# Selecting Mic Preamps

· **Mic Preamp Compatibility**

· **Mic Output Levels vs. Preamp Input Levels**

· **Mic Output Noise vs. Preamp Input Noise**

· **Conversion Tables for Mic Output Noise**

· **RMS Noise Summation for Mic & Preamp**

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**RaneNote 148**


## DIFFICULTIES

Selecting a power amplifier for a specific loudspeaker is easy; selecting a preamp for a specific microphone is not. Terminology is the problem. At one end we find power amplifier and loudspeaker manufacturers speaking the same language, or at least using the same vocabulary. Power amps are rated in watts and ohms, while loudspeakers are rated in ohms with a maximum power handling capability stated in watts.

Unfortunately, at the other end, microphone and preamp manufacturers do not speak the same language or use the same vocabulary. One is rated using sound pressure level (SPL) while the other rates itself in volts (dBu).

This note explains how to convert microphone specifications into preamp specifications, making selection and comparison easier. No math is involved since handy look-up tables do the math for you. Key terminology is explained and cross-referenced.

**Acknowledgement.** Acknowledgement usually comes at the end, however this technical note would not exist had it not been for an article authored by Tomlinson Holman, published in the September 2000 *Surround Sound Professional* magazine, titled “Capturing the Sound, Part 1: Dynamic Range.” In that article Tom deftly demonstrated the difficulty in properly matching microphones and preamplifiers. His article motivated me to do this expanded and generalized note.

## Worrisome Things

Buyer's guides for 2001 list microphones ranging in price from $50 to $8,000, and microphone preamplifiers from $150 to $4,500. Whether you spend $200 or $12,500 for one microphone and a preamp to go with it, it pays to make sure they are compatible. Luckily, knowing how to do this skillfully depends not on your budget – but rather on this free tech-note.

Selecting the right preamp for a given mic, or conversely selecting the right mic for a given preamp, involves two major things (and a bunch of minor ones):

- Input headroom – *Do you have enough?*
- Noise – *What will the preamp add to your mic?*

You need to determine whether the microphone under worst-case conditions is going to overload the preamp input stage and whether the preamp is going to materially degrade the noise performance of the microphone.

Actually, microphones have few specifications. Most are sold on sound, reputation and price. Specifications rarely enter into it. Even so, enough exist to make the right decision.

Other issues include the proper input impedance. Recently the trend is toward higher input impedances than classic designs, with many now rated 2 kilohms and higher. Since the connected impedance (i.e., mic plugged into the preamp) determines the noise performance, and the microphones are low impedance (150 - 200 ohms) then there is no noise penalty for providing higher input impedances.

Another thing to examine is phantom power. *Is it provided? Do you need it? Is it the correct voltage, and does it source enough current for your microphone?* This is an area where you need to make informed decisions. There is a huge myth circulating that microphones sound better running from 48 volts, as opposed to, say, 12 volts, or that you can increase the dynamic range of a microphone by using higher phantom power. *For the overwhelming majority of microphones both of these beliefs are false.* Most condenser microphones require phantom power in the range of 12-48 VDC, with many extending the range to 9-52 VDC, leaving only a very few that actually require just 48 VDC. The reason is that internally most designs use some form of current source to drive a low voltage zener (usually 5 volts; sometimes higher) which determines the polarization voltage and powers the electronics. The significance is that neither runs off the raw phantom power, they both are powered from a fixed and regulated low voltage source inside the mic. Increasing the phantom power voltage is never seen by the microphone element or electronics, it only increases the voltage across the current source. *But there are exceptions, so check the manufacturer, and don't make assumptions based on hearsay.*

Final selection details involve checking that the preamp's gain range is enough for your use, that there are overload indicators or metering to help in set up, that the plumbing is compatible with your wiring needs, and that the color doesn't clash with your tour jacket.

