VIAMED Foetal Heart

COMPANY OPERATING PROCEDURE

V1000 Simulator
VM3/COP/56.01

Date: 24-11-03	Revision Date:7-Apr-11	Issue: 1

Test equipment & Tooling required

Insert crimping pliers, side cutters, knife, soldering iron, reamers, dremel & bits, needle files, drill & brace, scissors, cross point screwdriver, flat blade screwdriver, isopropyl alcohol, silicon polish, and tissue.

Parts

Identity	Description	Type	Value / details	Viamed Part No.
RN1	Resistor net	0.125W	8 x 1k5	1430130
VR1	Pot	0.125W	10k0	1430135
	Intensity pot	1.000W	470k0	1430133 *
R1 / R14	Resistor	0.125W	4k7	1430109
R2 / R9	Resistor	0.125W	150k0	1430119
R3 / R28	Resistor	0.125W	1M0	1430123
R4 / R6	Resistor	0.125W	470R0	1430106
R5	Resistor	0.125W	100R0	1430103
R7	Resistor	0.125W	620k0	1430122
R8	Resistor	0.125W	300k0	1430121
R10	Resistor	0.125W	75k0	1430117
R11	Resistor	0.125W	36k0	1430115
R12	Resistor	0.125W	18k0	1430113
R13	Resistor	0.125W	9k1	1430111
R15	Resistor	0.125W	2k0	143???? *
R16	Resistor	0.125W	100k0	1430118
R17	Resistor	0.125W	160k0	1430120
R18 / R19	Resistor	0.125W	2R2	1430100
R20	Resistor	0.125W	68k0	1430116
R21	Resistor	0.400W	22k0	1430114
R22	Resistor	0.125W	620R0	143???? *
R23	Resistor	0.125W	150R0	1430104
R24	Resistor	0.125W	620R0	143???? *
R25	Resistor	0.125W	3R3	1430102
R26	Resistor	0.125W	510R0	1430107
R27	Resistor	0.125W	10k0	1430112
R29	Resistor	0.400W	10k0	1430126
R30	Resistor	0.400W	6M8	1430124
R31	Resistor	0.125W	43k0	143???? *
D1	Diode	1N5817		1430140
D2, D16	Diode	1N4148		1430141
D3, D12	3mm LED	Green	Low current	1430145
D4, D5, D6, D7, D8, D9, D10	3mm LED	Yellow	Low current	1430147
D11 / D13	3mm LED	Red	Low current	1430146
D14 / D15	Diode	1N4001		1430142
Spacers		13mm (height)		1430236
C1	Capacitor	Ceramic	220nF, 50V	1430154
C2 / C3	Capacitor	Ceramic	30pF	1430151
C4 / C12	Capacitor	Ceramic	10pF, 50V	1430150

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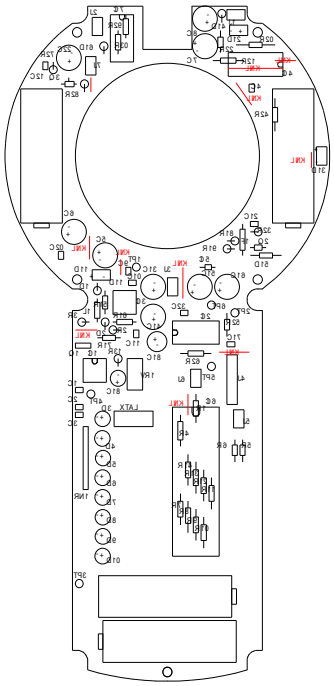
C5	Capacitor	Electrolytic	68microF, 20V	1430163
C6	Capacitor	Electrolytic	100microF, 20V	1430164
C7	Capacitor	Tant	1microF, 35V	1430167
C8	Capacitor	Electrolytic	10microF, 25V	1430161
C9, C10, C11, C17, C23	Capacitor	Ceramic	0.1microF, 50V	1430155
C13, C14, C15, C16	Capacitor	Electrolytic	470microF, 16V	1430166
C18	Capacitor	Electrolytic	4.7microF, 25V	1430160
C19	Capacitor	Electrolytic	47microF, 35V	1430162
C20	Capacitor	Ceramic	10nF, 63/50V	1430153
C21	Capacitor	Ceramic	1nF, 100V	1430152
C22	Capacitor	Electrolytic	330microF, 16V	1430165
L1	Inductor	Axial	47microH	1430170
Q1 / Q3	FET	BSS295	TO-92	1430180
Q2	Transistor	D45H11	PNP	1430175
F1	Fuse	Axial	500mA	1430215
IC1	Dual Op Amp	LM358N		1430195
IC2	Power Amp	LM384N		1430200 *
IC3	Power supply	MAX761CPA		1430185
IC4	Power supply	MAX713CPE		1430186
IC5	Regulator	LM78L05ACZ	5V REG	1430190
IC6	Micro controller	PIC16F877-04P		1430210 *
IC7	Dual D type FF	HEF4013BP		1430205
SIL connector	20 way strips			1430225
J4	6 pin header	Header	Keyed	1430230
Tp1 - Tp6	Test point		Pack of 100	1430220
B1	Batteries	NiMH, 1.2V, AAA	700mAh, pk of 2	??????? *
XTAL	Crystal	4MHz		1430182
Battery clip				1430245
Speaker, 66mm diameter				1430255
Silicon fluid				1430260
Bellows				1430265
PCB1, foetal heart simulator				1430270
Enclosure, foetal heart simulator				1430285
Enclosure seal kit				1430285
CE mark label	Pendle signs		£?.??	??????? *
Rear panel label	Pendle signs		£?.??	??????? *
DC input label	Pendle signs		£?.??	??????? *
Link wire				??????? *
PCB socket, 2 way, 2.5mm	RS	311-6451	£0.185 each	??????? *
Plug, 2 way, 2.5mm	RS	311-6209	£0.09 each	??????? *
PCB socket, 2 way, tactile tails	Toby	FPC-02-S-A	£?.??	??????? *
M3x12mm bolt	Farnell	149-642	£?.??	??????? *
Spacer, M3x3mm	Farnell	666-865	£1.04, pk of 25	??????? *
PCB2, foetal heart simulator	P&M Services	Foetal Heart Simulator, PCB2		??????? *
Overlay back panel	Material from Barkston. Cut at Pendle Signs.			??????? *

