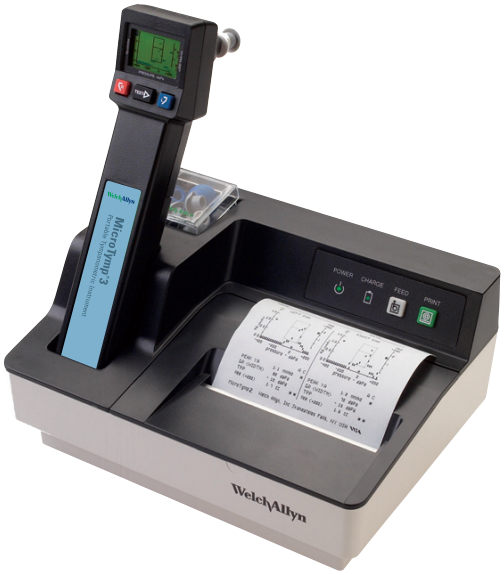
MicroTymp®3 portable tympanometric instrument



Directions for use

WelchAllyn®

Advancing Frontline Care™

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Germany	+ 49 7477 92 71 86	Japan	+ 81 3 3219 0071
Latin America	+ 1 305 669 9003	Netherlands	+ 31 15 750 5000
Singapore	+ 65 6419 8100	South Africa	+ 27 11 777 7555
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CE 0297

Welch Allyn®

Contents

1 Introduction

About this document

This document is written for clinical professionals who are qualified to perform tympanometry. The intended clinical environment is any location where tympanometry is performed (including but not limited to hospitals, clinics, medical offices, and schools).

This document describes how to operate and maintain the MicroTymp Handle and Printer/Charger.

Before using the tympanometer — or before setting up, configuring, troubleshooting, or servicing the device — you must read and understand this document and all other information that accompanies the tympanometer and its accessories.

Intended use

This device is an auditory impedance tester intended to detect possible otologic disorders associated with the functioning of the middle ear.

About the device

Federal US law restricts sale of the device identified in this manual to, or on the order of, a licensed physician.

Using this device's 226-Hz and 1000-Hz tympanometry settings, you can quickly and easily obtain objective results supporting diagnosis of otitis media with effusion and other middle ear disorders. This information can result in more thorough diagnoses as well as more effective monitoring, treatment, consultation, and referral.

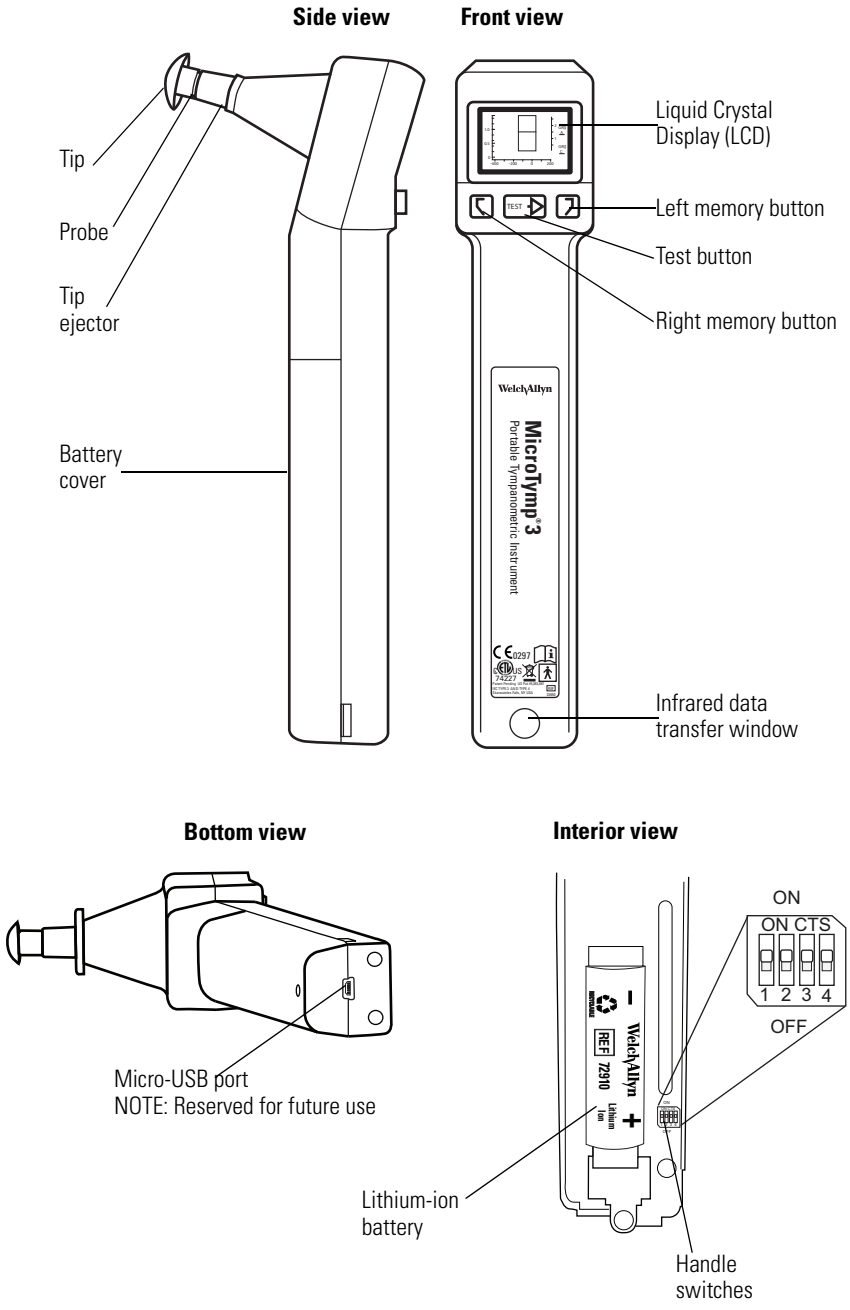
The 226-Hz test data stored in the memory of the Handle may be printed using the Printer/Charger. The Printer/Charger reads the information from the Handle and prints out tympanograms and interpretation.

Note The MicroTymp3 also provides the ability to test patients utilizing a 1000-Hz frequency mode. This mode features a quick interpretation result that displays a Pass, Refer, or Retest message on the LCD (see Chapter 4). Results from the quick interpretation mode can be documented using the 1000-Hz screening results card. Results from the 1000-Hz quick interpretation mode will not print.

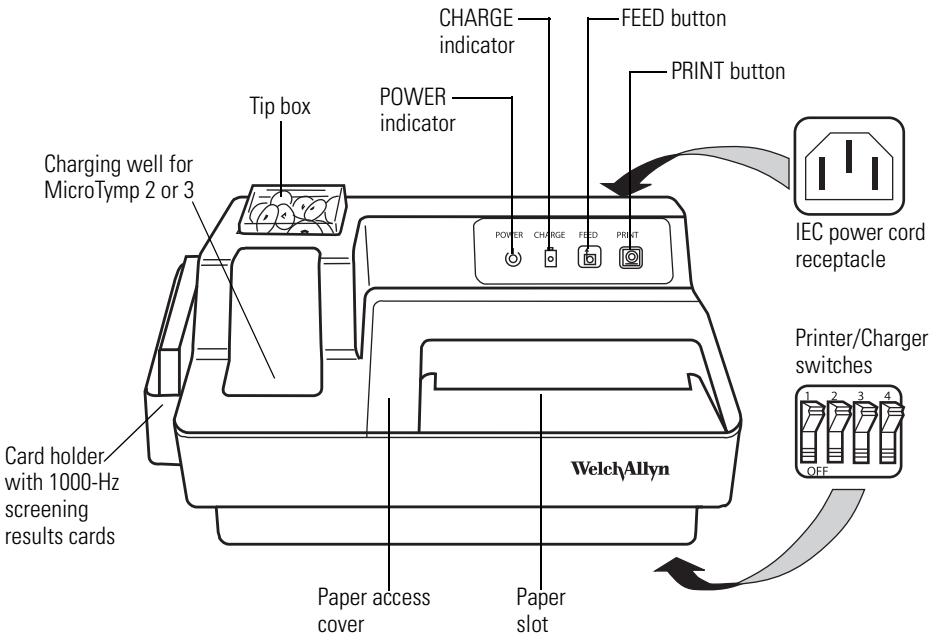
The Printer/Charger also charges the rechargeable battery in the Handle.

Controls, indicators, and connectors

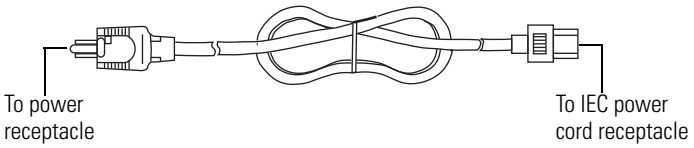
Handle components



Printer/Charger components



Power Cord



Symbols

Documentation symbols			
	Warning (Warnings indicate conditions or practices that could lead to illness, injury, or death.)		Caution (Cautions indicate conditions or practices that could damage the equipment or other property)
	Consult instructions for use		Hot surface

Operation symbols			
	POWER indicator		FEED button
	CHARGE indicator		PRINT button
	TEST button		RIGHT memory button
	Gradient width adult		LEFT memory button
	Gradient width child		Switch options ON/OFF symbol

Shipping, storing, and environment symbols			
	Temperature limits		Relative humidity limit
	This end up		Recycle
	Recycle the product separate from other disposables. See www.welchallyn.com/weee for collection point and additional information.		Separate batteries from other disposables for recycling.

Power and connectivity symbols	
Li-ion	Lithium-ion

Certification symbols			
CE 0297	Meets essential requirements of European Medical Device Directive 93/42/EEC	INTERTEK ETL LISTED C US 74227	Complies with applicable U.S. and Canadian medical safety standards
	Class I equipment, Type BF (Handle)	EC REP	European regulatory manager
	Class I equipment, Type B (Printer/Charger)		

Miscellaneous symbols			
REF	Reorder number		Manufacturer
SN	Serial number		

General warnings

WARNING Explosion risk. Do not use MicroTymp Handle or Printer/Charger near flammable anesthetics.

WARNING Electric shock hazard. Do not attempt to disassemble the Printer/Charger. Refer all servicing to Welch Allyn or a Welch Allyn authorized service representative.

WARNING Electric shock hazard. Use the USB connector only to connect to devices complying with IEC 60601-1 or other IEC standards as appropriate to the device. The user is responsible for verifying that the system complies with the requirements of the system standard IEC 60601-1-1 if additional devices are connected to the MicroTymp Handle.

WARNING Improper handling or disposal of the battery can lead to heat generation, smoke, bursting, or fire.

WARNING Do not disassemble, modify, or solder the battery.

WARNING Do not directly connect (short circuit) the positive (+) and negative (-) battery terminals.

WARNING To avoid short circuits, keep the battery terminals away from metal objects.

WARNING Do not dispose of the battery in fire.

WARNING Do not expose the battery to temperatures above 80°C (176°F).

WARNING Use only the specified charger to charge the battery.

General cautions

Caution Charge only Handle #23640, Handle # 23650, or AudioScope 3 (#23300) in the Printer/Charger.

Caution If the device has not been stored within the operating temperature range, allow 24 hours minimum for it to return to operating temperature range (15-35°C or 59-95°F) before using.

Caution Do not store either the Handle or Printer/Charger at temperatures below -20°C (-4°F) or above +49°C (120°F). Continual exposure to extremely low or high temperatures can permanently damage components.

Caution The battery must be removed if the Handle is to be stored or placed anywhere other than in the powered Printer/Charger for more than one month. Failure to do this can result in damage to the Handle.

Caution This instrument contains components which are static sensitive. Before touching any internal handle component, be sure that you have discharged any static electricity by touching a grounded metal object.

Caution To prevent equipment damage, charge the Handle only with the Printer/Charger (#7117x).

General notes

The MicroTymp Printer/Charger (#7117x) will charge and print data from the MicroTymp2 or MicroTymp3 Handle. However, the original MicroTymp Printer/Charger (#7113x) will neither charge nor print data from the MicroTymp3 Handle.

Please complete and return the warranty registration. It validates the warranty and allows Welch Allyn to communicate calibration notices and software changes.

Initial setup

Set up the printer/charger

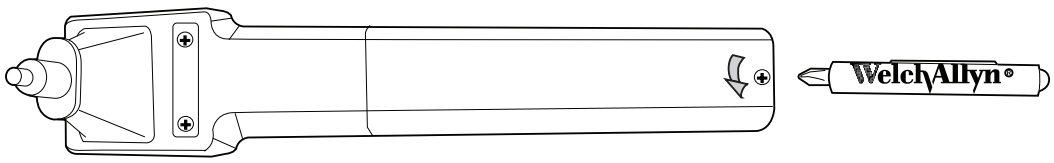
1. Place the Printer/Charger on a flat, horizontal surface.
2. Plug the power cord into the receptacle in the rear of the Printer/Charger, then connect the power cord to a receptacle with proper voltage, frequency, and plug type.

   The solid green POWER indicator will illuminate to indicate that the Printer/Charger is receiving power.

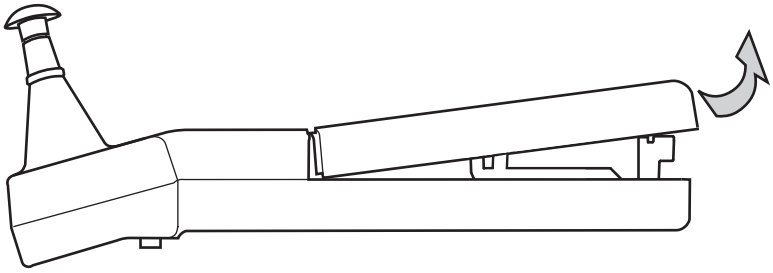
Set up the handle

Install the rechargeable battery in the handle as follows:

1. Unscrew the battery cover in a counterclockwise direction using the #1 Phillips head screwdriver provided. Save the screw.

