



## **Cost-Effective Noise Masking Systems**

- **Drag Net Solution**
- **Zones and Speaker Arrays**

**Terry Pennington  
Roy Gill  
Jeff Davies  
Michäel Rollins  
Dennis Bohn  
Rane Corporation**

**RaneNote 116  
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### **Introduction**

As the popularity of noise masking systems grows, so too does the cost of the equipment to implement it. However, like other sound system needs, Rane products can contribute a great deal to the cost-effectiveness of noise masking systems without sacrificing reliability or operational requirements.

Properly designed noise masking systems are an art form unto themselves. Their requirements far exceed what can be accomplished in this short space. The purpose of this note is to introduce noise masking designers to Rane products useful in their craft.

## Basic System

Figure 2 illustrates the internal functional blocks of a typical noise masking generator. Connect pink noise to the equalizer input, then connect the distribution and amplification electronics to the output of the equalizer. Downstream, a Rane SM 26S can provide the necessary splits and level controls for individual zones, followed by a Rane MA 4 power amplifier. The output of the amplifier may then be fed directly to low impedance loudspeakers or to a constant voltage transformer system such as the Rane MT 4 Multichannel Transformer kit. In any event, the result is an extremely cost-effective noise masking system with a minimum of components. Figure 3 depicts such a system.

## Multiple Array Noise Masking

Simple noise masking systems use one equalized noise generator, distributing the shaped noise throughout the ceiling array. While cost-effective, these simple systems too often are, themselves, a distraction. When this happens, the system gets switched off and the customer feels noise masking doesn't work and they wasted their money.

The evolution of successful noise masking produced the following guidelines (from "Acoustics of Open Plan Rooms," by Rollins Brook and "Sound System Design," by Chris Foreman in Glen Ballou, Ed., *Handbook For Sound Engineers* [Howard W. Sams & Co, Indianapolis, 1987]) for creating unnoticeable, yet very effective systems:

- Use three carefully equalized noise sources.
- Interlace noise sources driving speaker arrays.
- Disperse noise evenly in all areas ( $\pm 2$  dB).
- Use adequate amplification to avoid clipping.
- Use separate EQ for the paging source.
- Do not attenuate noise during paging.

These guidelines result in a fairly complex expensive system. Luckily, Rane products can help reduce both.

The most random signal results from the use of exactly three noise sources (more do not add more). This way, no two adjacent speakers emit the same sound. Each neighbor produces a randomly different sound. Experience has shown this approach creates the least distracting and most effective masking.

A non-irritating and successful noise source mimics the shape and range of normal speech. This means a maximum frequency range of about 200 Hz to 5 kHz, with an overall rolloff of 5-6 dB per octave beginning at 200 Hz and extending to around 5 kHz.

Thanks to DSP, a system can be assembled with greater flexibility and less expense than in the past. A RPM 44 contains the mic preamp, pink noise sources, equalization, and matrix mixer (see Figure 4). As a bonus, you have a few extra inputs for music that could be switched on when you don't need the noise masking. The RPM 44 is also remote-controllable, with source selection and levels in each zone. The Drag Net processing map is shown in Figure 6a with the required blocks for noise masking, block details are in 6b. Easily customizable, of course.

To start, set the Parametric EQ blocks after the pink noise. Set the Low Cut Filter to 240 Hz and the High Cut Filters to 5000 Hz. You might not need any more EQ than that, but additional filters may be used for room and speaker compensation. You may also add a Feedback Eliminator block for the microphone if it exists. The Matrix Mixer block is set to 4 in, 4 out. Assign the mic to all outputs while routing the noise generators to A, B, and C. The extra 'Mic Only' output could page the lobby or outdoor area without the noise.

An MA 4 / MT 4 combination drives the ceiling array. The outputs drive the loudspeakers in an interlaced array as shown by Figure 5. No two adjacent speakers receive the same source. This is not the wiring nightmare it first appears. Notice that the speakers still wire daisy-chained, just diagonal instead of straight.

The noise must be as uniform as possible throughout the office environment. This demands lots of speakers. The most successful systems extend the noise signal into ancillary areas (storage rooms, copying/FAX centers, closets, etc.) adding even more speakers.

