



bhi ltd  
PO Box 318  
Burgess Hill  
West Sussex  
RH15 9NR

tel: +44 (0)845 217 9926  
fax: +44 (0)845 217 9936

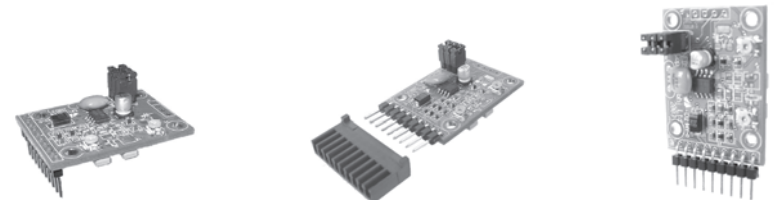
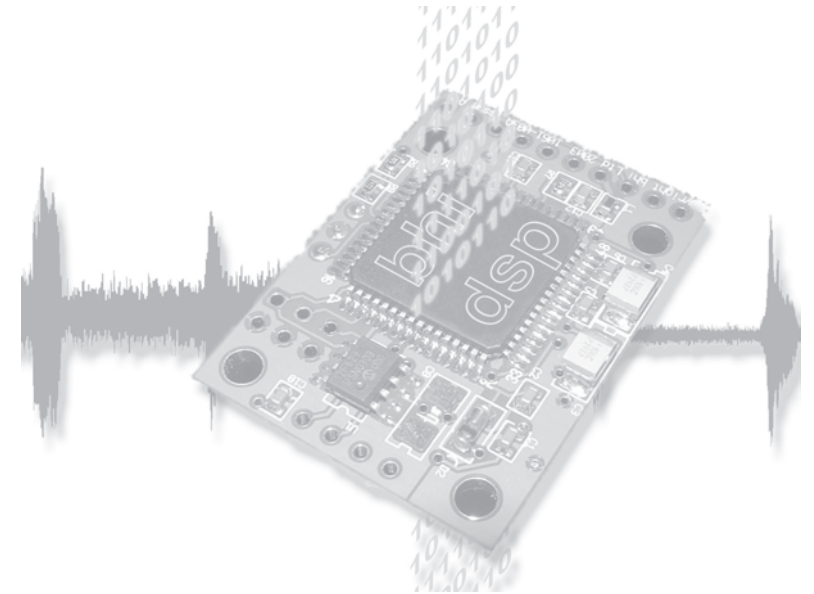
sales@bhi-ltd.com  
www.bhi-ltd.com



## NEDSP1061-PCB

Noise Eliminating Modules

### Installation and Operating Manual



1061-108D  
Issue C

## Important Information

Notes:

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Notes:

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## 1. Introduction

Notes:

The NEDSP1061 is a modular solution to noise reduction. It incorporates DSP technology to provide up to 35dB of noise cancellation.

### 1.1 NEDSP1061 module features:

- Fully adaptive to changing noise environments
- Input and output level controls
- Virtually no distortion to speech signal
- Up to 35dB of noise cancellation
- 8 levels of noise reduction
- Noise cancellation can be preset or remotely set during operation
- 5 – 15V supply range
- 4.6dB on board gain
- Wide range of connection possibilities
- Mounting holes

### 1.2 Limitations.

This module is designed to pass speech. Other signals such as data, music and morse (CW) will to some degree pass through, but the integrity of these signals cannot be guaranteed.

This module is designed to be placed in a low level audio path only. The module will not drive a loudspeaker or other high power load.

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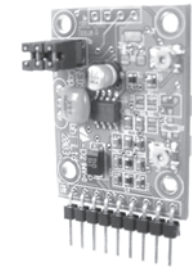
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## 1.3 Module connection and mounting

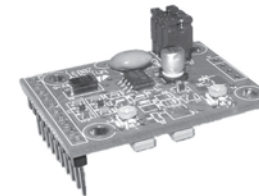
Connections to the module are made by a row of 10 pads at the right hand side of the PCB. These pads are on a 2.54mm (0.1") pitch, which allows the use of standard pin headers, PCB connectors and direct wiring.