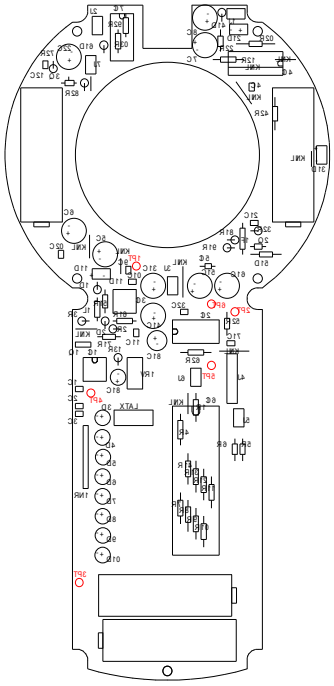
Overlay	Membrane Keyboards			??????? *
Socket, panel mount, 2.5mm diameter	Farnell	299-972	£6.28, pk of 10	??????? *
Conformal coating, high performance acrylic	RS	714-462	£6.51 each	??????? *
M2 spacers	Farnell	891-356	£1.54, pk of 50	??????? *
IC6 (blown with software)				??????? *
14 Colour Ribbon cable	Farnell	296-934	£33.35 per Roll	??????? *

Method

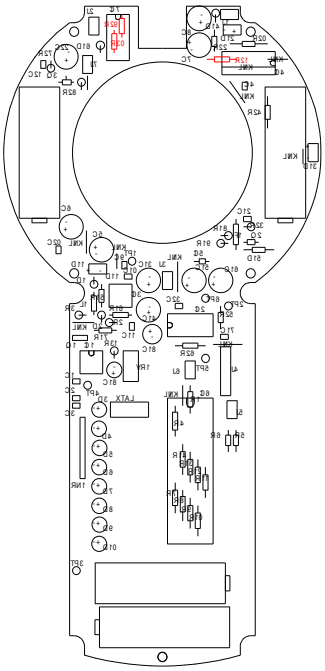
1. Fit & solder hard wire links x 11.



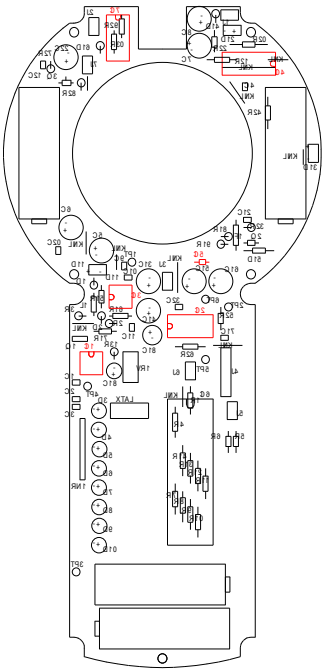
2. Fit & solder Tp1 To Tp6.



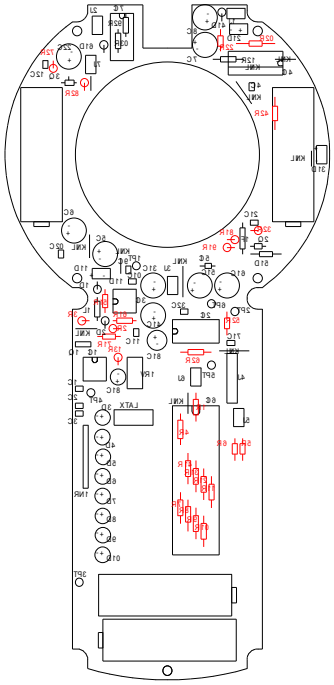
3. Fit & solder resistors R21, R29 & R30 (refer to current BOM for part number).



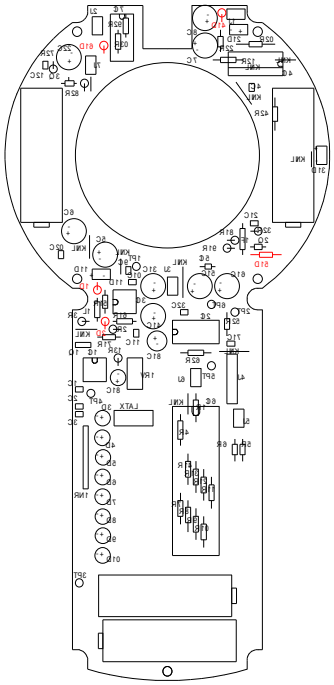
4. Fit & solder IC1, IC2, IC3, IC4, IC5 & IC7 (ensure correct orientation) (refer to current BOM for part number).



5. Fit & solder resistors R1 to R20, R22 to R28 & R31 (ensure correct orientation) (refer to current BOM for part number).



6. Fit & solder diodes D1, D2, D14, D15 & D16 (ensure correct orientation & polarity) (refer to current BOM for part number).



7. Fit & solder 2.5mm sockets at J1, J3, J6, D11, D12 & D13 (ensure correct orientation) (refer to current BOM for part number). Open side of socket faces down or to the left.

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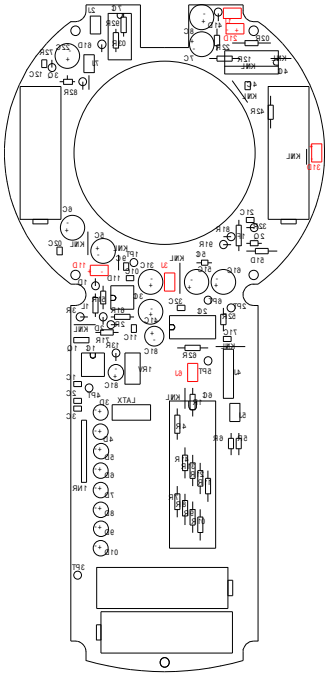
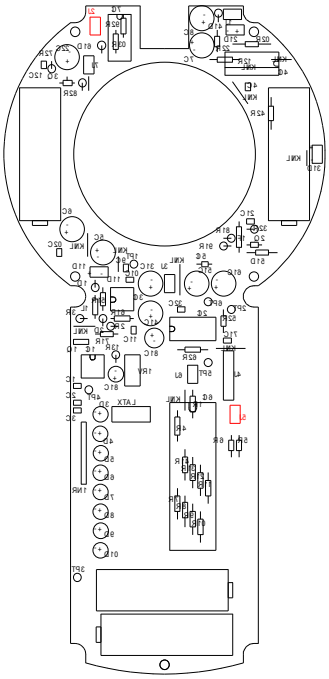


8. Fit & solder sockets for flexible cable at J2 & J5 (ensure correct orientation) (refer to current BOM for part number). Secure the socket to the PCB with a small amount of hot glue. Contacts are on the right hand side of the socket.



