

# bhi Noise Eliminating In-line Module

*a review by Ron Bertrand VK2DQ & Raff Lerro VK4XRF*

Some time ago I evaluated the NES10-2 Noise Eliminating Speaker. At the time the NES102 was the best noise eliminating device I had ever heard. It was also at that time Graham from bhi told me they were going to bring out an In-Line module.

This unit was a response from bhi to user feedback. While the Noise Eliminating speaker is a great device, many customers indicated that they would like a inline unit without a speaker, not as a replacement, but as an alternative profile. So bhi responded with NEIM1031, a new product without a speaker.

The user can add the NEIM1031 to their own existing speaker, or use the speaker and enclosure of their choice.

The NEIM1031 is designed to remove noise for audio (speech) signals with the intention to improve communication quality and readability of signals. It certainly does this and does it extremely well.

In fact, upon hearing the difference, the usual response goes something like; "Wow – that's amazing".

Personally I find one of the major advantages of using a DSP unit, especially this unit, is the reduction of operator stress that comes from listening to noisy HF bands in particular. With the "bhi" DSP, you don't have to put up with the noise.

Digital signal processing (DSP) is a very rapidly growing engineering field. The NEM1031 is an "Audio or speech Digital Signal Processor. Though primarily intended for communications, it can be used for other applications where speech is used. There is an example given in the manual of using the unit in the audio line of a digital camera.

## WHAT IS DIGITAL SIGNAL PROCESSING?

It seems everywhere we turn these days we are confronted with some sort of DSP.

The world of science and engineering is filled with all manner of signals. Radio users tend to think of most signals as being for voice communications over radio circuits and this is by and large true.

However DSP can and is applied to data that is transmitted via radio or over wires, images, data, video signals, signals generated by medical equipment, radar, sonar echoes, seismic vibrations, and countless other applications.

Figure 1  
- bhi NEIM1031  
Approximately actual size!



Digital Signal Processing is the science of using computers to analyse and manipulate many types of signals or data. DSP is applied to a wide variety of goals: filtering, noise elimination, speech recognition, image enhancement, data compression, and much more. DSP is one of the most powerful technologies that will shape science and engineering in the twenty-first century.

The NEIM1031 like the NES10-2 is an audio or speech digital signal processor primarily designed for use with, radio communications for the purpose of reducing noise on a signal thereby increasing the intelligibility of received signals and reducing operator stress.

The unit measures 170 x 85 x 34 mm. As can be seen in the photo it is rectangular. If the user wishes to use the unit orientated with the long dimension horizontal then bhi supply an alternate label for a modest fee.

The audio in and out is connected either via a pair of RCA, or 3.5mm jacks at one end of the case. With radio communications receivers you would usually intercept the audio out between the radio and your speaker.

The unit is powered from an external DC plug pack (not supplied) with the acceptable input voltage range from 12-24 volts. A plug pack can be supplied as an optional extra or you can supply your own to local requirements.

Many radio users already have a selection of DC power packs and will not require a plug pack.

Current drain is not mentioned in the manual, so to answer my curiosity, I ran the unit from my existing DC supply at 13.6 volts and measured the current drain at 100mA with no signal. A plug pack of 12-24 volts at 500mA maximum is recommended.

The NEIM1031 is a very easy to set up and start using. Once power and audio leads are connected you are on your way.

Noise cancellation can be switched ON and OFF. The input audio level can be adjusted. A green LED indicates the input audio level is okay and a red LED illuminates if the level is too high. With an eye on the LED's you adjust the audio input control.

There is a control for audio output as well to set the volume for up to 2.5 Watts RMS into 8 Ohms. That is plenty for most users but external amplification can be added post-bhi if you need (want) more.

The degree of noise cancellation is controlled by a small rotary BCD switch. Positions 8 and 9 are not used. Minimum noise cancellation is at position 0 and 7 is maximum. The level of noise cancellation is adjustable while the unit is in use. How much noise cancellation you use is dependent of the operator, type and level of signal and amount of noise present.

### HOW IT SOUNDS - THE BEST MEASURE!

The effect is just remarkable. In fact it really has to be heard to be appreciated. We could keep telling you about it but there is no better way than hearing it for yourself other than actually using the unit. For this reason we have made a number of mp3 files of actual communications available on the ESR website on a review page.

The degree of noise cancellation is adjusted and the audio is switched "through" on occasion for you to hear the difference for yourself. The filename(s) indicate the band and type of signal. Only by listening to the actual unit or these files can the reader truly appreciate the effectiveness of the NEIM1031.

When noise cancellation is set at '7' almost all noise is removed. However the audio takes on a rather robotic almost "Cylon" character (you know - 'by your command'!). Even at such high processing (7) the audio information is quite intelligible. However you would normally only use such high processing for the most severely noise effected signals. It most cases it was found that a setting of 3-5 was best - however this is entirely subjective.

Every user can and will choose a level that suits them and their listening best. Needless to say that some would prefer no noise and accept some audio degradation, while others will have best audio and accept some noise.



