D-0122850/D

Audiometer Fault Diagnosis & Repair Guide

For distributor use only

Models Covered:

116, 170, PC850, 240, 260, 270

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Contents

1. Introduction 4

2. Safety Considerations 5

3. Audiometer Accessories 6

3.1 Headphones & Audiocups 6

3.2 Mains Power Adaptors 7

4. Audiometer disassembly / re-assembly 8

5. Common audiometer faults 9

5.1 Technician requirements 9

5.2 Audiometer won't turn on 9

5.3 Audiometer power adapter input fuse 10

5.4 Audiometer power adapter input clamp diode 10

5.5 270 Rotary encoder issues (original encoder) 10

5.6 Refitting of control knobs (original encoder) 11

5.7 Static click on presentation 11

5.8 Attenuator Chip Failure 12

5.9 System Fault 12

6. Printers 13

6.1 Thermal printer types 13

6.2 How to change printer type in audiometer menu (if applicable*) 13

6.3 Printer maintenance & batteries 14

6.4 Martel printer configuration 14

7. Battery option Audiometers 15

8. PCA replacement information 16

9. Appendices 17

Appendix 1: Headphone cable replacement 17

Appendix 2: Audiocups - fitting & servicing 19

Appendix 3: 116/170/PC850/240 DSA302 PCA removal & reassembly 23

Appendix 4: 260 AE2000 PCA removal & reassembly 24

Appendix 5: 270 AE2000 PCA removal & reassembly 25

Appendix 6: Static 'click' on presentation: DSA302-S / DSA302-T 28

Appendix 7: Static 'click' on presentation: AE2000-C / AE2000-D (260, 270, SD270) 30

Appendix 8: Internal fuse, protection diode & audio attenuator details 32

Appendix 9: 270 rotary encoder replacement (original encoder) 34
Appendix 10: Control knob spacing tool 38
Appendix 11: Fitting 270 Control Knobs (original encoder) 39
Appendix 12: DSA302 Replacement PCA 42
Appendix 13: AE2000 Replacement PCA 43
Appendix 14: Fitting battery boards to current Amplivox 116 and 240 models 44
Appendix 15: Diagnostic flowchart - headphone related faults 46
Appendix 16: Diagnostic flowchart – power related faults 47
Appendix 17: Diagnostic flowchart – audio related faults 48
Appendix 18: Portable Thermal Printer Connection – Amplivox Audiometers 49
Old models 49
Serial number range 49
Thermal printer 49
Printer cable & stock code (old) 49
Appendix 19: Spare parts 52
19.1 Consumable parts 52
19.2 Service parts 54
19.3 Spare PCA assemblies 55

1. Introduction

This document describes how to diagnose some of the more common faults with Amplivox audiometers, and provides repair procedure information where relevant on how to fix the faults described.

It is assumed that the technician using this manual to assist with such work is competent with the repair techniques required to service these audiometers – this could include the use of light hand tools, light mechanical assembly and careful soldering.

For faults which are not covered in this manual, or which there is doubt about the ability of the operative to achieve satisfactory results, it may be necessary to return the item to the Amplivox service centre for repair.

In any instance where a product requires return, please contact Amplivox for shipping advice and return authorisation. Please also consider if there is anything else which needs to be returned (for example, the associated transducers if a re-calibration is likely).

This document should be used in conjunction with the product specific service/calibration manual.

Please note: If you attempt a repair and damage the instrument in anyway this is not covered under the manufacturer's warranty. If in doubt, please contact Amplivox to arrange return to our service centre for repair.

2. Safety Considerations

It is assumed that technicians working on Amplivox products are trained appropriately to work on electronic assemblies, and that they are suitably skilled in soldering and electronic techniques for re-work of both the SMD (surface mount device) and PTH (plated through hole) type PCA (printed circuit assembly).

Local solder rework regulations must be obeyed.

There are no lethal voltages present in any of these audiometers, the power input is limited to 10 Watts (5V DC @ 2A DC) for instruments using power supply A091-4 or A091-5, or is limited to 8 Watts for any later power supplies (5V DC @ 1.6A DC).

Note:

- Anti-static procedures must be adhered to at all times.
- Original specification parts must always be used to maintain relevant safety approvals.
- Where an audiometer requires calibration after repair, this will be noted in the manual and calibration in full should then be carried out (all transducers, not just headphones).

3. Audiometer Accessories

For this service manual, audiometer accessories will be assumed to be all parts of the audiometer system which are external to the main audiometer casework. These parts can all be diagnosed and replaced without the need to remove any of the casings from the audiometer.

3.1 Headphones & Audiocups

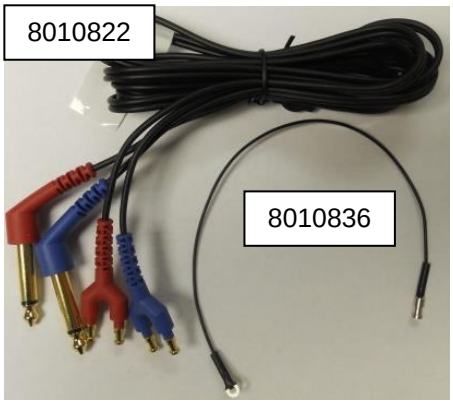
Old and worn headphone and Audiocup cables can cause intermittent sound or loss of sound from the headphones.

Refer to Appendix 15 for the relevant diagnostic flowchart.

Refer to Appendix 1 for details on replacing a headphone cable.

Refer to Appendix 2 for details on fitting and servicing Audiocups.

Headphone cables, Audiocup internal cable & stock codes

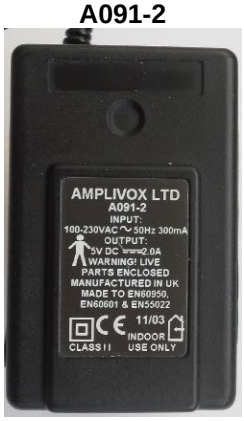


3.2 Mains Power Adaptors

To ensure that the product meets with relevant safety approvals, it is essential that all Amplivox products are used with an approved Amplivox mains power adaptor.

Various mains power adaptors have been used over the years and these can be identified from the images below: **Note:** This document only covers Amplivox power adaptors that are 5 Volts *and* have a circular plug, which does not include CA850 series 3.

A091-2



A091-4

A091-5

A091-6

A091-7

8512734 (A091-8)

Notes:

- The power adaptors are short circuit protected.
- A091-2 and A091-4 have a physical connection to mains earth.
- A091-5, A091-6 and A091-7 have a green LED indicator that will illuminate when the power adapter is functioning correctly.

Where a faulty power adapter is diagnosed, it is generally possible to substitute the current power adapter, but this is not always the case. Please refer to power adapter acceptable replacement table below:

Original adapter stock code	Replacement adapter stock code
A091-2	260 serials below 11825 and 270 serial numbers below 5801: A091-4. For higher serial numbers: 8512734 (A091-8).
A091-4	
A091-5	8512734 (A091-8)
A091-6	8512734 (A091-8)
A091-7	8512734 (A091-8)
8512734 (A091-8)	8512734 (A091-8) **Note:** Model 'UES12LCP' (not marked with stock code)

4. Audiometer disassembly / re-assembly

Investigation of any internal faults will necessitate that the PCA(s) are available to work on outside of the main case.

Amplivox PCA's fall into three main audiometer categories depending on the PCA family from which the audiometers are built:

- DSA302 (for model 116, 170 and PC850 screening audiometers). The buttons and display are incorporated in one PCA.
- DSA302 (for model 240 diagnostic audiometer). The buttons and display are incorporated in one PCA.
- AE2000 (for model 260 and 270 diagnostic audiometers). There are separate PCA's for the buttons and displays: TT1000 (model 260), TE2000 (model 270).

PCA removal is covered in the following sections:

For PCA removal from 116/170/PC850/240, please refer to Appendix 3

For PCA removal from 260, please refer to Appendix 4

For PCA removal from 270, please refer to Appendix 5

PCA removal should be carried out carefully and following Anti-Static procedures.

5. Common audiometer faults

5.1 Technician requirements

Service of some of the issues described below will require the use of a soldering iron to fit new parts.

Repairs carried out at PCA level must only be carried out by suitably qualified & experienced personnel whose skills are up to date in dealing with modern Surface Mount Device (SMD) PCA's, and in using the appropriate PCA rework tools for the process of de-soldering the old part and soldering in the replacement part.

The technician will need to judge whether the PCA is manufactured with Pb-free solder or not, and use appropriate solder to affect a repair correctly. In general, Amplivox PCA's swapped to a Pb-free process in 2010.

Failure to use the correct tools is likely to result in PCA damage such as lifted tracks around the devices. It is the responsibility of the technician working on the audiometer to ensure they have the appropriate skills and tools.

PCA's which are damaged due to an attempted repair are not the responsibility of Amplivox and will not be replaced under warranty.

If in doubt, please return the audiometer to the Amplivox service centre for repair

5.2 Audiometer won't turn on

There are various common reasons that an audiometer may not turn on, usually these relate to power supply or power switching issues, though sometimes they can relate also to other HW issues.

By following the appropriate diagnostic flowchart for fault finding, it should be possible to ascertain with reasonable confidence where the problem occurs.

In the instance that the flowchart is unable to provide a successful local repair to the PCA, it will be necessary to either replace the PCA entirely or to return the audiometer to the Amplivox service centre for investigation / repair.

Please refer to Appendix 16 for the diagnostic flowchart covering power related faults.

Please refer to Appendix 12 for details of how to fit an exchange DSA302 PCA.

Please refer to Appendix 13 for details of how to fit an exchange AE2000 PCA.

5.3 Audiometer power adapter input fuse

The power input is protected by a Slow acting fuse which should not blow in normal operation. It is not possible to blow this fuse with an A091-5, A091-6, A091-7 or A091-8 Amplivox mains power adaptor.

Connection of an incorrect power adapter may damage the protection fuse. This fuse will blow if the over voltage clamp diode acts, when a power adapter with higher output than 5V nominal and an output current rating of >2A is connected.

Note: Connection of an incorrect power adapter can cause multiple component failures – *the PCA may be beyond economical repair.* Replacement PCA's are very expensive. Audiometer users should be reminded that the correct Amplivox power adapter must always be used.

Please refer to Appendix 8 **for more details about the fuse and its replacement.**

5.4 Audiometer power adapter input clamp diode

The audiometer has an input clamping diode across the power adapter input, which will act to protect against fast transients. This diode will trip into conduction around 6.4V and is rated at 3.0A to be above the fuse rating and above the Amplivox mains power adaptor output rating.

With some older PCA's which do not have a fuse, it has been observed that use of an incorrect power adapter type can cause the clamp diode to fail. If the clamp diode fails then the usual failure mode is a short circuit. This can be found easily with a DVM.

When repairing a PCA with a failed clamp diode, consideration should be given to the state of the diode and the surrounding tracking. If the diode has visibly failed in a catastrophic manner then it is likely that the PCA has seen voltages exceeding 6.4V and in this instance, it may be that the tracking will have lifted in an irreparable manner and/or multiple devices on the board will have failed.

If the PCA does not work correctly after fitting a new diode then it is most likely beyond economic repair.