9. Fit & solder capacitors C1 to C23 (ensure correct polarity where necessary) (refer to current BOM for part number).

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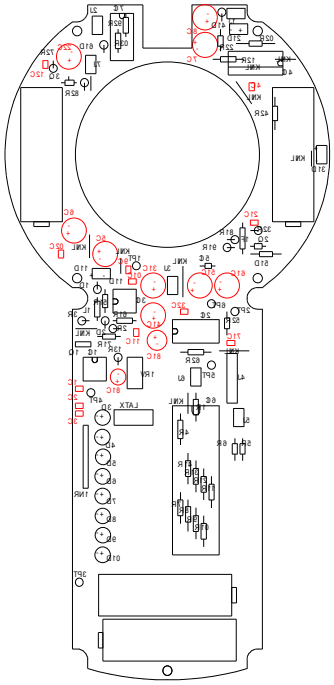
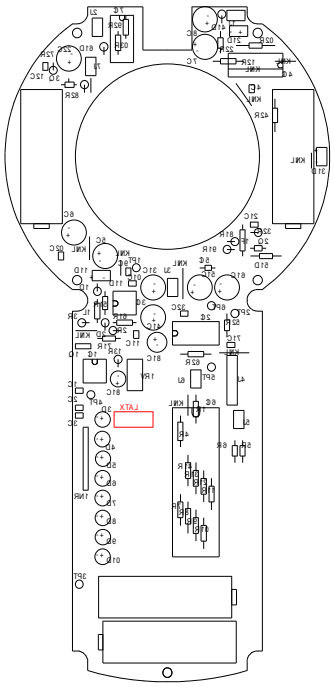


10. Fit & solder XTAL (ensure correct orientation) (refer to current BOM for part number).



11. Fit & solder VR1 & RN1 (ensure correct orientation) (refer to current BOM for part number).

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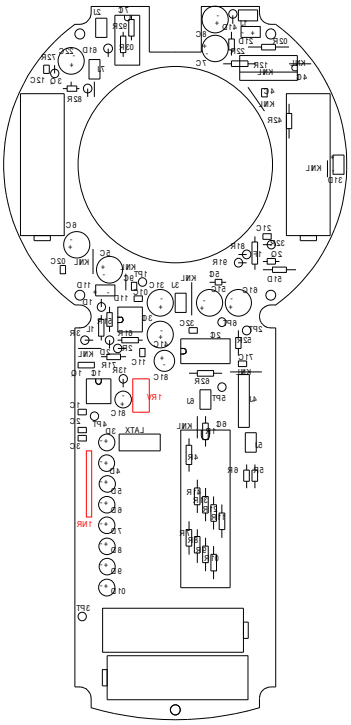
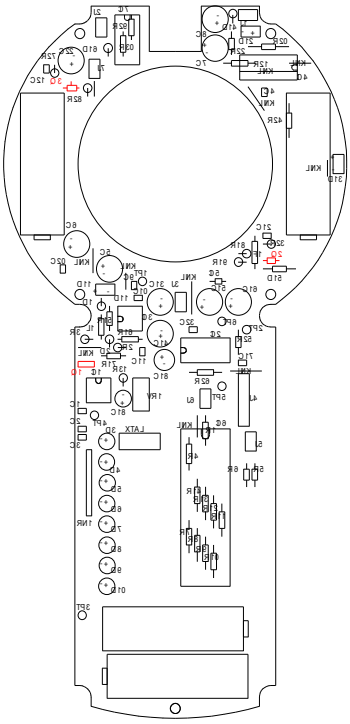
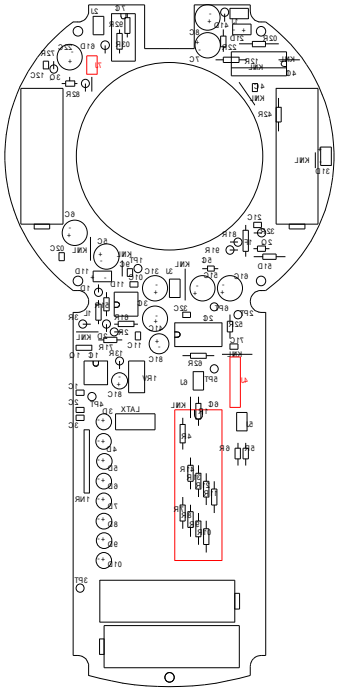


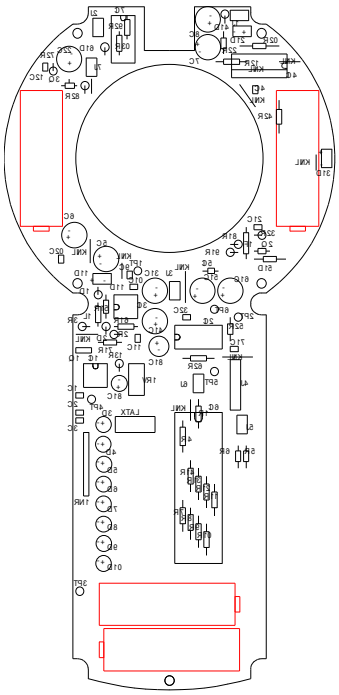
12. Fit & solder Q1, Q2 & Q3 (ensure correct orientation) (refer to current BOM for part number).



13. Fit & solder J4, J7 & SIL sockets for IC6 (Refer to current BOM for part number). Fit a shorting link across J7 to disable auto-shut off if required.



14. Fit battery clips x 8 (ensure correct orientation) (refer to current BOM for part number).



15. Insert D3 to D10 into 13mm spacers then fit & solder into position (ensure correct orientation) (refer to current BOM for part number). Green LED for D3, yellow LED's for D4 to D10.

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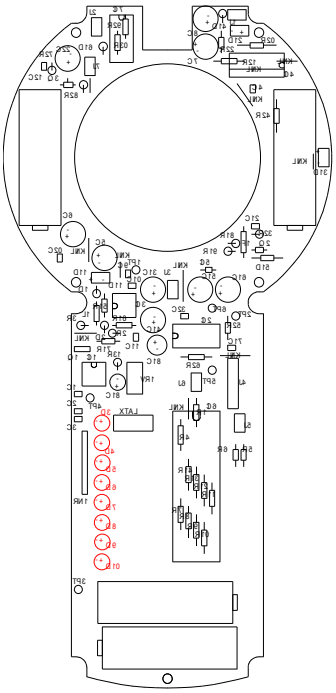
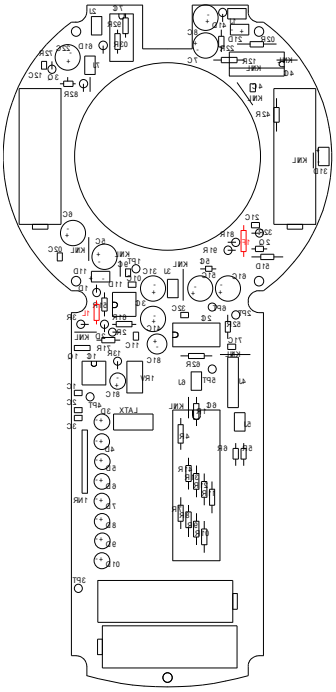