Neither Raff nor I liked the size of the rotary switch. The numbers are very small and difficult to see. However there is no real need to see them when all you care about it is the quality of the audio.

On the NES10-2 a dual in line (dip) switch was used to adjust the degree of noise elimination. The rotary switch performs the same adjustment on the NEIM1031. It's a minor point but a high profile knob would be better in our view.

The NEIM1031 is a "speech" digital signal processor and that be used with any audio speech application that has an upper frequency limit of 4.5kHz.

Figure 2 shows the frequency response compared to alternate technologies. As you can see the unit has a frequency response virtually flat from 50 to 4500 Hz.

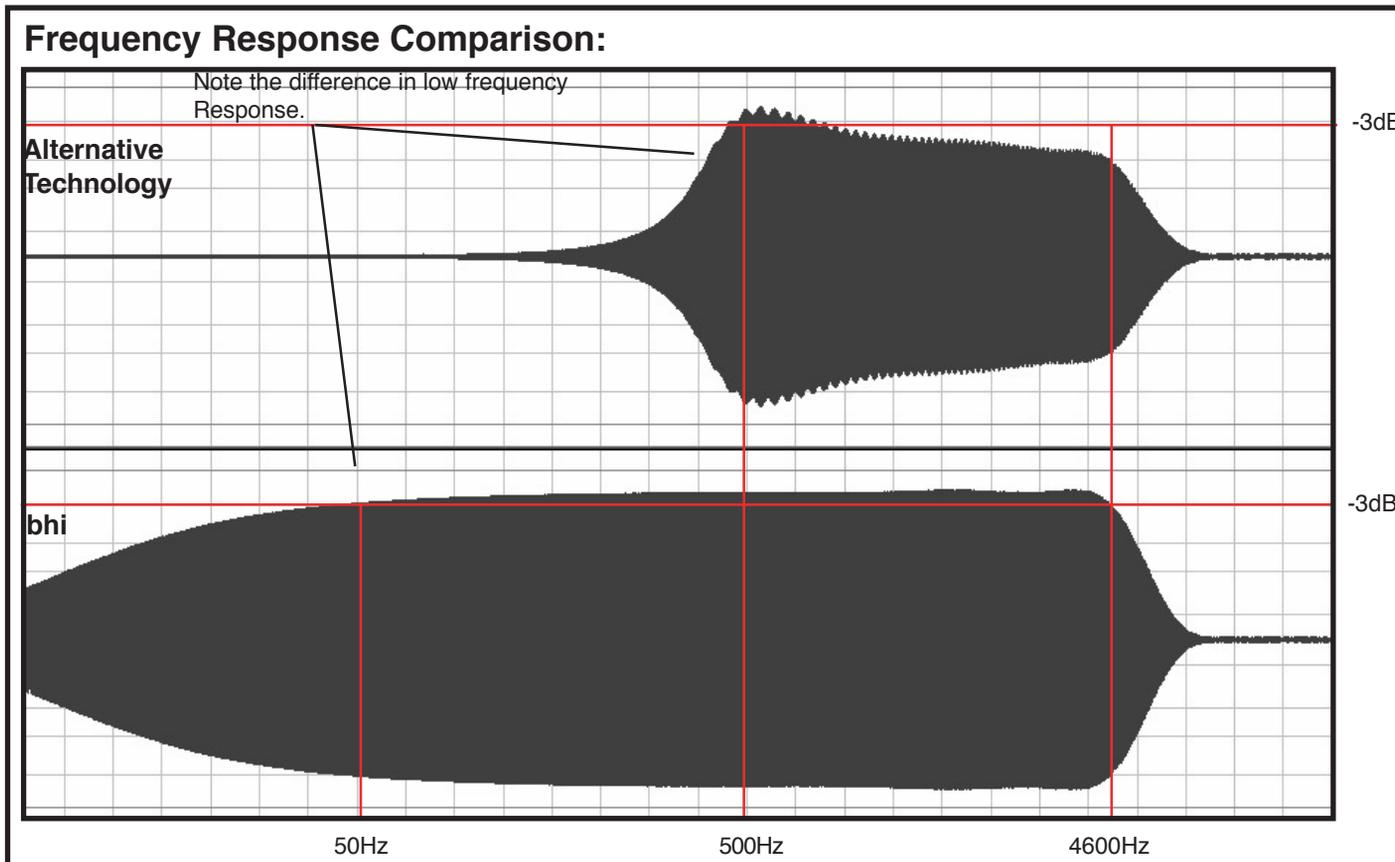
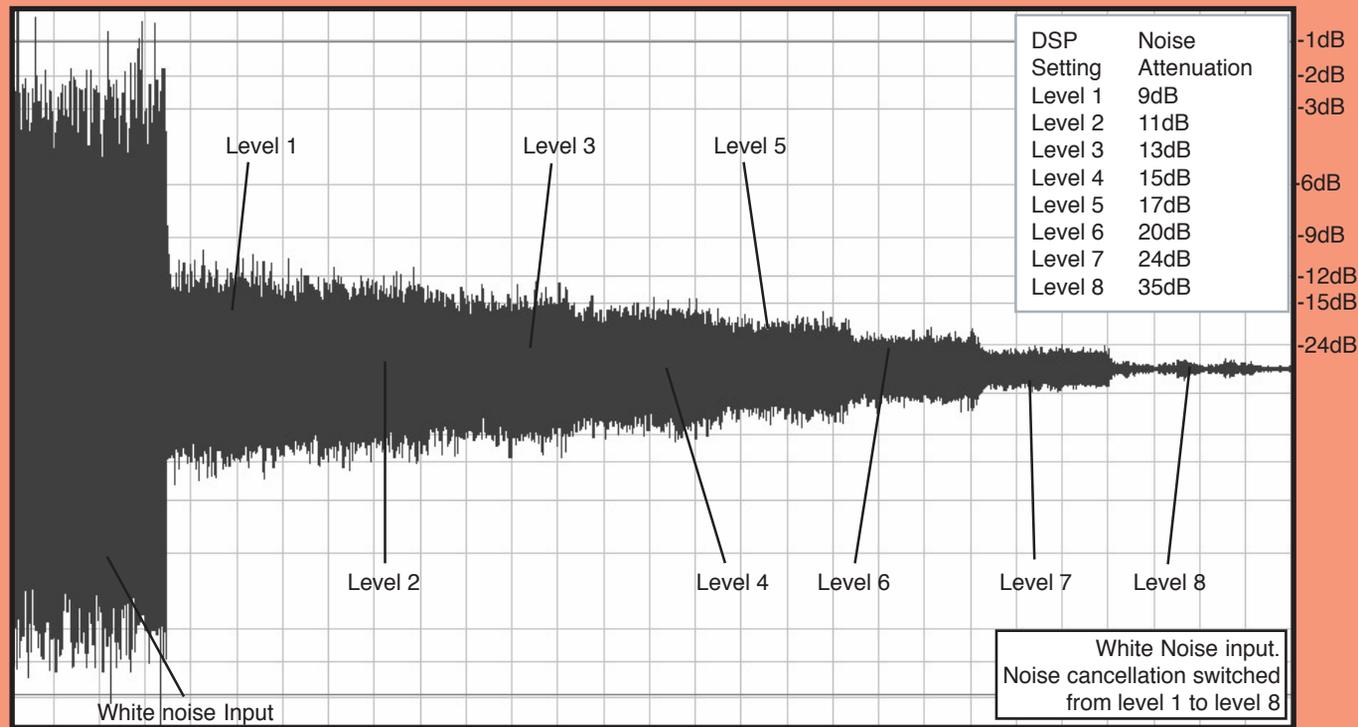