### Vertical mounting.

Use a 10 way 0.1" pitch right angled pin header in the PCB (J2). The module can then plug into a suitable mating connector, or be soldered directly to the target system.



*Plug in Vertically*



*Plug in Horizontally*

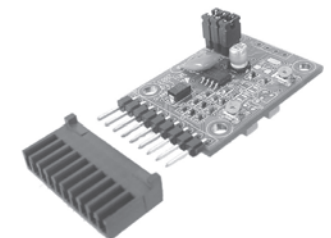
### Horizontal mounting.

Use a 10 way 0.1" pitch straight pin header in PCB (J2). Mount a 4 way header in the PCB (J1). **Do not** connect these pins to the circuit, use them purely for mechanical fixing.

### Other options.

Use a right angled pin header to mate with a 10 way wired connector.

Wire the PCB directly and mount using the four fixing holes.



*Horizontal connector*

*Figure 1. Connection options*

## 1.4 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.

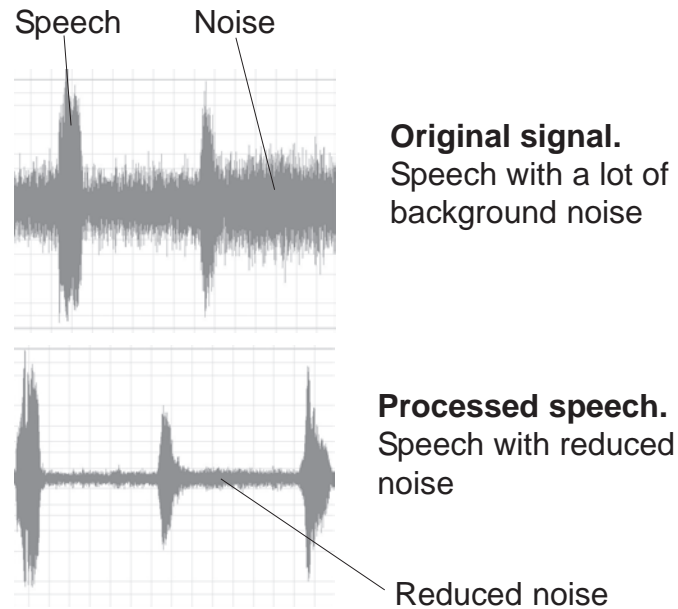


Figure 1. Noise cancellation.

## 5.3 Driving a low impedance load.

If the target system loads the output of the DSP module it may necessary to buffer the output. This can be achieved with a single op amp.

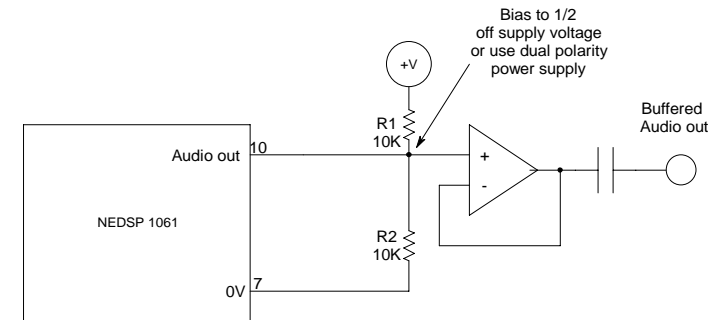


Figure 12. Buffered output stage.

## 5.4 Audio Bypass.

In safety critical applications a bypass should be included to maintain communications in the unlikely event of the NEDSP1061 or the power failing. The following circuit uses a relay to route the audio signal. In the even of power failure to the module the relay will de-energise and connect the input to output. Also shown is a switch to bypass the module manually.

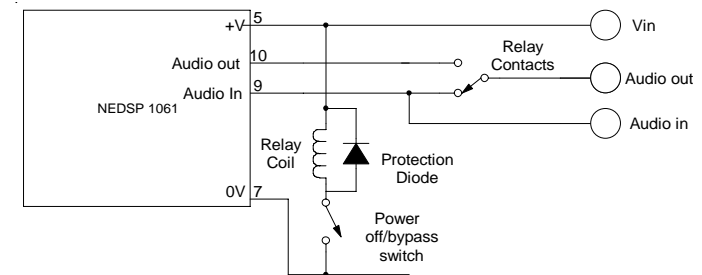


Figure 13. Audio bypass.