16. Fit & solder L1 & F1 (ensure correct orientation) (refer to current BOM for part number).



17. Fit IC6 (ensure correct orientation) (refer to current BOM for part number).

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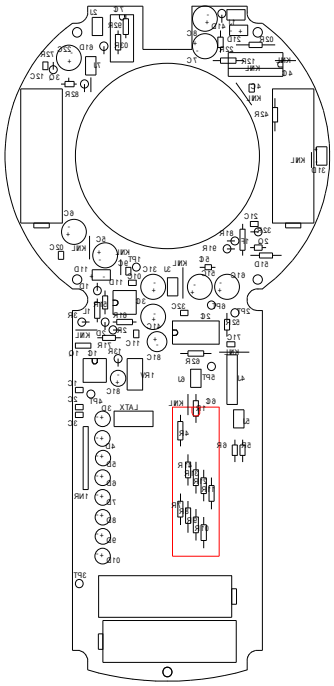
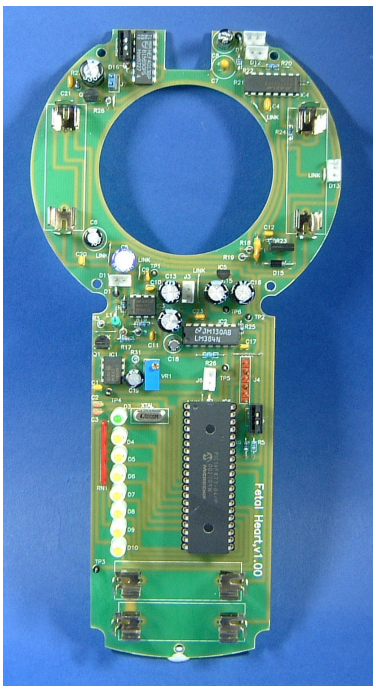


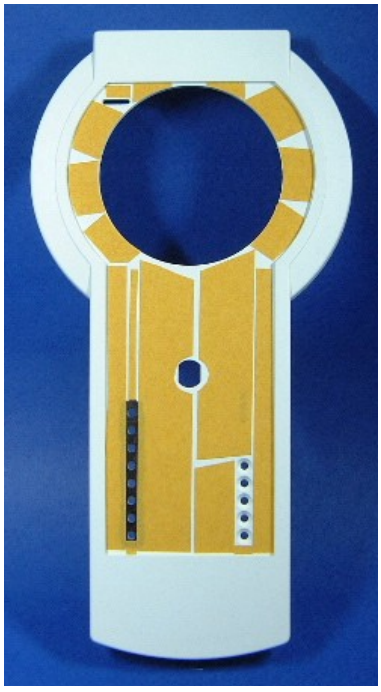
18. Conformally coat the underside & edges of the PCB, particularly where nicks in the tracks are visible.

19. Completed PCB.



20. Fit the seal ring into the channel in the upper case half.

21. Black out the area immediately around the left hand row of 8 x 3mm holes with permanent marker. Stick double sided tape to cover the majority of recessed area of the upper case half. Trim tape to suit.



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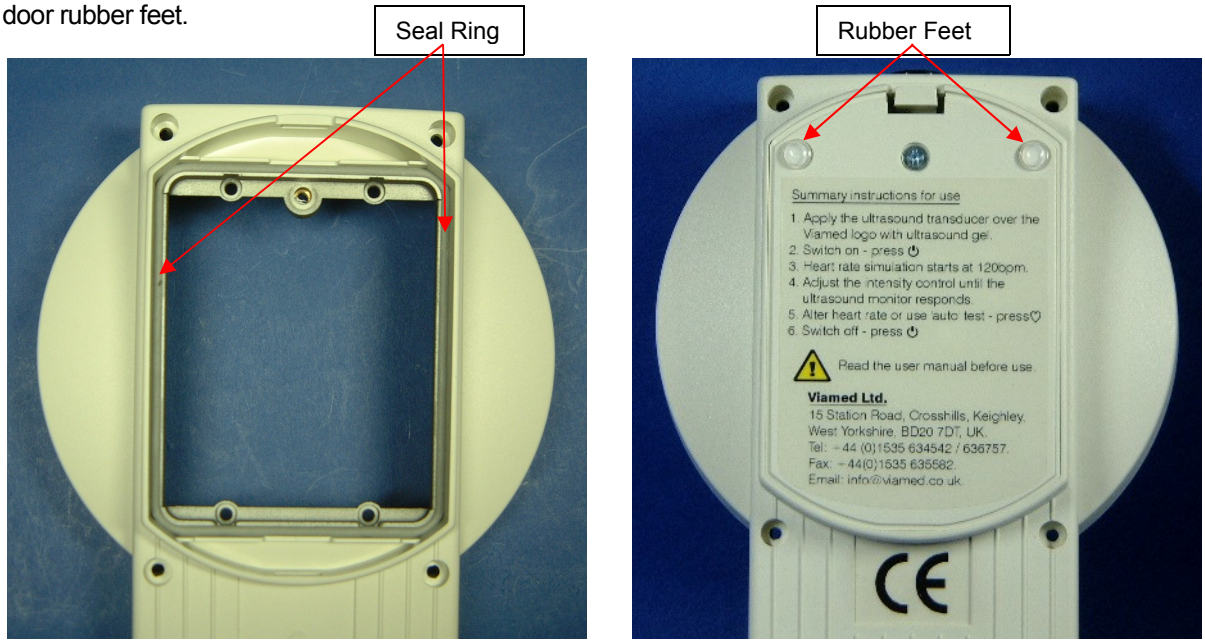
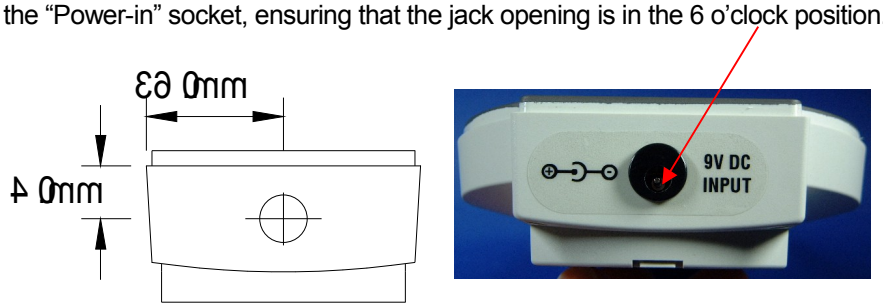
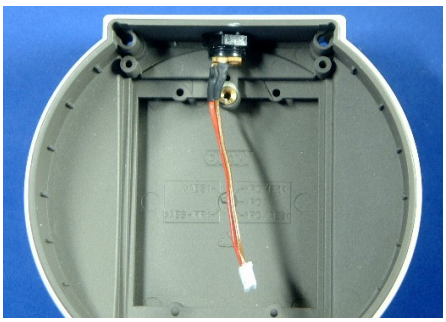
22. Ream out the hole in the battery cover to accommodate the retaining bolt. Fit the battery cover seal ring and battery cover. Secure the battery cover with the retaining bolt. Attach labels as appropriate. Fit battery door rubber feet.