Please refer to Appendix 8 **for more details about the diode and replacement.**

5.5 270 Rotary encoder issues (original encoder)

It is possible to damage the rotary encoders fitted to the 270 by means of rough handling of the audiometer.

Signs of a damaged encoder are a loose or excessively wobbly control knob and this is usually accompanied by the inability of the audiometer to read the encoder position, which will lead to the displayed dB readings not changing in a predictable manner.

Please refer to Appendix 9 **for details about replacement of the rotary encoders.**

Please note the encoders were enhanced from mid-2019, and this procedure only applies to audiometers manufactured before this date. It is not possible to fit enhanced encoders to

older audiometers in the field. If you wish to upgrade the encoders to the enhanced design the audiometer will need to be returned to our service centre.

5.6 Refitting of control knobs (original encoder)

If for any reason the control knob requires removal for service, repair, or simply to improve tactile feel, it is necessary to refit the control knob in a careful manner to restore the correct tactile feel.

Each control knob has three magnets embedded into the plastic, which act upon a steel 'spider' beneath the control knob, which provides tactile feel by means of magnetic detent. Upon refitting a control knob, it is imperative that the instructions are followed and the correct parts are used.

Obtaining the correct spacing between the control knob and the audiometer case is essential to achieve the correct detent.

Please refer to Appendix 10 for instruction on how to make a tool to space the knob from the audiometer correctly.

Please refer to Appendix 11 for instructions of how to correctly fit a control knob.

Please note the encoders were enhanced from mid-2019, and the control knob attaches slightly differently from mid-2019. This procedure only applies to audiometers manufactured before this date.

5.7 Static click on presentation

For a minority of audiometers manufactured through late 2012 to early 2013, a manufacturer's change of IC amplifier specification resulted a situation where a faint 'static click' could be heard immediately at the start of a tone presentation.

This can be cured simply by adding an R/C network to the amplifier on the back of the PCA, as detailed in the respective appendices.

There is no downside to adding this network to any Amplivox audiometer which uses a TDA2040 IC amplifier in its output stage.

Please see Appendix 6 for information relating to DSA302-S and DSA302-T

Please see Appendix 7 for AE2000 (260, 270)

Important Note: Calibration of the audiometer is essential following fitment of these parts

5.8 Attenuator Chip Failure

In very rare instances, it has been observed that the digital attenuator chip can fail and this may give rise to the following problems:

- Loss of one or both audio output channels
- Modest hiss, notable even on a 40dB sinusoidal output
- Presenting a short circuit to the power adapter and preventing the instrument powering on

Usually failure of the attenuator chip will be accompanied by visible package disruption and in this case the customer may report that they have smelt burning or seen smoke come from the audiometer.

Please refer to Appendix 17 for the diagnostic flowchart covering audio related faults.

Please refer to Appendix 8 for details about the digital attenuator chip and its replacement

Important Note: Calibration of the audiometer is essential following replacement of this part.

5.9 System Fault

On very rare occasions after switching an audiometer on, the screen may display 'System Fault' - the audiometer will also be unresponsive.

It is suspected that this is caused when the audiometer has been switched off by simply removing the power plug rather than the power button, which in turn may interfere with a critical write cycle of internal memory.

Audiometers should always be switched off using the 'OFF' function.

To remove the error message, it is necessary to switch on the audiometer, and then to press and hold a specific key sequence

For 270: Press and hold **Left, Right, <Hz, Hz>, Options**

For 116, 170, PC850, 240, 260: Press **Left, Right, Signal Up, Signal Down, Menu**

The audiometers calibration levels and stored identity should now be checked.

To check stored identity:

i) Switch on the audiometer and check model and headphone type are correct,
ii) Hold down MENU button (OPTIONS on 270) and press TALKOVER button to check model and serial number are correct.

If the audiometer has lost its stored identity it will be necessary to return it to the Amplivox service centre for repair.

6. Printers

6.1 Thermal printer types

Amplivox currently supplies a Sanibel portable thermal printer, stock code **8503007**, for use with audiometers and has historically supplied an Able portable thermal printer, stock code **8506761** (old: **PT01**) and Martel portable thermal printer, stock code **8011364** (old: **A091**). Each printer requires a different type of connecting cable.

Please refer to Appendix 18 to determine audiometer to thermal printer compatibility and the necessary printer cable required.

6.2 How to change printer type in audiometer menu (if applicable*)

*Not all audiometers have a printer option; please refer to the user manual supplied with the audiometer or the table in Appendix 18 if unsure.

For 116, 170, 240, 260

a) Note that Sanibel printer will work with Able printer selected, however correct cable is required (refer to Appendix 18).
b) With the audiometer switched on, press and hold down the MENU button.
c) While holding the MENU button, keep pressing the FREQUENCY> button to scroll through the menu items until ‘Select printer’ is displayed.
d) Press the SIGNAL up or down button, to the desired printer is shown.
e) Release the MENU button to save the selection.

For 270

a) Note that Sanibel printer will work with Able printer selected, however correct cable is required (refer to Appendix 18).
b) With the 270 switched on, press the OPTIONS button.
c) Keep selecting NEXT using the corresponding button underneath the display until ‘Select Printer’ is displayed.
d) Note the currently selected printer is shown in the top right corner of the display.
e) Select the desired printer type using the corresponding button underneath the display.
f) Select QUIT using the corresponding button underneath the display.

6.3 Printer maintenance & batteries

Thermal printers are virtually maintenance free and should only require charging prior to use.

Sanibel – charge for a minimum of **15 hours** prior to use.

Able – charge for a minimum of **15 hours** prior to use.

Martel – charge for a minimum of **8 hours** prior to use.

The Martel printer batteries can be replaced with alternative AA size NiMH batteries if desired. **DO NOT USE ANY OTHER BATTERY TYPE**.

It is only possible to replace the battery pack within the Sanibel and Able printers with one of the same type.

If printing is becoming faded, try replacing the paper roll.

Printing a test print from the Sanibel printer: With printer powered off (light off), hold the paper feed button while holding down printer power button for 2 seconds.

Printing a test print from the Able printer: With the printer switched on, tap the ON button twice.

Printing a test print from the Martel printer: With the printer switched off, hold down the MODE button for two seconds.

6.4 Martel printer configuration

To print from an audiometer, the Martel printer must be configured correctly. The printers *should* have the correct configuration when supplied by Amplivox. If printing problems are experienced, see below:

a) Print a test print (see section 6.3)
b) Note the RS232 PORT ‘Baud rate’ from the printout - this should be 2400. If not, see steps below.
c) With printer switched off, hold MODE button until green status LED flashes five times, then release button.
d) To select RS232 option, press button four times.
e) After a short delay the status LED will flash the same number of times as the selected option. If a mistake has been made wait for the printer to power-on and start again.
f) To configure RS232 Baud rate to 2400, press button four times (Martel MCP8830) or seven times (Martel MCP7830).
g) After a short delay the status LED will flash the same number of times as the setting. After a further delay the printer will power-on with the new setting.
h) Repeat step ‘a’ to check configuration.

7. Battery option Audiometers

A battery power option exists for the current Amplivox 116 and 240 models. Such products may occasionally require service.

The battery option consists of a modified instrument base panel containing a battery holder (4x C-cell) with a flying lead to a small battery interface PCA which plugs into the main DSA302 audiometer PCA.

General service procedures apply as for any other DSA302 based audiometer.

There are two types of recent battery board which have forwards compatibility only. Please refer to the table below to identity which type of board is fitted:

Original Battery board	Replacement PCA issue
 Issue C	216 Battery Board Rev C **OR** Rev E
 Issue E	216 Battery Board Rev E

If a replacement main PCA is required for a battery option audiometer, please note that the PCA will require minor modification in the form of the cutting of wire links.

Please refer to section 8 **for details of replacing a main PCA.**

Please refer to Appendix 14 **for details on fitting a battery board**.

It is important for the technician to note that an audiometer modified to run with the battery power option will also run from a mains power adaptor but only whilst the battery board is connected to the main PCA. If there is need to test this board without the battery power adaptor PCA in place (for example, if the battery power adaptor is thought to be faulty) then it is necessary to re-fit the links removed in Appendix 14 to allow the mains power option.

8. PCA replacement information

The need to replace the whole PCA is very rare, but may be required if it is deemed the PCA is beyond economical repair.

Note: Connecting non-Amplivox power adapters to Amplivox audiometers can result in PCA failure. Replacement PCA's are very expensive. Audiometer users should be reminded that the correct Amplivox power adapter must always be used.

Please see Appendix 12 for details of fitting a DSA302 audiometer PCA.

Please see Appendix 13 for details of fitting an AE2000 audiometer engine board.

Please see Appendix 14 for details on fitting a battery power board - links where applicable.

Please note that full calibration of the audiometer is essential following replacement of the main PCA.

9. Appendices

Appendix 1: Headphone cable replacement

Tools required:

Flat bladed ‘jewellers’ type screwdriver having approximately 2.0mm wide tip OR

0.9mm hex key

Procedure:

1.	If a plastic headband is being used, pull off the rubber ear cushions and release the earphones from each of the headbands earphone shells. This will expose the grub screws securing the headphone cable to the earphone.	
2.	Work with the blue earphone first. Slacken, but do not remove, both grub screws retaining the left (blue) cable in the earphone.	
3.	Remove the old cables blue two pin plug from the earphone. Fit the left (blue) plug from the new cable in the earphone and tighten the two grub screws finger-tight.	
4.	Repeat previous steps for the right (red) channel.	
5.	Connect the headset to the audiometer and test for sound output at a safe listening level.	

6.	Install the earphones back in the headband so cable is at bottom of earphones. *Metal headbands:* Push the headband locating lugs over the earphones so they locate in the dimples indicated in the photo. *Plastic headbands:* Locate each of the earphones within the earphone shells and replace the rubber ear cushions. Ensure each ear cushion is seated around the whole circumference of the locating lip of the earphone shells.	 Locate lugs of metal headband in these dimples

Appendix 2: Audiocups - fitting & servicing

Tools required:

Flat bladed ‘jewellers’ type screwdriver having approximately 2.0mm wide tip OR 0.9mm hex key