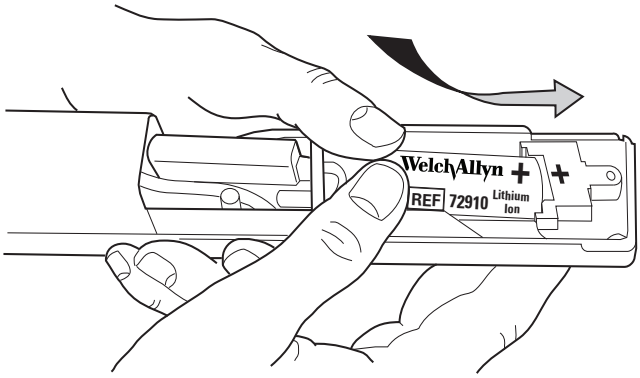


2. Remove the battery cover by lifting the bottom of the cover away from the probe tip.

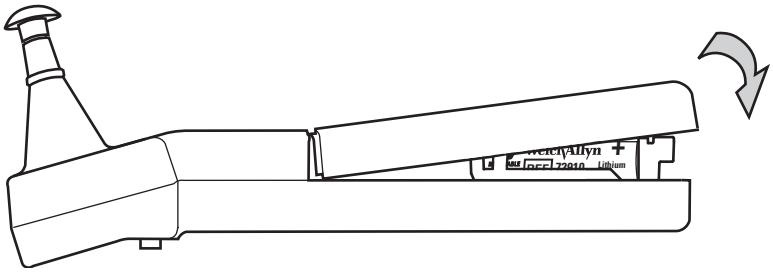


3. Insert the battery by placing the positive (+) end of the battery against the contact in the holder. Push the battery lightly to compress the contact, and lower the battery into the compartment.

Note Insert the battery only as shown. Failure to observe the correct polarity will prevent the instrument from functioning.



4. Replace the cover by inserting the tip end under the front cover, lowering the opposite end, and replacing the screw.



5. Tighten screw in clockwise direction. To avoid stripping the screw threads, do not tighten excessively.

Charge the handle

1. Before first use, place the Handle (with battery installed) into the Printer/Charger charging well with the LCD and buttons facing you.
2. Leave the Handle in the well for a minimum of 16 hours to achieve a full charge.

You are now ready to take a test. See Ch. 2 for instructions to take a test.

2 Completing a test

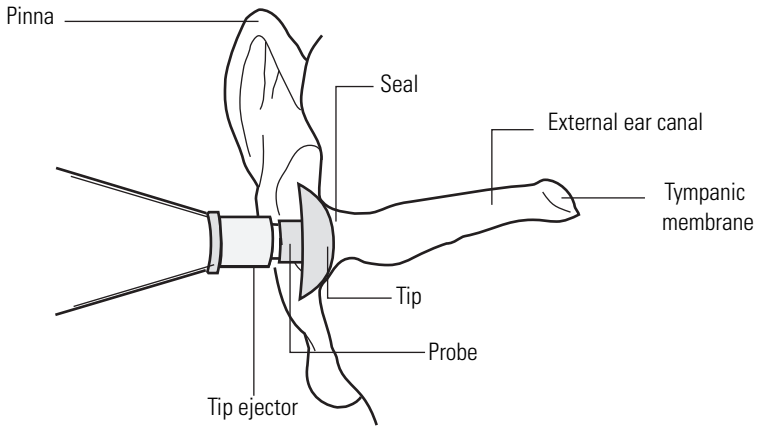
Obtaining a tympanogram

Select a probe tip

1. After examining the subject's ear canal opening, select a tip which is large enough to seal the entrance of the ear canal.

   To change tips, either pull the tip off by hand or slide the tip ejector towards the tip.

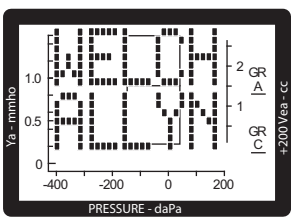
Note Tips are not intended to be deeply inserted into the ear canal. Using an improper tip size causes leaks, and will make it difficult to complete a test. Use only MicroTymp3 tips with the MicroTymp3 Handle.



2. Push the tip onto the probe, making sure that the tip is fully seated.

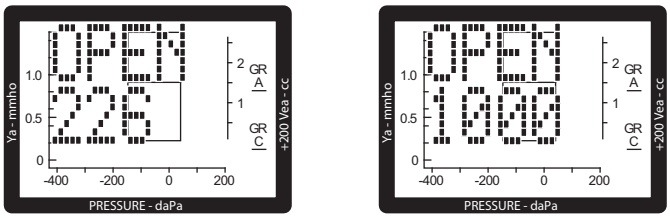
Start a test

1. Pick up the handle and press any button. The Welch Allyn screen will display.



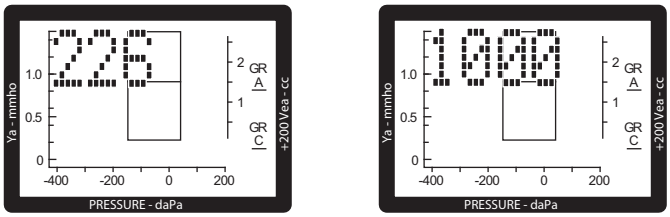
Note Time-out feature. The tympanometer automatically turns off 15 seconds after the last test or button activation.

2. Press the TEST button below the Liquid Crystal Display (LCD) to show the current frequency. One of the screens shown below will appear.



Note The default frequency set at the factory is 226 Hz. To change the default frequency to 1000 Hz, see the instructions at the end of this chapter.

3. To switch to the other frequency, press both the R Right memory and L Left memory buttons on the handle simultaneously until the desired frequency displays, as shown below. Pressing the two memory buttons repeatedly toggles between these two screens.



4. Press the TEST button again to confirm the desired frequency. Either the OPEN 226 or OPEN 1000 screen will display, as shown in step 2.

5. Once you've confirmed the desired frequency, proceed with the test. Grasp the subject's pinna. Pull gently back to straighten the child's ear canal (or up and back for adults). See the image on the left below.

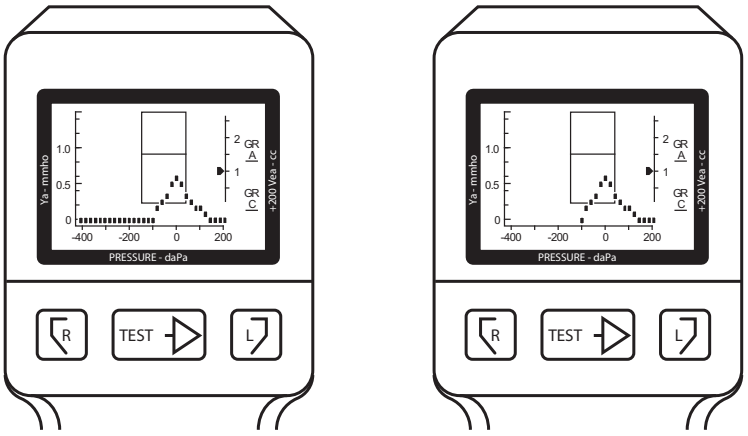
6. While maintaining tension on the pinna, press the tip firmly against the ear canal opening. See the image on the right below. Point the tip straight into the ear canal for adults and slightly anteriorly for children.

Note Because of changes in air pressure during a test, the subject will feel slight pressure in the ear canal. During the brief seconds when tympanometric measurements are made, it is important that the clinician's hand is steady, and that the subject does not talk, yawn, chew gum, cry, or move the head.

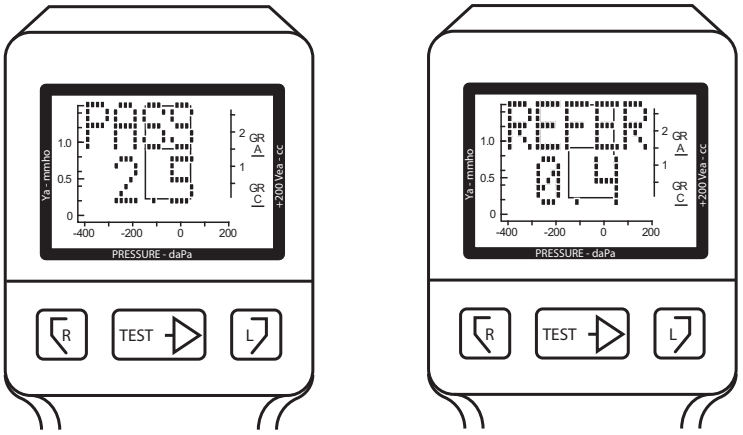
Note If the BLOCK, LEAK, or OPEN messages appear during the test, reposition the tip to restart the test.

Once a seal is achieved, the TEST message appears on the LCD, followed by the volume indication on the +200 Vea scale.

For 226 Hz, data points are displayed from right to left across the LCD as the test progresses. The test is complete when the last data point is displayed. The image below on the left illustrates the execution of a complete test. If patient or instrument movement causes a leak beyond -100 daPa in 226-Hz mode, the test will be stopped but the data will be saved. See the figure on the right below.



For 1000 Hz, the test is complete when one of two "Quick-Interpretation" messages appears--either PASS or REFER--as shown in the examples below. If patient or instrument movement causes a leak beyond -300 daPa in 1000-Hz mode, the test will be stopped but the data will be saved.

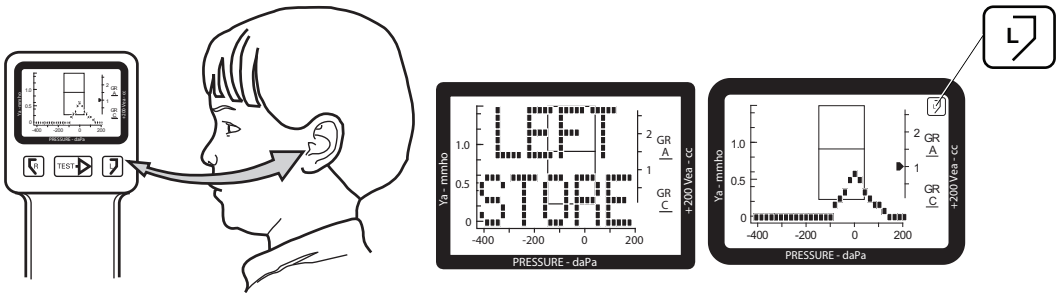


Note A RETEST message may also appear, indicating that you should rerun the test.

Store and display data

1. To store the results of the test, press the button which matches the tested ear, as illustrated below.

   The memory buttons are labeled [R] for the right ear and [L] for the left ear. When test results are stored in memory, the RIGHT STORE or LEFT STORE message appears momentarily on the LCD. Then the tympanogram which has been stored reappears along with the right or left symbol (to indicate the contents of that memory).



2. Press either the Left or Right memory button to recall the information stored in memory. You may recall memory contents at any time.

Erase memory contents

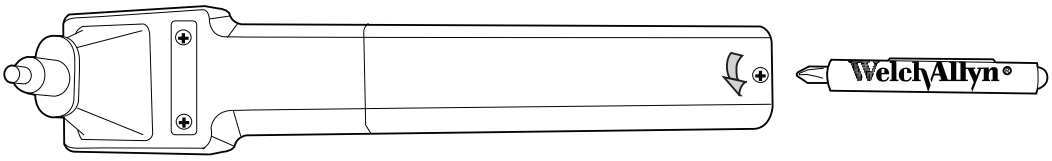
You can erase memory contents in two ways:

- By storing a new test. The device automatically erases the previous test when you store a new test.
- By pressing either the Left or Right memory button for more than three seconds. This action erases memory contents for that ear.

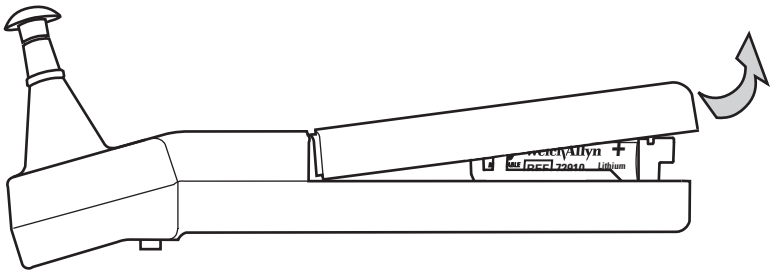
Change the default frequency

The default frequency set at the factory is 226 Hz. However, if the majority of your patients are infants less than six months old, you may set 1000 Hz as the default frequency. Use the procedure below to switch from one frequency to another.

1. Allow the Handle to power down.
2. Unscrew the battery cover in a counter clockwise direction using the #1 Philips screwdriver provided. Save the screw.

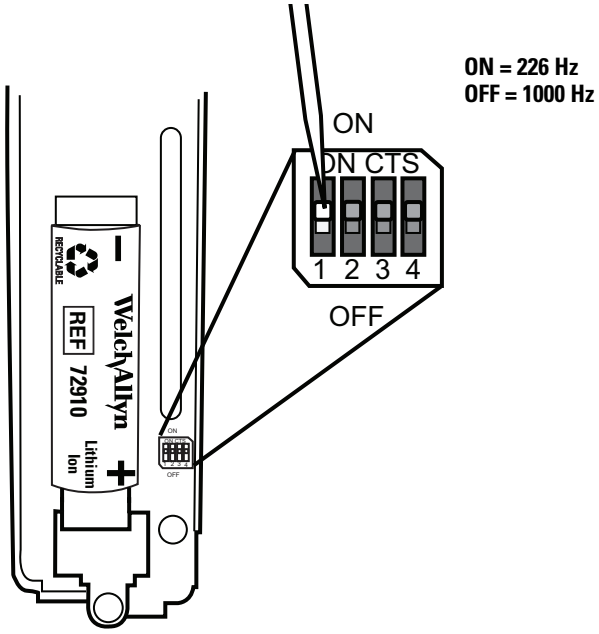


3. Remove the Handle cover by lifting the bottom of the cover away from the probe tip.



4. With a sharp, non-conductive object (like a toothpick or the wooden end of a Q-tip), move switch 1 to the desired position as shown below.