## Preamp Input Overload

Determining input headroom compatibility requires knowing the microphone *sensitivity* rating and the *maximum SPL* allowed. The sensitivity rating is usually the easiest and least ambiguous number to find on the data sheet, rated at 1 kHz and expressed in millivolts per pascal (mV/Pa). One pascal is the amount of pressure resulting from a loudness level of 94 dB (written as 94 dB SPL). For example, a sensitivity rating of 20 mV/Pa tells you that when a sound equal to 94 dB SPL strikes the microphone element, it results in an output voltage of 20 millivolts.

The sensitivity rating gives you a voltage level at one reference point; now all you need is the mic's maximum SPL and you can calculate the maximum output voltage. Then you use this to compare against the maximum input voltage rating of the microphone preamp.

The maximum allowed sound pressure level is stated in several ways: *Maximum SPL* (often with a stated THD level), *Max Acoustic Input*, *Sound Pressure Level for X% THD*, all are variations for the same rating.

With these two specifications it is a simple matter to calculate the maximum output level in volts and convert that into the familiar *dBu* units found on microphone preamp data sheets. To make this even easier Table 1 is provided. To obtain the microphone maximum output level in dBu, find your microphone's sensitivity rating on the left side and then move right until you are directly below your microphone's maximum SPL rating. As an example, for a microphone with a sensitivity rating of 20 mV/Pa and a max SPL equal to 130 dB, Table 1 tells us that the maximum output voltage is +4 dBu. You now have what you need to compare preamps regarding maximum input level.

Another example using Table 1 is to block out all possibilities that could overload a specific preamp. For example, the shaded triangle area represents all those combinations that could overload Rane's handy-dandy MS 1b Mic Stage. The MS 1b's maximum input level is rated at +10 dBu, therefore all microphone sensitivity and max SPL combinations resulting in greater than +10 dBu are excluded from consideration. Used this way, any new microphones can be quickly checked for overload threat.

**Caveats**. Remember though, that this output level only occurs under the worst-case condition of sound pressure levels equaling the maximum allowed by the microphone. This means that if your application has sources that cannot achieve the maximum sound pressure levels, then you can relax your input overload requirement accordingly. For instance, if you know your source is never going to exceed, let's say, 110 dB SPL, and your microphone is rated for maximum levels of 130 dB, then you can take 20 dB off the levels shown in Table 1, and widen your preamp choices considerably.

Note also that input overloading is a strong function of the preamp's gain control setting. Most preamp manufacturers measure the maximum input level with the gain control set at minimum. This means there is a real danger that after carefully matching the output and input levels of a microphone and preamp, you find that the mic *still* overloads the preamp. This happens when the system needs the preamp gain turned

**Table 1. Microphone Maximum Output Level (dBu)**

| Sensitivity | | Maximum Sound Pressure Level (Max SPL) @ 1 kHz | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mV/Pa | dBu | 120 | 122 | 124 | 126 | 128 | **130** | 132 | 134 | 136 | 138 | 140 | 142 | 144 | 146 | 148 | 150 |
| 2 | -52 | -26 | -24 | -22 | -20 | -18 | -16 | -14 | -12 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 |
| 4 | -46 | -20 | -18 | -16 | -14 | -12 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 |
| 6 | -42 | -16 | -14 | -12 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 |
| 8 | -40 | -14 | -12 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
| 10 | -38 | -12 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| 12 | -36 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 14 | -35 | -9 | -7 | -5 | -3 | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 |
| 16 | -34 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 |
| 18 | -33 | -7 | -5 | -3 | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 |
| **20** | -32 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 22 | -31 | -5 | -3 | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 |
| 24 | -30 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 |
| 26 | -29 | -3 | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 |
| 28 | -29 | -3 | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 |
| 30 | -28 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 |
| 32 | -28 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 |
| 34 | -27 | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 |
| 36 | -27 | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 |
| 38 | -26 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 40 | -26 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 42 | -25 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| 44 | -25 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| 46 | -25 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| 48 | -24 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 |
| 50 | -24 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 |

up (correspondingly reducing input headroom) and the microphone is used for a wide dynamic range source. Unless there is a person riding gain, or some provision for automatic input ranging, overload is STILL going to occur. This means that not only do you have to worry about matching your mic and preamp, but also about real-world sources and gain settings.