The module can be controlled with a microcontroller. As the DSP employs internal pull ups, it is not necessary to drive the microcontroller port pins high, they can be placed in a high impedance state.

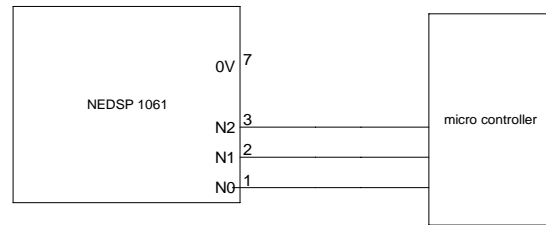


Figure 10. Control using a microcontroller

The following example employs a 7 segment display and keyboard. Noise on/off is also controlled by the microcontroller. In the diagram 3 buttons are used, up level, down level and DSP on/off.

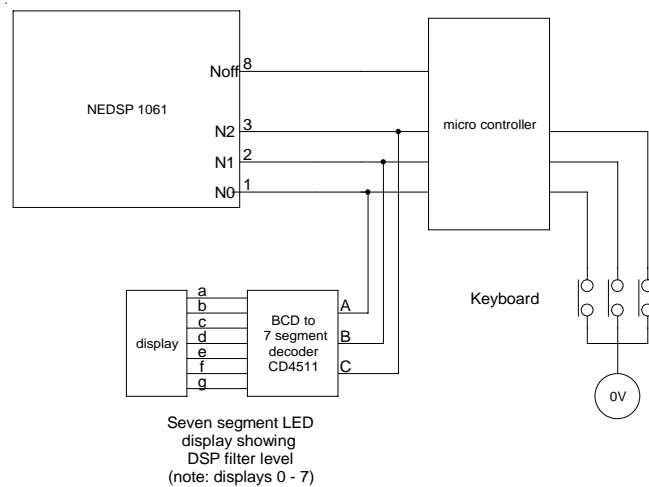


Figure 11. Control using a microcontroller with display and keyboard.

## 2. Module description

### 2.1 Block diagram.

The NESDP1061 module has the facility to be preset, or adjusted during operation. Digital inputs control the functions. These incorporate internal pull up resistors, so they can be left floating when not in use.

The audio signals into and out of the module are capacitor coupled.

The on board voltage regulator allows the module to be used with a wide range of input voltages, but to keep the power dissipation (and heat) down it is advisable to use as low as possible supply voltage. The power supply input is reverse polarity protected.

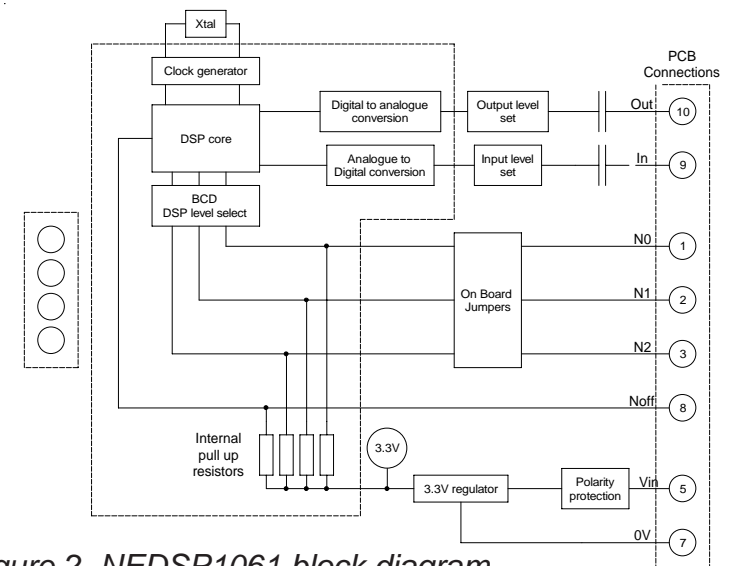


Figure 2. NEDSP1061 block diagram

## 2.2 Module Layout.

The following diagram shows the layout of the NEDSP1061 module.