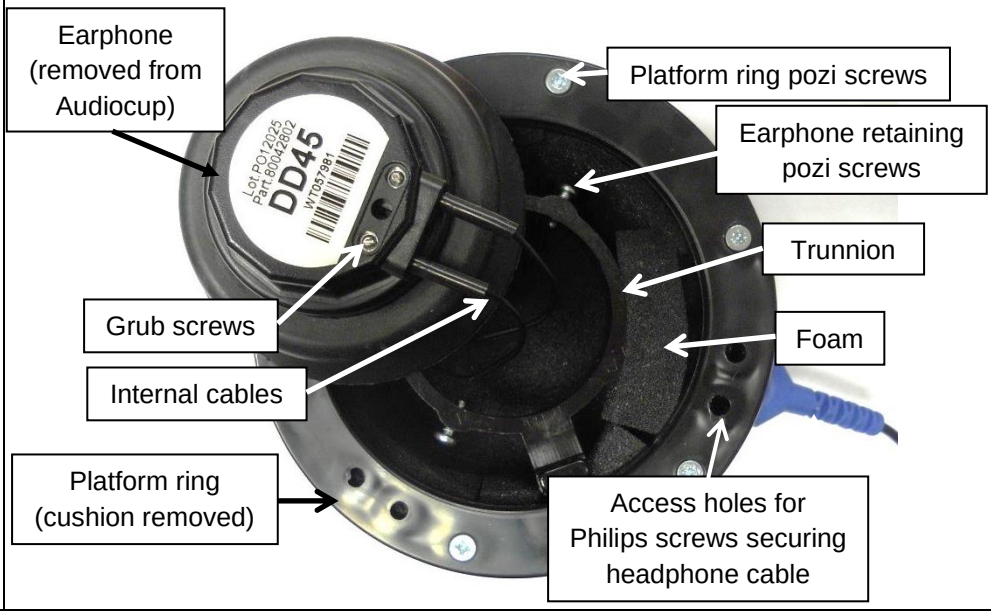
Pozi screwdriver, No.1 size

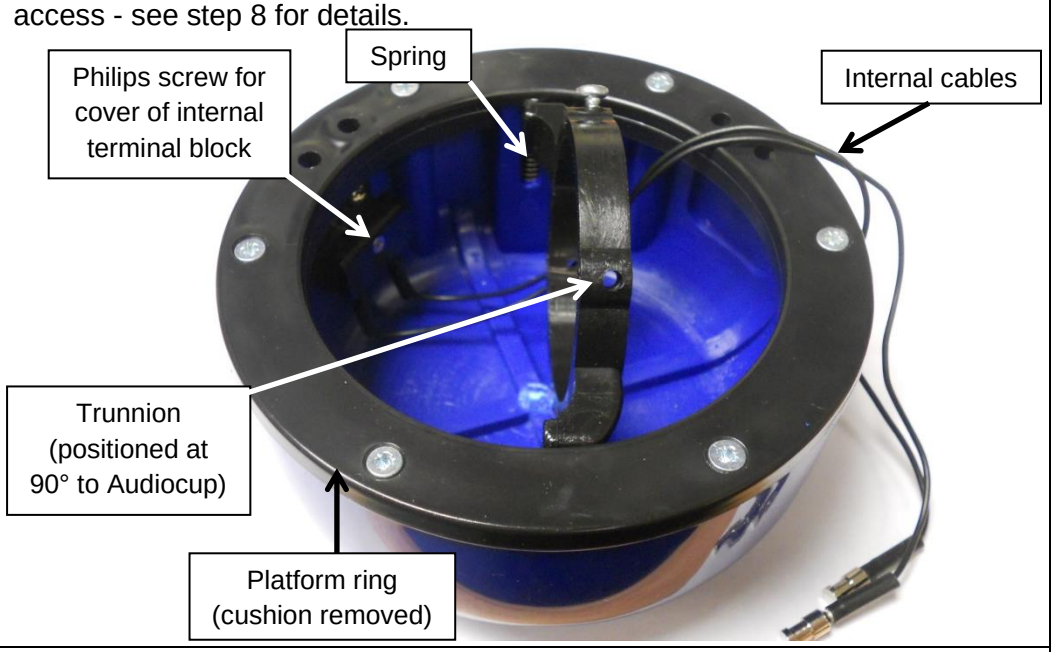
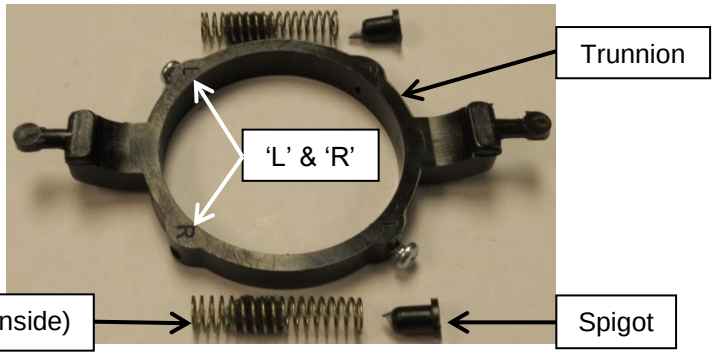
Phillps screwdriver, Ph.1 size, at least 20mm length

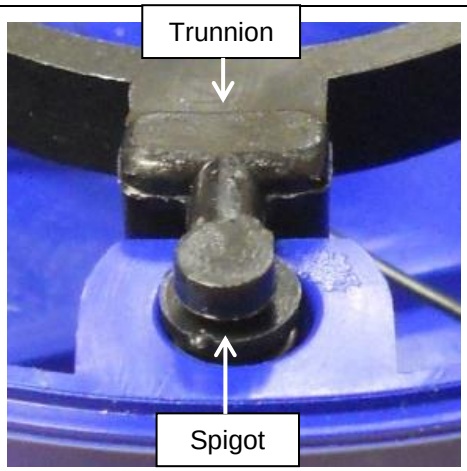
Phillps screwdriver, Ph.0 size, at least 100mm length

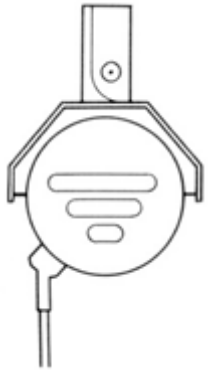
Flat bladed screwdriver having approximately 2.5mm wide tip, at least 100mm length

Procedure:

1.	If replacing a headband with new Audiocups, first remove the earphones from the headband. *Metal headbands:* Carefully prise the headbands locating lugs away from the earphones. *Plastic headbands:* Remove each of the rubber ear cushions and release the earphones from each of the headbands earphone shells.
2.	Refer to photo below. Remove the Audiocup ear cushion to expose the platform ring. 
3.	Note the two holes that allow access to the Philips screws securing the headphone cable. To access these screws, it will also be necessary to: • Remove the earphone (if present) - slacken (but do not remove) the two pozi screws retaining the earphone in the trunnion and remove the earphone. • Pull back the foam covering the two Philips screws securing the headphone cable.

4.	If it is desired to further dismantle the Audiocup, go to step 5. If it is only desired to replace a headphone cable or fit new Audiocups to the earphones, go to step 16.
5.	Disconnect the earphone from the Audiocup internal cables by slackening the grub screws with the jewellers screwdriver and remove the earphone from the Audiocup.
6.	Refer to photo below. Carefully pull out the foam from inside the Audiocup. **Note:** If desired, the platform ring can be removed at this stage to improve access - see step 8 for details. 
7.	If it is desired to further dismantle the Audiocup, go to step 8. If it is only desired to replace the internal cables, go to step 13.
8	The platform ring can be removed by undoing the six pozi screws. The trunnion and associated parts should be retrieved and placed in a bag for safe keeping. Refer to photo below: 
9.	Before installing the trunnion, install the foam in the Audiocup. Align the 'U' shaped cut-out in the foam with the internal terminal block.

10.	Refer to photo. With the two springs installed in the Audiocup, the spigots are inserted into the top of the springs. The trunnion rests on the two spigots - the ‘L’ and ‘R’ lettering on the retaining ring face outwards.	
11.	While ensuring the trunnion remains aligned over the spigots, align the holes in the platform ring over the holes in the Audicup – ensure the access holes for the headphone cable screws are aligned correctly.	
12.	Tighten the platform ring pozi screws finger tight.	
13.	If replacing the internal cables use the 100mm long Philips screwdriver to remove the terminal block cover screw and then remove the terminal block cover.	
14.	Use the same 100mm long Philips screwdriver to remove the two screws from the terminal block and then remove the two internal cables. **Note:** The 100mm long flat bladed screwdriver may be required for older Audiocups.	
15.	Replace the cables and tighten the terminal block screws to finger-tight. Replace the terminal block cover and tighten the screw to finger-tight.	
16.	If fitting new Audiocups for the first time bring the two internal black wires through the trunnion, fit the cable terminals into the earphone sockets and tighten both earphone grub screws to finger tight.	
17.	Fit the blue (left) headphone cable into socket of the blue Audiocup, tighten the Philips screws finger tight and replace the foam. **Note:** Look inside the Audiocup - the ‘L’ and ‘R’ labelling on the trunnion must face outwards.	
18.	The screws in the trunnion should engage in the dimples indicated in the photo. Arrange the earphone cable connectors so they diagonally oppose the Audiocups external cable connectors. Fit the earphone (with ear cushion) into the trunnion and secure with the two pozi screws. Do not over-tighten.	

19.	Check the Audiocups internal black cables are not caught on the trunnion screws. Check the earphone is free to pivot and move in/out.	
20.	Replace the Audiocup earcushion.	
21.	If replacing a headband with new Audiocups, mark the type and serial number of the audiometer on the foil label provided and fit the label in the recess on the outside of the Audiocup earshell.	
22.	Repeat above steps for the right (red) channel.	
23.	The individual Audiocup earshells should be located in the headband as shown:	
24.	Connect the headset to the audiometer and test for sound output.	

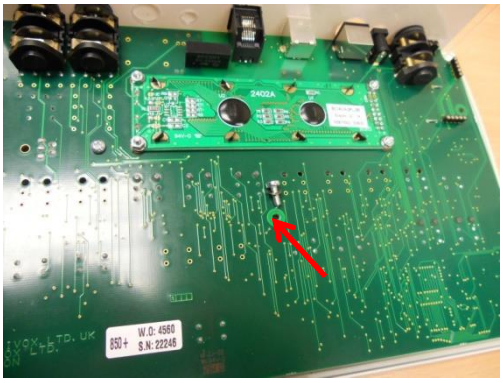
Appendix 3: 116/170/PC850/240 DSA302 PCA removal & reassembly

Tools required:

Pozi screwdriver, No.1 size

11mm socket

Procedure:

1.	Unscrew the four screws in the base (five screws in the older black cases). Then lift the base off. **Note:** The long screws go in the holes at the back and the short screws go in the holes at the front.	
2.	Undo the screw in the middle of the PCA (white cases only) indicated by the red arrow and lift the PCA off the facia. Do not turn the facia over as the buttons will fall out.	
3.	If desired, remove the back panel by undoing each of the bezels with an 11mm socket. Also retrieve the eight spacers from the jack sockets.	
4.	When reinstalling PCA, note colour coding of bezels are correct: Left: **Blue** Right: **Red** Bone: **Grey** Response: **Black** The socket identification is also marked on the PCA. **Note:** Finger tighten the bezels using the 11mm socket.	
5.	When reassembling the case, the long screws go in the holes at the back and the short screws go in the holes at the front.	

