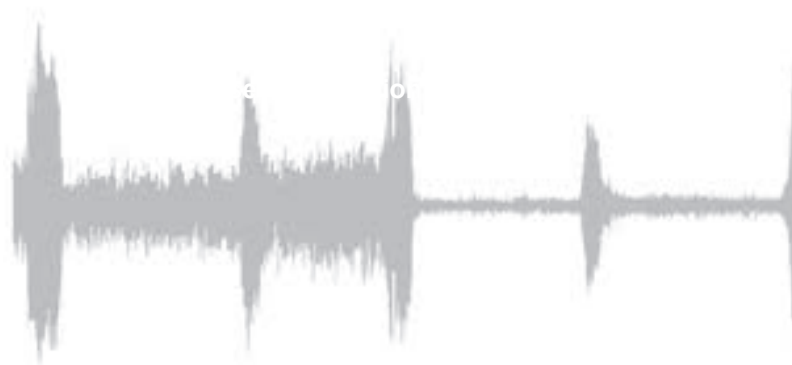


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bhi

'Noise Away'

ANEM MKII

Amplified Noise Eliminating Module

Installation and Operating Manual



**1065-102D
Issue E**

Important Information

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Warning

The 3.5mm mono Audio Out socket provides variable audio output for an external speaker (4 or 8 ohm impedance) or mono earphones. The audio level varies according to the volume setting of the equipment that the ANEM is being used with. When you plug mono earphones into the Audio Out socket (stereo earphones can be used with the bhi audio adapter ADP-S001), the **SP-PH Switch MUST BE** set to the to “PH” position, to prevent the possibility of injury to your ears.

6.5 Other products.

NCH2 Noise Cancelling Headphones



These headphones feed an inverted copy of the ambient noise to cancel it out.

The headphones effectively remove noise such as blower noise, ambient noise, jet engine noise or music from another room.

The headphones are supplied with an aircraft adapter, so you can now listen to the film, or CD player without all the jet engine noise. Also supplied with carry bag.



BBRP Banner Badge



Get the message across

Easy to program using push buttons on back: no cords, no wires, no software needed. Enter your message and watch it scroll across.

BBRP (Includes 2 CR2032 coin cells)
BBAT replacement CR2032 coin cell



Applications

- ID badge
- Club badge
- Restaurants
- Receptions
- Gifts
- Stag and Hen nights
- DJs
- etc...

What will yours say?

1042 Switch box

Allows connection of up to 6 pieces of equipment to one bhi noise elimination speaker or any other extension speaker.
(Includes 2 free ALD001 3.5mm audio leads)

6.4 Audio Adapters and Accessories.**Power adapters:**

1030-UKPA 12V DC UK power adapter

1030-EUPA 12 VDC European adapter

1030-VEPL Fused vehicle power adapter

Audio leads:

ALD-001 1.2m 3.5mm - 3.5mm mono lead

ALD-002 2.5m 3.5mm - 3.5mm mono lead

ALD-003 phono -phono plug

ALD-004 3.5mm stereo plug - phono plug

ALD-005 3.5mm mono plug - phono plug

Audio adapters:

ADP-P001 6.35mm plug - 3.5mm mono socket

ADP-P002 6.35mm plug - 3.5mm mono socket

ADP-P003 3.5mm stereo plug - 3.5mm mono socket

ADP-P004 Phono plug - 3.5mm mono socket

ADP-P005 2.5mm mono plug - 3.5mm mono socket

ADP-P006 2.5mm stereo plug - 3.5mm mono socket

ADP-P007 6.35mm stereo plug - 3.5mm stereo socket

ADP-P008 3.5mm stereo - aircraft adapter

ADP-S001 3.5mm mono socket - 3.5mm mono plug

ADP-S002 6.35mm socket - 3.5mm mono plug

ADP-S003 6.35mm stereo socket - 3.5mm mono plug

ADP-S004 2.5mm stereo socket - 3.5mm mono plug

ADP-S005 2.5mm mono socket - 3.5mm mono plug

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1. Introduction.

The **ANEM** is a compact, easy to use amplified DSP in-line module, and simply connects in between the communications equipment and extension speaker.

It is suitable for a wide range of applications, but is particularly useful for improving voice quality in amateur radio, removing unwanted noise and interference to give much improved readability and speech intelligibility across all bands.

