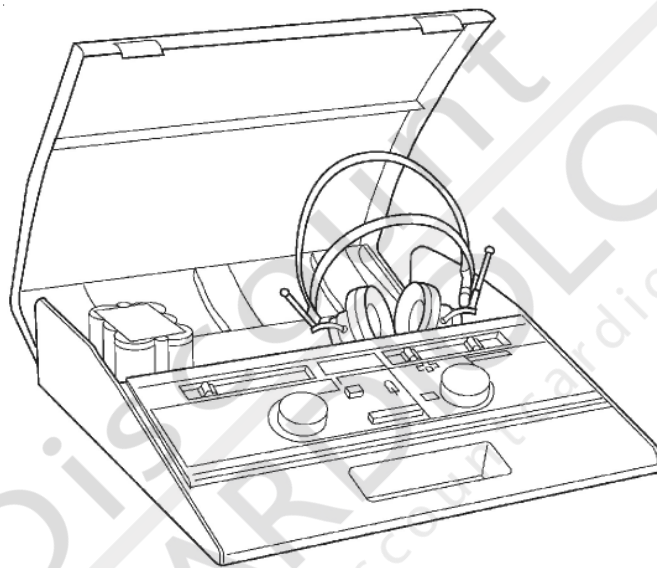


AM 232™ Manual Audiometer

Operating Instruction Manual



Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC)

Please refer to the Electromagnetic Compatibility Reference Guide on CD (part number 482-6387xx) for EMC information concerning your system.

Compatibilité électromagnétique (CEM)

Veuillez vous reporter au guide de référence de compatibilité électromagnétique sur CD (numéro de pièce 482-6387xx) pour des informations sur la CEM relatives à votre système.

Elektromagnetische Verträglichkeit (EMV)

Informationen über die EMV des Systems finden Sie im Referenz-Handbuch Elektromagnetische Verträglichkeit auf der CD (Teilenummer 482-6387xx).

Compatibilità elettromagnetica (EMC)

Vedere la guida alla consultazione per la compatibilità elettromagnetica contenuta sul CD (numero di parte 482-6387xx) per informazioni sulla compatibilità elettromagnetica relativa al sistema in dotazione.

Compatibilidad electromagnética (CEM)

Consulte la Guía de referencia sobre compatibilidad electromagnética incluida en el CD (número de pieza 482-6387xx) para obtener la información sobre la CEM de su sistema.

Electromagnetic compatibility (EMC)

Please refer to the Electromagnetic Compatibility Reference Guide on CD (part number 482-6387xx) for EMC information concerning your system.

电磁兼容性 (EMC)

有关系统的 EMC 信息, 请参阅 CD 上的电磁兼容性 (EMC) 参考指南 (部件号 482-6387xx)。

電磁適合性 (EMC)

お使いのシステムに関するEMC情報については、CD(パーツ番号482-6387xx)の『電磁適合性 (EMC)リファレンスガイド』を参照してください。

전자파적합성(EMC)

시스템에 관한 EMC 정보는 CD의 『전자파적합성(EMC) 가이드』(부품 번호: 482-6387xx)를 참조하십시오.

Compatibilidade Eletromagnética (EMC)

Favor consultar o Guia de Referência à Compatibilidade Eletromagnética no CD (número de peça 482-6387xx) para informações da EMC relativas ao seu sistema.



CE Mark per Medical Device Directive (93/42/EEC)

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Service and repair

Technical Service Department
Welch Allyn, Inc.
4341 State Street Road
Skaneateles Falls, NY 13153-0220
Tel.: 1-800-535-663 (in U.S.A. only)

Technical Service Department
Welch Allyn Canada Limited
160 Matheson Boulevard, East
Mississauga, Ontario, Canada L4Z 1V4
Tel.: 1-800-561-8797 (in Canada only)

Recalibration

Welch Allyn recommends that the AM 232 Manual Audiometer be recalibrated annually. Arrangements may be made by returning the instrument registration card or by contacting Welch Allyn's Technical Service Department (as listed above). A moderate fee is charged for recalibration.

Warranty

Note: Return of the instrument registration card is required for proof of purchase and warranty validation.

Welch Allyn, Inc. warrants the AM 232 Manual Audiometer to be free of original defects in material and workmanship and to perform in accordance with manufacturer's specifications for a period of one year from the date of purchase. If this instrument or any component thereof is found to be defective or a variance from the manufacturer's specifications during the warranty period, Welch Allyn will repair, replace or recalibrate the instrument or component(s) at no cost to the purchaser.

This warranty only applies to instruments purchased new from Welch Allyn or its authorized distributors or representatives. The purchaser must return the instrument directly to Welch Allyn or an authorized distributor or representative and bear the costs of shipping.


This warranty does not cover breakage or failure due to tampering, misuse, neglect, accidents, modification or shipping, and is void if the instrument is not used in accordance with manufacturer's recommendations or if repaired or serviced by other than Welch Allyn or a Welch Allyn authorized representative.


No other express or implied warranty is given.

Rechargeable battery warranty

Welch Allyn nickel-cadmium batteries are guaranteed by Welch Allyn for two years from date of manufacture (when used in Welch Allyn instruments only). Defective batteries will be replaced on a pro rata basis should failure occur prior to expiration data on battery.

Safety notes

 **WARNING** The AM 232 Manual Audiometer is designed to be used with a hospital grade outlet. Injury to personnel or damage to equipment can result when a three-prong or two-prong adapter is connected between the AM 232 Manual Audiometer power plug and an AC outlet or extension cord. Additionally, the AM 232 Manual Audiometer is equipped with a specific power transformer which should not be interchanged with any other transformer or supply.

This symbol  indicates the location of a service adjustment part and is intended for service personnel only. The AM 232 Manual Audiometer is a specifically calibrated audiometer and the periodic service and adjustments for the instrument that may be required should be done only by an authorized Welch Allyn service technician.

 **CAUTION** The AM 232 Manual Audiometer is designed to comply with the EMC requirements according to IEC 60601-1-2.

Radio transmitting equipment, cellular phones, etc. shall not be used in the close proximity of the device since this could influence the performance of the device. Particular precaution must be considered during use of strong emission sources such as High Frequency surgical equipment and similar device so that e.g., the HF-cables are not routed on or near the device. If in doubt, contact a qualified technician or your local representative. Refer to the Electromagnetic Compatibility (EMC) Guide on CD 482-638702.