Caution Potential damage to Handle. Do not use the screwdriver provided or any other metal object to move the switch.

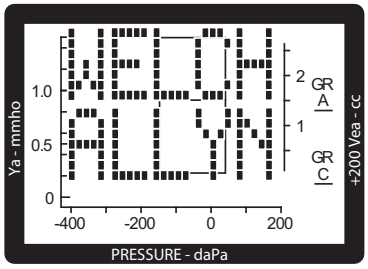


5. Replace the cover by inserting the tip end under the front cover, lowering the opposite end, and replacing the screw.
6. Tighten the screw in a clockwise direction. To avoid stripping the screw threads, do not tighten excessively.

3 Understanding the LCD messages

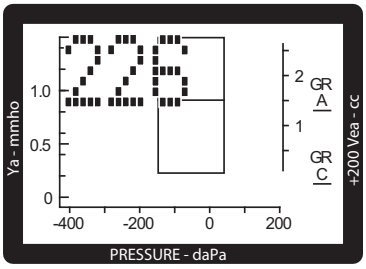
The following messages may be displayed on the LCD during Handle operation.

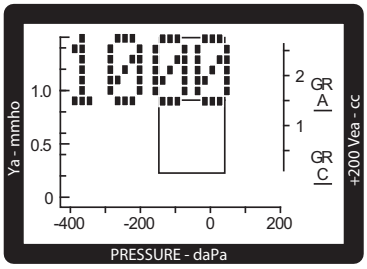
Company identification



The Welch Allyn message will appear when you press any button.

Frequency confirmation

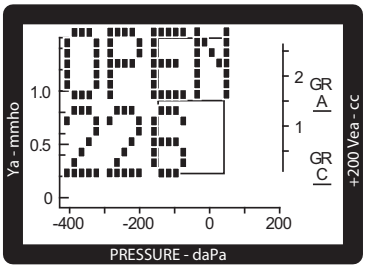


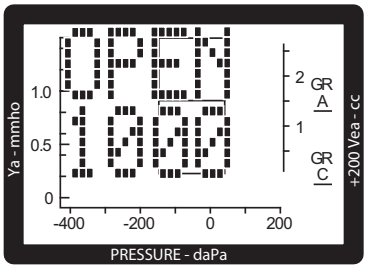


These messages indicate the unit's frequency options. You can toggle between frequencies by simultaneously pressing both the R Right memory and L Left memory buttons.

Press TEST to confirm selected frequency and to exit frequency confirmation mode.

Open





The test has not begun since a valid ear cavity has not been detected.

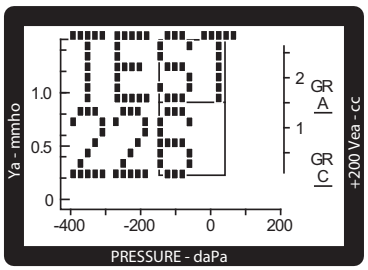
Possible causes:

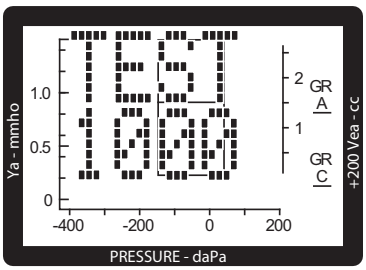
- Instrument is not in an ear
- Probe tip is not completely sealed in an ear
- Perforated tympanic membrane
- Ear with patent tympanostomy tubes
- Extremely large canal (> 2.5 cc)

Possible solutions:

- Reposition the probe tip
- Perform otoscopy to check for perforated membrane or patent tympanostomy tubes

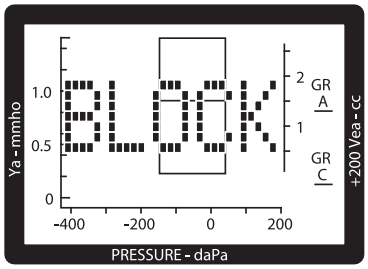
Test





The TEST message indicates that the test has started. Test data will begin to appear immediately.

Block



The test cannot continue since the measured admittance is less than 0.2 mmho.

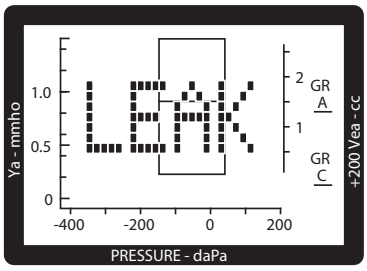
Possible causes:

- Probe tip is lodged against canal wall
- Ear canal occluded
- Collapsed ear canal
- Extremely small ear
- Probe tip is clogged with cerumen

Possible solutions:

- Reposition the probe tip
- Perform otoscopy to check for occlusion
- Remove cerumen from probe tip

Leak



The test cannot proceed since desired pressures within the ear have not been achieved.

Possible causes:

- Probe tip is not completely sealed in the ear canal
- Excessive movement of patient or practitioner
- Probe tip dislodged during a test

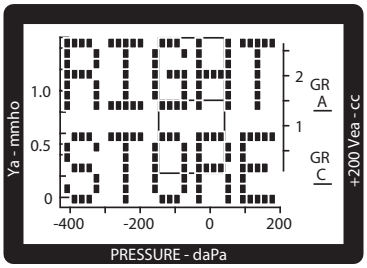
Possible solutions:

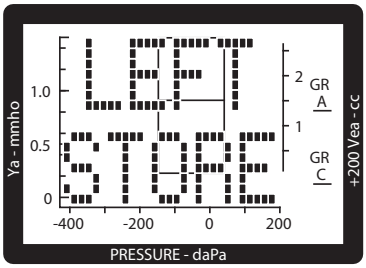
- Reposition probe tip
- Patient and practitioner must remain still
- Use a different size probe tip
- Increase pressure against the ear

If a leak condition occurs after -100 daPa pressure is reached at 226 Hz, results will remain on the display. If an identifiable peak is displayed at 226 Hz, you do not have to repeat the test. If no peak can be identified, repeat the test and try repositioning the tip, using a different size tip, or increasing the pressure against the ear canal opening.

If a leak condition occurs after -300 daPa pressure is reached at 1000 Hz, the PASS, REFER, or RETEST results will be displayed.

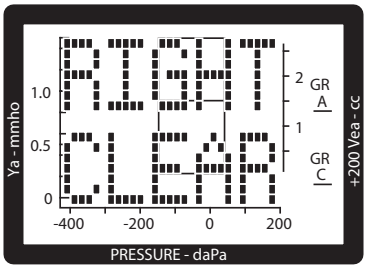
Right store/Left store

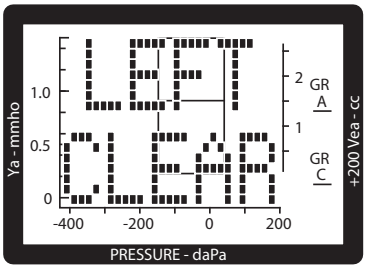




Test results have been stored in the designated memory location. Immediately following this message, the newly-stored tympanogram reappears along with the right or left symbol. For instructions on storing and erasing data, see Chapter 2.

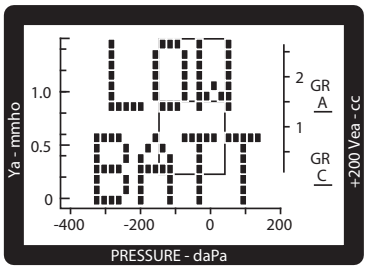
Right clear/Left clear





The designated right or left memory location contains no data. Either no data has been stored or previously stored data has been erased. See Ch. 2 for information on storing and erasing data.

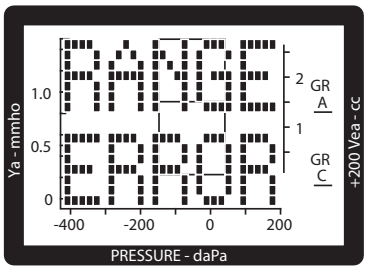
Low battery



The LOW BATT message indicates that the battery needs to be recharged. The system will not perform a test in a LOW BATT condition. All buttons are disabled to prevent inaccurate results due to inadequate battery voltage. Normal operation may be restored by recharging the battery or replacing the battery with a charged battery. Stored data is not lost when the battery is removed.

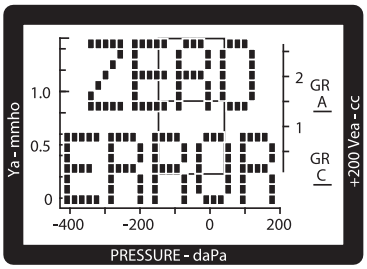
See Chapter 6, "Maintenance and troubleshooting," for instructions on removing and recharging the battery.

Range error



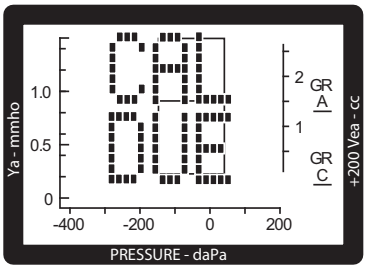
The RANGE ERROR message indicates that a large pressure change occurred during a test. If this message appears, press the TEST button and start the test again.

Zero error



The ZERO ERROR message indicates that a large pressure change occurred during automatic pressure compensation at the start of a test. If this message appears, press the TEST button and start the test again.

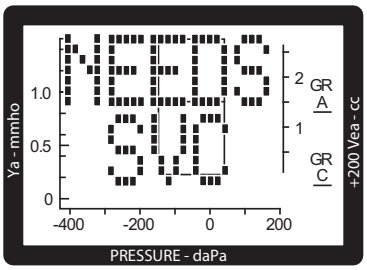
Calibration due



Welch Allyn recommends annual calibration of your tympanometer to ensure equipment accuracy. The CAL DUE message will display each time the device is powered on when one year has passed since the last calibration. Press and hold the TEST button for approximately two seconds to clear this message and resume patient testing or print information stored in the Handle.

Appropriate charges will apply each time your tympanometer is calibrated.

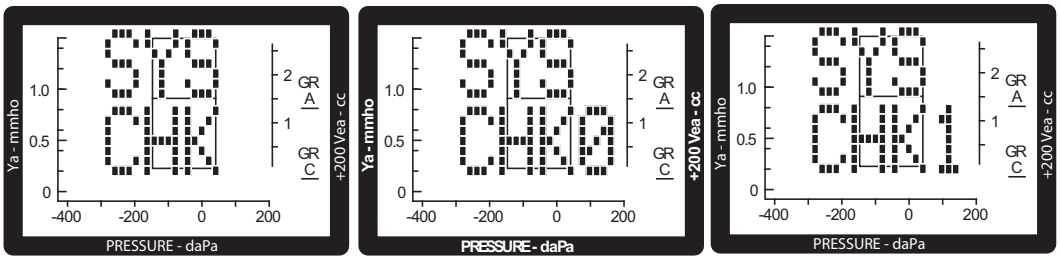
Needs service



The NEEDS SVC message appears when something has caused the tympanometer to fail an internal test. The NEEDS SVC message will display for approximately three seconds; then the device will power down. Return the tympanometer to a Welch Allyn service location for service. (See Service information.)

Note After each service, the device must be calibrated. Appropriate charges will apply each time your tympanometer is calibrated.

System check

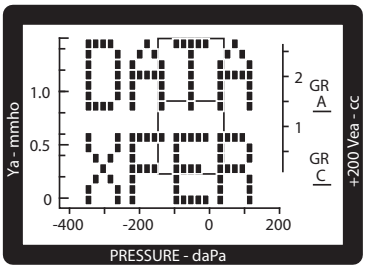


The SYS CHK (SYS CHK0, SYS CHK1) message indicates that the Handle is doing a self-check to ensure proper operation. The Handle will shut off upon completion of the test. Press any button to power the Handle and clear the condition.

If these messages persist, the Handle requires service. Return the tympanometer to a Welch Allyn service location for service. (See Service information.)

Note After each service, the device must be calibrated. Appropriate charges will apply each time your tympanometer is calibrated.

Data Transfer

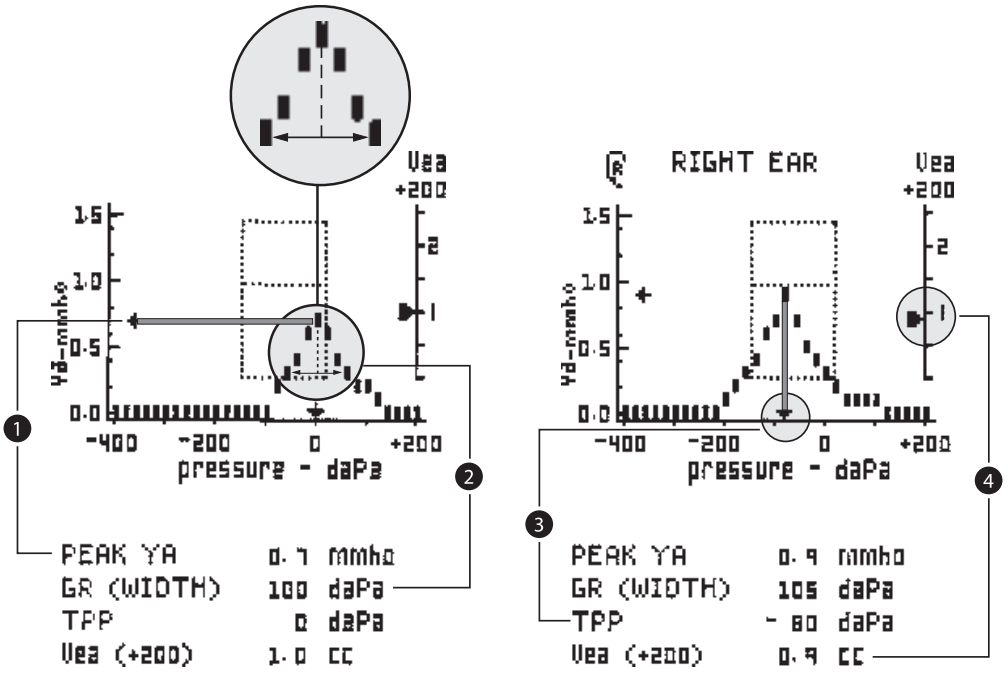


When the DATA XFER message displays, the device has made the data connection to the Printer/Charger. Any 226-Hz data stored in the Handle is now available for printing.