The **ANEM** is suited to customers who prefer simple controls and operation. It also offers a solution for those customers who do not want to fit the NEDSP1062-KBD amplified DSP module inside their existing extension speaker.

The **ANEM** is easy to set up and its functions are microprocessor controlled, enabling simple operation via two pushbuttons: Power on/off audio bypass and DSP filter on/off. 4 or 8 levels of noise cancellation are selectable via the pushbuttons on power up, the last selected filter level remaining in the memory when the unit is switched off. The unit has a Headphone/speaker select switch enabling the module to be used with an extension speaker or a pair of mono headphones (Warning - Do not switch to "SP" position whilst using headphones as this could damage your hearing). The **ANEM** comes boxed with a Fused DC power lead (2.1mm) and a 3.5mm mono plug lead 1.2m long, plus full operating instructions. Audio adapters are available to suit different connections, and Velcro strips are provided for mounting the module in a suitable position on your extension speaker or radio equipment.

6.3 NEIM1031MKII In-line module.

Then **NEIM1031MKII** provides a flexible solution to noise reduction. It features both amplified inputs and outputs, along with line level signal processing. The unit also features an audio bypass when the unit is switched off, so there is no need to disconnect when not in use.

Features:

- Fully adaptive noise cancellation 9 -35dB
- 8 user selectable noise cancellation levels
- Mono earpiece socket
- Input sensitivity control
- Noise cancellation On/Off switch
- Line level in/out
- Input overload indication
- Power on/off with audio bypass.



6.4 NEIM1031 accessories.



LSPKR

20 Watt 4 ohm extension speaker for use with the NEIM1031. Fitted with a 3.5mm mono jack plug.



1031-STAND

Clear Acrylic stand to mount the NEIM1031. The NEIM1031 can be used horizontally or vertically



1030-UKPA UK DC power adapter

1030-EUPA European DC power adapter

6.5 DSP pcb modules.

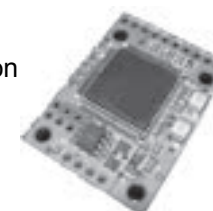
DSP module range.

NEDSP1061- KBD: Low signal level module

controlled by single button keyboard.

NEDSP1062 - KBD:

Amplified DSP module controlled by a 2 button keyboard.



6. Other bhi products

Other noise cancellation products from bhi. Visit www.bhi-ltd.com for more information:

6.1 NES10-2 MK3 Noise Eliminating Speaker.

Amplified DSP noise cancellation speaker with new rotary filter select knob and increased audio power.



Features:

- Fully adaptive noise cancellation 9 -35dB
- 8 user selectable noise cancellation levels
- Mono earpiece socket
- Input sensitivity control
- Noise cancellation On/Off switch
- LED indication of power and noise cancellation
- 12-24VDC operation
- On/Off audio bypass switch.
- Easy to install with adjustable mounting bracket
- 2m audio lead
- Optional extras available.



6.2 DSPKR



Superb 10 Watt rms audio DSP noise cancelling speaker

Features:

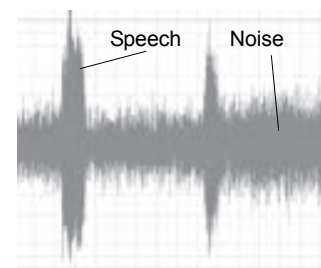
- 7 DSP filter levels 9 - 24dB
- 12-18V DC operation
- Simple control of all functions
- sleep mode - Filter store function
- Volume control - Input level indicator
- Comes with 2m audio lead, Fused DC power lead & manual

Features:

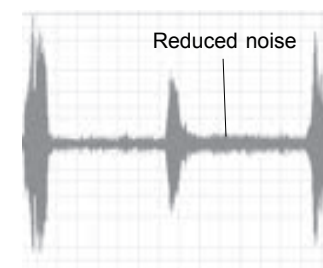
- Noise reduction 9 – 35dB
- Tone reduction 4 – 65 dB
- Power supply 12 – 18 V dc
- Input signal > 50mV
- Output load 2.5W 8ohm
- Current consumption 300mA
- Audio bandwidth 50 – 4.3KHz
- Dimensions (WxDxH) 100 x 60 x 40mm
- 4 or 8 filter levels (selectable)
- Visual and audio indication of filter level
- Audio bypass when switched off
- Headphone/speaker switch

1.2 DSP Noise cancellation.

The bhi DSP processes the incoming signal and then differentiates the speech from the noise. The unwanted noise and interference is then attenuated to leave only the speech. The following diagrams are taken from actual audio signals and illustrate how the signal is being processed.