23. Drill a 3mm hole in the top face of the enclosure as below. Extend out with a taper reamer to 12.6mm diameter, allowing the fit of the "Power-in" socket. Attach the label and trim away around the hole made previously. Fit the "Power-in" socket, ensuring that the jack opening is in the 6 o'clock position.



24. Cut 70mm of ribbon cable (red/brown) and solder to power in socket tags: red in 9 o'clock position and brown in twelve o'clock position. Sleeve each connection with 10mm lengths of black heat shrink tubing. Snip away the tag on the power in socket at the 3 o'clock position. Terminate the other end of the ribbon cable with a 2.5mm molex plug; red to the left hand pin, brown to the right hand pin.



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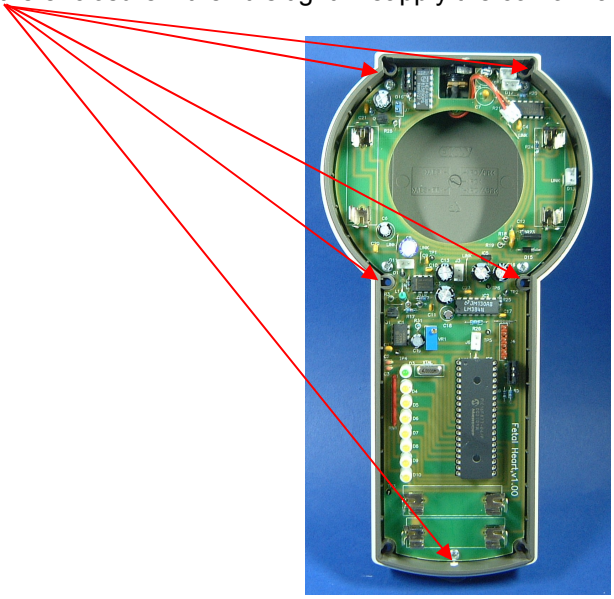
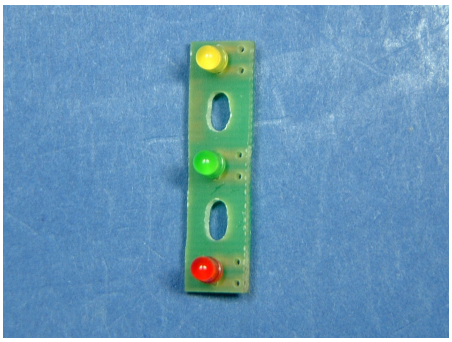
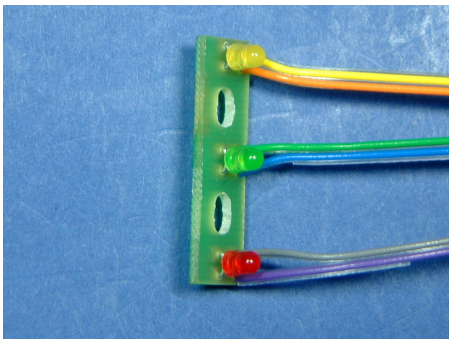
25. Conformally coat areas where nicks in the tracks on the PCB may short with the EMC screen coating. Fit the completed PCB into the lower case half. Fit 5 x retaining screws. Carefully grind the PCB and/or the enclosure if the fit is tight. Reapply the conformal coating to PCB as necessary.



26. Solder a yellow LED in the upper position on pcb2, a green LED in the middle position and a red LED in the lower position (the anodes are uppermost).



27. Cut 250mm lengths of ribbon cable (yellow/orange, blue/green & purple/grey). Solder to the edge of pcb2 from top to bottom in the order, yellow, orange, green, blue, purple, grey.



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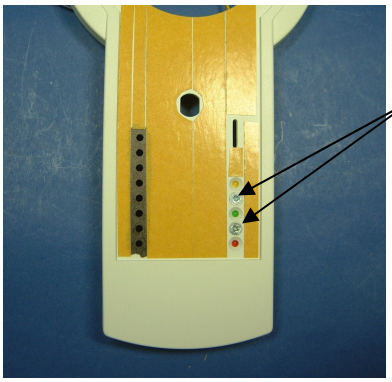
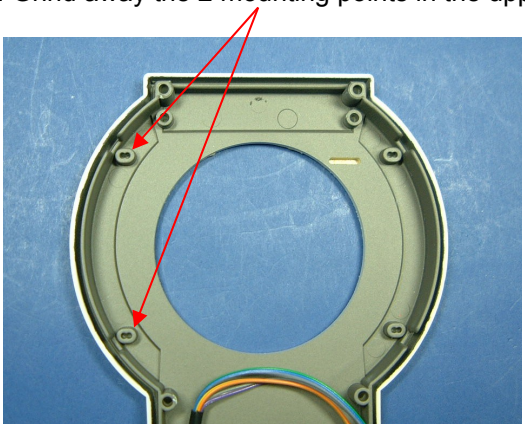
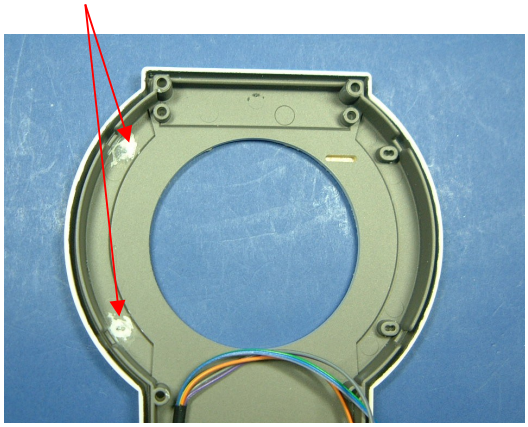
28. Install pcb2 into the upper case half using 2 x M3x12mm countersunk bolts, 2x 3mm spacers, 2x 3mm nylon washers and 2 x M3 nuts. Ensure that the bolt heads are flush with the surface of the enclosure.

