The i714 Audiometer Calibration Software is an easy, flexible and reliable solution for automated calibration of audiometers to IEC and ANSI standards.

Audiometer certification is the primary focus, but the software is designed to accommodate the everyday needs of hospitals and clinics as well as those of calibration and metrology laboratories. Other fields of use are audiometer R&D and factory production testing.

The software is based on the powerful Brüel & Kjær sound level meter and analyzer Type 2250. It utilizes the precision of the Class 1 measuring instrument, experience in calibration and simplicity of use. The software performs the tasks ranging from basic standard audiometer testing with fully automated procedures to advanced customized tests.

The software with integrated database takes care of test procedure execution as well as all house-keeping data including client e-mail reminder for next calibration.

The calibration software is not limited to any specific brand or type of audiometer as long as the audiometer complies with relevant ISO standards.

Audiometer Calibration
The purpose of any calibration measurement is to check that the measurement equipment is measuring correctly. Regular testing and calibration of an audiometer is required to maintain maximum measurement accuracy.

For absolute acoustic calibration the audiometer should be calibrated using an artificial ear, a special measuring microphone designed for that purpose and a known sound pressure level.

Accurate and reliable measurements are fundamental to characterise and quantify hearing loss, and consequently for selection of hearing aids and for general health and safety monitoring. Prober calibration ensures that the measurements are consistent, no matter where the they are carried out.

**Uses**
- Calibrate any type of audiometer fulfilling IEC 60645 family of standards.
- Calibrate Headphones, Inserts, HF phones, Bone Oscillators and Tympanometers
- Free field calibration (audiometry test room)

**Features**
- Calibration procedures based on ISO 61389 and ISO 318 standards for air conductive and bone conductive transducers.
- Multiple test procedures.
- Semi- or fully automated procedures execution.
- Automatic correction for microphone and artificial mastoid sensitivity deviations.
- Data on operators, customers, audiometers, tests and test equipment is managed in one database.
- Data can be retrieved by a range of query parameters.
- Tracking of calibration equipment inventory and calibration date.
- Audiometer adjustment instructions
- Customized calibration reports
- Calibration reminder via e-mail.
Step 1: System Set-up
The calibration system is set-up by connecting the relevant components and the instrument to be calibrated into a measurement chain. The audiometer under test is connected via LAN or USB interface.

Step by step the calibration software guides the operator through the preparation procedure—all in an intuitive and logical order. During calibration, only the audiometer is operated by calibration technician—the 2250 is controlled from software.

Step 2: Client Data
Data management is a critical part of the calibration process and a strong feature of the calibration software. Measurement data, reports, customer data, inventory data, audiometer data, procedures, corrections for headphones, vibrators, microphones, mastoids and operators are handled by SQL database.

It is of major benefit to have all data stored in a well-defined and organised form, which facilitates retrieval, editing and updating. An additional safety feature is the regular software notification to produce a database back-up—in case of computer failure all data are preserved.

Prior to starting the actual calibration, the operator must enter customer information, select calibration procedure and specify instruments used. The client and associated audiometer is selected from the database. If customer does not exist already in the database, information is entered, including audiometer and accessory data (type and serial number etc.).

The acoustic analyzer Type 2250 is recognized by its serial number and even more importantly by installed software (Active Template). Most frequently used standardised headphones and vibrators are available in the database as default. Additional equipment can be added by the user and correction values entered as required.

Microphone and mastoid calibration corrections can be im...
Step 3: Procedure
An audiometer calibration task incorporates several tests depending on the type of audiometer. All acoustic admit-tance instruments use a probe tone that must be calibrated for at least frequency, SPL and distor-tion.

The operator can select from a range of tests:
- Pure tone (Air and Bone conduction level)
- Masking level (Narrow band)
- Masking level (Broad band)
- Attenuator linearity
- Frequency
- Total Harmonic Distortion (THD)
- Narrow band cut-off frequencies and bandwidth
- Free-field calibration
- Tympanometer calibration

One, some or all supported procedures can be included in the calibration task. Several procedures can be merged into one procedure (e.g. Pure tone first, Insert second and Mastoid third).

Each set of tests is user-defined, meaning that the operator can select frequencies at which the tests are executed. All tests are compared to limit values defined by the user (in reference to standards in question).

Corrections for used transducer (microphone and/or mastoid) are automatically read from the database and taken into account for calculation of the expected result. All calculations are performed by the calibration software and presented in a table as well as graphically to provide overview.

During pure tone level calibration, THD and frequency are simultaneously measured and calculated.