Original signal.
Speech with a lot of background noise



Processed speech.
Speech with reduced noise

Figure 1. Noise cancellation.

2. Module Overview.

2.1 Whats in the box.

The **ANEM** is supplied with the following. Please check that all of the items are present.

- 1 off **ANEM MKII** module
- 1 off Fused DC power lead
- 1 off 3.5mm mono leads
- 1 off Operating manual
- 4 off Self adhesive rubber feet
- 1 off Hook and eye fastener strip

2.2 Getting Started.

Power connector
12 - 15V dc 300mA
centre positive

Audio out
(to loudspeaker)

Audio In
(from equipment)

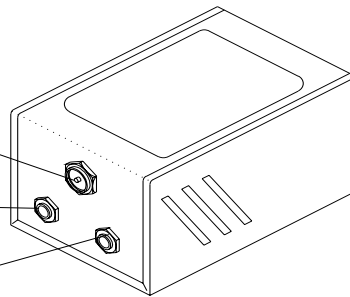
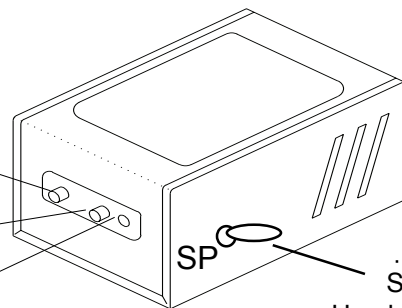


Figure 2. Connectors

Power on/off
bypass button

DSP function
button

DSP function LED

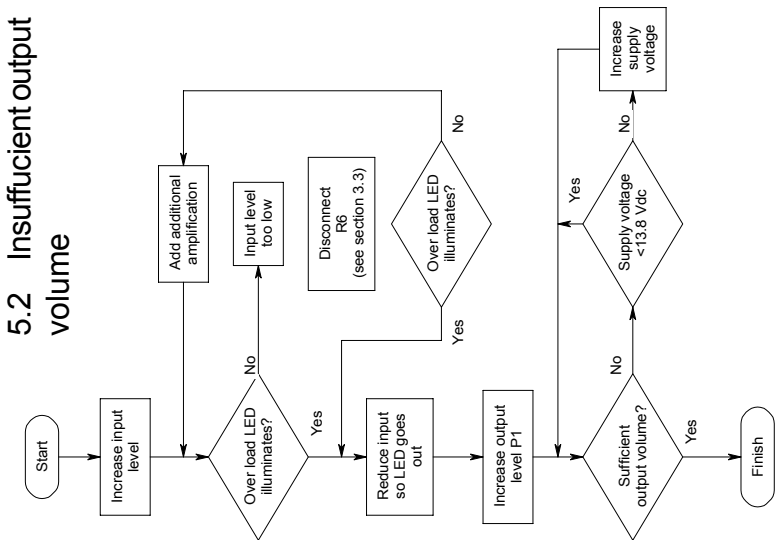


Speaker/
Headphone switch

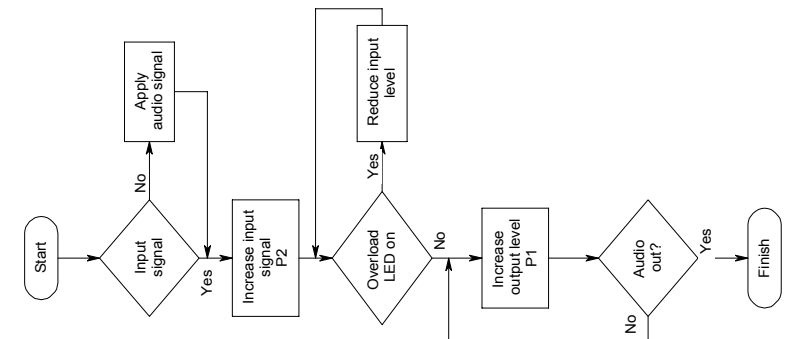
Figure 3. Controls

5. Troubleshooting

5.2 Insufficient output volume



5.1 No audio out



4.4 Driving from a low signal source.

The input to the module has a low impedance. This is to provide correct loading to any power circuits driving it. If the module needs to be driven from a low power signal then it must be modified in the following manner. The case must first be removed, as described in section 4.2.