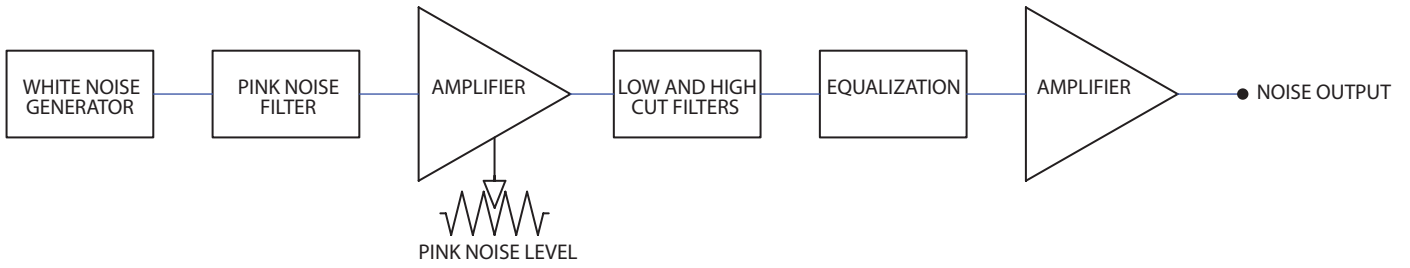


Figure 2. Typical Noise Masking Generator

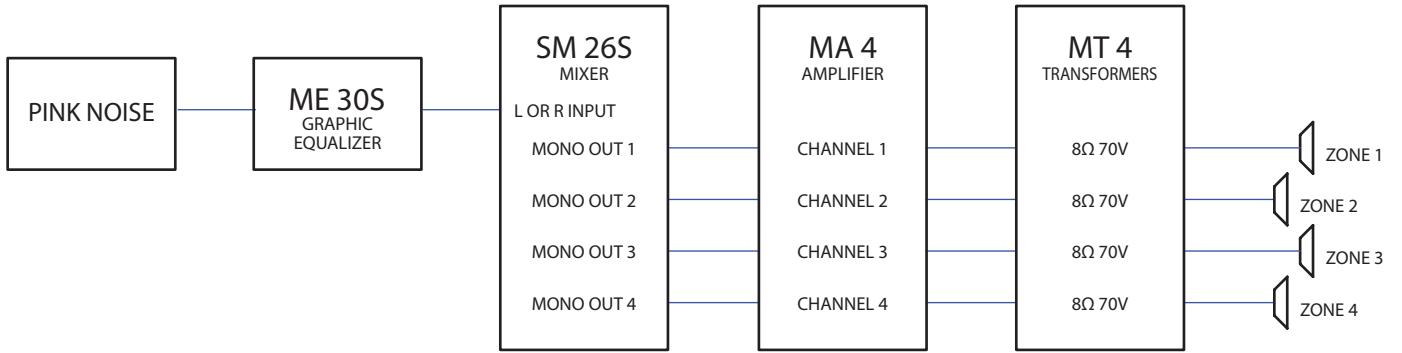


Figure 3. Basic Noise Masking System Example

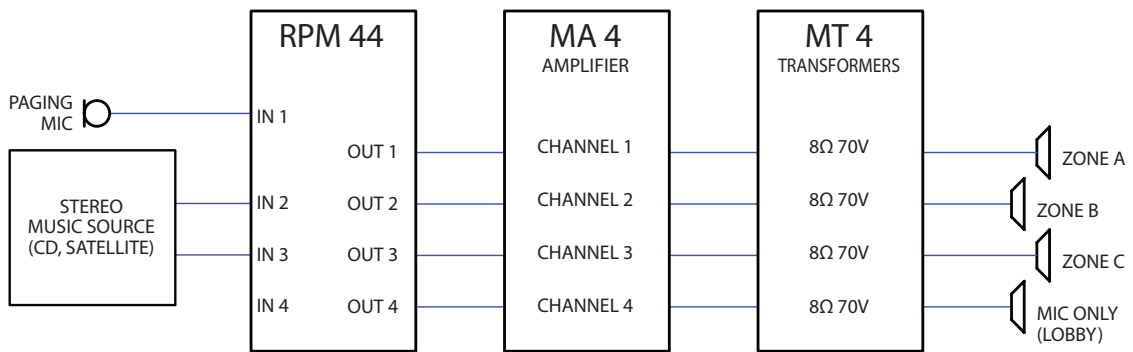


Figure 4. Multiple Array Noise Masking System Example

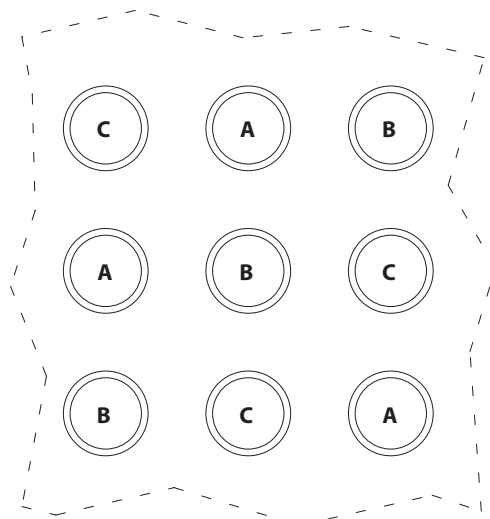


Figure 5. Noise Masking Ceiling Array

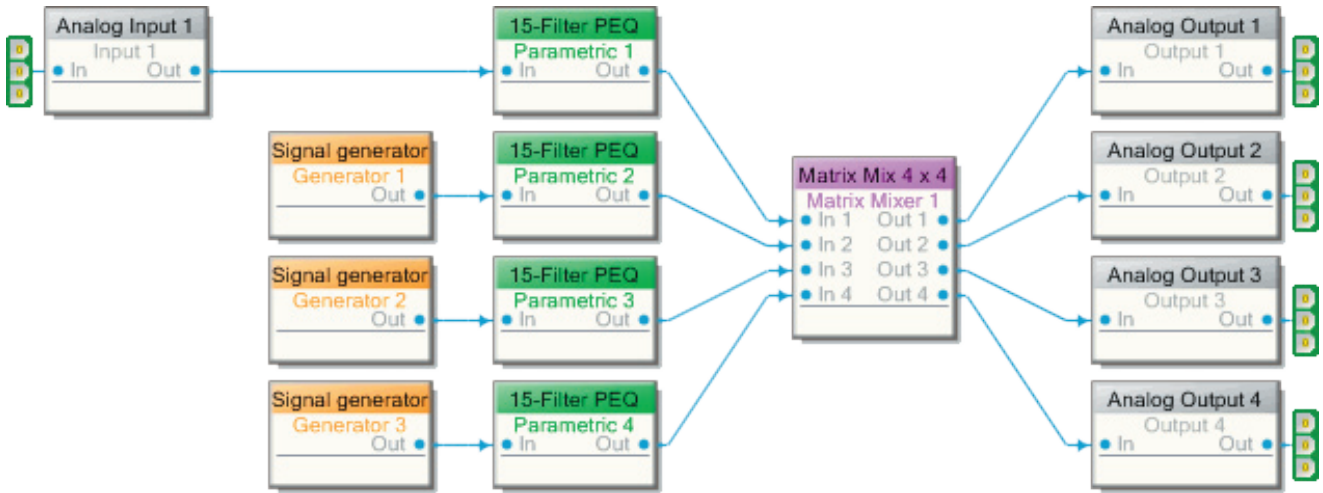


Figure 6a. Drag Net Processing Map for Noise Masking with the RPM 44

Figure 6b. Drag Net Control Block Details. Note the extra parametric bands available for room and speaker EQ.

Filter	Frequency	Level	BW: ~ 1/3.1 (Q=4.43)	Filter Type	Bypass
Filter 1	240	0.00	0.325	Low Cut (BW 2nd Order)	<input type="checkbox"/>
Filter 2	5000	0.00	0.325	Hi Cut (BW 2nd Order)	<input type="checkbox"/>
Filter 3	300	0.00	0.325	Band	<input type="checkbox"/>
Filter 4	400	0.00	0.325	Band	<input type="checkbox"/>
Filter 5	500	0.00	0.325	Band	<input type="checkbox"/>
Filter 6	600	0.00	0.325	Band	<input type="checkbox"/>
Filter 7	700	0.00	0.325	Band	<input type="checkbox"/>
Filter 8	800	0.00	0.325	Band	<input type="checkbox"/>
Filter 9	900	0.00	0.325	Band	<input type="checkbox"/>
Filter 10	1000	0.00	0.325	Band	<input type="checkbox"/>
Filter 11	1200	0.00	0.325	Band	<input type="checkbox"/>
Filter 12	1400	0.00	0.325	Band	<input type="checkbox"/>
Filter 13	1600	0.00	0.325	Band	<input type="checkbox"/>
Filter 14	2000	0.00	0.325	Band	<input type="checkbox"/>
Filter 15	2500	0.00	0.325	Band	<input type="checkbox"/>



Download this Drag Net configuration at [www.rane.com/note116.html](http://www.rane.com/note116.html)

### Reference

“Acoustics of Open Plan Rooms,” by Rollins Brook and “Sound System Design”, by Chris Foreman in Glen Ballou, Ed., *Handbook For Sound Engineers*, Howard W. Sams & Co, Indianapolis, 1987.