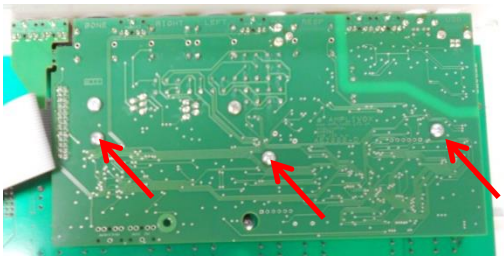
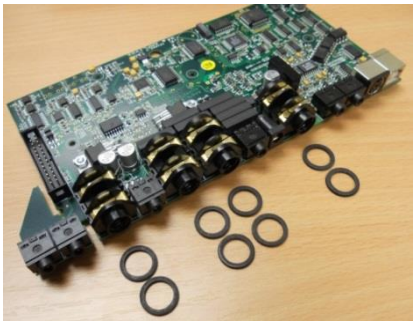
Appendix 4: 260 AE2000 PCA removal & reassembly

Tools required:

Pozi screwdriver, No.1 size

11mm socket

Procedure:

1.	Unscrew the four screws in the base (five screws in the older black cases). Then lift the base off. **Note:** The long screws go in the holes at the back and the short screws go in the holes at the front.	
2.	Undo the three screws indicated by the red arrows and lift the PCA off the facia.	
3.	If desired, remove the back panel by undoing each of the bezels with an 11mm socket. Also retrieve the eight spacers from the jack sockets.	
4.	The upper engine board can then be disconnected from the display board by unplugging the ribbon connector. **Note:** If required the display board can be removed by undoing the single central screw. Do not turn the facia over as the buttons will fall out.	
5.	When reinstalling PCA, note colour coding of bezels are correct: Left: **Blue** Right: **Red** Bone: **Grey** Response: **Black** The socket identification is also marked on the PCA. **Note:** Finger tighten the bezels using the 11mm socket.	

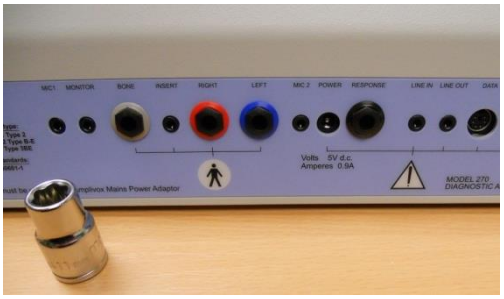
Appendix 5: 270 AE2000 PCA removal & reassembly

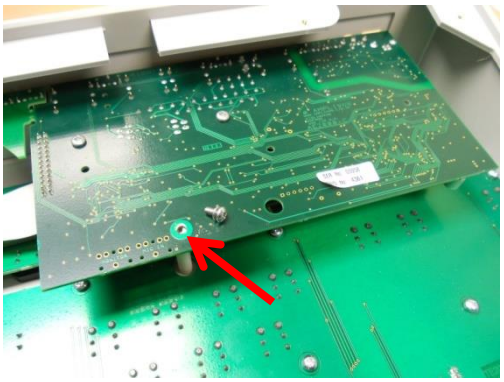
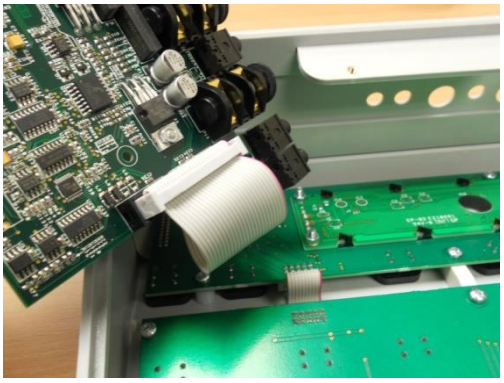
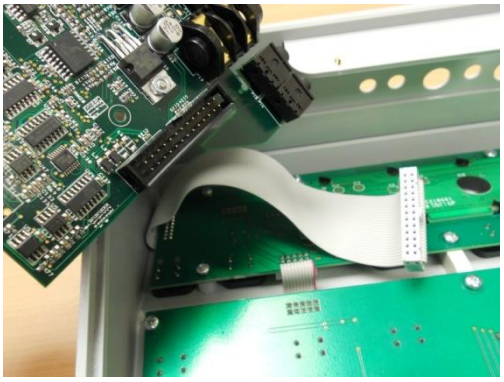
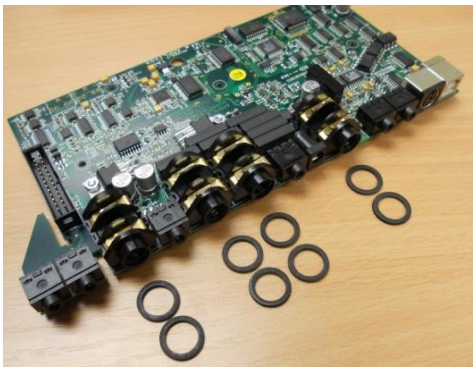
Tools required:

Pozi screwdriver, No.1 size

11mm socket

Procedure:

1.	Remove the four coloured bezels (grey, red, blue and black) from the back of the instrument using an 11mm socket.	
2.	Turn the device up-side-down. **Note:** The rotary encoder shafts must not be put under pressure. It's therefore vital that the instrument's front edge is supported at the front. In the photo, the knobs for the rotary encoders have been used to avoid damage to the rotary encoder shafts.	
3.	Remove the seven screws (three normal counter sunken screws and four with rubber feet on) from the bottom plate.	

4.	Remove the upper engine board. Remove this board by undoing the screw (red arrow). Carefully move the board away from the back of the instrument.	
5.	Tilt the board so you can access the ribbon connector; carefully pull it out of the socket.	 
6.	Remove the 8 spacers from the rear sockets.	
7.	Refit the engine board. First connect the ribbon connector (see step 5), then put two spacers on each of the jack sockets (see step 6). Put the board in place and refit the screw that was removed in step 4.	

8.	When reinstalling PCA, note colour coding of socket nuts are correct: Left: **Blue** Right: **Red** Bone: **Grey** Response: **Black** The socket identification is also marked on the PCA. **Note:** Finger tighten the bezels using the 11mm socket.
9.	Reattach the bottom with the 4 rubber feet and screws plus the 3 countersunk screws (see steps 3 and 4)

Appendix 6: Static ‘click’ on presentation: DSA302-S / DSA302-T

1. Background:

A change of IC amplifier specification requires a simple hardware modification to ensure stability is maintained under all operational conditions. There is need to add additional components which must be fitted to the back of the DSA302 PCA.

These parts already will be fitted for all PCA revisions after DSA302-T

NOTE: USE ANTI-STATIC PRECAUTIONS WHEN HANDLING PCA’s

These parts should be fitted prior to calibration.

2. Hardware Modifications:

2.1 Refer to Appendix 3. Place the audiometer face down and remove the four screws in the bottom of the case, lift the bottom of the case away from the audiometer.
2.2 Identify the amplifier located at U8 if working on a 116/170/PC850, or the amplifier IC’s U8 and U9 if working on a 240.
2.3 Fit a 4R7 1/8W metal film resistor to Pin 4 (Amplivox part F25, Farnell part 934-3296), and a 100nF X7R ceramic capacitor to Pin 3 (Amplivox part F26, Farnell part 205-7127) as shown in Figure 1. Ensure that the leads are kept short and routed so that they cannot contact other parts of the circuit.
2.4 Refit the case bottom to the audiometer, ensuring an even case bottom to case lid fitment around the edges

3. Software Update:

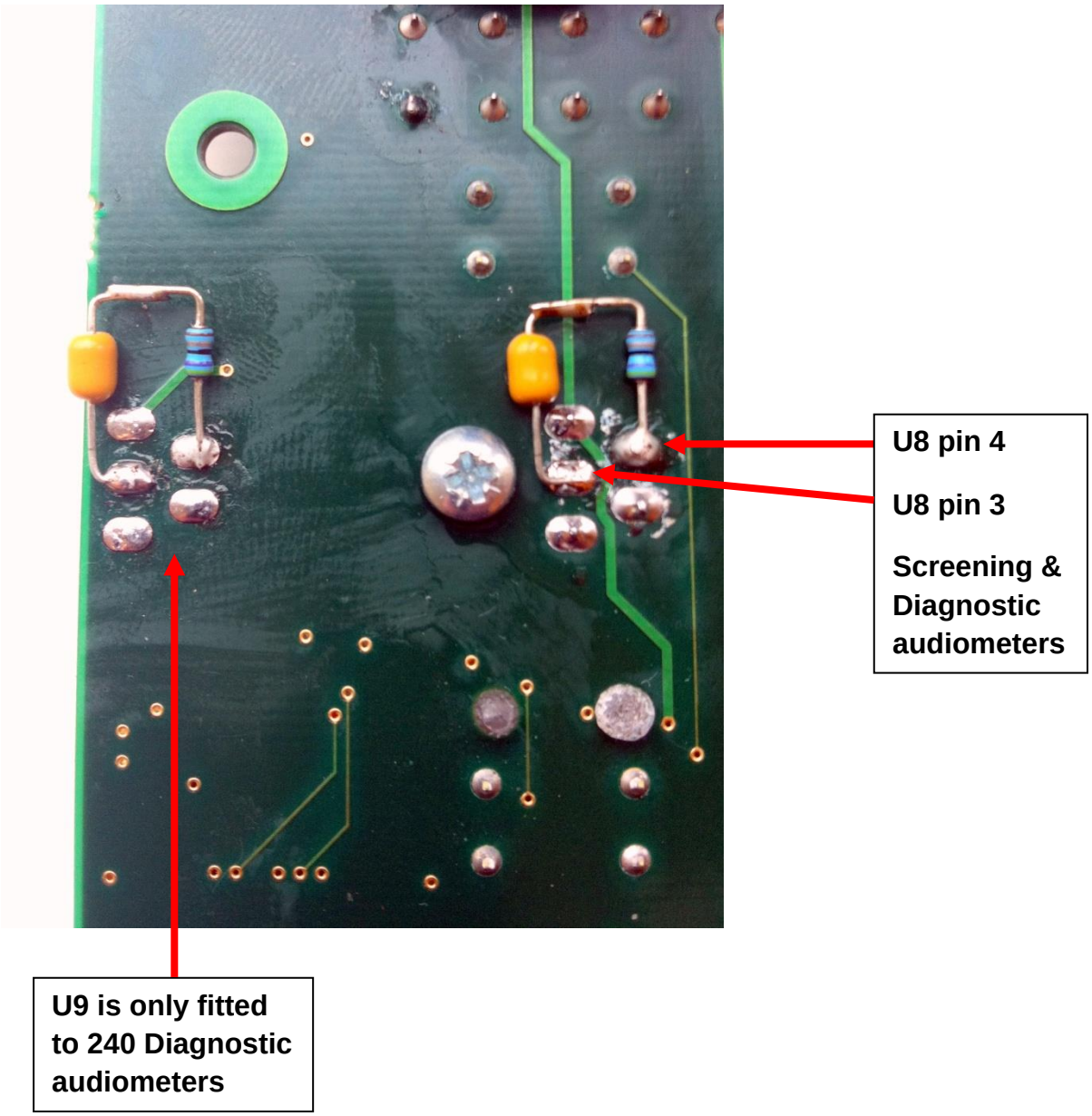
3.1 No software update is required.

4. Calibration:

4.1 The audiometer must now be calibrated. Any calibration which was made prior to modification is no longer valid.

5. Parts location image:

5.1Figure 1



Appendix 7: Static ‘click’ on presentation: AE2000-C / AE2000-D (260, 270, SD270)

1. Background:

A change of IC amplifier specification requires a simple hardware modification to ensure stability is maintained under all operational conditions. There is need to add additional components which must be fitted to the back of the AE2000 PCA.

These parts will already be fitted for all PCA revisions from AE2000-E

NOTE: USE ANTI-STATIC PRECAUTIONS WHEN HANDLING PCA’s

These parts must be fitted prior to calibration.