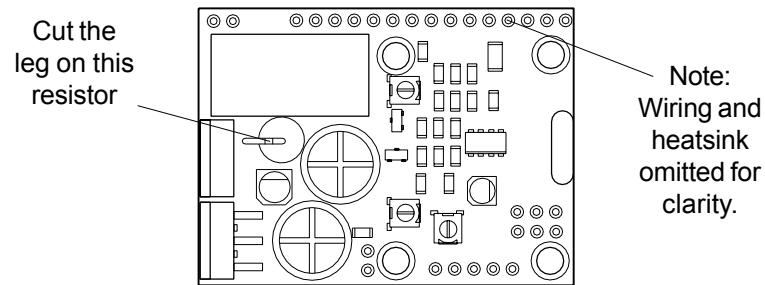


Figure 16. Physical modification for low power signal drive.

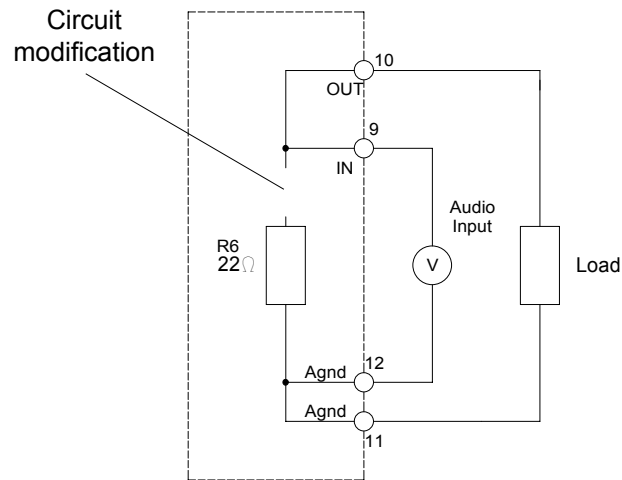


Figure 17. Circuit modification for low power signal drive.

2.3 Mounting options.

The **ANEM** can be used on the bench, or attached to your loudspeaker using the velcro strips supplied.

For bench mounting attach the four rubber feet to the bottom of the module as shown.

If the module is going to be mounted on the loudspeaker then attach the strip of hook and eye fastener as shown below.

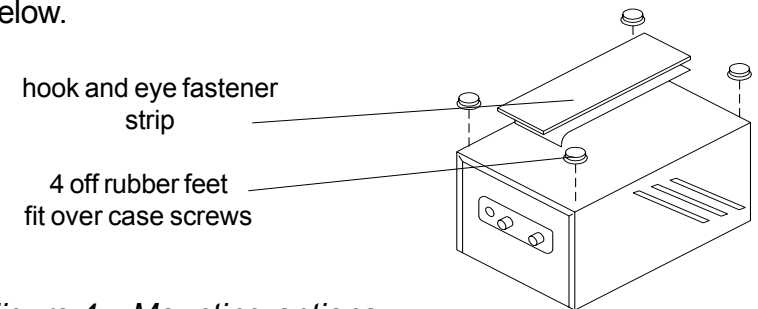


Figure 4. Mounting options



Mount it on the side...



..on the top..



..on the back..



..or use it on the bench...

2.4 Connections.

The **ANEM** is connected in-line between the equipment and the loudspeaker or headphones, as shown in the following block diagram.