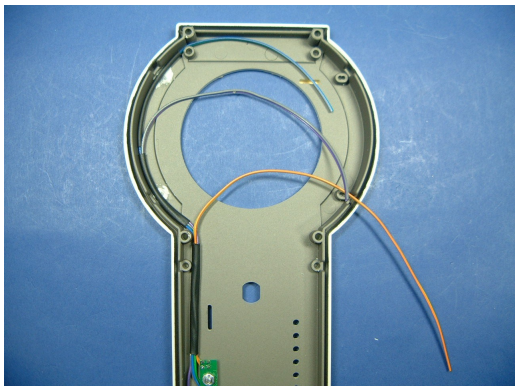


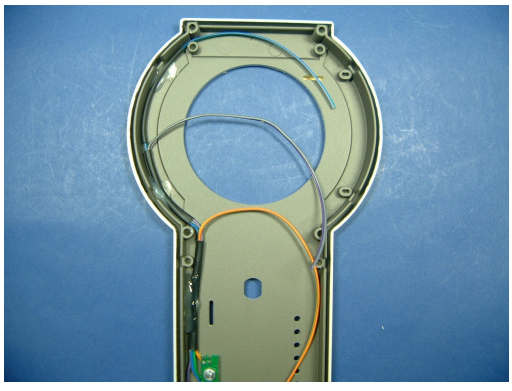
29. Grind away the 2 mounting points in the upper case half as shown.





30. Sleeve 50mm of wiring harness with black heat shrink tube. Allow the yellow/orange combination to exit the wiring harness, and sleeve a further 40mm of wiring harness (leave an 8mm gap between lengths of heat-shrink). Allow the purple/grey combination to exit the wiring harness and heat-shrink a further 50mm of the blue/green combination. Glue the wiring harness to the upper case half at the points shown with hot glue.





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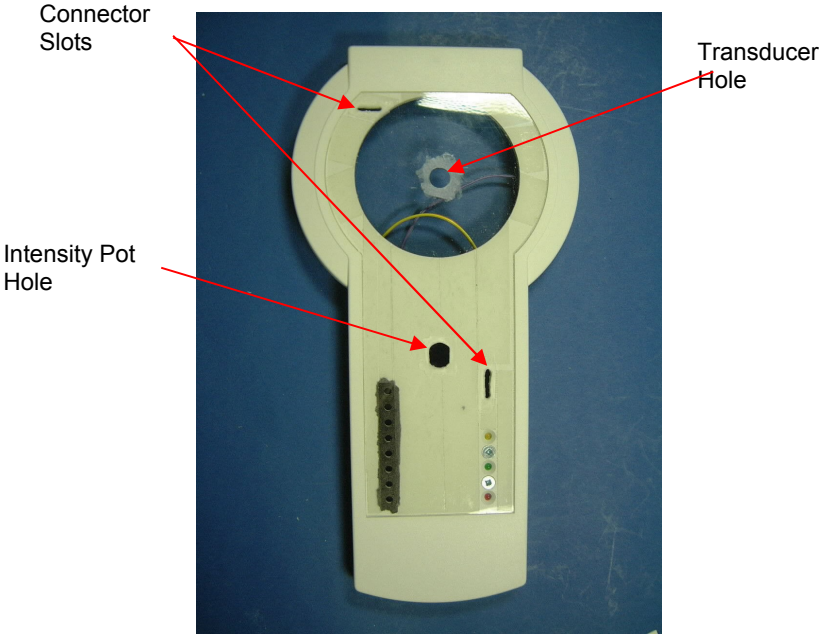
31. Fit the overlay back panel into the recess.

32. Using appropriate drills and files, duplicate the hole in the enclosure for the intensity pot and the two slots for the flexible connectors in the overlay back panel. Drill a hole in the centre of the transducer area to allow the nozzle of the syringe to be passed when filling the transducer with silicon fluid. Ensure that all swarf is removed (use tooth brush or such like) and the upper side of the top panel is ground perfectly flat where slots and holes fall (no sharp edges etc.).



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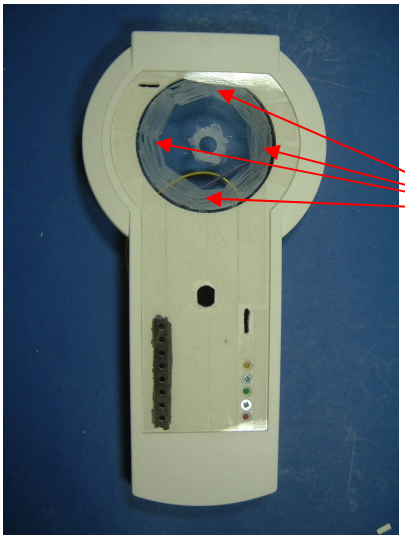
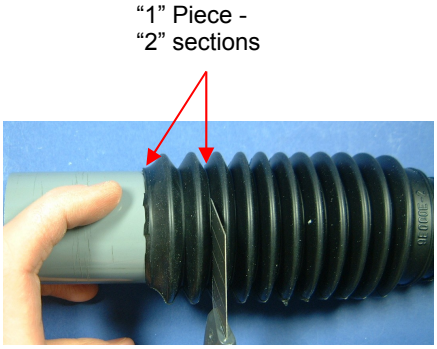
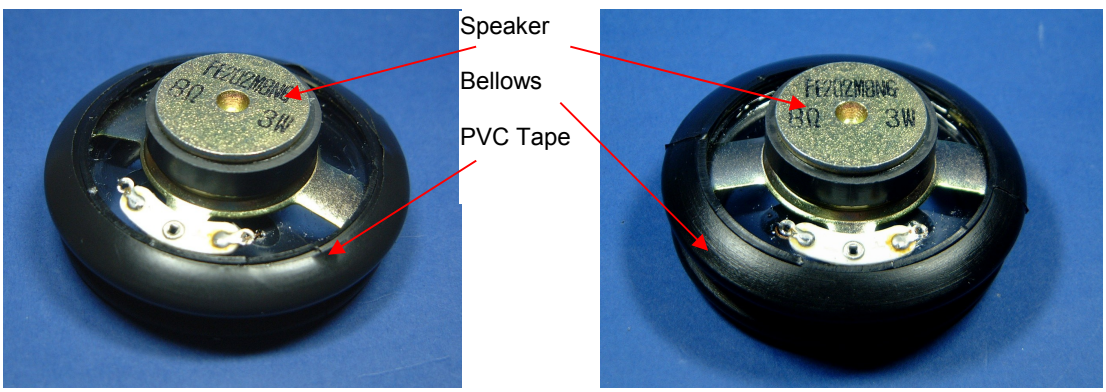
33. Grind a light circular pattern into the reverse side of the top panel where the bellows will be glued as a keyway for the adhesive.