Specifications

Standards

The AM 232 Manual Audiometer meets ANSI S3.6 and IEC 645 Type 4 Audiometer Standards.

UL 60601-1 Medical Electrical Equipment Requirements for Safety

IEC/EN 60601-1 General Requirements

CSA C22.2 No. 601-1-M90

Protective Classification

This system is intended for continuous operation and has a protective classification of Class II, Type B.

Class II  Type B  equipment symbols

Degree of protection against harmful ingress of water: Ordinary (no protection)

Frequency Range

Discrete Frequencies: 125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000 Hz

Accuracy: $\pm 3\%$

Total Harmonic Distortion: $< 2\%$

Intensity

Ranges: 125Hz: -10 to 50 dB HL

500 to 6000 Hz: -10 to 90 dB HL

250 and 8000 Hz: -10 to 70 dB HL (Increments of 5 dB steps)

Note: A “+10” dB switch extends maximum at all frequencies by 10 dB.

Accuracy: 125 to 4000 Hz: ± 3 dB

6000 to 8000 Hz: ± 5 dB

Signal to Noise Ratio: > 70 dB

Tone Type

Rise/Fall Time: 20-50 msec

Continuous: Steady when present bar depressed

Pulsed: 2.5 pulse/sec

FM: 5 Hz, $\pm 5\%$

Headset

Telephones TDH39 Earphones with MX41 AR Cushions (60 ohm impedance).

Power

Line Voltage: 100-240 V ($\pm 10\%$) **Note:** Desktop power supply
 Range: 50-60 Hz ($\pm 5\%$)
 Consumption: 9 Watts

Battery

Types: Rechargeable (NiCad) or Non-Rechargeable (Alkaline)
 Range: 7.0 V - 9.0 V
 Capacity: NiCad - 22 hours continuous operations
 Alkaline - 45 hours continuous operations

Environmental**Temperature:**

Operating: 60° F to 105° F (15° C to 40° C)
 Powerline Storage: -40° F to 140° F (-40° C to 60° C)
 Battery Storage: -40° F to 105° F (-40° C to 40° C)
 Humidity: 5% to 90%
 Warm-up Time: 10 minutes for instruments stored at room temperature

Mechanical

Dimensions: 13.25" W x 14" D x 3.75" H
 (33.66 cm x 35.56 cm x 9.53 cm)

Weight: 5.6 lb (2.53 kg) net
 8 lb (3.64 kg) shipping
 10 lb (4.55 kg) shipping with battery included

Supplied Accessories

Test headset (TDH39)	23223
Audiogram Forms (1 pad of 50)	52300
Instruction Manual	232001
AC Power Module	8000-0246

Catalog Numbers**Optional Accessories**

Response Handswitch	23220
Patch Cord, 2 Conductor	23221
Audiocups	23222
Replacement NiCad Battery Only	72320
Battery Pack Assembly	72329

Battery Pack includes Welch Allyn supplied NiCad battery. May also be used with six (6), Size C, Alkaline batteries (not included) Replacement NiCad

Catalog Listings

AM 232 Manual Audiometer, AC Power (USA)	23200
AM 232 Manual Audiometer, AC Power and Battery (USA)	23210
AM 232 Manual Audiometer, AC Power (Export)	23205
AM 232 Manual Audiometer, AC Power and Battery (Export)	23215

Chapter 1

Introduction

The AM 232 Manual Audiometer is a single-channel, pure tone, air conduction, portable instrument designed to provide basic audiometric screening capability for physicians' offices, schools and industry. The lightweight design allows easy transport to a variety of testing locations, and the built-in storage cavity and case provide enough room to contain all instrument accessories. The clearly labeled front panel controls and full frequency range make accurate, reliable testing a simple matter for any user.

The AM 232 Manual Audiometer is a precisely designed and calibrated instrument. With proper care it will deliver accurate sound-pressure levels to subject ears for your hearing screening program.

Note: The AM 232 Manual Audiometer should be recalibrated yearly (or sooner if a problem develops). See Chapter 4.



Unpacking and inspection

Although your AM 232 Manual Audiometer was carefully tested, inspected and packed for shipping, it is good practice after receiving the instrument to immediately examine the exterior of the container for any signs of damage. Notify your carrier if any damage is noted.

Carefully remove your AM 232 Manual Audiometer from its shipping container. If the instrument appears to have suffered mechanical damage, notify the carrier immediately so that a proper claim can be made. Be certain to save all packing materials so that the claim adjuster can inspect it as well. As soon as the carrier has completed the inspection, notify your Welch Allyn representative.

If the instrument must be returned to the factory, repack it carefully (in the original container if possible) and return it prepaid to the factory for necessary adjustments. Check that all accessories itemized in **Accessories supplied** below are received in good condition. If any accessories are missing, contact Welch Allyn immediately. See the **Specifications** section for the catalog numbers of accessories and also for a listing of optional accessories.

Accessories supplied

Test Headset Assembly (TDH39)
Audiogram Pad (1 pad of 50)
Battery Pack Assembly (used with #23210 and #23215 models only)
AC power cord

Connectors, Controls, Indicators

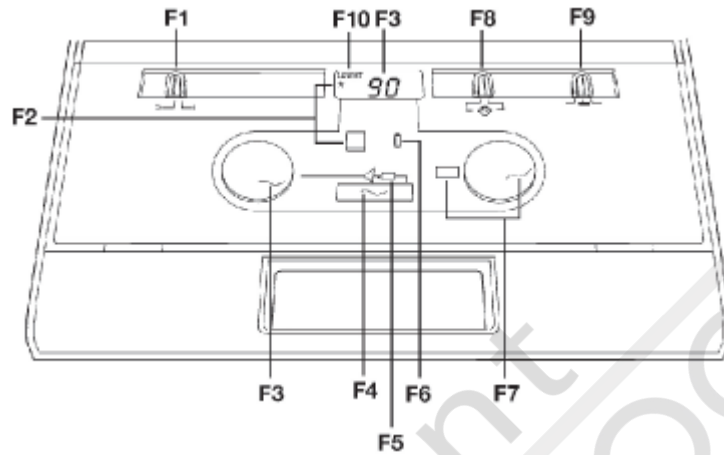


Figure 1: Front panel.