Step 4: Atmospheric Data
The environmental conditions of the calibration have to be documented. The levels of temperature, air humidity and air pressure are entered and will be included in the final calibration report. These data can be obtained from public sources.

Step 5: System Calibration
Traceability of measurement results is an integral part of the calibration procedure. Traceability is obtained by measurement chain calibration at the beginning of each audiometer calibration.

The software automatically in-
includes corrections for microphone and mastoid obtained from an independent calibration laboratory. The microphone chain sensitivity correction value is defined and saved for each completed calibration. The i714 Software constantly monitors the validity of calibration equipment in use. Calibration can start as soon as these conditions for correct calibration documentation are fulfilled.

Steps 6, 7 & 8: Calibration
When all relevant data are in the database, it is only a matter of selecting the calibration equipment and the audiometer to be tested, and calibration is started. The calibration of an audiometer is performed in three steps:
1. Calibration - deviations are calculated: the difference between expected values and measured values.
2. Adjustment - the audiometer is adjusted to meet expected values.
3. Recalibration, to ensure the correctness of the adjustment.
Online guidance eases the calibration and prevents the operator from missing important steps or taking incorrect actions. Each time the operator needs to intervene when calibration in progress, a window with clear and instructive information appears.

Any deviation exceeding limit value displays an information window with an option to repeat or accept the result. Results which are out of tolerance limits get red light in front of the step in question. During semiautomatic calibration, only the audiometer is operated by calibration technician. Intervention with Type 2250 is not needed at all—it is controlled from the software.

The calibration software constantly monitors the calibration validity of client audiometers and automatically sends out a notice on expired calibrations at start-up or on request.

**Step 9: Reporting**
Calibration results are saved in the database and available for creating report or just to be viewed on the screen. A query function provides capability to retrieve only the calibrations fulfilling specific criteria.

Selected calibrations can be examined on the screen or sent to Excel or Word using either a pre-defined or customer defined reporting template.

**Standards**
Confirms with the relevant parts of the following international standards:

- EN 60645-1 2002 Electroacoustics - Audiological equipment - Part 1: Pure-tone audiometers
- ISO 389 Acoustics - Reference zero for the calibration of audiometric equipment.
- EN 60318-3 2002 Acoustic coupler for the calibration of supra-aural earphones used in audiometry.
- ISO 8253-2 Measurements for free or quasi-free sound fields. The standard describes the characteristics of free-field and diffuse field characteristics and the procedures and conditions of use for sound field audiometry.
- IEC 60645-5 Technical requirements for the tympanometers and for audiometer part in IEC 60645-1.
- Calibration and test procedures are specified in IEC 1027 and ANSI S 3.39 - 1987.

Additional standards which has to be mentioned are:
- IEC 60645-5 / ANSI S 3.39-1987 Instruments for the measurement of aural acoustic impedance/admittance and IEC 1027 Test and calibration of Impedance audiometers (Tympanometers).
Audiometer Calibration Software i714

Benefits:
- Use to use—no special skills required
- Automated calibration and reporting
- On-line calibration instructions
- Automated correction of all instruments
- Traceable measurements and validity monitoring
- Easy data-handling—storage and retrieval
- Compliance to standards IEC 60645, 389 and 8253

ORDERING INFORMATION

i714 Audiometer Calibration Software

PC Requirements
Recommended PC: Pentium® III (or equivalent) processor, 128 MB RAM, SVGA graphics display/adaptor, sound card, CD ROM drive, mouse, USB, Windows® 7

Hardware
The software is designed to support Bruel & Kjaer Sound Level Analyzer type 2250 with the minimum configuration:
2250-A Precision Sound Level Meter loaded with BZ 7222 (basic functionality) conforming with the following National and International Standards:
- IEC 61672 – 1 (2002 – 05), Class 1
- IEC 60651 (1979) plus Amendment 1 (1993–02) and Amendment 2 (2000–10), Type 1
- IEC 60804 (2000–10), Type 1
Optional BZ 7223 for 1/3 Octave analysis or BZ 7230 for FFT analysis
See relevant Product Data from Bruel & Kjaer

Calibration options
The license for calibration software Type i714 is limited only by the applications available on 2250 and can cover:
- Pure tone (Air and Bone conduction level)
- Masking level (Narrow band)
- Masking level (Broad band)
- Attenuator linearity
- Frequency
- Total Harmonic Distortion (THD)
- Narrow band cut-off frequencies and bandwidth
- Free field calibration
- Tympanometer calibration (Manometer required)

For more information and ordering contact:
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