34. Pair off 1 piece of 2 sections of the rubber boot to form the bellows. Trim with scissors as necessary.



35. Use "MIL spec" silicon sealer to glue the Mylar speaker into the bellows. Ensure sufficient glue is used inside the bellows (in "V"), around the outer edge of the speaker and at the back of the speaker where the bellows stretches round. PVC tape can be used, stretched around the speaker / bellows, to hold the two firmly together until the adhesive sets. A watertight seal is essential.



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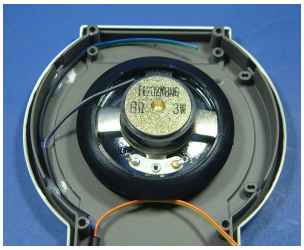
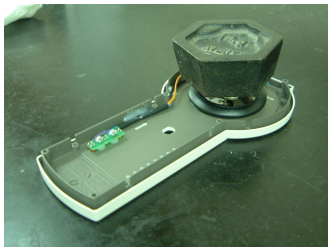
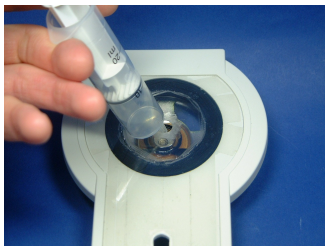
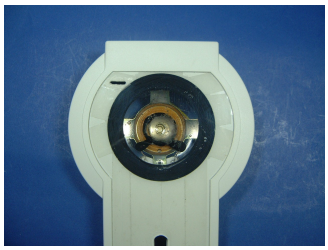
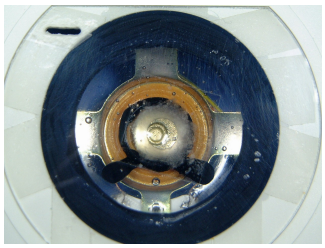
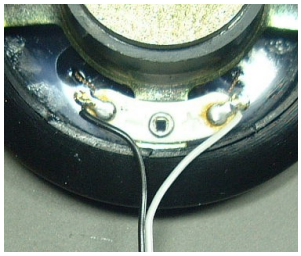
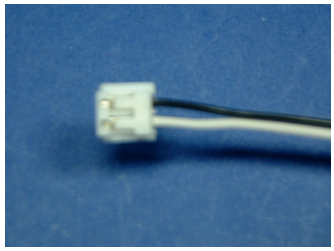
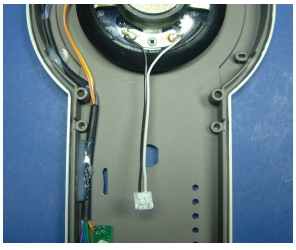
36. Grind away the shiny surface on the side of the bellows to be glued to the inside of the overlay back panel. Glue the bellows with silicon sealer to the overlay back panel ensuring a watertight seal. Use a weight on the reverse of the transducer assembly to apply pressure against the top panel whilst the glue goes off (use a piece of thin card to pack up the panel).


37. Fill the transducer assembly with silicon fluid using a syringe. Leave the upper case half supported horizontal overnight so that any air bubbles come to the surface. Feed in additional silicon fluid and remove / coax out, any trapped air bubbles. Repeat overnight stand as necessary. When the transducer is completely free of air bubbles, fill until absolutely full with silicon fluid and seal the hole with a small patch of clear sellotape.

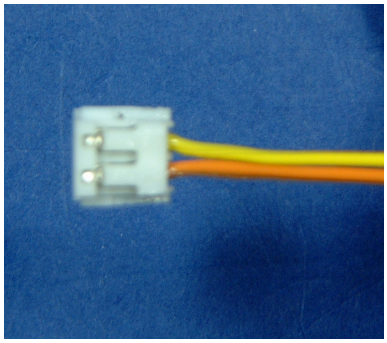
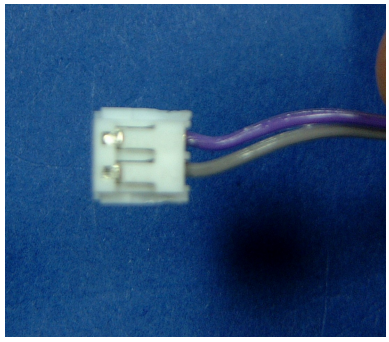
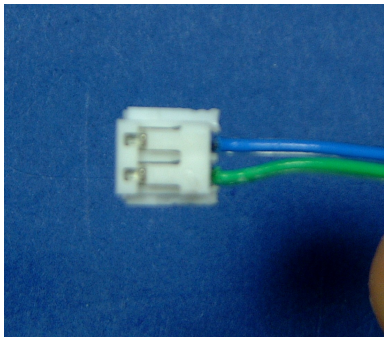




38. Solder a 2 way ribbon cable (white / black) to the speaker terminals; white-positive, black-negative. Fit a 2.5 molex connector to the cable ensuring the overall length of 70mm cable assembly.

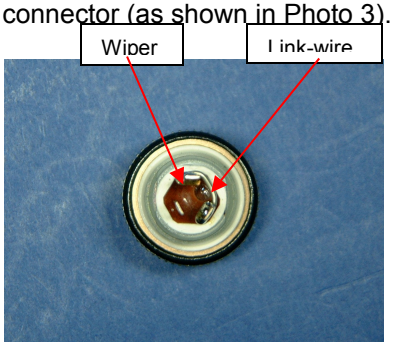




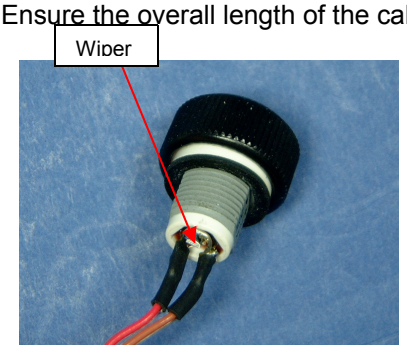
39. Starting at the bottom, apply the overlay panel ensuring that no air pockets are formed. Apply pressure gradually working toward the top, feeding the flexible cables through the slots in the case as appropriate.