Figure 2 - Frequency Response



## bhi White Noise Reduction:



This is more than enough to cover the speech range from radio communications and any other voice type audio applications -within those limits.

**Figure 3** shows the level of white noise reduction. This is rather impressive. White noise reduction is noticed most on an FM receiver with an open squelch (mute). So good is the white noise reduction that an open squelch FM receiver sounds like a quiet HF receiver!

### A TOUGH TEST

I have an old recording of Sir Laurence Olivier reciting the "Theme from time". This was originally made from a scratchy 45 r.p.m. record.

Even though the NEIM1031 is **not** intended for this use, you have already guessed what I had in mind.

The recording did not contain much in the way of high frequencies and it was primarily voice, so I gave it a go. I didn't really expect it to work, but it did!. Enough for me to make a better audio quality mp3 recording.

Don't buy the unit for this purpose however. There is speciality software and hardware available for cleaning up records at full music bandwidth. I did this test to try something different that I really was not expecting to work, certainly not as well as it did.

You can find some links to resources and tutorials on DSP at the ESR website or go to the Analogue Devices web site, or Texas Instruments.

If you are interested in learning more about DSP, I recommend a free electronic publication called "The Scientist and Engineer's Guide to Digital Signal Processing" which can be download in PDF format from <<http://www.dspguide.com/pdfbook.htm>>.

Visit the ESR website to download and listen for yourself to the recordings we made while reviewing this unit.

The Australian distributor for bhi is Andrews Communications. Lee advises that recommend retail price of the NEIM1031 module is \$399.

I asked Lee how both units are being received by customers and he replied "Ron, so far all purchasers are 100% happy with the performance of both the NES10-2 and NEIM1031 units."

If you are interested in adding DSP to your communications we recommend this product to you. If you are not interested in adding DSP - well the best advice we can give is don't listen to the unit as you will wonder how you will ever manage without one again.

For more information please contact Lee Andrews on (02) 9636 9060 or visit their web site at <<http://www.andrewscom.com>>. You can find more sound bytes and technical information at manufacturers web site .

Thanks to Graham at bhi who supplied us with the NEM1031 to review for you.

**ESR**