## Noise

Microphones and preamps each have their own noise floors. When selecting a mic preamp you want to know to what degree the preamp's noise degrades the noise of your microphone. Different microphone technologies use different terminology to describe noise.

**Dynamic Microphones.** Dynamic microphone data sheets rarely list noise as a specification since there is no active circuitry to generate noise; there is only a magnet and a coil. This category of microphone is properly called electro-magnetic or electrodynamic. The output noise is very low – so low they just don't list it. However, they do generate some noise and it is calculated by knowing the microphone's impedance.

Obtain the dynamic microphone impedance rating from the data sheet and use Table 2 to convert that into units of

**Table 2. Output Noise for Dynamic Mics (20-20 kHz, 20°C/68°F)**

| **Impedance** Ohms | **Noise** dBu A-wtd |
|---|---|
| 50 | -141 |
| 100 | -138 |
| 150 | -136 |
| 200 | -135 |
| 250 | -134 |
| 300 | -133 |
| 350 | -132 |
| 400 | -132 |
| 450 | -131 |
| 500 | -131 |
| 550 | -130 |
| 600 | -130 |

**Table 3. Output Noise for Condenser Mics (dBu)**

| Sensitivity | | Noise Floor (Equivalent Sound Pressure Level, dB-SPL, A-weighted) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mV/Pa | dBu | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 2 | -52 | -140 | -138 | -136 | -134 | -132 | -130 | -128 | -126 | -124 | -122 | -120 | -118 | -116 |
| 4 | -46 | -134 | -132 | -130 | -128 | -126 | -124 | -122 | -120 | -118 | -116 | -114 | -112 | -110 |
| 6 | -42 | -130 | -128 | -126 | -124 | -122 | -120 | -118 | -116 | -114 | -112 | -110 | -108 | -106 |
| 8 | -40 | -128 | -126 | -124 | -122 | -120 | -118 | -116 | -114 | -112 | -110 | -108 | -106 | -104 |
| 10 | -38 | -126 | -124 | -122 | -120 | -118 | -116 | -114 | -112 | -110 | -108 | -106 | -104 | -102 |
| 12 | -36 | -124 | -122 | -120 | -118 | -116 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 |
| 14 | -35 | -123 | -121 | -119 | -117 | -115 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 |
| 16 | -34 | -122 | -120 | -118 | -116 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 |
| 18 | -33 | -121 | -119 | -117 | -115 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 |
| 20 | -32 | -120 | -118 | -116 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 |
| 22 | -31 | -119 | -117 | -115 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 |
| 24 | -30 | -118 | -116 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 | -94 |
| 26 | -29 | -117 | -115 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 | -93 |
| 28 | -29 | -117 | -115 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 | -93 |
| 30 | -28 | -116 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 | -94 | -92 |
| 32 | -28 | -116 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 | -94 | -92 |
| 34 | -27 | -115 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 | -93 | -91 |
| 36 | -27 | -115 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 | -93 | -91 |
| 38 | -26 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 | -94 | -92 | -90 |
| 40 | -26 | -114 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 | -94 | -92 | -90 |
| 42 | -25 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 | -93 | -91 | -89 |
| 44 | -25 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 | -93 | -91 | -89 |
| 46 | -25 | -113 | -111 | -109 | -107 | -105 | -103 | -101 | -99 | -97 | -95 | -93 | -91 | -89 |
| 48 | -24 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 | -94 | -92 | -90 | -88 |
| 50 | -24 | -112 | -110 | -108 | -106 | -104 | -102 | -100 | -98 | -96 | -94 | -92 | -90 | -88 |

dBu, A-weighted. This noise is the white noise generated by the resistance of the wire used to create the coil, plus a correction factor of 5 dB for A-weighting. (This is somewhat arbitrary, as true A-weighting may decrease the level anywhere from 3-6 dB depending upon the nature of the noise, but agrees with Holman's article and measured results).