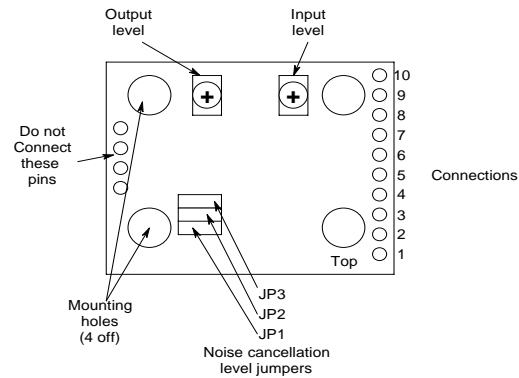


Figure 3. NEDSP1061 connections and controls

Pin No.	Name	Description
1	N0	BCD lsb noise cancellation bit
2	N1	BCD noise cancellation bit
3	N2	BCD noise cancellation MSB
4	N/C	Do not connect
5	Vin	Supply voltage
6	N/C	Do not connect
7	0V	0V connection
8	Noff	Noise cancellation on/off pin
9	In	Audio input
10	Out	Audio output

Table 1. NEDSP1061 connection functions

## 5.2 Remote adjustment of noise cancellation level.

This page illustrates various options for altering the DSP level remotely, during operation.

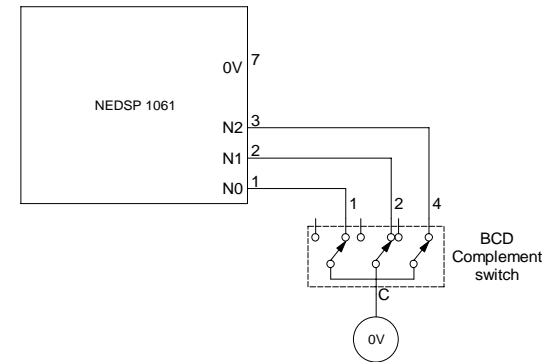


Figure 8. Basic setting using a BCD switch

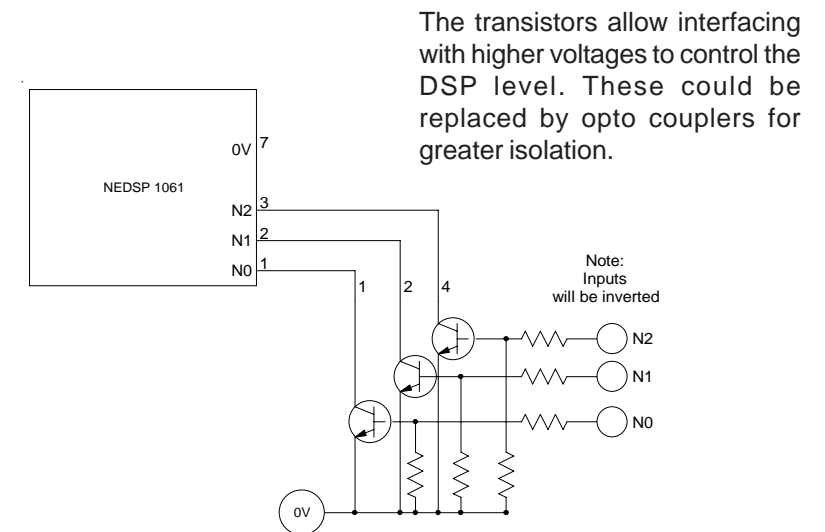


Figure 9. Basic setting using transistors



## 5. Application Notes.

### 5.1 Noise cancellation On/Off indication.

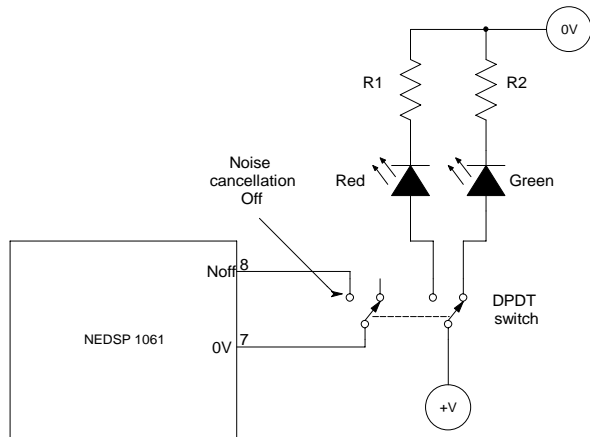


Figure 7. Red/Green LED indication of noise cancellation.