Front panel controls and indicators (see Figure 1)

F1 - Power switch and indicator for ON and OFF.

F2 - Range extension pushbutton allows you to increase the stimulus intensity 10 dB above the standard maximum HL at any frequency. When in use, a “+” appears on the LCD.

F3 - HL control for setting stimulus intensity level. Level is indicated on LCD.

F4 - Present bar for stimulus presentation.

F5 - Stimulus being presented via an earphone. Presentation indicated by illuminated green LED.

F6 - Subject response indicator shows you when the test subject has pressed the handswitch button by an illuminated green LED (with **optional** handswitch only).

F7 - Control for setting stimulus frequency. Frequency is indicated in the window adjacent to the control.

F8 - Routing switch for stimulus presentation to the earphone. Left or right indicated by illustration of subject.

F9 - Switch for setting the stimulus tone type.

FM = warble tone

— = steady tone

- - - = pulsed tone

F10 - Low battery indicator to alert you of a limited operating time. Recharge or replace batteries (dependent on whether NiCad or Alkaline batteries are used).

Rear panel connectors and indicators (see Figure 2)

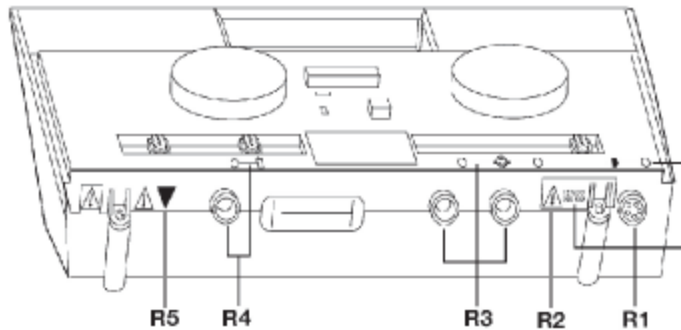


Figure 2: Rear panel.

R1 - Power input jack (5-pin DIN Connector) with front panel illustration showing its location and a rear panel label giving the input power specifications.

R2 -  Attention, consult accompanying document for instructions or warnings pertaining to these parts.

R3 - Earphone output jacks (standard phone jacks). Front panel illustration shows left and right phone.

R4 - Response handswitch input jack (standard phone jack) with front panel illustration showing location.

R5 -  Entry by qualified service personnel only.



Note: The above symbol is located inside the storage compartment. It denotes a Type B, Class II product per IEC 878 as referenced in IEC 60601-1.

Note: There is a symbol on the bottom panel (marked B1 in Figure 3) that indicates entry by qualified service personnel only.

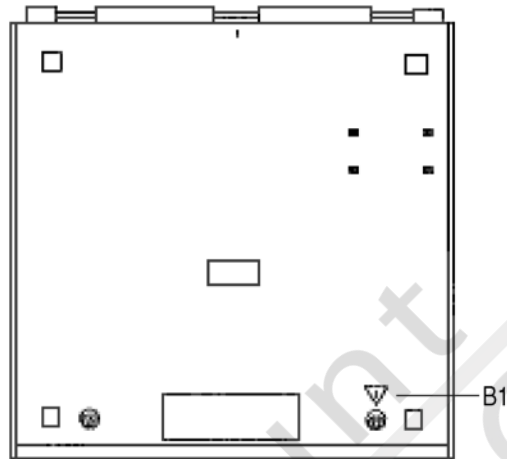
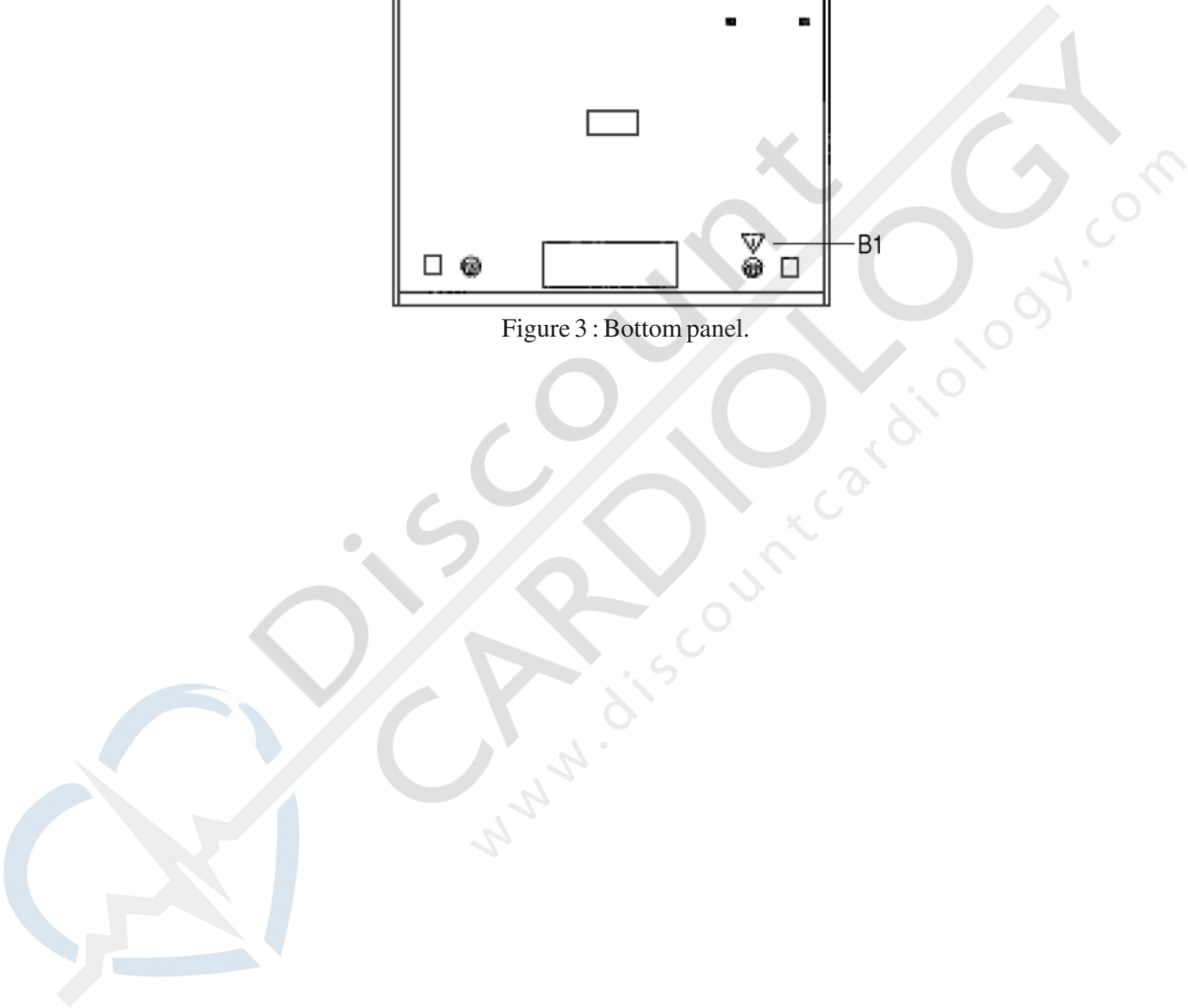