2. Hardware Modifications:

2.1 Refer to Appendix 4 or Appendix 5. Place the audiometer face down and remove the four screws in the bottom of the case, lift the bottom of the case away from the audiometer.
2.2 Identify the amplifier IC’s U46 and U37.
2.3 Fit a 4R7 1/8W metal film resistor to Pin 4 (Amplivox part F25, Farnell part 934-3296), and a 100nF X7R ceramic capacitor to Pin 3 (Amplivox part F26, Farnell part 205-7127) as shown in Figure 1. Ensure that the leads are kept short and routed so that they cannot contact other parts of the circuit.
2.4 Refit the case bottom to the audiometer, ensuring an even case bottom to case lid fitment around the edges

3. Software Update:

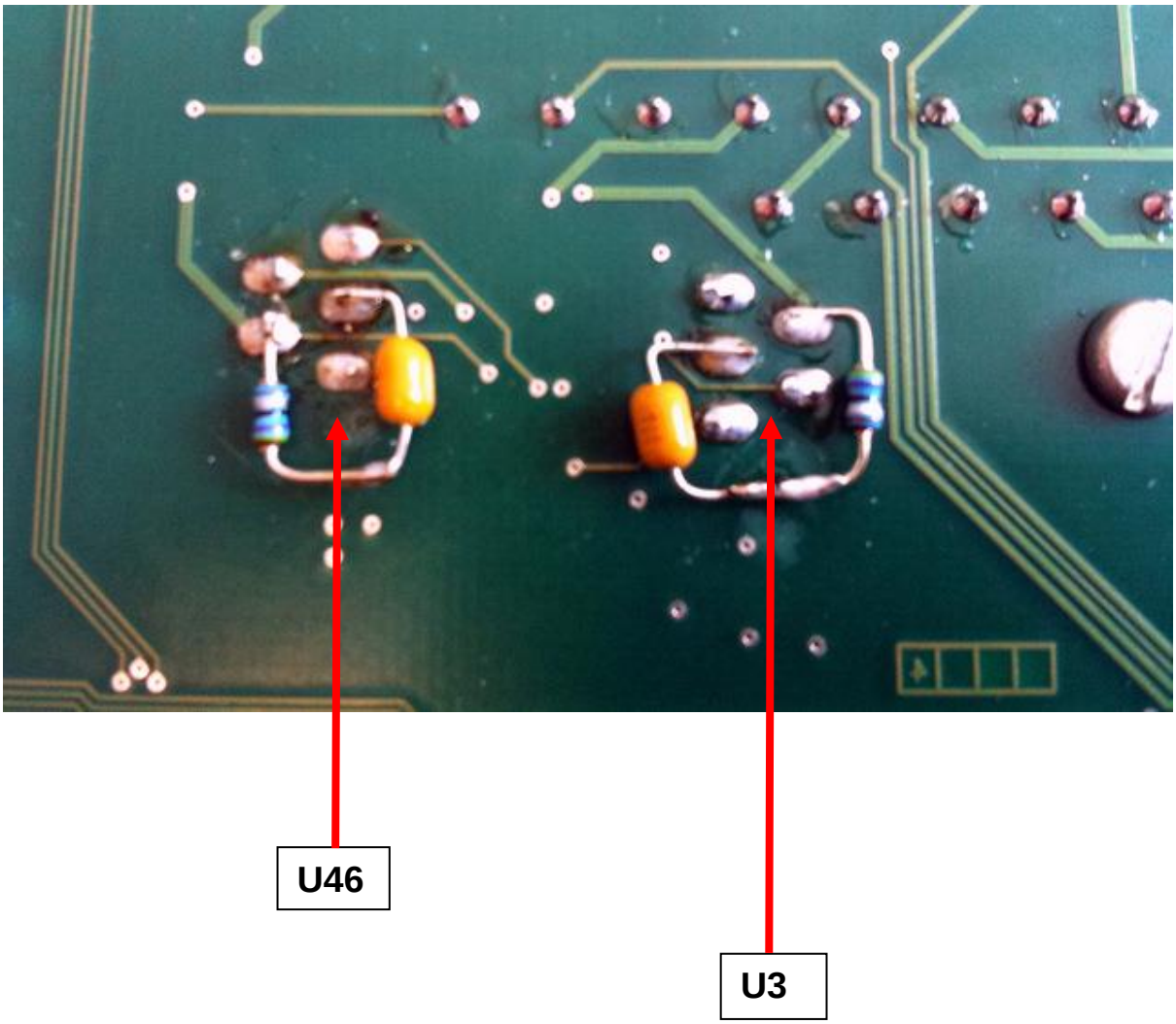
3.1 No software update is required.

4. Calibration:

4.1 The audiometer must now be calibrated. Any calibration which was made prior to modification is no longer valid.

5. Parts location image:

5.1 Figure 1



Appendix 8: Internal fuse, protection diode & audio attenuator details

See photos on next page for component locations.

The main instrument fuse (component number F1), labelled “S” is located close to the power socket as indicated by the red arrows.

Note: Replace the fuse with a new one of the same rating as the original.

Fuse specification: Slow blow ‘S’ (or ‘T’) 2.0A 1206

Amplivox Part No. 8507097

The protection diode (component number D4), is located close to the power socket as indicated by the orange arrows.

Note: Replace the diode with a new one of the same rating as the original.

Diode specification: SMBJ5

Amplivox Part No. 8507100

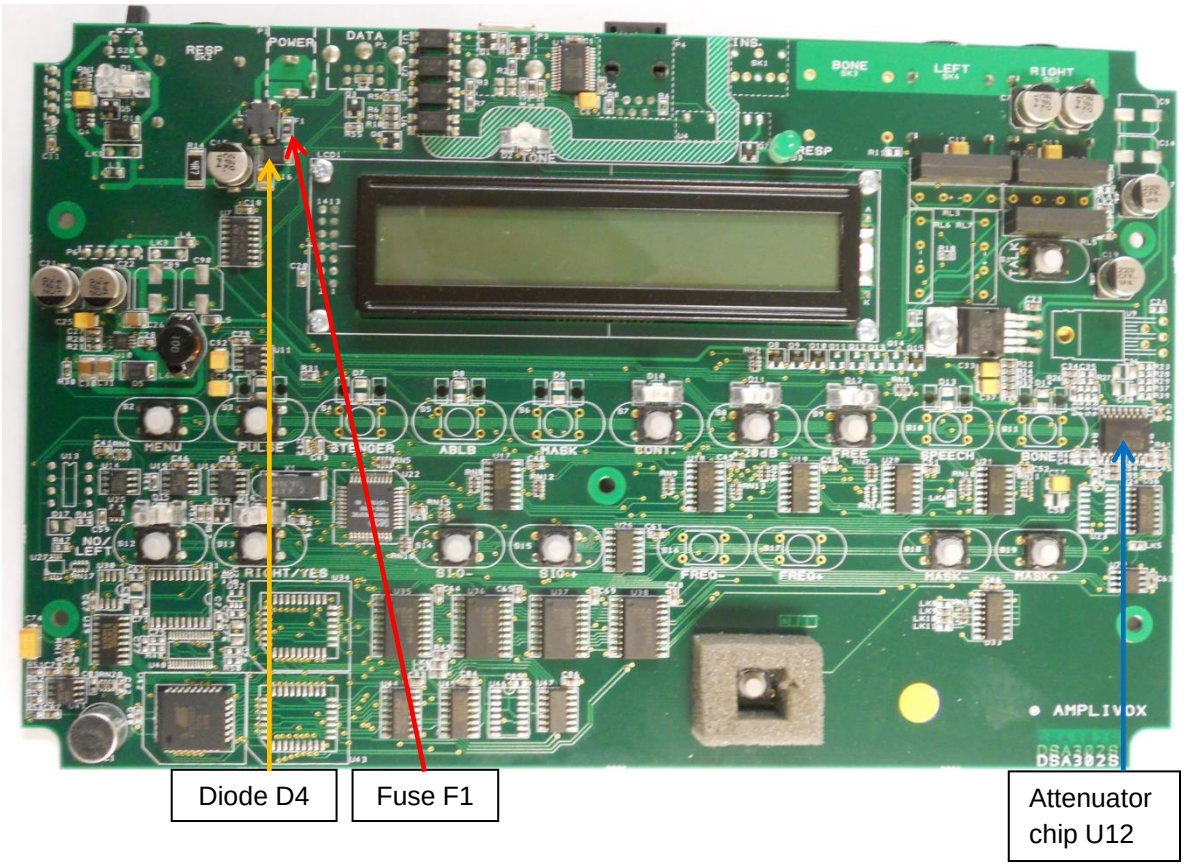
The audio attenuator chip (component number U12 on DSA302 or U44 on AE2000), is located towards the right of the board as indicated by the blue arrows.

Note: It is recommended to only use the Burr Brown part specified.

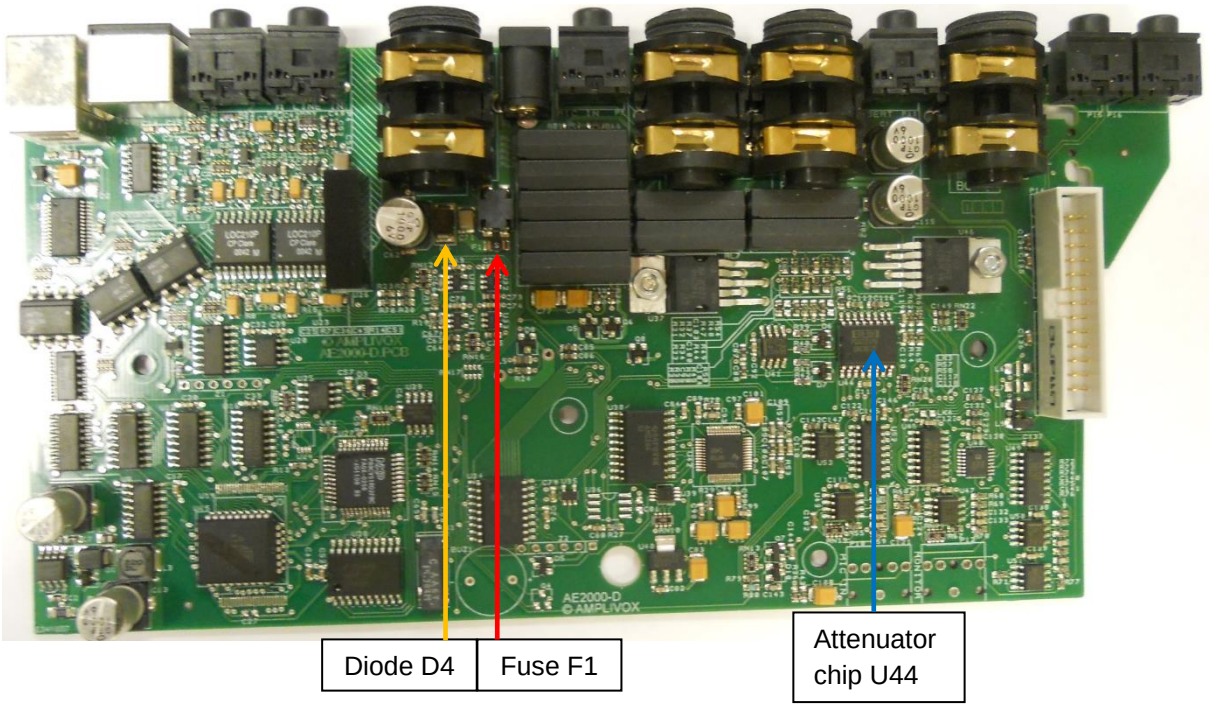
Attenuator specification: Burr Brown PGA2311U