The noise of the measuring standard 150 ohms (200 ohms for Europe) source resistor makes a good noise reference point. From Table 2, find that it equates to –136 dBu (A-weighted; –131 dBu when not). This means that you cannot have an operating mic stage, with a 150 ohm source, quieter than –136 dBu (A-weighted, 20°C/68°F, 20 kHz BW). Looking at Table 2 confirms that dynamic microphones, indeed, are quiet.

Use Table 4 to compare microphone output noise with preamplifier equivalent input noise (EIN). As an example, if your dynamic microphone's output noise equals –136 dBu and you are considering a preamplifier with a rated EIN of –136 dBu, then the difference between them is 0 dB and Table 4 lets you know that this preamp with this microphone will degrade the total noise by 3 dB. That is, the combination of mic and preamp adds 3 dB noise to the total. More on how this table works shortly.

**Table 4. RMS Noise Summation for Connected Mic & Preamp**

| Preamp Noise vs. Mic Noise dB | Noise Added by Preamp dB |
|---|---|
| +6 | 7.0 |
| +5 | 6.2 |
| +4 | 5.5 |
| +3 | 4.8 |
| +2 | 4.1 |
| +1 | 3.5 |
| 0 | 3.0 |
| -1 | 2.5 |
| -2 | 2.1 |
| -3 | 1.8 |
| -4 | 1.5 |
| -5 | 1.2 |
| -6 | 1.0 |
| -7 | 0.8 |
| -8 | 0.6 |
| -9 | 0.5 |
| -10 | 0.4 |
| -11 | 0.3 |
| -12 | 0.3 |
| -13 | 0.2 |
| -14 | 0.2 |
| -15 | 0.1 |
| -16 | 0.1 |
| -17 | 0.1 |
| -18 | 0.1 |
| -19 | 0.1 |
| -20 | 0.0 |

**Condenser Microphones.** Condenser, capacitor, or more properly, electrostatic microphone technology involves a polarizing voltage network and at least a buffer transistor built into the microphone housing, if not an entire preamp/biasing/transformer network – all of which contribute noise to the output. Electrostatic microphones are quite noisy compared to dynamic designs, but are very popular for other reasons.

Different manufacturers use different terminology on their electrostatic microphone specification sheets for noise: *Self-Noise*, *Equivalent Noise SPL*, *Equivalent Noise Level*, *Noise Floor*, and just plain *Noise* all describe the same specification. Microphone noise is referenced to the equivalent sound pressure level that would cause the same amount of output noise voltage and is normally A-weighted. This means the noise is given in units of dB SPL. A noise spec might read 14 dB SPL equivalent, A-weighted, or shortened to just 14 dB-A (*bad terminology, but common*). This is interpreted to mean that the inherent noise floor is equivalent to a sound source with a sound pressure level of 14 dB. Problems arise trying to compare the mic's noise rating of 14 dB SPL with a preamp's equivalent input noise (EIN) rating of, say, –128 dBu. *Talk about apples and oranges*.

Luckily (again) tables come to the rescue. Table 3 provides an easy look-up conversion between a microphone's output noise, expressed in equivalent dB-SPL, and its sensitivity rating, in mV/Pa, into output noise expressed in dBu, A-weighted. Using Table 3, a direct noise comparison between any microphone and any preamp is possible. The example shown by the half-toned column and row is for a microphone with a noise floor of 14 dB-SPL and a sensitivity rating of 20 mV/Pa, which translates into an output noise of –112 dBu, A-weighted.

Time to return to Table 4. Unfiltered electronic noise, whether from a resistor, a coil, an IC, or a transistor is white noise consisting of all audible frequencies occurring randomly. Due to this randomness you don't just add noise sources together, you must add them in an RMS (root mean square) fashion. Mathematically this means you must take the square root of the sum of the squares – which is why Table 4 is so handy – it does the RMS conversion for you.