In the above example a tricolour LED (or separate Red and Green LEDs) are used to give a visual indication of the noise cancellation mode. The green LED will illuminate when the noise cancellation is on, and the red when off.

## 2.3 Pin functions.

The basic operation of the NEDSP pins are described below. More detailed descriptions can be found later in this manual.

### Pins 1-3 DSP filter level set.

These pins allow remote setting of the noise cancellation level. If these pins are used, then remove the preset jumpers JP1 - JP3 from the PCB.

### Pin 5. Supply voltage.

Supply voltage 5-15VDC

### Pin 7 0V

0V pin.

### Pin 8 Noise cancellation on/off

Connecting this pin to 0V inhibits the noise cancellation. Leave this pin floating to enable noise cancellation.

### Pin 9 Audio input.

Audio signal to be processed.

### Pin 10 Audio out

DSP processed signal out from the module.

For optimum performance, keep all leads as short as possible. Use screened leads for the audio signal.

## 2.4 Controls.

The audio level control potentiometers P1 (Audio out), and P2 (Audio in) provide adjustment to the audio levels entering and leaving the module.

P1 is factory set near to maximum.

To set the input level correctly, adjust P2 until the overload led D1 (next to P2) illuminates, then back off the potentiometer approximately a 1/4 of a turn.

Turning the potentiometers anti clock wise will increase the levels.

## 2.5 Electrical characteristics.

Output impedance: Nominally 10k Ohms

Input impedance: 7.5k Ohms typical

Analogue Characteristics					
Parameter	Description	Min	Typ	Max	Units
$V_{in}$	Supply voltage	5	9	15	V
$I_{in}$	Supply current		45	50	mA
In	Audio input signal	50	300		Vrms
Out	Audio output signal (1.7 Xs input max)			630	Vrms
Digital Characteristics					
Parameter	Description	Min	Typ	Max	Units
$V_{inHigh}$	High Level Input voltage (Schmitt trigger)			3.3	V
$V_{inLow}$	Low level Input voltage (Schmitt trigger)	0.8			V
$I_{inHigh}$	Input leakage current - input high	10	30	60	uA
$I_{Low}$	Input leakage current - input low	-10	-30	-60	uA

Table 2. NEDSP1061 Electrical characteristics

Level	N2	N1	N0
1	0V	0V	0V
2	0V	0V	3.3V
3	0V	3.3V	0V
4	0V	3.3V	3.3V
5	3.3V	0V	0V
6	3.3V	0V	3.3V
7	3.3V	3.3V	0V
8	3.3V	3.3V	3.3V

Table 5. Remote DSP level setting.

### Note:

The DSP has internal pull ups on its inputs, so any cell in the table containing 3.3V may be left open circuit.

When processing signals with high levels of noise and high levels of noise cancellation, the signal may sound slightly strange. This is quite normal with this type of signal.

### 4.4 Noise Cancellation On/Off

The module has the provision for remotely enabling and disabling the noise reduction, while in operation. The default setting for the module is noise cancellation on. This may be switched by the use of the noise cancellation on/off pin (PCB pin 8).

To inhibit noise cancellation, connect this pin to 0V.

To enable noise cancellation leave the pin unconnected.

Level	JP3	JP2	JP1
1	On	On	On
2	On	On	Off
3	On	Off	On
4	On	Off	Off
5	Off	On	On
6	Off	On	Off
7	Off	Off	On
8	Off	Off	Off

Table 4. Preset DSP levels using on board jumpers.