Amplivox Part No. 8507232

DSA302 board - locations of fuse, diode & attenuator chip



AE2000 engine board - locations fuse, diode & attenuator chip



Appendix 9: 270 rotary encoder replacement (original encoder)

Tools required:

Pozi screwdriver, No.1 size

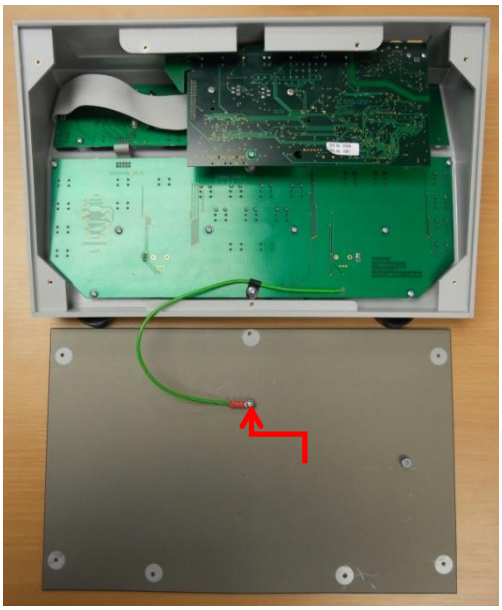
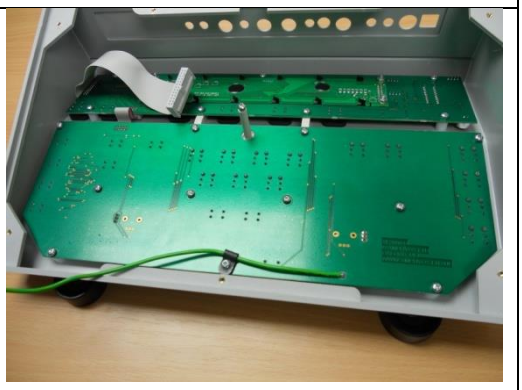
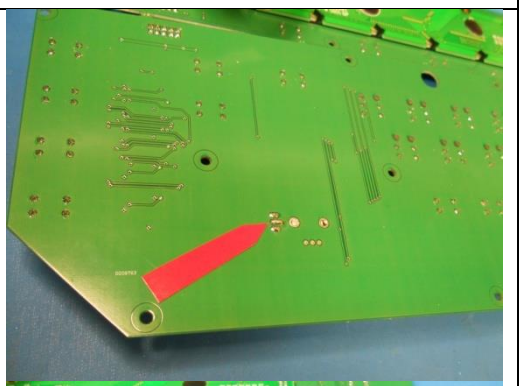
11mm socket

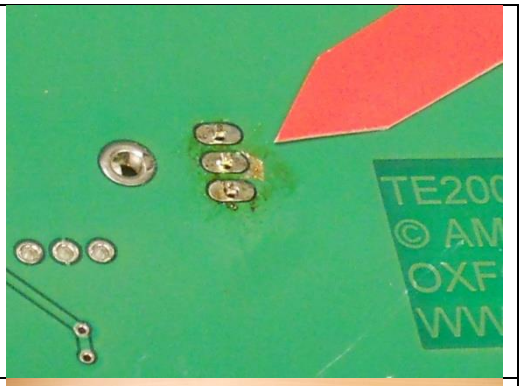
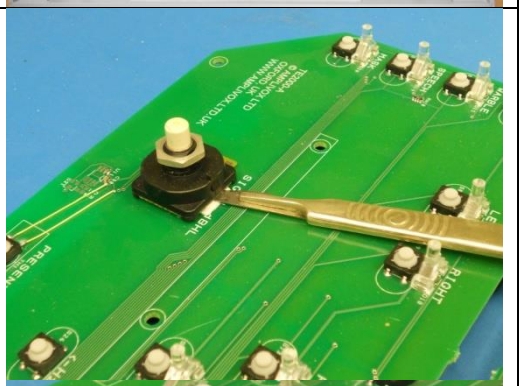
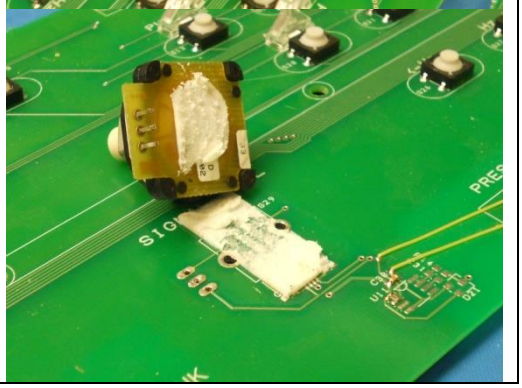
Adjustable spanner

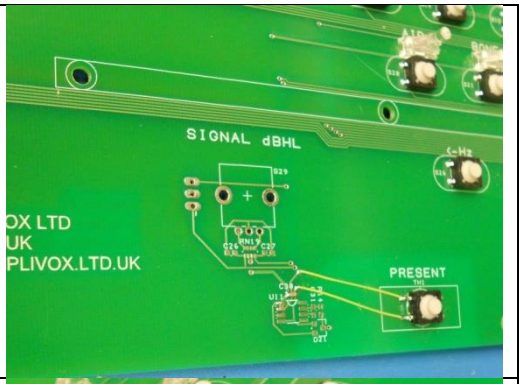
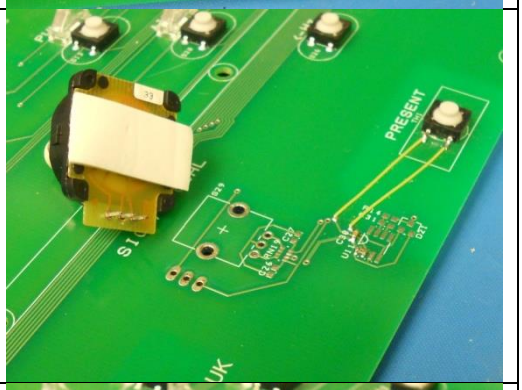
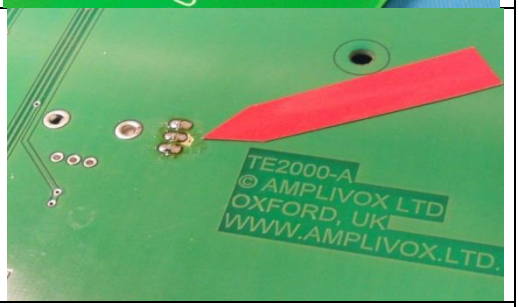
Soldering iron, solder, de-solder pump or de-solder braid

Procedure (please note this procedure is for original encoders only):

1.	Remove the rotary encoder knobs. First pull off the cap off to access the nut underneath. **Note:** You will need to remove both rotary encoder knobs even if you are only replacing one rotary encoder. **Tip:** The cap comes straight off, but you might need to wedge something thin in between the cap and the knob. Be careful not to damage the cap and knob.	
2.	Undo the 8mm brass nut and remove the brass washer, knob, the brass collet and the three plastic spacer washers from both rotary encoders.	
3.	Remove the 13mm nut and the 12-pointed star washer.	
4.	Refer to Appendix 5 in order to remover the base plate and upper engine PCA from the case.	

5.	Remove the green/yellow earth cable that grounds the bottom by undoing the screw (see red arrow in the photograph) in the base plate.	
6.	Undo the 11 screws that hold the keyboard board in place. **Note:** The screw holding the earth cable has got a plastic washer on it. **Note:** Some boxes use self-tapping screws **and** screws with inserts, whilst some other boxes only use screws with inserts. Make sure the correct screws go back in the correct holes.	
7.	The pins for the rotary encoders are located at the red arrows. There are three pins per encoder.	

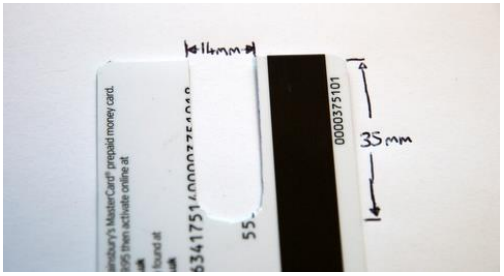
8.	Desolder the three pins on the rotary encoder you are about to replace. **Note:** Take extra care to remove all the solder, as sticking pins can damage the tracks and pads. **Tip:** Use solder wick or solder pump to remove any old solder.	
9.	Carefully turn the keyboard circuit board over, making sure not to damage any components or the ribbon cable.	
10.	Cut through the sticky pad, for example using a sharp, thin knife or blade. **Note:** Make sure not to damage the circuit board, and do not pull the encoder off the circuit board before making sure that the pins are not sticking. It is very likely that damage to the tracks will occur if the pins are not totally free. **Tip:** If the pins are sticking, try heating the pins up with a soldering iron whilst applying a bit of pulling force on the rotary encoder.	 

11.	Clean the sticky pad residue off the circuit board with, for example, *label remover*. **Note:** Do not damage the tracks on the circuit board. **Note:** Do not use abrasive tools or paper as this will most likely damage the circuit board tracks.	
12.	Take a new rotary encoder and a new sticky pad. Apply the sticky pad to the rotary encoder as shown in the photo.	
13.	Take off the backing of the sticky pad and stick the rotary encoder to the circuit board. **Note:** Remove the nut from the rotary encoder, this needs to be refitted on the outside of the case in Appendix 11.	
14.	Turn the circuit board over and solder the three rotary encoder pins.	
15.	Refit the keyboard, taking care that all light pipes are still in place before offering this into the case. Fasten the keyboard PCA with the eleven screws removed in step 6. **Note:** The screw with the plastic washer goes on the clip for earth cable.	
16.	Refitting of PCA is a reversal of removal. Now refer to Appendix 10 and Appendix 11 in order to fit the control knobs.	

Appendix 10: Control knob spacing tool

A spacing tool is required to fit 270 control knobs whilst retaining an even physical separation between the magnets in the control knob and the mild steel spider.

You can construct a spacing tool as follows:

1.	Obtain a suitable flexible plastic piece which should be between 0.70 and 0.80mm thick. A credit card or similar which has no embossing is perfect for this purpose, as shown in the image.	
2.	Cut a slot in the card such that it can pass around the nut holding the rotary encoder to the audiometer body. To leave sufficient width of card on which the control knob magnets will sit, the slot should be 14mm wide by 35mm deep approximately, as shown in the image.	