Use Table 3 to convert your microphone's rated noise output into units of dBu. Find the difference in dB between your mic's output noise and the preamp's input noise. Find that difference in the left column of Table 4 and read what the preamp added noise will do to the microphone's noise in the right column. For example, if the mic's output noise translates into –120 dBu, and the preamp you are interested in has an EIN of –127 dBu, then the difference between the mic and the preamp is –7 dB, that is, the preamp is 7 dB quieter than the microphone. Table 4, at the row marked –7 dB, tells you that this preamp will degrade your microphone's noise by only 0.8 dB. Looking at Table 4 tells us that after about a 10 dB difference, the noise added by the preamp becomes insignificant.

Similar to Table 1, you can use Table 3 to map out a preamp's A-weighted noise to show the combinations that add insignificant noise. If you use a –10 dB difference figure as a guide, then the preamp's noise amounts to less than 0.4 dB increase. The shaded triangle area in Table 3 shows an example of this. The areas not shaded represent all possible combinations of microphone sensitivity and noise specifications that can be used with Rane's MS 1b Mic Stage, for instance, and add less than 0.4 dB of noise. If you allow 1 dB net added noise, then even more combinations are possible. (The shaded area is figured by taking the EIN of the MS 1b at –128 dBu, reducing it to –133 dBu with the 5 dB factor for A-weighting, and using the –10 dB difference found in Table 4 for 0.4 dB added noise, resulting in all combinations less than –123 dB being blocked out.)

## DOING THE TWO-STEP

The following procedure summarizes this note for evaluating the compatibility of any microphone and any preamplifier:

### Evaluating Input Overload Compatibility

1. Locate the microphone **Sensitivity** rating on the data sheet.
2. Find the **Maximum SPL** from the data sheet.
3. Using **Table 1**, find the microphone Sensitivity rating down the left side.
4. Find the Maximum SPL rating along the top of Table 1.
5. Move right along the Sensitivity rating row and move down the Max SPL rating column until they intersect and note the number – *this is the microphone's maximum output level expressed in dBu*.
6. From the microphone preamplifier's data sheet find the **Maximum Input Level** (in dBu).
7. Compare the mic's maximum output level obtained from Table 1 against the preamp's maximum input level obtained from its data sheet to determine compatibility.

### Example Using Sample Data Sheets

1. Microphone's Sensitivity rating is 20 mV/Pa.
2. Microphone's Maximum SPL rating is 130 dB.
3. Table 1 shows the Sensitivity row marked 20 mV/Pa shaded.
4. Table 1 shows the Maximum SPL column for 130 dB shaded.
5. The intersecting point is at 4 dBu – *this is the maximum output level of the example microphone*.
6. The MS 1b Mic Stage data sheet lists the Maximum Input Level as +10 dBu.
7. Since this mic's max output level is +4 dBu and the preamp can handle +10 dBu, then this mic will not overload this preamp (when set for minimum gain).

### Evaluating Noise Performance
### Dynamic Mics

1. Find the impedance specification on the data sheet (use "actual" instead of "rated" if given the choice).
2. Use **Table 2** to find the **Output Noise** in dBu, A-weighted, by finding the closest impedance listed.
3. Find the EIN (equivalent input noise) in dBu rating on the preamplifier's data sheet.
4. Reduce the preamp's EIN by 5 dB to approximate A-weighting.
5. Calculate the difference between the microphone's output noise and the preamp's equivalent input noise (both expressed in dBu, A-weighted).
6. Use **Table 4** to determine how much total noise will be added by the proposed preamplifier.