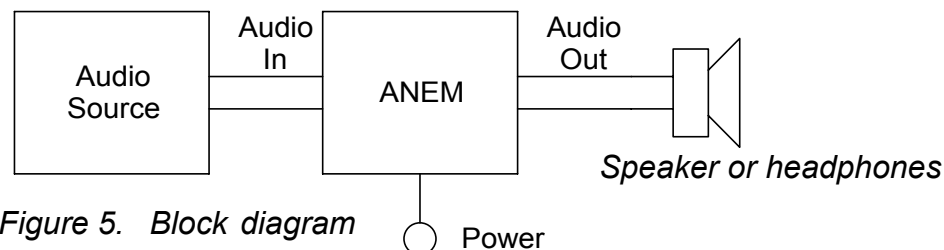


Figure 5. Block diagram

Connect the 3.5mm mono lead supplied to the extension speaker socket of your equipment and the audio in socket on the **ANEM**. Connect a loudspeaker or headphones to the audio out socket on the **ANEM**. **Warning:** The 3.5mm mono Audio Out socket provides variable audio output for an external speaker (4 ohm - 8 ohm impedance) or earphones. The audio level varies according to the volume setting of the equipment that the **ANEM** is being used with. When you plug mono earphones into the Audio Out socket (stereo earphones can be used with the bhi audio adapter ADP-S001), the SP-PH toggle switch **MUST BE** set to the "PH" position, to prevent the possibility of injury to your ears.

Look in section 6.4 for audio adapters to suit most equipment and applications.

Connect the fused DC power lead to a power supply capable of providing 12 - 18VDC @ 300mA. The centre pin of the power connector is positive (the lead with the white stripe is positive). If you require a separate power supply then refer to section 6.4 for details. The unit is now ready for use.

4.3.3 Change to output load.

The audio input to the module is loaded at 22Ω . This load is effectively connected across the output load when the unit is switched off (bypassed). This will reduce the impedance presented to the audio source.

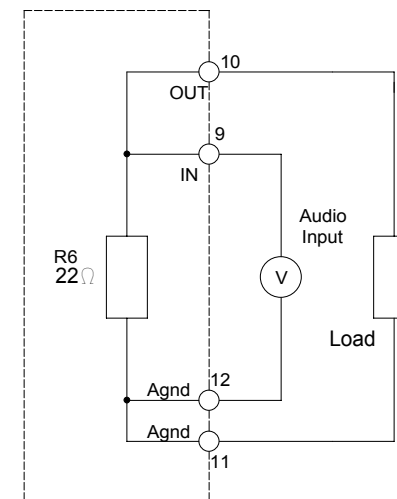


Figure 15. Input circuit - module powered down

For example:

8Ω will reduce to 5.9Ω

4Ω will reduce to 3.4Ω

4.3.4 Other signal considerations.

The **ANEM** requires a signal of 125mV rms or greater for optimum performance. Signals lower than this may be used but the noise cancellation performance will decrease, as the signal levels drops. If the unit is used with low level signals such as microphones, the signal will need amplifying before applying it to the **ANEM**.

Due to the adaptive nature of the noise cancellation a small delay may be heard when the audio signal changes. For optimum performance provide the module with a constant signal where possible.

When switching on the unit a small audio thump may be heard in the loudspeaker or headphones.

4.3 Module setup.

The module is factory set but both the input and output levels are adjustable on the module. This allows easy integration into target systems. If you need to adjust the module follow the instructions below.

4.3.1 Overview.

To obtain the best results from the noise reduction the module should be set up to give optimum performance. The input sensitivity control has a range of 0.70mW - 3W (Ω) output.

Under certain conditions, RF breakthrough can sometimes occur. To minimize this, the input level (P2) may need to be reduced or go to the FAQ page on the bhi website and download the FAQ on RF breakthrough. Under certain conditions the DSP can create a small amount of noise, you should not be able to hear this noise when a signal is applied to the module.

4.3.2 Suggested adjustment procedure:

Basic adjustment procedure.

- Open the unit by carefully pulling both sides of the bottom half outwards & easing the top half upwards.
- Ensure that the pcb is clear for any adjustments.
- Connect input source and output device.
- Ensure the **ANEM** is switched off.
- Set the audio source to a typical audio level.
- Switch on the **ANEM**.
- Adjust the input control (P2) until the overload LED illuminates. Reduce the level by approx. 1/4 turn.
- Adjust the output level (P1) to the desired level.
- Hold down the DSP button and adjust the volume of the sounder to suit using P3.

3. Module Operation.

3.1 Keyboard.

The keyboard has 2 buttons and a tricolour LED.

3.1.1 Power button.

The power button switches the module on and off. When the module is off, the audio bypasses the module, so the circuit will behave as if the module isn't present. Switching the power on routes the audio through the module.

Note: If the power is on and the DSP is switched off, the audio still passes through the DSP - but without any signal processing.

A single press on the button switches the power on, and a single press will switch it off. Also with the power connected and the module switched off the circuit will draw 6mA.