### 4.3 Remote setting of DSP filter level.

Remote setting of the DSP level can be achieved through the PCB connections. This allows the DSP filter level to be changed during operation. If remote DSP setting is used, remove the jumpers from the module.

These connections are connected directly to the DSP. The logic levels of the DSP are 3.3V, do not apply a voltage greater than this.

To set the DSP level remotely connect the pins N0, N1 and N2 (PCB pins 1,2, and 3) as shown on the following page.

## 3. Installation

The NEDSP1061 module is inserted into the path of noisy audio. Using the input and output level controls allows the unit to appear transparent to the audio signal.

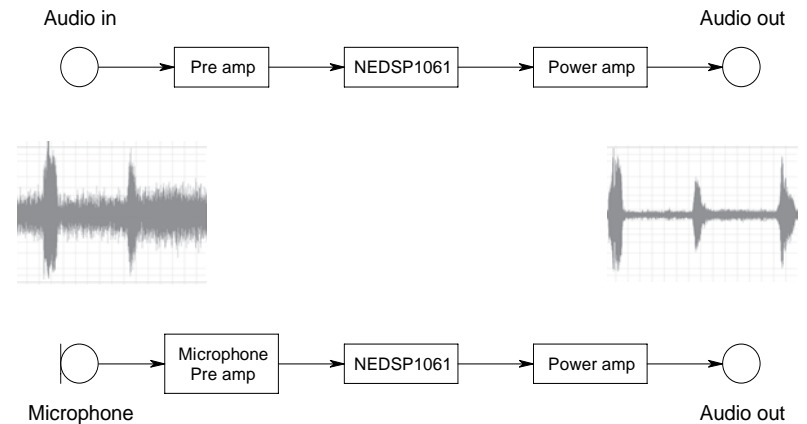


Figure 4. Basic connection diagram

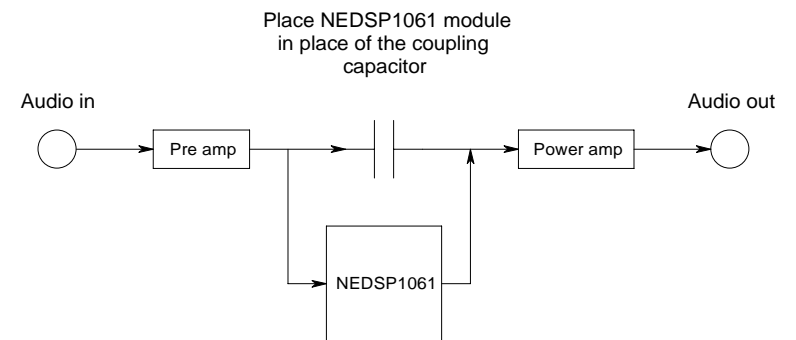


Figure 5. NEDSP1061 Audio path

The NEDSP1061 requires a signal of 50mV rms or greater for optimum performance. Signals lower than this may be used but the noise cancellation performance will degrade, as the signal levels drops. If the unit is used with low level microphones, the signal will need amplifying before applying it to the NEDSP1061. The output level can then be used to attenuate the signal back down to the original signal level.

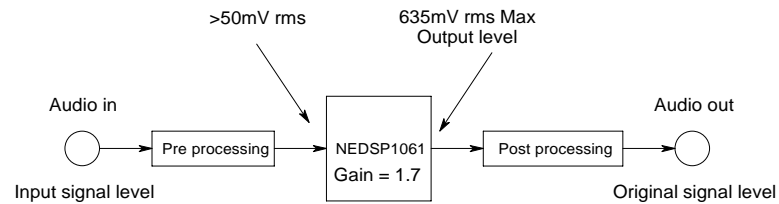


Figure 6. Signal levels.

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, for example if the unit is installed into a system employing a push to talk button - insert the NEDSP1061 in to the audio path before the button.

## 4. Functions

### 4.1 Noise reduction levels.

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

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

Table 3. Tone and noise reduction levels.

### 4.2 Setting different filter levels.

The levels are set by applying a BCD code to three jumpers on the module. See the table on the following page for more information. The positions of the jumpers are shown in section 2.1 module layout.