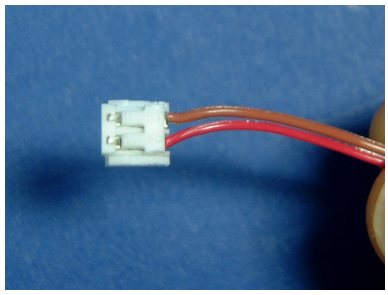

39. Cut excess cable away; yellow/orange to a length of 80mm, purple/grey to a length of 50mm and green/blue to a length of 50mm. Terminate to a 2.5mm molex connectors as below:

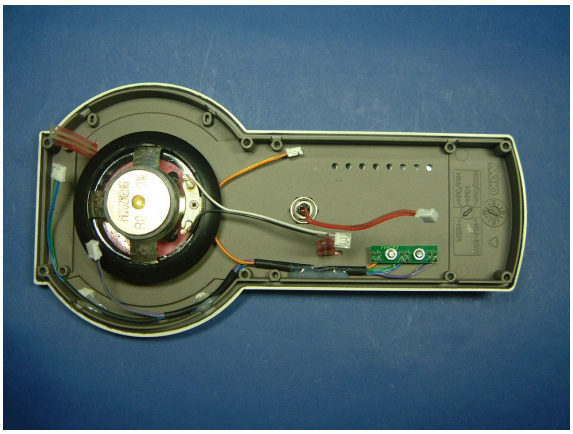
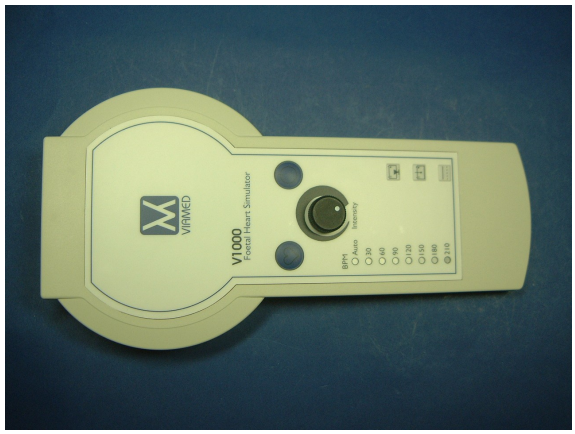
40. Solder a link from the wiper of the intensity pot to the right hand terminal (as below in photo 1). Solder a 2 way (red / brown) ribbon cable to the intensity pot and sleeve with 10mm lengths of black heat shrink tubing (as below in photo 2). Terminate the other end of the cable to a 2.5mm molex connector (as shown in Photo 3). Ensure the overall length of the cable is 70mm.







41. Insert the intensity pot, cable & plug through the hole in the upper case half (wiper uppermost) and secure with the nut.

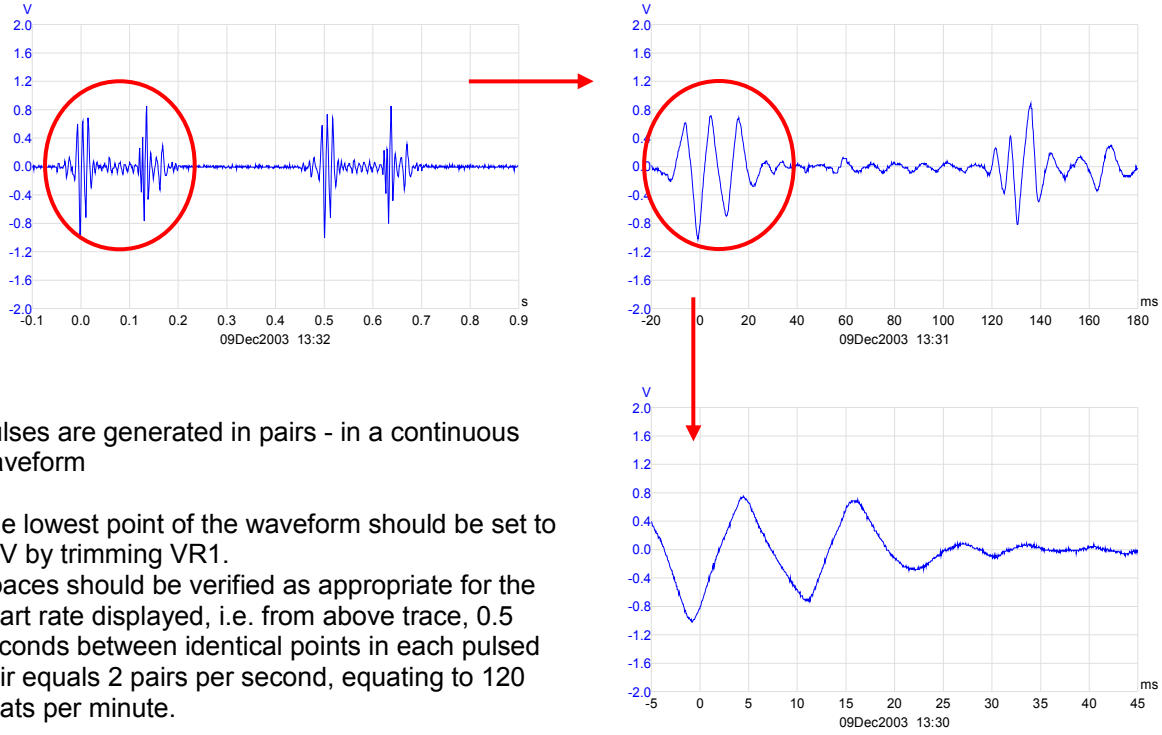
42. Fit the batteries following the polarity as shown on the PCB component reference layer.

43. Offer the upper case half up to the lower case half. Connect the flying leads and flexible tails from the overlay panel to the PCB sockets as follows:

DC - in socket to J1. Blue / green flying lead (green LED) to D12. Grey/ purple flying lead (red LED) to D13. Orange / yellow flying lead (yellow LED) to D11.	Intensity pot to J6. Transducer to J3. Upper flexible tail to J2. Lower flexible tail to J5.

44. Connect the Picoscope to Tp6 with respect to Tp3. Open file “V1000 set up”. Start the Picoscope running.

45. Setting the time-base appropriately, trim VR1 to obtain $-1V_{PEAK}$ on lowest point of the waveform.



Pulses are generated in pairs - in a continuous waveform

The lowest point of the waveform should be set to –1V by trimming VR1.
Spaces should be verified as appropriate for the heart rate displayed, i.e. from above trace, 0.5 seconds between identical points in each pulsed pair equals 2 pairs per second, equating to 120 beats per minute.

46. Ensure there is no apparent short circuit through the EMC screen by running the simulator on batteries alone and verifying that zero current is drawn from one terminal of the battery to it’s battery clip.

47. Place the two enclosure halves together, ensuring that the cables will not be trapped and secure with the 6 self-tapping screws.

48. Clean with isopropyl alcohol and a piece of soft kitchen towel to remove marks and then silicon polish.

49. Attach the serial number sticker to the battery cover ensuring that it covers the retaining bolt. Ensure stock sheets are completed.

50. Print and bind the Operator Manual.