Figure 3 : Bottom panel.



Installation

1. Plug the power cord into the appropriate jack (**R1**) on the back panel of the instrument.
2. Plug the other end into a line power (mains) outlet.
3. Plug the **earphones** into the earphone jacks (**R3**) on the rear panel. Note the symbol along the top of the front panel, which indicates which is right (RED) and which is left (BLUE).
4. Turn the power switch to **ON**.

Note: For battery operation, please refer to Chapter 2.



Discount
CARDIOLOGY
www.discountcardiology.com

Pretest procedure

Note: The AM 232 is a versatile audiometer designed for use in doctor offices, schools, industrial settings, the military, etc. The generic term “subject” used in this manual is used to identify the person whose hearing is being evaluated.

Any program aimed at obtaining reliable records of hearing thresholds should be staffed and supervised by **appropriately-trained** individuals. Training courses leading to certification are available for audiometric technicians in most urban areas.

Two prerequisites are of particular importance to the procurement of reliable audiograms:

- Prior to testing, allow adequate time for the subject to recover from the effects of a previous exposure to high-level sound.
- Tests should be performed in a quiet area.

Pretest noise recovery period

Exposure to high levels of sound (unmuffled lawn mowers, power tools, loud music, gunfire, etc.) tends to create a temporary threshold shift (**TTS**), which diminishes with time after exposure. Any subject tested soon after such exposure may manifest a hearing loss that does not reflect the subject’s normal hearing threshold. It is, therefore, important that the testing procedure prescribe some time interval - usually at least 16 hours - between the last exposure to high-level sound and the administration of any hearing test.

Elimination of ambient noise

Excessive noise in the test environment such as that produced by conversation, typewriters, or other machines also reduces test validity because it tends to mask the test signals particularly at the lower frequencies where earphone cushions provide less effective attenuation. An acoustically tested room may be required if ambient noise at the subject's ears reaches objectionable levels - i.e., sufficient to cause apparent hearing loss at the low frequencies. Also, Audiocups are available from Welch Allyn as an optional accessory. If the test subject is in the same room as the audiometer, it is recommended that the subject be seated about 1 meter (-3 ft) away from the instrument.

Maximum permissible test environment sound-pressure levels are specified by American National Standard Criteria for Permissible Background Noise during Audiometric Testing, S3.1-1977 (revised). Table 2 shows the maximum background levels that can be present inside the room while a valid hearing test is being conducted. For more comprehensive information about hearing testing and hearing conservation, refer to the *Bibliography*.

Permissible noise levels

Test Tone Frequency (Hz)	125	250	500	750	1000	1500	2000	3000	4000	6000	8000
Test Room *	34.0	22.5	19.5	21.5	26.5	26.5	28.0	33.5	34.5	38.0	43.5
Test Room **	29.0	17.5	14.5	16.5	21.5	21.5	23.0	28.5	29.5	33.0	38.5

*Ears covered maximum permissible octave band levels.

**Ears covered maximum permissible one-third octave band levels.

Disposal of non-contaminated electrical and electronic equipment directive 2002-96-EC-WEEE