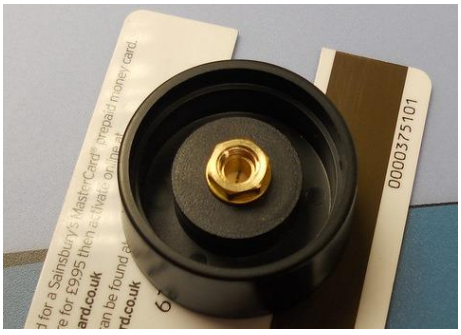
Appendix 11: Fitting 270 Control Knobs (original encoder)

Tools required:

Adjustable spanner

Procedure (please note this procedure is for original encoders only):

1.	Turn the audiometer on, and slowly rotate the LEFT encoder to find the point at which the displayed level just changes. Verify this by turning back in the opposite direction. Do the same for the RIGHT encoder (press MASK to enable this).	
2.	Place the 12-pointed star washer over the encoder shaft, ensuring that it does not have any legs which protrude upwards. Using a straight edge and a fine pen, draw a line across the encoder shafts in the vertical positions (as shown), using the legs of the 12-pointed star washer to aid alignment of the straight edge.	
3.	Rotate the marked encoders so that the drawn line now lies exactly half way between two adjacent legs of the star washer.	
4.	Place three mica spacers (example spacers shown) over each spindle, ensuring that they fit properly over the star washer and the encoder retaining nut.	

5.	Press a brass collet on to each encoder shaft, ensuring that the encoder shaft position remains the same.	
6.	One side at a time, place the spacing tool (see Appendix 10) on the case around the shaft of the rotary encoder and place the control knob over the encoder such that all three magnets are supported on the spacer. Allow the magnetic force to align this with the 12-pointed star washer.	
7.	Place the brass washer and nut on to the collet. Hold the control knob gently to prevent any rotation during tightening and then proceed to tighten the collet nut to only moderate hand tightness, making sure that you are not pressing down on the nut during tightening.	
8.	BEFORE removing the spacing tool, fit the knob caps to cover the collet nuts. These will be tight and require a firm but even push to fit into the control knob recess.	
9.	Remove the spacing tool (this should require a firm but even pull) and check that the encoders are sufficiently tight on the shaft by gently pulling on them.	
10.	Check the function of each control knob by rotating in either direction. Ensure that the operation of the knob is smooth and does not have too much play or contact the case. Check that the output levels on the LCD increment in 5dB steps in alignment with the magnetic polarizing force.	
11.	If the check is not satisfactory, remove the control knob and go back to step 1 and repeat the fitting procedure.	

12.	Once the audiometer passes control knob quality checks satisfactorily, the rotary encoders have been replaced successfully. Check the function of all other buttons, LED's, and that the expected outputs are present before the audiometer is returned to the customer.	

Appendix 12: DSA302 Replacement PCA

Two different build levels of DSA302 PCA can be ordered (116/170/PC850 or 240) and these are not interchangeable, please ensure that the appropriate PCA is ordered.

Please see spare parts list in Appendix 19 for details of PCA order codes.

Important: This applies only to more recent products with a USB socket on the rear panel, so PCA revision DSA302-S and newer.

Installing a new main PCA:

Please refer to Appendix 3 for details of how to remove the existing PCA from the audiometer.

Refitting the board is the reverse of removal.

Where more than one type of earphone is in use with the audiometer (e.g. DD45 and E-5A), refer to the relevant service manual.

Appendix 13: AE2000 Replacement PCA

Installing a new main PCA:

Please refer to Appendix 4 (260) or Appendix 5 (270) for details of how to remove the existing PCA from the audiometer.

Refitting the board is the reverse of removal.

Where more than one type of earphone is in use with the audiometer (e.g. DD45 and E-5A), refer to the relevant service manual.

Appendix 14: Fitting battery boards to current Amplivox 116 and 240 models

Parts required:

1x Battery Power PCA (Observe Static Handling Precautions).

1x Black P Clip.

1x Cable Tie.

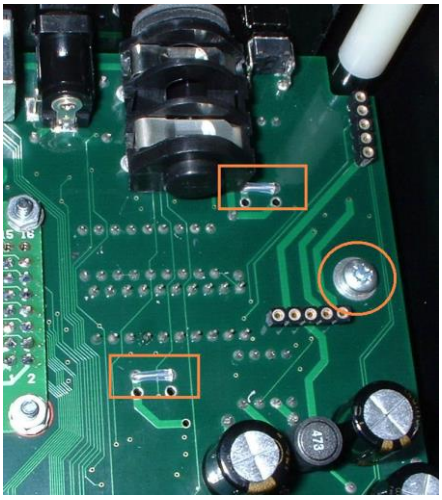
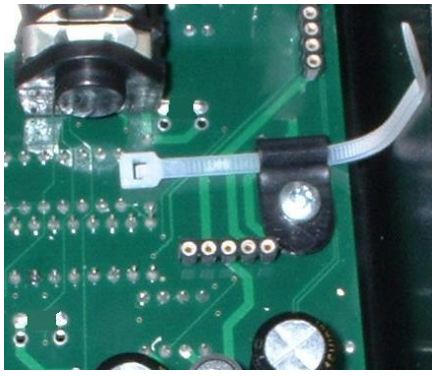
Tools required:

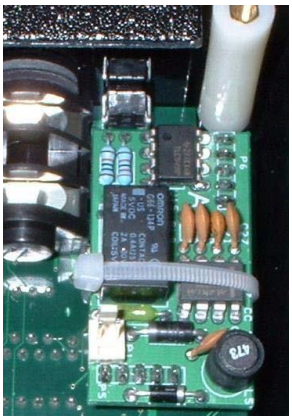
Anti-static bench and wrist strap

Pozi screwdriver, No.1 size

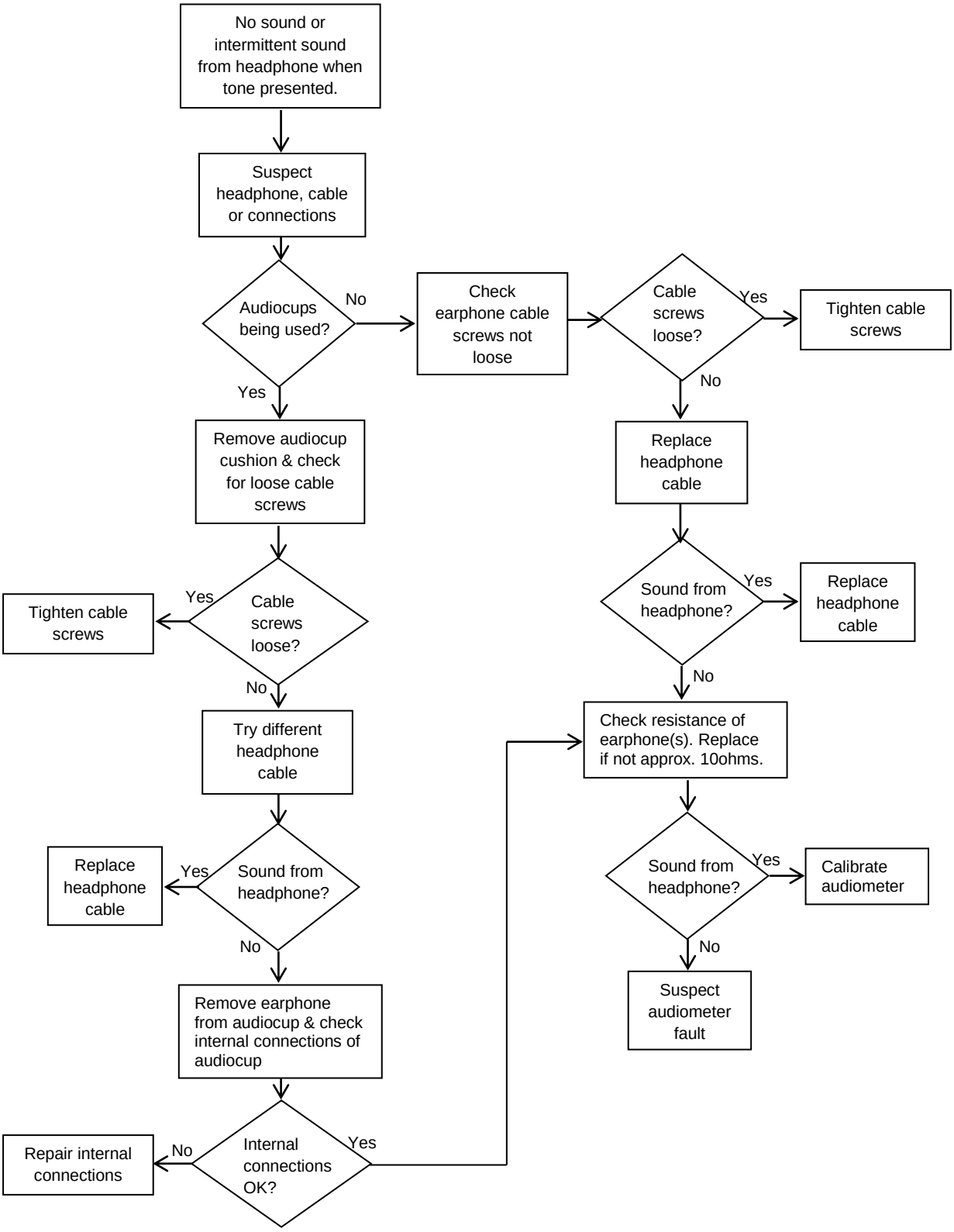
Wire cutters

Procedure:

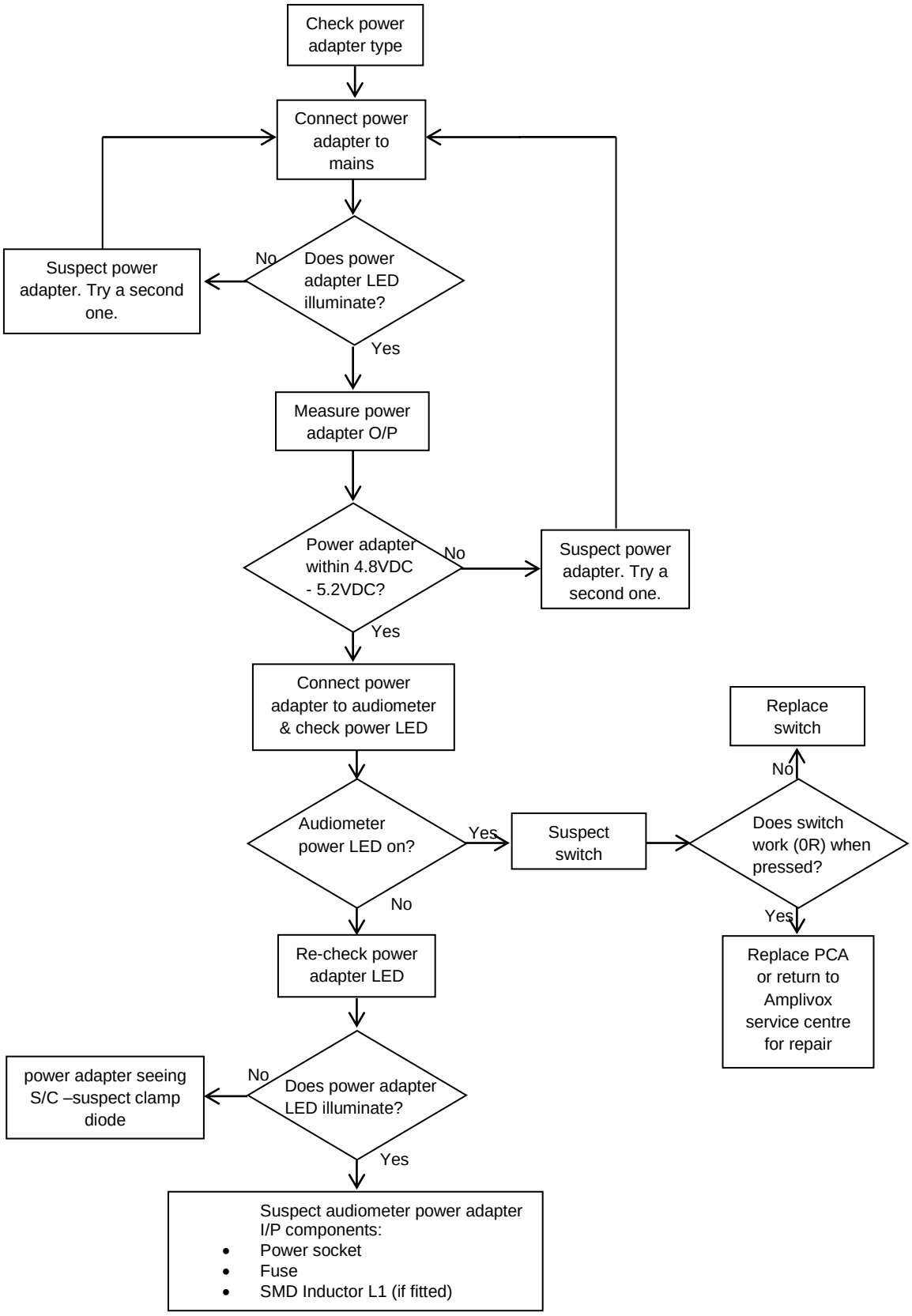
1.	Carefully cut and remove the two-wire links shown in the picture below, and remove the screw (circled). **Note:** If the battery board is removed, these two links will need to be replaced for the audiometer to function.	
2.	Thread the cable tie through the P clip, and fix the P clip to the board using the screw removed in step 1, as shown.	
3.	Carefully fit the Battery Power PCA into the two 5-way connector strips, ensuring the pins are lined up with the holes, and press home.	