4 Interpreting test results

When measured properly, tympanometric results are accurate and objective but should be interpreted in the context of the patient's overall clinical condition.

Tympanograms

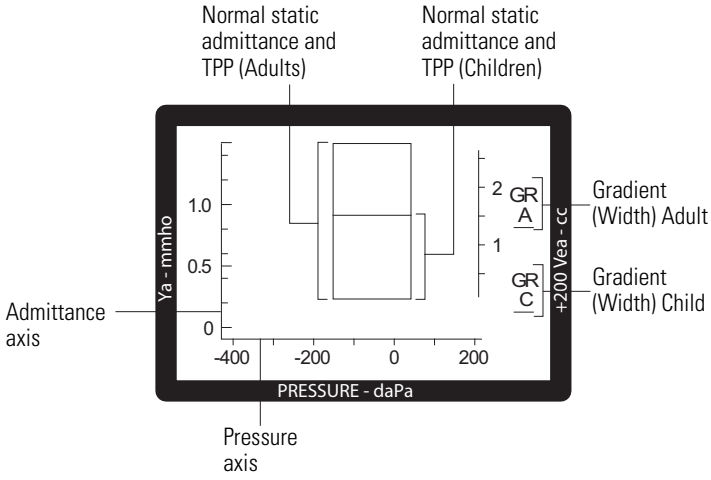


Key characteristics of the tympanogram

1	**Static Admittance (Peak Ya)** is a calculated measure of the compensated static acoustic admittance (height) of the tympanometric peak reported in acoustic s (mmho). Given appropriate normative values, static admittance (Peak Ya) is a useful indicator of middle ear disease.
2	**Tympanometric Gradient (GR)** is a measure of the width of the tympanogram reported in decapascals (daPa) at 50% of static admittance (Peak Ya) or the tympanometric peak. Given appropriate normative values, tympanometric gradient is a good indicator of the presence of middle ear effusion.
3	**Tympanometric Peak Pressure (TPP)** is the location of the tympanometric peak on the pressure axis. TPP is reported in decapascals (daPa). TPP indicates if there is pressure behind the eardrum but usually does not indicate middle ear disease.
4	**Equivalent Ear Canal Volume (+200 Vea)** is an estimate of the volume of air in front of the probe, measured in cubic centimeters (cc). A high volume suggests an eardrum perforation or patent tympanostomy tube. Perforations can be present when Vea is normal.

Gradient (width) measurements (226 Hz only)

When a tympanometric tracing is complete, the device measures the gradient or width of the tympanogram. If the gradient is abnormal, an asterisk will appear on the LCD under GR/A for the adult's ear (greater than 10 years of age), or GR/C for the child's ear (10 years of age or younger). A sample of the Liquid Crystal Display appears below.



226-Hz mode

Normative values

The normative values presented in the table below are taken from a study by Margolis and Heller (1987) and from the "Guidelines for Screening for Hearing Impairments and Middle Ear Disorders" (1990).

Note For purposes of tympanometric norms, an adult is defined as a person 10 years of age or older, and a child as under age 10.

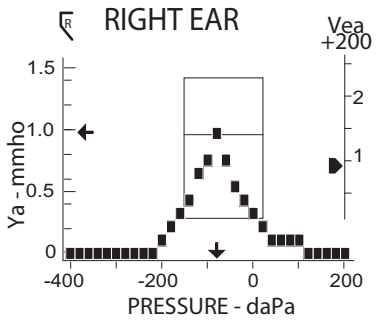
Normative tympanometric values (226 Hz)

Tympanometric Measurement	Child's Ear (Under Age 10) 90% Range	Adult's Ear (Age 10 & Over) 90% Range
Peak Ya (Positive Tail Compensation)	0.2 to 0.9 mmho	0.3 to 1.4 mmho
Gradient (GR) (Tympanometric Width)	60 to 150 daPa	50 to 110 daPa
Tympanometric Peak Pressure (TPP)	-139 to +11 daPa	-83 to 0 daPa
Equivalent Ear Canal Volume (Vea)	0.4 to 1.0 cc	0.6 to 1.5 cc

Interpreting 226-Hz tympanogram results

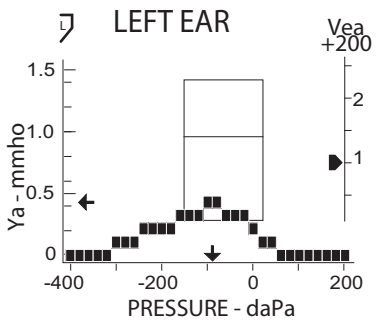
Normal middle ear

A tympanogram with normal Peak Ya, gradient (width), and tympanometric peak pressure appears below.



Low admittance tympanograms

Tympanogram with normal Peak Ya and abnormal gradient (width)

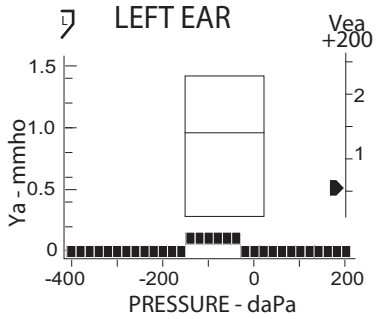


Conditions which cause tympanograms with normal height and increased width:

- Otitis media with effusion
- Tympanosclerosis

Note Low Peak Ya of the middle ear is produced by space-occupying lesions in various ways. A lesion that displaces air in the middle ear space causes low admittance by reducing the middle ear volume. The lesion also may interfere with the vibration of the ossicular chain, contributing to the low admittance. If the lesion is in contact with the eardrum, low admittance is a result of interference with eardrum vibration.

Tympanogram with low Peak Ya



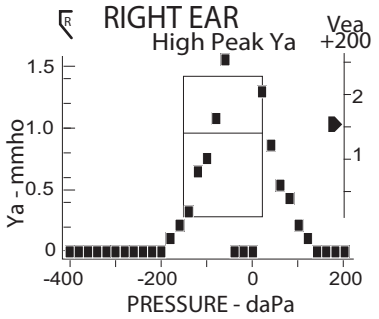
Conditions which cause tympanograms with reduced peak height (low Peak Ya):

- Otitis media with effusion
- Tympanosclerosis
- Cholesteatoma
- Middle ear tumor

See Appendix A for descriptions of low-admittance pathologies: otitis media with effusion, middle ear tumor, ossicular fixation, and otosclerosis.

High admittance tympanograms

Tympanogram with high Peak Ya



Conditions which cause tympanograms with increased peak height (high Peak Ya):

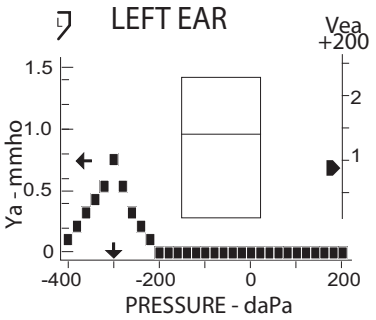
- Tympanic membrane abnormalities
- Ossicular disruption

Note When peak admittance exceeds 1.5 mmho, data points will be printed at baseline (0.0 mmho), as shown above.

See Appendix A for a description of tympanic membrane abnormalities and ossicular disruption.

Negative and positive peak pressure tympanograms (left or right shift)

Tympanogram with negative middle ear pressure

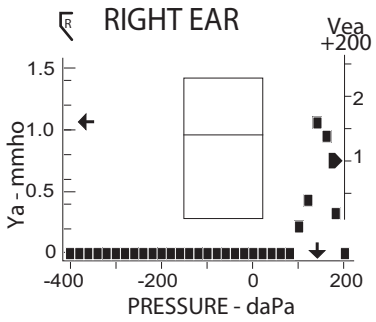


Conditions which cause negative middle ear pressure:

- Eustachian tube dysfunction
- Cold
- Allergies
- Vigorous sniffing

Note Negative pressure within the middle ear space will produce a tympanogram with a negative tympanometric peak pressure. Some degree of negative pressure is normal. Negative middle ear pressure often accompanies a cold or allergies, or can be a result of eustachian tube dysfunction. Negative middle ear pressure is not usually associated with effusion when peak Ya is normal. Vigorous sniffing may be the most common cause of negative tympanometric peak pressure in children.

Tympanogram with positive middle ear pressure



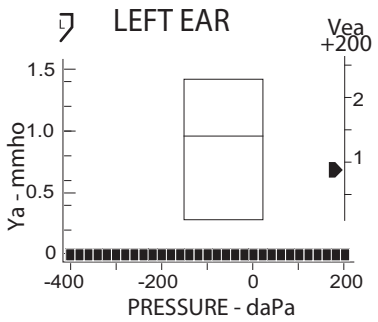
Condition which causes positive middle ear pressure:

- Acute otitis media

Note Positive tympanometric peak pressure tympanograms reflect positive pressure in the middle ear space. A high positive Tympanometric Peak Pressure (TPP) can be indicative of acute otitis media, but only if the tympanometric peak is extremely positive.

Flat tympanograms

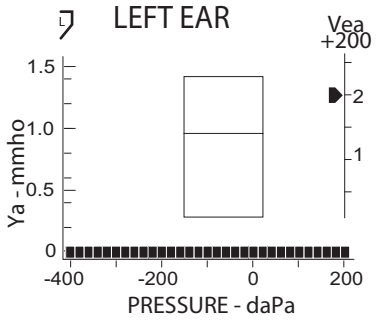
Flat tympanogram with normal ear canal volume



Condition which causes a flat tympanogram with normal ear canal volume:

- Middle ear effusion

Flat tympanogram with increased ear canal volume

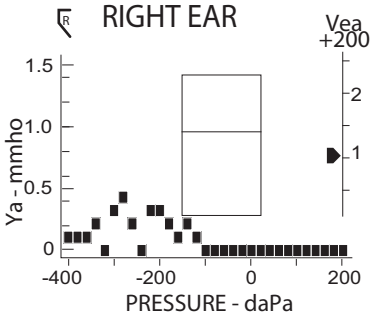


Conditions which cause flat graph and increased ear canal volume:

- Patent tympanostomy tube
- Perforated tympanic membrane

Note This condition may produce a persistent OPEN message if measured Vea is greater 2.5 cc. See page 24.

Tympanograms with artifact



Conditions which cause artifact:

- Patient movement
- Practitioner movement
- Vocalizing or crying

Note During the typanometric measurement, the clinician should keep a steady hand, and the patient should not talk, chew gum, yawn, cry, or move. If the display indicates too much artifact, the clinician must repeat the measurement.

1000-Hz mode

Tympanometry in young infants

Tympanograms obtained with a 226-Hz probe tone have been found to be insensitive to middle ear fluid in young infants. Recent studies using a 1000-Hz probe tone have shown good sensitivity to middle ear disease in this population. Research suggests the age at which 226-Hz tympanometry becomes an appropriate test is between four and six months. An appropriate guideline for selecting the appropriate age-based frequency is to use 1000-Hz tympanometry for infants below four months of age, 226-Hz for infants above six months of age, and both frequencies for infants four to six months of age.

The "Quick-Interpretation" feature of this tympanometer enables clinicians to test infants less than six months old and receive immediate interpretive feedback from the device. The 1000-Hz interpretations are based on proven clinical criteria, including calculated values in the shape of the curve.

Normative values

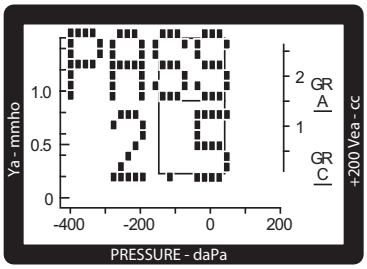
The table below presents normative values for 1000-Hz tympanometry for NICU babies and full-term 2- to 4-week-old babies. [Margolis, R.H., Bass-Ringdahl, S., Hanks, W.D., Holte, K., Zapala, D.A. Tympanometry in Newborn Infants - 1 KHz Norms. J. Amer. Acad. Audiol., 14, 383-392, 2003.]

Normative tympanometric values (1000 Hz)

Tympanometric Measurement	NICU 90% Range	Full-term 90% Range
Peak Ya (Negative Tail Compensation)	0.6 - 2.7 mmho	0.6 - 4.3 mmho
Tympanometric Peak Pressure (TPP)	-93 - +53 daPa	-133 - +113 daPa

Interpreting 1000-Hz results

Pass

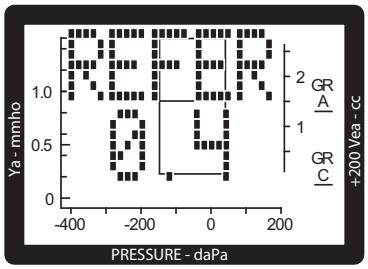


A normal tympanogram will yield a PASS result. The displayed numerical value represents the compensated admittance.

Condition which causes a PASS message:

- Peak Ya greater than or equal to 0.6 mmho

Refer



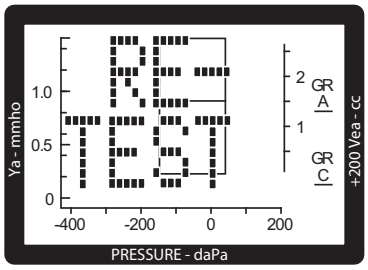
Condition which causes a REFER message:

- Peak Ya is less than 0.6 mmho

Infants with middle ear effusion have lower Peak Ya at 1000 Hz, just as older children have reduced Peak Ya at 226 Hz. When the Peak Ya is less than 0.6 mmho, the test is indicative of abnormal middle ear function, most commonly middle ear effusion.