English	<p>Do not dispose of this product as unsorted municipal waste. Prepare this product for reuse or separate collection as specified by Directive 2002/96/EC of the European Parliament and the Council of the European Union on Waste Electronic and Electrical Equipment (WEEE). If this product is contaminated, this directive does not apply.</p> <p>For more specific disposal information, see www.welchallyn.com/weee, or contact Welch Allyn Customer Service at +44 207 365 6780.</p>
Česky	<p>Tento výrobek nelikvidujte s netříděným domovním odpadem. Připravte ho k novému použití nebo do sběru separovaného odpadu podle směrnice Evropského parlamentu a Rady Evropské unie číslo 2002/96/EC o likvidaci elektronických a elektrických zařízení (Waste Electronic and Electrical Equipment, WEEE). Pokud je výrobek kontaminován, tato směrnice pro něj neplatí.</p> <p>Podrobnější směrnice o likvidaci najdete na adrese www.welchallyn.com/weee nebo zavolejte oddělení služeb zákazníků společnosti Welch Allyn na čísle +353 46 9067790.</p>
Dansk	<p>Produktet må ikke bortskaffes som sorteret husholdningsaffald. Produktet skal forberedes til genbrug eller særskilt indsamling som angivet i Europa-Parlamentets og Rådets Direktiv 2002/96/EF om affald af elektrisk og elektronisk udstyr (WEEE). Hvis produktet er kontamineret, gælder Direktivet ikke.</p> <p>Yderligere oplysninger om bortskaffelse fås på www.welchallyn.com/weee eller ved at kontakte Welch Allyn Kundeservice på +353 46 9067790</p>
Deutsch	<p>Dieses Produkt darf nicht mit unsortiertem Hausmüll entsorgt werden. Bereiten Sie dieses Produkt zur Wiederverwertung oder zur getrennten Sammlung entsprechend der Richtlinie 2002/96/EG des Europäischen Parlaments und des Rats der Europäischen Union über Elektro- und Elektronik-Altgeräte (WEEE-Richtlinie) vor. Diese Richtlinie gilt nicht bei Kontamination des Produkts.</p> <p>Detailliertere Informationen zur Entsorgung finden Sie unter www.welchallyn.com/weee bzw. erhalten Sie beim Kundendienst von Welch Allyn unter der Telefonnummer +49 7477 92710</p>
Español	<p>No deseche este producto como residuos municipales sin clasificar. Prepare este producto para su reutilización o recogida selectiva como se especifica en la Directiva 2002/96/CE del Parlamento Europeo y el Consejo sobre residuos de aparatos eléctricos y electrónicos (RAEE). Si este producto está contaminado, no se aplica esta directiva.</p> <p>Para obtener información más específica sobre los desechos, consulte www.welchallyn.com/weee o póngase en contacto con el servicio de atención al cliente de Welch Allyn llamando al +34 91 7499357.</p>
Eesti keeles	<p>Ärge vabanege antud tootest kui sorteerimata olmejäätmetest. Valmistage toode ette korduvkasutamiseks või lahuskogumiseks, nii nagu on kindlaks määratud Euroopa Parlamendi ja nõukogu direktiivis 2002/96/EÜ elektri- ja elektroonikaseadmete jäätmete kohta. Kui toode on reostunud, siis nimetatud direktiiv ei kohaldu.</p> <p>Täpsemat teavet jäätmekõrvaldamise kohta saab www.welchallyn.com/weee või võtke ühendust Welch Allyn' klienditeenindusega telefonil +353 46 9067790.</p>
Ελληνικά	<p>Μην απορρίπτετε το προϊόν στα κοινά δημοτικά απορρίμματα. Προετοιμάστε το προϊόν για επαναχρησιμοποίηση ή ξεχωριστή συλλογή απορριμμάτων όπως καθορίζεται στην Οδηγία 2002/96/ΕΚ του Ευρωπαϊκού Κοινοβουλίου και του Συμβουλίου της Ευρωπαϊκής Ένωσης σχετικά με τα απόβλητα ειδών ηλεκτρικού και ηλεκτρονικού εξοπλισμού (ΑΗΗΕ). Αν αυτό το προϊόν είναι μολυσμένο, η παραπάνω οδηγία δεν ισχύει.</p> <p>Για περισσότερες πληροφορίες σχετικά με την απόρριψη, μεταβείτε στην ιστοσελίδα www.welchallyn.com/weee ή επικοινωνήστε με την Εξυπηρέτηση Πελατών της Welch Allyn στο τηλέφωνο +44 207 365 6780.</p>
Français	<p>Ne mettez pas au rebut ce produit avec les ordures ménagères non triées. Préparez-le en vue d'un recyclage ou d'une collecte séparée, comme stipulé par la Directive 2002/96/EC du Parlement européen et du Conseil de l'Union européenne sur les déchets d'équipements électroniques et électriques (WEEE). Cette directive ne s'applique pas si le produit est contaminé.</p> <p>Pour des informations plus spécifiques sur la mise au rebut, visitez le site www.welchallyn.com/weee, ou contactez le service clientèle Welch Allyn au +33 1 55695849.</p>



Italiano	<p>Non smaltire questo prodotto con i normali rifiuti. Approntare il prodotto per il riutilizzo oppure smaltirlo in modo differenziato, in base a quanto stabilito dalla Direttiva 2002/96/EC del Parlamento Europeo e del Consiglio dell'Unione Europea in materia di smaltimento delle apparecchiature elettriche ed elettroniche (WEEE). Se il prodotto è contaminato, tale direttiva non viene applicata.</p> <p>Per ulteriori informazioni sui metodi di smaltimento, visitare il sito Web all'indirizzo www.welchallyn.com/weee oppure contattare l'assistenza clienti Welch Allyn al numero +39 02 69682425.</p>
Lietuvių k.	<p>Neišmeskite šio gaminio kartu su nerūšiuotomis miesto atliekomis. Paruoškite šį gaminį pakartotinam naudojimui ar surinkimui atskirai, kaip nurodyta Europos Parlamento ir Tarybos direktyvoje 2002/96/EB dėl elektros ir elektroninės įrangos atliekų (EE[A]). Jei gaminys yra užkrėstas, direktyva jam netaikoma.</p> <p>Norėdami gauti daugiau specifinės informacijos, žr. www.welchallyn.com/weee, arba susisieki su Welch Allyn Klientų aptarnavimo skyriuje +353 46 9067790.</p>
Magyar	<p>Ne dobja ki a termékét a települési vegyes hulladékgyűjtőbe. A terméket az újrafelhasználási vagy egyéb, speciálisan ilyen célokra kijelölt gyűjtőhelyen kell leadni, az Európai Parlament és a Tanács elektromos és elektronikai berendezésekből származó hulladékról (WEEE) szóló, 2002/96/EK számú irányelvének megfelelően. Ha a termék befertőzött, az említett irányelv rendelkezései nem vonatkoznak a kidobására.</p> <p>A hulladékkezeléssel kapcsolatos részletes tájékoztatást megtalálhatja a www.welchallyn.com/weee webhelyen, illetve érdeklődhet a Welch Allyn ügyfélszolgálatánál a +353 46 9067790-es számon.</p>
Nederlands	<p>Dit product mag niet worden weggegooid bij niet-gesorteerd huishoudelijk afval. Het product moet worden geprepareerd voor hergebruik of gescheiden inzameling conform de richtlijn 2002/96/EC van het Europees parlement en de Raad van de Europese Unie inzake de verwerking van elektrisch en elektronisch afval (WEEE - Waste Electronic and Electrical Equipment). Deze richtlijn is niet van toepassing indien het product is verontreinigd.</p> <p>Ga voor specifieke instructies voor afvalverwijdering naar www.welchallyn.com/weee, of neem contact op met de klantenservice van Welch Allyn op het nummer +31 15 7505000</p>
Norsk	<p>Produktet skal ikke kastes som restavfall. Produktet skal leveres for gjenbruk eller som spesialavfall i henhold til Europaparlamentets og EU-rådets direktiv 2002/96/EF om avfall fra elektronisk og elektrisk utstyr (WEEE). Hvis produktet er forurenset, gjelder ikke dette direktivet.</p> <p>Se www.welchallyn.com/weee eller kontakt Welch Allyn kundeservice på +44 207 365 6780 for nærmere opplysninger om avfallshåndtering.</p>
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Chapter 2

Battery Option

This chapter describes the battery option of the AM 232 Manual Audiometer. It pertains only to those customers who purchased Models #23210 or #23215 with the battery pack installed or to those who later purchased the #72329 Battery Pack Assembly. In both cases, a rechargeable NiCad battery is included.