3.1.2 DSP level button.

This button is used to set the following:

- DSP on/off
- DSP level
- 4 or 8 levels of noise cancellation
- Demonstration modes

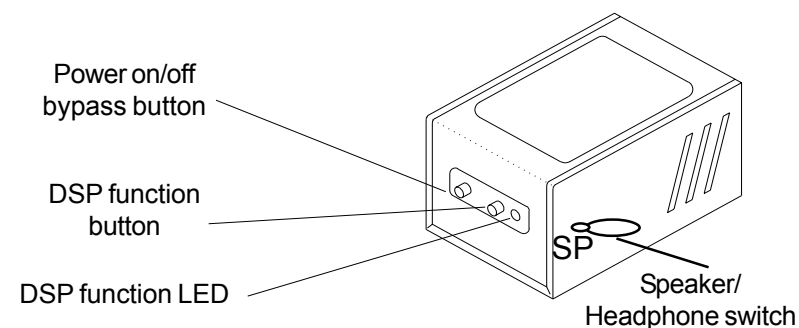


Figure 6. Controls

3.2 Set up.

The following flow chart shows the functions of the DSP button.

Holding down the DSP button when switching on causes the module to enter the set up mode.

This is indicated by a 2 tone beep.

Releasing the DSP button at this point the module goes in to demonstration mode 1

Releasing the DSP button at this point the module goes in to demonstration mode 2

Keep the button down until the desired level has been reached, then release the button. The module will continuously scroll through 4 and 8 levels until the button is released.

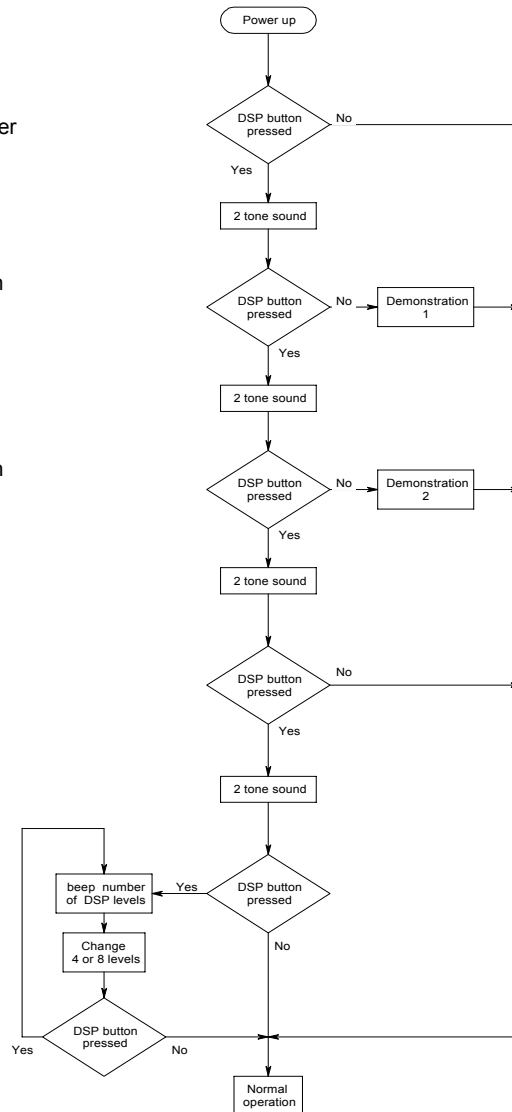


Figure 7. 4/8 level setting.

4.2 Controls.

The level controls provide adjustment for the audio levels entering and leaving the module. The modules are factory set to the maximum level.

Turning the potentiometers clock wise will decrease the levels. These potentiometers do not have end stops, so it is possible to set them in a position where the audio will be lost.

Audible indication of operation is provided by an piezo sounder. The volume of this sounder can be varied by potentiometer P3. The sounder volume is independent of the incoming audio volume.

The input to the module is loaded at 22Ω to provide a dummy load to the preceding circuit. This can be removed if required, such as using the module in applications where the audio source is provided by a low level, low power signal source. More information on this can be found in section 3.3 in this operating manual.

If V_{in} is less than approx. 13.8V ensure the power supply is well decoupled otherwise the power supply rejection ratio will deteriorate. Best results are obtained in the range of 13.8V - 16Vdc.

4. Technical Information.

4.1 Module Layout.

In order to access the printed circuit board the case needs to be removed.