Note You may choose to retest the patient to confirm a REFER result.

Retest



Note Certain testing or patient conditions may cause inconclusive results, yielding a RETEST message on the display. You may interpret a series of RETEST results as a REFER result.

Influence of altitude

As the altitude above sea level increases, the admittance of a given volume of air also increases. Therefore, equivalent ear canal volume (+200 Vea) overestimates actual ear canal volume as noted in the table below. To estimate ear canal volume, subtract the appropriate value in the table from the Vea Reading. Altitude can also affect MicroTest Cavity results. See Functional Checks starting on page 55.

Altitude adjustments for Vea readings

Altitude	Adjustment for 0.2 cc	Adjustment for 0.5 cc	Adjustment for 1.0 cc	Adjustment for 1.5 cc	Adjustment for 2.0 cc	Adjustment for 2.4 cc
-1200 ft (-366 m)	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.0 cc
0 ft (0 m)	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.0 cc
1000 ft (305 m)	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.0 cc
2000 ft (610 m)	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.0 cc	0.1 cc
3000 ft (914 m)	0.0 cc	0.0 cc	0.1 cc	0.1 cc	0.1 cc	0.1 cc
4000 ft (1219 m)	0.0 cc	0.1 cc	0.1 cc	0.1 cc	0.1 cc	0.1 cc
5000 ft (1524 m)	0.0 cc	0.1 cc	0.1 cc	0.1 cc	0.1 cc	*
6000 ft (1829 m)	0.1 cc	0.1 cc	0.1 cc	0.2 cc	0.2 cc	*
7000 ft (2134 m)	0.1 cc	0.1 cc	0.1 cc	0.2 cc	0.2 cc	*
8000 ft (2438 m)	0.1 cc	0.1 cc	0.2 cc	0.2 cc	0.3 cc	*
9000 ft (2743 m)	0.1 cc	0.1 cc	0.2 cc	0.3 cc	0.3 cc	*
10000 ft (3048 m)	0.1 cc	0.2 cc	0.2 cc	0.3 cc	0.4 cc	*

* The MicroTymp3 will read “OPEN” when used on this ear canal volume at this altitude and will not run a test.

Influence of temperature

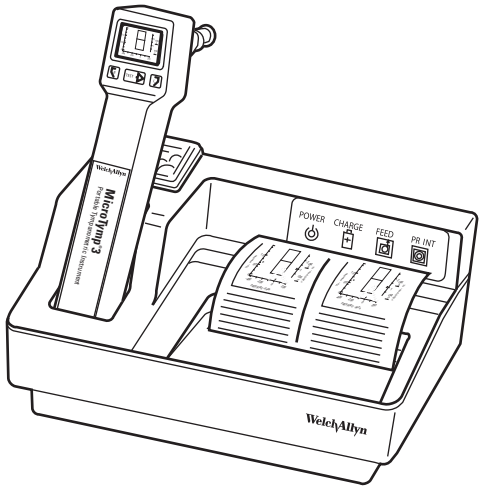
No corrections for temperature are required with this device.

5 Printing 226-Hz results

Print memory contents

Follow the steps listed below to print tympanometric data stored in the Handle:

1. Place the Handle in the well with the Liquid Crystal Display (LCD) and buttons facing you. When the Handle is properly seated in the well, the green CHARGE indicator illuminates.
2. Press the PRINT button.
3. To feed extra paper, press the FEED button. Paper continues to feed as long as the button is depressed.



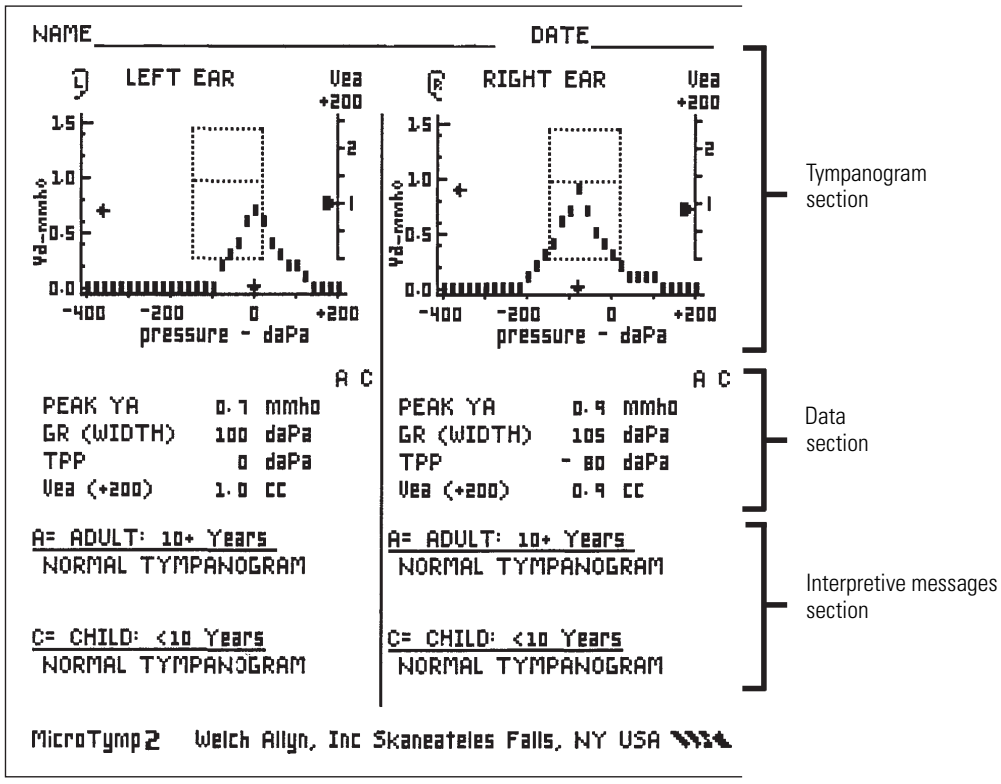
4. To remove the printout, pull the paper forward and to the left or right to tear it along the cutting edge.
5. To obtain an additional copy of the test results, leave the Handle in the well and press the PRINT button again. Removing the Handle from the well causes the data to be removed from the Printer/Charger memory.

Note

- The Printer/Charger has been pre-set at Welch Allyn to print a complete printout as illustrated below and to print in manual mode. To change formats or print in automatic mode, follow the instructions on page 45.
- If only one ear has been tested, the memory for the other ear should be erased (see page 20) so as not to confound current data with data from a previous patient.
- If only one memory location has data, only one result is printed.
- Do not use transparent adhesive tape on the printed portions of a printout, as those portions will then fade.

Printout formats

A complete tympanometric printout is shown below. The printout is divided into three sections: tympanogram, data, and interpretive messages. Following is a detailed account of the information presented in each of these sections. For instructions on changing the format of the printout, see page 45.



Tympanogram section

The tympanogram is a graph which records the admittance of the ear as a function of air pressure.

Data section

The data section displays numeric values for the four key characteristics of the tympanogram:

- **Static Admittance (Peak Ya)** is a calculated measure of the compensated static acoustic admittance (height) of the tympanometric peak reported in acoustic millimhos (mmho). Given appropriate normative values, static admittance (Peak Ya) is a useful indicator of middle ear disease.
- **Tympanometric Gradient (GR)** is a measure of the width of the tympanogram reported in decapascals (daPa) at 50% of static admittance (Peak Ya) or the tympanometric peak. Given appropriate normative values, tympanometric gradient is a good indicator of the presence of middle ear effusion.
- **Tympanometric Peak Pressure (TPP)** is the location of the tympanometric peak on the pressure axis. TPP is reported in decapascals (daPa). TPP indicates if there is pressure behind the eardrum but usually does not indicate middle ear disease.
- **Equivalent Ear Canal Volume (+200 Vea)** is an estimate of the volume of air in front of the probe, measured in cubic centimeters (cc). A high volume suggests an eardrum perforation or patent tympanostomy tube. Perforations can be present when Vea is normal.

If the numeric values are greater or less than the 90th percentile of the normative data for a child or an adult, an asterisk appears under the C(hild) or A(dult) column. The normative data are listed in the table on page 32.

For the following tympanometric results, no data will be printed:

- 1000-Hz results
- Peak Ya is greater than 1.5 mmho. The message "High Peak Ya" will appear at the top of the tympanogram.
- Peak Ya less than 0.3 mmho.
- Peak Ya which is incomplete; for example, a negative pressure tympanogram which is so far negative that the peak has not been reached and data are incomplete.
- Tympanogram has too much artifact. Artifact is generally caused by movement of the subject or the instrument.

Interpretive messages section

The interpretive messages section of the printout provides an interpretive, verbal description of the tympanometric result.

The computer in the Printer/Charger examines the data for clinically-significant deviations from the normal values. For example, a tympanogram which is too wide may be indicative of a developing or resolving otitis media; the message reads "Tympanogram Is Wide."

The hierarchy of messages displayed is as follows:

Noisy Tympanogram

Low Peak Height, Small Ear Volume

Low Peak Height, Normal Ear Volume

Low Peak Height, Large Ear Volume

Tympanogram Is Wide

Negative Tympanometric Peak Pressure

Positive Tympanometric Peak Pressure

High Peak Height

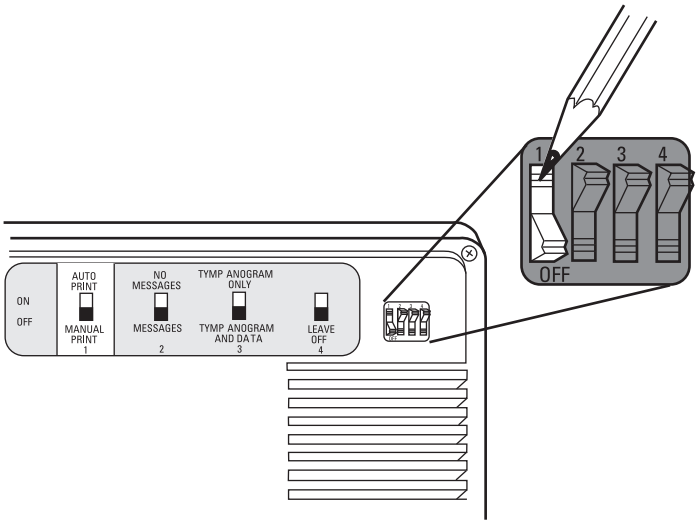
Normal Tympanogram

The computer scans the list of messages and prints the first message that applies. The hierarchy is arranged so that the most clinically-important message is displayed first.

Select printout formats

The four switches used to select the printout format and printer mode of operation are located on the bottom of the Printer/Charger.

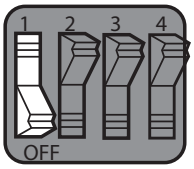
Use a pointed object to depress appropriate ON or OFF portion of the switch.



Change from manual to automatic printout

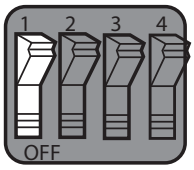
Automatic vs. Manual Printout (Switch #1)

Auto Print



Depress the ON portion of the switch to select this option. This causes the printout to begin automatically once the Handle is placed in the well, and data transfer is complete.

Manual Print

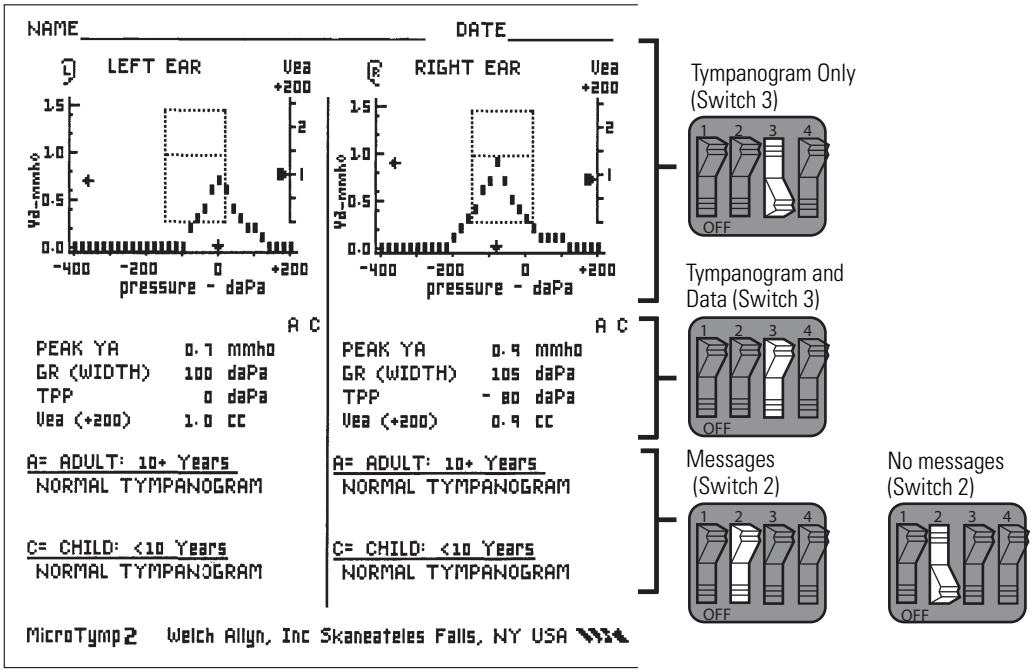


Depress the OFF portion of the switch to select this option. This causes the printout to begin only when the PRINT button is depressed.

Note In the manual mode, a beep will occur as a reminder that data has been transmitted; however, it is not necessary to wait for the beep before pressing the PRINT button.