NiCad BATTERY OPERATION

The AM 232 Manual Audiometer battery option is supplied with an installed, rechargeable NiCad battery pack. It requires about 18 hours to charge fully, which will provide about 22 hours of continuous operation. The green LED on the pack itself illuminates when charging is in progress. The words **LO BAT** illuminates on the front panel LCD when the battery charge is getting low, alerting you to recharge the batteries. When **LO BAT** appears, the instrument will operate (continuously) for about two more hours before it shuts down completely.

Note: In no instance will loss of battery power affect the instrument calibration.

To save battery life, the AM 232 Manual Audiometer has a special "Sleep Mode" in which the instrument will shut down after 5 minutes of no operation. You will know the instrument is "asleep" because the LCD will show three dash lines (- - -). To "wake up" the instrument, press the **Present bar**. There is no danger of presenting a loud tone to the test subject when the instrument "wakes up" because no tone is presented until the Audiometer is awake. In addition, the instrument automatically resets its output to 0 dB HL.

If the AM 232 Manual Audiometer is operated until the battery charge has dropped below an acceptable voltage level, the instrument will cease to function. The display will be blank except for the **LO BAT** indication, and the controls will cease to function. To restore operation, the batteries must be recharged for some period of time, up to 18 hours (full charge), or line power (mains) may be used. If the Audiometer is operated off of line power (mains) with the rechargeable batteries in place, some battery charging will occur.

Recharging NiCad batteries

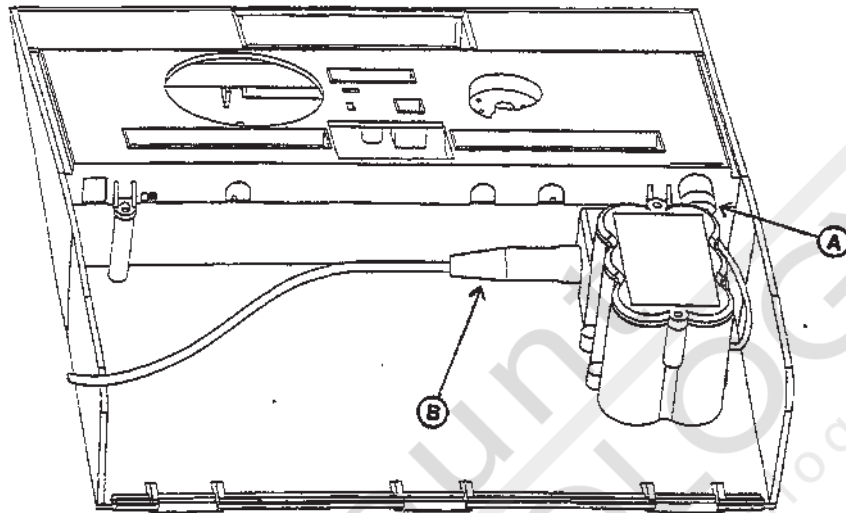


Figure 1: Recharging the NiCad battery.

Refer to Figure 1 when recharging NiCad batteries and proceed as follows:

- a. Be certain that the battery pack power cord is connected to the power cord receptacle on the back panel of the audiometer - (**A**)
- b. Connect the instrument power cord to the receptacle on the lower edge of the battery pack - (**B**).
- c. Plug the power cord into a wall outlet.

⚠ CAUTION Although no damage to the rechargeable NiCad batteries will occur if the pack is left charging for more than the 18 hours required for a full charge, the batteries should not be left charging for extended periods (several days) because the useful life of the rechargeable NiCad pack will be shortened. Welch Allyn recommends unplugging the battery pack power input cord from the back of the audiometer and plugging the main line power cord into the jack if main line power is to be used most of the time.

Replacing NiCad batteries

Please refer to Figures 2, 3, 4 below and proceed as follows:

1. Unplug the AM 232 Manual Audiometer from the line power (mains).
2. Remove the two screws on the battery pack cover and lift off the cover.
3. Pull the NiCad battery out of the pack. The battery is actually a set of 6 batteries wrapped in plastic, but they will be removed as a single unit.

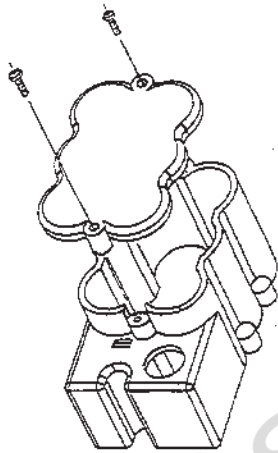


Figure 2:
Removing the battery cover

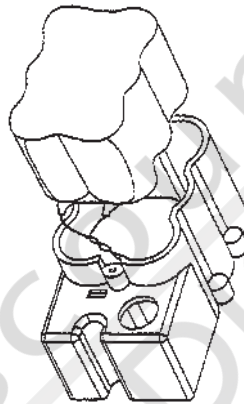


Figure 3:
Removing the battery pack

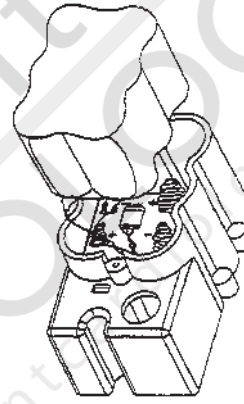


Figure 4:
Internal view of the
battery compartment

4. Carefully disconnect the lead wires of the NiCad battery from the battery compartment by removing the small connector.
5. Remove the NiCad battery pack.
6. Attach the lead wire connector on the new NiCad battery to the mating connector in the battery pack base.
7. Place the new NiCad into the battery pack.
8. Replace the battery pack cover. There is only one way that the cover can be replaced and the screws tightened. Note that the screw housing is longer on one end. Orient the top cover so that it will sit flat on the top of the battery compartments and replace screws.

Alkaline battery installation/operation

For longer continuous battery operation, such when recharging on a regular basis is not possible, the rechargeable batteries can be replaced with six size C alkaline batteries. These batteries will provide about 45 hours of continuous operation.

