tr>
<td>Source Types</td>
<td>Composite (FP40-style chirp or 6500 noise), sine, or Digital Speech in Noise with choice of flat, ANSI, or ICRA weighting, available in coupler and real-ear screens. Polarity / group delay signals available in Enhanced DSP screen. Three choices of pure-tone sweeps.</td>
<td>Composite, sine, or Digital Speech in Noise, with choice of flat, ANSI, or ICRA weighting depending on screen. Polarity / group delay signals available in Enhanced DSP screen.</td>
</tr>
<tr>
<td>Telecoil output</td>
<td>1.00, 1.78, 3.16, 5.62, 10.0, 17.8, 31.6, 56.2, and 100 mA/m ANSI 3.22, 1996 with telewand</td>
<td>10 mA/m, 31.6 mA/m Other levels with external box ANSI 3.22, 1996 with telewand</td>
</tr>
<tr>
<td>Chamber output</td>
<td>40–100dB, all supported source types.</td>
<td>40–100dB, depending on source type. (49–99dB flat weighted composite, 40–90 dB ANSI and ICRA weighted, 50–100dB puretone)</td>
</tr>
</tbody>
</table>

Table continued
<table>
<thead>
<tr>
<th>Harmonic distortion analyzer</th>
<th>7000</th>
<th>6500-CX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.1 %</td>
<td>0.1 %</td>
</tr>
<tr>
<td>Frequency range</td>
<td>200–2600 manual 400–1900 sweep</td>
<td>400–2500 manual 400–1900 sweep</td>
</tr>
<tr>
<td>Accuracy</td>
<td>within 10%</td>
<td>within 10%</td>
</tr>
<tr>
<td><strong>Attack &amp; release</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement Range</td>
<td>1–5000 mS</td>
<td>2–2000 mS</td>
</tr>
<tr>
<td>Accuracy</td>
<td>10% or 2 mS, whichever is larger</td>
<td>10% or 2 mS, whichever is larger</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 to 5 mS depending on freq.</td>
<td>1.25 to 10 mS depending on freq.</td>
</tr>
<tr>
<td>Attack and Release Stimuli</td>
<td>Pure tone at 250, 500, 1000, 2000, 4000 Hz (all other puretone measurements from 50-8000Hz on 50Hz intervals available upon completion of attack and release screen, composite shortly thereafter.)</td>
<td>Pure tone at 100, 200, 300, 400, 500, 800, 1000, 1600, 2000, 3200, 4000, 6400, 8000 Hz and Composite</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source voltage</td>
<td>100–240 VAC auto-switching, 50–60Hz</td>
<td>100, 120, 230, or 240 VAC manually-selected, 50–60 Hz</td>
</tr>
<tr>
<td>Power</td>
<td>50VA</td>
<td>50VA</td>
</tr>
<tr>
<td><strong>Display</strong></td>
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<td></td>
</tr>
<tr>
<td>Format</td>
<td>640 x 480</td>
<td>320 x 210</td>
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<tr>
<td>On-screen Colors</td>
<td>16</td>
<td>5</td>
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<tr>
<td><strong>Internal printer</strong></td>
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<td></td>
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<tr>
<td>Type</td>
<td>Thermal</td>
<td>Thermal</td>
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<tr>
<td>Paper width</td>
<td>4.41&quot; (112 mm)</td>
<td>2.36&quot; (60 mm)</td>
</tr>
<tr>
<td>Speed</td>
<td>~80 mm/s</td>
<td>~30 mm/s</td>
</tr>
<tr>
<td>Dot structure</td>
<td>832 dots/line</td>
<td>320 dots/line</td>
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<tr>
<td>Printed Pixel resolution</td>
<td>~100dpi</td>
<td>~45dpi</td>
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<tr>
<td><strong>External printer</strong></td>
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<td></td>
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<tr>
<td>Type</td>
<td>HP compatible (HPCL5) Epson (ESC-P2)</td>
<td>HP compatible (HPCL5)</td>
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<td><strong>I/O ports</strong></td>
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<td>Video</td>
<td>VGA</td>
<td>VGA</td>
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<td>External Printer</td>
<td>Parallel</td>
<td>Serial</td>
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<tr>
<td>Probe mic.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Insert Earphone (ER3)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sound field speaker</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Coupler mic.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Monitor headphones</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Scope Monitor</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Sound chamber</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test area</td>
<td>7&quot; x 7&quot; x 1.5&quot; deep</td>
<td>6&quot; x 3&quot; x 1.5&quot; deep (FC6020)</td>
</tr>
<tr>
<td>Ambient noise isolation</td>
<td>45 dB @ 1000 Hz</td>
<td>45 dB @ 1000 Hz</td>
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<tr>
<td><strong>Safety</strong></td>
<td>EN 60601-1</td>
<td>EN60601-1, UL544</td>
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<tr>
<td><strong>EMC</strong></td>
<td>EN 60601-1-2</td>
<td>EN 60601-1-2</td>
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