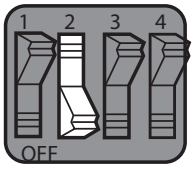
Change printout format

Use Switches #2 and #3, located on the bottom of the Printer/Charger, to change printout format. Printout options are shown below.



Print interpretive messages (Switch #2)

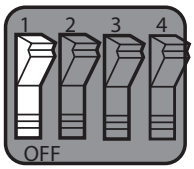
No messages



Depress the ON portion of the switch to select this option. This causes messages which interpret the tympanogram to not be included on the printout.

Refer to the Printout formats section on page 42 for more information on these messages.

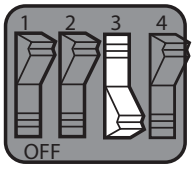
Messages



Depress the OFF portion of the switch to select this option. This causes the messages which interpret the tympanograms to be included on the printout.

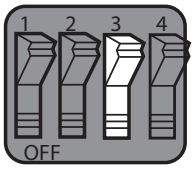
Print tympanogram only or tympanogram and data (Switch #3)

Tympanogram only



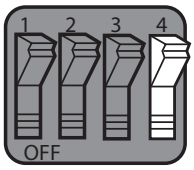
Depress the ON portion of the switch to select this option. Only the tympanogram and the GR (Width) numeric value will print.

Tympanogram and data



Depress the OFF portion of the switch to select this option. Both the tympanogram and its corresponding numeric data will print.

Manufacturing switch (Switch #4)



This switch is used during manufacturing only. Leave this switch in the OFF position. The Printer/Charger will not operate normally if this switch is on.

Printer function messages

If tympanometric results are not printed, a message will appear describing the reason. These messages are listed in the table below.

Printer messages

Printer function message	Possible cause	Possible solution
No Data Reinsert Handle	The Handle is not located in the well.	Seat the Handle in the well.
	The Handle is not seated properly in the well.	Ensure that the Handle is fully seated in the well with the Liquid Crystal Display (LCD) and buttons facing you.
	The Handle has a discharged or missing battery.	Verify battery is in place and charged (LOW BATT messaged does not appear).
	The Handle is not functioning properly.	Call your nearest Welch Allyn service location, distributor, or factory representative.
No Data Nothing in Memory	Both right and left memory locations in the Handle are empty or data stored is in "Quick-Interpretation" (1000-Hz) mode.	Ensure that data is being stored correctly.
Computer Interface Switch 4 is Set on Bottom of Printer	Switch #4 on the Printer/Charger is ON.	Turn off Switch #4.

Printer service codes

When the Printer/Charger is plugged into an electrical outlet, the green POWER indicator illuminates and the instrument beeps to indicate that the printer is ready for use.

If a problem exists, the green POWER indicator flashes. The number of flashes corresponds to the specific problems listed in the table below.

Printer/Charger flashing indicators

Number of flashes	Problem	Solution
One	Printer/Charge is out of paper	Replace paper.
Two	Paper lever is in wrong (forward) position.	Return paper to its original, correct position.
Three or More	System failure within Printer/Charger.	Verify that switch #4 is in the OFF position. Unplug the Printer/Charger. Wait one minute, then re-apply power to the instrument. If Printer/Charger does not return to normal operation, return it to the nearest Welch Allyn service location.

Note If the green POWER indicator is not illuminated, verify connection to live power source. If the problem persists, return the Printer/Charger to the nearest Welch Allyn service location.

6 Maintenance and troubleshooting

Maintain the equipment

About the battery

The rechargeable Lithium-ion battery is intended for many charge/discharge cycles and is warranted for two years. The warranty expiration date is imprinted on the battery.

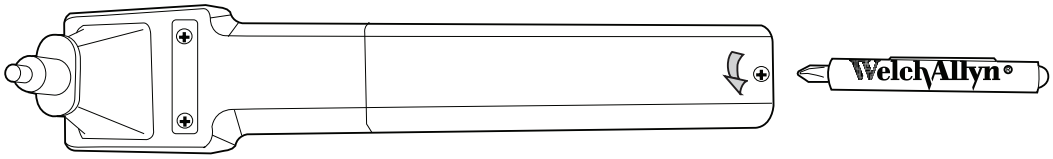
Caution Replace battery with Welch Allyn model #72910 battery only.

Note Disassembly of the tympanometer beyond the extent described in this manual will void the warranty. Refer all servicing to Welch Allyn or a Welch Allyn Authorized Service Representative.

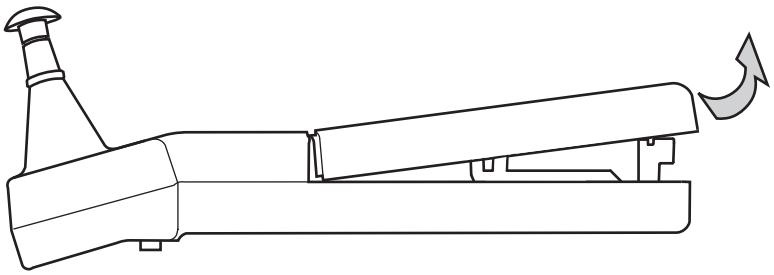
Replace the battery

Replace the rechargeable battery in the handle as follows:

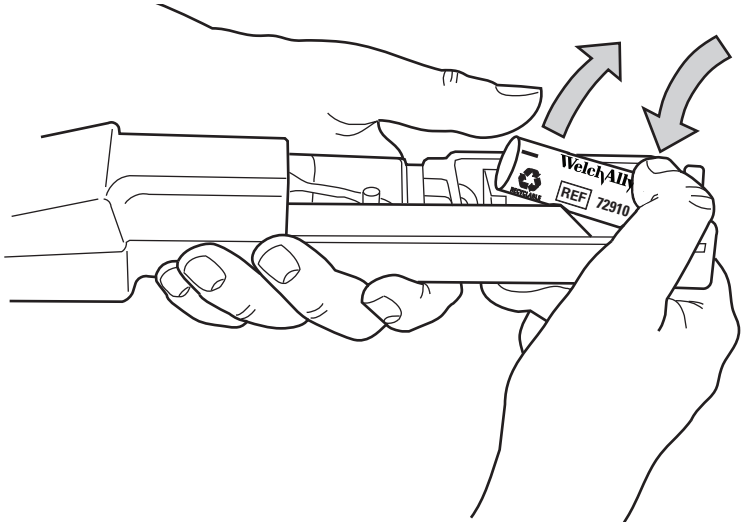
1. Allow the Handle to power down.
2. Unscrew the battery cover in a counterclockwise direction using the #1 Phillips head screwdriver provided. Save the screw.



3. Remove the battery cover by lifting the bottom of the cover away from the probe tip.

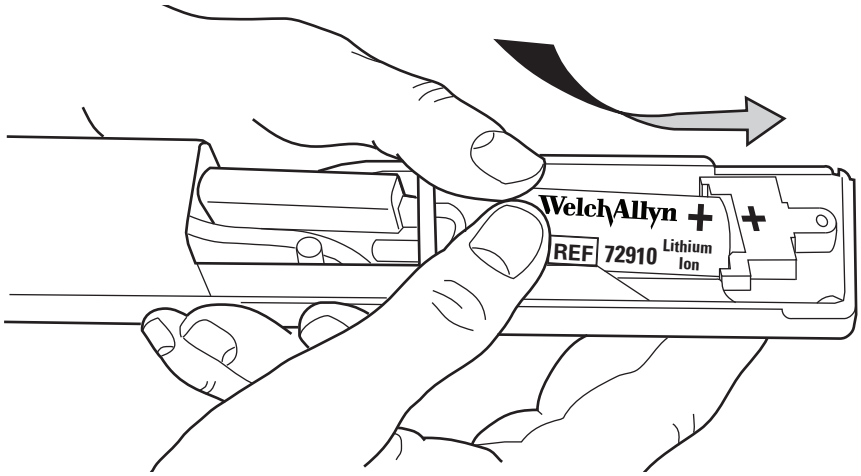


4. Push down on the positive (+) end of the battery. The battery will eject.

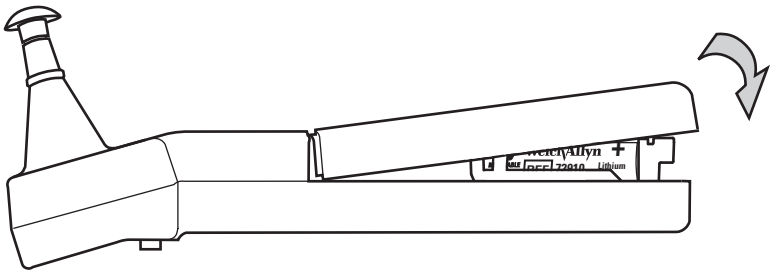


5. Insert the new battery by placing the positive (+) end of the battery against the contact in the holder. Push the battery lightly to compress the contact, and lower the battery into the compartment.

Note Insert the battery only as shown. Failure to observe the correct polarity will prevent the instrument from functioning.



6. Replace the cover by inserting the tip end under the front cover, lowering the opposite end, and replacing the screw.

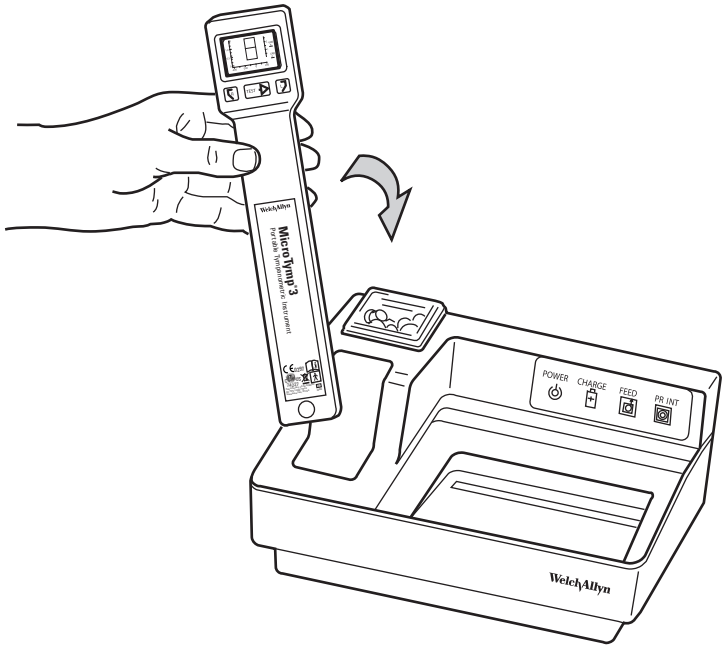


7. Tighten screw in clockwise direction. To avoid stripping the screw threads, do not tighten excessively.
8. Place the Handle into the charging station for a minimum of 10 seconds to enable the battery protection circuit.

Note The unit will not power up if you do not enable the battery protection circuit.

Recharge the battery

To recharge the battery, place the Handle in the Printer/Charger well with the LCD and buttons facing you.



Caution To prevent equipment damage, charge the Handle only with the Printer/Charger (#7117x).

The 3.7V Lithium-ion battery used in the Handle, when fully charged, provides a full day of operation without the need for recharging and yields a minimum of 300 double-ear tests. This makes the instrument optimal for mass screening or off-site situations where there may not be a need to print, but there is a need for continuous operation.

A fully drained battery should be recharged overnight (16 hours).

Note
- The Handle may be charged indefinitely without damage to the battery.
- Slight heating of the Handle during charging is normal.
- The battery will self-discharge gradually over a period of approximately 60 days when stored at room temperature (70°F/21°C); storage at higher temperatures accelerates the discharge rate.

Recycle the Battery

Check with your local waste management agency for the proper recycling procedure for a Lithium-ion battery.

Lithium-ion battery.
Must be recycled or
disposed of properly.

Replace the tips

Replace the probe tips after six months of use.

Replace the paper

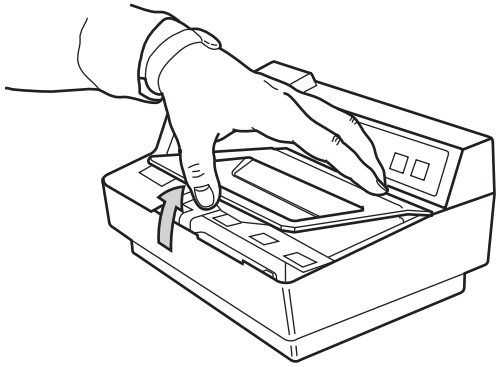
The Printer/Charger signals the need for changing the paper in one of two ways:

- A pink strip appears along the edge of the paper indicating the paper is nearing the end of the roll.
- The POWER indicator flashes in single pulses indicating that there is no paper, and no printing can occur.

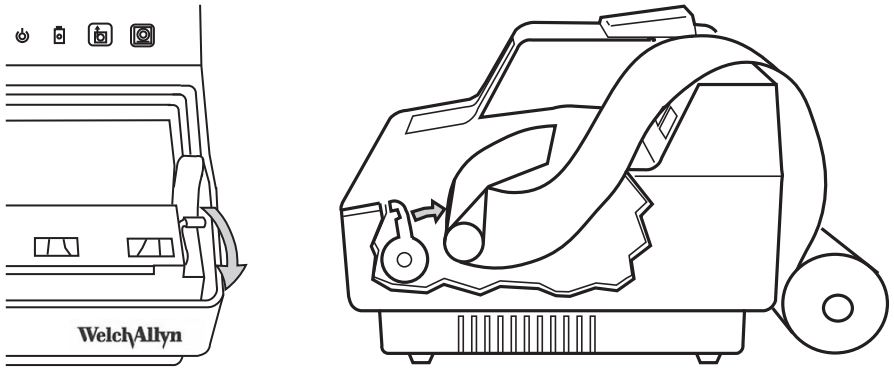
Note
- Use only an appropriate heat-sensitive paper or the Printer/Charger life may be shortened and the warranty voided.
- The paper is thermally activated, so it must be stored in a cool, dark location to prevent exposure and degraded performance.
- Because the paper is thermally activated, no printing will appear on the paper if it is inserted backwards.
- Do not use transparent adhesive tape on printed portions of the printout, as those portions will then fade.