The low voltage indicator operates the same way for alkaline batteries as it does for NiCad batteries. The words **LO BAT** appears on the LCD when about 6 hours of continuous battery operation remains. In addition, the “sleep mode” also works with the alkaline batteries to prolong their useful life.

To install the alkaline batteries, refer to figures 2, 3 and 4 on the previous page, and proceed as follows:

1. Unplug the AM 232 Manual Audiometer from the line power (mains).
2. Remove the two screws on the battery pack cover and lift off the cover.
3. Pull the NiCad battery out of the pack. The battery is actually a set of 6 batteries wrapped in plastic, but they will be removed as a single unit.
4. Carefully disconnect the lead wires of the NiCad battery from the battery compartment by removing the small connector.
5. Remove the NiCad pack.
6. There are six spring mounts on the top and bottom of the battery compartment to hold the alkaline batteries and the label on the bottom surface of the compartment indicates the correct position for each battery. Place each one of the six batteries into the pack matching the polarity (+ or -) as shown on the label.
7. Replace the battery pack cover. Make sure the cover is positioned such that the spring mounts touch the batteries. There is only one way that the cover can be replaced and the screws tightened. Note that the screw housing is longer on one end. Orient the top so that it will sit flat on top of the battery compartment and replace screws.

Note: If the alkaline batteries are not going to be used on a regular basis, they should not be stored in the audiometer. They should be removed from the battery pack and stored in a cool, dry place.

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Chapter 3

Operation

Throughout this chapter are references to front panel (**F**) and rear panel (**R**) connectors, controls and indicators. Please refer to *Connectors, Controls and Indicators* and Figures 1 and 2 in Chapter 1 of this manual for specific descriptions and locations.



Preliminary check

1. Prior to testing, ensure that the power cord and earphone cords are plugged in (**R1** and **R3** respectively).
2. Turn the audiometer on.
3. Select the desired tone type (**F9** - pulsed, steady or FM).
4. Make whatever notations your procedure requires on the audiogram form.

! **CAUTION** Always handle earphones with care. Neither drop them nor permit them to be squeezed together. Severe mechanical shock may change their operating characteristics and require their replacement.

IMPORTANT: Always clean and maintain your earphone cushions, for hygiene purposes. Check periodically for cracking or signs of wear. Cleanse cushions daily or after each use (depending upon population being tested). Use a solution of diluted alcohol or mild soap and water, taking care not to get any of the cleaning solution into the earphone speaker. Use earphones only when completely dry. Insert the earphone cords between the earphone cushions during storage to prevent damage from mechanical shock.

Instructing the subject

You should put the subject as much at ease as possible before the test begins. In addition, you should try to make the subject understand how the test is to be conducted and what the subject will hear. For the sake of uniformity, an unvarying explanation is advisable - something similar to the following:

“I am going to place these earphones over your ears. You will hear a variety of tones - some high, some low, some loud, some very soft. Whenever you hear, or think you hear one of these sounds, raise your hand. Lower your hand when you no longer hear the sound.

Remember that though some of the tones will be easy to hear, others will be very faint. Therefore, you should listen very carefully and raise your hand whenever you think you hear the tone.”

Modify the instructions accordingly if the optional response handswitch is to be used.

Placing the earphones

The most important thing to remember is that a good seal is required between the earphone cushion and the subject's head and ear. To increase the likelihood of a good seal:

- a. Eliminate all obstruction between earphone and subject (hair, eyeglasses, earrings, hearing aids, etc.).
- b. Adjust the headband so that it rests solidly on the crown of the subject's head and exerts firm pressure on both ears.
- c. Center earphones carefully over both ears, earphone with red connector on right ear. Take care to eliminate any visible gaps between earphone cushions and portions of the subject's head and the ear on which the cushion rests.

Response handswitch

If the optional response handswitch is to be used insure that the plugs and jacks are properly connected. The AM 232 Manual Audiometer front panel indicator will be illuminated when the subject presses the response button.

Audiogram form

The AM 232 Audiogram form (see Figure 1) consists of three distinct parts:

- Space for entering information about the person to be tested.
- A convenient chart for manually plotting test data.
- Space for entering comments about the subject or the test.

AM 232 AUDIOGRAM

Name _____
Age _____ Sex _____ Date _____ Time _____
Job Description _____

Audiometer Model No. _____
Serial No. _____
Examiner _____
Signature _____

SYMBOLS			
Ear	Response	No Response	Phone
Left	X	X	Blue
Right	○	○	Red

COMMENTS _____

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HEARING LEVEL IN DECIBELS
ISO 389-1985 ANSI S3.6-1989

250 500 750 1000 1500 2000 3000 4000 6000 8000
TONE FREQUENCY (Hz)

Figure 1: Audiogram Form

Routine calibration check

It is good practice to make and file, at the start of each month's testing, the audiogram of a single subject or of a small group of subjects who are likely to be routinely available for this purpose. Where physical arrangements permit, you can serve as a subject.

This procedure should be performed when the Audiometer is installed, and be performed each month thereafter. If the AM 232 Manual Audiometer is to be used to monitor employee thresholds as part of an industrial Hearing Conservation Program, this "biological listening check" must be done at the beginning of each day the audiometer is to be used (per CFR 1910.95 Occupational Noise Exposure, March 8, 1983).

Since individual thresholds can shift up or down as much as 5 dB from one day to the next, variation within this range may be considered acceptable. Variations that exceed this range, however, are likely to reveal problems that require attention. The routine maintenance checks described in Chapter 4, may suggest the source and solution to the problem. If they do not, the instrument should receive technical service by a certified technician before further use.



Routine test administration

HL control (F3)

The HL control increases or decreases the presented intensity in 5 dB HL steps with the currently available intensity displayed on the LCD. Rotating the **Control** knob clockwise increases the intensity; counterclockwise decreases intensity. When the maximum or minimum available intensity is reached for any frequency, the display will flash to alert you that the available range can not be exceeded.

Range Extension pushbutton (F2)

This control allows the operator to present tones of up to 10 dB above the standard maximum HL at any frequency. It will only function when the intensity is set within 10 dB below the maximum standard intensity at any frequency. This feature requires an extra step to access or use the highest available intensities, requiring the operator to make note of those individuals requiring testing at these levels. It also prevents accidental presentation of the highest intensities to normal subjects, and it alerts the operator to present the stimulus for only brief periods of time.