Carefully pull the sides of the case outwards, until the upper section can be removed. When re-assembling the module ensure that none of the wires become trapped in the case halves.

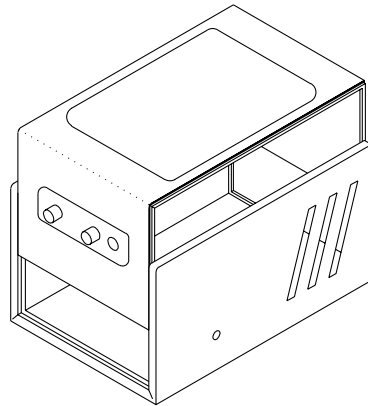


Figure 13. ANEM case dis-assembly detail.

The following diagram shows the internal layout of the **ANEM** printed circuit board.

Note:

Wiring and heatsink omitted for clarity

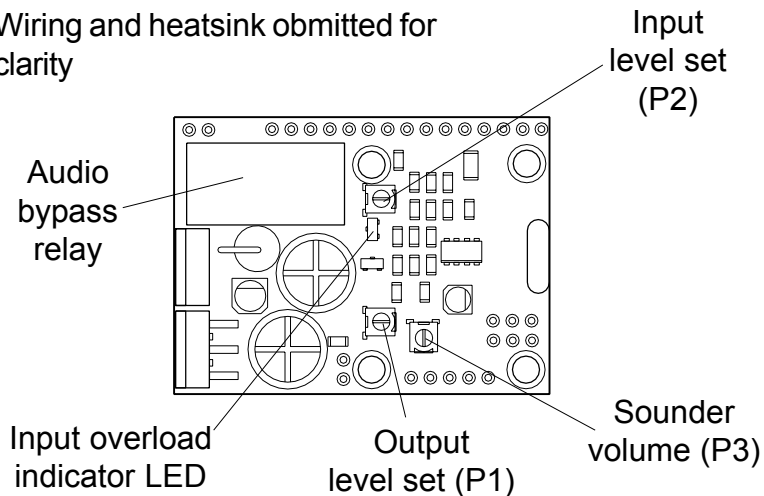


Figure 14. ANEM PCB and controls

To listen to the demonstration modes, or change the number of DSP levels it is necessary to put the module into the set up mode.

To do this, ensure the module is Off. Press and hold the DSP level button. Turn on the module and a 2 tone beep will be heard indicating that the module is in the set up mode.

Releasing the button after the first 2 tone beep will enter demonstration mode 1.

Releasing after the second 2 tone beep will enter demonstration mode 2.

Releasing after the third 2 tone beep will set the unit to level 2 in the 4 level mode.

After the fourth beep, keep the button depressed. 4 beeps will indicate 4 level mode and 8 beeps 8 levels. Release the button to select the desired level mode.

The module will return to normal operation after this. The colour of the LED will indicate the mode of operation, red for 4 level and orange for 8 level.

DSP mode	4 Levels	8 Levels
OFF	RED	ORANGE
ON	GREEN	GREEN

Table 1. LED mode indication.

3.3 Demonstration modes.

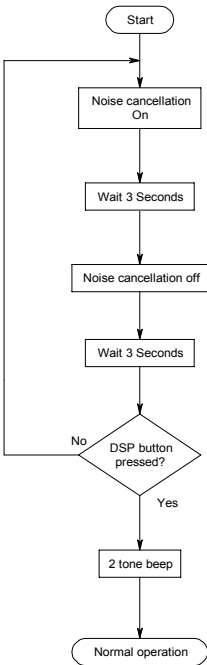


Figure 8.
Demonstration
modes.

Demonstration 1.

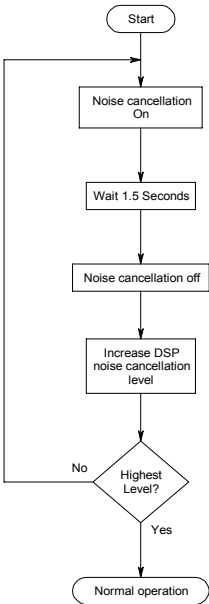
The module switches the noise cancellation on for 1.5 seconds, then off for 1.5 seconds. It will then move to the next level and repeat the process. This mode is particularly effective at demonstrating the different DSP levels. Alternatively pass a clean audio signal through the module to see hear how little the DSP alters the speech.