WARNING Electric shock hazard. Do not attempt to disassemble the Printer/Charger. Refer all servicing to Welch Allyn or a Welch allyn authorized service representative.

1. Remove the paper access cover by pulling up on the front edge.



2. Depress the FEED button to advance any remaining paper through the printer. *Do not pull paper backwards through the printer.* Remove and discard old paper roll. Save the black spindle that guides the paper.
3. Pull the paper lever forward.



4. Place the roll of paper behind the Printer/Charger for easier handling.
5. Insert the paper (from of the bottom of the roll) into the slot under the pinch roller, making sure that the paper is centered.
6. Return the paper lever to its original position, and press the FEED button to advance several inches of paper beyond the pinch roller.
7. Tighten the paper on the paper roll, reinsert the black spindle through the roll, and place the paper roll in the paper cradle.
8. Feed the paper through the slot in the paper access cover.

Note Make sure that the paper is taut before replacing the paper access cover. Loose paper can cause printer malfunction.

9. Replace the cover by sliding the back edge into place first and lowering the front of the paper access cover.

Cleaning

Clean the handle

Clean the Handle by wiping it with a cloth that has been lightly dampened with 70% Isopropyl alcohol. Make sure liquid does not seep into the instrument, especially in the probe area.

Clean the printer/charger

Clean the Printer/Charger by wiping it with a cloth that has been lightly dampened with 70% Isopropyl alcohol. Make sure liquid does not seep into either the printer area or the charging well.

Clean the probe tips

After each use, inspect small openings in the tip for debris, then remove tip from Handle. If you observe no debris, wipe with a clean cloth and a 70% isopropyl alcohol solution. Allow to air dry.

If you observe debris after use, rinse tip with warm tap water for one minute, then soak the tip in 70% alcohol for 20 minutes. Rinse tip with tap water and air dry.

Functional Checks

Check the handle

A MicroTest Cavity is included with the Handle. The cavity provides a functional test of the Handle to determine if it is working properly. The 0.5 cc cavity is used to test the Low Range of ear canal volume (Vea). The 2.0 cc cavity is used to test the High Range of the ear canal volume (Vea).

Check the Handle with the MicroTest Cavity at least once a month and whenever the operation of the Handle is questioned.

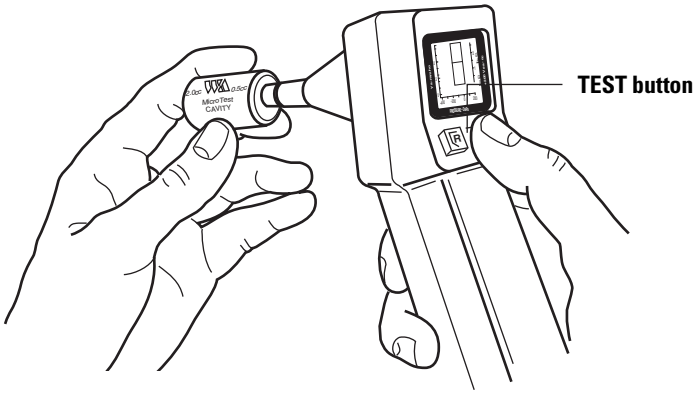
Note Functional testing must be done in both the 226-Hz mode and the 1000-Hz mode.

To switch the frequency, simultaneously press R and L.

After completing both tests, you can toggle back to desired frequency by pressing the same buttons.

226-Hz check

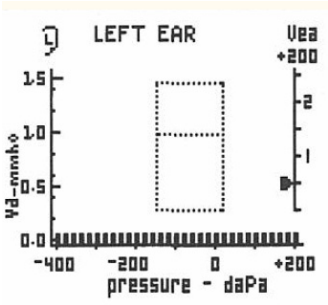
1. Make sure the Handle is in 226-Hz mode.
2. Using any size probe tip, place the probe tip against the 0.5 cc cavity as if it were an ear. Hold the handle and MicroTest Cavity carefully to prevent movement. Depress the TEST button and test the cavity as you would an ear.



3. Store the information using either the right or left memory buttons.
4. Repeat Steps 2 and 3 using the 2.0 cc cavity. Store the information in the opposite memory location used in Step 2.
5. Print the information using the Printer/Charger.

A properly functioning instrument will produce two results:

- A flat tympanogram (see the figure below). All data points must fall within the two bottom rows of the graph.
- An ear canal volume (Vea) which corresponds to the cavity tested. See the Expected Vea readings table for the acceptable range for each cavity both at sea level and at different altitudes.



Tympanogram from 0.5 cc cavity

Expected Vea readings for MicroTest cavity

Cavity Measured	Acceptable Tolerances	Acceptable Range at Sea Level	Acceptable Range at 3000 ft (914 m)	Acceptable Range at 5000 ft (1524 m)
0.5 cc Cavity	±0.1 cc	0.4 cc to 0.6 cc	0.4 cc to 0.6 cc	0.5 cc to 0.7 cc
2.0 cc Cavity	±0.1 cc	1.9 cc to 2.1 cc	2.0 cc to 2.2 cc	2.0 cc to 2.2 cc

Refer to the Influence of altitude table on page 40 for a more comprehensive treatment of altitude's effect.

If the readings do not fall within the acceptable range, then the Handle requires calibration. Send the Handle to a Welch Allyn service location.

As the altitude above sea level increases, the admittance of an air-filled cavity also increases. Therefore, at altitudes above sea level, results using the MicroTest Cavity will change.

1000-Hz check

1. Make sure the Handle is in 1000-Hz mode.
2. Using any size probe tip, place the probe tip against the 0.5 cc cavity as if it were an ear. Hold the handle and MicroTest Cavity carefully to prevent movement. Depress the TEST button and test the cavity as you would an ear.
3. Store the information using either the right or left memory buttons.
4. Repeat Steps 2 and 3 using the 2.0 cc cavity. Store the information in the opposite memory location used in Step 2.

The Handle should display REFER 0.4 or less in both the 0.5 cc and 2.0 cc cavities.

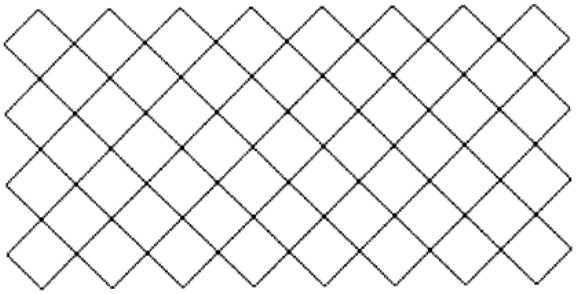
Note While the MicroTest Cavity provides a functional test, it does not replace full calibration. Welch Allyn recommends that the Handle be calibrated annually.

Troubleshooting the Handle

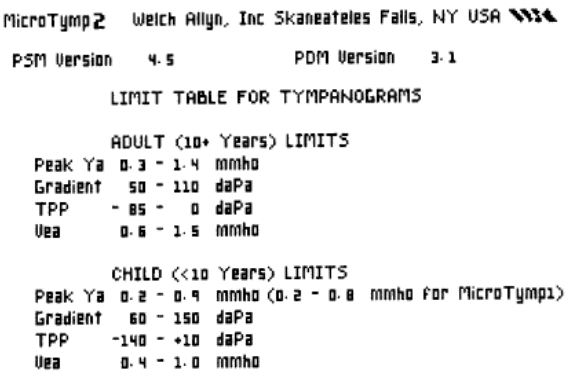
Symptom	Possible Cause	Possible Solution
Handle does not turn on	No battery.	Put battery in. Reset the battery protection circuit.
	Battery is in backwards.	Reposition the battery observing correct polarity. Reset the battery protection circuit.
	Battery is not charged/dead.	Charge/replace the battery. Reset the battery protection circuit. If symptom still persists, return to local Welch Allyn service location for service.
	Battery protection circuit was not reset.	Place the Handle in the Printer/Charger for a minimum of 10 seconds to reset the battery protection circuit.
Too much artifact on LCD	Too much movement during test.	See page 37.
	Handle has too much internal noise.	Check handle in MicroTest cavity. If handle passes functional check, artifact is due to motion. If handle does not pass functional check, return to Welch Allyn service location for service.
"Frozen" display on LCD OR "Checkerboard" pattern on LCD	Microcomputer has malfunctioned.	Push TEST and repeat. If symptom persists, push all three handle buttons (TEST, R MEM, L MEM) simultaneously to reset microcomputer. If symptom persists, remove and reinsert the battery. If symptom persists, return to local Welch Allyn service location for service.

Check the printer/charger

Pressing the FEED and PRINT buttons simultaneously causes a test pattern to print, as shown below.



1 Test Pattern



2 Software Version

3 Normative Data Reference

1. **Test Pattern** - The test pattern is used to confirm that the print head is functioning properly. If any of the print head elements are not functioning, a white line will appear vertically down the printout. A defect in the paper may also cause white lines or light printing. Repeat the test pattern to confirm any suspected printing problems. If paper advances but nothing prints out, check to be sure the paper is inserted properly (see page 52).
2. **Software Version** - The test pattern also includes the software version for the Printer/Charger.
3. **Normative Data Reference** - The test pattern is followed by normative data for tympanometric characteristics for both the MicroTymp2 and MicroTymp3 Handle. This is provided along with the test pattern for the convenience of the user, not specifically as a functional check.

A Middle ear pathologies

Low-admittance pathologies

Otitis media with effusion (OME)

Otitis media with effusion (OME) is an inflammation of the middle ear accompanied by an accumulation of fluid. Fluid in the middle ear can cause conductive hearing impairment when it interferes with the normal vibration of the eardrum by sound waves. In advanced cases, OME results in flat tympanograms (low Peak Ya). In intermediate stages of OME, the peak height may be normal, but the gradient may be widened.

Middle ear tumor

A wide variety of neoplastic processes exist that invade the middle ear. The most common is the keratoma (cholesteatoma), a collection of keratinizing squamous epithelium that frequently originates from Shrapnel's membrane (pars flaccida) of the tympanic membrane or the ear canal wall and invades the middle ear space. Other middle ear tumors include the cholesterol granuloma, glomus tumor, and squamous cell carcinoma. These pathologies generally result in a flat tympanogram.

Lateral ossicular fixation

Lateral ossicular fixation may result from tympanosclerosis, a complication of chronic otitis media that may involve the eardrum, malleus, incus, and/or stapes. In general, the more lateral the fixation, the more effect the condition has on the tympanogram. Lateral fixations typically cause low Peak Ya and wide tympanometric widths.

Otosclerosis

Because the otosclerotic lesion is more medial than lateral ossicular fixation, the tympanogram is less affected. The tympanometric shape is often indistinguishable from normal, although the Peak Ya may be slightly low and the tympanometric gradient (width) may be narrower than the normal tympanogram.

Tympanic membrane abnormalities

The tympanic membrane is normally a stiff, conically-shaped structure that derives its stiff characteristic from the lamina propria, a layer of connective tissue that is situated between the outer layer of squamous epithelium (skin) and the inner layer of mucous membrane. When the eardrum heals after a relatively large perforation, the lamina propria may be absent or thin in the region of the scar. This neomembrane can be set into

vibration with greater ease than the normally stiff tympanic membrane. The result is a high Peak Ya. Although the tympanogram is abnormal, this condition rarely affects hearing sensitivity or requires further medical treatment.

Ossicular disruption

Disruption of the ossicular chain can range from partial interruption to complete absence of the ossicles. These conditions result from the erosive effects of chronic infection, trauma, and congenital defect. Ossicular disruption is usually associated with a substantial conductive hearing loss. Because the ossicles normally "load" the eardrum, contributing to its tension, the eardrum in an ear with ossicular disruption can be more easily set into vibration than the normal eardrum, resulting in high Peak Ya.

B Service and warranty information

Service

Repair

Repair must be performed by Welch Allyn authorized personnel. Failure to do so invalidates the warranty. A moderate fee is charged to calibrate the Handle after a repair.

Contact Customer Service in your region for service options.

Calibration

Welch Allyn recommends that the Handle be calibrated annually. Arrangements may be made by returning the registration card or by contacting Welch Allyn's Technical Service Department or an authorized Welch Allyn distributor. A moderate fee is charged for calibration.

A monthly functional check using the MicroTest Cavity is recommended in addition to annual calibration.

The Printer/Charger does not require calibration.

Warranty

Instrument

Welch Allyn Inc. warrants the Handle and Printer/Charger 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 at variance from the manufacturer's specifications during the warranty period, Welch Allyn will repair, replace or calibrate 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. Ground shipping charge to return a defective device to the nearest Welch Allyn center is included.

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.

Purchase date determines warranty and annual calibration requirements. No other express or implied warranty is given.