To enable the range extension feature, press the button labeled **+10 dB**. Note that a “+” sign appears on the LCD. To disable the feature, either press the button a second time, reduce the intensity (with the **HL** control knob) to 20 dB below the standard maximum HL or change any other parameter (Frequency or Routing).

Tone Type Selector (F9)

This control allows you to choose the type of tone presented to the test subject. It can be set on **steady**, **pulsed** (2.5 pulses per second) or **FM** (warble tone).

Pulsed tones and warble tones are often used with difficult to test subjects, such as children and hard of hearing individuals, because they hold the subject’s attention better than the steady tone.

Typical testing session

Pretest Review

1. Turn the instrument on.
2. Check that the earphones are operating properly.
3. Seat subject comfortably in the test area.
4. Explain the test procedure.
5. Assist subject with the earphones.
6. Select the desired tone type.
7. Make **appropriate** entry on the subject's audiogram.

Familiarization

1. Set the Routing selector to route the test tone to the selected ear.
2. Demonstrate the 1000 Hz tone at a 40 dB level. The Tone Duration should be between 1 and 2 seconds.
3. Set the HL control to **-10 dB**.
4. **Practice:** Beginning with the tone on continuously (Present Bar held down), gradually increase the intensity by turning the HL control until a response occurs. Switch the tone off for at least two seconds and present the tone again at the same level. If there is a second positive response, proceed to threshold measurement. If a second response does not occur, repeat this step. Practice is preliminary to threshold measurement determination and is to be completed at each new frequency setting.

Determining the threshold (Pure Tone)

1. The level of the first presentation shall be 10 dB below the level at which the subject responded during the familiarization procedure. Present the tone for a period of one or two seconds. Time between tones can be varied, but not shorter than the duration of the test tone itself. After each failure to respond to a signal, the level is increased by 5 dB until the first response occurs. After the response, the intensity is decreased 10 dB and another ascending series is begun.

Note: Down 10 dB, Up 5 dB

2. The threshold is considered to be the minimum dial setting at which a response has occurred two out of three times. Record this setting on the **audiogram** form.

Testing procedure

1. Repeat the *Familiarization* and *Determining the threshold (Pure Tone)* procedures for each tone-setting in the following order: 1000, 2000, 3000, 4000, 6000, and 8000 Hz.
2. Retest 1000 followed by 500 and 250.

If there is a difference of 20 dB or more between two successive octaves, test the inter-octave responses (i.e., 750, 1500, 3000 Hz). Record this information on the audiogram form.

3. Repeat *Familiarization*, *Determining the threshold (Pure Tone)* and *Testing procedure* for the other ear.

Chapter 4 Routine Maintenance



Calibration

The biological listening check, or routine calibration check, should be performed at least monthly. (See *Routine calibration check* in Chapter 3).

The following checks should be made at periodic intervals, even if routine calibration checks do not reveal any problems. These procedures presuppose normal hearing on the part of the person doing the checking.

Earphone cords

With extended use, earphone cords tend to fray internally at the junctions of both earphone and audiometer connectors. This fraying will ultimately either decrease the signal level in the associated earphone or cause signals to be intermittent as the cord is flexed.

To check for either condition:

1. Set the Audiometer frequency control (**F7**) to 1000 or 2000 Hz.
2. Set the HL control (**F3**) at a comfortable audible level.
3. Press the **Present** bar (**F4**) and flex earphone cord next to plug at both ends, listening for intermittent signal, abrupt changes in signal level, or a scratchy sound superimposed over the signal that coincides with the flexing of the cord. The presence of any of these three conditions signifies that the cord should be replaced.
4. Repeat the test for the other earphone.

Hum and random noise

This test can be made during the check for attenuator noise. With the instrument set on 1000 Hz, move the HL control (F3) from 0 to 60 dB and listen for low-frequency hum (60 to 120 Hz) and random noise (hiss or low rushing sound) at all attenuator levels. Some audible random noise at levels above 60 dB is permissible. Below 60 dB, however, only the signal should be audible. Any of these noises can be confused with the signal by naive subjects and affect the accuracy of the audiogram. Schedule the audiometer for immediate service if any of the three is detected.

Distortion and frequency shift

This check can be best made by listening to the output of the AM 232 Manual Audiometer through the earphones while presenting all 11 frequencies at a loud, but **not uncomfortable**, level (70 to 80 dB HL for normal ears.)

Listen for rattling, rasping or distortion in the tones presented. Listen also to ascertain that signal frequencies change plausibly when the frequency selector (F7) is moved to a new position. If distortion is heard in one earphone but not in the other, the chances are high that the earphones are at fault and should be replaced. In any case, the audiometer should be scheduled for immediate maintenance.

Special messages

The AM 232 Manual Audiometer performs a self-check each time the instrument is turned on (the self-check does not occur when instrument operation resumes from the “sleep mode”). Certain messages will be displayed on the front panel LCD if any error in the instrument operation is detected. These messages are described below.

CAL

When a transducer or frequency is selected that has a calibration error (e.g., right earphone at 2000 Hz), the word “CAL” will be displayed. The audiometer will not function at this frequency with this transducer, so no invalid results can be recorded. The word “CAL” will be displayed as long as the erroneous transducer and frequency settings are selected. If the calibration error is an isolated situation, changing either the frequency or the transducer (e.g., left earphone at 3000 Hz) will restore normal instrument function.

As in the case with any instrument malfunction, a certified service technician should be contacted immediately. Remember to make note of the combination of transducer and frequency that cause the “CAL” message.

Exx

When an error code consisting of an “E” and a two digit number xx = number) appears on the audiometer’s display, a system error has been detected. The AM 232 Manual Audiometer will enter a “lockout” mode which will not permit the instrument to operate. The specific error code will remain on the display for several seconds, then the instrument will shut itself down completely. Should an Exx appear on the LCD, take the following steps:

1. Power down, power up again. This could be only a **temporary** failure and may never appear again. However, should the Exx message appear again, proceed to steps b and c.
 - a. Write down the numbers displayed on the display.
 - b. Contact your certified service representative and give them the numbers you recorded.



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