4.	Tie the cable tie around the newly fitted board and pull tight. Snip off the excess cable tie. The audiometer should now look as below (**Note:** Battery board may vary slightly from that shown).	
5.	Check the serial number on the battery base matches that shown on the main circuit board, then connect the flying lead from the battery pack into the white connector on the Battery Power PCA.	
6.	Fit the battery base into the case, observing that the battery connection is not pulled out, and refit the base screws.	
7.	Perform power-up tests from both mains adaptor power and battery power to ensure audiometer operation.	

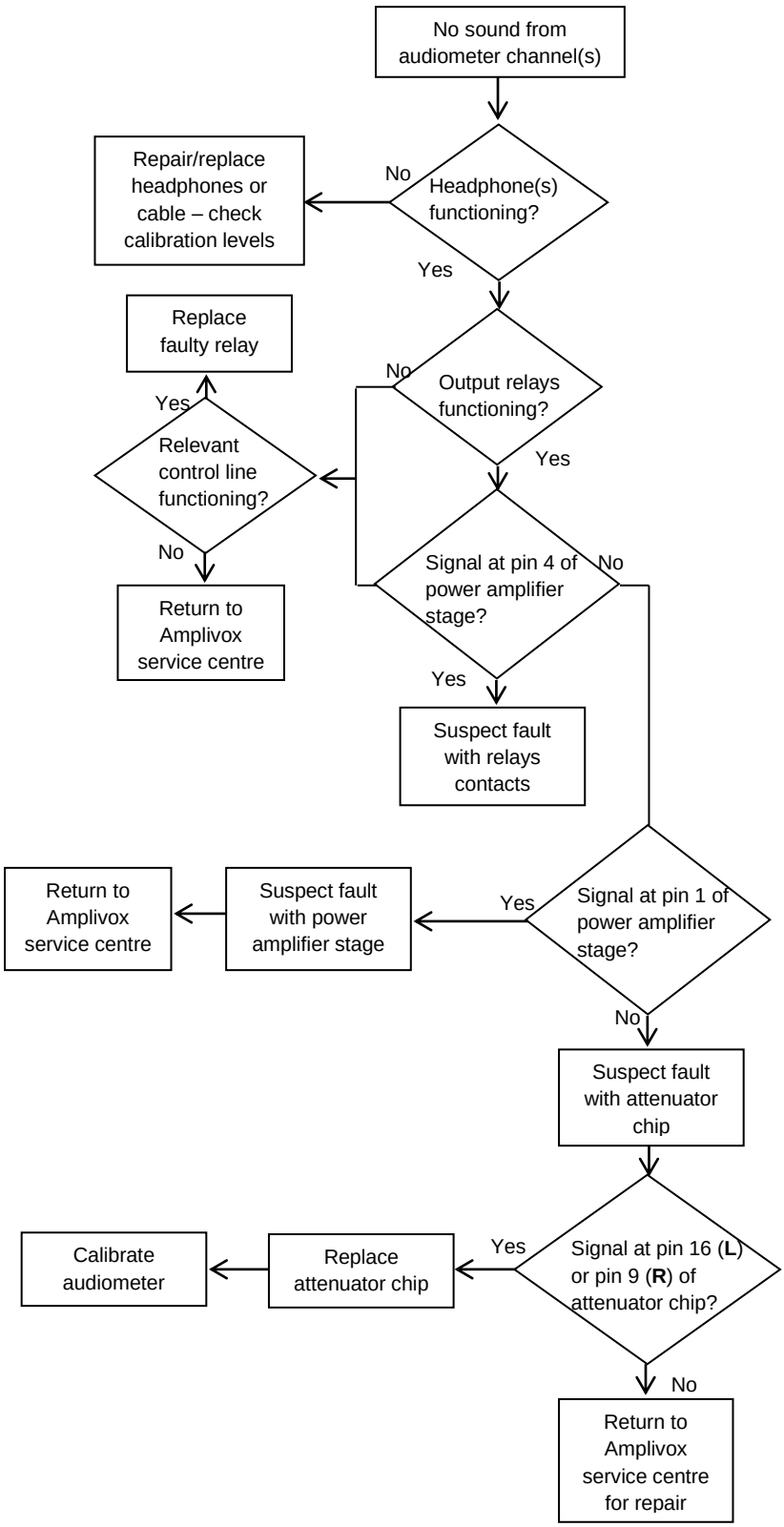
Appendix 15: Diagnostic flowchart - headphone related faults



Appendix 16: Diagnostic flowchart – power related faults



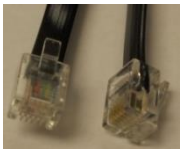
Appendix 17: Diagnostic flowchart – audio related faults



Appendix 18: Portable Thermal Printer Connection – Amplivox Audiometers

Please see the serial numbers listed below to determine audiometer to thermal printer compatibility and the necessary printer cable required. The Sanibel MPTII printer (stock code **8503007**) is currently supplied by Amplivox. *For instructions on changing printer type, refer to* section 6.2.

Old models	Serial number range	Thermal printer	Printer cable & stock code (old)
116	< 22070	Martel	8121823 (A104)
170	30000 to 30574		
240	<11825		
260	<11825		
270	< 5800		

Interim models	Serial number range	Thermal printer	Printer cable & stock code (old)
 170	21880 to 22069 *Can use Sanibel (8505753 cable required)*	Able 	8505752 (A105)
 240	11825 to 30999 *Selecting 'Able' in menu allows use of Sanibel (8004419 cable required).*	Martel **OR** Able 	8507757 (A107)  8505751 (A108)
 260	11825 to 12424 *Selecting 'Able' in menu allows use of Sanibel (8505753 cable required).*	Martel **OR** Able 	8121823 (A104) 8505752 (A105)
 270	5800 to 5949 *Can use Sanibel (8505753 cable required).*	Able 	8505752 (A105)

Current Models	Serial number range	Thermal printer	Printer cable & stock code (old)
116	22070 & above *If 'Sanibel' is not present in menu, select 'Able' (8004419 cable required).*	Sanibel **OR** Able	8004419 (A102) 8505751 (A108)
170			
240	31000 & above *If 'Sanibel' is not present in menu, select 'Able' (8004419 cable required).*		
260	12425 & above *Selecting 'Able' in menu allows use of Sanibel (8505753 cable required).*	Sanibel **OR** Martel **OR** Able	8505753 (A101) 8121823 (A104) 8505752 (A105)
270	5950 & above *Selecting 'Able' in menu allows use of Sanibel (8505753 cable required).*		

Appendix 19: Spare parts

Spare parts have been split into two categories, those considered to be accessories (outside of the audiometer case) and those which are service parts.

19.1 Consumable parts

Part Description	Application	Stock Code (old)	Image
Headphone lead	All	8010822 (A030)	
Bone Vibrator lead (2-pin, grey)	Diagnostic	8011136 (A029-2)	
Bone Vibrator lead (3 pin, green right angle)	Diagnostic	8107612 (A029-3GN)	
Bone Vibrator lead (3 pin, grey right angle)	Diagnostic	8521413 (A029-3GY)	
Bone Vibrator lead (3 pin, grey straight)	Diagnostic	8515713 (A029-3S)	
Insert Masker lead	Diagnostic	8004447 (C14)	
Headband for AC headset	All	8010882 (A023)	
Paediatric headband for AC headset	All	8517379 (A023-P)	
Audiocup lead	All	8010836 (AC1039)	
Audiocup headband	All	8507920 (AC1047)	

Audiocup headband cover	All	8010834 (AC1048)	
Audiocup cushion	All	8010835 (AC1042)	
Earcushion	All	8010857 (A026-W)	
Mains power adaptor	All	8512734 (A091/8)	

19.2 Service parts

Part Description	Application	Stock Code (old)	Image
Power input socket	All	8507219 (C69)	
6.3mm jack socket gold, incl. black nut and two washers	All	8029297 (C40)	
Blue bezel Red bezel Grey bezel Black bezel		8002154 (C43) 8002151 (C44) 8002155 (C45) 8002150 (C46)	
Input fuse T2A 1206	All	8507097 (H086)	
Clamping diode SMBJ5.0A	All	8507100 (H090)	
On-off switch SPST-NO 0.05A 24V (re-use existing switch cap)	DSA302 only	8507060 (SP001)	
PCA soft key	All	8009905 (H027)	
Input filter inductor 700mA 0805	All up to 2001	n/a	
Resistor 4R7 1% 0.125W	All	8031078 (F25)	
Capacitor 0.1u 10% 100V	All	8031079 (F26)	
Rotary Encoder (original)	270 only	8030454 (J013)	
Encoder spacer ring	270 only	8001746 (J036)	
Control knob with magnet (re-use existing knob cap)	270 only	8508886 (J011+MAG)	
Digital attenuator	All	8507232 (F10)	

19.3 Spare PCA assemblies

Part Description	Application	Stock Code (old)	Image
DSA302-V (screening)	116, 170, PC850	8030432 (PCA01)	
DSA302-V (diagnostic)	240	8030431 (PCA02)	
AE2000-D (diagnostic)	260, 270	8030428 (PCA03)	
TT1000-D	260 display & keyboard	8030429 (PCA04)	
TE2000-D	270 display & keyboard	8031046 (J062)	
216 series battery PCA	Battery option	8507743 (H0231)	

Note: Main boards require programming with instrument firmware and serial number. Please contact Amplivox for further details.