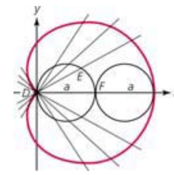
### Condenser Mics

1. Find the **Noise** rating on the microphone date sheet (this is stated as *Equivalent Noise Level*, *Self-Noise*, *Equivalent Noise SPL*, or *Noise Floor*), expressed in dB SPL, A-weighted.
2. Locate the microphone's **Sensitivity** rating on the data sheet.
3. Using **Table 3**, find the microphone Sensitivity rating down the left side.
4. Find the **Noise** rating in dB SPL, A-weighted along the top of Table 3.
5. Move along the Sensitivity rating row and move down the Noise column until they intersect and note the number – *this is the output noise converted to dBu, A-weighted*.
6. Find the **EIN** (equivalent input noise) in dBu rating on the preamplifier's data sheet.
7. Reduce the preamp's EIN by 5 dB to approximate A-weighting.
8. Calculate the difference between the microphone's output noise and the preamp's equivalent input noise (both expressed in dBu, A-weighted).
9. Use **Table 4** to determine how much total noise will be added by the proposed preamplifier.

Condenser Microphone Example Using Sample Data Sheets

1. Microphone's Equivalent Noise Level is 14 dB SPL, A-weighted.
2. Microphone's Sensitivity rating is 20 mV/Pa.
3. Table 3 shows the Sensitivity row marked 20 mV/Pa shaded.
4. Table 3 shows the Noise column for 14 dB SPL, A-weighted shaded.
5. The intersection point is at –112 dBu, A-weighted: *this is the output noise of the microphone*.
6. The MS 1b Mic Stage data sheet lists the Equivalent Input Noise as –128 dBu (no weighting).
7. Reducing this by 5 dB yields a preamp EIN of –133 dBu, A-weighted.
8. The difference between the microphone's output noise of –112 dBu, A-weighted and the preamp's EIN of –133 dBu, A-weighted is –11 dB.
9. Table 4 shows that the total noise added by the preamp is an insignificant 0.3 dB.

Mickey's Mics



**Model MM-100**

**Super Heart-Shaped Gold Vapor Large Diaphragm Condenser Microphone**

"It's the best!" … Anonymous, Mukilteo, WA

Unparalleled response with a pickup pattern following the locus of a fixed point on a circle that rolls on the circumference of another circle with the same radius.

### SPECIFICATIONS

| | |
|---|---|
| **Transducer Principle** | Condenser, or since 1950, Electrostatic |
| **Pick-up Pattern** | Super-Cardioid |
| **Frequency Range** | 20 Hz – 20 kHz (±2 dB) |
| **Sensitivity @ 1 kHz** | 20 mV/Pa |
| **Impedance** | 150 ohms |
| **Equivalent Noise Level** | 14 dB-SPL, A-weighted |
| **Maximum SPL** | 130 dB (1 kHz, 0.5% THD) |
| **Power Requirement** | 12-48 VDC Phantom Powering, 5 mA |
| **Housing/Finish** | Yttrium-Titanium/Glaring Fuchsia |

RANE

## MS 1b Microphone Stage

### Features and Specifications

| Parameter | Specification | Limit | Units | Conditions/Comments |
|---|---|---|---|---|
| Input Impedance | 10k | 1% | ohms | Balanced 5k + 5k |
| Gain Range | 18 to 66 | typ. | dB | |
| Phantom Power | +48 | 4% | volts | 10 mA max. |
| Max. Input Level | +10/-32 | min. | dBu | Gain 18/60, balanced output |
| Equivalent Input Noise | -128 | typ. | dBu | 20 kHz BW, Rs=150 ohms, Gain = 60 dB |
| S/N re 4 dB | 96 | typ. | dB | 20 kHz BW, Rs=150 ohms, Gain = 18 dB |
| Dynamic Range | 120/95 | typ. | dB | Gain 18/66 |
| CMRR | 80 | typ. | dB | Rs=150 ohms, 120 Hz, Gain = 60 dB |
| Frequency Response | 30/45 to 200k | typ. | Hz | +0, -3dB, Gain 18/60 dB |
| THD+Noise | .007 | typ. | % | +20 dBu, 55 Hz – 20 kHz, 22 kHz BW |
| Max. Output Level | +27/+22 | min. | dBu | Balanced/Unbalanced, 2k ohm load |
| Output Impedance | 50 | 1% | ohms | Each Leg |