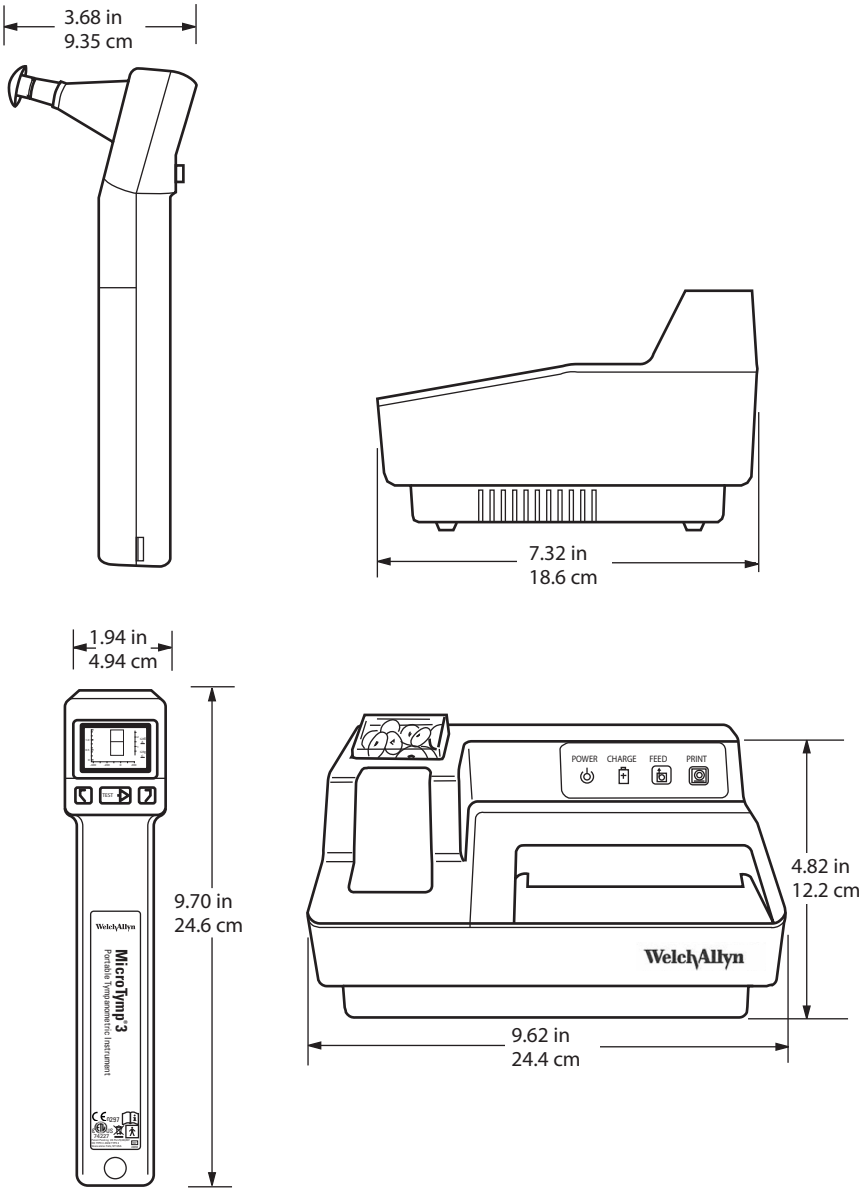
Note Proof of purchase date is required for warranty validation.

Rechargeable battery

Welch Allyn Lithium-ion batteries are warranted by Welch Allyn for two years from date of manufacture (when used in Welch Allyn instruments only). Defective batteries under warranty will be replaced when the unit is sent to Welch Allyn for service.

C Specifications

Physical characteristics



Technical specifications

Probe tone

226-Hz Amplitude: 85 ± 3 dB SPL

1000-Hz Amplitude: 83 ± 3 dB SPL

Frequency Accuracy: ± 2%

Total Harmonic Distortion: 3% maximum

Signal Type: Continuous Sinusoid

All specifications measured in an ANSI HA-1 (2.0 cc) coupler.

Pressure measurement system

Direction of sweep: positive to negative pressure

Sweep Rate: 400 daPa/sec average during data acquisition period (applies only at sea level)

Range: +200 to -400 daPa

Display resolution: 20 daPa

Accuracy: ±15% or ±10 daPa, whichever is greater

Compensation: Auto-zero every test cycle

Admittance measurement system

226-Hz mode

Range: 0.2 to 4.0 mmho total

0.0 to 1.5 mmho for Ya

0.2 to 2.5 cc for +200 Vea

Accuracy: ±0.1 mmho or ±5%, whichever is greater

Positive tail compensation

1000-Hz mode

Range: 0.9 to 16.6 mmho total

0.0 to 6.5 mmho for Ya (for ear canal volumes ≤ 2.0 cc)

0.2 to 2.5 cc for +200 Vea

Accuracy: ± 0.4 mmho or ± 5%, whichever is greater

Negative tail compensation

Display resolution

0.1 mmho for Ya

0.2 cc for +200 Vea

Weight

Handle: 0.61 lb/0.28 kg

Printer/Charger: 3.98 lb/1.81 kg

Operating environment

Temperature: 15°C to 35°C

Relative Humidity: 10% to 90%

Barometric Pressure: 700 hPa to 1060 hPa

Note No warm-up period is required if the instrument is stored in conditions consistent with the operating environment.

Storage environment

Temperature: -20°C to +49°C

Relative Humidity: 15% to 95%

Note Units must be stored in conditions consistent with the defined operating environment for a period of 24 hours prior to use.

Battery

3.7 V Lithium-ion rechargeable, 800 mAh capacity

All specifications are met over a battery voltage range of 3.1V to 4.2V.

Probe tips

Five color-coded sizes: Extra Small, Small, Medium, Large, Extra Large

Tip outer diameter dimensions

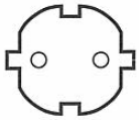
Tip Size	Diameter (in.)	Diameter (mm)
Extra Small	0.30 in.	7 mm
Small	0.37 in.	9 mm
Medium	0.48 in.	12 mm
Large	0.62 in.	16 mm
Extra Large	0.79 in.	20 mm

Printer paper

4.42 in. (112 mm) wide with core

Printer/Chargers

Printer/Charger models

Welch Allyn Model Number	Nominal Output	Major Geographic Areas	Plug Type
71170	120 V~, 1A	Canada, Japan, United States	
71172	230 V~, 1A	Europe	
71174	230 V~, 1A	United Kingdom	
71176	230 v~, 1A	Australia, New Zealand	

Operating ranges

Input voltage for all Printer/Charger models is 100 to 240 V~

Input frequency for all Printer/Charger models is 50 to 60 Hz

Input current is 1A maximum

Equivalent units and symbols

Acoustic Admittance: mmho = $10^{-8}m^3/Pa*s$

Air Pressure: daPa = Air Pressure (daPa) (1 daPa = 1.02 mmH2O)

Equivalent Volume = V_e = +200 Vea

Pressure on LCD/printout = Relative Pressure = Δps

Pressure on LCD/printout = pressure - daPa = Air Pressure (daPa) (1 daPa = 1.02 mmH2O)

Admittance on LCD/Printout = Ya - mmho = Acoustic Admittance (acoustic mmho)

Standards compliance

This instrument complies with the following standards based on the most recent revision available at the time of design:

UL 60601-1

CAN/CSA C22.2 No. 601.1-M90

EN/IEC 60601-1:1990

EN/IEC 60601-1-2

ANSI S3.39-1987 - ANSI Type 4 instrument

IEC 60645-5: 2004 - IEC Type 3 Instrument

Handle:
Class I Equipment, Type BF

Printer/Charger:
Class I Equipment, Type B

Authorized European representative address:

European Regulatory Manager
Welch Allyn, Ltd.
Navan Business Park
Dublin Road, Navan
County Meath, Republic of Ireland
Tel. 353 46 28122
Fax 353 46 28536

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

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.

For more specific disposal information, see www.welchallyn.com/weee, or contact Welch Allyn Customer Service at +44 207 365 6780.

Guidance and manufacturer's declaration

Emissions and immunity information

Caution The MicroTymp3 needs special precautions regarding EMC and needs to be installed and put into service according to the following EMC information provided.

Portable and mobile RF communications equipment can affect the MicroTymp3.

Electromagnetic Emissions

The MicroTymp3 is intended for use in the electromagnetic environment specified below. The customer or user of the MicroTymp3 should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF emissions CISPR 11	Group 1	The MicroTymp3 uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The MicroTymp3 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Electromagnetic Immunity

The MicroTymp3 is intended for use in the electromagnetic environment specified below. The customer or user of the MicroTymp3 should assure that it is used in such an environment.

Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment - Guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/ burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines. IEC 61000-4-11	>95% dip in 0.5 cycle 60% dip in 5 cycles 30% dip for 25 cycles >95% dip in 5 seconds	>95% dip in 0.5 cycle 60% dip in 5 cycles 30% dip for 25 cycles >95% dip in 5 seconds	Mains power quality should be that of a typical commercial or hospital environment. If the user of the MicroTymp3 requires continued operation during power mains interruptions, it is recommended that the MicroTymp3 be powered from an uninterruptible power supply or battery. Note: “Dip” refers to a dip in mains voltage.
Power frequency (50/60Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

Electromagnetic Immunity

The MicroTymp3 is intended for use in the electromagnetic environment specified below. The customer or user of the MicroTymp3 should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the MicroTymp3, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	V1 = 3 Vrms	$d = (1.17)\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	E1 = 3 V/m	$d = (1.17)\sqrt{P}$ 80 MHz to 800 MHz $d = (2.33)\sqrt{P}$ 800 MHz to 2.5 GHz where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol: 

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the MicroTymp3 is used exceeds the applicable RF compliance level above, the MicroTymp3 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the MicroTymp3.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the MicroTymp3

The MicroTymp3 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or user of the MicroTymp3 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the MicroTymp3 as recommended below, according to the maximum output power of the communications equipment.

	Separation Distance According to Frequency of Transmitter (m)		
Rated Max. Output Power of Transmitter (W)	**150 kHz to 80 MHz** $d = (1.17)\sqrt{P}$	**80 MHz to 800 MHz** $d = (1.17)\sqrt{P}$	**800 MHz to 2.5 GHz** $d = (2.33)\sqrt{P}$
0.01	0.11667	0.11667	0.23333
0.1	0.36894	0.36894	0.73785
1	1.1667	1.1667	2.3333
10	3.6894	3.6894	7.3785
100	11.667	11.667	23.3333

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

D Replacement parts and accessories

Note Items are not drawn to scale.

Battery
#72910 3.7 V
Lithium-ion

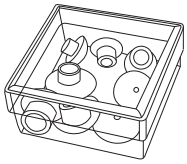
Screw for Battery Cover
#236081

Screw Driver for Battery Cover
#236200-2

MicroTest Cavity
#711772-501

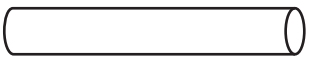
Probe Tips - Four of the selected size in a bag

#24621	#24622	#24623	#24624	#24625
Black	Gray	Blue	Green	White
Extra Small	Small	Medium	Large	Extra Large

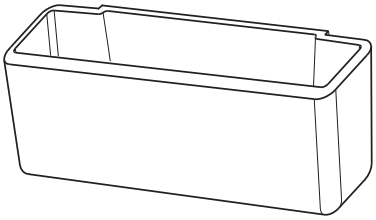


Box with two sets of tips
#24620

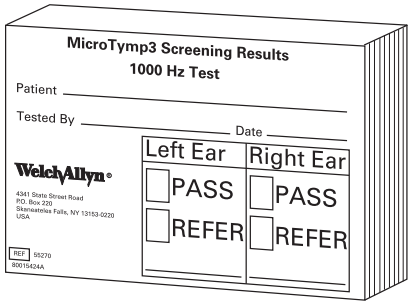
MicroTymp 2 and 3 Paper
#56100



Spindle for Paper
#761050-1

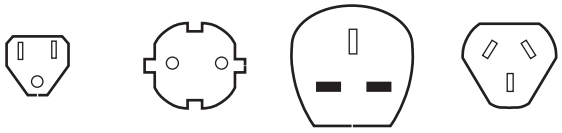


Card Holder
#55260



1000-Hz Screening Results Cards - Quantity 100: four packs of 25
#55270

Replacement Power Cords (order by plug type)



#761076-0
120 V
Canada, Japan, U.S.

#761076-2
230 V
Europe

#761076-4
230 V
United Kingdom

#761076-6
230 V
Australia, New Zealand

Handle
#23650

Carrying Case for MicroTymp 2 or 3 and AudioScope 3
#05276-U

Glossary

acoustic admittance The ease with which acoustic energy is transferred into a system; the ratio of volume velocity to sound pressure.

acoustic millimho (mmho) The unit of acoustic admittance; 1 mmho = $10^{-8}m^3/Pa*s$.

cholesteatoma See keratoma.

decapascal (daPa) The unit of air pressure used for tympanometric measurements. 1 daPa = 1.02 mm H_2O

equivalent ear canal volume (+200 Vea) An estimate of the volume of air in front of the probe, measured in cubic centimeters (cc).

keratoma A collection of keratinizing squamous epithelium that invades the middle ear; keratoma frequently originates from a perforation in Shrapnell's membrane (pars flaccida) of the tympanic membrane; also called cholesteatoma.

lateral ossicular fixation Fixation of the malleus and/or incus, frequently caused by tympanosclerosis, a complication of chronic otitis media.

middle ear effusion An accumulation of fluid (liquid) in the middle ear.

neomembrane A scar on the tympanic membrane; the scarred region may be thinner and have a higher admittance than the normal tympanic membrane; also called monomere.

otalgia Ear ache or pain.

otitis media with effusion Inflammation of the middle ear, often accompanied by an accumulation of fluid (liquid).

otorrhea External ear discharge.

otosclerosis A genetic abnormality of the temporal bone, frequently causing fixation of the stapes and conductive hearing loss.

sound pressure The average (rms) difference between the air pressure that occurs during sound transmission and the ambient air pressure.

static admittance (Peak Ya) A calculated measure of the compensated static acoustic admittance (height) of the tympanometric peak in acoustic millimhos (mmho).

tympanogram A recording of the admittance of the ear as a function of ear canal pressure.

tympanometric gradient A measure of the width of the tympanogram reported in decapascals (daPa) at 50% of static admittance (Peak Ya) or the tympanometric peak.

tympanometric peak pressure The location of the tympanometric peak on the pressure axis. TPP is reported in decapascals (daPa).

tympanometry The measurement of acoustic admittance in the sealed ear canal as a function of ear canal air pressure.

tympanosclerosis A complication of otitis media that is characterized by sclerotic regions involving the tympanic membrane, ossicles, and middle ear mucosa. Tympanosclerosis increases the stiffness of the middle ear system.

volume velocity The volume of air that passes through a plane per unit time.