Demonstration 2.

The module switches the noise cancellation on for 3 seconds then off for 3 seconds. This is a good demonstration of the before and after effects of removing the noise.

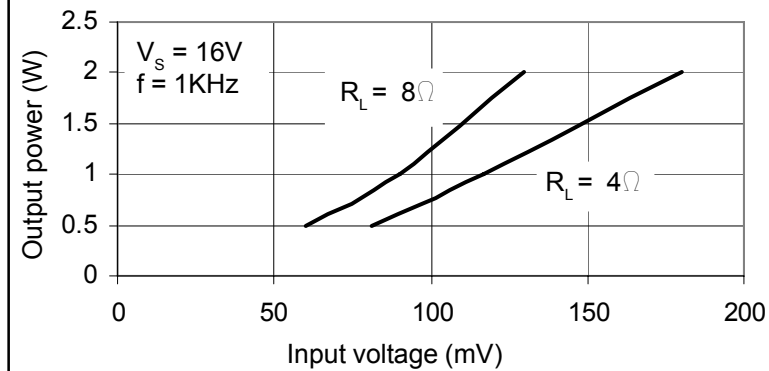
Note:

To exit the demonstration modes hold down the DSP button until a 2 tone beep is heard.



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Figure 11. Sensitivity.



Section 4 contains information on adjusting the operation of the **ANEM**. The module is supplied factory set and under normal circumstances no further adjustment is necessary. The following information is for guidance only and any adjustments to the DSP circuit should only be carried out by those who have a technical understanding of what they are doing.

3.4 Noise reduction levels.

4 or 8 levels of noise reduction are available. The amount of noise and tone reduction is shown in the table below.

Level (4)	Level (8)	Tone Reduction	White Noise Reduction
	1	4dB	9dB
1	2	5dB	11dB
	3	6dB	13dB
2	4	8dB	15dB
	5	16dB	17dB
3	6	21dB	20dB
	7	25dB	24dB
4	8	65dB	35dB

Table 2. Tone and noise reduction levels.

The column marked level (4) shows the noise and tone reduction when operating the module with 4 levels, and the level (8) column for 8 levels.

Holding down the DSP select button will continuously change the DSP level. When the desired level has been reached, release the button. The module will retain this level until it is changed.

The **ANEM** is factory set up and ready for use. If you are using the module in an application which requires adjustment. For the optimum performance refer to section 4 for more information.

3.5 Electrical characteristics.

ELECTRICAL CHARACTERISTICS

($V_s = 16V$, $T_{amb} = 25^\circ C$ unless otherwise stated)

DC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_s	Supply voltage		12	16	18	V
I_{q_s}	Quiescent current	$V_s = 12V$ $V_s = 16V$ $V_s = 18V$		4.6 6.8 7.1		mA
$I_{q_{on}}$	Quiescent current DSP on no load no signal	$V_s = 12V$ $V_s = 16V$ $V_s = 18V$		143 160 161		mA

AC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
P_o	Output power	$d = 10\%$ $f = 1KHz$ $R_L = 8\Omega$ $R_L = 4\Omega$	12V 1.16 1.7	16V	18V 2.06 3.17	V_s W W
V_i	Input sensitivity 4 Ω load	$f = 1KHz$ $P_o = 0.5W$ $P_o = 1.0W$ $P_o = 2.0W$			60 90 130	mV
V_i	Input sensitivity 8 Ω load	$f = 1KHz$ $P_o = 0.5W$ $P_o = 1.0W$ $P_o = 2.0W$			81 117 180	mV
B	Frequency response (-3dB)	$P_o = 1W$ $R_L = 8\Omega$	50		4300	Hz
d	Distortion	$f = 1KHz$ $P_o = 0.2 - 2.4W$ $R_L = 8\Omega$ $P_o = 0.2 - 2.4W$ $R_L = 4\Omega$		0.8 0.8		%
R_i	Input resistance		21	22	23	Ω
G_v	Voltage gain	$f = 1KHz$		27		dB
n	Efficiency	$f = 1KHz$ $P_o = 3W$ $R_L = 4\Omega$ $P_o = 2W$ $R_L = 8\Omega$		33 38		%

ANALOGUE CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max.	Units
T_d	System delay			26		mS

Table 3. Electrical characteristics 1

